UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

December 23, 2015

Refer to NMFS No:
2014-1797

Patrick J. Rutten
West Coast Region Restoration Center Supervisor
NOAA Restoration Center
777 Sonoma Ave. Rm. 219
Santa Rosa, CA. 95409

Dear Mr. Rutten:

Thank you for your letter of November 19, 2014, 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 NOAA Restoration Center's (RC) Fisheries Habitat Restoration Program in South-Central and Southern California. Enclosed is NMFS' biological opinion for the subject proposed action. The NOAA RC is the lead action agency that proposes to fund qualifying restoration projects, and the Corps proposes to issue a 10 year Regional General Permit (RGP) to provide coverage for Corps regulated activities. This biological opinion addresses the effects of the proposed action on the threatened South-Central California Coast Distinct Population Segment of steelhead (*Oncorhynchus mykiss*) and the endangered Southern California Distinct Population Segment of steelhead and designated critical habitat for these species in accordance with section (7)(a)(2) of the ESA.

The biological opinion concludes that the proposed action is not likely to jeopardize the continued existence of the federally threatened or endangered steelhead or result in adverse modification to designated critical habitat. NMFS believes the proposed action is likely to result in incidental take of steelhead, and therefore the incidental take statement includes the amount and extent of anticipated incidental take with reasonable and prudent measures and non-discretionary terms and conditions that NMFS believes are necessary and appropriate to minimize and monitor incidental take of steelhead. Please call Rick Bush at (562) 980-3562 if you have a question concerning this biological opinion or would like additional information.

Sincerely,

for William W. Stelle, Jr.
Regional Administrator

Enclosure

cc: Roger Root, USFWS, Ventura
Mary Larson, CDFW, Los Alamitos
Administrative File: 151422WCR2014CC00285

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

Programmatic Consultation on funding and permitting restoration projects within watersheds of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange and San Diego counties, California

NMFS Consultation Number: *2014-00285*

Action Agencies: National Oceanic and Atmospheric Administration's Restoration Center (NOAA RC), and United States Army Corps of Engineers, Los Angeles 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?
South-Central California Coast (SCCC) Steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	No
Southern California Coast (SCC) Steelhead (*O. mykiss*)	Endangered	Yes	No	No

*Please refer to section 2.4 for the analysis of species or critical habitat that are not likely to be adversely affected.

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

Issued By: 

William W. Stelle, Jr.
FOR Regional Administrator

Date: December 23, 2015

1. INTRODUCTION

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

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement 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 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' Southern California Branch office.

1.2 Consultation History

The NOAA Restoration Center (RC) requested formal Section 7 programmatic consultation under the U.S. Endangered Species Act (ESA) to implement a fisheries habitat-restoration program in all coastal anadromous streams from the northern San Luis Obispo County line to the U.S.-Mexico border. The phrase "Program" is used in this biological opinion to collectively relate to all aspects of the NOAA RC Restoration Program described in this opinion. The NOAA RC's activities that are the basis of this consultation are similar to NOAA RC activities that have formed the basis of past consultations, though the specific information considered in recent and past consultations differ. Accordingly, in addition to describing the recent consultation history underlying this biological opinion, aspects of the past consultations that are essential for understanding key differences between the recent and past consultations are subsequently described.

1.2.1 Recent Consultation History

On November 19, 2014, NMFS received from the NOAA RC a written request to consult formally and a draft biological assessment (BA) entitled "Fisheries Habitat Restoration Projects in South-Central and Southern California". The NOAA RC intends to provide funds and technical assistance for qualifying fisheries habitat restoration projects (see the description of the proposed action below for greater detail). Because the proposed action may affect the threatened South-Central California Coast Steelhead Distinct Population Segment (SCCCS DPS) and endangered Southern California Steelhead Distinct Population Segment (SCS DPS), and critical habitat for these species, the NOAA RC requested formal consultation. Additionally, the NOAA RC requested consultation for potential adverse effects to essential fish habitat (EFH) for fish species managed with the Pacific Groundfish Management Plan and Pacific Coast Salmon Fishery Management Plan under the Magnuson-Stevens Fishery Conservation and Management Act. The consultation package received by NMFS on

November 19, 2014, appeared to comport with the requirements for initiating formal consultation as defined in 50 CFR § 402.14, and therefore formal consultation was initiated on the same day.

On January 13, 2015, a teleconference with NOAA RC and Sustainable Conservation (a sponsor of the Program) occurred to develop a schedule for the programmatic consultation. Also on January 13, 2015, NMFS submitted a written request for a 60-day extension in the duration of the formal consultation to (1) collaborate with the NOAA RC on clarifying or refining several project-related details as described in the BA prepared by Sustainable Conservation, and (2) fully evaluate the relatively large amount of information that is the basis of the proposed action. On the same day, the NOAA RC provided written notification granting the 60-day extension.

On January 29, 2015, a second teleconference with NOAA RC and Sustainable Conservation occurred to (1) discuss technical matters related to the Proposed Action, and (2) clarify a few key uncertainties in Section II of the BA regarding protection measures for steelhead and its habitat. On February 4, 2015, a third teleconference with the NOAA RC followed, which resulted in two action items for the NOAA RC: (1) coordinate with NMFS' Environmental Services Branch (ESB) regarding small-dam removal, and (2) deliver a final revised BA to NMFS.

As the result of the teleconference between NMFS' ESB and the NOAA RC on February 17, 2015, NMFS' engineers provided the NOAA RC with a recommended definition of suitable dam-removal projects, recommended minimization and conservation measures, and information that would be needed to properly appraise the expected efficacy of future removal projects under this programmatic consultation. The impact minimization and conservation measures were developed by NMFS' ESB to ensure small dam removal actions in the Program will be conducted in a manner least damaging to steelhead and their habitat.

On March 2, 2015, the NOAA RC sent an email to NMFS containing a revised BA and "Small Dams Memo" dated February 23, 2015, for NMFS to develop an improved understanding of the effects of the proposed action on threatened and endangered steelhead and designated critical habitat for these species. Many of the measures developed by NMFS' ESB were incorporated into the Program and are specified in Appendix A of this opinion.

On April 29, 2015, the NOAA RC agreed to NMFS' request to extend the duration of the ongoing ESA Section 7 consultation from June 4, 2015, to July 13, 2015, owing to the 6 weeks that transpired while NMFS collaborated with the RC and Sustainable Conservation and then awaited receipt of the final BA.

On June 12, 2015, the NOAA RC notified NMFS by email that they were removing their request for EFH consultation from the proposed action based on discussions with NMFS' Protected Resources Division. In their correspondence, the NOAA RC indicated they would seek EFH consultations on a case-by-case basis for any coastal wetland projects that may affect EFH pursuant to section 305 (b)(4)(A) of the Magnuson-Stevens Fishery Conservation and Management Act and the Fish and Wildlife Coordination Act.

On June 29, 2015, NMFS teleconferenced with and notified NOAA RC staff that the U.S. Army Corps of Engineers (Corps) could not be listed as a co-lead applicant on the consultation as indicated in the BA until NMFS received a request for consultation from the Corps. In an e-mail on July 3,

2015, the NOAA RC asked NMFS to proceed with development of the draft biological opinion without the Corps as a co-applicant, and to remove the proposed action regarding installation of infiltration galleries because it was inadvertently included in the project description. In the same email the NOAA RC suggested modification to the proposed action by establishing a 900-cubic yard sediment storage threshold for small dam removal projects, unless additional analysis demonstrated that chronic sedimentation would be avoided or minimized.

On July 8, 2015, the NOAA RC informed NMFS that they were sending the Corps a letter requesting Corps participation in the consultation as a co-lead action agency, and the NOAA RC expressed their willingness to extend the duration of the consultation to July 31, 2015, at which time they requested the opportunity to review the draft opinion. On July 29, 2015, NMFS sent an e-mail to the NOAA RC explaining that a final draft biological opinion would be provided to them for their review about two weeks after NMFS receives the Corps' letter requesting consultation.

On August 5, 2015, NMFS was informed that the Corps possessed sufficient federal nexus and would be a co-lead federal action agency. In addition, NMFS understood it would soon receive a letter from the Corps requesting consultation. On September 3, 2015, NMFS received the Corps' letter that determined the proposed restoration projects would result in discharges of fill material in waters of the United States. Because these activities require authorization under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act, the Corps requested consultation as an action agency on this programmatic biological opinion for the purpose of screening potential projects where the applicant applies for a Corps permit for authorization under this Restoration Program.

On October 5, 2015, NMFS provided the draft biological opinion to the NOAA RC. The draft biological opinion concluded the proposed action is not likely to jeopardize the continued existence of the endangered Southern California DPS of steelhead and is not likely to destroy or adversely modify critical habitat for this species.

On October 23, 2015, NMFS received a letter from the NOAA RC that contained comments on the draft biological opinion. On November 12, 2015, the NOAA RC, NMFS and the Corps participated on a teleconference to discuss suggested revisions to the biological opinion. On November 13, 2015, the NOAA RC sent an email providing additional information on topics discussed during the teleconference and included comments to clarify roles of the federal action agency.

On November 18, 2015, NMFS shared select revisions of the biological opinion with the NOAA RC. In an email from the NOAA RC on November 19, 2015, biological opinion reporting timeframes and monitoring requirements were verified. On November 24, 2015, the NOAA RC sent a follow-up email clarifying that the proposed action should be revised to only include small dam removal projects impounding less than 900-cubic yards of sediment.

This biological opinion is based on the best scientific and commercial data available, including the description of the proposed action (SusCon 2015). A complete administrative record for this consultation is maintained on file at NMFS' office in Long Beach, California.

1.2.2 Past Consultation History

NMFS has consulted with the NOAA RC on similar programmatic restoration activities since 2006. In particular, NMFS consulted formally with the NOAA RC on proposed actions that were expected to adversely affect endangered steelhead and designated critical habitat for this species (see Table 1 for a detailed list of the past consultations and specific proposed actions). In the subject biological opinions, NMFS concluded the proposed action is not likely to jeopardize the continued existence of endangered steelhead or result in the destruction or adverse modification of designated critical habitat for this species. However, this current consultation differs from past consultations in a few notable respects.

One difference is that this current Program includes the use of explosives as a proposed method for small-dam removal. Another difference is that the current Program does not prohibit small-dam removal projects based on the amount of sediment stored upstream. In addition, debris-basin dams (prevalent throughout southern California) were added to the Program list of eligible dam types covered by this opinion. Lastly, due to the uniqueness of the southern California landscape (e.g., confined streams owing to urbanization, high sediment loads, flashiness of the streams), a Small Dam Memo was developed by the RC to specify additional data requirements that Applicant must comply with before undertaking removal of small dams in southern California (Appendix A).

With regard to the action area, the biological opinion developed for the Corps' permitting of the California Department of Fish and Wildlife's (CDFW) Fisheries Restoration Grant Program (FRGP) is similar in geographical scope to the area covered for this biological opinion, but the FRGP opinion also covered San Bernardino and Riverside counties. However, the FRGP opinion did not cover the following activities that are part of the new proposed action now considered in this biological opinion: (1) removal of small dams, (2) creation of off-channel/side-channel habitat, (3) water-conservation projects, (4) use of explosives for barrier removal, and (5) placement of imported spawning gravel.

Table 1. List of past U.S. Endangered Species Act formal Section 7 consultations undertaken between NMFS and the NOAA RC and (or) Corps for similar activities that are the basis of the RC's proposed action.

Existing Programmatic Biological Opinions	Reference	Date Opinion Became Effective	Opinion Expiration Date
NOAA RC – Central California Opinion	NMFS 2006a	21-June-06	21-June-16
Corps – Southern California FRGP Opinion	NMFS 2008a	23-May-08	23-May-15
NOAA RC – Northern California Opinion	NMFS 2012a	21-Mar-12	21-Mar-22
NOAA RC – OR, WA and ID Opinion	NMFS 2013a	03-Dec-13	03-Dec-23

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 threatened South-Central California Coast Steelhead Distinct Population Segment (DPS) of steelhead (*Oncorhynchus mykiss*) and the endangered Southern California Coast Steelhead DPS of steelhead, and designated critical habitat for these species, are present in the areas to be affected by the proposed action.

The NOAA RC is the lead Federal Agency for Restoration Program activities (described in section 1.3.2) and will provide funding for these restoration activities, and the Corps is the action agency responsible for permitting the restoration activities that occur within the bankfull width of stream channels. All restoration projects included in the Program and covered by this biological opinion will be subject to the administration process described in the Oversight and Administration section of this biological opinion (section 1.3.5). Restoration projects may be submitted to the Program by either the Corps or the NOAA RC.

This section of the biological opinion describes the main components and activities that comprise the proposed action, organized below into eight main categories: (1) *Summary of Program Characteristics*, (2) *Program Activities, (3) Excluded Program Activities, (4) Data Requirements (including sub-categories for certain project types), (5) Oversight and Administration, (6) Proposed Monitoring and Reporting, (7) Protection Measures, and (8) Action Area* (SusCon 2015). Each of these are described as follows.

1.3.1 Summary of Program Characteristics

This biological opinion specifically considers restoration projects funded by the NOAA RC, or projects that require a section 404 permit from the Corps and are determined by the RC to be within the scope of the Program (referred to as "qualifying projects"). To specifically qualify, all proposed restoration projects must satisfy one or more of the following objectives: 1) restore degraded steelhead habitat, 2) improve instream cover, pool availability, and spawning gravel; 3) remove barriers to fish passage; and, 4) reduce or eliminate sources of erosion and sedimentation. Due to the evolving nature of the various techniques and guidelines for salmonid restoration, the NOAA RC requires that projects authorized under this Program must adhere to the most current practices and best available guidelines and techniques for design and implementation.

The number of restoration projects implemented on an annual 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 potentially other factors not considered here. The NOAA RC and Corps have estimated that on average 10 to 15 projects will be implemented annually, and a maximum of 150 restoration projects will be constructed during the proposed 10-year term of this biological opinion (see Table 2). Potential sources of funding for stream restoration projects in this region that may utilize this biological opinion include the NOAA RC, United States Fish and Wildlife Service (USFWS), U.S Department of Agriculture's Natural Resources Conservation Service (NRCS), U.S. Forest Service (USFS), National Park Service (NPS), Bureau of Land Management (BLM), California Department of Parks and Recreation, California Wildlife Conservation Board (WCB), State Coastal Conservancy, California Department of Water Resources (DWR), and National Fish and Wildlife Foundation (NFWF).

Table 2. Estimated annual number of restoration projects that the NOAA RC has determined will be implemented under this NOAA RC and Corps Restoration Program based on NOAA RC project implementation on California's North Coast (since 2012) and North-Central and Central Coast region (since 2006) (Sus Con 2015).

Geographical Area	Average Annual Number of Projects Implemented / Expected	Maximum Annual Number of Projects Implemented / Expected
North Coast Region (NMFS'Arcata Office)	7	15
North-Central and Central Coast (Santa Rosa Office)	8	18
Estimated Total for South-Central / Southern California DPS combined	**10**	**15**

Habitat restoration projects will be designed and implemented consistent with techniques and minimization measures presented in California Department of Fish and Wildlife's (CDFW) *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. 1998, hereafter referred to as the "CDFW Manual").

1.3.2 Program Activities

The following is a summary of the Program's restoration activities considered in this biological opinion. The proposed instream construction period for all Program activities is June 1 through November 30. For greater detail and discussion of sideboards proposed for any of the specific activities see the Program biological assessment (SusCon 2015).

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, digger logs, spider logs, and log and boulder combinations), boulder structures (boulder weirs, vortex boulder weirs, boulder clusters, and single and opposing log wing-deflectors), log structures (log weirs, upsurge weirs, single and opposing log wing-deflectors, engineered log jams, and Hewitt ramps), and placement of imported spawning gravel. Implementation of these 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 to the greatest extent feasible. 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.

2. *Instream Barrier Modification for Fish Passage Improvement*.—Instream barrier modification projects are intended to improve steelhead passage and increase access to currently inaccessible or difficult-to-access steelhead habitat. Projects may include those designed to improve passage at existing culverts, bridges, debris basin 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 pools to facilitate jumps, or interior baffles or weirs to mediate velocity and the effects of shallow sheet flow. 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.). Proposed projects must be designed and implemented consistent with CDFW's Manual, specifically Part IX (*Fish Passage Evaluation at Stream Crossings*) and Part XII (*Fish Passage Design and Implementation*).

3. *Bioengineered Stream Bank Stabilization and Riparian Habitat Restoration.*—This category of proposed activities are intended to reduce sediment from bank erosion by stabilizing streambanks with site specific techniques including: boulder stream bank stabilization structures, log stream bank stabilization structures, tree revetment, native plant material revetment, willow wall revetment, willow siltation baffles, brush mattresses, natural fiber rolls, riparian vegetation check dams, water bars, and exclusionary fencing. The proposed riparian habitat restoration projects are intended to aid in the restoration of natural riparian habitat by increasing the number of plants and plant groupings, and include the following specific types of projects: natural regeneration, livestock exclusionary fencing, bioengineering, and revegetation projects. Guidance for stream bank stabilization techniques is described in Part VII (*Project Implementation*) and Part XI (*Riparian Habitat Restoration*) of the CDFW Manual, but projects are not limited to the bank stabilization and habitat restoration techniques discussed in the CDFW Manual. Implementation of these project types may require the use of heavy equipment.

4. *Upslope Watershed Restoration.*—Upslope watershed restoration projects are intended to reduce delivery of sediment to steelhead streams. Proposed road-related upslope watershed restoration projects include: road decommissioning, road upgrading, and storm-proofing roads. Part X of the CDFW Manual (*Upslope Assessment and Restoration Practices*) describes methods and provides guidance for identifying and assessing erosion problems, evaluating appropriate treatments, and implementing erosion control treatments in steelhead streams. Upslope watershed restoration projects are not limited to the methods described in the CDFW Manual. Implementation of these types of projects may require the use of heavy equipment.

5. *Removal of Small Dams.*—The NOAA RC/Corps proposed small dam removal to restore fisheries access to historic habitat for spawning and rearing and to improve long-term habitat quality and proper stream geomorphology. Proposed types of small dams considered under this program activity include permanent, flashboard, debris basin, and seasonal dams.

Project applicants are required to provide project designs to NOAA technical monitors during the project review process. Data requirements and analysis to be provided with dam removal project design should attempt to meet NMFS 2011 Anadromous Salmonid Passage Facility Design

guidelines (NMFS 2011). If proposed project designs do not meet the NMFS 2011 guidelines a variance may be granted at the discretion of NOAA RC and NMFS engineers if there is a clear benefit to fish passage. Applicants will be required to implement the NOAA RC Fish Passage Barrier Removal Performance Measures and Monitoring Worksheet (see Appendix C) that includes recommended regional fish passage criteria for fish passage projects.

Two proposed conditions that may preclude a small dam removal project from eligibility for coverage under this opinion involve:(1) if sediments stored behind dam have a reasonable potential to contain environmental contaminants (dioxins, chlorinated pesticides, polychlorinated biphenyls, or mercury) beyond the freshwater probable effect levels summarized in the NOAA Screening Quick Reference Table guidelines (see Buchman 2008) or (2) 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 has occurred. In these cases, sediment sampling is required for a project to be properly evaluated.

As referenced in the *Consultation History*, the NOAA RC and Corps have proposed to use explosives for small dam removal. The Program requires that any use of explosives for small dam removal must be justified by the applicant owing to site-specific conditions that preclude the use of mechanical removal (e.g., no access for heavy equipment). Further, use of explosives must be conducted in dry or dewatered conditions, and any potential harm to steelhead from the explosives blast and pressure waves must be adequately analyzed.

Supplemental detailed information regarding the removal of small dams was provided to NMFS by the NOAA RC and these requirements appear in Appendix A, and are outlined in the Data Requirements section of this biological opinion.

6. *Creation of Off-channel/Side-channel Habitat Features.*— These restoration projects may include removal or breaching of levees and dikes, channel and pond excavation, creating temporary access roads, constructing wood or rock tailwater control structures, and construction of large woody material and rock boulder habitat features. Implementation of these types of projects may require the use of heavy equipment.

Additionally, the NOAA RC/Corps proposed that these types of projects are likely to occur in lower mainstem river channels or estuarine habitats. The specific types of side-channel or off-channel habitat features proposed for this Program involve: (1) reconnection of abandoned side-channel or pond habitats to restore steelhead access, (2) connection of adjacent, floodplain mining pits, (3) oxbow lakes on floodplains that have been isolated from the meandering channel by river management actions, or channel incision, (4) new side-channel or off-channel habitat features that create self-sustaining channels that will be maintained through natural processes, and (5) increasing the hydrologic connection between floodplains to main channels. Off-channel ponds constructed under this proposed action will not be eligible as a point of water diversion. Logs or boulders are proposed to be used as stationary water level control structures. All off-

channel /side-channel habitat creation project designs will require review by NMFS or CDFW engineers (SusCon 2015).

The Program requires that information regarding water supply (channel flow/overland flow/groundwater), water quality, and water source reliability, risk of channel change, and channel/hydraulic grade, must be provided by project proponent for agency review. Project data should 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).

7. *Water Conservation Projects*.—The NOAA RC/Corps proposed water-conservation projects to increase streamflow. Specific techniques for water-conservation projects may involve developing an alternative off-stream water supply (e.g., wells, ponds), creating tail water collection ponds, installing water storage tanks, piping ditches and/or re-profiling ditches, and installing fish screens, head gates and water measuring devices. Additional details for these specific Program activities can be found in the biological assessment (SusCon 2015). Implementation of these types of projects may require the placement of infrastructure (i.e., screens, headgates, pumps, and piping) in or adjacent to the stream to provide alternative water intake facilities. Mechanized equipment may be used to install the water-conservation infrastructure, but hand labor will be utilized when possible. All water conservation projects included in this Program will require "stream diverters" to verify compliance with water rights.

1.3.3 Activities Excluded from the Program

The following activities are not within the scope of the NOAA RC and Corps Restoration Program; hence, they are not analyzed in this opinion:

- off-channel/side-channel habitat projects that require the installation of a flashboard dam, head gate or other mechanical structures;
- projects that have the potential to create a steelhead passage barrier as determined by NMFS Fish Passage guidelines (including any associated maintenance activities, or lack thereof);
- projects that would dewater or disturb more than 500-feet of contiguous stream;
- dam removal projects that impound more than 900-cubic yards of sediment;
- riprap bank protection, other than bridge installation projects where the minimum amount of riprap needed to protect against scour is permitted;
- installation of infiltration galleries;
- construction of new or retrofitting of older fish ladders/fish ways; and
- construction of concrete-lined channels of any sort.

1.3.4 Data Requirements

This section describes the data and required analyses that project applicants must provide to the RC and the Corps to evaluate if the proposed restoration project is a covered Program activity. These data requirements were taken directly from the BA (SusCon 2015).

Small Dam Removal 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 a small dam removal project, along with the potential data needs for a more complex project, are listed below.

A. Minimal Data Requirements

1) A clear statement of the steelhead passage objectives of the project. Objectives shall be explicitly stated for any small dam removal project (e.g., to improve steelhead passage, improve sediment continuity and downstream spawning habitat, and/or to provide passage meeting specific steelhead passage guidelines).
2) A clear statement and justification for the project's method of restoring the channel along with a sediment-management plan.
3) 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.
4) The distance and location of nearest upstream grade-control feature (natural or anthropogenic).
5) An estimate of depth, volume and grain size distribution 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, quantify sediment grain size distribution and quantify the stored sediment. Wolman pebble counts (Harrelson et al 1994 and Kondolf 1997) should be used to characterize the sediment quality (i.e., grain size distribution) above and below the dam along the same five cross-sections used to quantify the stored sediment.
6) Detailed information on project/reference reach including:

    - Location of project/reference reach.
    - 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.
    - Any existing geomorphic features present and that will be incorporated into the channel (e.g. pools, riffles, runs, step-pools, etc.).

- 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.
- Maximum channel slope: determined through the site before and after the project using pre-project and as-built (post-project) longitudinal profiles
- 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.
- 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.

7) 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 Restoration Manual).
8) Post construction monitoring results: based on a post-implementation survey, the applicant should provide as-built conditions of channel width, channel slope, and maximum jump height.
9) The number of stream miles blocked by each small dam project should be estimated before removal and verified as steelhead accessible 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) Operation and maintenance costs: Determine the expected operation, maintenance and/or liability costs over the next 5 years of the dam's operation if the dam were to remain in place. Periodic or less frequent costs that may occur during this period (e.g. structural upgrades to meet safety or regulatory requirements may be incorporated into this estimate). Determine the expected operation, maintenance and/or liability costs over the next 5 years if the dam is removed. Provide a comparison of these two estimates.
11) A survey of any downstream spawning areas that may be affected by sediment released by removal of the dam.
12) Surveys to assess presence of steelhead. The surveys will be stratified according to pre-implementation and post-implementation for a particular habitat-improvement activity, as described more fully below.

    Pre-implementation: Under the proposed action, one of the following survey techniques, defined in California Coastal Salmonid Population Monitoring: Strategy, Design, and Methods (Adams et al. 2011), will be used 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 steelhead. If a pre-implementation survey is not possible, report whether the barrier is a known full barrier or partial barrier for steelhead. 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.)

Post-implementation: 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. 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, this parameter should be monitored one time following implementation, and if funding 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. Once target fish presence is detected upstream of the project site post-implementation, monitoring for this measure is complete. 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.

B. Potential Data Needs for Complex Small Dam Removal Projects

1) Hydraulic modeling immediately upstream and downstream of the project site, and throughout the project reach.
2) 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.
3) A detailed geomorphic assessment of the watershed and/or stream reach.
4) A detailed hydrologic analysis of the watershed and how it will drive the geomorphic conditions within the watershed before and after dam removal.
5) 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.

1.3.4.1 More Complex Project Types Requiring Additional Oversight and Engineering Review

More complex project types covered by this programmatic consultation will require a greater level of oversight (e.g., engineering review) and review by the NOAA RC and Corps, which will consult with NMFS biologists and NMFS or CDFW engineers when appropriate. These project types involve (1) fish passage at stream crossings, (2) permanent removal of flashboard-dam abutments and sills, (3) removal of small dams involve special or complex conditions such as those in high risk areas (e.g. urbanized streams), dams in the lower portions of watersheds (where head cuts could be sent up multiple tributaries), and dams located in heavily incised channels, (4) debris basin removal, and (5) creation and/or connection of off-channel habitat features.

Specific requirements associated with these more complex project types include the following:

1) For stream crossing and small dam projects, if the stream at the project location was not passable to or was not utilized by all life stages of steelhead prior to the existence of the road crossing, the project shall pass the life stages of steelhead that historically passed there. Retrofit culverts shall meet steelhead passage criteria for all life stages historically passing through the site prior to the existence of the road crossing according to NMFS and CDFW stream crossing criteria.

2) All designs for dam removal, off-channel habitat features, and steelhead passage projects must be reviewed and authorized by NMFS (or CDFW) engineers prior to commencement of work. Off-channel habitat projects that reduce the potential for stranding using water control structures will be encouraged, but uncertainties in future stream flows and drought conditions cannot be predicted and may result in fish stranding in certain flow conditions.

1.3.4.2 Limitations on Project Size and Footprint

Any adverse impacts that may result from construction activities in this Program are proposed to occur on a localized scale. One impact associated with this Program that may extend beyond the project footprint is the disturbance of stream substrate that may increase stream turbidity. But as discussed in greater detail in this opinion (see Section 1.4), the extent of the impact is expected to remain localized and the release of fine sediment from project sites is expected to only occur during storm events when natural runoff has elevated stream turbidity. To further minimize the potential for short-term adverse impacts, the following limitations apply to individual projects that can be authorized under the proposed programmatic consultation each year:

1) Maximum length of stream dewatered per project is 500 linear feet.
2) The disturbance footprint for a project's staging areas may not exceed a total of 0.5 acres.
3) 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 > 36-in. dbh will be retained. In limited cases removal will be permitted if trees/snags occur over culvert fill. No removal will occur without a site visit and written approval from the NOAA RC.
4) 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 process for administration of the Program. According to the description of the proposed action, the NOAA RC will bear primary Program administration responsibilities. The NOAA RC will communicate directly with staff from the Corps regarding all proposed actions that require a Corps permit. Project applications for in-channel fisheries restoration projects, consistent with those actions covered by the Program, will require a Corps

permit[1]. The NOAA RC proposes creating a team comprised of staff from the NOAA RC, Corps and NMFS' Southern California Branch Office (as available) to participate in the oversight of projects that are proposed to be authorized each year. The NOAA RC will track the overall number and locations of projects, and any incidental take that occurs, resulting from Program activities each year to ensure compliance with the limits and protection measures outlined in the proposed action. The following summarizes the proposed process the NOAA RC has outlined for reviewing individual projects for consideration and authorization under the Program and the annual administration process.

1) *Submittal of project applications to be considered for authorization under the programmatic consultation.*— All proposed projects that are funded by non-NOAA RC sources must (a) receive section 404 or section 10 permits from the Corps, and (b) meet all the requirements and limitations described in the proposed action.

2) *Timeline for Submittals/Review.*—Project applications will be submitted throughout the year and distributed to/by NOAA RC and Corps staff for review and approval. For projects requiring NMFS' Southern California Branch Office review, a minimum of 45 days will be scheduled for biologist review. For complex projects requiring engineering review (see Section 1.3.4), a more lengthy review process is anticipated. The engineering review process shall be coordinated on a case-by-case basis with NMFS and/or CDFW engineers.

3) *Submittal Requirements.*—Project applicants seeking coverage under the Restoration Program must submit sufficient information about their project to allow the NOAA RC and Corps 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 NOAA RC (for NOAA 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 above in section 1.

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

   b) Project description containing the following:
      i) Project problem statement;
      ii) Project goals and objectives, etc.;
      iii) Watershed context;
      iv) Description of the type of project and restoration techniques utilized (culvert replacement, instream habitat improvements, etc.);
      v) Project dimensions;
      vi) Description of construction activities anticipated (types of equipment, timing, staging areas or access roads required);

[1] The NOAA RC website will include a link to the Corps-Los Angeles District Regulatory Division's website which provides instructions for the Corps' section 404 application requirements. The NOAA RC will coordinate closely with the Corps each year to ensure that they have received all project applications in a timely manner for the appropriate section 404 permit to prevent project delay.

vii) 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 steelhead;
viii) Construction start and end dates;
ix) Estimated number of creek crossings and type of vehicle;
x) Materials to be used;
xi) 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;
xii) Description of existing site conditions and explanation of how proposed activities improve or maintain these conditions for steelhead within expected natural variability; and,
xiii) 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 steelhead in project area.

c) Description of applicable protection measures incorporated into the project (as described in Appendix B).

d) A proposed monitoring plan for the project describing how the applicant will ensure compliance with the applicable monitoring requirements described in the programmatic opinion (e.g., photo monitoring, revegetation, etc.), including the source of funding for implementation of the monitoring plan.

e) 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.

4) *Initial Project Screen by NOAA RC and the Corps.*—The Corps will be the first level of review for projects received by the Corps as part of the 404 or section 10 permit application process. The NOAA RC will be the first level of review in screening potential NOAA RC-funded projects for authorization under the proposed action. The NOAA RC will first determine whether the project's goals, techniques, location and design are consistent with the proposed action. Then, the NOAA RC will determine whether the project is (a) "*Not Likely to Adversely Affect"*, or (b) "*May Affect"*, and whether the proposed action comports to the conditions of the opinion. Under the proposed action, prospective project proponents not receiving NOAA RC funds are required to submit an application to the NOAA RC, whom would then review the application to identify whether projects qualify for use on the NOAA RC's Program.

5) *Authorization of Projects and Field Checks.*—NOAA RC and Corps staff will utilize a pre-established checklist (i.e., "checklist for consistency") in reviewing submitted projects to determine whether they meet the requirements of the Restoration Program. Once projects have passed through the initial screen to exclude proposals that are outside the scope of the Restoration Program, staff will compile a report (e.g., project summary sheet) that includes information about each project (e.g., size, description, type/s of work proposed, DPSs present, etc.) proposed for authorization for the upcoming construction season. Field visits may be necessary before projects are authorized for inclusion in the Restoration Program.

6) *NOAA RC Authorization and Project Construction*.—With NOAA 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 Appendix B).

7) *Post-Construction Implementation Monitoring and Reporting*.—Qualifying applicants will be required to carry out all post-construction implementation monitoring for projects implemented under this NOAA RC and Corps Restoration Program. This will include photo-documentation (using standardized guidelines for photo-documentation consistent with the pre-construction monitoring requirements); as-built drawings for projects with an engineering component; evidence of implementation of required avoidance, minimization, and mitigation measures; 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 Corps and NOAA RC for data assembly described in below.

8) *Project Tracking and the Annual Report.*—The NOAA RC and Corps propose to work with NMFS to maintain a database that includes information on all Program activities implemented under this 10-year RGP. To monitor any impacts to steelhead and critical habitat during the term of the RGP, and to track any incidental take of listed steelhead, the NOAA RC and Corps will annually prepare and submit to NMFS a report of the previous year's restoration activities (see details below under *Proposed Monitoring and Reporting Requirements*). 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 Proposed Monitoring and Reporting Requirements

The NOAA RC proposes that all applicants shall utilize standard post-construction monitoring protocols developed under the lead of CDFW for their Fisheries Restoration Grant Program (FRGP). These are the same current monitoring protocols CDFW follows for implementation of their FRGP. The current proposed monitoring forms and instructions used by CDFW are enclosed in Appendix D (URL contained in appendix to ensure compliance with most recent requirements). In addition, applicants will utilize NMFS' September 2001 Guidelines for Salmonid Passage at Stream Crossings for post-construction evaluation and long-term maintenance and assessment protocols.

1. *Post-construction Monitoring and Reporting Requirements*.—Implementation monitoring will be conducted for all projects implemented under this NOAA RC and Corps Restoration Program. Following construction, project applicants must submit a post-construction implementation report to NOAA RC and the Corps. Submittal requirements 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 steelhead killed or injured during the

proposed action; the number and size (in millimeters) of any steelhead captured and removed; and any effects of the proposed action on steelhead not previously considered.

2. *Monitoring Requirements for Off-channel/Side-channel Habitat Features*.—Restoring off-channel/side-channel habitats is a relatively new restoration practice in California and the lessons learned through monitoring these features will provide valuable information for adaptive management and future projects. All off-channel/side-channel habitat projects implemented under this NOAA RC and Corps Restoration 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 NOAA RC and Corps:

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

   b. Project Description that contains the following:
      i. Project problem statement;
      ii. Project goals and objectives, etc.;
      iii. Watershed context;
      iv. Description of the type of off-channel feature and restoration techniques utilized;
      v. Project dimensions;
      vi. Description of outlet control feature (if present);
      vii. 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;
      viii. Construction start and end dates,
      ix. Materials to be used;
      x. 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;
      xi. Description of existing site conditions and explanation of how proposed activities improve or maintain these conditions for steelhead, within the range of natural variability expected at the site;
      xii. 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 steelhead in the project area;
      xiii. 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;
      xiv. 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; and
      xv. A description of any stranded fish observed. If steelhead are stranded, the applicant will contact NMFS and NOAA RC staff immediately to determine if a fish rescue action is necessary. CDFW (Mary Larson, (562) 342-7186) may also be contacted and provided with fish rescue information and/or mortalities by species.

1.3.7 Annual Report

Annually, the NOAA RC and Corps will prepare a report summarizing results of projects implemented under this NOAA RC and Corps Restoration 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 DPS affected. The report shall include the following project-specific summaries:

1) Steelhead relocation activities, including the number of individuals in each DPS that are relocated and the number of individuals 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/side-channel habitat features enhanced or created.
4) The length of streambank (feet) stabilized or planted with riparian species.
5) The number of culverts replaced or repaired, including the number of miles of restored access to unoccupied steelhead habitat.
6) The size and number of dams/barriers removed, including the number of miles of restored access to unoccupied steelhead habitat.
7) The distance (feet) of aquatic habitat disturbed at each project site.

1.3.8 Protection Measures

The NOAA RC proposed protection measures, as they apply to particular project impacts, to be incorporated into the project descriptions for individual projects authorized under the Program. A complete list of these protection measures is attached in Appendix B.

1.4 Action Area

The action area is defined as all areas affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). The NOAA RC proposed that restoration projects could potentially occur within any coastal stream that is designated as critical habitat or have the potential to be occupied by steelhead, from the northern San Luis Obispo County line to the U.S.-Mexico border. The NOAA RC has proposed that most restoration activities involving instream construction will affect only the immediate project site, but has acknowledged that fine sediment releases from some restoration activities may have short term effects such as an increase in turbidity and sediment movement for a short distance downstream during storm events within the first year in which significant runoff occurs following construction. Based on the NOAA RC proposed measures to minimize disturbance from instream construction, including eliminating the use of mechanized equipment in wetted channels and use of appropriate erosion prevention measures after construction until erosion has subsided, NMFS anticipates that turbidity for instream construction projects will extend downstream no more than 100-feet. Water conservation projects involving removal of streamflow or groundwater within the riparian corridor are expected to affect all downstream habitats in the watersheds where these projects occur.

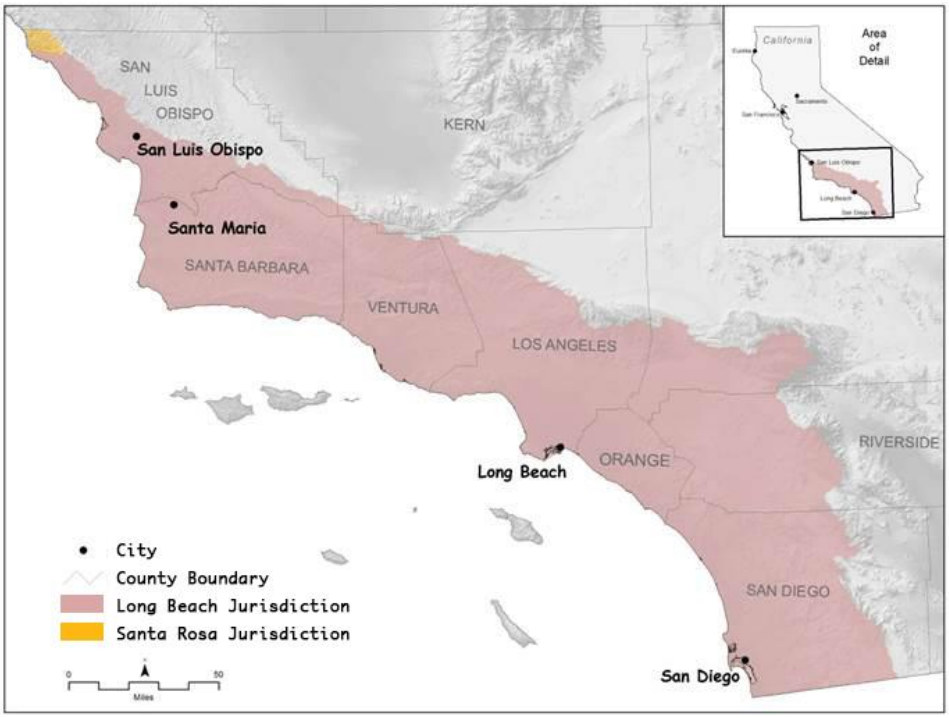

Figure 1. Map showing extent of the action area for the proposed Program (SusCon 2015).

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

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitat. If incidental take is 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 does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[2]

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

- Identify the range-wide status of the species and critical habitat likely to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.
- Reach jeopardy and adverse modification conclusions.
- If necessary, define a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

Because this biological opinion considers the potential effects of the proposed action on the threatened SCCCS DPS and endangered SCS DPS of steelhead and critical habitat for the species, the status of steelhead and critical habitat as well as the species' life history and habitat requirements are described as follows.

[2] 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).

Table 3. This biological opinion analyzes the effects of the proposed action on the following listed DPSs and designated critical habitat, which occur in the action area.

Threatened South-Central California Coast Steelhead Distinct Population Segment (SCCCS DPS)

Salmonid Species	ESU/DPS Name	Original Listing	Revised Listing(s)	4(d) Protective Regulations	Critical Habitat Designations
Steelhead *(O. mykiss)*	South-Central California Coast Steelhead DPS (SCCCS DPS)	FR Notice: 62 FR 43937 Date Listed: 08/18/1997 Classification: Endangered	FR Notice: 71 FR 5248 Date: 01/05/2006 Re-classification: Threatened Status Review 5-year Update Date: 05/20/2011 Extinction Risk: No Change (Threatened)	FR Notice: 70 FR 37160 Date: 06/28/2005	FR Notice: 70 FR 52488 Date: 09/02/2005

Endangered Southern California Coast Steelhead Distinct Population Segment (SCS DPS)

Salmonid Species	ESU/DPS Name	Original Listing	Revised Listing(s)	Critical Habitat Designations
Steelhead *(O. mykiss)*	Southern California Coast Steelhead DPS (SCS DPS)	FR Notice: 62 FR 43937 Date Listed: 08/18/1997 Classification: Endangered	FR Notice: 67 FR 21586 Date: 05/01/2002 Classification: Southern Range Extension FR Notice: 71 FR 5248 Date: 01/05/2006 Re-classification: Endangered	FR Notice: 70 FR 52488 Date: 09/02/2005

2.2.1 Summary Description and Status of each Species

SCCCS DPS

Steelhead, an ocean-going form of rainbow trout, are native to Pacific Coast streams from Alaska to California and have decreased significantly from their historic levels (Swift et al. 1993). Reasons for the decline of steelhead (including factors affecting steelhead) include past and present destruction, modification or curtailment of the species habitat; over-utilization for commercial, recreational and educational purposes; disease and predation; and inadequacy of existing regulatory mechanisms (August 18, 1997, 62 FR 43937; January 5, 2006, 71 FR 834). The decline of the species prompted listing of the SCCCS DPS of steelhead as threatened on 18

August 1997 (62 FR 43937). Coastal steelhead occupy rivers from the Pajaro River, Santa Cruz County, south to but not including the Santa Maria River, in Santa Barbara County. NMFS characterized the abundance of steelhead in the SCCCS DPS when the species was originally listed (August 18, 1997, 62 FR 43937) and cited this information as the basis for the recent relisting of SCCC steelhead (January 5, 2006, 71 FR 834). In the mid-1960s the CDFW estimated an annual run size of 17,750 adult steelhead spawning in this coastal DPS. Recent estimates for those SCCCS DPS rivers where comparative abundance information is available generally show a substantial decline during the past 30 years. For instance though no recent estimates for total run size exist for the entire DPS, there are recent run size estimates available for five rivers (the Pajaro River, Salinas River, Carmel River, Little Sur River, and Big Sur River). The total annual run of steelhead for these five rivers is currently estimated at fewer than 500 adults compared with a total of 4,750 for the same rivers in 1965, which suggests a substantial decline for this entire DPS from 1965 levels. Abundance observations for adult steelhead in the Carmel River are the only time series within the SCCCS DPS with data gathered for 1964 through 1977 and 1988 to 2002 (Good et al. 2005). Based on these data there was a declining trend in the population from 1964 to the early 1990's but an increase in localized abundance (Good et al. 2005) in this system from the early 1990's to 2002. Despite this recent increase in abundance the estimated population of steelhead in this system is still less than 5% of historic population estimates and it is uncertain if this upward trend will be sustained into the future.

As part of the assessment and listing of SCCC steelhead, NMFS convened a biological review team (BRT) composed of an expert panel of scientists. The BRT evaluated the viability and extinction risk of naturally spawning populations within each DPS. The BRT found high risks to abundance, productivity, and the diversity of the SCCCS DPS and expressed particular concern for the DPS's connectivity and spatial structure. During the most recent status review for SCCC steelhead (Williams et al. 2011) it was determined that there is little evidence to suggest that the biological status of the overall population has changed appreciably and factors for the population's decline appeared to have essentially remained unchanged. As a result, the review concluded that the SCCCS DPS of steelhead should continue to be listed as a threatened population.

SCS DPS

The geographic range of this DPS extends from the Santa Maria River, near Santa Maria, to the California–Mexico border (NMFS 1997, 2002, 2006), which represents the known southern geographic extent of the anadromous form of *O. mykiss*. NMFS described historical and recent steelhead abundance and distribution for the southern California coast through a population characterization (Boughton et al. 2006). Surveys in Boughton et al. (2005) indicate between 58 percent and 65 percent of the historical steelhead basins currently harbor *O. mykiss* populations at sites with connectivity to the ocean. Most of the apparent losses of steelhead were noted in the south, including Orange and San Diego counties (Boughton et al. 2005). The majority of losses (68 percent) of steelhead were associated with anthropogenic barriers to steelhead migration (e.g., dams, flood-control structures, culverts, etc.). Additionally, authors found the barrier exclusions were statistically associated with highly-developed watersheds.

Steelhead in southern California are categorized as "winter run" because they can migrate into natal streams between December and April (e.g., Fukushima and Lesh 1998), arriving in reproductive condition and spawning shortly thereafter. Adults may migrate several miles, hundreds of miles in some watersheds, to reach their spawning grounds. Steelhead have evolved to migrate deep into the extreme fringes of a watershed to exploit the environmental conditions that favor production of young (e.g., Montgomery et al. 1999). Steelhead in southern California streams can be tolerant of warm water, remaining active and feeding at temperatures that are higher than the temperature preferences and heat tolerances reported for the species based on individuals from northern latitudes (Spina 2007). While 46 drainages support this DPS (see Table 4), only 10 population units possess a high and biologically plausible likelihood of being viable and independent[3] (Boughton et al. 2006).

Although the geographic area of the DPS is broad, the individual population units are sparsely and unevenly distributed throughout the DPS with extensive spatial breadth often existing between nearest-neighbor populations (Boughton et al. 2005, NMFS 2005a, and Boughton et al. 2006). Extinction of some population units has been observed as well as contraction of the southern extent of the species' geographic range (Boughton et al. 2005, Gustafson et al. 2007). One reason for the extensive spatial gaps between neighboring population units and the range contraction involves man-made barriers to steelhead migration (Boughton et al. 2005).

This DPS also experiences a high magnitude of threat to a small number of extant populations vulnerable to extirpation due to loss of accessibility to freshwater spawning and rearing habitat, low abundance, degraded estuarine habitats and watershed processes essential to maintain freshwater habitats (Williams et al. 2011). The recovery potential is low to moderate due to the lack of additional populations, lack of available/suitable freshwater habitat, high number of steelhead passage barriers, and inadequate instream flow. There is a moderate magnitude of threat to smaller watersheds, and higher risk in larger watersheds with major water supply and flood control facilities. Conflict was determined to be present due to existing and anticipated future development, habitat degradation, and conflict with land development and associated flood control activities and water supplies. There is little new evidence to suggest that the status of the Southern California Coast DPS has changed appreciably in either direction since publication of the last status review (Good et al. 2005, Williams et al. 2011). New information since the last review concerning the status of anadromous runs in the DPS is limited and does not suggest a change in extinction risk.

Extremely small (<10 fish) but surprisingly consistent annual runs of steelhead are currently being monitored across a limited but diverse set of basins within the range of this DPS (Williams et al. 2011). A relatively large number of adult steelhead were observed in 2008, two years after an extended wet spring that presumably gave smolts ample opportunity to migrate to the ocean. Some of the strength of the 2008 season may also be an artifact of conditions that year. Low rainfall appears to have caused many spawning adults to get trapped in freshwater, where they were observed during the summer; in addition, low rainfall probably improved conditions for viewing fish during snorkel surveys, and for trapping fish in weirs (Williams et al. 2011).

[3] Independent population: a collection of one or more local breeding units whose population dynamics or extinction risk over a 100-year time period is not substantially altered by exchanges of individuals with other populations (Boughton et al. 2006).

Table 4. South-Central (SCCCS DPS) and Southern California (SCS DPS) coastal basins historically and recently occupied by steelhead (N to S) based on historical data and surveys[1] (adapted from Boughton et al. 2006).

Basin	Extant? [2]	Basin	Extant? [2]
SCCCS DPS		Eagle Canyon	Not determined
San Carpoforo Creek	Y	Tecolote Canyon	Barrier
Arroyo de la Cruz	Not determined	Bell Canyon	Barrier
Little Pico Creek	Not determined	Goleta Slough Complex	Y
Pico Creek	Y	Arroyo Burro	Barrier
San Simeon Creek	Not determined	Mission Creek	Y
Santa Rosa Creek	Y	Montecito Creek	Y
Villa Creek	Y	Oak Creek	Barrier
Cayucos Creek	Y	San Ysidro Creek	Y
Old Creek	Negative observation	Romero Creek	Y
Toro Creek	Dry	Arroyo Paredon	Y
Morro Creek	Y	Carpinteria Creek	Y
Chorro Creek	Y	Rincon Creek	Barrier
Los Osos Creek	Y	Ventura River	Y
Islay Creek	Y	Santa Clara River	Y
Coon Creek	Y	Big Sycamore Canyon	Negative obs.
Diablo Canyon	Y	Arroyo Sequit	Y
San Luis Obispo Creek	Y	Malibu Creek	Y
Pismo Creek	Y	Topanga Canyon	Y
Arroyo Grande Creek	Y	Los Angeles River	Barrier
SCS DPS		San Gabriel River	Barrier
Santa Maria River	Y	Santa Ana River	Barrier
Santa Ynez River	Y	San Juan Creek	Negative obs.
Jalama Creek	Negative obs.	San Mateo Creek	Y
Cañada de Santa Anita	Y	San Onofre Creek	Dry
Cañada de la Gaviota	Y	Santa Margarita River	Negative obs.
Canada San Onofre	Negative obs.	San Luis Rey River	Barrier
Arroyo Hondo	Y	San Diego River	Barrier
Arroyo Quemado	Barrier	Sweetwater River	Barrier
Tajiguas Creek	Barrier	Otay River	Barrier
Cañada del Refugio	Negative obs.	Tijuana River	Not determined
Cañada del Venadito	Barrier		
Cañada del Corral	Barrier		
Cañada del Capitan	Negative obs.		
Gato Canyon	Not determined		
Dos Pueblos Canyon	Barrier		
Eagle Canyon	Not determined		

[1]Historical Data: Titus et al. (2002). Recent data: Boughton et al. (2005).
[2] "Negative obs." indicates juveniles were observed to be absent during a spot-check of best-occurring summer habitat in 2002. "Dry" indicates the stream had no discharge in anadromous reaches during summer of 2002. "Barrier" indicates that all over-summering habitat was determined to be above an anthropogenic barrier, believed to be impassable. See Boughton et al. (2005).

2.2.2 Steelhead Life History and Habitat Requirements

The major freshwater life-history stages of steelhead involve spawning, incubation of embryos, freshwater rearing, emigration of juveniles, smoltification, and upstream migration of adults. Steelhead juveniles typically rear in freshwater for 1 to 4 years before migrating to the ocean, usually in the spring, and spend 1 to 3 years in the marine environment before returning to spawn. Steelhead grow and reach maturity at age 2 to 5 while in the ocean. This ocean-going life history pattern, known as anadromy, leads to more rapid growth than can be accomplished by non-anadromous individuals that spend their entire life in freshwater. The discussion of the steelhead life history below begins with the adults that are about to enter freshwater to spawn.

In south-central and southern California, adults typically immigrate to natal streams for spawning during December through May. Spawning adults enter freshwater during winter and spring freshets when streamflow is sufficient to breach sandspits that form at river mouths. Adults may migrate several to hundreds of kilometers in some watersheds to reach their spawning grounds. Although spawning may occur during December to June, the specific timing of spawning may vary a month or more among streams within a region. Steelhead exhibit an iteroparous life history type, unlike many of the other Pacific salmon (*Oncorhynchus* spp.), which means adult steelhead are capable of surviving after spawning and have the ability to migrate downstream as post-spawned adults (i.e., kelts) to the ocean and make subsequent spawning migrations. Individual steelhead have been documented repeating their spawning migration up to four times (Shapovalov and Taft 1954).

Female steelhead select spawning sites based on a variety of factors, including substrate size, water velocity, depth, and temperature. Females dig their nests (i.e., redds) in the riffle crests that form at the tailouts of complex pools with suitable gravel substrate and adequate instream cover. Spawning involves courtship between the female constructing the redd and one or more suitable males. Egg pockets are excavated in gravel-cobble substrates at a mean depth of about 20-cm (Sheutt-Hames et al. 1996). When the depth of the redd and the coarseness of the gravel meet the female's criteria, and she is courted by an acceptable male, she will release her eggs (Quinn 2005). Successful egg burial occurs immediately following fertilization by the male. In order to cover the embryos with a layer of clean gravel, the female digs a new egg pocket upstream of the pocket containing the fertilized eggs and the excavated, clean gravels are swept downstream by the current to bury the embryos. Depending on the size of the female and the number of eggs deposited in each pocket, the spawning pair may continue to excavate new egg pockets in an upstream fashion enlarging the overall size of the redd. The developing embryos incubate in the gravel for a period of 3 to 8 weeks prior to hatching.

Streams are the initial rearing habitats for juvenile steelhead from the time they emerge from the egg pocket to the pre-smolt stage when juveniles have grown large enough to begin their seaward migration. Alevins, juveniles with an external yolk sac still attached, emerge from redds about 2 to 6 weeks after hatching in the gravel egg pocket. When the yolk sac is fully used up, juvenile steelhead are classified as fry. Steelhead fry forage along low-velocity channel margins and utilize gravel-cobble substrate and instream vegetation for cover. Juveniles tend to congregate in schools, but as they grow these schools break up and the fish (now called parr) spread throughout the stream, selecting individual territories with access to adequate cover and

food (Shapovalov and Taft 1954). Preferred territories are commonly associated with deep pools, instream large woody debris, boulder clusters, undercut stream banks and deeper riffle/run feeding habitats. During the summer and fall low-flow season, parr make seasonal movements in search of perennial stream reaches with suitable water quality and food availability. Stream habitats formed by scour (i.e., pools) associated with boulders, large woody debris, and intact rootwads are the preferred habitats where south central and southern California steelhead parr over-summer (Spina 2003, Spina et al. 2005, Boughton and Goslin 2006). During winter high-flow events, juveniles seek low velocity, off-channel habitats such as backwater pools, side channels, and inundated woody riparian vegetation that serve as refugia (Shapovalov and Taft 1954, Solazzi et al. 2000).

The physiology of salmonids prepares them for seaward migration (i.e., smoltification) and estuary rearing. Steelhead have the most flexible freshwater life history of any of the Pacific salmonids such that emigration instincts are not obligate. While most steelhead go to sea before maturing, some individuals of both sexes spawn (with anadromous or resident life forms) before going to sea, while still others complete their life cycles without going to sea at all (McPhee et al. 2007, Christie et al. 2011). Transformation of steelhead parr into smolts is the physiological preparation for ocean residence and includes changes in shape and color, osmoregulation (salt balance) and energy storage (Quinn 2005). Larger individuals in good condition tend to migrate to sea in the spring, whereas smaller individuals are more likely to remain in freshwater or reside in estuarine habitats. Estuaries encompass a wide range of habitat types including riparian edge, bottom, slough, and open water environments. Estuaries play an important role in steelhead life history prior to ocean entry, providing nutrient rich feeding areas, transition to seawater, and predator avoidance. Some steelhead populations rear in estuaries for months (Bond et al. 2008), but patterns of estuarine entry and use likely differ between regional watersheds based on estuary size, habitat complexity, smolt size, tidal influence, water quality and food availability.

This highly variable life cycle gives rise to complex habitat needs, particularly during the freshwater phase. South central and southern California steelhead habitat consists of water, substrate, and riparian vegetation representing both estuarine and riverine habitat types. Spawning gravels must be of a certain size and free of sediment to allow successful incubation of the eggs. Eggs require cool, clean, and well-oxygenated waters for proper development. Juveniles often feed on insects that drift in the current, so fish orient upstream and defend feeding positions adjacent to instream cover and consume drifting prey items. The same instream cover used as feeding territories doubles as places to hide from predators, such as under logs, root wads, instream boulders, and beneath overhanging vegetation. Juveniles need places to seek refuge from periodic high flows (side channels and off channel areas) and occasionally from high summer water temperatures (cold water springs and deep pools). Low streamflow, high water temperature, physical barriers, low dissolved oxygen, and high turbidity can delay or halt downstream migration of juveniles and subsequent entry into the marine environment (i.e., estuary, lagoon, or ocean). Returning adults generally do not feed in fresh water but instead rely on limited energy stores to migrate, mature, and spawn. During all life stages steelhead require cool water that is free of contaminants and suitable places to rest and hide from predators. They also require rearing and migration corridors with adequate passage conditions (water quality and quantity available at specific times) to allow access to the various habitats required to complete their life cycle (70 FR 52519).

2.2.3 Population Viability

Before NMFS can evaluate the effects of the proposed action on a population and a species, an understanding of the condition of the population and species in terms of their chances of survival and recovery is critical for the effects analysis. The chances of survival and recovery contribute to NMFS' understanding of whether the population is likely to experience viability. Population viability is the hypothetical state(s) in which extinction risk of the broad population is negligible over a 100-year period and full evolutionary potential is retained (Boughton et al. 2006).

Four principal parameters were used to evaluate the extinction risk for the endangered Southern California Coast DPS of steelhead and the threatened South-Central California Coast DPS of steelhead: abundance, population growth rate, population spatial structure, and population diversity. These specific parameters are important to consider because they are predictors of extinction risk, and the parameters reflect general biological and ecological processes that are critical to the growth and survival of steelhead (McElhany et al. 2000).

There are three basic concepts (adapted from Boughton et al. 2006) that describe the meaning of population viability and how population growth rate and related parameters work together to provide a framework for judging the persistence of a population in the wild. The first concept is that for a population to persist indefinitely, on average each adult fish in the population has to give rise to at least one adult fish in the next generation (i.e., the population of adults must replace itself year after year). The second concept involves the size of the population. The larger the population, the less likely the population is to become extinct and the less likely that all mates will fail to produce eggs. Large population size is the single most important trait to protect a population from being driven to extinction due to random events. The third concept involves the relationship of vital events (e.g., births, deaths, and matings). The more correlated that vital events tend to be across the population, the larger the population has to be to protect it from extinction.

These concepts are expected to apply to the endangered SCS DPS and threatened SCCCS DPS of steelhead. The largest populations within these two DPSs are needed to support an effective recovery strategy. The role of the largest populations in recovery is based on population theory, which suggests the largest populations would have the highest viability if restored to an unimpaired condition (see Boughton et al. 2006). In nature, population abundance fluctuates for a variety of reasons including random changes in environmental conditions (often referred to as environmental stochasticity). If the fluctuations are large enough, the number of individuals in the population can fall to zero, even though the population may be relatively large initially. The influence of environmental stochasticity on both DPSs is expected to be high, and because environmental stochasticity increases extinction risk to the population, and to compensate for the environmental influences, both the SCS DPS and the SCCCS DPS need to have a larger average size than a broad population that is not as affected by chance fluctuations in environmental conditions (Boughton et al. 2006).

The expected sources of environmental stochasticity in both DPSs involve drought (and associated features such as high temperatures, low streamflow, lack of sandbar breaching at the mouths of rivers), floods, and wildfire. Southern California is currently experiencing a severe multi-year drought; extensive instream drying has been observed in numerous coastal drainages

in the range of the SCS DPS of steelhead prompting NMFS and CDFW to collaborate on a high number of steelhead relocations in an attempt to enhance survival of fish in the wild. Under such conditions stream temperature can increase dramatically, exceeding the heat tolerance of fish, and dissolved-oxygen concentration can fall below levels tolerable for steelhead. Finding dead or dying juvenile steelhead is not uncommon under such conditions. In July 2007, the "Zaca" wildland fire was reported and burned over 240,000 acres within and near Santa Barbara County, including steelhead-bearing drainages (Janicki et al. 2007). Overall, water year 2014 was the third dry year in a row for most of California, and precipitation thus far in 2015 has not brought much reprieve. Dry conditions have already resulted in an early start to the California wildland fire season.

Based on the complete population viability evaluation and findings in Boughton et al. (2006), neither DPS is viable and is at high risk of extinction. That is, each DPS has a low likelihood of viability. This finding is consistent with conclusions of past and recent technical reviews (Busby et al. 1996, Good et al. 2005, Williams et al. 2011), and the formal listing determinations for the species (NMFS 1997, 2006).

Spatial structure of a steelhead population is also critical to consider during the jeopardy analysis when evaluating population viability. Each population's spatial structure comprises of both the geographic distribution of individuals in the population and the processes that generate that distribution (McElhany et al. 2000). Understanding the spatial structure of a population is important because the population structure can affect evolutionary processes and; therefore, alter the ability of a population to adapt to spatial or temporal changes in the species' environment. Populations that are thinly distributed over space are susceptible to experiencing poor population growth rate and loss of genetic diversity (Boughton et al. 2007). Because human activities have decreased the total area of habitat, a negative trend on population viability is expected (McElhany et al. 2000). Construction and the ongoing impassable presence of man-made structures throughout the Southern California DPS have rendered many habitats inaccessible to adult steelhead (Boughton et al. 2005). In many watersheds that are accessible to these species (but that may currently contain few or no fish), urbanization and exploitation of water resources has eliminated or dramatically reduced the quality and amount of living space for steelhead.

Population diversity is an additional factor considered within the viability criteria. Steelhead possess a suite of life-history traits, such as anadromy, timing of spawning, emigration, and immigration, fecundity, age-at-maturity, behavior, physiological and genetic characteristics, to mention a few. The more diverse these traits (or the more these traits are not restricted), the more likely the species is to survive a spatially and temporally fluctuating environment. Factors that constrain the full expression of a trait are expected to affect the diversity of a species (McElhany et al. 2000). The loss or reduction in anadromy and migration of juvenile steelhead to the estuary or ocean is expected to reduce gene flow, which strongly influences population diversity (McElhany et al. 2000). Evidence indicates genetic diversity in populations of southern California steelhead is low (Girman and Garza 2006).

Habitat is the "templet" for ecological variation in a species (Southwood 1977) and, accordingly, when a species' habitat is altered, the potential for the habitat to promote ecological variation is also altered. Loss or limited migration opportunities are expected to adversely affect the species' basic demographics and evolutionary processes, causing a reduced potential for both DPS units

(SCCCS and SCS) to withstand environmental fluctuations. Activities that affect evolutionary processes (e.g., natural selection) have the potential to alter the diversity of the species. Hence, the widespread effects of anthropogenic activities in southern California are believed to have contributed to a decline in genetic diversity of southern California steelhead (Girman and Garza 2006).

2.2.4 Status of Critical Habitat

As previously demonstrated in Table 3, critical habitat for the endangered SCS DPS and threatened SCCCS DPS of steelhead was designated on September 2, 2005 (70 FR 52488). NMFS' Critical Habitat Analytical Review Teams (Review Teams) developed a list of Primary Constituent Elements (PCEs) specific to steelhead and their habitat, and relevant to determining whether occupied stream reaches within a hydrologic subarea watershed fit the definition of critical habitat. The PCEs within these streams are essential for the conservation of the SCS DPS and SCCCS DPS of steelhead, and involve those sites and habitat components that support one or more steelhead life stages and in turn contain physical or biological features essential to steelhead survival, growth, and reproduction, and the conservation of the DPSs. PCEs for both DPSs of steelhead and their habitat include:

1) Freshwater spawning sites with sufficient water quantity and quality and adequate accumulations of substrate (i.e., spawning gravels of appropriate sizes) to support spawning, incubation and larval development. Habitat features responsible for accumulating and storing spawning gravels include instream large wood, boulder clusters and instream aquatic vegetation.
2) Freshwater rearing sites with sufficient water quantity and floodplain connectivity to form and maintain physical habitat conditions and allow salmonid development and mobility; sufficient water quality and forage to support juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
3) Freshwater migration corridors free of obstruction 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.
4) Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and salt-water; natural cover; and juvenile and adult forage supporting growth and maturation.
5) Nearshore marine areas free of obstruction with sufficient water quality and quantity conditions and forage to support salmonid growth and maturation; and natural cover.
6) Offshore marine areas with sufficient water quality and forage, including marine invertebrates and fishes, to support salmonid growth and maturation.

SCCCS DPS

Designated critical habitat for the SCCCS DPS includes 1,249-miles of stream habitat and 3-square miles of estuary habitat within Monterey, San Benito, Santa Clara, Santa Cruz, and San Luis Obispo counties from the Pajaro River Hydrologic Sub-area south to the Estero Bay Hydrologic Unit (to but not including the Santa Maria River Hydrologic Unit). There are 30 occupied hydrologic sub-unit watersheds within the freshwater and estuarine range of the DPS. The action area for the proposed Program overlaps with designated critical habitat for SCCC steelhead only in San Luis Obispo County.

Critical habitat for the SCCCS DPS was designated on September 2, 2005 (70 FR 52488), and includes streams listed above in the *Status of the Species* section. Critical habitat has a lateral extent as defined by the bankfull discharge, also known as a 2-year flood event. Estuarine areas of listed streams are also included in the designation, but the riparian zone is not included in the designation. Primary constituent elements (PCE) within these streams essential for the conservation of the DPS are those sites and habitat components that support one or more steelhead life stages. These include freshwater spawning sites and rearing sites with water quantity and quality sufficient to form and maintain physical habitat conditions that support juvenile growth and mobility. PCE include natural cover such as shade, submerged and overhanging large wood, logjams, beaver dams, aquatic vegetation, large rocks, boulders, side channels and undercut banks (70 FR 52488). Additional PCE of critical habitat consist of freshwater migration corridors free of obstruction and excessive predation that have sufficient water quantity and quality, and physical cover within migration corridors that supports steelhead mobility and survival, as well as estuarine areas that also share these attributes. Also listed as PCE are juvenile and adult steelhead food forage, including aquatic invertebrates and fishes that support steelhead growth and maturation (70 FR 52488).

Streams designated as critical habitat in the SCCCS DPS have the above PCE attributes to varying degrees, depending on the stream location and the impacts associated with the watershed. NMFS' most recent status reviews for SCCCS steelhead (Good et al. 2005, Williams et al. 2011) identified habitat destruction and degradation as serious ongoing risk factors for this DPS. Urban development, flood control, water development, and other anthropogenic factors have adversely affected the proper functioning and condition of some spawning, rearing, and migratory habitats in streams designated as critical habitat. Urbanization has resulted in some permanent impacts to steelhead critical habitat due to stream channelization, increased bank erosion, riparian damage, migration barriers, and pollution (Good et al. 2005). Many streams within the DPS have dams and reservoirs that reduce the magnitude and duration of flushing stream flows, withhold or reduce water levels suitable for fish passage and rearing, physically block upstream fish passage, and retain valuable coarse sediments for spawning and rearing. In addition, some stream reaches within the DPS' designated critical habitat may be vulnerable to further perturbation resulting from poor land use and management decisions.

SCS DPS

Critical habitat for the SCS DPS encompasses 708 miles of stream habitat within a small part of San Luis Obispo County, and Santa Barbara, Ventura, Los Angeles, Orange and San Diego

Counties from the Santa Maria River Hydrologic Unit south to the San Juan Hydrologic Unit. The action area for the proposed BO includes all designated SCS DPS critical habitat.

Critical habitat for the SCS DPS was designated on September 2, 2005 (70 FR 52488). We summarize here relevant information from the final rule regarding the primary constituent elements and activities with the potential to affect critical habitat; the final rule provides more detail. The designation identifies PCEs that include sites necessary to support one or more steelhead life stages and, in turn, these sites contain the physical or biological features essential for conservation of the DPS. Specific sites include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, and estuarine areas. The physical or biological features that characterize these sites include water quality, quantity, depth, and velocity, shelter/cover, living space, and passage conditions. Activities with the potential to affect critical habitat for the SCS DPS are similar to those listed in the previous section.

Habitat for steelhead has suffered destruction and modification, and anthropogenic activities have reduced the amount of habitat available to steelhead (Nehlsen et al. 1991, NMFS 1997, Boughton et al. 2005, NMFS 2006b). In many watersheds throughout the range of the SCS DPS, the damming of streams has precluded steelhead from hundreds of miles of historical spawning and rearing habitats (*e.g.*, Twitchell Reservoir within the Santa Maria River watershed, Bradbury Dam within the Santa Ynez River watershed, Matilija Dam within the Ventura River watershed, Rindge Dam within the Malibu Creek watershed, Pyramid Dam and Santa Felicia Dam on Piru Creek). These dams created physical barriers and hydrological impediments for adult and juvenile steelhead migrating to and from spawning and rearing habitats. Likewise, construction and ongoing impassable presence of highway projects have rendered habitats inaccessible to adult steelhead (Boughton et al. 2005). Within stream reaches that are accessible to this species (but that may currently contain no fish), urbanization (including effects due to water exploitation) have in many watersheds eliminated or dramatically reduced the quality and amount of living space for juvenile steelhead. The number of streams that historically supported steelhead has been dramatically reduced (Good et al. 2005). Groundwater pumping and diversion of surface water contribute to the loss of habitat for steelhead, particularly during the dry season (e.g., NMFS 2005a, see also Spina et al. 2006). The extensive loss and degradation of habitat is one of the leading causes for the decline of steelhead abundance in southern California and listing of the species as endangered (NMFS 1997, 2006).

A significant amount of estuarine habitat has been lost across the range of the DPS with an average of only 22-percent of the original estuarine habitat remaining (Williams et al. 2011). The condition of these remaining wetland habitats is largely degraded, with many wetland areas at continued risk of loss or further degradation. Although many historically harmful practices have been halted, much of the historical damage remains to be addressed and the necessary restoration activities will likely require decades. Many of these threats are associated with the larger river systems such as the Santa Maria, Santa Ynez, Ventura, Santa Clara, Los Angeles, San Gabriel, Santa Ana, San Luis Rey, Santa Margarita, San Dieguito, and San Diego rivers, but they also apply to smaller coastal systems such as Malibu, San Juan, and San Mateo creeks. Overall, these threats have remained essentially unchanged for the DPS as determined by the last status review (Williams et al. 2011) though some individual, site specific threats have been

reduced or eliminated as a result of conservation actions such as the removal of small fish passage barriers.

2.2.5 Regional Climatic Variation and Trends

Climate-driven changes to stream, estuarine and marine environments (i.e., all PCEs discussed in *Status of Critical Habitat*) have the potential to significantly impact steelhead populations. Coupled with naturally stressful environments at the southern limit of the species distribution, multiple stressors are likely to be amplified by ongoing increases in temperature, changes in precipitation patterns, and decreases in snowpack (Mote et al. 2003, Hayhoe et al. 2004). Research suggests that a change in climate would be expected to shift species distributions as they expand in newly favorable areas and decline in marginal habitats (Kelly and Goulden 2008). When climate interacts with other stressors such as habitat fragmentation, additional threats to natural resources will likely emerge (McCarty 2001), including threats to the viability of steelhead populations. In particular, seasonal access to perennial, cool water habitats, especially smaller streams at higher elevations, will likely become more important to endangered salmonids seeking refuge from unsuitable temperature and streamflow (Crozier et al. 2008).

World-wide CO2 levels from human activities (e.g., fossil fuel use) have been steadily increasing. Climate scientists have documented increases in global temperatures and predict continued increases (IPCC 2007). This warming is affecting large-scale atmospheric circulation patterns (Dettinger and Cayan 1995), and it is impacting climate at global, regional, and local scales (Zwiers and Zhang 2003, Cayan et al. 2008). Climate change is occurring and is accelerating (IPCC 2007, Battin et al. 2007). While continued changes in climate are highly likely, estimating the magnitude of the change is more difficult the further into the future one must go. For example, increases in air temperatures globally are more certain than increases in air temperature in a particular watershed in California. Increases in global air temperatures may shift wind patterns, and these changes, in combination with regional topography, may affect how air temperatures in a particular watershed change in relation to changes in global air temperatures.

Environmental monitoring data in the southwestern United States indicate changes in climatic trends that have the potential to affect steelhead life history strategy and habitat requirements. The southwest U.S. average annual temperature is projected to rise approximately 4° F to 10° F over the region by the end of the century (USGCRP 2009). Southern California is also experiencing an increasing trend in droughts, measured by the Palmer Drought Severity Index from 1958 to 2007 (USGCCRP 2009). Snyder and Sloan (2005) project mean annual precipitation in central western California will decrease by about 3-percent by the end of the century. Small thermal increases in summer water temperatures have resulted in suboptimal or lethal conditions and consequent reductions in *O. mykiss* distribution and abundance in the northwestern United States (Ebersole et al. 2001). Thus, climate variability will likely be an important factor in evaluating how the *Status of the Species* is influenced by changing climate.

Wildfire frequency, intensity, and extent are all important parameters to consider when considering a changing climate and associated impacts to steelhead and their habitat. Changes in vegetation communities for this region will likely include increases in the amount of grassland and decreases in most other major vegetation communities (e.g., chaparral, riparian woodland).

Based on a wildfire risk assessment in southern California, it was determined that the probability of large (>200-ha) fires ranges from a decrease of 29 to an increase of 28-percent (Westerling and Bryant 2008). The variation in range is due to the type of model used to make forecasts. Wildfires can have long-term benefits for fish habitat (such as producing influxes of spawning gravels to the stream), but in the short-term they can be catastrophic due to accumulation of fine sediment that negatively affects spawning, foraging and depth refugia (Boughton et al. 2007). Many of the foregoing climatic trends are likely to further degrade endangered steelhead over-summering habitat in southern California by reducing stream flows and raising stream temperatures (Katz et al. 2012). Impacts to steelhead may result in increased thermal stress even though this species has shown to tolerate higher water temperatures than preferred by the species as a whole (Spina 2007). Conservation of existing steelhead populations will rely on identifying and providing unimpeded passage to the highest quality over-summering and spawning habitats which are expected to buffer habitat against changing climatic and hydrologic conditions. Habitat connectivity becomes as important as habitat quantity and quality when populations decrease and habitat is fragmented (Isaak et al. 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). Within this section, NMFS describes the current status of steelhead and critical habitat in the action area by describing each DPS separately, and provides a single analysis of the ongoing threats to steelhead and designated critical habitat in the action area owing to the similarity of threats that both DPSs experience.

2.3.1 Status of Steelhead and Critical Habitat in the Action Area

SCCCS DPS

This part of the action area includes all coastal streams entering the Pacific Ocean in San Luis Obispo County south to, but not including the Santa Maria River. It includes naturally spawned anadromous populations of *O. mykiss* that inhabit those portions of coastal watersheds that are at least seasonally accessible to steelhead entering the ocean. The area is dominated by a steep mountain range along the coast (Santa Lucia Mountains), coastal valleys and terraces. Watersheds within this region fall into two basic types: (1) those characterized by short coastal streams draining mountain ranges immediately adjacent to the coast (e.g., watersheds draining to Estero Bay), and (2) those containing larger stream systems that extend inland through gaps in the coastal ranges (e.g., Arroyo Grande Creek).

Major steelhead watersheds in this part of the action area (see Table 4) include San Simeon, Santa Rosa, San Luis Obispo, Pismo, and Arroyo Grande creeks (Busby et al. 1996, 1997, Titus et al. 2002, Good et al. 2005). The creeks in the northern part of San Luis Obispo County occur in relatively undisturbed areas, as development within the watersheds increases in a southerly direction, especially near the cities of San Luis Obispo, Pismo Beach, and Arroyo Grande. Urban development is concentrated in coastal areas and inland valleys, with the most extensive

and densest urban development located within the San Luis Obispo and Arroyo Grande watersheds. Some coastal valleys and foothills are extensively developed with agriculture – principally row-crops, orchards, and vineyards (e.g., Arroyo Grande valley).

Significant portions of the upper watersheds within the SCCCS DPS are found within the Los Padres National Forest (Monterey and Santa Lucia Ranger Districts). These lands are managed primarily for water production, recreation, livestock grazing, mining, oil and gas production and protection of native fish, wildlife, and botanical resources.

SCS DPS

This part of the action area includes all coastal streams entering the Pacific Ocean from the Santa Maria River in northern Santa Barbara County south to the Mexican border. Although critical habitat for the SCS DPS only extends down to San Mateo Creek in the San Juan Hydrologic Unit in San Diego County, the action area extends through San Diego County to the Mexican border. This area is dominated by a series of steep mountain ranges and coastal valleys and terraces. Watershed types within this region are similar to the SCCCS DPS, characterized by short coastal drainages adjacent to the coast (e.g., Gaviota Coast streams, tributaries to Santa Monica Bay), and larger river systems that extend inland through the coastal ranges (e.g., Santa Maria River, Santa Ynez River, Ventura River, Santa Clara River, San Gabriel River, Santa Ana River, San Luis Rey River, and San Diego River).

Major inland watersheds occupied by steelhead in the SCS DPS (see Table 4) include the Santa Maria, Santa Ynez, Ventura and Santa Clara River systems (Good et al. 2005, Boughton et al. 2006). Many smaller coastal streams in Santa Barbara County (Arroyo Hondo Creek, Mission Creek, Montecito Creek and others), Ventura County (Rincon Creek), and northern Los Angeles County (Malibu Creek, Topanga Creek and others) also currently support naturally spawning *O. mykiss*. Three watersheds in southern Orange County and northern San Diego County (San Juan Creek, San Luis Rey River, and San Mateo Creek) have also had recent observations of steelhead. These southernmost populations are separated from the northernmost populations by approximately 80 miles.

Significant portions of the upper watersheds within the area are contained within four National Forests (Los Padres, Angeles, San Bernardino, and Cleveland National Forests). These forests are managed primarily for water production, recreation and wildlife habitat (with limited grazing and oil, gas, and mineral production).

Urban development is concentrated in coastal areas and inland valleys, with the most extensive and densest urban development located within the Los Angeles Basin. This area is home to more than 21 million people, over half the population of the State of California. Some coastal valleys and foothills, such as the Santa Ynez, Santa Clara, and San Luis Rey watersheds are extensively developed with agriculture – principally row crops, orchards, and vineyards (NMFS 2012b).

2.3.2 Threats to Steelhead and Designated Critical Habitat in the Action Area

The past and ongoing effects of numerous anthropogenic activities in the action area have reduced the quality and availability of habitat for endangered and threatened steelhead and

threaten the long-term survival and recovery of these species (NMFS 2012b, 2013b). While some activities are physically outside the action area the activities adversely affect critical habitat and steelhead in the action area (e.g., in the case of land-use activities causing input of sand and smaller particles to habitats within the action area, or in the case of a water storage or diversion facility altering the downstream pattern and magnitude of discharge in the action area). Forecasts regarding pending climatic changes portend future adverse alterations to habitat for the species. The activities threatening steelhead and designated critical habitat in the action areas are described quite extensively in NMFS' recovery plan for endangered steelhead (NMFS 2012b) and threatened steelhead (NMFS 2013b), and because threats to each species are the same or similar, the following summary describes threats pertaining to the entirety of the action area and each species.

1. Urban Development

Urbanization has degraded anadromous salmonid habitat through stream channel realignment, flood plain drainage, and riparian damage (reviewed in 61 FR 56138). When watersheds are urbanized, problems may result simply because structures are placed in the path of natural runoff processes, or because the urbanization itself has induced changes in the hydrologic regime. In almost every point that urbanization activity touches the watershed, point source and nonpoint pollution occur. Sources of nonpoint pollution, such as sediments washed from the urban areas, contain heavy metals such as copper, cadmium, zinc, and lead. These toxic substances, together with pesticides, herbicides, fertilizers, gasoline, and other petroleum products, contaminate drainage waters and harm aquatic life necessary for anadromous salmonid survival. Water infiltration is reduced due to extensive ground covering with impervious surfaces (e.g., parking lots). As a result, runoff from the watershed is flashier, with increased flood hazard.

2. Flood-Control Activities

Streams within the action area have been altered over the past decades through activities that promote conveyance of flood waters. One activity has involved the removal of large and small woody debris (e.g., live trees, downed tree trunks, limbs, root wads) from instream areas. Removing such debris from streams can have the overall effect of reducing the quality and availability of habitat for anadromous salmonids because woody debris in streams (Bryant 1983, Lisle 1986) creates complex habitat for fish and loss of such habitat is reported to cause reductions in stream-fish abundance (Dolloff 1986, Elliott 1986).

Routine removal of riparian and instream vegetation has been reported to have a host of adverse consequences for stream-fish populations, including reductions in streamside and instream cover, increased stream temperature, streambank erosion and channel widening, lack of tree root structure creating undercut banks, reductions of live and fallen large woody debris within bankfull channel and reductions in fish abundance (Hicks et al. 1991, Platts 1991, Thompson et al. 2008). Thompson and others (2012) found that in southern California steelhead streams standing live and dead trees contributed a high proportion, 72%, of the total LWD loading within the bankfull width and were often key pieces in wood habitat features. Within the action area, removal of woody debris and vegetation from creeks is widespread, and occurs in numerous creeks each year that are designated critical habitat for steelhead (SBCFCD 2001, Questa 2003, SWCA 2010). Regional studies have identified that the extended summer low-flow period

allows trees to become established within the bankfull channel that in turn provide critical habitat features utilized by steelhead (Thompson et al 2008, 2012). Given the value of instream woody debris to stream salmonids and the reported effects of woody-debris removal on stream habitats, the annual removal of live and dead stream vegetation has likely caused a reduction in the functional value of designated critical habitat for endangered and threatened steelhead, including a decrease in living-space capacity, and reduced abundance of juvenile steelhead in the action area.

Flood control and land drainage schemes may concentrate runoff, resulting in increased bank erosion that causes a loss of riparian vegetation and undercut banks and eventually causes widening and down-cutting of natural stream channels. The construction of concrete-lined channels, or channelization, is one flood-control method practitioners have utilized to protect urban infrastructure from concentrated storm runoff. Channelization and concrete-lined flood control channels exist throughout the action area and were constructed and are maintained to decrease roughness and maximize flood conveyance. Channelization of river channels can have numerous biological effects on waterways, including effects to essential features of instream habitat that are important to sustain growth and survival of stream fish (Brookes 1988), and is principally responsible for the current character and condition of certain waterways in the action area.

3. Conversion of Wildland and Land Use

Conversion of wildlands for agriculture is apparent in the action area, and while not widespread, the agricultural activities themselves can increase runoff of nitrogen from fertilizers and animal waste, pesticides, and fine sediments into streams in the action area (i.e., critical habitat for steelhead). This is of concern because an increase in agricultural runoff can results in eutrophication (*i.e.*, excessive nutrients) of river mainstems, and their estuaries (Weaver and Garman 1994, Bowen and Valiela 2001, Quist et al. 2003). Eutrophication can have negative effects on endangered and threatened steelhead and critical habitat because it results in excessive blooms of algae and bacteria, lower dissolved oxygen levels, and kills macroinvertebrates that salmonids use for food (Spence et al. 1996). Agricultural runoff can result in increased turbidity and sedimentation in streams, which reduces water quality (Alexander and Hansen 1986) and is harmful to steelhead (Cordone and Kelley 1961, Hillman et al. 1987, Chapman 1988). However, NMFS is not aware of the specific type, amount, and extent of agricultural runoff to waterways in the action area and related potential effects on endangered or threatened steelhead and designated critical habitat for either species.

Within the SCCCS action area, some coastal valleys and foothills are extensively developed with agriculture - principally row-crops, orchards, and vineyards. Several of the watersheds within the SCCC DPS (e.g., Pajaro, Salinas, Santa Rosa, and Arroyo Grande) are developed for commercial agriculture, particularly row crops which are subjected to regular applications of a variety of pesticides (NMFS 2013b). The nature and extent of the short and long-term effects of these pesticides on steelhead within the action area has not been extensively studied, and consequently is not well known. Agriculture developments within the Salina River watershed, including livestock ranching and increasingly vineyards, are important land uses that directly or

indirectly affect watershed processes throughout this DPS. A major consequence of agricultural activity in this region is reservoir development (NMFS 2013b).

Within the SCS action area, the conversion of wildlands for agriculture is perhaps most prevalent along coastal terraces, like the Santa Maria River Valley, which is intensively farmed. Managed flow releases from Twitchell Dam provide irrigation water to approximately 35,000 acres of cropland (USBR website). Seventy-five percent of the water supply from the Santa Maria River watershed goes to irrigation, watering crops such as sugar beets, strawberries, alfalfa, and, more recently, grapes (USBR 1996). Agricultural and urban development has severely constrained floodplain connectivity on sections of the Santa Maria River floodplain (SWCA 2011). Other areas in the SCS action area where agriculture is a significant land use activity includes the Santa Ynez and Santa Clara River Valley in the south (NMFS 2012b).

Estuarine functions are adversely affected through a range of activities, including filling, diking, and draining. Approximately 75 percent of estuarine habitats across the SCCCS DPS have been lost and the remaining 25 percent is constrained by agricultural and urban development, levees, and transportation corridors such as highways and railroads (NMFS 2013b), while the SCS DPS has been artificially reduced 70 to 95-percent by development (NMFS 2012b). In addition to the loss of overall acreage, the habitat complexity and ecological functions of South-Central and Southern California estuaries have been substantially reduced as a result of: (a) loss of shallow-water habitats such as tidal channels, (b) degradation of water quality through both point and non-point waste discharges, and (c) artificial breaching of the seasonal sandbar at the estuaries mouth which can reduce and degrade steelhead rearing habitat by reducing water depths and the surface area of estuarine habitat.

4. Ongoing Operation of Dams

The construction of dams in the action area is expected to have contributed to declines in abundance of threatened and endangered steelhead (e.g., Nehlsen et al. 1991), owing to reported effects of dams on fish species and their habitat (Morita and Yamamoto 2002). Within the action area, the ongoing operation of several dams continues to block steelhead from historical spawning and rearing habitats. A summary description of these dam types and their effects are presented as follows.

Steelhead access to spawning and rearing habitat in the SCCCS DPS action area has been significantly reduced as a result of dams and other instream structures that block or impede migration of adult steelhead (NMFS 2013b). Dams and diversions have a multitude of effects on fishery resources and quality of steelhead habitat (Blahm 1976, Mundie 1991, Smith et al. 2000). Several drainages in San Luis Obispo County are completely blocked to steelhead migration owing to their respective dams, including the Nacimiento River (Nacemiento Reservoir Dam), Old Creek (Whale Rock Dam), West Corral De Piedra (Righetti Dam), Arroyo Grande Creek (Lopez Dam), Santa Maria River (Twitchell Dam), and Chorro Creek (Chorro Creek Dam). All of these dams block steelhead from a substantial portion of the upper watersheds, which contain the majority of historical spawning and rearing habitats for anadromous *O. mykiss*, remain intact (though inaccessible to anadromous fish) and protected from intensive development as a result of their inclusion in the Los Padres National Forest (NMFS 2013b).

Steelhead access to spawning and rearing habitat in the SCS DPS action area has also been significantly reduced as a result of dam construction and continued operation on numerous steelhead drainages. The damming of the larger drainages including the Santa Ynez River (Gibraltar Dam and Bradburry Dam), Ventura River (Casitas Dam and Matilija Dam), Piru Creek (Santa Felicia Dam and Pyramid Dam) and Malibu Creek (Rindge Dam) blocks steelhead from historical spawning and rearing habitat because none of these reservoirs were constructed to allow fish passage. The amount of historical spawning and rearing habitat rendered unavailable to steelhead in these watersheds due to the construction of dams is substantial. As an example, the Santa Felicia Dam blocks 95% percent of the steelhead habitat within the Piru Creek watershed; more than 30 miles of stream lies between Santa Felicia Dam and Pyramid Dam alone (NMFS 2008b).

Remnant steelhead populations that reside upstream of dams have the potential to occasionally out-migrate downstream past these dams, but *O. mykiss* survival is expected to be low. The reason for the low expected survival is that steelhead smolts must migrate through large, static reservoirs and either pass over high head dams via steep spillways or through the dam by circumventing the high velocity outlet works (i.e., gates, energy dissipators). Operations of dams and diversions may decrease water available for surface flows, reducing rearing opportunities for steelhead and adversely affecting the physicochemical and biological characteristics of streams (Poff et al. 1997).

5. Surface and Groundwater Withdrawals

In addition to blocking threatened and endangered steelhead from historical spawning and rearing habitats, the agricultural, municipal and private withdrawal of surface and groundwater from drainages in the action area, as well as characteristics of local geology, can lead to reach-specific instream dewatering primarily during the dry season and periods of below normal rainfall (NMFS 2012b, NMFS 2013b). The artificial reduction in the amount and extent of surface flows can translate into decreased living space for steelhead, particularly over-summering juveniles and death of this specific life stage (Spina et al. 2006). Because freshwater rearing sites for over-summering steelhead are geographically limited throughout southern California, including the action area, the artificial reduction in freshwater rearing sites for juveniles during the summer can translate into a reduction in abundance of juvenile steelhead and therefore the number of returning adults in subsequent years.

Diversions in the action area can have adverse effects on fishery resources that are similar to the effects of dams, particularly when the diversion functions over a relatively broad range of discharges and is not designed to allow fish migration (Blahm 1976, Mundie 1991, Smith et al. 2000). Many larger screened diversions are installed on streams by constructing low-head dams that pond water and allow for stream diversion while providing some portion of discharge as a "bypass" flow for the intended purpose of providing sufficient fish migration flows. One such facility is the Robles Diversion Dam on the Ventura River is capable of diverting up to 500-cfs discharge in a concrete channel while the Casitas Municipal Water District maintains a minimum 50-cfs augmentation flow in the mainstem river for fish passage. Diversion dams can affect steelhead by causing migration delays and attenuating stream discharge that serves as a natural

cue for migratory fish to emigrate in unregulated rivers, and affect habitat by disrupting the natural transport of spawning gravels and establishment of healthy riparian vegetation. Operation of unscreened diversions in the action area can disrupt migration of steelhead and prevent a large fraction of smolts from reaching the ocean due to entrainment of juveniles.

Groundwater withdrawals (primarily for irrigation) have reduced surface streamflow in many streams throughout California which has the functional effect of decreasing the amount and quality of steelhead rearing habitat. Water quantity problems are a significant cause of habitat degradation and depressed fish populations. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion of it. Water withdrawals have a significant effect on steelhead over-summer rearing habitat and seasonal flow patterns by removing water from streams when discharge is naturally modest (i.e., May through September). Over-summer rearing habitat has been found to be the most restricted habitat type in the SCCCS and SCS DPSs (Boughton and Goslin 2006).

6. Gravel Mining

Extraction of alluvial material from within or near a stream bed has a direct impact on the stream's physical habitat parameters such as channel hydraulics, morphology, sediment transport, bed elevation, and substrate composition (NMFS 2005b). The immediate and direct effects are to reshape the boundary, either by removing or adding materials. The subsequent effects are to alter the flow hydraulics when water levels rise and inundate the altered features. This can lead to shifts in flow patterns and patterns of sediment transport. Local effects also lead to upstream and downstream effects.

Altering these habitat parameters can have deleterious impacts on instream biota, food webs, and the associated riparian habitat (Spence et al. 1996). For example, impacts to anadromous fish populations due to gravel extraction can include reduced fish populations in the disturbed area, replacement of one species by another, replacement of one age group by another, or a shift in the species and age distributions (Moulton 1980). Changes in physical habitat characteristics of aquatic systems can alter competitive interactions within and among species; similarly, changes in temperature or flow regimes may favor species that prey on anadromous fish populations (Spence et al. 1996). In general terms, Rivier and Seguier (1985) suggest that the detrimental effects to biota resulting from bed-material mining are caused by two main processes: (1) alteration of the flow patterns resulting from modification of the river bed, and (2) an excess of suspended sediment.

The aggregate mining in the Santa Maria River and lower Sisquoc River since the early 1900's is expected to have caused a number of adverse effects on the quality and availability of habitat for endangered steelhead, given the reported effects of gravel mining on riverine environments (Kondolf 1997). Gravel mining can lead to overall physical degradation to the structure and function of river channels. In turn, a reduction in the physical and biological capability of the channel to support growth and survival of stream fish can be observed as well as an overall reduction in abundance.

Mining of sand and gravel occur in certain watersheds within San Luis Obispo County (e.g., Salinas River, San Simeon Creek). Mining can contribute soil to streams, and cause sedimentation and turbidity, which can be harmful to fish (Cordone and Kelley 1961, Hillman et al. 1987, Chapman 1988) and their habitat (Alexander and Hansen 1986,). Floodplain and instream mining can also cause changes to the stream channel (i.e., head-cuts, channel widening, etc.) that have the potential of adversely affecting steelhead migration (NMFS 2005b).

7. Environmental Stochasticity

Surface and groundwater pumping in or near many coastal streams (*e.g.*, San Simeon, Santa Rosa Creek, Arroyo Grande Creek, Morro Creek, San Luis Obispo Creek, Chorro Creek, See Canyon Creek) and larger river systems have the potential to adversely affect threatened and endangered steelhead. In some cases, these pumping operations have reduced available surface flows and even dried portions of streams, thereby reducing available habitat quantity and quality for rearing steelhead (Spina et al. 2006). In many watersheds there are certain portions of the stream that naturally dry yearly. In these stream sections pumping operations may cause drying of the stream earlier than normal.

Changes in land use through conversion of lands (*e.g.*, due to development of urban areas) can increase input rates of nitrogen and sediment (*i.e.*, sand and smaller particles) to receiving waters (and therefore critical habitat for steelhead), leading to reductions in the quality of critical habitat and abundance of desirable aquatic species, and increased eutrophication of receiving waters such as estuaries and streams (Weaver and Garman 1994, Bowen and Valiela 2001, Quist et al. 2003). Past and present development of lands often results in an increase of impervious surfaces which can lead to increased potential for runoff of pollutants to surface water. Increased runoff may not necessarily be confined to the wet season, but may extend into the dry season as a result of people washing streets, parking lots, vehicles, and other elements of the urban environment. Once in surface water, pollutants of sufficient concentration may impair water quality and alter the characteristics of the channel bed. Long-term urbanization effects have been associated with lower fish species diversity and abundance (Weaver and Garman 1994). Consequently, the proliferation of urban areas within many of the coastal watersheds throughout the San Luis Obispo County as well as major river watersheds such as the Salinas River is of concern.

Direct and indirect evidence of cattle in riparian areas and streams within many of the Estero Bay and Salinas watersheds (NRCS 2010) have been observed. It is estimated that 90% of the 1,691,810 acres of land used for agriculture in San Luis Obispo County is used for cattle grazing (NRCS 2010). Cattle have been observed in and along parts of these rivers and tributaries, grazing on slopes above waterways, and exposing soil, thereby increasing the potential for water-quality alterations related to sedimentation and turbidity (Platts 1991). Therefore, cattle grazing has the potential to impact steelhead rearing and spawning habitat.

2.4 Effects of the Proposed 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.

The purpose of this section is to identify the direct and indirect effects of the proposed action on the SCCCS DPS of threatened steelhead and the SCS DPS of endangered steelhead and designated critical habitat for these species. Our presentation of the effects on the species generally pertains to both the threatened and endangered species, and DPS-specific effects are distinguished only when necessary and appropriate. We are unaware of any specific interrelated or interdependent action associated with the proposed action; therefore, the effects discussion does not consider interrelated or interdependent activities.

Although the proposed action includes creating a team of staff from the NOAA RC, Corps and NMFS' Southern California Branch Office that would "oversee" projects proposed annually (Section 1.35), we clarify here that NMFS' role and responsibilities will be confined to advising the NOAA RC and Corps on matters pertaining to the analysis we conducted during consultation and related compliance with the Section 7 of ESA. This would include assessing whether the annually proposed projects are consistent with the analysis presented in this programmatic biological opinion and then relaying the result of the assessment to the NOAA RC and Corps. The following effects description reflects this role and responsibility.

Because projects will occur in the future and exact project descriptions needed to determine the precise effects of the proposed action on steelhead and their habitats are limited or unavailable at this time, this assessment of effects is primarily qualitative, except where data are available. Our approach to assess effects is based on a review of ecological literature concerning the effects of loss and alteration of habitat elements important to salmonids, including water, substrate, food, and adjacent riparian areas, which are the primary constituent elements of critical habitat that will be affected. This information was then compared to the likely effects associated with the proposed Program activities: (1) release of fine sediments from Program activities, (2) construction of access ramps and temporary access roads, (3) dewatering activities, (4) altering channel form and function, (5) localized loss of pools, (6) reduction of instream flows, and (7) need for continued site maintenance.

As an overview to the effects section, the available information suggests effects of the proposed action would be predominantly on over-summering juveniles and migrating life stages (smolts and adults). Based on data received from CDFW for FRGP projects constructed within the action area since 2003, and our observations and surveys in southern and south-central California streams, we anticipate that a small proportion of the total number of rearing juvenile steelhead within a stream will be within the action area of the Program activities.

With regard to adverse effects on critical habitat, the proposed action is expected to affect certain PCE, with the expected impacts for individual projects to vary from elevating turbidity to dewatering juvenile rearing habitat. In this context, NMFS describes the effects to critical habitat, followed by effects to the species. This section also evaluates the efficacy of the proposed protection measures. Below is a summary of anticipated effects from each element of the proposed action and NMFS' summary analysis (Table 5), which is further developed within the sections that follow. Table 6 lists the anticipated beneficial effects of each Program activity.

Table 5. Summary of anticipated adverse effects on critical habitat and steelhead resulting from implementing the proposed action. Key to Program activities are as follows: (1) Instream habitat improvement, (2) Instream barrier modification for fish passage improvement, (3) Bioengineered stream bank stabilization and riparian habitat restoration, (4) Upslope watershed restoration, (5) Removal of small dams, (6) Creation of off-channel/side-channel habitat features, and (7) Water conservation projects.

Anticipated Effects / Impact	Program Activity	Duration of Impact	Severity of Impact	Rationale for Anticipated Effect / Impact	Habitat Response	Steelhead Response
Increase turbidity	1, 2, 3, 4, 5, 6, 7	Limited to first wet season post disturbance[1]	Moderate	Exposed soil will result, increase potential for sedimentation	Fine sediment fouling spawning & rearing sites	Avoidance by spawning adults, impaired embryo development & impaired juvenile feeding.
Access ramp & road construction	1, 2, 5, 6	Vegetation should re-establish w/in 1-2yrs	Low	Heavy equip. requires access ramps, veg. removal, hand tools used often	Loss of stream shading, substrate compaction	Temporary avoidance by juveniles & spawning adults
Dewatering	1, 2, 3, 5, 6, 7	Low Flow Season	Moderate - High	Need to capture and relocate steelhead	Reduction in habitat quantity & quality	Avoidance, handling stress, possible death
Alter channel form	2, 5, 6	Continuous	Moderate	Lack of certainty regarding application of NMFS guidelines & analyses	Channel incision, bank failure, confined simple channel	Lack of quality spawning habitat
Alter channel function	7	Continuous	Low – Moderate	Construction of instream infrastructure	Create passage barrier, loss of habitat access	Restricted seasonal movements
Reduction of instream flow	6, 7	Low flow season, post high flow events	Moderate	Risk of off/side-channel habitats dewatering, experimental technology	Isolated pool formation, poor water quality, alteration to PCEs	Stranding, heat stress, injury, predation, death
Loss of pools	2, 5	Permanent	Low	Instream barrier modification typically removes forcing feature creating scour hole	Loss of depth refugia, increase flow velocity	Redistribution, more prone to predation, increased energy use
Need for continued site maintenance	5, 6, 7	Continuous	Low	Need to repair & protect instream infrastructure, remove excess veg/sediment	Temporary alterations to PCEs at project sites	Avoidance measures, unfavorable spawning & rearing conditions

[1] Program activities described in the *More Complex Projects* (e.g., culvert removal, small dam removal) would likely have effects with greater duration and severity of impact, as described in the sections that follow.

2.4.1 Effects on Critical Habitat

1. Release of Fine Sediments from Program Activities

In unimpaired settings, the natural movement of water around channel obstructions creates areas of streambed scour and deposition, and variations in water column depth and velocity that can establish and maintain complex habitat for juvenile steelhead in the form of refugia or productive feeding areas. Productive freshwater rearing sites for juvenile steelhead include gravel, cobble and boulder substrate, with limited areas of sand and silt. Such substrate types provide cover for juvenile steelhead and colonizing surface for macroinvertebrate species that steelhead consume. However, elements of the proposed action are expected to create instream and geomorphic conditions that increase mobilization of fine sediment and the potential to diminish the functional value of habitat including designated critical habitat for endangered and threatened steelhead. This Program activity is expected to have a low to moderate severity of impact on critical habitat based on the discussion that follows.

Proposed Program activities (especially dam-removal activities) will expose extensive areas of fine and coarse sediments, thereby increasing the potential for erosion, turbidity and sediment-related effects on critical habitat. An understanding of the type, magnitude, and degree of probable sediment releases is necessary to develop a basis for predicting the possible effects on critical habitat. Therefore, the following discussion briefly summarizes which Program activities will create sediment disturbance, types and extent of sediment releases, the timing of the expected turbidity increase, and protection measures to minimize impacts. The discussion of the sediment releases is taken directly from the supporting environmental documents (e.g., SusCon 2015) as well as supplemental information (Appendix A), where additional information and specific details can be found. Although a substantial effort was undertaken to assess potential sediment impacts, the variable southern California climate challenges the development of a reliable prediction of the effects on critical habitat (and steelhead).

As described in Table 5, it is anticipated that all Program activities will increase turbidity and suspended sediment levels within project work sites and downstream areas, including Instream Habitat Improvements, Instream Barrier Modification for Fish Passage Improvement, Bioengineered Stream Bank Stabilization, Upslope Watershed Restoration, Removal of Small Dams, Creation of Off/Side-Channel Habitat features, and Water Conservation Projects. These restoration activities may cause temporary increases in turbidity and alter channel dynamics and stability, but chronic effects related to elevated turbidity are not expected to occur owing to the protection measures discussed below. Sediment-related impacts are largely expected to occur during winter storm events when any project disturbed sediment has the potential to be mobilized. Any increase in sediment and turbidity levels resulting from proposed Program activities is expected to be minor due to the small work footprint of most projects, which makes the mobilization of large volumes of project-related sediment unlikely (SusCon 2015).

As described in Table 6, instream barrier modification is expected to improve steelhead passage and increase access to suitable spawning and rearing habitats upstream. Impassible barriers define the limit of anadromous steelhead migration and seasonal movement within action area drainages. Other obstructions, such as road crossings, culverts, concrete grade control structures, and flood-control channels, occur in the action area and may partially or temporally impede fish passage into historically used reaches. According to the proposed action, more than 1400 anthropogenic migration barriers are constricting steelhead movement in the SCS DPS (SusCon 2015). Successful implementation of this

Program activity would help restore steelhead access into currently unoccupied habitats and bi-directional gene flow, two factors that are expected to reduce extinction risk.

To minimize the potential for short-term adverse impacts, the NOAA RC has developed limitations on the area of disturbance and construction timing for individual projects. The proposed maximum length of stream that may be dewatered for each Program activity is 500-linear feet, and maximum project staging area footprint shall not exceed 0.5-acres. As described in the proposed action, all construction activities shall occur between June 1 and November 30 each year. In terms of the temporal impacts of increased mobilization of fine sediment, the available information indicates that the proposed Program activities would translate into negative, albeit temporary, impacts to habitat for steelhead because this action is implemented to restore natural processes that are intended to create and maintain habitat for steelhead (i.e., restore habitat connectivity and sediment transport).

The NOAA RC and Corps have proposed an additional protection measure that requires any work using heavy equipment within the stream channel to occur in isolation from flowing water (SusCon 2015). If there is any flowing water (or isolated pools capable of supporting steelhead) when the construction occurs, the project proponent is required to construct cofferdams upstream and downstream of the excavation site and divert all flowing water around the workspace. Foreign materials such as sand bags and any sheet plastic shall be removed from the stream upon project completion. Based on the information provided, it is assumed that turbidity increase during construction will be limited to the actual day of construction and removal of the coffer dams. Therefore, the largest amount of sediment is expected to be mobilized during the first few storm events in the wet season following the construction, at a time when baseline turbidity rates are highest in southern California drainages. After flood peaks have passed, the concentrations of fine materials are expected to quickly decrease.

The biological assessment specifies that eligible dam removal projects must (1) 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 (2) be designed to remove sediment trapped by the dam down to the elevation of the target thalweg including design channel and floodplain dimensions. As the result of numerous teleconferences and meetings with NMFS, the NOAA RC recognized the higher level of sediment disturbance by these project types and thus proposed to exclude dam removal projects from the Program that impound greater than 900-cubic yards of sediment. While this additional measure developed by the NOAA RC has the potential to minimize sediment-related impacts in larger watersheds, it does little to ensure that the amount of sediment released by dam removal projects will indeed be relevant to the size of the watershed. Additionally, these proposed protection measures focus entirely on sediment quantity and do not address the composition of the stored sediment and the potential for release of fine sediment. Lastly, the proposed action assumes that streamflow will be sufficient to remove the quantity of sediment in its entirety *during the initial high flow event the following winter season*, but stream hydrology or geomorphic support was not provided to support this assumption. As a result of these proposed conditions, NMFS believes that these measures are insufficient to avoid downstream sediment-related impacts associated with increased mobilization of fine sediment in action area creeks.

Small dam removal Program activities have the potential to result in temporary adverse effects to critical habitat. As described in Table 5, these adverse effects include fine sediment fouling of spawning and rearing habitats in stream reaches downstream of dam removal sites. The NOAA RC acknowledged the concern for sediment-related impacts downstream of dam removal sites in the biological assessment, but discounted the likelihood it would occur owing to complete sediment transport during the first storm

event following construction. NMFS expects that substantial transport of smaller substrate (e.g., sand and gravel) from project sites would occur during a bankfull flow event (i.e., 2-year event), and that an event in excess of a 5-year event would be necessary to redistribute a significant portion of the larger bedload (e.g., coarse gravel, cobble, boulder) to downstream stream reaches (Zimmerman and Lapointe 2005, Florsheim et al. 1991). However, the transport of fine sediment would begin to occur when the project site is re-watered and would continue during base flows and all storm events at a magnitude less than a 2-year flow event. Based on the proposed action and NMFS' familiarity with the action area streams, NMFS anticipates the highly variable hydrology characteristic to the action area streams has the potential of resulting in sediment fouling of stream reaches extending up to 100-meters downstream of dam removal sites for a period of 1 to 2 years.

Certain Program activities, such as upslope watershed restoration, are expected to have an entirely beneficial effect on steelhead designated critical habitat as illustrated in Table 6. Examples of short-term benefits to steelhead and their habitat expected from upslope watershed restoration are erosion control treatments to minimize sediment delivery routes to steelhead streams, while long-term benefits addressing the sediment source such as road decommissioning projects would be expected to minimize impacts associated with chronic sedimentation in action area streams.

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 stabilization) will increase background suspended sediment loads. With regard to fine sediments, releases into flowing water are not expected until the first rains after construction activities are completed and the flows are reintroduced into the reconfigured channel. Because of the proposed protection measures, it is anticipated that the expected increase in background sediment levels resulting from most restoration activities is unlikely to adversely affect steelhead critical habitat. For small dam removal projects, temporary adverse effects to critical habitat 100 meters downstream of the project sites are anticipated as described above.

2. Construction of Access Ramps and Temporary Access Roads

Riparian corridors are important to aquatic habitats because they contribute to the functional value of freshwater rearing sites and provide numerous benefits to aquatic environments and stream-fish populations including filtering pollutants from runoff (Castelle et al. 1994, Wang et al. 1997). Riparian trees and shrubs can create cover for juvenile steelhead in the form of shade or overhanging vegetation, and streamside vegetation can contribute woody debris to streams. Once in streams, the debris alters water column depth and velocity, increases habitat complexity, and creates and maintains habitat for fish (Lisle 1986). This Program activity is expected to have a low severity of impact on critical habitat, as explained in the discussion that follows.

Implementation of various Program activities will require the use of in-channel heavy equipment. As described in the proposed action, and Table 5 above, four of the Program activities may require use of heavy equipment, including instream habitat improvements and barrier modifications, streambank stabilization activities, small dam removal, and water improvement projects (e.g., fish screen installation). Due to the programmatic nature of the proposed action, very little information was provided in the consultation package on how project applicants would access in-channel work sites. Therefore, NMFS compiled the best available scientific information and made the following assumptions to fully evaluate how this activity would impact steelhead designated critical habitat.

Preexisting heavy equipment access ramps are occasionally situated along certain action area drainages maintained by local flood-control districts (see SBCFCD 2001 for a discussion of maintained creeks in Santa Barbara County). For the purpose of this analysis, NMFS assumes all Program activities requiring in-channel use of heavy equipment will utilize pre-existing access ramps to the greatest extent possible. However, if an individual project site location precludes the use of a preexisting ramp because in-channel mechanical transport is likely to cause a greater impact to steelhead habitat, as compared to construction impacts of a new ramp, then it is assumed in this opinion that a new access ramp will be constructed. Because the NOAA RC and Corps have excluded projects impacting more than 500-linear feet from the proposed action, it is also assumed that if the total project footprint (including in-channel travel distance from nearest access ramp) exceeds 500-linear, a new access ramp will be constructed.

Construction, maintenance and use of existing access ramps increase the potential for fine sediment to become disturbed, exposed, and mobilized to flowing water owing to the removal of riparian vegetation. Sediment may be washed into creek habitats adjacent to access ramps or may be washed downstream during rain events and increase turbidity and loading of fines in substrate. Excess sedimentation in stream habitats during periods when sediment loads are normally low (e.g., late spring through fall) is especially detrimental to steelhead health and survival throughout the species' freshwater life history. High loads of fine sediment reduce foraging success (Gregory 1990), impair growth (Sigler et al. 1984), and may decrease survival of developing embryos in the substrate (Everest et al. 1987). Accessing creeks at existing ramps and driving heavy equipment in stream channels for extended distances are expected to degrade instream habitat within localized areas. The effects of stream substrate compaction and colmation (i.e., gravel and cobble layer clogged with fine sediment) can include decreased (1) refugia space for benthic macroinvertebrates, (2) riparian vegetation recruitment and (3) reproductive success of fish spawning on gravel (Brunke and Gonser 1987, Zeh and Donni 1994). In-channel transportation of heavy equipment has the potential to modify stream habitat by levelling stream contours that may result in the loss of pools, and overall channel roughness features that reduce habitat complexity.

The NOAA RC has proposed a protection measure that indirectly addresses the impacts of road and access ramp construction. General protection measure A-6 (Appendix B) assures that *if the thalweg of the stream has been altered due to construction activities, efforts shall be undertaken to reestablish it to its original configuration.* As a result, it is unlikely that pools in the action area will be lost or modified as the result of heavy equipment access to project sites. If sensitive pools cannot be avoided by heavy equipment, then these habitat types will be reconfigured and their forcing features (e.g., large woody debris or boulders) will be restored to their original configuration to prevent loss of steelhead PCEs.

Specific protection measures were also incorporated in the proposed action to minimize disturbance from instream construction (SusCon 2015). Protection measure C-5 states that *use of heavy equipment shall be avoided in a channel bottom with rocky or cobbled substrate*. Because gravel-cobble substrates are important habitats for steelhead spawning and rearing, this protection measure minimizes adverse impacts to habitat containing these substrate types and in turn conserves the function of these habitats for providing PCEs to steelhead. Measure C-5 also provides assurances that woody debris and vegetation shall not be disturbed if outside of the project's scope. Additionally, applicants for individual projects are required to submit detailed project descriptions that describe how the applicant proposes to access the project site (see SusCon 2015, page 27). Because this information will be reviewed by the NOAA RC to evaluate consistency with covered Program activities for each Program activity, and restoration objectives in general, it is assumed that all protection measures will be adequately applied to minimize impacts associated with accessing project sites.

Several Program activities proposed by the NOAA RC are expected to offset the impacts associated with the construction of access ramps and temporary access roads. Stream bank stabilization projects are expected to reduce sedimentation from bank erosion, decrease turbidity levels, and improve long term water quality for steelhead. Riparian restoration projects are expected to increase stream shading, reduce stream temperatures, and improve water quality through pollutant filtering. NMFS anticipates steelhead will benefit from riparian restoration projects owing to an eventual increase in overhead cover as well as supply of deadfall trees that will increase instream cover and habitat complexity. An increase in pool habitats may result as an indirect effect of the proposed action because numerous bioengineered stream bank stabilization projects (e.g., native material revetment) contain features that encourage scour which may result in pool formation. Additionally, fallen logs that recruit to the stream channel may also create scour pool habitats.

Based on the effects described above and associated protection measures, it is anticipated that critical habitat (e.g., steelhead rearing and spawning areas) in the vicinity of access ramps and access road sites may be temporarily affected by increases in sedimentation, substrate compaction, and limited removal of riparian vegetation. With regard to the duration of the temporary affects, NMFS anticipates that after a bankfull flow (i.e., 2-year event) occurs the fine sediment will be flushed from the substrate and the interstitial spaces between spawning gravels will be restored that create areas suitable for steelhead spawning. Depending on the specific species of riparian trees and shrubs that are affected, re-establishment can be realized in two to three years. These localized impacts may cause juvenile and returning adult steelhead to temporarily avoid these habitat areas. Overall, the impacts attributed to access ramp and road construction will be offset by the associated restoration projects that are intended to increase access to previously inaccessible habitat, and improve the quality of existing steelhead habitat.

3. Dewatering Activities

Because of the hydrology specific to the SCCCS DPS and the SCS DPS, NMFS believes many Program activities will occur at sites that are dry, or have isolated pools during the proposed construction window of June 1-November 30. NMFS anticipates the following six Program activities may require dewatering: instream habitat improvements, instream barrier modification for fish passage improvement, bioengineered stream bank stabilization and riparian habitat restoration, removal of small dams, creation of off-channel/side channel habitat features, and water conservation projects. Dewatering is expected to have a moderate to high severity of impact on critical habitat, as explained below.

The dewatering resulting from in-channel Program activities is expected to cause temporary loss, alteration, and reduction of aquatic habitat. Based on recent restoration project data from projects conducted in Santa Barbara and Los Angeles counties (SusCon 2015), the Corps and NOAA RC anticipate that a small reach averaging about 200 linear feet will be dewatered for individual Program activities. Observations indicate streamflow was not always present during the proposed construction window, and when water was present during construction it was typically in the form of isolated pools, possibly resulting from groundwater. The maximum length of stream that may be dewatered for any individual Program activity is 500 linear feet. Dewatering project work areas may also cause short-term increases in turbidity levels as previously discussed.

Benthic aquatic macroinvertebrates may be temporarily lost or their abundance reduced when creek habitat is dewatered (Cushman 1985). Effects to aquatic macroinvertebrates resulting from streamflow diversions and dewatering will be temporary because construction activities will be relatively short-lived, and rapid recolonization (about one to two months) of disturbed areas by macroinvertebrates (Cushman

1985, Thomas 1985, Harvey 1986) is expected following rewatering. In addition, the effect of macroinvertebrate loss 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 as a result of dewatering activities is not expected to diminish the functional value of designated critical habitat.

Effects on critical habitat associated with dewatering activities will be minimized due to the multiple protection measures that are required as described in Appendix B. For certain projects where it is deemed necessary to work in a flowing stream, the work area would be isolated and all the flowing water would be temporarily diverted around the work site to maintain downstream flows during construction. Protection measure B-3 requires that prior to dewatering, it is necessary for a qualified individual to determine the best means to bypass flow through the work area to minimize disturbance to the channel and associated steelhead habitat features. Protection measure B-6 requires that the length of the dewatered stream channel and duration of dewatering activity are minimized. As a result of this protection measure, the direct effects of the activity on critical habitat are minimized by dewatering the shortest stream reach necessary to complete the Program activity. Because the duration of dry channel conditions is kept to a minimum, it is likely that stream habitat functions will quickly return to the site when re-watered. Additionally, protection measure B-16 assures that cofferdam removal and release of water will be gradual. NMFS anticipates this protection measure will sufficiently minimize the risk of a sudden breaching event. As a result, dewatering activities are not anticipated to cause sudden instream habitat changes that would diminish the functional value of designated critical habitat.

4. Alter Characteristics of Channel Form and Function

In many ways, designated critical habitat for steelhead depends on adequate supplies of substrate (i.e., boulder, cobble, and gravel) to promote life history function (NMFS 2005a). For instance, freshwater spawning sites include substrate supporting spawning, incubation and larval development, whereas large rocks and boulders provide natural cover and areas of forage within freshwater rearing sites for the species. Lastly, freshwater migration corridors include large rocks and boulders supporting juvenile and adult mobility and survival. Given the function and value of sediment in streams for supporting life history and habitat requirements of steelhead, any activity that is likely to affect the availability, type, and distribution of sediment in waterways, has the potential to affect primary constituent elements of designated critical habitat for this species. In this regard, the following section establishes the context for effects of the proposed action on designated critical habitat in terms of potential changes in the type of channel form that exists in action area streams, as well as changes/disruptions to the distribution and function of sediment (i.e., geomorphology) in the action area that may create fish passage barriers. This Program activity is expected to have a low to moderate level severity of impact on critical habitat.

Installing instream habitat structures as described in the proposed action (per CDFW Manual guidance) is expected, overall, to have beneficial effects on designated critical habitat. Installing rock and (or) wood structures in action area streams is expected to beneficially alter the physical characteristics of the treated site. For example, placement of rock or large woody debris deflectors is likely to change the distribution and magnitude of water depths and velocities within the treated area and perhaps to some extent downstream. When structures are properly oriented and anchored within the channel, the resulting changes are expected to produce a long-term benefit and improve habitat conditions including those conditions that promote rearing, spawning and migration opportunities for this species. Instream habitat improvement projects may also increase complexity of the existing habitat.

Although the proposed action includes provisions that have the potential to benefit steelhead habitat in many ways, the provisions lack important details and generate a number of uncertainties. Unintended changes to channel form (e.g., headcut issues) may result from barrier and dam removal, owing to the lack of proposed data requirements and analysis (e.g., hydrological, hydraulic, geomorphic) for these proposed actions. Because the proposal lacks an established, scientific process to guide the development of dam-removal projects, a physical alteration to a dam may not necessarily restore the freshwater migration corridor for steelhead, especially across a meaningful range of streamflows. With regard to water-conservation projects, the proposal describes the installation of instream infrastructure and states the formation of this Program activity will not create fish passage barriers, but omits a description of the precautions applicants would undertake for the purpose of ensuring fish-passage barriers would not be created or perpetuated.

There is a risk that creation of off-channel/side-channel habitat features could cause a significant and abrupt change of channel alignment resulting in a new channel across the floodplain (i.e., known as an avulsion) (Saldi Caromile et al. 2004). An avulsion is caused by concentration of overland flow that scours or headcuts a new or enlarged channel. If the flow capacity of a side channel were greatly increased, elevated discharge might cause enough water to flow through a side channel that the upstream connection to the mainstem could scour during a flood, increase the flow to the side channel, and eventually divert the entire mainstem into the side channel alignment. Risks of avulsion include potential loss to property, infrastructure and habitat. According to Saldi Caromile and others (2004), if there is even a moderate risk of avulsion, a hydraulic analysis of avulsion should be conducted.

The NOAA RC proposed protection measures to minimize degradation of water quality that could help offset the effects of project impacts caused by changes to the form and function of the stream channel. For instance, protection measure D-6 and D-8 encourage the use of instream grade and scour-control structures to control channel scour, sediment routing, and headwall cutting. However, the protection measures are written in a way that creates uncertainty because they state that grade control would be utilized "when needed," yet no decision criterion is presented in this regard. We are therefore left not knowing whom would be responsible for determining whether grade/scour control is needed (e.g., the applicant or representative from the NOAA RC), how it would be determined (qualitative or quantitative analysis), and how this information would be used and acted upon to minimize effects on designated critical habitat.

Specific to small-dam removal, the NOAA RC proposed three protection measures to minimize negative impacts associated with sediment stored upstream of dams, toxicity of impounded sediments, and loss of riparian vegetation Additionally, an extensive list of data requirements and analyses was proposed owing to the technical nature of this restoration activity (see Section 1.3.4). The list of data needs and required analyses is commensurate with the increasing complexity of individual projects; a list of *Minimal Data Needs* is proposed for conducting more simple small-dam projects, while a list of *Potential Data Needs for Complex Projects* was proposed for small dam removal projects believed to have a higher level of complexity. Most, if not all, of the information detailed in the list of data requirements is the same information NMFS engineers require from applicants designing dam-removal projects. However, two key uncertainties exist with regard to the list of data analyses for complex projects.

First, not enough information is provided to determine how dam-removal projects would be classified as either simple or complex, and who is responsible for this determination. In this regard, no classification criterion is specified that allows for a clear distinction between simple and complex projects in the proposed action, and ultimately it is this ambiguity that creates uncertainty regarding the true benefits of

dam removal, and the level of analysis and information that will be provided as proposed under the Program.

Based on NMFS' understanding of the proposed action, it is likely that the NOAA RC and/or the applicant will be responsible for deciding if projects are complex projects. The BA does not specify who will be involved in the decision-making process regarding determining whether a project is complex, but rather focuses on assigning different data and analysis requirements for projects of varying complexity. In addition, the lack of information regarding what professional certifications and/or licenses are required of individuals conducting the complex dam removal analyses generates concerns. NMFS' fish-passage guidelines recommend applicants must have on staff or contract all the qualified personnel needed to develop the design plans for the project. At a minimum, this should include a certified engineer and/or a geomorphologist. Without NMFS involvement at the early stage in the decision-making process, NMFS is concerned that insufficient analyses may be conducted to support the small dam-removal design process.

Potential adverse effects to critical habitat that may result from complex projects lacking sufficient analyses include the creation of a headcut that advances upstream through one or more tributaries, conversion of a fish passage impediment into a more severe fish passage barrier, and creation of a reoccurring maintenance activity to decrease flood risk (e.g., sediment or debris removal). The effects associated with a potential headcut would create permanent effects to critical habitat, such as channel incision and decreased streambank stability. The unintentional creation of a more severe fish passage barrier would be a temporary impact to critical habitat that would require additional in-channel construction and funding to remediate the problem. Additionally, complex projects sites that do not conduct a sediment transport analysis and incorporate the results into the design process could result in long-term impacts to critical habitat by requiring reoccurring in-channel maintenance and removal of sediment and debris using heavy equipment. This type of maintenance could result in a reduction of stream habitat complexity and reduce the transport of spawning gravel to downstream areas.

Regarding the application of appropriate regional fish passage guidelines, the NOAA RC proposes to apply CDFW's Culvert Criteria for Fish Passage and "*attempt to meet"* NMFS (2011) fish passage guidelines (Suscon 2015, page 14). As a result of this specific condition, there is little assurance that NMFS' fish-passage design metrics will be achieved. If NMFS' fish-passage design metrics are not incorporated into the design, uncertainty exists regarding the safe, timely, and efficient upstream and downstream passage of anadromous salmonids at project sites. Projects that are not designed appropriately will require follow-up instream construction that has the potential to continue to impede steelhead migration and cause additional impacts that were not evaluated as part of the original project review. Nevertheless, improvement in fish passage is expected to result from most, if not all of the proposed projects. Additional minor and temporary adverse effects to critical habitat are likely in some instances if fish passage conditions need to be improved further after projects are constructed. While NMFS cannot estimate the number of fish passage projects that may need remedial work, impacts to critical habitat from that work are likely to be limited to short term disturbance of small stream areas and the short term generation of small amounts of sediment and turbidity.

As described in the BA, the CDFW Manual does not contain guidance on dam-removal projects. If the design of dam-removal projects do not meet the NMFS 2011 Guidelines (or most current NMFS guidelines), the NOAA RC proposed that a variance may be granted at the discretion of NOAA RC and NMFS engineers if there is a clear benefit to fish passage. Based on discussions that occurred during this consultation, as described in detail in the *Consultation History*, and guidance in the CDFW Manual,

NMFS anticipates that designs for small dams will be developed and implemented according to the site-specific and watershed physical and biological characteristics. In these cases, although fish passage may be more limited than what would occur had the dam not been in place, NMFS expects the value of critical habitat to listed species in the watershed will not be compromised.

Lastly, the proposed action is ambiguous about how the creation of off-channel habitat features would avoid creating fish-passage barriers or impediments. Specifically, projects that propose to install infrastructure in the stream channel, such as off-channel inlet and outlet structures, create a concern for fish passage owing to scour, armoring, maintenance and repair of these channel features. NMFS (2011) cautions that if instream infrastructure is improperly sited, failure may occur that results in severe adverse habitat impacts to stream habitat and possible loss of steelhead habitat access. Because off-channel habitat features are still considered a relatively new restoration technique in California (SusCon 2015), NMFS (2011) recommends following the process outlined for developing experimental fish passage technology until these projects are considered proven conventional technology. Yet, the proposed action does not adopt this framework for creation of off-channel/side-channel projects and instead relies on post-construction monitoring for adaptive management. As a result of the precautionary process described in NMFS' fish passage guidelines not being incorporated as part of the proposed action, NMFS anticipates creation of off-channel/side-channel habitat features may diminish the functional value of designated critical habitat for steelhead in the action area where this Program activity occurs.

5. Reduction of Instream Flow

The two Program activities that have the potential to reduce instream flows are the creation of off-channel/side-channel habitat features, and water-conservation projects. These Program activities are expected to have a moderate severity of impact on critical habitat, as described in greater detail below.

The Program activity involving the creation of off-channel/side-channel habitat features is intended to result in the formation of floodplain habitats to provide PCEs for steelhead. Yet, the potential for adverse effects exists when these newly created habitats are filled during the wet-season and dewatered during the dry season. The proposed action states these projects may result in an increase in streamflow in reaches that exhibit no to little surface flow (SusCon 2015). Therefore, if this Program activity successfully creates freshwater rearing habitat, there is the potential that the newly created habitat may only function seasonally. In the event newly constructed off-channel habitats do not maintain flow throughout the summer rearing season, and these habitats fail to maintain PCE essential for survival, this would diminish the functional value of designated critical habitat for threatened or endangered steelhead.

The NOAA RC did not propose a minimization measure for this Program activity, however, additional data requirements and monitoring activities were specified in the proposed action. In this regard, consideration of water supply (channel flow/overland flow/groundwater), water quality, water source reliability, risk of channel change, and channel/hydraulic grade must be included with project submittals. Additionally, all off-channel habitat projects included in the restoration Program will require an additional level of physical and biological monitoring to create a feedback loop of information to the NOAA RC for the purpose of adaptively managing project implementation to prevent adverse impacts (SusCon 2015). Examples of the meaningful project specific monitoring elements required for these projects include measurement of inlet and outlet-structural features as compared to the 2-year flood elevation, daily monitoring of flow connectivity into off-channel habitats and procedural guidance for advance notification regarding potential fish stranding events. Based on the information that applicants

need to provide and the extended monitoring requirements for off/side channel habitat creation, NMFS expects this Program activity will be implemented in a manner that will minimize impacts and the constructed channels will contain habitat features that create self-sustaining channels that will be maintained through natural processes. For these reasons, this program activity is not expected to permanently diminish or destroy critical habitat within the action area.

Water conservation projects are proposed within the action area and NMFS anticipates these Program activities will result in temporal and spatial reductions to streamflow in designated critical habitat. For water storage activities, filling of tanks and ponds may reduce streamflow during pumping for storage activities. Construction and filling of off-channel storage reservoirs creates another concern with regards to modifying natural discharge patterns in the action area. The NOAA RC and the Corps included a sideboard addressing this Program activity that limits storage reservoirs size to 2 acres or less, and requires applicants to screen all pump intakes according to NMFS/CDFW guidelines.

As seen in Appendix B, separate protection measures were not included as part of the proposed action to minimize water withdrawal quantity or effects to instream flow. However, in the Section V of the BA the NOAA RC has proposed to place a special condition on water-conservation activities that limits *the quantity of water pumped and rate at which it is pumped [so the pumping] will not dewater more than 10% of the wetted channel, and will not dewater the channel at such a rate that steelhead become stranded (SusCon 2015)*. The NOAA RC proposed special condition is intended to make sure these reductions of streamflow will be small, gradual, short-term, and not result in permanent impacts to critical habitat. Even though the special condition sets a limit on the quantity of water pumped, the proposed action will nevertheless cause a reduction in the amount and extent of surface flow, such that a decrease in habitat quality or availability is observed. The aforementioned special condition is focused on the rate of pumping to prevent sudden changes in discharge intended to prevent dramatic changes in streamflow stage (i.e., dewatering); however, aquatic habitat can suffer adverse effects long before the habitat experiences actual or approximate dewatering. Although the proposed action sets a numerical limit that is intended to limit the quantity of water pumped, there is no detail provided that specifies how applicants of water-conservation projects would be required to monitor their streamflow diversion. Discharge in the vicinity of each project site is expected to be the same as natural-flow conditions except when water-conservation projects are actively withdrawing water from action area streams. The details regarding extent, magnitude, duration, frequency and monitoring of the pumping activity are lacking important details; therefore, NMFS anticipates the water withdrawal limitations imposed by the special condition may be insufficient to protect PCEs specific to designated critical habitat for threatened or endangered steelhead. Given the expected magnitude (i.e., small relatively to the amount of water available) and timing (i.e., generally when surface water is most available) of the water withdrawal, the specific effects are anticipated to be confined to the localized area in the vicinity of the withdrawal area.

6. Localized Loss of Pools

The importance of pools to steelhead life-history is illustrated by the critical functions that pools serve throughout the many different life stages for the species. Steelhead adults utilize pools during their upstream migration as resting areas and spawn in the pool tailout where the substrate is well-sorted, free of fine sediment and well aerated. Developing embryos and swim up fry begin life in pools before they move into shallow water habitats along channel margins. Juvenile parr compete for territories in pools that provide productive feeding areas and refugia. Parr spend 1 to 3 years rearing predominantly in these freshwater habitats. Large, deep pools in action area streams likely contribute to steelhead survival, especially that of larger juveniles, based on the relationship between the counts of steelhead and mean

pool depth (and area) documented by studies in south-central California streams (Spina et al. 2005). Lastly, steelhead smolts stage, or congregate, in large deep pools waiting for their migration cues as they emigrate to the ocean. This Program activity is expected to have a low severity of impact on critical habitat based on the discussion that follows.

In general, the loss of pools in the action area could contribute to an overall decline in the functional value of freshwater rearing areas in creeks of the action area, for at least a few reasons. During the dry season and naturally modest habitat conditions that persist at that time, pools may be the principal or sole source of suitable rearing areas for juveniles. Loss of pools likely decreases the variance of channel structure, depth, and velocity, and thus the diversity of habitat available to the different life history stages (Fausch 1993). Hence, pool loss in action area creeks may decrease both the amount and quality of freshwater rearing areas.

The proposed modification of instream barriers and small dam removal activities in the action area is an aspect of the proposed action that is expected to translate into localized loss of pools associated with introduced migration barriers. The scour pool on the downstream side of road crossings or small dams, and any pools occurring within the project reach, are typically lost as the channel grade is steepened (i.e., regraded) to make up for the channel elevation difference upstream and downstream of the instream structure. Modification of instream barriers is less likely to result in pool loss since the instream structure is typically modified to allow fish passage, but not removed in its entirety.

7. Potential for Continued Maintenance

Program activities that involve the modification of pre-existing structures, or construction of new infrastructure in the steam channel create the potential for continued site maintenance to preserve structural integrity and function. The proposed program activities that create the potential for continued maintenance are instream barrier modification for fish passage improvement, removal of small dams, creation of off-channel/side-channel habitat features, and water conservation projects. Maintenance activities associated with barrier modification and small dam removal that could adversely affect designated critical habitat have similar effects owing to the similarity of the actions, and these activities could include the use of instream heavy equipment to remove excess sediment, repair hydraulic control structures after high flow events, and correct scour problems that may result at the upstream or downstream terminus of project sites. The proposed timing, frequency and effects of these maintenance activities were not described in the proposed action. This Program activity is expected to have a low severity of impact on critical habitat, as described more fully below.

The proposed action lacks a detailed monitoring program that would be reasonably expected to track and then reconcile spatial and temporal adverse changes in the quality and availability of designated critical habitat owing to the Program activities that require continued maintenance. This is considered an adverse effect of the proposed action for at least a few reasons. NMFS' effects analysis predicts that numerous maintenance activities of the proposed action would perpetuate measurable reductions in the functional value of designated critical habitat for threatened and endangered steelhead. The projected effects of the proposed action would conceivably continue unabated into the future with no means of detecting or remediating adverse characteristics or condition. Overall, to minimize the amount and extent of effects on designated critical habitat, the proposed action should include a meaningful monitoring program that would allow the NOAA RC to reasonably track and reconcile harmful effects of the maintenance activities on freshwater migration corridors, freshwater rearing sites, freshwater spawning sites, and the estuary. At a minimum, a sufficient monitoring program would be required to record the

extent, magnitude, frequency and cumulative effect of Program activities requiring continued maintenance on steelhead PCE in tabular format.

Although the proposed action includes some level of monitoring and tracking of effects (e.g., post-construction, and off-channel habitats), the proposed action lacks a reliable method for meaningfully reconciling the effects of continued maintenance required at project sites. As a result, the NOAA RC propose to collect only a portion of the information described above, and it is unclear how the information will be summarized and reported for the 100 – 150 projects constructed as part of the proposed action. More importantly, NMFS could find nothing in the project description describing how the monitoring information would be evaluated or used to ensure that essential habitat functions would be maintained over time and space within the action area.

In summary, even though there will be some localized and mostly temporary adverse effects, overall the function and value of critical habitat will be improved because passage barriers will be reduced, instream complexity will be increased, water withdrawals will likely be diminished, and off-channel and side-channel habitats will be restored on the floodplain. Types of beneficial effects to steelhead critical habitat owing to specific Restoration Program activities include an increase in pool frequency, improvements to spawning habitat, restored access to blocked habitat, increases to stream flows and instream cover and improvements to water quality as described below in Table 6.

Table 6. Program activities listed against the types of beneficial effects on critical habitat that each activity has the potential to create. A "+" placed in the box under an effect designates that Program activity has the potential for directly causing that effect, while a "±" designates the potential for indirectly resulting in that effect. However, though a Program activity has potential to incur a particular effect, it may not always incur that effect depending on level of impact of each individual project. The magnitude of effect also would vary between projects.

Program Activities	Increase Pools	Increase Spawning Habitat	Increase Access to Blocked Habitat	Increase Stream Flows	Improve Instream Cover & Habitat Complexity	Improve Water Quality
Instream Habitat Improvements	+	+			+	±
Instream Barrier Modification for Fish Passage Improvement	±	±	+			
Bioengineered Stream Bank Stabilization & Riparian Habitat Restoration	±				+	+
Upslope Watershed Restoration		±				+
Removal of Small Dams	+	+	+		+	±
Creation of Off-channel/Side-Channel Habitat Features	+	±			+	
Water Conservation Projects	±	±	±	+		±

2.4.2 Effects to Steelhead

In this section, NMFS describes the effects of the proposed action on the threatened SCCCS DPS and endangered SCS DPS of steelhead. Information presented in sections 2.2 and 2.3 of this biological opinion indicates listed anadromous *O. mykiss* exist within watersheds of the action area albeit at critically low levels. Presence of this species appears intermittent at times, and the listed anadromous form may be absent from some of the action area drainages due to the ongoing presence of passage barriers as described in Table 1 of the BA (SusCon 2015). These facts may not be readily apparent in the following narrative of the effects, which we suspect creates the impression that steelhead are abundant and widespread. The description of the effects on steelhead was written with the intention of illustrating the expected effects when steelhead are present.

Many of the effects reported in this section have been predicted from the assessment of how the proposed action would affect habitat for threatened and endangered steelhead, including designated critical habitat for this species, and knowledge of the life history and habitat requirements of steelhead. What follows is a discussion of how the proposed action is expected to affect steelhead by (1) release of fine sediments from Program activities, (2) construction of access ramps and temporary access roads, (3) dewatering activities, (4) altering channel form and function, (5) localized loss of pools, (6) reduction of instream flows, (7) need for continued site maintenance, and (8) use of explosives for small dam removal. Yet, despite the largely temporary and localized adverse effects of the construction activities, the completed restoration projects are expected to have an overall beneficial effect on threatened and endangered steelhead.

1. Release of Fine Sediments from Program Activities

Construction and maintenance activities will likely result in the release of fine sediments as described in the preceding *Effects to Critical Habitat* section. Short-term increases in turbidity are anticipated to occur during construction and removal of coffer dams, dewatering activities, maintenance activities, and during storm events following project implementation. 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 (Waters 1995). Impairment of embryonic development owing to high sediment concentration (Fudge et al. 2008) and mortality of juvenile fry due to increased turbidity (Sigler et al. 1984) have been reported for steelhead. Even small pulses of turbid water can cause salmonids to disperse from established territories (Waters 1995), which may 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 action. This Program activity is expected to have a low to moderate severity of impact on steelhead based on the discussion that follows.

Because the effects of fine sediment releases from Program activities on critical habitat (and primary constituent elements) are to some degree uncertain, only a general characterization of the possible effects on steelhead can be made. While steelhead in the action area are expected to be affected when high flows contact project sites, increasing the potential for release of fine sediment, the release is proposed to be limited to the first wet-season following construction, short lived (2 to 3 days) and create low turbidity concentrations. Aside from small dam removal projects, the program activity sites themselves will be designed to minimize contact of fine sediment with flowing water. Background turbidity concentrations

are expected to be elevated during periods of increased flows; therefore, the potential exists that background levels could mask turbidity concentrations resulting from the release of sediment from project work sites. The severity of the effects on steelhead will depend on both suspended sediment concentration and duration of exposure (Newcombe and Macdonald 1991, Newcombe and Jensen 1996), but are expected to be discountable based on the foregoing. Even though construction activities are scheduled to occur outside the spawning and embryonic development stage, exposed sediments are expected to be released downstream of project sites for the first couple winter storm events that coincide with steelhead spawning. With regard to effects due to sedimentation (see exception for small dam removal projects described in greater detail below), once mobilized the fine sediments released from project work sites are not expected to settle, and therefore eggs, incubating embryos, and alevins in nests are not expected to be harmed.

Accumulated sediment loads behind dams in the action area have the potential to be substantial. Releasing these large sediment loads can be detrimental to steelhead and their habitats by reducing or impairing instream spawning and rearing sites (see Section 2.4.1). In general, the proposed action suggests the sediment-related impacts related to small dam removal are most likely to occur during winter storm events when any remaining project-related sediment may be mobilized. Unlike other preexisting NOAA RC consultations described in Section 1.2 Table 1 (e.g., NMFS 2006a), the biological assessment did not establish a numerical limit for the amount of sediment that could be released into the stream channel when small dam removal projects are implemented. As described in the *Consultation History*, after review of the draft biological opinion the NOAA RC proposed a numerical threshold of 900 cubic-yards of sediment as the maximum amount of sediment that can be released from small dam removal projects. While properly designed projects implemented in conjunction with the minimization measures identified above will effectively minimize most potential sediment impacts, some minor short-term effects to fish behavior/health may still occur as the result of certain dam removal projects. These adverse effects could include adult steelhead avoidance of spawning areas impacted by dam-released fine sediment. NMFS anticipates these effects would be temporary, and that spawning steelhead would search for other areas less impacted by the sediment release, and possibly avoid the impact altogether by moving upstream of the dam removal site and establish spawning sites in newly accessible habitats.

Another more severe adverse effect is the potential for mobilization of fines by winter small to moderate flow events (< 2-year event) into areas where spawning has already occurred. The effects in these downstream areas containing steelhead redds include reduced redd permeability and impaired embryonic development. While the action agency is correct in assuming that a typical bankfull storm event should be sufficient to transport much of the sediment impounded by most small dams in one or two storm events, the proposed action does not include any protection measures that would prevent chronic release of fine sediment into downstream habitats if stream hydrology meeting the bankfull flow (i.e., 2-year flow event) does not occur in the same year the dam is removed. Because on average a bankfull flow event typically occurs only every other year, there is a risk that downstream steelhead redds could be affected by the unmetered release of fine sediment. To minimize the potential effects of large or chronic fine sediment releases, the Program should ideally include a sediment management plan to minimize the impacts of managing accumulated fine sediments upstream of dam embankments. NMFS anticipates these effects would be temporary (i.e., lasting no more than 1 to 2 years) and that reduced egg to fry survival would occur if steelhead spawn within close proximity (i.e.,100-meters) downstream of the dam removal site.

Based on NMFS limited knowledge of steelhead spawning ecology throughout the action area, it is assumed that no more than one steelhead redd would be affected from fine sediment fouling downstream

of small dam removal projects. Moderate intensity rain–runoff events can trigger sand/silt suspension transport and, in turn, lead to fines infiltration into spawning sites. Zimmerman and Lapointe (2005) directly measured a sudden reduction of interstitial redd flow associated with fine sediment transport that occurred during high recurrence, moderate intensity runoff events. Fine sediment fouling in streams is believed to reduce intergravel flow by decreasing the hydraulic conductivity of the gravel which reduces oxygen flow into the redd and the removal of waste products (Lisle and Lewis 1992). Fine sediment cap formation over a steelhead redd also increases the physical entrapment of emerging fry (Fudge et al. 2008). The available information suggests that a complete loss of developing embryos in the redd is unlikely owing to factors such as hyporheic flow and groundwater upwelling. The precise percent reduction in survival, or number of individuals affected cannot be determined without additional site-specific information (i.e., percent fines, sediment quantity, stream hydrology, distance from project site to redd, fish fecundity, etc.). As a conservative estimate based on the fine sediment study findings discussed above, and supplemented by a review paper by Chapman (1988), NMFS anticipates up to 50% reduction in survival of developing embryos in the sediment fouled redd could occur.

Evaluating the overall effect of redd fouling resulting from small dam removal projects is further complicated because the NOAA RC did not indicate the number of small dam removal projects that would occur annually. As described in the biological assessment, the overall 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. Because small dam removal projects are more complex projects that require additional analyses, engineering review and have a higher design and construction cost, NMFS anticipates that small dam removal Program activities will occur on average at a frequency of no greater than one project every other year. As a result, this temporary adverse effect is expected to reduce the survival of one redd every two years.

Additionally, the spatial and temporal limitations (as described in Section 1.3.6) restricting project activities are expected to preclude significant additive sediment-related effects in the action area. Sediment effects generated by each individual project, excluding small dam removal projects discussed above, will likely impact only the immediate footprint of the project location. Under this expected scenario, only a small number of steelhead, if any, are likely to be temporarily affected (see Table 5, page 43) by increased turbidity and sedimentation. Also, effects to steelhead are expected to be non-lethal, since most project-related sediment will likely mobilize during the initial high flow event the following winter season when background water turbidity is naturally elevated. In summary, the predominate expected magnitude and duration of sedimentation and turbidity resulting from habitat restoration activities is not anticipated to appreciably affect the survival, reproduction, or distribution of steelhead within, or downstream of, each individual project area.

2. Construction of Access Ramps and Temporary Access Roads

Construction of access ramps and temporary access roads have the potential to indirectly affect steelhead owing to the direct effects this activity has on their critical habitat as described in *Effects to Critical Habitat* Section above. Although this Program activity has the potential to adversely affect both rearing juveniles and spawning adults, the anticipated effects, should they occur, would be temporary and not severe, as detailed in the discussion that follows.

The construction of access ramps and transportation of heavy equipment through the dewatered stream channel may affect juvenile and adult steelhead in numerous ways. Depending on the extent of distance

traveled by heavy equipment and the type of machinery used, steelhead habitat complexity may be reduced, and unique habitat features may be lost. This type of effect could translate into steelhead avoidance of these construction sites, higher predation on juvenile steelhead remaining in these simplified habitats, decreases in stream shading resulting from vegetation removal, and a reduction in reproductive success (i.e., redd construction) due to substrate compaction. Protection measure C-5 requires that 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. Implementation of this protection measure, which will have the functional effect of minimizing compaction of the natural streambed, should minimize many of the effects on juvenile and adult steelhead associated with this Program activity. Decreases in stream shading and overhead cover for steelhead will be minimized by implementation of protection measures E-1 and E-2, which require retaining as much shade-producing tree habitat as feasible and using pre-existing access points, respectively. Effects to steelhead resulting from construction of access ramps, including temporary road building activities, are expected to be non-lethal and temporary.

3. Dewatering and Fish Relocation Activities

Dewatering stream reaches to facilitate instream construction is expected to be problematic for steelhead because the temporary loss of water, and therefore habitat would disrupt behavioral patterns of individuals present in the dewatered area. Steelhead need suitable living space for ontogeny and survival; living space absent surface water is not suitable. Streamflow diversion could harm individual steelhead by concentrating or stranding them in residual wetted areas (Cushman 1985) or by causing them to move to adjacent habitats (Kraft 1972, Campbell and Scott 1984). Dewatering the workspace may cause harm, injury and mortality to steelhead by confining them to areas that are predisposed to dewatering or desiccation, increased water temperature, decreased dissolved oxygen concentration and predation (Cushman 1985).

The NOAA RC has proposed several reasons to expect that dewatering effects on threatened and endangered steelhead will be minimized. First and foremost, the number of steelhead that may be affected by isolating workspaces from flowing water is expected to be relatively low, based on the number of juvenile steelhead recently observed in the action area. Protection measures B-2 and B-6 require that project applicants (1) exclude fish from the work area with mesh net measuring $\leq$ 1/8-inch diameter, (2) remain at the project work site during dewatering to net and rescue any additional fish that may have become stranded throughout the dewatering process, (3) check the upstream and downstream nets three times daily, and (4) minimize the length of the dewatered stream channel and duration of dewatering activity. While the description of the protection measures generally conforms to NMFS guidance on dewatering activities, the description of the proposed protection measures does not sufficiently specify the number or qualifications of the individual(s) that would be required to implement protection measures B-2 and B-6 in order to suitably minimize the effects of the dewatering activity.

General conditions for fish capture and relocation activities are also included in the proposed action. All fish capture and relocation activities must be performed by a qualified fishery biologist during morning periods, and prior to capturing fish the monitoring biologists are required to determine the most appropriate release location(s) to minimize heat and handling stress. Electrofishing, if determined necessary, is proposed to be conducted according to NMFS' guidelines (NMFS 2000), including NMFS approved modifications for high conductivity waters found throughout the action area. The description of the proposed protection measures relating to fish capture does not specify a suitable number of qualified individuals that would be required to safely conduct electrofishing activities in order to suitably

minimize the effects of steelhead capture and relocation activities. Specifically, the NOAA RC proposed electrofishing guidelines require two qualified individuals to capture fish using an electrofisher; however, NMFS Electrofishing Guidelines recommend a minimum of three individuals for the safe capture and efficient relocation of threatened and endangered steelhead using a backpack electrofisher.

Although the proposed dewatering and fish relocation project description contains measures to minimize effects on steelhead, our experience with dewatering and fish relocation activities indicates injury and mortality of a small number of juvenile steelhead is possible and probable. This is particularly true for the exceedingly small number of individual steelhead (usually less than five individuals) that typically avoid capture in the project work area. NMFS expects that the number of juvenile steelhead that will be killed as a result of stranding or crushing during site dewatering activities is low, typically less than 3 to 4-percent of the total number captured. As described earlier in the *Proposed Action* (Section 1.3), the number of restoration projects is not expected to exceed 15 projects per year. The consultation materials provided by the NOAA RC lacked detailed information on the number of projects that are expected to include dewatering activities that have the potential to require fish relocation activities. As a conservative estimate, NMFS assumed that all restoration projects would require dewatering and that the number of juvenile steelhead requiring relocation at each project site would be 20 individuals (based on FRGP reporting for restoration projects in southern California). Therefore, NMFS anticipates that up to 300 juvenile steelhead would be captured on an annual basis owing to Program activities, and no more than 12 individuals would be killed during the capture and relocation activities. This is based on the spatial distribution of the proposed restoration projects throughout the SCCCS and SCS DPSs, the small area affected during dewatering at each site, and our familiarity with the action area, including abundance of steelhead.

4. Altering Channel Form and Function

As described in the *Effects to Critical Habitat* section, the proposed action may result in changes to channel form and function as a result of the proposed action and the uncertainties identified. This Program activity is expected to have a low to moderate severity of impact on steelhead.

The effects on steelhead that may result from altering stream and river channel form and function are of concern to NMFS. Given the potential effects of the change in channel form on critical habitat (e.g., headcutting, alteration of freshwater rearing and spawning sites, and bank failure), certain steelhead life stages are at an elevated risk of experiencing adverse effects. This expectation is explained more fully below.

With regard to unanticipated physical alterations of the channel bed due to barrier modification and small dam removal, changes in the coarse sediment load have the potential to affect all life stages of steelhead within the action area since the sequence and locations of pools, riffles and runs could be changed (Pizzuto 2002). Changes to areas of freshwater rearing sites (e.g., pools, side channel habitats) have the potential to reduce the quality of such sites for juvenile steelhead. A reduction in the availability of suitable rearing sites increases the potential that the abundance of juvenile steelhead would decrease within the action area. While properly designed projects implemented in conjunction with the minimization measures identified above will effectively minimize most potential sediment impacts, very minor short-term effects to fish behavior may occur as the result of certain dam removal projects. Channel scour forming at the upstream or downstream terminus of a project reach creates the potential for a passage impediment to form. Based on the information provided, NMFS is uncertain to what degree these changes in channel form and function may occur, but the proposed comparison of completed

projects to as-built designs should detect the potential for potential passage impediments. NMFS anticipates that through implementation of the proposed protection measures, sediment-related effects on steelhead (based on impacts to habitat) can be detected and will be remedied as appropriate and necessary. The foregoing projected sediment-related effects on steelhead are expected to be offset by the ecological benefits due to removal of the dam, which are described as follows.

While the process of removing small dams is expected to create temporary instream conditions that are not entirely agreeable with the habitat requirements of steelhead, habitat connectivity will be restored by successful projects that meet NMFS fish passage guidelines and steelhead will once again have access to historical spawning and rearing habitats. The elimination of habitat fragmentation and restoration of bi-directional gene flow (i.e., movement of steelhead to and from the reaches upstream of former dam sites) is expected to decrease the risk of species extinction (Rieman and Allendorf 2001).

5. Reduction of Instream Flows

Through creation of off-channel/side-channel habitats and water conservation projects, the proposed action may cause decreases in streamflow that translate into a reduction in the quantity and quality of living space for steelhead in the action area. This Program activity is expected to have moderate to severe impacts' on the species because steelhead need instream flows in sufficient quantity to complete all life-history stages and express the full range of life-history pathways, and the modest habitat characteristics at the southern geographic extent of the species range are highly susceptible to habitat alterations.

The creation of off-channel/side-channel habitats has the potential to strand adult and juvenile steelhead in the event these habitats are unable to maintain continuous flow throughout the year. Productive side-channel/off-channel habitats typically form naturally in SCCCS and SCS watersheds where springs, seeps and tributaries enter the floodplain and provide reliable water sources (R. Bush, NMFS, pers. obs.). Construction of these habitats without regard for a reliable water source makes these created habitats more prone to dewatering than naturally formed off-channel habitats.

The potential also exists for these Program activities to cause a low flow impediment to migrating adult and juvenile steelhead owing to the lack of information provided in the proposed action regarding the amount of flow diverted relative to the bypass flows to create these off-channel habitats. Because data on steelhead use of off-channel or side-channel habitat in south-Central or southern California is limited, there is an inherent risk associated with construction of these habitats. Owing to the overall uncertainty and lack of demonstrable benefits this Program activity will provide to steelhead, the NOAA RC proposed project specific monitoring requirements and adaptive management for this Program activity. Elements of the proposed adaptive management program are expected to verify that the facility functions as designed, including verification that the inlet and outlet features are maintaining continuous streamflow sufficient for juvenile steelhead rearing, and early notification by project applicants (to NMFS and CDFW) that a relocation of stranded steelhead may be required. NMFS anticipates that few of these Program activities will be implemented during the 10-year term covered by this biological opinion, and that effects described above will be minimized owing to the proposed monitoring requirements and adaptive management program.

The implementation of water conservation projects (e.g., installation of water storage facilities, development of off-channel livestock watering areas) has the potential to reduce instream flows and negatively impact steelhead. Water withdrawals have a significant effect on summer rearing habitat and

seasonal flow patterns by removing water from streams during the low flow season (mostly May through September). Water withdrawals from shallow water aquifers that are connected to stream surface flows are also a concern to NMFS because even though the threat of entrainment and impingement of steelhead is eliminated, any reduction in the amount or quality of streamflow is likely to negatively impact rearing steelhead. Summer rearing habitat has been found to be the most restricted habitat type in the SCCCS and SCS DPSs (Boughton and Goslin 2006). Water withdrawals during periods of winter low flows between rain events can adversely affect adult immigration to high quality freshwater spawning habitats. Reduction of instream flows can affect steelhead by increasing water temperatures that causes changes in behavior, increasing migration delays, and decreasing feeding opportunities through reduced macroinvertebrate drift.

According to the BA, water-conservation projects can cause an increase in streamflow in areas of the floodplain that were dry (e.g., side channel habitat) (SusCon 2015). These localized increases in streamflow owing to rerouting a portion of the discharge could result in steelhead colonization of areas that were previously dry. The newly wetted reaches could fail to maintain flow throughout the rearing season, which could strand, and result in mortality to steelhead residing in the water conservation project area. As described in the preceding *Effects to Critical Habitat* section, the NOAA RC propose a water withdrawal limitation for water conservation projects such that *the quantity of water pumped and rate at which it is pumped will not dewater more than 10-percent of the wetted channel*. Additionally, off-channel water storage reservoirs will not be greater than 2 acres in size. Beyond proposing these two conservation measures in an attempt to protect steelhead, the NOAA RC did not submit any data that indicates these criterion are in fact protective of steelhead.

As discussed above, the creation of off-channel/side-channel habitats and water conservation projects both have the potential to result in a reduction of instream flow that can lead to steelhead stranding. NMFS anticipates that the NOAA RC proposed conservation measures would prove to be insufficient for avoiding adverse effects associated with this Program activity including stranding, harming, relocation and death of steelhead. NMFS anticipates that no more than 30 steelhead will be stranded annually by the operation of these Program activities, and that the early detection of these individuals by the proposed monitoring will result in relocation and thus is not likely to result in harm. However, because instream conditions that lead to the stranding of steelhead are not always easy to detect and predict in advance, NMFS anticipates that juvenile steelhead stranding owing to these Program activities may result in mortality of up to 5 individuals each year.

6. Localized Loss of Pools

Loss of existing pools at the base of introduced migration barriers and within project reaches that require regrading is expected to occur as a result of instream barrier modification and small dam removal. Modification of instream habitat or structures can affect the depth and subsequent quality of the steelhead habitat in streams. Deep pools provide critical functions for steelhead freshwater rearing and is the single, most-limited habitat type in the action area (R Bush, NMFS, pers. obs.). The scour pool losses associated with steepening a channel to achieve fish passage typically result from installing fill, channel grading, channel shaping to reduce channel width, and removal of introduced migration barriers. Although scour pools formed at the base of introduced migration barriers and those within the project reach (up to 500 linear feet) subject to regrading would be lost or altered, the expected improvement in passage conditions for steelhead and increased access to spawning and rearing habitats, including pools, is anticipated to compensate for the loss of pools within the project reach. This Program activity is expected to have a low severity impact on steelhead based on the discussion that follows.

The overall impact to steelhead associated with the loss of pools depends on the extent of the project footprint, as well as the protection measures implemented to minimize the effect of the Program activity. The pre-existing scour pools may be high quality steelhead habitat in itself, however, the Program activity is intended to remove an instream passage barrier and restore access to historical habitats where higher quality habitat is likely to occur. The limit of the area of instream disturbance for these project types is 500-linear feet. Because stream grading typically occurs upstream and downstream of instream barriers, NMFS anticipates that a maximum of about 250-linear feet of habitat will be disturbed upstream and downstream at barrier modification and dam removal sites. NMFS anticipates that juvenile steelhead in these areas will redistribute to nearby undisturbed habitats, possibly to newly available habitat upstream, and thus the effects of this activity on juvenile rearing steelhead are expected to be negligible. Furthermore, because the NOAA RC proposes to retain onsite or use any downed trees (i.e., logs > 24 in. dbh and 10 ft. long) for instream habitat improvement within project sites (SusCon 2015), NMFS assumes that these pieces of key woody debris that are naturally or artificially recruited into the channel will create instream scour and minimize any loss of pools owing to the Program activity.

7. Need for Continued Site Maintenance

Numerous proposed actions may lead to continued maintenance that could negatively impact steelhead. Most of these impacts were previously discussed in the *Effects to Critical Habitat* section because most of the impacts to steelhead are a result of modifications to their habitat. This Program activity is expected to have a low severity impact on steelhead based on the discussion that follows.

Project sites that construct or modify instream infrastructure will require continued maintenance as long as the infrastructure remains in the active channel. Specific program activities subject to continued maintenance include barrier modifications, dam removal sites where part of the dam structure remains, fish screens, and off-channel inlet structures. Maintenance activities associated with these Program activities typically include sediment and vegetation removal. While removal of sediment and vegetation that support healthy steelhead populations is considered a negative effect of the action, NMFS anticipates the maintenance activities will only cause localized disturbance (e.g., around intake structures or fish screens) to habitat features and will be conducted in dry channels that will only result in discountable effects to steelhead. Furthermore, protection measures C-3, C-4 and C-5 will limit the amount of in-channel heavy equipment use in favor of long reach equipment that can conduct the maintenance activity from the streambank. The proposed action also indicates hand tools will be used whenever feasible. Instream infrastructure also requires protection (e.g. riprap installation) and periodic repair that may negatively affect steelhead and their habitat. NMFS anticipates that any instream infrastructure associated with habitat restoration projects would have the smallest footprint possible, and steelhead would be expected to avoid those localized areas without resulting in any significant effects to steelhead.

8. Use of Explosives for Small Dam Removal

Injury or mortality could occur from ground vibration or water overpressure rises from blasting operations. Blast-induced ground vibrations, measured in inches per second (i/s), can have deleterious effects on fish embryos (fertilized eggs) at certain stages of their development. Blast induced overpressures in water, measured in pounds per square inch (psi), can injure or kill juvenile and adult

fish. Studies have shown that adult fish are less sensitive to blast-induced overpressures than juvenile fish (Kolden and Aimone-Martin 2013). A recent review of literature on the effects of blasting on salmonids indicated that the most sensitive life stage of salmonids is embryos, which begin to experience mortality at vibrations around 5.8 i/s (Kolden and Aimone-Martin 2013). This led the State of Alaska to establish a 2013 blasting standard limit of 2.0 ips for projects where salmonids are present (Timothy 2013).

The NOAA RC proposed that explosives use must be conducted in dry or dewatered conditions and potential harm to steelhead from the explosives blast and pressure waves must be analyzed. The description of the NOAA RC/Corps proposed action does not include sufficient information to evaluate what type of vibrations juvenile and adult steelhead may be exposed to as a result of dam removal by use of explosives. Because instream work is proposed to occur as early as June 1, the potential exists that juvenile steelhead and embryos may be present in the project area at the time of year that blasting could occur. Based on the proposed action, NMFS assumes that the length of channel dewatering for this program activity will be determined based on the results of a detailed blast analysis, and will not exceed 500-feet overall (see Section 1.3.3). Therefore, this element of the Program represents an adverse effect to threatened and endangered steelhead owing to dewatering and fish relocation activities, similar to small dam removal activities not using explosives. An estimate was not provided by the RC as to how many of these projects types may occur annually. NMFS anticipates that this Program activity may require the capture and relocation of up to 150 juvenile steelhead, of which no more than 6 individuals would be killed. Relocating juvenile steelhead from the area that would be affected by use of explosives is expected to eliminate potentially widespread mortality of steelhead due to a blast.

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. Threatened and endangered steelhead in the action area are likely to be affected by the continuation of the future non-federal activities which are described in the *Environmental Baseline* section, and further discussed below.

Non-Federal activities that are reasonably certain to occur within the action area include urban development, flood-control activities, agricultural development, operation and maintenance of non-federal dams, water withdrawals/diversions, mining, state or privately sponsored habitat restoration activities on non-Federal lands, and road work.

Urban development will likely increase the amount of impervious surfaces within some watersheds, which is expected to raise the potential for dry and wet-season runoff and input of potentially toxic elements into steelhead streams. Flood control activities (that do not require a Corps permit) may reduce riparian vegetation, alter natural stream hydrology, and impede or block fish passage. Ongoing urbanization is expected to cause elevated rates of treated wastewater releases to streams, possibly increasing nitrogen loads and the likelihood of adverse effects on aquatic organisms. Residential developments constructed in or near historical floodplains of rivers, streams or tributaries are expected to cause, or perpetuate, the loss of aquatic habitat and riparian vegetation. Agricultural development and land use is expected to increase agricultural water use and runoff, which could increase the potential for input of fertilizers, pesticides and herbicides into streams inhabited by steelhead. New surface and groundwater withdrawals in the action area are expected to translate into decreased living space for

steelhead. Ongoing mining activities will likely modify channel form and stream depth, and increase runoff of fine sediment into action area streams.

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 purpose of this synthesis is to develop an understanding of the likely short-term and long-term responses of listed species to the proposed action. NMFS also considers the effects analysis of the proposed action to the species as a whole and to the entire designated critical habitat for SCCC threatened steelhead and SCC endangered steelhead.

Restoration projects implemented as part of the Program can potentially occur within any coastal anadromous stream from the northern San Luis Obispo County line to the U.S.-Mexico border. Many of these watersheds include stream segments that are confirmed to be occupied by threatened and endangered steelhead and designated as critical habitat for this species. Therefore, presence of steelhead within the action area and at some future project sites is expected. Implementation of these projects in steelhead occupied areas have the potential to subject the species to an elevated exposure risk for a range of direct and indirect effects depending on the project (e.g., loss of vegetation, increased turbidity, dewatering). Proposed minimization measures within the Program are expected to significantly reduce the potential risk and/or degree of impact for many of these effects.

Although projects authorized through the Program are for the purpose of restoring steelhead habitat, adverse effects to SCCC and SCC steelhead and their critical habitat are expected in the form of short-term behavioral changes with a minimal amount of mortality. The release of fine sediment from small dam removal projects has the potential to cause sedimentation that may cause adult steelhead to temporarily avoid spawning in those areas, and may cause short term effects to juvenile steelhead feeding behavior. Small dam sediment releases are also likely to adversely affect embryo development in steelhead redds constructed downstream of dam removal sites. As discussed in the effects of the action (Section 2.4), the sediment-related effects on developing embryos are expected to occur at a single redd downstream of the dam removal site at a frequency of one redd impacted every other year. However, restored access to newly accessible habitats upstream of dam removal sites will compensate for the short-term sediment impacts downstream of the dam. Additionally, the lack of certainty regarding application of NMFS fish passage guidelines has the potential to lead to changes to critical habitat including channel incision and bank failure that can reduce the quality of spawning habitat. Construction of instream infrastructure for water conservation projects can create partial passage barriers that may result in loss of habitat access, or restrict seasonal movements. Overall, coordination with NMFS during development of project designs, in combination with the proposed minimization measures within the Program, are expected to significantly reduce the potential risk and/or degree of impact for many of these effects.

Restoration Program activities that require dewatering and relocation of captured individuals will account for the single largest effect to steelhead in the action area. Steelhead present during the implementation of restoration projects may be disturbed, displaced, injured or killed by project activities, and steelhead present in some project work areas will be subject to capture, relocation, and related stresses. Anticipated mortality rates from relocation activities, as reported by Collins (2004), are expected to be as low as 0.6-percent, and no higher than 4-percent of fish relocated. Few, if any fish, are expected to remain in construction areas after relocation efforts.

Perhaps the highest potential for direct effects and degree of risk exposure to SCCC and SCC steelhead is for those projects that may involve dewatering of the stream channel and would potentially necessitate the capture and relocation of steelhead from these areas that creates the potential for harm or death to these individuals. This includes relocation of stranded individuals. A few stranded individuals may not be relocated in time and will likely die. Overall, these steelhead would be lost from small localized areas within different watersheds across the eight county action area and represent a small fraction of the entire SCCC and SCC steelhead populations. Therefore, it is unlikely that the low-level mortality of steelhead that NMFS anticipates from fish relocation (based on CDFW reporting of take associated with FRGP projects), stranding, and reduced egg survival, will have any significant impact on the greater SCCC and SCC steelhead populations.

Generally, habitat restoration projects authorized through this consultation are expected to be designed and implemented consistent with standard techniques and protection measures, including measures in the project description and Appendix B of this biological opinion, NMFS' electrofishing guidelines, NMFS' Screening Guidelines, and the CDFW Manual, all for the purpose of maximizing the benefits of each project while minimizing adverse effects to salmonids. All of the restoration projects are intended to restore degraded steelhead habitat and improve instream cover, pool availability, and spawning gravel; screen diversions; remove barriers to fish passage; and reduce or eliminate erosion and sedimentation impacts. Although there will be short-term impacts to habitat, including designated critical habitat, associated with a small percentage of projects implemented annually, NMFS anticipates most projects will provide long-term improvements to steelhead habitat. NMFS also anticipates that the additive beneficial effects to salmonid habitat over the ten-year period of the proposed action should improve local instream habitat conditions for multiple life stages of steelhead and contribute to improving chances for the species long-term survival and recovery.

Therefore, the effects of individual Program activities and their combined effects are not likely to appreciably reduce the numbers, distribution, or abundance of SCCC threatened steelhead or SCC endangered steelhead, and are not likely to appreciably diminish the value of designated critical habitat for these species.

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 action is not likely to jeopardize the continued existence of the endangered Southern California Coast DPS of steelhead or the threatened South-Central California Coast DPS of steelhead, and is not likely to destroy or adversely modify designated critical habitat for these species.

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.

2.8.1 Amount or Extent of Take

In this biological opinion, NMFS has enough information available to indicate that the proposed action with implementation of the protection measures is likely to principally cause capture, collection, injury and mortality of individual steelhead through the following activities:

1. Small dam removal and instream barrier modification projects, which would necessitate isolating the work area from flowing water;

2. Small dam removal projects that release a large amount of fine sediment downstream, which is expected to create inhospitable instream conditions for developing embryos.

3. Creation of side-channel/off-channel habitat features, including appurtenant structures and instream areas, which are expected to create inhospitable instream conditions ; and,

4. Construction and operation of new water conservation project facilities, including appurtenant structures and instream areas, which are expected to create inhospitable instream conditions.

In this context, the amount and extent of take that is anticipated to result from the proposed action in the SCCCS and SCS DPSs is listed in Tables 8 and 9, respectively. This level of take was estimated from the information made available to NMFS, habitat conditions in the action area and the anticipated effects of the proposed action, and our knowledge of the ecology and behavior of steelhead in, including what we know about their abundance and distribution in the action area.

The majority of the anticipated incidental take will likely occur as the result of fish capture and relocation for projects that require stream dewatering. Program activities are proposed to occur during the summer and fall low-flow period, when over-summering juvenile steelhead are the predominant life-form present in Southern and South-Central California steelhead streams. As described in Tables 8 and 9 NMFS anticipates juvenile steelhead will be captured more frequently; however, adult steelhead could be captured in action area streams during project dewatering owing to insufficient streamflow that didn't allow for spring outmigration after spawning. Steelhead may be injured or killed during capture and relocation activities, but few are expected to be killed based on capture and relocation efforts during other projects in Southern California streams. The mortality of fish missed during the dewatering process is also expected to be very low to none, since fish surveys are proposed to occur continually during the dewatering process.

The total number of estimated projects per year for the entire action area combined (including both the SCCCS DPS and the SCS DPS) is fifteen. Although it is expected that the fifteen projects will be distributed between the two DPSs, Tables 8 and 9 summarize the potential take if all fifteen projects were implemented in a single DPS. The take estimate assumes that one or more instream barrier removals will occur each year, which may not be realistic since these are typically complex projects that require additional analyses. The take estimate also assumes that small dam removal would occur on average once every other year as described in Section 2.4.2. A very small fraction of juvenile steelhead within each DPS are expected to be relocated each year, due to the modest number of projects expected and because, in reality, not all projects are likely to require dewatering and fish relocation. The best estimates for actual numbers of steelhead that may be affected by Program activities when dewatering and fish relocation occurs are based on CDFW's FRGP monitoring reports for projects implemented in South Central and Southern California steelhead streams from 2003 to 2008. An average of 67 juvenile steelhead were captured and relocated each year during implementation of an average of 3.3 restoration projects per year (SusCon 2015). The FRGP results suggest that an average of about 20 juvenile steelhead may be affected per project implemented under the proposed Program. Assuming these numbers are typical, and as many as 15 projects are implemented per year under the proposed action, and all require dewatering and fish relocation, an estimated total of greater than 300 juvenile steelhead could potentially be relocated each year during Program activities. Based on the proposed fish capture and relocation methodologies and associated minimization measures, NMFS anticipates the total number of steelhead mortalities owing to capture and relocation activities will not exceed 4-percent of the total number captured. This estimate is based on regional data including FRGP reporting and southern California capture and relocation activities associated with NMFS' Section 10 (a)(1)(A) enhancement of survival permit. The differences described in Tables 8 and 9 regarding the expected number of fish captured or affected in the SCCC DPS as compared to the SCS DPS are based on NMFS' familiarity with the action area, and observed juvenile steelhead rearing densities in these streams.

Table 8. Estimated annual amount and extent of incidental take anticipated to result from the Program activities throughout the SCCCS DPS. Annual incidental take is based on the assumption that 15 projects are implemented in this DPS.

Source of take[1]	Steelhead life stage	Form of take	Annual number of individuals expected to be taken
Modification and removal of dams & instream barriers	Juvenile	Capture, injury	300
Modification and removal of dams & instream barriers	Juvenile	Capture, inury[2]	12
Modification and removal of dams & instream barriers	Adult	Capture	2
Operation activities	Juvenile	Capture, injury	30
Operation activities	Juvenile	Kill[3]	5
Operation activities	Adult	Capture	1
Construction activities	Juvenile	Capture, injury	330
Construction activities	Juvenile	Kill	13
Construction activities	Adult	Capture	1

[1]For clarification, the phrase "operation activities" refers to the post-construction operation and function of the Program projects, consistent with the proposed action, and related incidental take of threatened and endangered steelhead (e.g., steelhead stranding in constructed off-channel habitat, or pools within a water conservation project area). "Construction activities" refers to Program activities that incorporate a dewatering element, including instream habitat improvements, stream bank stabilization, creation of off-channel/side-channel habitat features, and water conservation projects.
[2]Includes individuals that will be captured and potentially injured when preparing a worksite for the use of explosives for small dam removal.
[3]Includes individuals that become stranded and die owing to a reduction in streamflow during operation of off-channel/side-channel habitat features and water conservation projects.

Table 9. Estimated annual amount and extent of incidental take anticipated to result from the Program activities throughout the SCS DPS. Annual incidental take is based on the assumption that 15 projects are implemented in this DPS.

Source of take[1]	Steelhead life stage	Form of take	Annual number of individuals expected to be taken
Modification and removal of dams & instream barriers	Juvenile	Capture, injury	200
Modification and removal of dams & instream barriers	Juvenile	Kill	8
Modification and removal of dams & instream barriers	Adult	Capture	1
Operation activities	Juvenile	Capture, injury	30
Operation activities	Juvenile	Kill	5
Operation activities	Adult	Capture	1
Construction activities	Juvenile	Capture, injury	250
Construction activities	Juvenile	Kill	10
Construction activities	Adult	Capture	1

*The same footnotes listed for Table 8 apply to Table 9.

In addition to the estimated annual amount and extent of incidental take anticipated to result from the Program activities throughout the action area described above, NMFS determined that small dam removal activities will adversely modify steelhead spawning and rearing habitat extending 100-meters downstream of dam removal sites. As discussed in Section 2.4, the resulting unmetered release of fine sediment in areas where spawning has occurred is expected to directly harm steelhead embryos buried in any redds constructed within close proximity (i.e., 100-meters) downstream of the dam removal site. Based on regional steelhead spawning observations, NMFS assumes that no more than one steelhead redd would be affected from fine sediment fouling downstream of small dam removal projects. NMFS anticipates that fine sediment fouling would reduce egg to fry survival in one steelhead redd by up to 50-percent. This harm to steelhead embryos is expected to occur at a frequency of once every other year.

Counting the amount of eggs killed by fine sediment is not possible for several reasons: 1) digging up redds to examine each egg would likely kill more eggs because eggs are very small and relatively fragile, 2) redds may not be observable once covered by fine sediment and therefore could not be found easily, if at all, and 3) determining the exact cause of egg death is difficult in many circumstances. Therefore, NMFS will use the amount of dam removal projects expected per year as a surrogate for the extent of take as described in the effects section of the preceding biological opinion. If more than 1 dam removal project every other year is authorized or implemented under the proposed action, the extent of take may be exceeded.

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.

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). NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize and monitor incidental take of SCCC and SCC steelhead.

1. Implement a steelhead rescue and relocation protocol for dewatering activities that is protective of juvenile and adult steelhead.

2. Report to NMFS all take (inclusive of steelhead-relocation activities) associated with minimizing and monitoring the *Effects of the Proposed Action*.

3. Develop and implement a streamflow monitoring plan to minimize effects of Program activities that result in a reduction of instream flow.

4. Minimize input of sand and smaller particles to action area drainages as a result of creating, maintaining, and (or) using access ramps and temporary access roads.

5. Submit adequate Project information for NMFS' review and agreement to ensure Program impacts are minimized within the area affected by the proposed action.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the NOAA RC/ Corps or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR §402.14). The NOAA RC 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 may lapse.

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

    A. A minimum of two qualified fisheries biologists shall be on-site the day the project site is dewatered for relocation of any remaining steelhead, and to monitor the upstream and downstream block nets. For the remainder of the instream work period requiring stream diversion, one qualified biologist shall be on-site each day the diversion is in place to check the upstream and downstream block nets at a minimum of 3 times per day (before the work activity begins each day, during construction, and after construction has ended for the day). If any fish become entangled in the nets, this shall be reported to NMFS biologist Rick Bush (562-980-3562) for the purpose of developing a plan to further minimize harm to steelhead.

B. A minimum of one qualified fishery biologist (having logged > 20 hours of electrofishing experience) and two assistants shall perform all seining, electrofishing, and fish relocation activities. There should be a minimum of two individuals netting fish during electrofishing activities to ensure maximum efficiency and removal of steelhead prior to dewatering. Steelhead should be enumerated, measured and transported to the release site as soon as possible after capture to minimize stress. This typically requires a crew of four individuals or more depending on the complexity of the project site and the distance to the relocation site(s).

C. The NOAA RC shall contact the NMFS designee immediately if one or more steelhead are found dead, injured or stranded at any Program activity project site, or maintained facility. Dead individuals shall be measured to the nearest mm (FL), georeferenced, photographed, sealed in a labeled freezer ziplock bag, and frozen until the carcass can be transferred to NMFS. The purposes of the contact shall be to review the activities resulting in take, to determine if additional protective measures are required, and to discuss additional handling procedures for dead steelhead.

D. In the event pre-rescue information collected by the NOAA RC indicates that a pending fish relocation is likely to exceed the level of take for an activity described in Tables 8 and 9, NMFS biologist Rick Bush must be contacted by phone immediately at 562-980-3562 prior to the capture of any fish. The purpose of the contact is to review the anticipated capture and relocation effort and to determine the proper course of action.

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

A. Notify NMFS two weeks prior to capture and relocation of steelhead to provide NMFS staff an opportunity to provide watershed specific guidance and/or attend the relocation (call Rick Bush at (562) 980-3562 or via email at Rick.Bush@noaa.gov).

B. The relocation data that will be collected as required by the NOAA RC proposed protection measures shall be recorded on NMFS standardized relocation data sheets (Appendix E), along with information about creek discharge, water temperature, and electrofishing settings used, and then entered and saved into an electronic spreadsheet (Microsoft Office Excel). The electronic spreadsheet and report describing all relocation activities and protection measures implemented will be transmitted to a NMFS designated electronic address of NMFS staff in the Long Beach office no later than March 15 of each year for a period of 10 years.

C. In addition to the NOAA RC rescue and relocation activity reporting described in term and condition 2.B, the NOAA RC/Corps shall submit an annual comprehensive summary of all take (including relocated individuals) associated with Program activities described in this biological opinion. The take summary shall be submitted to NMFS (Rick Bush, 501 W. Ocean Blvd., Suite 4200, Long Beach, California 90802) no later than March 15 of each year and shall include the following information:

i. A detailed account of the number of steelhead killed, injured and captured during implementation of each Program activity (e.g., creation of side-channel/off-channel habitat, maintenance of water conservation projects).

ii. An explanation of the likely cause of take.

iii. A discussion of the potential operational changes that may decrease the likelihood of future take owing to Program activities.

D. The NOAA RC shall take additional conservation measures when using explosives for blasting and removal of small dams to protect steelhead in the vicinity of the project area. These conservation measures shall include:

i. The applicant must conduct an analysis of the peak overpressures that would occur as a result of the proposed blasting operations along with an analysis of the setback distance required to achieve a peak overpressure of 10 psi.

ii. The applicant must install a fish exclusion zone upstream and downstream of the dam as determined appropriate to minimize or avoid overpressure effects.

iii. The applicant must conduct a stream reconnaissance survey with two fisheries biologists 500 feet upstream and downstream of the dam to collect information on the sub-lethal effects of the blast, and to recover any injured or dead steelhead that did not drift into the exclusionary fence/nets. The survey should occur no more than 30 minutes following the blast, or as soon as the project area is deemed safe to enter.

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

A. The NOAA RC shall collaborate with NMFS to develop and implement monitoring plans that are appropriate for determining post-project hydrological conditions resulting from Program activities that reduce instream flow (i.e., water depth, pool availability or habitat connectivity). This collaboration is necessary to ensure that Projects are designed according to the life history and habitat requirements of steelhead and maintenance of appropriate fish passage at project locations. This monitoring shall occur for Program activities including construction of side-channel/off-channel habitat features and water conservation projects. Prior to implementing the annual monitoring plan, the NOAA RC/Corps shall submit the draft plan to NMFS (Rick Bush, 501 W. Ocean Blvd., Suite 4200, Long Beach, California 90802) annually no later than April 1 for review and approval. The monitoring plans shall achieve the following:

i. Streamflow monitoring plans developed for water conservation projects shall include sufficient information to demonstrate that the Program activity will not negatively affect steelhead habitat. The NOAA RC/Corps shall collaborate with project applicants to provide the following information for the site of diversion, including extent, magnitude, duration, frequency and timing of water withdrawals at each individual project site. Detailed pumping records, diversion flow rates, and continuous water level measurements upstream and downstream of the point of diversion are required data anytime streamflow is diverted from a stream to provide water for a water conservation project. Supplemental Statement of Water Diversion and Use Forms submitted to the State Water Resources Control Board that estimate water use are not sufficient to meet this monitoring requirement.

ii. The project specific streamflow monitoring plan for water conservation projects and side-channel/off-channel habitat projects shall clearly describe the proposed methodology for verifying that the pumping activity does not dewater greater than 10% of channel, as described in the proposed action. The project applicant must quantify the rate of diversion using “Best available technologies”, which requires the use of technologies at the highest technically practical level,

using flow totaling devices, and if necessary, data loggers and telemetry (per California Water Code Section 5100).

iii. The streamflow monitoring plan shall clearly identify the point of diversion and the point of compliance for term and condition 3.A.ii above, using a map drawn to scale and provide GPS coordinates. If the point of compliance is not the point of diversion, adequate justification must be provided demonstrating that monitoring at the point of diversion is infeasible.

iv. Water conservation projects and side-channel/off-channel habitat projects should not be operated in areas where spawning may occur. Should spawning occur within 10 feet of a portion of a diversion/pump intake, then use of those diversions within 10 feet of any redd should be discontinued for 90 days, or as directed by NMFS.

v. Annual streamflow monitoring plan results will be transmitted to a NMFS designated electronic address of NMFS staff in the Long Beach office no later than April 1 of each year for a period of 10 years.

B. The NOAA RC shall collaborate with NMFS as early as possible during the design phase (but not less than 90 days before construction) for projects with the potential to modify instream hydrologic conditions. These Program activities include small dam removal, instream barrier modification, creation of off-channel/side-channel habitats, and water conservation projects. Depending on the complexity of the project and/or habitat where it will be installed, NMFS will determine whether it will be necessary for the NOAA RC/Corps to obtain a detailed pre and/or post project topographical survey of the stream reach to be affected by the installation of a particular Program activity. If site conditions indicate there is a moderate risk of avulsion, a hydraulic analysis of avulsion should also be conducted according to standard methods (Saldi Caromile 2004). The survey shall possess sufficient detail to quantify pool depths, head cuts, hydraulic drops, rock weir inverts, and any other information NMFS believes is necessary to further an understanding of the implications of the Program activities listed above for threatened and endangered steelhead and critical habitat for this species. The NOAA RC shall submit the results of the survey to NMFS (at 501 W. Ocean Blvd., Suite 4200, Long Beach, California, 90802).

i. After installation of any off-channel/side-channel projects, the NOAA RC or project applicant shall annually monitor the project site (particularly after storm events) at a frequency agreeable to NMFS for the purpose of ensuring NMFS fish-passage guidelines are maintained at the inlet and outlet structures over time and newly created habitats are not stranding steelhead. The NOAA RC shall include the results of this monitoring activity in the streamflow monitoring plan required in 3B above.

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

A. The NOAA RC shall implement the following measures to minimize the contribution of sand and smaller particles from access ramps to creeks within the action area:

i. Stabilize exposed soil areas to prevent soil from eroding during rain events. This is particularly important on steep slopes;
ii. Use native plant species to revegetate ramps following use, preferably with a mulch or binder that will hold the soils in place while the vegetation is establishing;

iii. If vegetation cannot be established for a particular ramp following use, apply temporary erosion-control mats or blankets, straw, or gravel as appropriate; and,

iv. For ramps where sediment is already eroded and mobilized, temporary controls shall be installed. These may include: sediment-control fences, fabric-covered triangular dikes, gravel-filled burlap bags, biobags, or hay bales staked in place.

5. The following terms and conditions implement reasonable and prudent measure 5:

A. The NOAA RC shall submit an annual report summarizing all Program activities described in this biological opinion that were implemented during the previous year. The report shall contain the post-construction implementation monitoring reporting described in Section 1.35. The annual report shall be submitted to NMFS (Rick Bush, 501 W. Ocean Blvd., Suite 4200, Long Beach, California 90802) no later than March 15 of each year.

B. For all Program activities involving instream barrier modification for fish passage improvement (including small dam removal), the NOAA RC/Corps shall submit steelhead post-implementation survey results documenting the effectiveness of establishing fish passage upstream of the project site using the methods referenced in the biological assessment (SusCon 2015, page 17). These monitoring results shall be submitted to NMFS (Rick Bush, 501 W. Ocean Blvd., Suite 4200, Long Beach, California 90802) no later than August 15 of each year.

C. The determination as to whether a Program activity is a "Complex Project" shall be a joint decision made during early consultation between the NOAA RC/Corps and NMFS. The factors that will be assessed in determining project complexity shall include 1) the height of the dam, 2) the gradation and amount of sediment stored upstream of the dam, 3) local hydrology, 4) channel morphology, 5) sediment transport processes, 6) hydraulic conditions in the stream, and 7) any anthropogenic factors present.

i. Program activities classified as Complex projects will require the applicant to retain a professional engineer and/or geomorphologist to draw up design plans (plan, profile, details, and cross sections) and conduct a scour analysis for NMFS' review and concurrence. Upon receipt of these engineering design plans, NMFS will review and provide comments to the NOAA RC/Corps within 45 days to provide specific recommendations associated with these more complex project types to protect steelhead and their habitat.

ii. Complex project technical assistance shall consist of one or more meetings between NMFS or CDFW engineers, NOAA RC/Corps and project applicants that include a site visit and concept development meeting meetings to discuss project objectives and identify measures to minimize effects to steelhead and their habitat. Project applicants must submit 30%, 60% and 90% design drawings and a detailed project narrative for complex projects. NMFS will review the project plans and provide comments within 30 days. If changes to the project design are identified at any of these design phases that NMFS determines may affect steelhead in a manner that is not offset by the proposed protection measures, a meeting will be scheduled between all parties and NMFS will require 30 days from the date of the meeting to review and provide written comments to the NOAA RC/Corps on how to minimize project impacts.

D. If the minimal data requirements described in Section 1.3.4 provided by the NOAA/Corps indicate a proposed small dam removal project site contains greater than 50-percent impounded fine sediment (i.e., sand and smaller particles), and its unregulated release may cause chronic (i.e., extending beyond the first year post-project) impacts to steelhead and downstream habitats that were not identified in the project description, the Project applicant will be required to develop a Sediment Management Plan. If NMFS determines a Sediment Management Plan is warranted, the applicant will be required to mechanically remove all of the fines within the bankfull channel (i.e., 2 year flood event), or clearly demonstrate using both geomorphic and sediment transport analyses that the proposed project is sufficient to remove the sediment using natural stream processes in 1-2 storm events based on the hydrological record of that stream, or nearest gaged drainage of comparable size.

E. All Program activities that possess a fish passage element shall be constructed and monitored in accordance with NMFS' most recent fish passage guidelines.

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 recommendations for this proposed action.

2.10 Reinitiation of Consultation

This concludes formal consultation for NOAA Restoration Center funding and U.S.
Army Corps of Engineers permitting of restoration projects within watersheds of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange and San Diego counties.

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.

3. 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.

3.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful,

serviceable, and beneficial to the intended users. The intended users of this opinion are the NOAA Restoration Center and the U.S. Army Corps of Engineers. Other interested users could include (e.g., permit or license applicants, 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, U.S. Army Corps of Engineers and, and California Department of Fish and Wildlife. 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.

3.2 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.

3.3 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 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 reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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5. APPENDICES

Appendix A. NOAA RC Small Dams Memo dated February 23, 2015, submitted to NMFS on March 6, 2015, as a supplement to the proposed action.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NOAA RESTORATION CENTER
Southwest Region
777 Sonoma Avenue, Room 219-A
Santa Rosa, CA 95404

MEMORANDUM FOR: Biological Assessment for Fisheries Habitat Restoration Projects in South-Central and Southern California

FROM: Stacie Fejtek Smith

SUBJECT: Small Dam Removal

DATE: February 23, 2015

This memo is regarding language in the Biological Assessment for Fisheries Habitat Restoration Projects in South-Central and Southern California (hereafter the BA) concerning the activities included in the proposed action with a focus on removal of small dams. This memo serves to establish: 1) Support for the narrative definition of small dams, 2) Data requirements and analysis to be provided with small dam removal projects, and 3) Description of methods for small dam removal for coverage under the programmatic BO.

Habitat restoration projects authorized by the proposed programmatic biological opinion (BO) will be designed and implemented consistent with 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. 1998, hereafter referred to as "CDFW Manual") in order to maximize the benefits of each project while minimizing potential short-term, adverse impacts to steelhead, other aquatic and terrestrial species, and stream and riparian habitat. However the BA includes the removal of small dams as a covered activity that is not described in the CDFW manual leaving the definition and conditions associated with the activity open to additional consideration and clarification.

The BA submitted to Anthony Spina (November 17, 2014) included the definition for small dams provided by the California Division of Dam Safety(CDDS), but has been discussed with National Marine Fisheries Service (NMFS) regulatory biologists, NOAA's Restoration Center (RC) staff, and NMFS engineers as not inclusive enough to cover foreseeable restoration projects in southern California. The CDDS definition of small dams that was used in the BA included the limitation of a barrier that "*must be 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 definition would drastically limit the capability of the proposed BO to address small dams (including debris basins) found in the region. For example, in a recent BO for Santa Barbara County built-as dam height was compared to current dam heights and found a mean increase of 46% from the built-as height. Therefore while their built-as height would fall within the CDDS definition their current height would exclude them from the proposed programmatic BO.

In light of this consideration the definition of small dams and a relying on the following narrative definition which defines small dams based on impact rather than height or acre-feet.

"***Definitions of a small dam removal project:*** *A small dam removal project pertains to the removal of a standalone barrier (permanent, flashboard, debris basin, and/or seasonal). This covered activity only includes dam removal projects that will form a channel at natural grade and shape upstream of the dam, naturally or with excavation, in order to minimize negative effects on downstream habitat. Dam removal projects will have: 1) 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 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 natural shaped channel that provides the same hydraulic conditions and habitat for listed fish as the natural channel and that has the capacity to accommodate flows up to a 2-year flood. Note dams in high risk areas such as urbanized streams, base level dams (where head cuts could be sent up multiple tributaries), and dams located in heavily incised channels will be receive additional engineering review"*

Data requirements and analysis to be provided with dam removal project design were discussed with the goal of maximizing benefits to the species, but not placing an undue burden to small scale projects that provide clear benefits to fish passage. The following language was developed in order to replace the initially proposed criteria:

"Project applicants are required to provide project designs to NOAA technical monitors prior to project approval and implementation. 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 granted at the discretion of NOAA RC and NMFS engineers if there is a clear benefit to fish passage. Applicants will be required to implement the NOAA Restoration Centers 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 applying regionally appropriate fish passage criteria to fish passage project which have been incorporated into the below minimal data needs.

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 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. Below the minimal data needed to conduct simpler small dam projects along with some of the potential data needs for more complicated projects are listed below.*

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 simply 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. Including anticipated and actual start and end dates of project.*
d. *The distance and location of next 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. Determined by 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. *<u>Detailed information on project/reference reach including:</u>*
   i. *Location of project/reference reach*
   ii. *Chanel width (baseline and target range in feet): determined by taking three measurements of active channel at the dam and immediately upstream and downstream of the dam.*
   iii. *Any existing geomorphic features present and that will be incorporated into the channel (e.g. pools, riffles, runs, step-pools, etc.,).*
   iv. *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.*
   v. *Maximum channel slope: determined through the site before and after the project using pre-project and as-built (post-project) longitudinal profiles*
   vi. *Representative photographs pre and post project implementation of the dam, upstream sediment deposit/reservoir, channel morphology upstream and downstream of the proposed project reach.*
   vii. *Maximum jump height (baseline and target range in inches): using the pre-project and/or as built longitudinal profile determine the maximum height a fish would have to jump to migrate through the site.*

g. *A longitudinal profile of the stream channel thalweg for at least 20 channel widths upstream and downstream (pre and post project)of the structure and long enough to establish the natural channel grade, whichever is farther, shall be used to determine the potential for channel degradation (as described in the CDFW Restoration Manual)*

h. *Post construction monitoring results: based on a post-implementation survey, the applicant should provide as-built conditions of channel width, channel slope, and maximum jump height.*

i. *The number of stream miles opened by each project should be estimated pre-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).*

j. *Operation and maintenance costs: Pre-implementation, determine the expected operation and maintenance and/or liability cost over the next 5 years if the dam were to remain in place. Periodic or less frequent cost that may occur during this period (e.g. structural upgrades to meet safety or regulatory requirements may be incorporated into this cost. Determine the expected operation and maintenance and/or liability cost over the next 5 years once the dam is removed.*

k. *A survey of any downstream spawning areas that may be affected by sediment released by removal of the water control structure.*

l. *Presence/Absence of steelhead:*
   <u>Pre-implementation:</u> Use one of the following survey techniques defined in the California Coastal Salmonid Population Monitoring: Strategy, Design, and Methods(2011)[1] 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 steelhead. If a pre-implementation survey is not possible, report whether the barrier is a known full barrier or partial barrier for steelhead. Describe any pre-project data that is available. If no recent, biological information is available, include surrogate information (e.g. last time species seen 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. In this case, the post-implementation result may be "continued presence". Describe the methodology used to determine presence/absence status of the

[1] Adams, P.B., L.B. Boydstun, S. P. Gallagher, M. K. Lacy, T. McDonald, and K. E. Shaffer. 2011. California Coastal Salmonid Population Monitoring: Strategy, Design, and Methods. California Department of Fish and Game. Fish Bulletin (180).

target fish species. Frequency / Duration of sampling: The timing and frequency should correlate with the life history of the targeted. At a minimum, this parameter should be monitored once post-implementation, and at a maximum it could 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. Once target fish presence is detected upstream of the project site post-implementation, monitoring for this measure is complete. Optional Monitoring for partial barriers or projects where the pre-implementation status was identified as "present", the proportional change in the number of adults or juveniles may be measured.

Some Potential Data Needs for Complex Projects:

1) *Hydraulic modeling immediately upstream, downstream, and throughout the project reach*
2) *Sediment modeling immediately upstream, downstream, and throughout the project reach 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. Bed and bank grain size distributions*
3) *A detailed geomorphic assessment of the watershed and/or stream reach*
4) *A detailed hydrologic analysis of the watershed and how it will drive the geomorphic conditions within the watershed before and after dam removal.*
5) *A detailed assessment of the habitat conditions within the watershed and/or upstream and downstream of the project reach.*

The following language will be added to the BA to incorporate specific methodologies for small dam removal projects:

"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. Where appropriate, dams removed by the use of explosives are covered under this programmatic consultation. 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 follows:*

Natural channel evolution : *The natural channel evolution approach to restoring a channel bed consists of removing all hardened portions (by hand efforts, heavy equipment, or explosives) 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 (or all risks can be mitigated) to any of the downstream habitats and the aquatic organisms inhabiting them (based upon the amount and size gradation of the material being stored above the dam) if all of the sediment upstream of the dam is released during a single 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) when possible project implementation should consider follow procedures that have been documented to have been successfully performed elsewhere under similar circumstances; 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 extreme 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."

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Appendix B. NOAA Restoration Center protection measures that are required to be incorporated into Program activities. These protection measures, in their original format, were provided by the NOAA RC and the Corps on pages 32 to 48 of the revised biological assessment received by NMFS on March 2, 2015.

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 programmatic BO.

A. General Protection Measures

1. Work shall not begin until a) the NOAA 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 1 to November 30. 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 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 NOAA RC, Corps and NMFS. Revegetation activities including limited soil preparation outside the active channel may occur beyond November 30 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. 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. Poured concrete shall be excluded from the wetted channel for a period of 30 days after it is poured. During that time, the poured concrete shall be kept moist, and runoff from the concrete shall not be allowed to enter a live stream. Commercial sealants may be applied to the poured concrete surface where difficulty in excluding water flow for a long period may occur. If sealant is used, water shall be excluded from the site until the sealant is dry and fully cured according to the manufacturers specifications.

5. Herbicides may be applied to control established stands of non-native species. Herbicides must be applied to those species according to the registered label conditions. Herbicides must be applied directly to plants and may not be spread

upon any water. Herbicide shall be tinted with a biodegradable dye to facilitate visual control of the spray.

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 programmatic BO.)

B. Requirements for Fish Relocation and Dewatering Activities

Guidelines for Dewatering:

Project activities authorized under the programmatic BO 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, or installing boulder clusters. 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 work in a flowing stream/creek, the work area shall be isolated and all the flowing water shall be temporarily diverted around the work site to maintain downstream flows during construction.

2. Exclude fish 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 steelhead upstream or downstream do not enter the areas proposed for dewatering between passes with the electrofisher or seine.

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

4. Coordinate project site dewatering with a qualified biologist to perform fish and

amphibian relocation activities. The qualified biologist(s) will possess a valid State of California Scientific Collection Permit as issued by CDFW and/or an ESA section 10(a)(1)(A) scientific collection permit issued by NMFS and will be familiar with the life history and identification of steelhead, State-listed fish, and listed amphibians within the action area.

5. 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.

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 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 1/8-inch mesh 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 a wetted channel. Projects will adhere to currently approved CDFW and NMFS *Fish Screening Criteria* (NMFS 2008b).

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. Cofferdams 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.

General Conditions for all Fish Capture and Relocation Activities:

1. Fish relocation and dewatering activities shall only occur between June 1 and November 30 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 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 NOAA RC, Corps and NMFS. If the channel is expected to be seasonally dry during this period, construction should be scheduled if possible 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 steelhead prior to construction of the water diversion structures (*e.g.* cofferdams). The qualified fisheries biologist shall note the number of steelhead observed in the affected area, the number of steelhead 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 steelhead:

    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 dipnetting fish.

    b. Notify NMFS one week prior to capture and relocation of steelhead to provide NMFS staff an opportunity to attend (call Anthony Spina at (562) 980-4045 or via email at Anthony.spina@noaa.gov).

    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. In many instances, additional fish will be captured that eluded the previous day's efforts.

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 fish health.. 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 steelhead.

***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), including modifications for South Central and Southern California streams

2. The backpack electrofisher shall be set as follows when capturing fish:
   Voltage setting on the electrofisher 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 electrofisher shall be utilized to ensure maximum capture probability of steelhead 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.

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 steelhead 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.

Guidelines for Relocation of Steelhead:

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+ steelhead with larger steelhead, or other potential predators, that may consume the smaller steelhead. 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 steelhead relocation pools. To minimize predation of steelhead, these species shall be distributed throughout the wetted portion of the stream to avoid concentrating them in one area.

4. All captured steelhead 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 steelhead 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 steelhead. 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.

12. If more than 3 percent of the steelhead captured are killed or injured, the project permittee shall contact NMFS (Anthony Spina, (562) 980-4045 or via email, anthony.spina@noaa.gov and CDFW (Mary Larson, (562) 342-7186 or via email, mary.Larson@wildlife.ca.gov).

13. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All steelhead 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.

C. 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:

1. Construction will occur between June 1 and November 30. Revegetation activities, including soil preparation, may extend beyond November 30, if necessary, to better ensure successful plant establishment during the onset of winter precipitation. Exceptions 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 NOAA RC, Corps and NMFS.

2. 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 steelhead will be properly contained, removed from the work site, and disposed of daily.

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

4. No mechanized equipment (e.g. internal combustion hand tools) will enter wetted channels.

5. 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.

6. All mechanized equipment working in the stream channel or within 25 feet of a wetted channel shall have a double containment system for diesel and oil fluids. Hydraulic fluids in mechanical equipment working within the stream channel shall not contain organophosphate esters. Vegetable-based hydraulic fluids are preferred.

7. 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).

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

9. 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.

10. 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 are 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.

11. 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.

D. Measures to Minimize Degradation of Water Quality

Construction or maintenance activities for the projects covered under this proposed programmatic BO may result in temporary increases in turbidity levels in the stream. In general, these activities must not result in significant 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:

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 reptiles and 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. Catch basins shall be maintained so that no more than 15 cm of sediment depth accumulates within traps or sumps.

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.

Guidelines for Temporary Stockpiling:

6. 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 streams supporting, or historically supporting populations of steelhead. 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.

7. 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.

Minimizing Potential for Scour

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

9. 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.

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

Post-Construction Erosion Control

11. 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.

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

13. 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.

14. 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.

E. 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 programmatic BO that result in disturbance to riparian vegetation are also described below.

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.

Revegetation and Success Criteria

5. 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.

6. 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).

7. 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 50% survival of plantings or 50% 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.

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

F. 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 programmatic BO:

1. 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.

2. 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 26-50%: 50 feet; (4) for road or trail gradients greater than 50%: 50 feet. Depending on site-specific conditions, more frequent intervals may be required to prevent road surface rilling and erosion.

3. 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.

4. 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.

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

6. 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.

7. After the first year of installation, erosion control facilities shall be inspected prior to the beginning of the winter period (November 30), after the first major storm event, and prior to the end of the winter period (May 15).

8. 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 steelhead. Spoils shall be contoured to disperse runoff and stabilized with mulch and (native) vegetation.

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

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

Measures to Minimize Impacts from Small Dam Removal

1. Dam removal projects shall: 1) have a relatively small volume of sediment available for release, that when released by storm flows, will have minimal effects on downstream habitat, 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 natural shaped channel that provides the same hydraulic conditions and habitat for steelhead as the natural channel and that has the capacity to accommodate flows up to a 2-year flood.

2. 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 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.

3. 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 coffer dams, 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.

4. Data and Analysis Requirements: 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 are listed below.

   <u>Minimal Data Needs</u>:

   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:
    i. Location of project/reference reach
    ii. 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.
    iii. Any existing geomorphic features present and that will be incorporated into the channel (e.g. pools, riffles, runs, step-pools, etc.).
    iv. 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.
    v. Maximum channel slope: determined through the site before and after the project using pre-project and as-built (post-project) longitudinal profiles
    vi. 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.
    vii. 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.
g. 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 Restoration Manual).
h. Post construction monitoring results: based on a post-implementation survey, the applicant should provide as-built conditions of channel width, channel slope, and maximum jump height.
i. 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).
j. Operation and maintenance costs: Determine the expected operation, maintenance and/or liability costs over the next 5 years of the dam's operation if the dam were to remain in place. Periodic or less frequent costs that may occur during this period (e.g. structural upgrades to meet safety or regulatory requirements may be incorporated into this estimate). Determine the expected operation, maintenance and/or liability costs over the next 5 years if the dam is removed. Provide a comparison of these two estimates.
k. A survey of any downstream spawning areas that may be affected by sediment released by removal of the dam.
l. Presence/Absence of steelhead:

Pre-implementation: Use one of the following survey techniques defined in California Coastal Salmonid Population Monitoring: Strategy, Design, and Methods (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 steelhead. If a pre-implementation survey is not possible, report whether the barrier is a known full barrier or partial barrier for steelhead. 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.)

Post-implementation: 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. 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, this parameter should be monitored one time following implementation, and if funding 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. Once target fish presence is detected upstream of the project site post-implementation, monitoring for this measure is complete. 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.

Potential Data Needs for Complex Projects:

1) Hydraulic modeling immediately upstream and downstream of the project site, and throughout the project reach
2) 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
3) A detailed geomorphic assessment of the watershed and/or stream reach
4) A detailed hydrologic analysis of the watershed and how it will drive the geomorphic conditions within the watershed before and after dam removal
5) 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

Appendix C. NOAA Restoration Center Fish Passage Barrier Removal Performance Measures and Monitoring Worksheet with guidance materials. This Fish Passage Barrier Removal Worksheet can be accessed electronically at the link below, or by contacting the NOAA RC. http://www.habitat.noaa.gov/toolkits/restoration_center_toolkits/forms_and_guidance_documents/ori_monitoring_sheet_w_guidance.pdf

NOAA Restoration Center

Fish Passage Barrier Removal Performance Measures and Monitoring Worksheet

A General Info

Once complete, please remember to submit this form via e-mail to your local NOAA Restoration Center project technical monitor.

Project Name		
Funding Mechanism		*Award Date*
Performance Measures / Monitoring Contact (person filling this form)	*Phone*	*Email*

B Project Timing

PRE-IMPLEMENTATION		POST-IMPLEMENTATION	
Anticipated Start Date	*Anticipated End Date*	*Actual Start Date*	*Actual End Date*

C Available Habitat

What is the anticipated number of stream miles to be made accessible upstream of the project site? miles

What is the actual number of stream miles made accessible upstream of the project site? miles

Verification methods

D Site "Passability"

Describe the following physical parameters of the project design.

Channel Width in Project Area:

Baseline ..... ft.

Target Range ..... to ft.

Channel Slope / Gradient in Project Area:

Baseline ..... %

Target Range ..... to %

Maximum Channel Slope. ..... %

Maximum Jump Height:

Baseline ..... in.

Target Range ..... to in.

Does the project design meet regionally appropriate fish passage criteria? ☐ Yes ☐ No

Provide reference sources used to develop target ranges.

Describe the as-built parameters at the site.

Channel Width in Project Area:

As-Built Condition ..... ft.

Channel Slope / Gradient in Project Area:

As-Built Overall Slope ..... %

As-Built Maximum Channel Slope ..... %

Maximum Jump Height:

As-Built Condition ..... in.

Does the as-built conditions fall within the target ranges listed at left? ☐ Yes ☐ No

Comments

NOAA Restoration Center

Fish Passage Barrier Removal Performance Measures and Monitoring Worksheet

	PRE-IMPLEMENTATION	POST-IMPLEMENTATION
E Presence of Target Fish Species	*Identify ONE target diadromous fish species:* *What is the upstream status of the target diadromous fish species?* ☐ Present ☐ Absent *For which life stages is passage limited?* ☐ Adult ☐ Juvenile *List other fish species that will benefit and their pre-project status:* *Species:* ☐ Present ☐ Absent ☐ Present ☐ Absent *Describe the methodology used to determine presence/absence of the target species.*	*What is the upstream status of the target diadromous fish species? (This may be reported annually from 1-5 years post-implementation.)* ☐ Present ☐ Absent *Which life stages, if any, have been observed upstream?* ☐ Adult ☐ Juvenile *List other fish species and their post-project status:* *Species:* ☐ Present ☐ Absent ☐ Present ☐ Absent *Describe the methodology used to determine presence/absence of the target species.*
F Community Participation	*What is the anticipated number of volunteers and volunteer hours to be associated with the project?* Estimated Number of Volunteers. . . . . . Estimated Volunteer Hours.	*What were the actual number of volunteers and volunteer hours associated with the project?* Actual Number of Volunteers. . . . . . Actual Volunteer Hours . . . . . . *Verification methods*
G Community Enhancement	*Will there be a civic project (e.g. park development, recreation enhancement, etc.) associated with the barrier removal anticipated?* ☐ Yes ☐ No *If yes, please describe.*	*Was the anticipated civic project associated with the barrier removal carried out?* ☐ Yes ☐ No *Comments*

NOAA Restoration Center

Fish Passage Barrier Removal Performance Measures and Monitoring Worksheet

	PRE-IMPLEMENTATION	POST-IMPLEMENTATION
H Operating and Maintenance Costs	*Will the barrier removal result in reduced annual operating, maintenance and / or liability costs at the site?* ☐ Yes ☐ No *What is the estimated average **annual** operating, maintenance, and/or liability cost over the next five-year period if the barrier were to remain in place?* /year	*What is the estimated average **annual** operating, maintenance, and / or liability cost over the next five-year period without the barrier in place?* /year *What is the **annual** average change in cost? (This will auto-fill)* /year
I Public Safety	*Will the barrier removal eliminate or diminish a documented safety hazard?* ☐ Yes ☐ No *If yes, please describe.*	*Did the barrier removal eliminate or diminish a documented safety hazard?* ☐ Yes ☐ No
J Additional Project Monitoring (if applicable)	*Please indicate if any additional monitoring activities will be conducted at the project site.* ☐ No additional monitoring ☐ Juvenile surveys ☐ Outmigrant trapping ☐ Spawner surveys ☐ Topographic channel surveys ☐ Habitat evaluation ☐ Photo points ☐ Other *If yes, please describe. Wherever possible, please include information on methodology used, as well as baseline and target conditions.*	*If additional monitoring studies were completed, please describe post-implementation conditions.*

Once complete, please remember to save this form, then submit it via email to your local NOAA Restoration Center project technical monitor.

I. Background

In order to assess progress towards program goals, the NOAA Restoration Center is collecting pre and post implementation data for a variety of parameters for stream barrier removal projects. This may include dam removal, culvert removal, and culvert replacement projects where the primary goal is to restore natural stream conditions and unrestricted migratory fish passage to upstream habitat.

II. General Guidance

Award period.

☑ NOAA can only require monitoring within the duration of the award period. Award periods may be established to allow for post-implementation monitoring. Any data gained beyond the award period may be useful to further inform post-implementation results and would be welcomed.

Worksheet Data Collection.

☑ The Stream Barrier Removal Performance Measures and Project Monitoring Worksheet is designed be to completed by the grantee at the beginning and end of a stream barrier removal project funded through the NOAA Restoration Center, with the assistance of local NOAA Restoration Center technical monitors and/or representatives from partner organizations.

☑ The pre-implementation portions of the worksheet should be completed prior to project implementation. The post-implementation portions of the worksheet should be filled out at the close of the award period. For some parameters, data collected after the award period would be useful to further inform post-implementation results.

Project Monitoring Parameters.

☑ Parameters included in the worksheet were not developed to be an exhaustive set of parameters that could be measured, but rather to contribute to a specific set of program level performance measures that assess progress towards NOAA Restoration Center program goals.

☑ Projects are welcome to monitor projects beyond the parameters outlined within the worksheet to assess their projects.

III. Worksheet Protocols

A ***GENERAL INFORMATION***

☑ Please provide the official ***project name*** from your award materials.

☑ The ***funding mechanism*** is the specific grant program through which your project was funded (e.g. NOAA Open Rivers Initiative, American Rivers, FishAmerica Foundation, etc.).

☑ Enter the official ***award start date*** found on your award materials.

☑ Enter in the ***contact information*** (full name, phone number, and email address) for the designated person who will complete the monitoring worksheet.

B ***PROJECT TIMING***

☑ **Pre-implementation.**
Indicate the dates on which the implementation is intended to begin and end. These dates should reflect the duration of all activities funded through the award.

☑ **Post-implementation**
In some cases, delays may change the start or end dates for a project. Indicate the actual starting and ending dates for project implementation.

C ***AVAILABLE HABITAT***
The number of stream miles made accessible upstream of the project site as a result of barrier removal.

☑ **Pre-implementation.**
Project grantees can use a combination of the following data sources to estimate the number of upstream stream miles to be made accessible as a result of the project. Stream miles should be calculated from project site to next upstream fish passage barrier or extent of anadromy.

- Existing aerial photos and maps of the project watershed (used to locate additional unreported barriers or a significant increase in stream slope that would influence habitat use).
- Local or regional barrier databases.
- Existing staff or local expert knowledge of the project watershed.
- Field verification (in cases where there is permission to access the stream).

☑ **Post-implementation.**
Grantees can use a combination of the following sources to verify the number of upstream miles made accessible as a result of the project.

- Existing aerial photos and maps of the project watershed (used to locate additional unreported barriers or a significant increase in stream slope that would influence habitat use).
- Local or regional barrier databases.
- Existing staff or local expert knowledge of the project watershed.

- Field verification (in cases where there is permission to access the stream).

On the worksheet, in addition to describing the verification methods used, also describe any uncertainties that may have affected the calculation.

☑ **Frequency / Duration of Sampling.**

- The number of stream miles opened by each project should be estimated pre-implementation and verified after project completion.
- A small number of barrier removal projects may require stream channel adjustment before passage through the site has been fully restored. Even in these cases, number of stream miles made accessible will be reported immediately after barrier removal implementation.

D ***SITE "PASSABILITY"***
Improved "passability" for target species as a result of barrier removal based on measureable physical conditions within the stream channel at the site.

☑ **Pre-implementation.**

- The project grantee is requested to provide project designs to NOAA technical monitors prior to implementation. Projects should be designed to meet regionally appropriate fish passage criteria (see below).
- Specific baseline and target range information should be provided in the worksheet for channel width, channel slope and maximum jump height within the project area.
- The **baseline** should reflect the actual conditions before the project, and the target ranges should be based on regionally appropriate fish passage criteria and should reflect project design plans (see below).
- **Channel width** should be determined by taking three measurements of the active channel width immediately within the barrier removal site (for culverts, just under the crossing and for dams, at the dam and immediately upstream and downstream). Take the average of these three measurements to determine channel width.
- **Channel slope** should be determined by taking a longitudinal profile throughout the project reach upstream and downstream to the extent of barrier influence on the channel slope. Determine the **overall channel slope** from just upstream of the influence of the barrier to just downstream of its influence. Determine the **maximum channel slope** through the site before and after the project using the pre-project and as-built longitudinal profiles.
- Using the pre-project and/or as-built longitudinal profile, determine the **maximum height** a fish would have to jump to migrate through the site.

☑ **Regionally Appropriate Fish Passage Criteria.**

- **California.** All projects should be designed to meet appropriate criteria as described in NMFS Southwest Fish Passage Guidelines.
- **Oregon and Washington.** All projects should be designed to meet appropriate criteria defined in NMFS Northwest Fish Passage Guidelines.
- **Northeast.** Although there is not a single standard in the Northeast, grantees must describe and document how their design criteria for the chosen target species were established and how their design meets these criteria. Design criteria should include flow velocities as they relate to swimming abilities of the target species (including burst and sustained swimming speeds), jump heights, flow depths, channel width and gradient. If necessary, hydraulic modeling should be used to verify whether the design will meet these criteria.
- **Southeast.** Although there is not a single standard in the Southeast, project grantees must describe and document how their design criteria for the target species were established and how their design meets these criteria. Design criteria should include flow velocities as they relate to the swimming abilities of the target species (including burst and sustained swimming speeds), jump heights, flow depths, channel width and gradient. If necessary, hydraulic modeling should be used to verify whether the design will meet these criteria.

☑ **Post-implementation.**

- Based on a post-implementation survey, the grantee should provide as-built conditions for channel width, channel slope, and maximum jump height (see instructions above in pre-implementation section).
- Site "passability" is determined by comparing the as-built conditions to the target ranges determined during project design.

- It is possible that project grantees could encounter unexpected conditions at the site, such as a natural rock ledge or water fall, that prevent the contractors from implementing the plans as designed. In these cases, a barrier could still exist at the project site even if the project is built as designed. Any such unexpected conditions should be described.

☑ **Frequency / Duration of Sampling.**

- A pre-implementation survey should be conducted at the site to document baseline conditions prior to barrier removal.
- The post-implementation survey should be conducted immediately after project implementation and document as-built conditions.

☑ **Optional Monitoring.**

- Measure the channel conditions over several years after project implementation to observe channel adjustment over time.
- Flow velocities (via a flow meter) and depths in the barrier reach post-project could be measured. This would verify passable conditions in a direct way and would evaluate how successful the design process was at estimating the necessary channel geometries for fish passable conditions.

E ***PRESENCE OF TARGET FISH SPECIES***
Change in presence of target diadromous species upstream of the project site.

☑ **Pre-implementation.**

- Identify *one* target diadromous species and its life stage (juvenile or adult) that, if able to pass through the site, would represent adequate passage for all other species in the area. For example, if two diadromous species are likely to use the site, choose the species and life stage with the least swimming or jumping abilities. Use one of the following survey techniques[1] to identify and report presence/absence for either adults or juveniles of the target species upstream of the project site:

  Adults. Upstream weirs, mark-recapture, spawner surveys, videography at barrier location, snorkel counts.

  Juveniles. Mark-recapture, migrant traps, snorkel counts, electroshocking, videography.

- Describe the survey techniques used to determine the presence/absence status of the target diadromous fish species.
- If a pre-implementation survey is not possible, report whether the barrier is a known full barrier or partial barrier for the target diadromous fish species. Describe any pre-project data that is available. If no recent biological information is available, include surrogate information (e.g. last time the target species was seen above the barrier, a description of "completeness" of barrier, etc.).

☑ **Post-implementation.**

- 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. In this case, the post-implementation result may be continued "presence".
- Describe the methodology used to determine presence/absence status of the target diadromous fish species.

☑ **Frequency / Duration of Sampling.**

- The timing and frequency should correlate with the life history of the target species. At a minimum, this parameter should be monitored once post-implementation, and at a maximum it could 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.
- Once target fish presence is detected upstream of the project site post-implementation, monitoring for this measure is complete.

☑ **Optional Monitoring.**

- For partial barriers or projects where the pre-implementation status was identified as ***present***, the proportional change in the number of adults or juveniles may be measured.

F ***COMMUNITY INVOLVEMENT***
Number of volunteers associated with the project and the number of volunteer hours contributed, if applicable.

1 Use regional or state protocol for fish surveys. If unknown then refer to the following document: Roni, P. (Editor) 2005. Monitoring stream and watershed restoration. *American Fisheries Society*, Bethesda, Maryland, 350 p.

☑ **Pre-implementation.**

- Estimate the number of volunteers that may participate in the project and the number of volunteer hours that may be contributed.
- Volunteers may include youth crew members (e.g. California Conservation Corps) or other in-kind services enabling project implementation.

☑ **Post-implementation.**

- Calculate the cumulative number of volunteers associated with the project and the number of volunteer hours contributed.
- Describe the methods used to calculate the number of volunteers and volunteer hours in the worksheet.

☑ **Frequency / Duration of Sampling.**

- Data can be collected throughout the award period and reported as cumulative numbers at the end of the award.

G *COMMUNITY ENHANCEMENT*

Local civic enhancement projects associated with the barrier removal.

☑ **Pre-implementation.**

- Determine whether or not there will be a local community, civic enhancement project associated with the barrier removal project.
- Local civic enhancement projects may include but are not limited to adjacent recreation enhancement, park development, and/or riverfront revitalization.
- Describe the local civic enhancement project(s) associated with the barrier removal.

☑ **Post-implementation.**

- Confirm whether or not the local civic enhancement project(s) associated with the project was carried out.

H *OPERATING AND MAINTENANCE COSTS*

Change in operations, maintenance and/or liability costs associated with the barrier removal.

☑ **Pre-implementation.**

- Determine the expected operations, maintenance and/or liability costs over the next 5 years if the barrier were to remain in place
- Periodic or less frequent costs that may occur during this period (e.g. structural upgrades to meet safety or regulatory requirements) may be incorporated into the estimate.
- Divide this number by 5 to determine the average annual operations and maintenance costs associated with the barrier.

☑ **Post-implementation.**

- Determine the expected operations, maintenance and/or liability costs of the site over the next 5 years once the barrier has been removed.
- Divide this number by 5 to determine the average annual Operations and Maintenance costs associated with the barrier.
- The post implementation average cost will automatically be substracted from the pre-implementation average cost to determine the average annual change in operations and maintenance costs.

☑ **Frequency / Duration of Sampling.**

- Estimated costs should be calculated prior to implementation and following project implementation.

☑ **Optional Monitoring.**

- Track actual expenses for 5 years post-implementation to verify estimated change in operating costs.

I *PUBLIC SAFETY*

Improved public safety associated with the barrier removal, if applicable.

☑ **Pre-implementation.**

- Describe whether or not barrier removal will eliminate or diminish a public safety hazard.
- Safety hazards may include barriers that serve as attractive nuisances and present swimming and boating dangers. Also, barriers that are structurally deficient, in danger of failure, or cause flooding may be considered public safety hazards.
- Describe the safety hazards caused by the barrier and how they will be eliminated or diminished through removal.

☑ **Post-implementation.**

- After implementation, confirm that the public safety hazard has been eliminated or diminished.

J *ADDITIONAL PROJECT MONITORING*

Describe additional project monitoring, such as pre-and post project spawner or juvenile surveys, outmigrant trapping, topographic data collection, geomorphic monitoring, photo documentation or other monitoring activities associated with the project but not described in the form.

Appendix D. NOAA Restoration Center proposed post-construction monitoring forms and instructions developed under the lead of CDFW for their Fisheries Restoration Grant Program. NMFS encourages restoration practitioners to access the most current versions of these documents electronically at the URL below, or by contacting the NOAA RC*.

http://ftp.dfg.ca.gov/Public/FRGP/Qualitative_Monitoring_Forms/

*Additional information including checklists and monitoring protocols are available from the NOAA RC, or at the aforementioned URL.

General Instructions for Implementation and Effectiveness Monitoring

To begin the qualitative monitoring process, the evaluator must first review the FRGP grant agreement to determine the project's objectives, statement or scope of work (SOW), location(s), and other supplemental information. It is also advisable to review the original project proposal submitted to the FRGP if it is available. After this initial review the evaluator should list the project's different features, and which monitoring checklist(s) best evaluates those features. Next, check with the FRGP's grant manager to determine any changes which may have occurred regarding the projects SOW, feature types and/or their locations. Any changes should have been approved by the grant manager.

FEATURE:

A feature is a distinct physical implementation at a location within a project work site intended to interact with the environment to improve anadromous salmonid habitat. Features consist of one or more restoration treatments.

Within one project site there can be numerous features. For implementation monitoring, features are divided by treatment type and location. However, functional groups of structures or treatments can be grouped as one feature. For example, a group of tightly spaced willow baffles should be considered one feature. It is impractical to separate each baffle because they interact and work together as a group for the same objective at the same location. A string of closely spaced grade control weirs is another example of this situation. However, willow baffles and rip-rap bank stabilization at the same location would need to be separated into different features because they have different objectives.

SITE:

A project site is defined as a point, length (reach), or area which spatially describes a work area where specific restoration activities take place.

Many projects employ multiple treatment types within a given work site. *Example of dividing a project into sites:* A project that included instream restoration and riparian treatments in a contiguous area would require two sites; a line for the instream activities and a polygon for the riparian plantings. The reach of stream may have instream habitat structures, streambank stabilization structures, and a log jam barrier removal and be considered as one line site, provided the distance between any two individual features is less than 0.5 miles apart. Similarly, the area of riparian habitat where Himalayan blackberry was removed and conifer trees were planted would be one polygon site.

PROJECT:

For restoration project implementation and effectiveness monitoring, a project is defined as all work taking place under one FRGP grant number or the CHRPD number assigned to a non-FRGP funded project that is carried out under DFG's U.S. Army Corps of Engineers Section 404 Permit RGP-12.

Which Checklist to Use?

- Choose which checklist to use based on the objectives of the individual feature(s).
- Checklists purposely do not share names or initials with FRGP project types.
- There is no direct correspondence between a checklist and a project's FRGP project type, but the following information will help choose the right checklist.

Note: If you are using the correct checklist, you should be able to easily answer the majority of the questions. Sometimes the checklist itself contains guidance as to which checklist(s) are needed to evaluate the feature treatments employed. *For example, if an instream or upslope project includes a planting component, a note directs the user that revegetation is a separate feature, and the RT or revegetation checklist should be used.*

Frequently not all questions on a checklist will be applicable, but that is okay, the goal is to use the checklist questions that best illustrate and evaluate the feature that is being monitored. Sometimes one feature will require multiple checklists, but this generally does not occur. If you have any doubts on which to use, please e-mail FConsolati@dfg.ca.gov with your questions.

Checklist Titles

1. **IN - INSTREAM HABITAT & BANK RESTORATION**
2. **CB - CHANNEL RECONSTRUCTION & BANK STABILIZATION**
3. **FS – FISH SCREENING OF DIVERSIONS**
4. **SF – STREAM FLOW TREATMENTS ***
5. **FC – FISH PASSAGE AT STREAM CROSSINGS**
6. **FB – FISH PASSAGE AT BARRIERS**
7. **RT – REVEGETATION TREATMENTS**
8. **VC – VEGETATION CONTROL & REMOVAL**
9. **LU – LAND USE TREATMENTS & EXCLUSION FENCING**
10. **CD – STREAM CROSSING DECOMMISIONING**
11. **RD – ROAD SEGEMENT DECOMMISIONING**
12. **CU – STREAM CROSSING UPGRADING**
13. **RU – ROAD SEGMENT UPGRADING**
14. **US – UPSLOPE STABILIZATION & DELIVERY PREVENTION**

* 2010 SF-STREAM FLOW TREATMENTS checklist are not available at this time.

Checklist Descriptions

FRGP project type: HI- Instream Habitat Restoration and HS – Instream Bank Restoration

For typical features of FRGP projects classified as HI or HS, there are three checklists to use: IN, CB, and RT.

IN – INSTREAM HABITAT & BANK RESTORATION checklist is for ***habitat unit specific*** instream features. The feature may have instream restoration objectives, streambank restoration objectives, or both as long as each feature is installed in a small (less than 100' length), discreet treatment area; preferably installed in one habitat unit. The implementation checklist focuses on traditional types of structures that are installed within the bankfull channel width of a wadable stream. The effectiveness checklists include habitat unit specific measures of effectiveness such as shelter rating and residual depth.

CB – CHANNEL RECONSTRUCTION & BANK STABILIZATION checklist is for larger instream features that cannot be associated with one habitat unit or small treatment area. These types of instream and streambank features may: 1) ***extend the length of many habitat units***, 2) ***be in non-wadable stream or river***, 3) be in ***a dry stream reach at the time of survey***, or 4) be ***bank or channel reconstructions*** where no habitat or stream channel currently exists. The implementation checklist focuses on construction of larger structures and reconstruction/recontouring treatments. The effectiveness checklists do not focus on habitat specific measures of effectiveness, but more general indicators of channel and bank restoration.

RT – REVEGETATION TREATMENTS checklist is used to supplement IN or CB for features where bioengineering methods are used to stabilize the streambank or channel. The CB or IN checklists are used to answer general channel and bank questions. Using the same feature number, one will answer all the applicable questions on the RT checklist. When using RT as a supplement to another checklist, one does not need to "duplicate answer" any questions and can simply cross out the BANK or CHANNEL sections on the RT checklist.

FRGP project type: HR- Riparian Restoration and HA – Habitat Acquisition

For typical features of FRGP projects classified as HR, there are three possible checklists to use – RT, VC, and LU.

RT – REVEGETATION TREATMENTS checklist is for ***any type of riparian or upland planting feature,*** therefore it can be used in combination with any of the checklists as long as a planting feature is proposed and implemented. The implementation checklist focuses on planting of vegetation. Effectiveness checklists focus on the vegetation composition and cover from planted vegetation. This checklist can also be used when nothing is planted, but an area is treated by fencing or acquisition and has the same objectives as a planting feature.

VC – VEGETATION CONTROL & REMOVAL checklist is for ***any type of riparian or upland feature that removes vegetation, usually non-native invasive species***. This type of feature may have the same objectives as a planting project, but achieves them by removing certain types of vegetation to increase targeted vegetation. The implementation checklist focuses on the location of removal, type of vegetation removed, and removal methods. Effectiveness checklists focus on composition and abundance of native versus non-native species. When vegetation control is done in conjunction with planting, there are two overlapping features, one RT and one VC, and both checklists are used.

LU – LAND USE & EXCLUSION FENCING checklist is for project features that are land use related. Land use related features 1) ***impose land use restrictions***, 2) ***change pre-existing land use,*** 3) ***install exclusion fencing***, or 4) ***install stock watering stations***. Implementation checklists establish the type of land use restriction agreement, and covers installation of fencing and watering stations. Effectiveness checklists cover the basics about adherence to restrictions and the condition and success of fencing. Additionally, it directs the user which other checklist to use for specific objectives such as riparian enhancement, streambank stabilization, instream habitat improvement, or upslope stabilization.

FRGP project type: FP – Fish Passage at Stream Crossings and FL – Fish Ladders

For typical features of FRGP projects classified as FP or FL, there are four possible checklists to use – FC, FB, CU, or CD,.

FC – FISH PASSAGE AT STREAM CROSSINGS checklist is used for fish passage improvement projects at stream crossings only, even if the crossing itself is a barrier to fish passage. The effectiveness checklist focuses on fish passage criteria for adults and juveniles, passage problems and passage objectives. The implementation checklist evaluates the stream crossing, channel, and performance measures.

FB- FISH PASSAGE AT BARRIERS checklist is used during implementation monitoring at stream crossings when evaluating grade control or back-flooding weirs or structures associated with the crossing.

CU- STREAM CROSSING UPGRADING checklist is used when a FP project intends to replace or upgrade a *pre-existing* stream crossing type. Only for effectiveness, the CU checklist is used with the FC checklist to describe the proposed treatment for the stream crossing. When using the CU in conjunction with the FC disregard all categories except *Stream Crossing* on the CU. The FC implementation checklist addresses both the stream crossing upgrade as well as the fish passage criteria, therefore does not need to be used with the CU.

CD- STREAM CROSSING DECOMMISSIONING checklist is used when a FP project proposes to decommission a stream crossing type. For effectiveness this checklist is used in addition with the FC checklist to address the stream crossing treatment. When using a CD in conjunction with an FC disregard all categories except *Stream Crossing* on the CD. The implementation checklist addresses the crossing decommission as well as the fish passage criteria, therefore does not need to be used with the CD.

FRGP project type: HB – Instream Barrier Modification

FB- FISH PASSAGE AT BARRIERS checklist is used on ***instream*** barrier modifications or removal that occurs anywhere other than a stream crossing (i.e. debris jams or dams). The implementation checklist evaluates structure installation and modification. Also, the implementation form can be used to evaluate grade control or back-flooding weirs/structures associated with stream crossings. The effectiveness checklist addresses barrier and passage problems and objectives.

FRGP project type: HU – Watershed Restoration (Upslope)

For typical features of FRGP projects classified as HU, there are six possible checklists to use - RU, RD, CU, CD, US, and RT.

US- UPSLOPE STABILIZATION & DELIVERY PREVENTION checklist is used to address treatments to gullies, landslides, or eroding slopes as well as restoration of rock pits, spoil disposal sites, and other developed areas. It can be used in conjunction with an RU or RD, but also can be used singularly. The effectiveness checklist focuses on sediment delivery and feature location. The implementation checklist evaluates installed structures and sediment delivery objectives.

RU – ROAD SEGMENT UPGRADING checklist is used on projects that intend to improve road drainage to decrease erosion and stream sedimentation (*RU techniques: disconnect and disperse runoff by using road shape, road surface, and critical dips and rolling dips*). The RU evaluates roads that will continue to be accessed by vehicles. Project treatments include road drainage improvements, stream crossing upgrades (CU), and/or treatment of road related landslides (US). The effectiveness checklist

addresses sedimentation and percent connectivity. The implementation checklist evaluates road shape and drainage structures installed. *When using an RU it is important to remember that each separate road is a feature, not a site. Refer to the site definitions for the parameters of a road site.*

RD- ROAD SEGMENT DECOMMISSION checklist is used for projects that will permanently or temporarily decommission roads for use by vehicles, but may convert the road into a trail. RD treatments include stream crossing excavation, landslide treatment, road drainage improvement, decompaction, and revegetation. The effectiveness checklist covers road surface drainage and sediment delivery. The implementation checklist evaluates the road decommission treatments and spoils placement. *When using an RD it is important to remember that each separate road is a feature, not a site. Refer to the site definitions for the parameters of a road site.*

CU- STREAM CROSSING UPGRADING checklist is used to evaluate modifications, new installations, or replacements of stream crossing structures. Generally it is used in conjunction with an RU checklist. The CU evaluates the stream crossing feature located in the RU's site, but both the stream crossing and the road upgrade are separate features. The effectiveness checklist addresses the current stream crossing problems/objectives, the sediment delivery potential, and the channel and bank condition. The implementation checklist evaluates the upgraded crossing type, spoils placement, and channel conditions.

CD- STREAM CROSSING DECOMMISSIONING is used on projects that intend to remove and/or decommission a pre existing stream crossing. Generally the CD is used in conjunction with an RD. The effectiveness checklist addresses the current crossing type and condition, sediment delivery, and channel, bank condition. The implementation checklist evaluates the stream crossing decommission according to CDFG standards.

FRGP project type: SC – Fish Screening of Diversions

For typical features of FRGP projects classified as SC, there is one possible checklist to use - FS.

FS – FISH SCREENING OF DIVERSIONS is used to evaluate projects that involve the installation of fish screens or head gates at streamflow diversions. The effectiveness FS checklist addresses fish access, diversion flow, fish screen, channel and banks. The implementation FS checklist evaluates the installation of the fish screen and headgate, and diversion rate according to CDFG standards.

FRGP project type: SF- Stream Flow Treatments

For typical features of FRGP projects classified as WC or WD, there is one possible checklist to use – SF.

SF – STREAM FLOW TREATMENTS checklist is under development at this time. We apologize for any inconvenience this may cause. If you have any questions, please contact fconsolati@dfg.ca.gov.

Additional forms

After choosing the correct checklist(s) to evaluate the project's features, the evaluator will need to fill out some general forms that are ALWAYS required for each project.

These are:

- **Site Access And Location Data Form**
- **Onsite Navigation Form**
- **Photo Description Form**
- **And, if conducting annual implementation monitoring, additional site summary forms will be needed (see below for further explanation).**

Summaries

During the implementation monitoring phase, Summary checklist forms are required to organize and compile annual site metrics and evaluation ratings. The following forms are available for use:

1. ANNUAL IMPLEMENTATION MONITORING SUMMARY
   - Summarizes qualitative implementation ratings (CHRPD tab 7)
   - One per project per year when implementation has occurred.

2. SITE SUMMARY – Instream/Fish Passage Implementation Monitoring

3. SITE SUMMARY – Riparian/Instream Implementation Monitoring

4. SITE SUMMARY – Upslope Implementation Monitoring
   - Summarizes performance measures (CHRPD Tab 3)
   - Try to use a summary that captures all the possible performance measures for the site.
   - If needed, use a combination of site summaries, but answer the "ALL" metrics only once for the site.

ANNUAL IMPLEMENTATION MONITORING SUMMARY

Grant #: **Project title:**

Evaluator: **Reporting Date (mm/dd/yy):** **For Calendar Year:**

Answer Y (yes), N (no), or A (not applicable) in the box to indicate if the data has been correctly entered in CHRPD, if not attach information.

	Is the "Work Status" field up-to-date, as of the reporting date? → Work Status:
	Are the "Limiting factors addressed by the project" correct? (Tab 1)
	Is the "As-built description (actual work)" for completed features concise, accurate and complete? (Tab 1)
	Have Annual Site metrics been entered for all sites in this project? (Tab 3)
	If project complete, have All-Years Site Metrics been entered for this project? (Tab 3)
	Was the name of the watershed plan in which this project was identified as a priority entered correctly? (Tab 4)
	Are actual construction dates entered? (Tab 5) Construction begin date:_____Construction end date:_____
	If no work for the project was completed this year, has the "No Work This Year" box been checked? (Tab 5)
	Has all channel dewatering and species relocation data been entered into the CHRPD? (Tab 5)
	Is at least one field inspection, including "% Complete" field, entered? (Tab 8) → % Complete:

Overall Implementation Rating (circle one): **EXCELLENT** **GOOD** **FAIR** **POOR** **FAILED**

Rational/Recommendations:

Is this Project Maintenance (PM)? Yes No If yes, original contract #:

Checklist Name		# Project Features	# Features Monitored	# EXCELLENT	# GOOD	# FAIR	# POOR	# FAILED
CB	Channel Reconstruction & Bank Stabilization							
CD	Stream Crossing Decommissioning							
CU	Stream Crossing Upgrading							
FB	Fish Passage at Barriers							
FC	Fish Passage at Stream Crossings							
FS	Fish Screening of Diversions							
IN	Instream Habitat & Bank Restoration							
LU	Land Use Treatments and Exclusion Fencing							
RD	Road Segment Decommissioning							
RT	Revegetation Treatments							
RU	Road Segment Upgrading							
SF	Streamflow Treatments							
US	Upslope Stabilization & Delivery Prevention							
VC	Vegetation Control & Removal							
UN	Unavailable checklist							

PRE-TREATMENT EFFECTIVENESS MONITORING SUMMARY

Grant #: **Project title:**

Evaluator: **Reporting Date (mm/dd/yy):**

Is this Project Maintenance (PM)? □Yes □ No If yes, original contract or grant #:

Checklist Name		# Project Features	# Features Monitored
CB	Channel Reconstruction & Bank Stabilization		
CD	Stream Crossing Decommissioning		
CU	Stream Crossing Upgrading		
FB	Fish Passage at Barriers		
FC	Fish Passage at Stream Crossings		
FS	Fish Screening of Diversions		
IN	Instream Habitat & Bank Restoration		
LU	Land Use Treatments and Exclusion Fencing		
RD	Road Segment Decommissioning		
RT	Revegetation Treatments		
RU	Road Segment Upgrading		
SF	Streamflow Treatments		
US	Upslope Stabilization & Delivery Prevention		
VC	Vegetation Control & Removal		

Monitoring Summary/Notes:

continued on back ☐

POST-TREATMENT EFFECTIVENESS MONITORING SUMMARY

Grant #: **Project title:**

Evaluator: **Reporting Date (mm/dd/yy):**

Is this Project Maintenance (PM)? □Yes □ No If yes, original contract or grant #:

	Checklist Name	# Project Features	# Features Monitored	# EXCELLENT	# GOOD	# FAIR	# POOR	# FAILED
CB	Channel Reconstruction & Bank Stabilization							
CD	Stream Crossing Decommissioning							
CU	Stream Crossing Upgrading							
FB	Fish Passage at Barriers							
FC	Fish Passage at Stream Crossings							
FS	Fish Screening of Diversions							
IN	Instream Habitat & Bank Restoration							
LU	Land Use Treatments and Exclusion Fencing							
RD	Road Segment Decommissioning							
RT	Revegetation Treatments							
RU	Road Segment Upgrading							
SF	Streamflow Treatments							
US	Upslope Stabilization & Delivery Prevention							
VC	Vegetation Control & Removal							

Overall Effectiveness Rating (circle one): **EXCELLENT** **GOOD** **FAIR** **POOR** **FAILED**

Rational/Recommendations

continued on back □

Long-term post-treatment monitoring recommended □ No □ Yes - Year of next monitoring visit:_____

Coastal Restoration Monitoring and Evaluation Program
Validation Monitoring Snorkel Survey Datasheet

6/1/2011 Draft

Grant #:	**Project Title:**	**Proj.Type:**
Site ID:	**Site Name:**	
Date:	**Diver/s:**	**page____of_____**
Stream:		

Project Type		UPS	DNS		UPS	DNS
HB/FP	**Reach Length from Barrier: (ft)**			**Total Hab Units in Reach:**		
HI	**Reach Length: (ft)**			**Total Features in Reach:**		

Bankfull Width:(ft) **Gradient: (%)** **Visibility:** **Water Temp:(°F)**

Feature #	**Avg Length:(ft)**		**Avg Width:(ft)**		**Residual Max Depth:(ft)**				**Habitat Unit Coord:**
Feature Type Code:									
Steelhead trout			**Chinook salmon**		**Coho salmon**		**Cuttroat trout**		**N**
YOY	**1+**	**2+**	**YOY**	**1+**	**YOY**	**1+**	**1+**	**2+**	
									W
									WP:
Feature #	**Avg Length:(ft)**		**Avg Width:(ft)**		**Residual Max Depth:(ft)**				**Habitat Unit Coord:**
Feature Type Code:									
Steelhead trout			**Chinook salmon**		**Coho salmon**		**Cuttroat trout**		**N**
YOY	**1+**	**2+**	**YOY**	**1+**	**YOY**	**1+**	**1+**	**2+**	
									W
									WP:
Feature #	**Avg Length:(ft)**		**Avg Width:(ft)**		**Residual Max Depth:(ft)**				**Habitat Unit Coord:**
Feature Type Code:									
Steelhead trout			**Chinook salmon**		**Coho salmon**		**Cuttroat trout**		**N**
YOY	**1+**	**2+**	**YOY**	**1+**	**YOY**	**1+**	**1+**	**2+**	
									W
									WP:
Feature #	**Avg Length:(ft)**		**Avg Width:(ft)**		**Residual Max Depth:(ft)**				**Habitat Unit Coord:**
Feature Type Code:									
Steelhead trout			**Chinook salmon**		**Coho salmon**		**Cuttroat trout**		**N**
YOY	**1+**	**2+**	**YOY**	**1+**	**YOY**	**1+**	**1+**	**2+**	
									W
									WP:
Feature #	**Avg Length:(ft)**		**Avg Width:(ft)**		**Residual Max Depth:(ft)**				**Habitat Unit Coord:**
Feature Type Code:									
Steelhead trout			**Chinook salmon**		**Coho salmon**		**Cuttroat trout**		**N**
YOY	**1+**	**2+**	**YOY**	**1+**	**YOY**	**1+**	**1+**	**2+**	
									W
Note: Fish age classes: (0+) = 0-3", (1+) = 3-6", (2+) = >6"									**WP:**

Notes:

SITE SUMMARY - Instream/Fish Passage Implementation Monitoring

Site Name: **Site ID:**

Grant #: **Project title:**

Year: **Evaluator:** **Checklists** (circle types attached)**: CB FB FC FS IN SF**

Summary of Performance Measures by Site

DFG project type	Metric name as it appears in the CHRPD	Conversion	Reporting Metric	Reporting Unit
HI	Length of instream habitat treated - except for bank stabilization (sum of individual feature lengths)	ft /5280 ft =		miles
HS	Length of streambank stabilized (count both sides of stream where applicable)	ft /5280 ft =		miles
HI	Length of stream treated for channel reconfiguration/connectivity	ft /5280 ft =		miles
HI	Length of off-channel stream created	ft /5280 ft =		miles
HI	Length of stream treated for channel structure placement (sum of individual channel structure lengths, for feature types 301-303 and 310-344)	ft /5280 ft =		miles
HI	Length of stream treated with spawning gravel placement	ft /5280 ft =		miles
HI	Gravel volume added to stream →			cubic yards
HI	Instream features installed/modified →			number
HI	Instream pools created/added →			number
HI	Type of instream habitat or streambank stabilization treatment (list 3-digit numeric type codes):			list codes
HI	Amount of wetland area treated	ft²/43,560 ft² =		acres
HI	Amount of artificial wetland area created	ft²/43,560 ft² =		acres
HI	Amount of estuarine area treated	ft²/43,560 ft² =		acres
HI	Amount of estuarine area created	ft²/43,560 ft² =		acres
FP	Stream crossings treated to improve fish passage →			number
FP	Stream length opened for fish passage by improving stream	ft /5280 ft =		miles
HU	Sediment volume prevented from entering stream (if applicable) →			cubic yards
HB	Barriers other than stream crossings removed/modified →			number
HB	Stream length opened for fish passage - barriers other than stream crossings	ft /5280 ft =		miles
SC	Fish screens installed →			number
SC	Fish screens replaced/maintained →			number
SC	Flow rate at screened diversion from the water right →			cfs
SC	Quantity of water protected by screens as stated in the water right →			acre-feet/yr
SC,WD	Water flow gauges installed →			number
WC,WP	Amount of water returned to the stream (not including water maintained in stream)			cfs
WP	Volume of water leased or purchased →			acre-feet/yr

REQUIRED ***for all implementation projects or see Site Summary page____ of ____. Total for the site, for the calendar year.***

ALL	Overall stream length treated (one side of stream only)*	ft /5280 ft =	miles
ALL	Length of aquatic habitat disturbed →		feet
ALL	Area (footprint) of instream features installed within bankfull channel →		feet²

Field Verification of Site Location: ☐The site is digitized correctly or ☐pdated site information has been submitted

*Enter "All" metrics into CHRPD even when they are 0. *Length of entire reach where work occurred.*

PHOTO DESCRIPTION FORM

Grant #: **Project title:**

Site ID: **Site Name:**

Date : **Purpose of Photos:** **Page ___ of ___**

Camera ID: **Digital photo frame # prefix:** **File type:**

Compass adjusted for declination? ☐ **Y** ☐ **N** **Dec:_____°** **Photographer:**

Frame # / Match #	**Photo taken**		**Location of photographer**	**Direction**	**Scene Description**	**Panorama?**
	at photo-point?	of project feature?	**Standing:**	**Facing: ***	**Looking at:**	
enter # given by camera	enter PP##, if applicable	enter feature (#), if applicable	Describe where the photographer was standing if photo is not taken from a photopoint OR provide additional relocation information.	N/W/S/E, AZ°, UPS, DNS, LBK, RBK, etc.	"Looking at" - describe feature or subject, position of subject (cntr, top, btm, side), notable landmarks, points of special interest, etc. as applicable.	Y or N

* If photo is taken at the photopoint, include azimuth (°) in Direction Facing column. CRMEP 06/01/11 Draft

SITE SUMMARY - Riparian/Bank Implementation Monitoring

Site Name: Site ID:

Grant #: **Project title:**

Year: **Evaluator:** **Checklists** (circle types attached)**: CB IN LU RT VC**

Summary of Performance Measures by Site

DFG project type	Metric name as it appears in the CHRPD	Conversion	Reporting Metric	Reporting Unit
HR	Length of riparian stream bank treated (count both sides of stream if applicable)	ft /5280 ft =		**miles**
HR	Amount of riparian area treated (including fencing, excluding invasive species treatments)	ft² /43,560 ft² =		**acres**
HR	Area planted in riparian	ft² /43,560 ft² =		**acres**
HR	Amount of riparian area treated for invasive species	ft² /43,560 ft² =		**acres**
HU	Amount of upland area treated	ft² /43,560 ft² =		**acres**
HR	Trees planted →			**number**
HR	Species of plants treated/removed in riparian (use USDA codes from Plant Species Code List)			**list codes**
HR	Fence length installed/repaired (actual length of fence)	ft /5280 ft =		**miles**
HR	Type of riparian treatment (use 3-digit treatment type codes):			**list codes**
HI	Amount of wetland area treated for invasive species	ft² /43,560 ft² =		**acres**
HI	Amount of estuarine area treated for invasive species	ft² /43,560 ft² =		**acres**
HA	Length of stream protected by acquisition, easement or lease	ft /5280 ft =		**miles**
HA	Area protected with acquisition, easement or lease	ft² /43,560 ft² =		**acres**
HI	Length of instream habitat treated - except for bank stabilization (sum of individual feature lengths)	ft /5280 ft =		**miles**
HS	Length of streambank stabilized (count both sides of stream where applicable)	ft /5280 ft =		**miles**
HI	Gravel volume added to stream →			**cubic yards**
HI	Instream features installed/modified →			**number**
HI	Type of instream habitat or streambank stabilization treatment (use 3-digit treatment type codes):			**list codes**
HI	Amount of wetland area treated	ft² /43,560 ft² =		**acres**
HI	Amount of artificial wetland area created	ft² /43,560 ft² =		**acres**
HI	Amount of estuarine area treated	ft² /43,560 ft² =		**acres**
HI	Amount of estuarine area created	ft² /43,560 ft² =		**acres**

REQUIRED ***for all implementation projects or see Site Summary page_____ of _____. Total for the site, for the calendar year.***

ALL	Overall stream length treated (one side of stream only)*	ft /5280 ft =	**miles**
ALL	Length of aquatic habitat disturbed →		**feet**
ALL	Area (footprint) of instream features installed within bankfull channel →		**feet²**

miles to 0.0001, acres to 0.0001

*Enter "All" metrics into CHRPD even when they are 0. *Length of entire reach where work occurred.*

Field Verification of Site Location: ☐ The site is digitized correctly or ☐ Updated site information has been submitted

☐ Comment on back.

SITE SUMMARY - Upslope Implementation Monitoring

Site Name: Site ID:

Grant #: **Project title:**

Year: **Evaluator:** **Checklists** (circle types attached)**: CD CU FC RD RT RU US**

Summary of Performance Measures by Site

DFG project type	Metric name as it appears in the CHRPD	Conversion	Reporting Metric	Reporting Unit
HU	Amount of upland area treated →	$ft^2/43{,}560\ ft^2$ =		**acres**
HU	Road length treated →	ft /5280 ft =		**miles**
HU	Length of road treated for drainage improvements/reconstruction →	ft /5280 ft =		**miles**
HU	Length of road closed/abandoned →	ft /5280 ft =		**miles**
HU	Upslope stream crossings treated (not for fish passage) →			**number**
HU	Sediment volume prevented from entering stream →			**cubic yards**
HU	Erosion/sediment control installations (sediment basins, collection ponds, traps or water bars) →			**number**
HU	Trees planted →			**number**
HU	Species of plants planted for erosion control (use USDA codes from Plant Species Code List)			**list codes**
HU	Area treated for upland vegetation management (vegetation treatment or removal for water conservation or sediment control)	$ft^2/43{,}560\ ft^2$ =		**acres**
HU	Species of plants in upland vegetation management →			**number**
HU	Livestock water installations/developments →			**number**
FP	Stream crossings treated to improve fish passage →			**number**
FP	Stream length opened for fish passage by improving stream crossings	ft /5280 ft =		**miles**

REQUIRED ***for all implementation projects or see Site Summary page____of ____. Total for the site, for the calendar year.***

ALL	Overall stream length treated (one side of stream only)*	ft /5280 ft =		**miles**
ALL	Length of aquatic habitat disturbed* →			**feet**
ALL	Area (footprint) of instream features installed within bankfull channel →			**$feet^2$**

** Road projects not on a Class I stream, enter zero in CHRPD. Enter "All" metrics into CHRPD even when they are 0.* *miles to 0.0001, acres to 0.0001*

Comments:

Field Verification of Site Location: ☐ The site is digitized correctly or ☐ Updated site information has been submitted

☐ Comment on back

SITE ACCESS AND LOCATION DATA FORM

Page ___ of ___

Grant #: **Project title:**

Site ID: **Site Name:**

Date : **Crew:**

4th field HUC: **USGS Quad(s):** **Legal Description: T R S**

ACCESS INFORMATION FOR SITE

Contact Information for Project

Entity	Name	Affiliation	Phone	E-mail
CDFG				
Grantee				
Landowner				
Construction				
Monitoring & Evaluation				

Gates and Access

Landowner permission required?	Written or Verbal	Gate combo or key required?
Comments:		

DIRECTIONS TO SITE

Driving Directions to Parking Site and/or Departure Point (include landmarks, roads and distances)

Parking Site and/or Departure Point Location

Datum:

Point name	Photo #*	Waypoint	Latitude	Longitude	Description of point

***Document the optional photo(s) of the Parking Site and/or Departure Point on the Photo Description Form**

Sketch of Parking Site Relative to Work Site(s) and Major Roads

Restoration Project Site Sketch

Grant #: **Project title:**

Date : **Sketch artist:** **Site ID:** page ___ of ___

North Arrow

Magnetic or True

Create a key to map symbols on this page. Designate north in the "north arrow" box. CRMEP 06/01/11 Draft