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

July 23, 2019 **Refer to NMFS No:** WCRO-2019-00929

Steven Mietz
Superintendent, Redwood National Park
National Park Service
1111 Second Street
Crescent City, California 95531

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Greater Prairie Creek Ecosystem Restoration Program

Dear Mr. Mietz:

Thank you for your letter of May 23, 2019, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Greater Prairie Creek Ecosystem Restoration Program (Program). Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action. This letter transmits NMFS' final biological opinion and EFH response for Redwood National and State Parks' (RNSP) proposed Program.

The enclosed biological opinion describes NMFS' analysis of potential effects on threatened Southern Oregon/Northern California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*), California Coastal (CC) Chinook salmon (*O. tshawytscha*), Northern California (NC) steelhead (*O. mykiss*), and their designated critical habitat in accordance with section 7 of the ESA. Based on the best scientific and commercial information available, NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon, and NC steelhead or destroy, or adversely modify designated critical habitat for these species. NMFS expects the proposed action would result in incidental take of SONCC coho salmon, CC Chinook salmon, and NC steelhead. An incidental take statement, with terms and conditions, is included with the enclosed biological opinion.

The enclosed EFH consultation was prepared pursuant to section 305(b) of the MSA. The proposed Program includes areas identified as EFH for coho salmon and Chinook salmon, Pacific Salmon species managed under the Pacific Coast Salmon Fishery Management Plan. Based on our analysis, NMFS concluded that the Program would adversely affect EFH for coho salmon and Chinook salmon. Therefore, we have included the results of that review in Section 3

of this document. Additional conservation measures under EFH were not identified for this Program.

Thank you for the opportunity to provide early technical assistance and for our involvement in the development of minimization measures. We also appreciate your well documented biological assessment that we received with your request for formal consultation. And, finally, thank you for continuing to restore the ecosystem upon which ESA-listed salmon and steelhead depend on for recovery.

Please contact Leslie Wolff in Arcata, California at 707-845-6282, or via email at Leslie.Wolff@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

for Alicia Van Atta
Assistant Regional Administrator
California Coastal Office

Enclosure

ec: Copy to ARN File # 151422WCR2019AR00116
Leonel Arguello, Redwood National Park
Keith Bensen, Redwood National Park

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

NMFS Consultation Number: WCRO-2019-00929
Action Agency: National Park Service (NPS), Redwood National Park (RNP)

Table 1. Affected Species and NMFS' Determinations:

| ESA-Listed Species | Status | Is Action Likely to Adversely Affect Species? | Is Action Likely To Jeopardize the Species? | Is Action Likely to Adversely Affect Critical Habitat? | Is Action Likely To Destroy or Adversely Modify Critical Habitat? |
|---|---|---|---|---|---|
| Southern Oregon/Northern California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*) | Threatened | Yes | No | Yes | No |
| Northern California (NC) steelhead steelhead (*O. mykiss*) | Threatened | Yes | No | Yes | No |
| California Coastal Chinook (CC) salmon (*O. tshawytscha*) | Threatened | Yes | No | Yes | No |

Table 2. Essential Fish Habitat and NMFS' Determinations:

| Fishery Management Plan That Identifies EFH in the Project Area | Does Action Have an Adverse Effect on EFH? | Are EFH Conservation Recommendations Provided? |
|---|---|---|
| Pacific Coast Salmon | Yes | No |

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

**Issued By**: for Alicia Van Atta
_____
Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

**Date**: July 23, 2019

## Table of Contents

# 1 INTRODUCTION

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

## 1.1 Background

NOAA's National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402. We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

The Redwood National and State Parks (RNSP) complex was formed by the NPS and the California Department of Parks and Recreation (CDPR) through a 1994 Memorandum of Understanding (MOU) for the cooperative management of the parks. The RNSP complex includes RNP, Prairie Creek Redwoods, Jedidiah Smith Redwoods, and Del Norte Redwoods State parks. The General Management Plan/General Plan and Environmental Impact Statement/Report (GMP) for RNSP provides comprehensive guidance for managing the National and state parks as one complex with similar resources.

In partnership with Save the Redwoods League (a non-profit conservation organization), the NPS and CDPR have formed a forest management collaborative to restore previously logged redwood forests in the Prairie Creek sub-basin on park lands. The Program area is a high priority for ecosystem restoration because of its location in context with the surrounding landscape. To the north and south lie two of the largest remaining old growth redwood forests in the world, and forest restoration will accelerate the connectivity of habitat between these forests, and shorten the time for development of late seral forest habitat conditions throughout Prairie Creek.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at the NMFS Northern California Office in Arcata, California.

## 1.2 Consultation History

A May 14, 2003, MOU between NPS, CDPR, NMFS, and the United States Fish and Wildlife Service (USFWS) establishes a process for streamlining consultation and creates the Interagency Consultation Team (ICT) for the RNSP complex of parks. The MOU establishes a quarterly meeting schedule for the ICT, where multiple agencies, including RNSP, NMFS, USFWS, and the California Department of Fish and Wildlife (CDFW) meet to discuss project design features and minimization measures for listed species during early project or program development.

As part of this ongoing commitment to collaboration and early involvement, RNSP invited the NOAA Restoration Center (NOAA RC), NMFS, and other agencies to an early scoping meeting on October 31, 2013, to discuss watershed restoration opportunities in lower Prairie Creek. Informal discussions began in 2015 regarding RNSP's collaborative work with Save the

Redwoods League to plan a comprehensive ecosystem restoration program for lower Prairie Creek, and the Program was first formally presented at an ICT meeting on February 8, 2017.

Since 2017, NMFS participated in many field trips and planning meetings with RNSP to discuss design features, particularly in riparian areas, that would minimize effects to listed salmonids and their habitat from Program activities. During 2018, RNSP, with input from NMFS, developed an analytical approach to determine cumulative watershed and sediment effects from the Program, and began outlining information needs for development of the biological assessment (BA).

Also in 2018, NMFS determined that the NPS could include state park lands in the Program area for this consultation (Harwood 2018). Pursuant to the ESA section 7 implementing regulations, an "action" includes all activities or programs of any kind authorized, funded or carried out, in whole, or in part, by Federal agencies. Since the NPS and the CDPR will sign a joint decision document under both the National Environmental Policy Act (NEPA) and the California Environmental Policy Act (CEQA) for the entire Program area, the NPS is making a decision in part to manage both Federal and state lands. However, while RNSP will implement the coordinated management for the Program, the NPS is the Federal action agency for this consultation and is responsible for ongoing coordination with NMFS, including any required monitoring, reporting and project verification for applicability under the Program.

The RNSP provided drafts of the Program BA for NMFS review during March and April, 2019. On May 17, 2019, NMFS and RNSP agreed on the final version of the BA, and on May 24, 2019, NMFS received the RNSP's request to initiate formal ESA consultation on the Program, including information to inform the EFH review. The RNSP determined that the Program may adversely affect Southern Oregon/Northern California Coast (SONCC) coho salmon, California Coastal (CC) Chinook salmon and Northern California (NC) steelhead, and their designated critical habitats. The BA originally determined that the Program was likely to affect, but not likely to adversely affect, Southern Resident Killer Whales (SRKW). However, based on additional information about juvenile to adult Chinook salmon equivalents (NMFS 2013), RNSP subsequently changed their determination for SRKW to no effect (Bensen 2019). The consultation was initiated on May 24, 2019. Important information sources include: 1) the Program BA (RNSP 2019), 2) the Synthesis of Science to Inform Land Management within the Northwest Forest Plan Area (Spies et al. 2018), 3) The Fisheries and Aquatic Resources of Prairie Creek (Wilzbach and Ozaki 2017), and 4) salmonid monitoring reports from CDFW and HSU (Sparkman et al. 2015, Wilzbach et al. 2016, Wilzbach et al. 2017).

### 1.3 Proposed Federal 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). For EFH consultation, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal agency (50 CFR 600.910).

RNSP proposes to restore approximately 9,200 acres of the lower Prairie Creek sub-basin (major tributary to Redwood Creek) by thinning and yarding second growth forests to enhance late seral characteristics, removing old logging roads to reduce sediment sources, and enhancing aquatic habitat by placing large wood in streams and planting native vegetation in riparian zones. Prior to their removal, old logging roads will be re-constructed and used to support forest restoration. The

Program will begin in 2019 or 2020, and will take approximately 15 years to implement. Activities will be grouped into three phases, which were determined based on a combination of factors, including the urgency in addressing stream sedimentation threats or problems, proximity to old growth stands, and current forest stand density. Restoration of second growth forests will promote late seral (i.e., old growth) forest development, helpful for carbon storage in the face of climate change.

### 1.3.1 Implementation Phases

The overall sequence for Program planning and implementation is shown in Figure 1. Large wood placement in streams will occur as wood becomes available throughout any Program phase. Riparian and wetland plantings will also occur along mainstem Prairie Creek during any phase after placement of large wood.

Sequencing within each phase is based on a road-shed approach (i.e., road flow from secondary roads to main haul roads). Specifically, the most distant areas within a road-shed will be prioritized, and work (including road rebuilding, forest and aquatic restoration, as well as road removal) will progress back towards the direction of the entry point. Each phase will consist of a series of implementation planning sub-units developed to facilitate treatment operations. Treatments within each sub-unit will vary based on stand conditions, topography, access, and landscape context. The order of activities within a given implementation planning sub-unit that uses heavy equipment will occur as shown in Table 3.

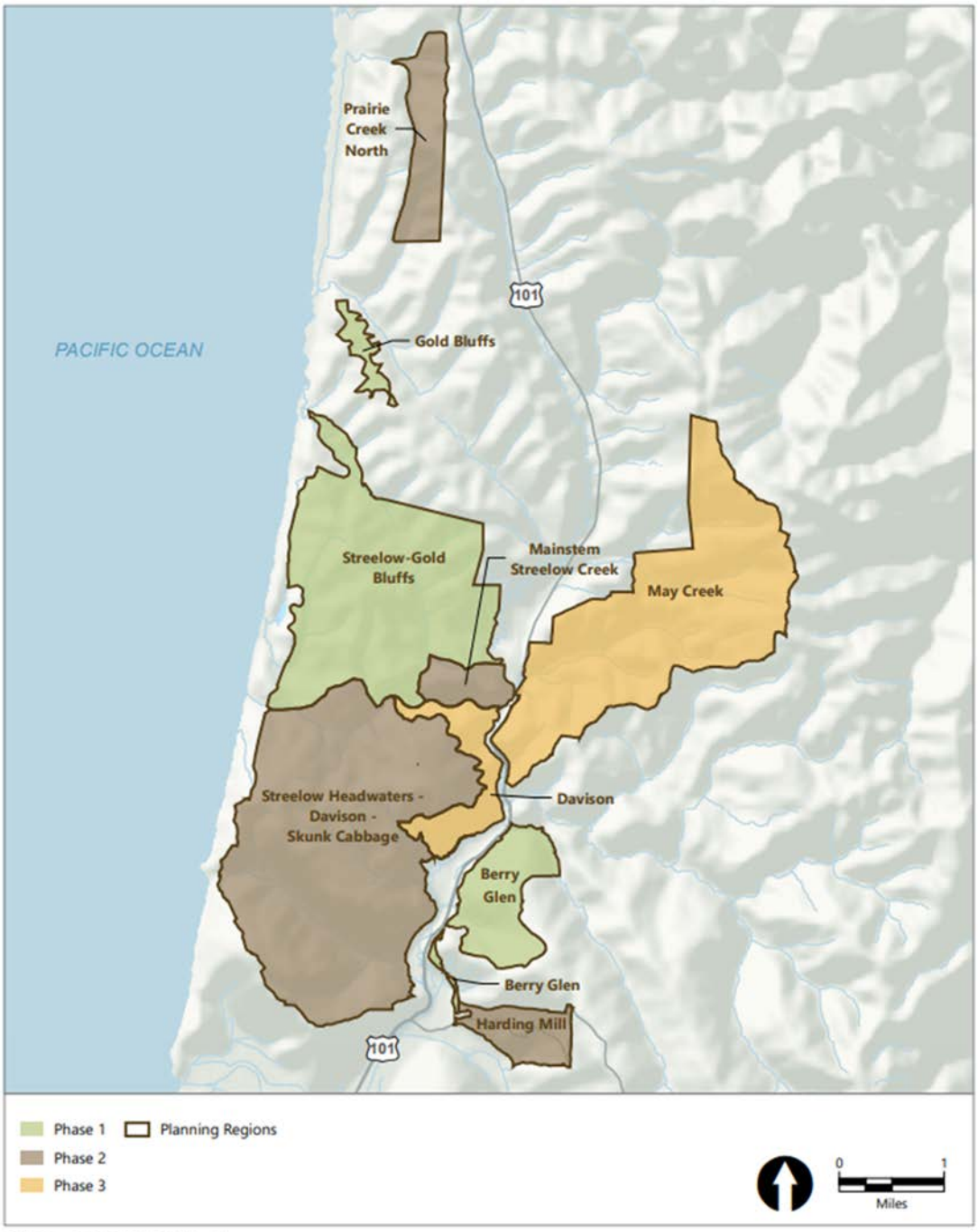


Figure 1. Map of Program areas grouped for phased implementation.

Table 3. Order of Program activities.

| Order | Activity | Description |
|---|---|---|
| 1 | Site Access and Preparation | Reconstruct roads leading to the sequence unit |
| | | Reconstruct stream crossings to ensure roads leading to sequence unit are stable |
| 2 | Forest and Aquatic Restoration | Complete forest thinning treatment |
| | | Yard logs in ground based and cable yarding units |
| | | Place large wood in tributaries |
| | | Maintain and winterize access roads as needed between field seasons |
| 3 | Road Removal or Maintenance Activities | Complete road removal activities |
| | | Repair roads to be maintained |

Some forest stands will be thinned and the wood left on the ground, known as lop-and-scatter units. Direct road access will not be required for lop-and-scatter units, so these units will not require all of the activities shown in Table 3. Lop-and-scatter treatment will occur in portions of the Gold Bluffs Beach area, and all of the Prairie Creek North and Harding Mill areas shown on Figure 1, and as an option in all other areas.

### 1.3.2 Within Season Work Timing

Heavy equipment (e.g., bulldozer, excavator, feller buncher, sky-line yarder, and logging truck) work will occur any time during the normal operating season (NOS) from June 15 - October 15. If work is not completed by October 15 and a period of dry weather is predicted, work would be implemented within the window of predicted dry weather. NOAA's Fall Transition Season Precipitation and Hydrology Decision Support Service notifications would be consulted as they become available to ensure the project is completed or fully winterized prior to the onset of fall rain, or if significant rain is predicted during the NOS. Heavy equipment and log trucks will not be used in the spring season previous to the normal operating period.

### 1.3.3 Forest Restoration

Variable density thinning (VDT), which focuses on the enhancement of spatial heterogeneity (i.e., uneven variation of tree spatial pattern over areas and time), will be used to thin second growth forests. VDT incorporates a mixture of silvicultural treatments, including the following:

- Low thinning (thinning from below) focuses on the removal of trees from the lower crown classes (i.e., suppressed, intermediate, and co-dominant crown classes) to benefit trees in the upper crown classes (i.e., co-dominant and dominant crown classes), and generally removes the smallest diameter trees. Trees in the lowest diameter class (generally less than 24 inches) will be removed first, with successively larger trees removed until the basal area retention is met.

- Crown thinning focuses on the removal of trees from the dominant or co-dominant crown classes to benefit adjacent trees of the same crown class. While diameter class ranges from stand to stand, most trees cut would be in the middle diameter class (8 to 30 inches) as opposed to the smaller diameter class cut in the low thinning method.
- Gaps (areas with few trees and up to one-half-acre) will be used to establish and maintain a new cohort of trees, encourage a robust assemblage of understory vegetation, and promote landscape-scale heterogeneity. All trees larger than 30 inches in diameter would be retained in gaps (an average of 10 per acre), and no more than 10 percent of the area within in any unit will be treated with forest gaps. Road restoration corridors will be incorporated into gap distribution across the landscape.
- Skips refer to areas where few to no trees will be cut and may be established at the same size and frequency as gaps to further increase stand heterogeneity.
- Conifer release removes competition around individual trees or small groups of trees that are retained. For example, every tree that falls within the drip line of a retention tree or retention group would be cut. This method may be implemented in hardwood-dominated stands to release conifers.

Forest thinning treatments will vary in intensity to encourage heterogeneity throughout the program area. Regardless of thinning method, no tree with a diameter greater than 30 inches will be cut, except for the removal of non-native species (e.g., hybrid Monterey pine) or trees growing directly on a road. The thinning method will vary according to current conditions and landscape context, per the following treatment considerations:

- In some areas, previous logging activities have altered the species composition (e.g., redwood is underrepresented, excessive alder in-growth, inland Sitka spruce). Thinning treatments would aim to shift species composition, which can result in patchy thinning severities and removal of undesired trees species (e.g., exotic and overrepresented tree species).
- No forest thinning will occur in areas, including inner gorge areas, identified as geologically unstable by park staff geologists. Slope stability modeling and subsequent ground truthing will be used to map geologically unstable areas.
- Existing snags and logs will be retained, and following forest thinning operations, additional snags may be created by girdling selected trees.

#### 1.3.3.1 Riparian Area Thinning Prescription Minimization Measures:

Thinning prescriptions will not vary in riparian areas but will be carried through riparian areas in order to enhance streamside tree growth rate. As in the rest of thinned stands, an average of at least 60 percent conifer canopy cover will be retained, over 1,000 foot stream reaches. The only exception to this prescription will be when roads are within 150 feet of an open, perennial or fish bearing stream, in which case all trees will be retained between the road prism and the stream channel. All trees contributing to stream bank stability will be retained in all riparian areas. Ground-based yarding riparian area minimization measures descriptions are presented in Table 4.

#### 1.3.3.2 Operational Method

Operational method refers to the method by which trees are felled (mechanized heavy equipment or manually with chainsaws) and how woody material is treated and/or removed from the treatment area. Two types of operational methods will be used, biomass removal and lop and scatter. The Program BA (RNSP 2019) describes the operational method for each unit, in each phase of operation. In summary, there will be 4,396 acres of ground-based operations, 3,582 acres of skyline operations, and 830 acres of lop and scatter operations out of a total of 8,808 forest thinning acres (Figure 2).

##### 1.3.3.2.1 Biomass Removal

Biomass removal refers to removing trees from units to break up fuel continuity and encourage understory development. Restoration thinning at the scale proposed would generate far more wood than can be used for ecological purposes if all areas were only lop-and-scattered. Removing the boles of trees will provide space for understory shrubs and young trees to grow unimpeded (Harrington et al. 2005). No wood will be removed from the project area until consideration is given to its usefulness for other restoration projects, such as terrestrial or stream habitat improvement or as coarse woody debris on site. Two types of biomass removal methods will be used, ground-based yarding, or skyline yarding operations. Excess biomass that is not removed from the site would be lopped and scattered on site. The BA (RNSP 2019) provides more detail on unit by unit location, acreage, implementation phase, and operational type. In summary 4,396 acres are planned for ground based operations, 3,582 acres are planned for skyline operations, and 830 acres are planned for lop and scatter.

*Ground-based Yarding Operations*

Ground based operations refers to the use of ground-based mechanized equipment (e.g., feller-buncher, skidder, harvester/processor) to fell trees and/or skid logs or whole trees from the stump area to the landing or roadside area. At the landing, a processor will limb and buck the material into lengths appropriate for hauling. All limbs and tops (slash) will be returned to the unit to be scattered on skid roads as mulch. Skidders will run over the slash/mulch to fix it to the soil. Loaders will be used to load log trucks, which will transport the logs along main haul roads out of the park and eventually to a mill or cogeneration power plant. Tree removal using ground-based operations will be restricted to areas under 40% grade (Figure 2).

Ground based yarding operations will occur during dry conditions after June 15 and before October 15. If work is not completed by October 15 and a period of dry weather is predicted, work would be implemented within the window of predicted dry weather. NOAA's Fall Transition Season Precipitation and Hydrology Decision Support Service notifications will be consulted as they become available to ensure the project is completed or fully winterized prior to the onset of fall rain. Skid trails within ground-based yarding units will be fully mulched with lopped tree tops and limbs (i.e., slash), immediately post treatment and before winter rains. Heavy equipment and log trucks will not operate in the spring prior to June 15. Ground-based riparian area minimization measures are presented in Table 4.

Table 4. Riparian area minimization measures for ground-based operations.

| Stream Type | Open Channel Perennial or Fish Bearing of Any Type | Open Channel Intermittent Non-Fish Bearing | Buried Channel Perennial | Buried Channel Intermittent and Ephemeral |
|---|---|---|---|---|
| Equipment Exclusion Zone (EEZ) Size* | 150 feet from bank full width or 50 feet from break in slope**, whichever greater | 50 feet from bank full width or top of break in slope**, whichever greater | 50 feet from bank full width or top of break in slope**, whichever greater | 50 feet from edge of buried channel or top of break in slope**, whichever greater |
| Other restrictions | Fallen trees may not be removed by heavy equipment if they lie below the break in slope | Fallen trees may not be removed by heavy equipment if they lie below the break in slope | Ground-based equipment may remove trees below the break in slope via end lines, unless yarding causes significant gouging of soil.*** | Ground-based equipment may remove trees below the break in slope via end lines, unless yarding causes significant gouging of soil.*** |

* No heavy equipment will be used within the EEZ buffer, except for when an existing road lies within the EEZ. Heavy equipment will only be used on road prisms within the EEZ.
** The break in slope will be identified and physically marked by a qualified park forester or geologist.
*** Significant gouging of soil is defined as a dragged tree bole causing exposure of soil, not other woody debris.

*Skyline Yarding Operations*

Skyline operations refers to the use of a cable yarding machine, an overhead system of winch-driven cables, to pull logs or whole trees from the stump area to the landing or roadside area. All trees will be felled and processed (cut to log length and limbed) using chainsaws prior to skyline yarding. Trees to be removed will be skyline yarded to a landing, skid trail, or road using a cable yarder or yoader. A slack-pulling carriage will be used to skid felled trees to the main cable yarding corridor. Cable yarding corridors are generally not larger than 20 feet. Tree removal from skyline operations would generally be restricted to areas greater than 40 percent grade

(Figure 2). All yarded logs or trees will be fully suspended in the air across any stream channels of any type.

#### 1.3.3.2.2 Lop and Scatter

Lop-and-scatter refers to an operational method where felled tree branches are cut off (i.e., lopped) and broadcast (i.e., scattered) throughout the treatment area. The goal is to get the felled tree boles on to contact with the ground to speed up natural decomposition. No felled trees will be removed, and heavy equipment will not be used. All tree felling, de-limbing and bucking will be done by hand crews with chainsaws. Hand crews will access areas on foot or with All Terrain Vehicles (ATVs). Work will occur during any time of the year; however, vehicles will not be used on non-rocked roads in winter. Lop-and-scatter areas will occur where the equipment necessary to remove biomass cannot access the stand because of unstable slopes, special management zones, or because the area lacks existing roads.

In addition, lop-and-scatter is a default option across the entire program area; if it is determined that biomass removal is not feasible in an area, the operational method would switch to lop-and-scatter. If biomass removal operations cannot be implemented (e.g., road access is no longer available, or no contractor bids are submitted) then those areas would be treated with lop-and-scatter operations using the same silvicultural thinning method described previously. Note that the lop-and-scatter unit named Harding Mill, located within the mainstem Redwood Creek watershed (the only unit within that watershed in the program area), is at least 500 feet from any stream channel, located on top of a ridge and not adjacent to the creek or riparian area, and thus RNSP determined that this unit would have no effect on listed salmonids or designated critical habitat.

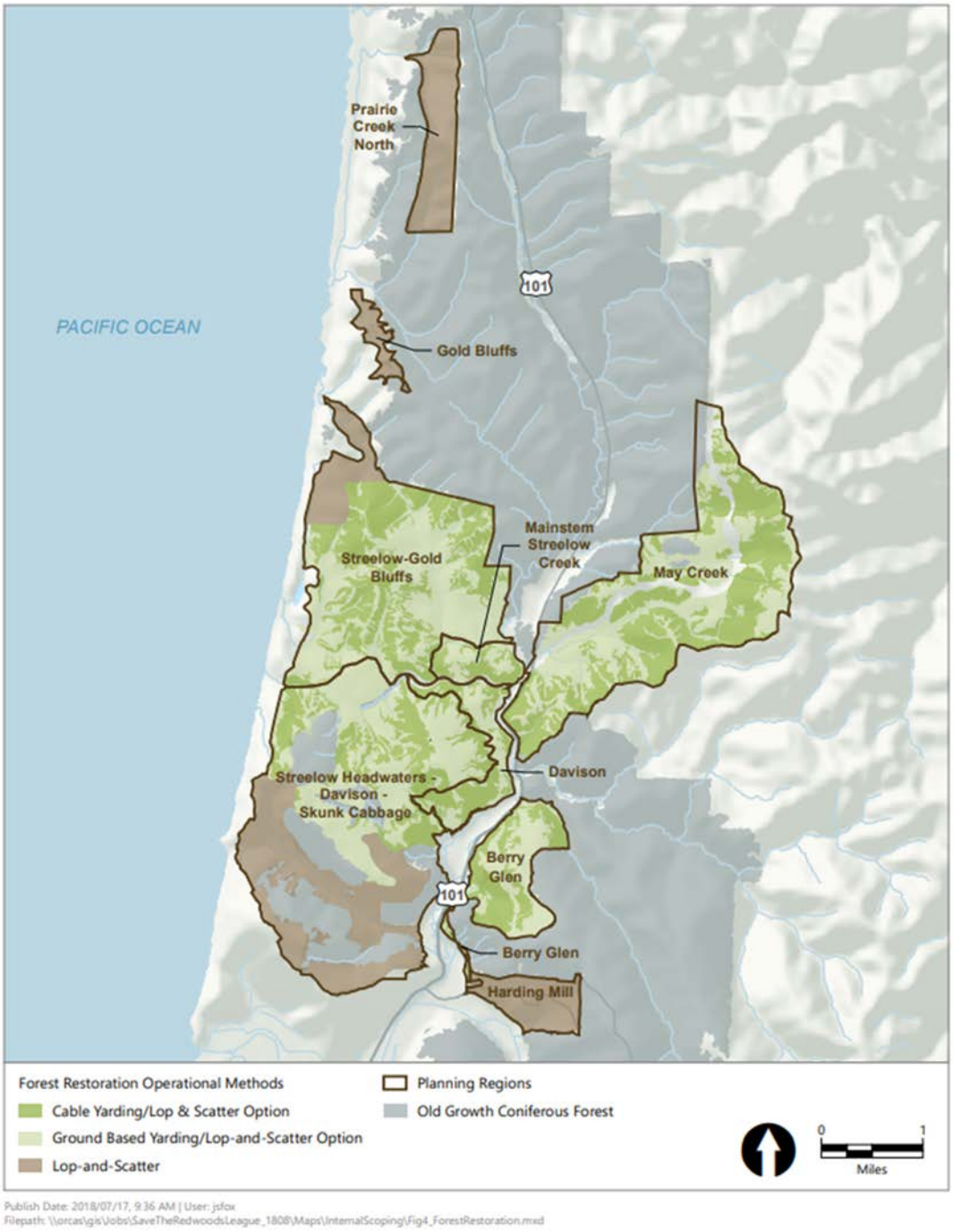


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Figure 2. Map of ground based yarding, cable yarding, and lop and scatter areas within Greater Prairie Creek Restoration Program area.

### 1.3.4 Aquatic Restoration

Aquatic restoration includes placement of large wood in streams, planting trees in riparian corridors and around wetlands, and treatment of a planted alder forest at the Davison Mitigation Site along mainstem Prairie Creek (Figure 3). Aquatic restoration activities will occur in all phases of the Program. Increasing channel complexity through large wood additions and

increasing riparian function are identified recovery actions for SONCC coho salmon, CC Chinook salmon and NC steelhead (NMFS 2014, 2016).

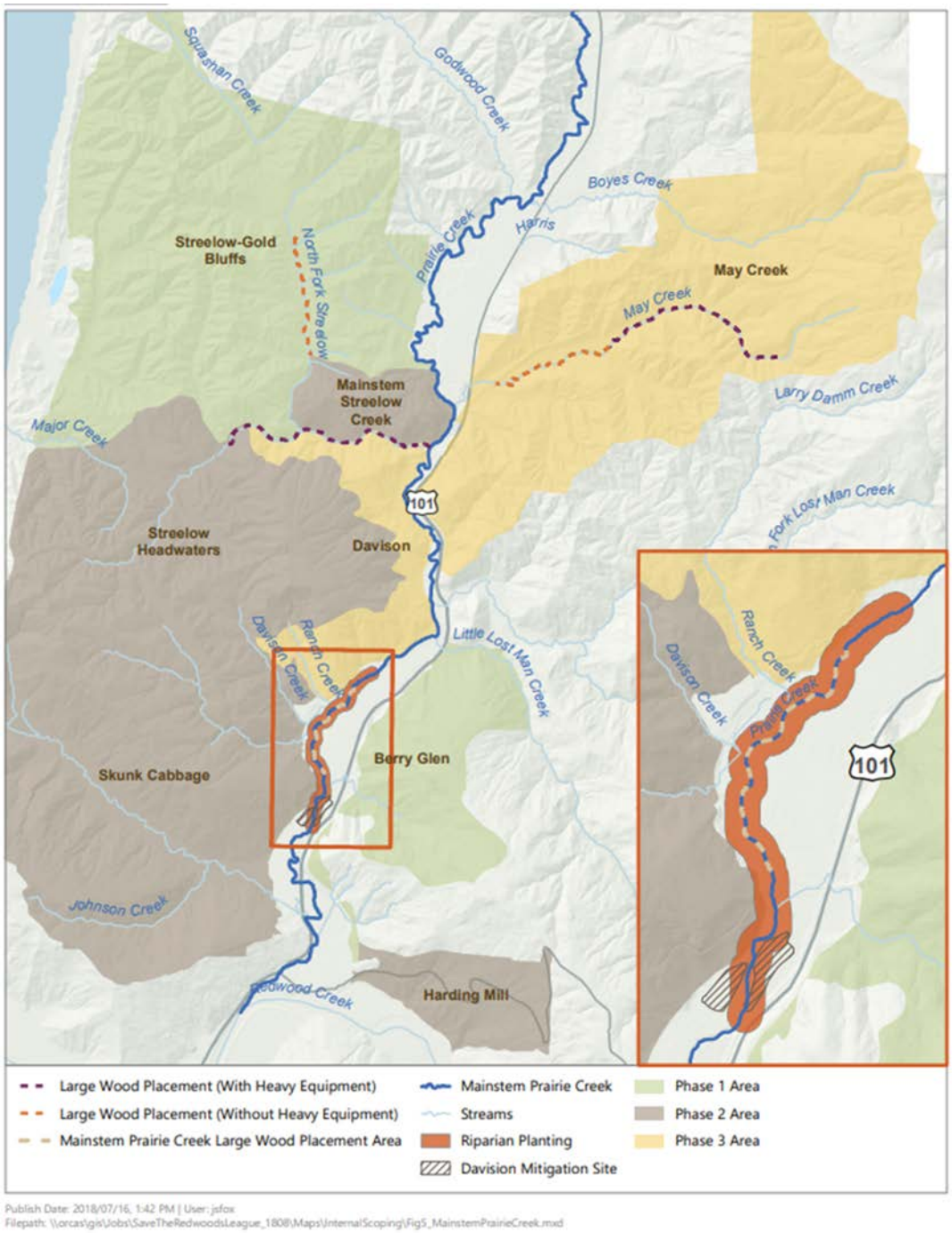


Figure 3. Locations of aquatic restoration activities in the Program area.

#### 1.3.4.1 Large Wood Placement in Creeks

Large wood will be placed in streams to create complex fish habitat by creating areas of lower velocity during higher flows, providing additional instream cover, scouring pools, and recruiting wood.

##### 1.3.4.1.1 Mainstem Prairie Creek

Large wood placement will occur within the Prairie Creek mainstem as wood becomes available throughout any Program phase. Riparian conifers will also be planted to provide future large wood for natural recruitment to the channel. Large wood placement locations within the channel were identified based on adequate site access and avoiding impacts to large established conifers (Figure 3). Where access allows, approximately 40 to 50 pieces of large wood will be placed in the channel in separate locations as single logs or small groups of logs. Some of the large wood pieces may be live alders pushed into the stream channel while maintaining the trees' roots in the stream bank. In addition, several large alders will be removed from the right bank and placed in the wetland pond at the Elk Meadows Picnic area to provide cover for juvenile salmonids using the pond. Himalayan blackberry and other invasive plants will be removed where they are found within reach of the excavator at equipment location sites. Heavy equipment will remain on the access road on top of the bank. Any soil disturbance on the bank will be fully mulched.

##### 1.3.4.1.2 Streelow and May Creeks

Large wood placement would also occur opportunistically in Streelow Creek (phases 1 and 2) and May Creek (Phase 3) as wood becomes available. In some stream reaches, wood will be placed by heavy equipment because a temporary haul road is located next to a stream within the reach of an excavator arm. On other stream reaches, wood will be placed by hand crews using cables and winches. Locations for heavy equipment and hand crew wood placement reaches are shown on Figure 3.

The upper limits of large wood loading will be 68 pieces per mile of wood greater than 24 inches in diameter and 50 feet in length. This target is based on large wood surveys on Godwood Creek (a nearby reference reach). Stream reaches will be inventoried for large wood prior to deciding whether additional wood should be placed. Two techniques will be used to place large wood in tributary streams:

- With heavy equipment: Large wood will be placed in streams using heavy equipment from roads adjacent to stream channels. Heavy equipment will not cross floodplains, streambanks, or streams and will use existing roads for equipment access. Any soil rutting caused by moving large wood will be fully mulched.
- Without heavy equipment: Entry to streams will be on foot and use chainsaws to drop wood into the channel, or large wood may be pulled into the stream from the banks and/or floodplain. A come-a-long winch would be used to move and position large wood in the channels. Any soil rutting caused by moving large wood will be fully mulched.

Cable and rebar will not be used to anchor large wood due to safety risks and aesthetic concerns. Large wood is expected to be dynamic in the channel and natural processes may re-deposit wood at downstream sites.

#### 1.3.4.2 Riparian and Wetland Plantings

Riparian and wetland plantings will occur along the mainstem of Prairie Creek following large wood placement, during any program phase. Planting will use a variable spacing of riparian trees and understory vegetation within 200 feet on both sides of Prairie Creek adjacent to the large wood placement reach (Figure 3). Native plants will be planted within wetlands dominated by the invasive grasses, mannagrass (*Glyceria spp.*) and/or reed canarygrass (*Phalaris arundinacea*), within 200 feet of the stream channel.

Additionally, Sitka spruce, redwood, big leaf maple, or other native species would be planted along well-drained soils within 200 feet of both sides of the stream channel. Saplings will be between two and four feet tall and will be grown from stock appropriate to the site.
At wetland planting areas, existing invasive grasses may be removed with hand tools or line trimmers, after which saplings would be planted. The planting areas will be maintained with hand tools or line trimmers to prevent invasive grasses from out-competing planted trees for five years.

#### 1.3.4.3 Davison Mitigation Site Enhancement

The red alder stand in the Davison mitigation site (Figure 3) will be thinned using a similar variable density thinning prescription as described above. Native shrubs and trees will be planted as needed. All felled trees will be lopped and scattered with chainsaws within the stand.

### 1.3.5 Logging Road and Log Landing Reconstruction, Maintenance, Use, and Removal

Road work will entail three steps: 1) road and log landing reconstruction and use, 2) multi-season main haul road use and maintenance (and possibly sediment basin maintenance) and, 3) road removal. Roads within the entire program area (i.e., phases 1, 2, and 3) have been inventoried and categorized based on landscape position, including inner gorge, midslope, and ridge (Figure 4). Inner gorge and mid-slope roads are the highest priority for removal. Log landings have not been inventoried or mapped. However, all log landings will be located on existing sites along roads, outside of riparian areas, and no new landings will be created. No landing will be larger than 0.25 acre.

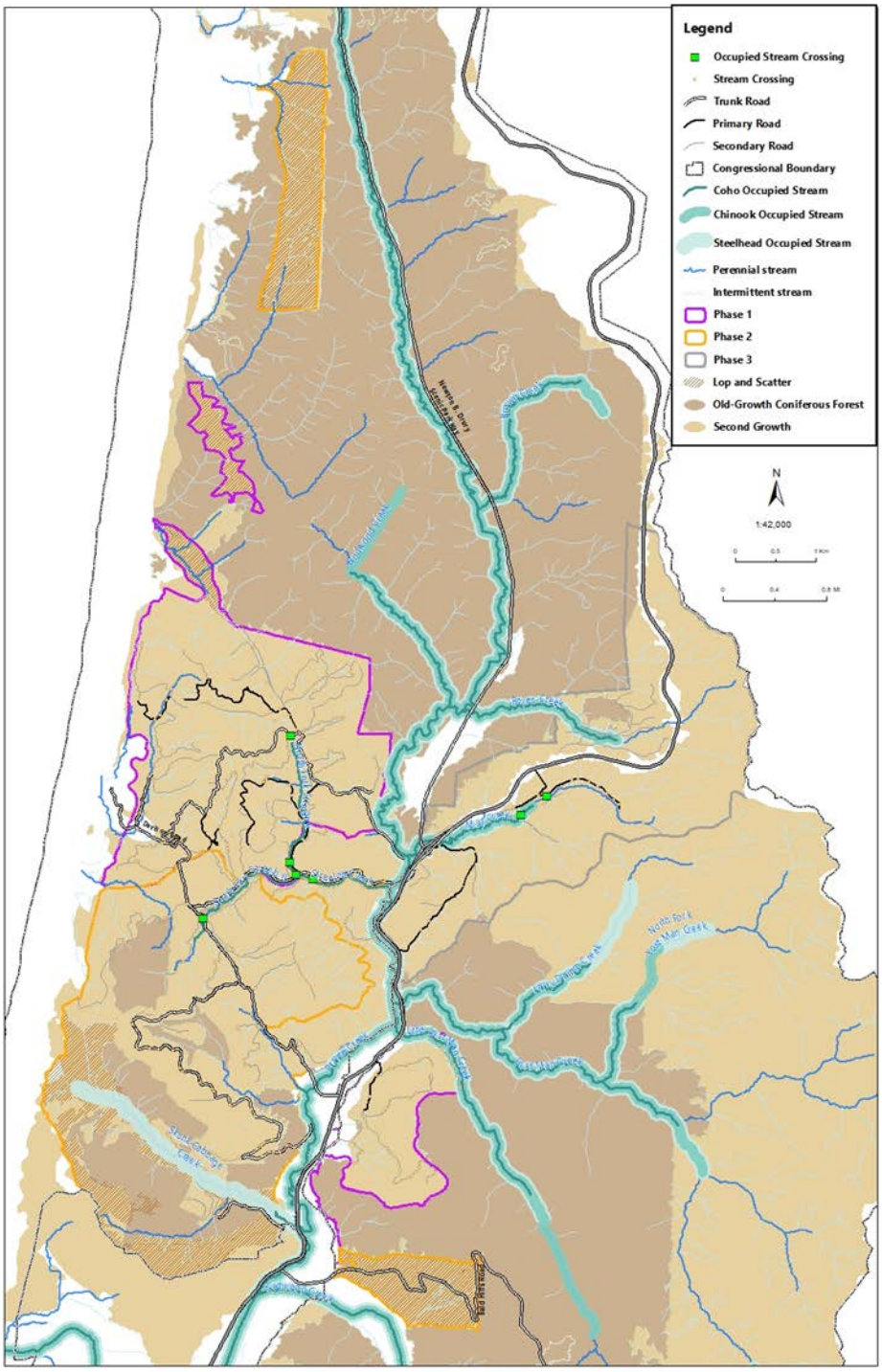


Figure 4. Salmonid distribution, roads, and stream crossing locations within the Program area. Note that steelhead also occupy the exact same reaches as coho salmon in the Streelow Creek subwatershed, but are not shown on this map.

#### 1.3.5.1 Temporary Road and Log Landing Reconstruction, Maintenance and Use

Throughout the program area, abandoned and long-unmaintained haul roads and landings will require reconstruction to provide access for forest and aquatic restoration activities (Figure 3, Figure 4). Trees and brush that have grown in on the road surface will be removed with chainsaws and/or masticators and roads will be upgraded to two different levels depending on whether they will be used over a single or multiple NOS, (i.e., from June 15 – October 15). Single season temporary roads will be reconstructed, used, and removed within one NOS. Multi-season use main haul roads will be reconstructed, used, and maintained over one to five NOSs and will "overwinter" on the landscape. After use, the multi-season main haul roads will be removed similar to single season roads.

##### 1.3.5.1.1 Single Normal Operating Season Road and Landing Reconstruction and Use

The majority of road sections will be reconstructed, used, and removed within one NOS (indicated by light gray lines on Figure 4). For single NOS use roads, no work will occur during the winter or spring before June 15. If work is not completed by October 15 and a period of dry weather is predicted, work would be implemented within the window of predicted dry weather. NOAA's Fall Transition Season Precipitation and Hydrology Decision Support Service notifications would be consulted as they become available. If more than 0.5 inches of rain is forecast during the NOS, project operations will temporarily cease and sites will be winterized.

Reconstruction of the road surface will involve removing brush and small trees, removing or covering stumps, and minimally grading the old road surface. Cross drains and rolling dips will be unnecessary because single season roads will be removed before winter rains except for locations where adjacent springs or seeps are actively draining across the road surface. Reconstructing single season landings will be similar to opening single season roads, that is, brush and small trees will be removed and minimal grading and possible stump removal may occur.

Single NOS road reconstruction will also include either: 1) the removal of stream crossing structures that are non-functional and replacement with temporary stream crossing structures for access to forest restoration sites on non-anadromous fish stream reaches, or 2) the installation of a temporary bridge on currently open channel anadromous fish stream reaches.

*Temporary Single Normal Operating Season Humboldt Crossing and Culvert Replacement on Non-Fish Bearing Stream Reaches*

Approximately 250 legacy stream crossings have been identified on 52 miles of haul roads in the program area. Most of these crossings were constructed by pushing wood and sediment into streams to create a "Humboldt crossing" that interfere with streamflow. These Humboldt crossings have been eroding since their construction in the 1950s and 1960s. A limited number of the old crossings are culverts. Based on information collected on the inventoried crossings, the average crossing contains 1,500 cubic yards of fill requiring removal (ranging from 200 to 2,500 cubic yards per crossing; approximately 448,460 cubic yards total throughout the program area for roads inventoried to date). None of the old Humboldt or culvert crossings are located on anadromous fish stream reaches (indicated by tan dots on Figure 4).

Removal of old Humboldt crossings and culverts, and temporary stream crossing structure installation, will be done with bulldozers and excavators. Equipment will dish the crossing out and the excavator will dig to the old crossing structure and pull it from the stream course, making sure to not disturb the original channel. The stream will be pumped around the work area if it is actively flowing during crossing replacement activities. Pump intakes will be installed to capture a majority of the stream flow. A new temporary stream crossing structure (a plastic pipe culvert) will be placed by the excavator along the stream course. The equipment will then backfill the removed material and the roadbed will be graded.

*Temporary Bridge Installation and Removal on Single Normal Operating Season Temporary Roads on Anadromous Fish Stream Reaches*

One open channel stream crossing (i.e., a channel not buried by old logging slash), located on an anadromous section of May Creek, will be constructed, used and removed within one NOS. The modular style temporary bridge will be less than 100 feet long, the bridge will completely span the wetted stream channel, and both abutments will be placed outside of the bank full stream width, on top of the stream banks. Temporary encased gravel style abutments will be used that are made of vertically placed culverts filled with gravel. This type of abutment requires minimal ground excavation to "seat" the abutment, and no geotechnical testing of soils prior to constructing the abutment. Work will occur after June 30 and before October 15 to minimize disturbance, although there will not be disturbance within the stream channel. Channel spanning logs will be placed across the stream, above water level, for equipment that must cross the channel during bridge construction in order to avoid contact with the wetted stream channel; no equipment will enter the stream at any time. Disturbed soil areas will be fully mulched after the temporary bridge is installed and removed.

#### 1.3.5.1.2 Temporary Multi-season Main Haul Roads and Potential Sediment Basin Installation and Maintenance

Temporary multi-season main haul roads (Figure 4, labeled as trunk roads) and associated log landings that will be used over multiple NOSs will remain open from one to five years. Reconstruction of the road surface will involve removing brush and small trees, removing or covering stumps, and grading the old road surface. All attempts will be made to grade the entire roadbed to drain to the outboard side. Cross drains/ditch relief culverts, however, may be re-installed if necessary, as well as rolling dips, to accommodate onsite conditions. Reconstructing multiple NOS landings will be similar to opening multiple season roads, brush and small trees will be removed, and minimal grading and possible stump removal may occur.

For these multiple NOS roads and landings, no reconstruction work will occur before June 15; if work is not completed by October 15 and a period of dry weather is predicted, work would be implemented within the window of predicted dry weather. NOAA's Fall Transition Season Precipitation and Hydrology Decision Support Service notifications would be consulted as they become available.

All multiple NOS roads and landings will be winterized to prevent erosion, including:

- Grading exposed road and landing surfaces to allow water to freely drain across them without concentrating, ponding or rilling.
- Installing rolling dips/drains to drain steeper sections of road.
- Clearing clogged drains and other erosion control devices where necessary to convey concentrated water across exposed road and landing surfaces.
- Native surface road segments will be covered in crushed rock within 100 feet of every crossing and along steeper road sections to limit surface erosion. Crushed rock will be brought into the site by dump trucks and spread with graders. Rocked sites away from crossings will be determined based on road bed steepness and potential to generate sediment, including any road sections that run parallel within 50 feet of open stream channels.
- No ground based or skyline based log yarding or any log hauling will occur on any roads, including main haul roads, during the winter or spring before June 15. If log yarding and hauling is not completed by October 15 and a period of dry weather is predicted, work would be implemented within the window of predicted dry weather. NOAA's Fall Transition Season Precipitation and Hydrology Decision Support Service notifications would be consulted as they become available. If more than 0.5 inches of rain is forecast during the NOS, project operations will temporarily cease and sites will be winterized. Work sites, including roads and landings, will be winterized at the end of the NOS, or during the NOS if significant rains are forecast that may cause exposed roads or landings to erode.

Multiple NOS road reconstruction will also include: 1) the removal of old Humboldt/culvert crossing structures that are non-functional and replacement with temporary plastic culverts on non-anadromous fish stream reaches, 2) the installation of temporary bridges (Figure 4) on currently open channel anadromous fish stream reaches, and 4) possible temporary sediment basin installation at non-fish bearing stream crossings.

All non-fish bearing culvert replacements on main haul roads will be placed and sized to pass a 100 year flow event. Reconstruction will be similar to single season crossing replacement previously described, except that rock armoring may be utilized along culvert inlets and outlets. All disturbed soil areas will be fully mulched. Crushed rock will be placed along the road surface at the crossing approach and exit to minimize sediment delivery to the stream from road use. Installation will be the same for multiple NOS use temporary bridges as single NOS temporary bridges, except that road approaches and exits for multiple NOS bridges will be covered in crushed rock to minimize sediment delivery to streams.

Sediment basins may be placed at stream crossings on non-anadromous fish bearing tributaries along main haul roads at the mouths of some sub-watersheds to capture upstream sediment generated by the Program. Exact designs would vary from site to site, but sediment basin designs would be evaluated and agreed upon in coordination with NMFS previous to installation. Accumulated sediment within the basins would be removed with a backhoe and transported with dump trucks to stable sites throughout the lifespan of the basin and haul road to prevent over-topping and sediment delivery downstream. Sediment basins would be removed when the main haul road is removed.

#### 1.3.5.2 Road Removal

Road removal will occur after forest thinning and aquatic restoration activities are complete in an area accessed by a road. The locations of proposed treatments are shown in Figure 4.

Five stream crossings are on anadromous fish bearing stream reaches (Figure 4). The five stream crossings that will be reconstructed and then removed (i.e., temporary bridges) will not require instream work for the crossing removal (or for the reconstruction, as described previously). All soil disturbance will be fully mulched after temporary bridge removal.

Non-anadromous fish bearing stream reach crossing removals include removal and disposal of road fill contained within the stream crossing, the culvert if there is one, and removal of old logging slash from the crossing site. Fill removed from the crossing would be moved to a stable location by pushing it with a bulldozer, or by placing it in a dump truck and hauling it to a stable location within the Program area. The finished stream crossing excavation would approximate the original (pre-road construction) stream channel profile and side bank configuration as much as feasible. Generally, the original buried topsoil and channel armor beneath the road fill would be exposed during stream channel excavation and left intact when feasible. Large wood uncovered during the excavation would either be placed in the restored channel and on the side slopes providing both sediment control and habitat complexity, or potentially be used at large wood restoration sites as part of this program. Bare soils adjacent to live channels would be treated for surface erosion as prescribed in the Watershed Restoration Erosion Control and Monitoring Plan [Appendix A in the BA (RNSP 2019)].

#### 1.3.5.3 Low-threat Roads

Roads with little to no threat of delivering sediment to streams would be closed, and then treated by ripping the surface to promote rainfall infiltration and vegetation growth. Typically, these roads are on ridges or gentle slopes where erosion potentials is already minimal (Figure 4).

#### 1.3.5.4 Davison Road-Streelow Creek Crossing Replacement

One anadromous fish bearing stream crossing removal and replacement within the Program area will be permanent, the Davison Road at Streelow Creek crossing. The current corrugated, galvanized steel, full-round culvert is showing signs of failure and Davison Road (Figure 4, Figure 6) is an important access road for the public that stays open year round. Although a specific design has not been developed for the crossing replacement, the structure will most likely be some form of bottomless, arched culvert that will provide fish passage for all species, all life stages. Replacement crossing designs will be evaluated and agreed upon in coordination with NMFS previous to stream crossing replacement. The final design may or may not require coffer dams and dewatering at the crossing site. However, anadromous fish are known to be present at the crossing location (RNSP 2019), and the following relocation protocol will be used at the stream crossing if de-watering or a work exclusion zone are necessary:

- Fish exclusion fencing shall be installed on the upstream and downstream edges of the work area, far enough from the construction area to not be disturbed by the construction activities. Care will be taken to ensure the bottom of all exclusion fencing is securely attached to the stream bottom with no gaps that can allow fish to enter the exclusion area.

- A first attempt to capture fish stranded within exclusion zone shall be made using seine nets and dip nets, where possible, and, if necessary, electrofishing.
- Prior to capturing fish, determine the most appropriate release location. Suitable areas shall be identified based on quality of habitat, risk of predation, stranding, and water quality using the following order of preference:
    - In the stream upstream of the work area
    - In the stream downstream of the work area
    - In the stream approximately 500 feet downstream of the work area.

- Perform initial fish relocation efforts 3-5 days prior to the start of construction. This provides the qualified fishery biologist an opportunity to return to the work area and perform additional fish captures prior to construction. A second attempt, the morning following the initial endeavor, shall be made to capture any remaining fish.
- Exclude fish from re-entering work area by blocking the stream channel above and below the work area with fine-meshed net or screens. Mesh size should be no greater than one-eighth inch. The bottom edge of the net or screen will be completely secured to the channel bed to prevent fish from re-entering the work area. Exclusion fencing will be placed in areas of low water velocity to minimize impingement of fish. Screens will be checked periodically and cleaned of debris to permit free flow of water.
- Air and stream temperatures will be periodically monitored, and activities will cease when water temperatures exceed 68 degrees Fahrenheit (°F) [20 degrees Celsius (°C)].
- Handling of salmonids will be minimized. If handling is necessary, hands and nets will be wetted prior to touching fish.
- Captured fish will be placed in cool, shaded, aerated, dark-colored containers filled with cool, clear water. Aeration will be provided with a battery powered external bubbler. Fish will be protected from jostling and noise, and fish will not be removed from the container until time of release. Fish will be released when the container reaches capacity or within one and a half hours after capture.
- A thermometer will be placed in the holding container, and water will be partially exchanged if the water temperature gets too warm, or if there is more than an hour of delay between when the holding container exceeds maximum capacity and the time of release.
- Overcrowding of fish in containers will be avoided. Two containers will be used to segregate young of the year fish from larger age classes to avoid predation. Densities shall not exceed 5 fish per gallon of water in each container. If found, place large amphibians, such as Pacific Giant salamanders, in the container with the larger fish.
- Capture will cease and listed salmonids will be released when containers are filled to capacity.
- Species and year classes of listed salmonids will be visually identified at time of release. Listed salmonids will not be anesthetized or measured.
- If mortality during relocation exceeds 5 percent of fish captured, capture will stop, and NMFS will be contacted.

#### 1.3.5.4.1 Possible Fish Relocation at Two Additional Stream Crossing Sites

As previously stated, the only known stream crossing that will be replaced/removed where anadromous fish are known to occur is Davison Road at Streelow Creek. There is a low possibility, however, that up to two additional stream crossings needing replacement and removal will require fish relocation. All fish relocation best management practices described in the previous section will be implemented if additional stream crossings are found to have fish present.

### 1.3.6 Summary of Minimization Measures

- All ground disturbing work will occur during the NOS (June 15 – October 15), and/or during dry soil conditions. No work will occur in the winter or spring before June 15. If work is not completed by October 15 and a period of dry weather is predicted, work would be implemented within the window of predicted dry weather. NOAA's Fall Transition Season Precipitation and Hydrology Decision Support Service notifications would be consulted as they become available to ensure the project is completed or fully winterized prior to the onset of fall rain. If more than 0.5 inches of rain is forecast during the NOS, project operations will temporarily cease and sites will be winterized. Work sites, including roads and landings, will be winterized at the end of the NOS, or during the NOS if significant rains are forecast that may cause exposed roads or landings to erode.
- Large wood placement in streams will only occur during the NOS to avoid disturbance to adult salmonids (note that summer steelhead are not known to use the Prairie Creek sub-basin). If work is not completed by October 15 and a period of dry weather is predicted, work would be implemented within the window of predicted dry weather. NOAA's Fall Transition Season Precipitation and Hydrology Decision Support Service notifications would be consulted as they become available. The mouth of Redwood Creek (usually closed by sand bar formation from about mid-July to about mid-October) will be monitored from October 15 onwards to ensure that it remains closed during any extension of the dry season. Large wood placement will cease once the Redwood Creek mouth is open to the ocean and adult salmonids enter the watershed.
- Temporary haul roads and crossings that will be used within one season will be completely removed and disturbed ground mulched before the onset of winter rains.
- Temporary roads that will be used for more than one season, that is, main haul roads, will be fully winterized each year that the road remains on the landscape.
- Replaced culverts at stream crossings on temporary multi-season use main haul roads (all but the Davison Road at Streelow Creek and possibly two other crossings are located on non-fish bearing stream reaches) will be designed to withstand 100 year flood events.
- Temporary bridge abutments (all of which are located on fish bearing stream reaches) will be installed entirely outside of the bankfull stream channel and designed to withstand 100 year floods.
- Fish relocation will adhere to all the criteria described in the previous section, consistent with CDFW and NMFS guidelines.
- Sediment basins may be installed at crossings on main haul roads at the mouth of sub-watersheds (non-fish bearing stream reaches) to reduce sediment into streams. Sediment

basins would be designed and maintained while the main haul road is being used to prevent stored sediment from being conveyed downstream of the basin.

- All heavy equipment will be cleaned of exotic vegetation and mud as well as checked for fluid leaks before being transported to the program area. All equipment refueling will be done at least 300 feet from any streams, and spill equipment kits will be present on site.
- Forest thinning within riparian areas will not decrease conifer canopy cover below 60 percent average over 1,000 foot long stream reaches.
- No tree contributing to stream bank stability will be felled.
- Ground based yarding will be restricted to areas with less than 40 percent slope.
- Variably sized (depending on stream type, Table 4) heavy equipment exclusion zones will be utilized on all streams within ground based yarding forest thinning units.
- Geologically unstable areas (both modeled and as determined by qualified staff geologists) within all forest thinning units will be off limits to heavy equipment and all trees will be retained.
- All ground-based yarding skid trails will be fully covered in mulch immediately after use and before the onset of winter rains.
- Full tree suspension will be used on all cable yarding corridors crossing any stream channels.
- All existing logging roads, crossings and sediment basins (if installed) will be removed once forest thinning operations are completed in a sequence to minimize road network sediment sources.
- All re-contoured road beds and excavated stream crossings will be fully mulched once completed to decrease post-road/crossing removal sediment yield into streams using established park guidelines [(Appendix A in the BA (RNSP 2019)].

### 1.3.7 Monitoring, Notification, Verification and Reporting

RNSP will coordinate with NMFS to provide pre-project notification, agreement-on-design, relevant information about implementation, verification that a project fits within the Program and reporting. During all phases of the Program, coordination will occur on:

- Layout and site specific design for each sediment basin previous to installation.
- Annual notification of specific restoration actions that are going to take place, their extent, and locations by January 30 of the same calendar year.

Prior to Program phases 2 and 3, coordination will also occur on:

- Road-shed sequencing of forest thinning and road removal work within each phase.
- Specific road and stream crossing reoccupation, use, maintenance, and removal designs not already described in this *Proposed Action* section, if any.
- Detailed design specifications and installation methods for the Davison Road-Streelow Creek crossing replacement.

Monitoring will be conducted in all phases of the Program in Streelow and May creeks. Monitoring will include stream turbidity (as a proxy for suspended sediment), stream temperature, and flow rates. The specific design of the monitoring program will be discussed and agreed to during ICT meetings.

Post project annual verification reporting will include:

- Miles and locations of temporary roads reconstructed.
- Types, number and locations of temporary crossings reconstructed.
- Miles and locations of temporary main haul roads winterized.
- Number of fish, by species, relocated from the Davison Road-Streelow Creek crossing and any mortality results.
- Acres of forest thinned.
- Detailed descriptions and locations of any large wood placement, live alder trees pushed into streams, and riparian planting.
- Miles and locations of temporary roads and crossings removed.
- Any petroleum spills.
- Any non-compliance with best management practices including but not limited to EEZ violations.

### 1.3.8 Minor Variance Process

Because of the wide range of proposed activities and the natural variability within and between stream systems, some Program actions may require minor variations from those described in this *Proposed Action* section. The proposed variance will provide equal or greater conservation benefit, and will not result in effects that were not analyzed during consultation. Minor variance requests will be documented as part of the pre-project notification process, will include the following information, and will be agreed to by NMFS:

- Restoration activity and/or design feature that needs a variance will be described.
- Why the variance is necessary will be explained, and a rationale of why the variance will provide equal or greater conservation as compared to the originally described activity, and how the variance will not cause additional adverse effects from those analyzed in this opinion.

Variances that do not result in an effect to listed salmonids (i.e., following or not following a minimization measure would have no effect positive or negative) will documented in the annual verification reporting.

### 1.3.9 Interrelated and Interdependent Actions

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

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

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

## 2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and/or 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.

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

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

- Identify the rangewide status of the species and critical habitat expected 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 by: 1) Reviewing the status of the species and critical habitat, and 2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a reasonable and prudent alternative (RPA) to the proposed action.

## 2.2 Rangewide Status of the Species and Critical Habitat

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

### 2.2.1 Species Description and General Life History

#### 2.2.1.1 SONCC Coho Salmon

Coho salmon have a generally simple 3-year life history. The adults typically migrate from the ocean and into bays and estuaries towards their freshwater spawning grounds in late summer and fall, and spawn by mid-winter. Adults die after spawning. The eggs are buried in nests, called redds, in the rivers and streams where the adults spawn. The eggs incubate in the gravel until fish hatch and emerge from the gravel the following spring as fry. These 0+ age fish typically rear in freshwater for about 15 months before migrating to the ocean. The juveniles go through a physiological change during the transition from fresh to salt water called smoltification. Coho salmon typically rear in the ocean for two growing seasons, returning to their natal streams as 3-year-old fish to renew the cycle.

#### 2.2.1.2 CC Chinook Salmon

CC Chinook salmon are typically fall spawners, returning to bays and estuaries before entering their natal streams in the early fall. The adults tend to spawn in the mainstem or larger tributaries of rivers. As with the other anadromous salmon, the eggs are deposited in redds for incubation. When the 0+ age fish emerge from the gravel in the spring, they typically migrate to saltwater shortly after emergence. Therefore, Chinook salmon typically enter the estuary as smaller fish compared to coho salmon. Chinook salmon are typically present in the stream-estuary ecotone, which is located in the downstream portions of major tributaries to estuaries like Humboldt Bay, from early May to early September, with peak abundance in June/July (Wallace and Allen 2007). Similar to coho salmon, prey resources during out-migration are critical to Chinook salmon survival as they grow and move out to the open ocean. A study by MacFarlane (2010) indicated that juvenile Chinook salmon require less prey in the estuary, equivalent to one northern anchovy

(*Engraulis mordax*) per day, compared to a range of one to four anchovies needed per day in the ocean.

#### 2.2.1.3 NC Steelhead

Steelhead exhibit the most complex suite of life history strategies of any salmonid species. They have both anadromous and resident freshwater life histories that can be expressed by individuals in the same watershed. The anadromous fish generally return to freshwater to spawn as 4 or 5 year old adults. Unlike other Pacific salmonids, steelhead can survive spawning and return to the ocean only to return to spawn in a future year. It is rare for steelhead to survive more than two spawning cycles. Steelhead typically spawn between December and May. Like other Pacific salmonids, the steelhead female deposits her eggs in a redd for incubation. The 0+ age fish emerge from the gravel to begin their freshwater life stage and can rear in their natal stream for 1 to four years before migrating to the ocean.

Steelhead have a similar life history as noted above for coho salmon, in the sense that they rear in freshwater for an extended period before migrating to saltwater. As such, they enter the estuary as larger fish (mean size of about 170 to 180 mm or 6.5 to 7.0 inches) and are, therefore, more oriented to deeper water channels in contrast to Chinook salmon that typically enter the estuary as 0+ fish. The CDFW data indicate that steelhead smolts generally migrate downstream toward the estuary between March 1 and July 1 each year, although they have been observed as late as September (Ricker et al. 2014e). The peak of the outmigration timing varies from year to year within this range, and generally falls between early April and mid-May.

### 2.2.2 Status of Species and Critical Habitat

In this biological opinion, NMFS assesses four population viability parameters to help us understand the status of each species and their ability to survive and recover. These population viability parameters are: abundance, population productivity, spatial structure, and diversity (McElhaney et al. 2000). While there is insufficient information to evaluate these population viability parameters in a thorough quantitative sense, NMFS has used existing information, including the Recovery Plan for SONCC Coho Salmon (NMFS 2014) and Coastal Multispecies Recovery Plan (NMFS 2016), to determine the general condition of each population and factors responsible for the current status of each Distinct Population Segment (DPS) or Evolutionarily Significant Unit (ESU). We use these population viability parameters as surrogates for numbers, reproduction, and distribution, the criteria found within the regulatory definition of jeopardy (50 CFR 402.02).

#### 2.2.2.1 Status of SONCC Coho Salmon

SONCC Coho Salmon Abundance and Productivity: Although long-term data on coho salmon abundance are scarce, the available evidence from short-term research and monitoring efforts indicate that spawner abundance has declined since the last status review for populations in this ESU (Williams et al. 2016). In fact, most of the 30 independent populations in the ESU are at high risk of extinction because they are below or likely below their depensation threshold, which can be thought of as the minimum number of adults needed for survival of a population.

SONCC Coho Salmon Spatial Structure and Diversity: The distribution of SONCC coho salmon within the ESU is reduced and fragmented, as evidenced by an increasing number of previously

occupied streams from which SONCC coho salmon are now absent (NMFS 2001, Good et al. 2005, Williams et al. 2011, Williams et al. 2016). Extant populations can still be found in all major river basins within the ESU (70 FR 37160; June 28, 2005). However, extirpations, loss of brood years, and sharp declines in abundance (in some cases to zero) of SONCC coho salmon in several streams throughout the ESU indicate that the SONCC coho salmon's spatial structure is more fragmented at the population-level than at the ESU scale. The genetic and life history diversity of populations of SONCC coho salmon is likely very low and is inadequate to contribute to a viable ESU, given the significant reductions in abundance and distribution.

#### 2.2.2.2 Status of CC Chinook Salmon

CC Chinook Salmon Abundance and Productivity: Low abundance, generally negative trends in abundance, reduced distribution, and profound uncertainty as to risk related to the relative lack of population monitoring in California have contributed to NMFS' conclusion that CC Chinook salmon are likely to become an endangered species within the foreseeable future throughout all or a significant portion of their range. Where monitoring has occurred, Good et al. (2005) found that historical and current information indicates that CC Chinook salmon populations are depressed. Uncertainty about abundance and natural productivity, and reduced distribution are among the risks facing this ESU. Concerns regarding the lack of population-level estimates of abundance, the loss of populations from one diversity stratum , as well as poor ocean survival contributed to the conclusion that CC Chinook salmon are likely to become an endangered species in the foreseeable future (Good et al. 2005, Williams et al. 2011, Williams et al. 2016).

CC Chinook Salmon Spatial Structure and Diversity: Williams et al. (2011) found that the loss of representation from one diversity stratum, the loss of the spring-run history type in two diversity substrata, and the diminished connectivity between populations in the northern and southern half of the ESU pose a concern regarding viability for this ESU. Based on consideration of this updated information, Williams et al. (2016) concluded the extinction risk of the CC Chinook salmon ESU has not changed since the last status review. The genetic and life history diversity of populations of CC Chinook salmon is likely very low and is inadequate to contribute to a viable ESU, given the significant reductions in abundance and distribution.

#### 2.2.2.3 Status of NC Steelhead

NC Steelhead Abundance and Productivity: With few exceptions, NC steelhead are present wherever streams are accessible to anadromous fish and have sufficient flows. The most recent status review by Williams et al. (2016) reports that available information for winter-run and summer-run populations of NC steelhead do not suggest an appreciable increase or decrease in extinction risk since publication of the last viability assessment (Williams et al. 2011). Williams et al. (2016) found that population abundance was very low relative to historical estimates, and recent trends are downwards in most stocks.

NC Steelhead Spatial Structure and Diversity: NC steelhead remain broadly distributed throughout their range, with the exception of habitat upstream of dams on both the Mad River and Eel River, which has reduced the extent of available habitat. Extant summer-run steelhead populations exist in Redwood Creek and the Mad, Eel (Middle Fork) and Mattole Rivers. The abundance of summer-run steelhead was considered "very low" in 1996 (Good et al. 2005), indicating that an important component of life history diversity in this DPS is at risk. Hatchery

practices in this DPS have exposed the wild population to genetic introgression and the potential for deleterious interactions between native stock and introduced steelhead. However, abundance and productivity in this DPS are of most concern, relative to NC steelhead spatial structure and diversity (Williams et al. 2011).

#### 2.2.2.4 Status of Critical Habitats

The condition of SONCC coho salmon, CC Chinook salmon, and NC steelhead critical habitat, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined that currently depressed population conditions are, in part, the result of the following human induced factors affecting critical habitat: logging, agriculture, mining, urbanization, stream channelization, dams, wetland loss, and water withdrawals (including unscreened diversions for irrigation). Impacts of concern include altered stream bank and channel morphology, elevated water temperature, lost spawning and rearing habitat, habitat fragmentation, impaired gravel and wood recruitment from upstream sources, degraded water quality, lost riparian vegetation, and increased erosion into streams from upland areas (Weitkamp et al. 1995). Diversion and storage of river and stream flow has dramatically altered the natural hydrologic cycle in many of the streams within the ESU's and DPS. Altered flow regimes can delay or preclude migration, dewater aquatic habitat, and strand fish in disconnected pools, while unscreened diversions can entrain juvenile fish.

### 2.2.3 Factors Responsible for the Decline of Species and Degradation of Critical Habitat

The factors that caused declines of species and degradation of critical habitat include hatchery practices, ocean conditions, habitat loss due to dam building, degradation of freshwater habitats due to a variety of agricultural and forestry practices, water diversions, urbanization, over-fishing, mining, climate change, and severe flood events exacerbated by land use practices (Good et al. 2005, Williams et al. 2016). Sedimentation and loss of spawning gravels associated with poor forestry practices and road building are particularly chronic problems that can reduce the productivity of salmonid populations. Late 1980s and early 1990s droughts and unfavorable ocean conditions were identified as further likely causes of decreased abundance (Good et al. 2005). From 2014 through 2016, the drought in California reduced stream flows and increased temperatures, further exacerbating stress and disease. Ocean conditions have been unfavorable in recent years (2014 to present) due to the El Nino in 2015 and 2016. Reduced flows can cause increases in water temperature, resulting in increased heat stress to fish and thermal barriers to migration.

One factor affecting the range wide status and aquatic habitat at large is climate change. Information since these species were listed suggests that the earth's climate is warming, and that this change could significantly impact ocean and freshwater habitat conditions, which affect survival of species subject to this consultation. In the coming years, climate change will influence the ability to recover coho and Chinook salmon in most or all of their watersheds. Steelhead are particularly vulnerable to climate change due to their need for year-round cool water temperatures (Moyle 2002). Through effects on air temperatures and stream flows, climate change is expected to increase water temperatures to the detriment of coho and Chinook salmon. Climate change effects on stream temperatures within Northern California are already apparent. For example, in the Klamath River, Bartholow (2005) observed a 0.5°C per decade increase in

water temperature since the early 1960's, and model simulations predict a further increase of 1-2°C over the next 50 years (Perry et al. 2011).

In coastal and estuarine ecosystems, the threats from climate change largely come in the form of sea level rise and the loss of coastal wetlands. Sea levels will likely rise exponentially over the next 100 years, with possibly a 50-80 cm rise by the end of the 21st century (IPCC 2007). This rise in sea level will alter the habitat in estuaries and either provides an increased opportunity for feeding and growth or in some cases will lead to the loss of estuarine habitat and a decreased potential for estuarine rearing. Marine ecosystems face an entirely unique set of stressors related to global climate change, all of which may have deleterious impacts on growth and survival while at sea. In general, the effects of changing climate on marine ecosystems are not well understood given the high degree of complexity and the overlapping climatic shifts that are already in place (e.g., El Niño, La Niña, and Pacific Decadal Oscillation) and will interact with global climate changes in unknown and unpredictable ways. Overall, climate change is believed to represent a growing threat, and will challenge the resilience of listed salmonids in Northern California.

As more fully described in the two following sections, the Program area is contained within the Prairie Creek sub-basin of the Redwood Creek watershed. The Redwood Creek watershed (including Prairie Creek) contains independent populations of SONCC coho salmon, CC Chinook salmon and NC steelhead. NMFS' SONCC Coho Salmon Recovery Plan (2014) and NMFS' Coastal Multispecies Recovery Plan (2016) describe that the Redwood Creek populations of these species are either core for recovery (SONCC coho salmon) or essential for recovery (CC Chinook salmon and NC steelhead), and that in general, the Prairie Creek sub-basin: 1) provides good to very good habitat with cool water, 2) is a stronghold for salmon and steelhead, 3) will provide an important anchor for species recovery (NMFS 2014, 2016).

## 2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The Program action area is within the mid to lower part of the Prairie Creek sub-basin of the Redwood Creek watershed. Prairie Creek enters Redwood Creek close to its mouth, at river mile 3.5. Redwood Creek flows into the Pacific Ocean 1.7 miles west of the town of Orick, California. The action area is 9,160 acres, encompassing the treated sub-basins and their stream miles, downstream to the mouth of Prairie Creek (Table 5, Figure 5). The action area includes all bed, bank, channel and riparian areas, including Prairie Creek downstream to its confluence with Redwood Creek, which is the extent to where temporary increases in turbidity may occur (RNSP 2019).


Figure 5. Map of the Program action area on the North Coast of California (RNSP 2019).

Table 5. Program sub-basin areas and stream lengths (RNSP 2019).

| Sub-Basin Name | Sub-Basin Area (square miles) | Stream Length (miles) |
|---|---|---|
| Streelow Creek | 2.8 | 7.1 |
| Skunk Cabbage Creek | 2.2 | 4.5 |
| May Creek | 1.8 | 4.3 |
| Main stem Prairie Creek | --- | 4.0 |
| Davison Creek[1] | 0.4 | 0.7 |
| Berry Creek[1] | 0.4 | 0.6 |
| Ranch[1] | 0.2 | 0.5 |
| Total | 7.7 | 18.2 |

[1] Anadromous fish only present near mouth of each respective creek (NPS 2017).

## 2.4 Environmental Baseline

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

The Program area is located in the lower portions of the Prairie Creek watershed within RNP and Prairie Creek Redwoods State Park, and is a high priority for restoration because of its location in context with the surrounding landscape. To the north and south lie two of the largest remaining redwood old growth forests, and forest restoration that improves forest structure, species compositions, and understory stand development in the action area would accelerate the connectivity of habitat between these two large old growth redwood forest patches. Restoration will also shorten the time for development of late seral forest habitat conditions within the action area. The area contains small isolated stands of old growth redwood and is bordered in most areas by larger contiguous stands of old growth redwood forest (Figure 6).

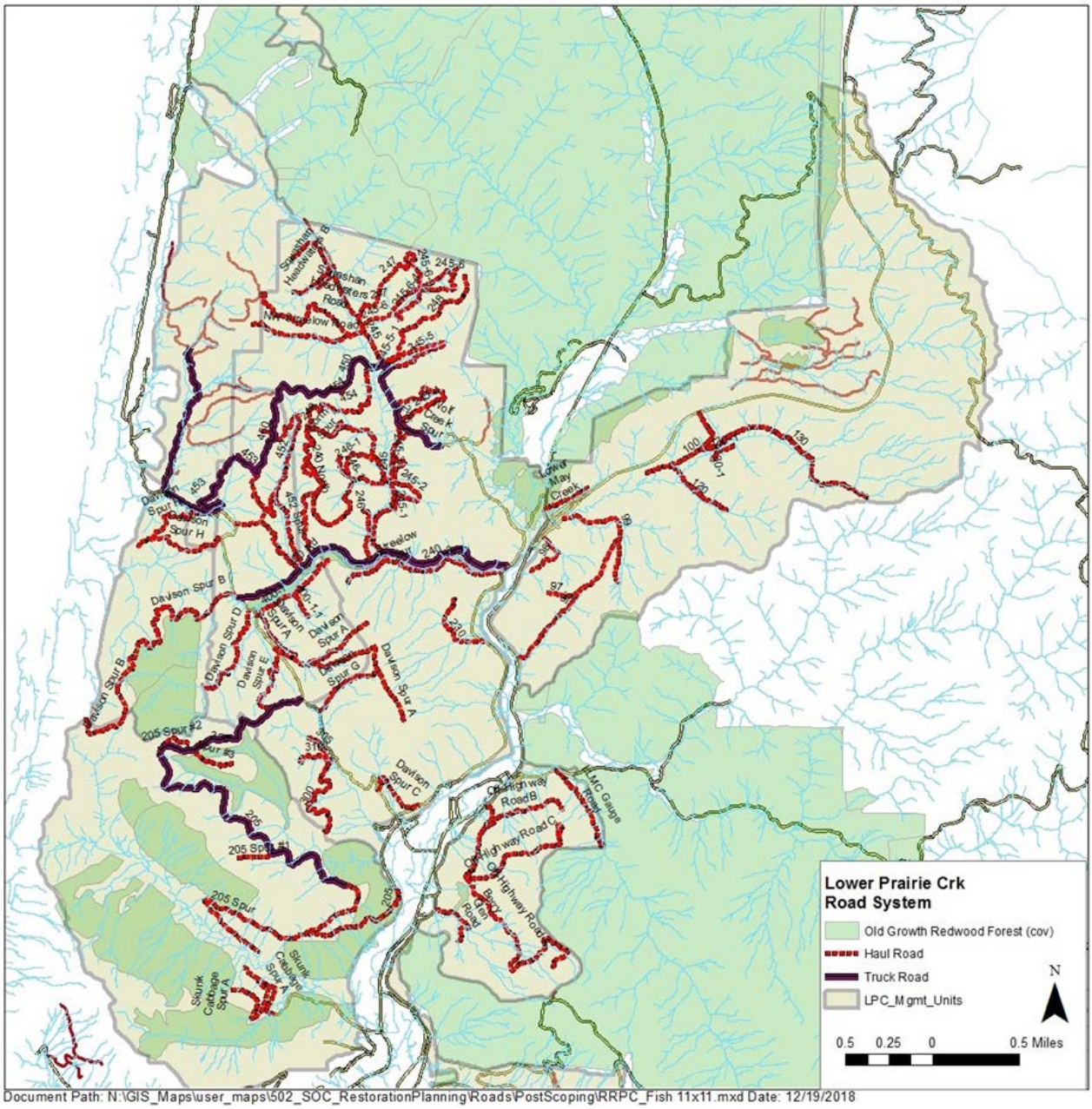


Figure 6. Map of program area with roads, streams, old growth forest and second growth forest (restoration areas) designated (RNSP 2019).

The action area is located within the marine climate zone, dominated by wet winters and relatively damp, foggy summers. The farthest inland portion of the Program area is five miles from the coast, within the coastal summer fog zone (http://climate.calcommons.org).

The threat to SONCC coho salmon, CC Chinook salmon, and NC steelhead from climate change is low in the action area due to the sub-basin's location within the coastal fog zone, and in an area that contains old growth redwood forests, including shady, complex stream and riparian areas, and cool stream temperatures (NMFS 2014, 2016). In future years and decades, we expect

that Prairie Creek will continue being a refuge for SONCC coho salmon, CC Chinook salmon, and NC steelhead within the Redwood Creek watershed, and within their respective ESUs and DPS. The Prairie Creek sub-basin's role as a continued habitat refuge for listed salmonids is due in part to the watershed being nearly all (98 percent) park lands, the large amount of old growth forest, the cool, coastal climate, and that there has been, and continues to be a focus on restoring the part of the sub-basin that was previously logged.

The Program area was logged from the 1930s until the expansion of RNP in 1978 (NPS 2008, 2014). The second growth forest stands in the action area have not been managed since the 1970s and consist of unnaturally dense forests where growth is hindered, tree species composition has shifted away from the natural redwood dominated forest, and biodiversity is generally low. Unmaintained logging roads, skid trails, and stream crossings have eroded since construction, leading to legacy logging related sediment entering nearby stream channels, and stream crossing subsidence at many old Humboldt crossings (RNSP 2019). These historical uses degraded aquatic habitat within the action area, and the mainstem of lower Prairie Creek lacks large pieces of wood needed for complex fish habitat, as compared to upstream reaches of Prairie Creek, and some of its tributaries, that were never logged and were surveyed as reference reaches for large wood stream density (RNSP 2019).

Many tributary stream channels in the action area are choked with old logging debris, called "buried channels," and shown on Figure 7. The buried channels often contain (Figure 7) subterranean flow, not accessible to salmonids. Of the approximately 43.1 miles of perennial and intermittent stream channels within the Program area, approximately 61 percent are estimated to be buried (RNSP 2019). All perennial stream channels were surveyed in the Program area, while approximately two-thirds of intermittent channels have been surveyed to date, and total miles of buried intermittent channels were extrapolated from surveyed reaches. Out of the 21.7 perennial stream miles in the action area, 14.1 miles are open and 7.6 miles are buried, while out of the 21.4 intermittent stream miles in the action area, 2.6 miles are estimated open and 18.8 miles are estimated buried (RNSP 2019).

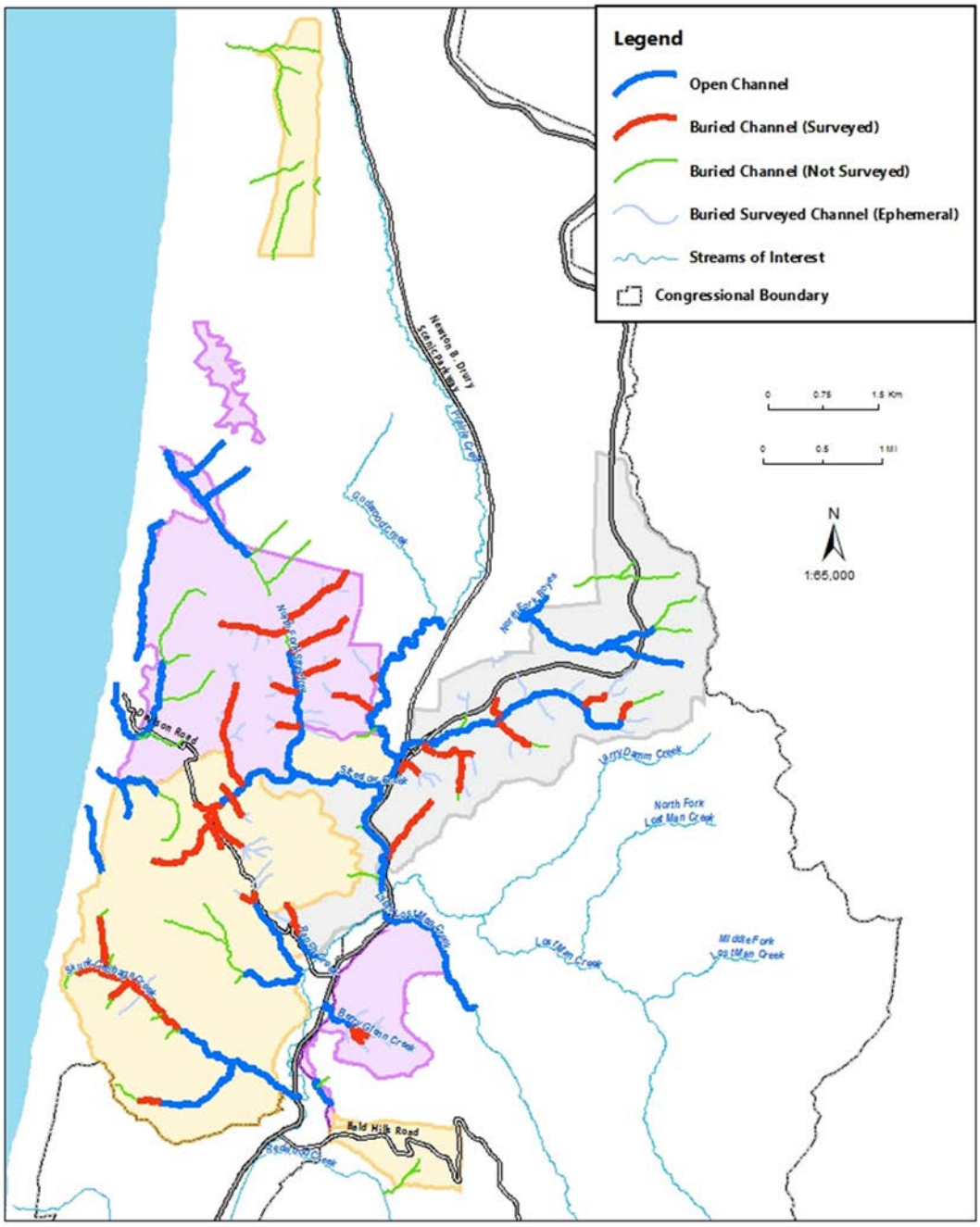

Figure 7. Map of buried and open stream channels in the Program area (RNSP 2019).

Juvenile and adult fish are found throughout the action area. All three listed salmonids spawn in mainstem Prairie Creek and in some of the larger tributaries. Listed salmonids rear throughout much of the action area in the open tributaries until logging debris or gradient makes a stream reach inaccessible (Figure 4). The action area includes the anadromous fish bearing tributaries: Skunk Cabbage, Berry Glen, Little Lost Man, Streelow, Home, May, and Boyes creeks, as well as mainstem Prairie Creek.

### 2.4.1 Status of Listed Species and Critical Habitat in the Action Area

#### 2.4.1.1 Coho Salmon

Coho salmon occurring in the action area belong to the Redwood Creek population of SONCC coho salmon, which is considered at high risk of extinction in the NMFS SONCC Coho Salmon Recovery Plan (2014), with key threats being channelization/diking and roads, and key stresses being impaired estuarine function, and lack of floodplain and channel structure (NMFS 2014). Roads are also a very high threat, and sediment a high stress in this population. Current population-wide abundance estimates are low, averaging in the low to mid hundreds of adults, suggesting that the population is quite far from the number needed (4,900 adults, NMFS 2014) to be at low risk of extinction.

However, the Prairie Creek portion of the population is by far the most robust and productive in the watershed, and is considered a stronghold for coho salmon. Based on spawner surveys of coho salmon from 2009 to 2015, CDFW estimated adult returns to Prairie Creek numbering in low to mid hundreds of fish (Ricker et al. 2014 a, b, c, d, and Ricker 2011), and estimates that Prairie Creek supports about 80 percent of the Redwood Creek coho salmon population.

Smolt abundance was monitored from 2011-present in the lowermost section of Prairie Creek, by HSU in collaboration with CDFW. Data are summarized in Sparkman et al. (2015) for the years 2011-2014, in Wilzbach et al. (2016) for the years 2011-2015, and in Wilzbach et al. (2017) for the years 2011-2016. During 2011-2014, the annual estimate of 1+ coho salmon emigrating past the downstream migrant trap in lower Prairie Creek averaged 17,804 individuals, a majority (86 percent) of which were classified as smolts. The smolt population estimate averaged 18,550 from 2011-2015, and 17,615 from 2011-2016; the estimate staying relatively consistent through the study period. Drobny (2016) estimated a juvenile density of coho salmon in late summer 2014 to be 0.52 fish/square yard (SD=0.38, SE = 0.03, n = 159) using a 2-pass snorkeling method in pools distributed throughout the Prairie Creek watershed.

A two year freshwater life history has been documented in Prairie Creek (Bell and Duffy 2007, Ransom 2007, and Moore 2014). For the three Prairie Creek streams he studied (Prairie, Streelow, and Boyes creeks), Ransom found that the incidence of a two year freshwater life history ranged from 1.6 to 29.5 percent in 2000 through 2002. The largest proportions of individuals with a two year life history were observed during summer, following the winter with the mildest streamflow. Adults enter the action area November through February and the peak timing of smolt outmigration in Prairie Creek occurs in April and May. Coho salmon occupy approximately 12.2 miles of spawning and rearing habitat in the action area (Calfish 2016 and NPS 2017).

#### 2.4.1.2 Chinook Salmon

Chinook salmon in the action area belong to the Redwood Creek population, which the NMFS Coastal Multispecies Recovery Plan (2016) estimates the current abundance from the upper hundreds to a few thousand fish, suggesting that at least in some years, the population is close to the number needed (3,400 adults, NMFS 2016) to be at low risk of extinction. Channel modification is a very high threat to this population and sediment from roads is a high threat (NMFS 2016).

Adults typically enter Prairie Creek during the first two weeks in November, continuing through the end of December or early January. Chinook salmon occupy approximately 7.9 miles of spawning habitat in the action area (Calfish 2016, NPS 2017). Chinook salmon juveniles typically rear for three to six months in the action area, and then migrate downstream from their natal streams to the Redwood Creek estuary to rear. Wilzbach et al. (2017) reported that average smolt production between 2011 and 2016 equals 47,106 individuals. The smolt population estimate average was 36,509 from 2011-2015, and was 39,996 from 2011-2014, showing more variability than the other salmonid species. Peak smolt outmigration typically occurs in April and May. Chinook salmon smolts from Prairie Creek have been found to enter the estuary earlier than smolts from Redwood Creek, and at a smaller size (Sparkman et al. 2015). This suggests a greater dependency of Prairie Creek Chinook salmon to complete their rearing in lower Redwood Creek and estuary to reach a size that increases marine survival.

#### 2.4.1.3 Steelhead

Steelhead in the action area belong to the coastal and interior Redwood Creek populations of NC steelhead, and are estimated to be below the number needed population-wide (5,400 adults, NMFS 2016) to be at a low risk of extinction. NMFS (2016) estimates that the steelhead populations range from a total of hundreds of adult fish, to around a 1,000 adult fish (population-wide). Channel modification is a very high threat to this population and sediment from roads is a high threat (NMFS 2016)

Annual escapement of steelhead to Prairie Creek, estimated from redd observations, ranged from 0-67 from 1998/1999 through 2012/2013 (Ricker et al. 2014 a, b, c, d and Ricker 2011). Annual production of steelhead smolts from Prairie Creek averaged 7,059 during 2011-2014, 8,108 during 2011-2015, and 7,940 during 2011-2016 (Sparkman et al. 2015, Wilzbach et al. 2016, and Wilzbach et al. 2017), remaining relatively consistent. Although steelhead are the most widely distributed salmonid in the Redwood Creek Basin (Anderson 1988), they are outnumbered by coho salmon in the Prairie Creek sub-basin. In each study year, 1+ steelhead juveniles outnumbered 2+ steelhead juveniles caught at the trap, with population estimates of 1+ juveniles being about twice as many as 2+ juveniles. Most spawning occurs in the mainstem of Prairie Creek or in Lost Man Creek. Steelhead occupy approximately 12.2 miles of spawning and rearing habitat in the action area (Calfish 2016, NPS 2017). All of the steelhead within the Prairie Creek sub-watershed are fall or winter run (RNSP 2019).

#### 2.4.1.4 Critical Habitat for all Listed Salmonids

The condition of SONCC coho salmon, CC Chinook salmon and NC steelhead critical habitat, specifically the habitat's ability to provide for the species conservation, is in generally good to very good condition. Some of the action area provides excellent instream and riparian habitat adjacent to old growth redwood forest, and some of the action area provides somewhat degraded (i.e., fair) habitat where legacy logging impacts remain. Many habitat parameters reflect this mix of conditions within the action area.

The pristine, upper portions of Prairie Creek and Little Lost Man Creek offer some of the highest quality habitat for salmonids within California. In addition, extensive road removal in the Lost Man Creek drainage has removed future sediment sources from old logging roads and landings. Sub-watersheds still recovering from legacy logging impacts, such as Streelow and May creeks, are expected to provide increasing habitat quality with time and/or appropriate management

activities. Below the Highway 101 Bridge to the Bald Hills Bridge, the habitat quality of mainstem Prairie Creek is impaired by a deeply incised channel, eroding stream banks and lack of floodplain access (Anderson *in* RNSP 2019).

Lisle (1989) found that the majority of surface material in Prairie Creek, near the Wolf Creek Bridge fell within the preferred size range used by spawning salmon (80 percent was between 10 and 100 mm). Madej et al. (2006) measured a range in median particle sizes from 18 mm (Godwood Creek) to 147 mm in Little Lost Man Creek. In a survey of 10 Prairie Creek locations, Cannata et al. (2006) reported the least embeddedness in May, Godwood, and upper Prairie creeks (rated at very good), and the greatest embeddedness in Brown and Boyes creeks (rated as poor). Cannata et al. (2006) also reported that in a sample of 10 reaches within the Prairie Creek sub-basin, pools comprised an average of 27 percent of stream length, with a low in Boyes Creek of 19 percent pools, and a high in Lost Man Creek of 47 percent pools.

RNSP (2019) reports that number of LWD pieces per mile of stream in all reaches of Prairie Creek exceeded target values established by NMFS (2014) for ranking channel structure as very good. However, evidence of a legacy logging effect in lower reaches of the stream is suggested by the reduced volume of LWD per mile relative to that observed in upper reaches, particularly in the largest size class of wood, and that most of the wood in the lower reaches of Prairie Creek was of small size.

Water quality and quantity in the action area is good to very good. Although Redwood Creek is listed as temperature impaired under section 303(d) of the Clean Water Act, water temperatures in Prairie Creek are suitable for salmonids throughout the year. Since 1997, stream temperature has been continuously monitored during summer months (June-September) by RNSP at a number of sites throughout the Prairie Creek watershed, including within the action area. Maximum weekly maximum temperatures (MWMT) have very rarely exceeded 61 °F (16 °C) since 1997, and have not exceeded 61 °F since 2007. The U.S. Environmental Protection Agency (USEPA) uses a MWMT of 16 °C as the upper limit for core juvenile salmonid rearing areas (RNSP 2019). Hydrologic function in Prairie Creek is not impaired by dams or large diversions.

In operation since 1990, gaging stations in the action area provide continuous stage and turbidity data, monitor stream discharge and collect suspended sediments using automated pumping samplers controlled by turbidity threshold sampling. Using NMFS (2014) recovery criteria, that is, numbers of hours per year exceeding 25 formazin nephelometric units (FNU), Prairie Creek above Brown Creek, Prairie Creek above Godwood Creek, and Prairie Creek above Boyes Creek are ranked as very good, with 25 FNU or less. Little Lost Man Creek would rank as good (120-360 hours per year greater than 25 FNU), and Lost Man Creek would rank as good to fair (361-720 hours per year greater than 25 FNU) (Klein et al. 2011).

In addition, Klein (2012) monitored turbidity associated with road removal projects in Lost Man Creek and found that stream crossing excavations contributed relatively large amounts of sediment on occasion, but sediment contributions decreased rapidly over time, with most sediment being transported after the first significant rain event post stream crossing excavation. At present, RNP operates three long-term gaging stations at Little Lost Man Creek (pristine),

Lost Man Creek at the Hatchery (logged and most roads recently removed), and at Prairie Creek above Boyes Creek (pristine).

Several studies in Prairie Creek have documented that over-winter survival of anadromous salmonids is positively correlated with fish body size (Brakensiek and Hankin 2007, Moore 2014, Drobny 2016). In recent years, overwinter survival estimates of juvenile coho salmon have been higher in Prairie Creek (Moore 2014, Sparkman et al. 2015, Wilzbach et al. 2016) than in another coho salmon stronghold, Mill Creek, tributary to the Smith River. In comparison with Freshwater Creek, fewer juvenile coho salmon exhibited an early migration from Prairie Creek in fall of 2013 or 2014 [e.g., 2 percent of tagged fish in 2013 versus 30 percent in nearby Freshwater Creek (Rebenack et al. 2015)], perhaps reflecting more favorable instream habitat conditions.

### 2.4.2 Previous ESA Section 7 Consultations and Research Approvals in the Action Area

Routine road and bridge improvements occur regularly within the parks, including within the action area. Previous road removal and second growth forest thinning projects have also been implemented in the Prairie Creek sub-basin near or within the action area in the recent past. The Lost Man Creek road removal project was completed in 2010, with 50 miles of road and associated stream crossings removed from the watershed, and short term increases in turbidity levels that have since decreased to below pre-project levels. The NPS implemented thinning treatments in the South and Middle Forks of Lost Man Creek from 2009 to 2011 and 2015 to the present, respectively (NPS 2008, 2014); both projects were determined unlikely to adversely affect listed salmonids.

NMFS' ESA Section 10(a)(1)(A) research and enhancement permits, and research projects that are part of the annual CDFW ESA Section 4(d) rule research program (4d program) will likely occur in Prairie Creek, and in the action area, especially during 2019 and 2020. Funding for the research post 2020 is not currently secured. The research approved through 2020 under the 4(d) program includes juvenile salmoinid outmigrant monitoring at the rotary screw trap at the mouth of Prairie Creek conducted by HSU, and visual spawning and carcass surveys conducted by CDFW throughout the sub-basin. In general, these activities are closely monitored and require measures to minimize take during the research activities. NMFS determined these research projects are unlikely to affect future adult returns.

## 2.5 Effects of the Action

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

The Program has the potential to result in:

1. Increased stream temperatures due to forest thinning in riparian areas.
2. Decreased delivery of large wood due to thinning in riparian areas.
3. Delivery of petroleum products to stream channels through the use of heavy equipment or power tools within and near riparian areas.
4. Displacement of fish from habitat due to placement of instream large wood and stream

diversions.

5. Juvenile fish mortality due to fish relocation during stream crossing removal and reconstruction.
6. Sediment delivery and increased turbidity in stream channels, particularly when considering ground disturbing activities cumulatively.

### 2.5.1 Thinning in Riparian Areas

#### 2.5.1.1 Stream Temperatures

Potential increases in summer water temperatures could occur when juvenile coho salmon and steelhead are present in streams in the action area (Wilzbach and Ozaki 2017). Thinning within riparian areas, defined as one tree height distance from the bank full width of the stream, is within the zone of influence for potential increases in stream temperatures and a potential decrease in large wood delivery (Spies et al. 2018). However the Program will maintain at least 60 percent canopy cover post treatment in all riparian areas, as measured over a 1,000 foot stream reach, and all streams within the action area are within the coastal summer fog zone where ambient air temperature remains relatively low (i.e., up to about 70 °F) all year long, and the average hours of summer sunshine are also relatively low (RNSP 2019) In addition, upwards of 60 percent of the total stream channel lengths in the action area are buried (Figure 7) and the subterranean flow of these stream reaches are immune to solar gain, further decreasing the potential for increased stream temperatures. The remaining open channels (tributaries to Prairie Creek) have topographic shading and cool water temperatures. Therefore, due to: 1) the retention of at least 60 percent canopy cover to provide shade, 2) the presence of topographic shading and cool water, 3) the extent of buried channels within the action area, and 4) the location within the coastal summer fog zone, the riparian thinning within the action area will cause a negligible increase in stream temperature, and no reduction in individual fitness for all species and life stages.

#### 2.5.1.2 Large Wood Delivery

A decrease in large wood in streams could occur at any time of the year, as tree delivery processes occur year round, potentially exposing juvenile and adult salmonids of all listed species to a decrease in complex rearing and spawning habitat. Thinning in riparian areas for old growth stand characteristics using variable density thinning will increase tree size and vigor over the long term faster than if the forest were left untreated, and current riparian stand structure within the Program area consists of young, smaller diameter second growth trees. These trees, by definition, are not large and would not be expected to provide the same pool forming habitat function, if any, as larger trees, nor have long stream residency times (Spies et al. 2013). However, Benda et al. (2016) modeled wood recruitment in Pacific Northwest streams running through thinned forests. According to their model, there was a decrease in wood recruitment in stands where trees were removed, and where trees were not artificially added to the stream. Benda et al. (2016) also found that adding wood to channels in thinned stands would meet or exceed the wood recruitment seen in un-thinned stands.

Within the action area, wood recruitment is important in anadromous salmonid occupied and potentially occupied stream reaches where thinning operations will remove trees within the riparian zone. In the Program area, mainstem and North Fork Streelow, and mainstem May creeks meet these criteria, and would also influence downstream wood availability in Prairie Creek. All of these creeks (Streelow, May and Prairie) will have wood added to the streams as described in the *Proposed Action* section of this opinion.

Wood placement is not proposed for Skunk Cabbage Creek despite there being proposed lop-and-scatter thinning units within the watershed. Skunk Cabbage Creek is unique within the Program area in that the reach accessible to anadromous fish is a low gradient, "u" shaped valley where the entire riparian zone is a Sitka spruce swamp or sedge dominated wetland. No thinning is proposed within one potential tree height of the stream due to saturated ground conditions, thus all riparian trees will be retained.

In addition, no wood placement is proposed for the short anadromous reach of Little Lost Man Creek within the Program area because only the southern side of the stream is proposed for thinning, the northern side is old growth redwood forest that provides large wood to the stream, as evidenced by its current habitat condition (RNSP 2019). And, no wood placement will occur in the short, 0.25 mile reach of Boyes Creek in the Program area because only a short, steep section of this anadromous stream is within a proposed thinning unit (Figure 4) where fish have not been detected recently, and where fish presence may have been mapped too far upstream in the past (RNSP 2019). In addition, Boyes Creek is adjacent to old growth forests in some sections, which are sources of large wood. Home Creek is a non-anadromous fish bearing stream (Figure 4), where large wood is not needed for listed salmonids.

Importantly, all trees will be retained that provide stream bank stability, and that are on unstable or potentially unstable slopes. Retaining these trees will protect the dominant tree delivery mechanisms within the action area. Benda et al. (2002) analyzed wood recruitment mechanisms, and the mass balance of instream wood in Little Lost Man and Prairie creeks and found that: 1) wood delivery in tributary streams, such as Little Lost Man Creek, are dominated by landslide processes, 2) wood delivery in mainstem streams, such as Prairie Creek, are dominated by mortality and bank erosion processes. The average proportion of tree volume recruited by mortality, bank erosion, and landslides in Prairie Creek was 60, 40, and 0 percent, respectively, and in Little Lost Man Creek was 20, 22, and 58 percent, respectively. Note that second growth thinning is not proposed near, or in the riparian area of mainstem Prairie Creek, thus large wood delivered from morality will not be affected.

Benda et al. (2002) also found that: 1) logging-related debris and high forest mortality rates in conifer and deciduous forests contributed to high wood storage in second-growth forests, 2) diameters of wood were significantly greater in older forests, and 3) wood recruitment from forest mortality in old-growth forests was low compared with second-growth sites, driven by differences in conifer mortality rates. RNSP (2019) expects that the canopy in thinned stands will close within 15 to 30 years (Teraoka 2010), and will close within about three years within riparian areas (Chan et al. 2006, Yeung et al. 2017). Once the canopy closes, riparian sub-dominant trees will experience increased mortality [(Teraoka 2019 *in* RNSP (2019)] and

potentially be recruited into streams as large wood, along with any trees contributed from natural bank erosion or landslides. Therefore, it is expected that the riparian forest thinning will have a negligible effect on wood recruitment into all streams within the action area and no reduction in individual fitness (all species and life stages).

### 2.5.2 Petroleum Products

During the NOS when heavy equipment will be operating, juvenile coho salmon and steelhead will be rearing in streams in the action area (Wilzbach and Ozaki 2017). With any heavy equipment and power tool use in the riparian area, there is the possibility that petroleum products may enter the stream network, either through spills or leaks. Spill plans, checking equipment for fluid leaks, refueling at least 300 feet from any stream and having spill kits on site should prevent or minimize the probability of runoff of hazardous materials in the unlikely event of a spill or leak associated with power tool or heavy equipment use. Therefore, the potential for exposing juvenile coho salmon and steelhead to petroleum products is improbable since the Program would adhere to all design features pertaining to containment and prevention of petroleum product spills, and since a spills would be unlikely to reach streams due to the heavy equipment exclusion zones in riparian areas, and that refueling will not occur within 300 feet of streams.

### 2.5.3 Displacement of Fish from Habitat

Large wood placement along the mainstem of Prairie Creek and along Streelow and May creeks will occur when juvenile coho salmon and steelhead may be present (Wilzbach and Ozaki 2017). Individual fish may be flushed from areas when logs or whole trees are set in the creeks with equipment that is parked on the stream bank. This disturbance is expected to be minor and temporary to juvenile fish, given that there is suitable habitat in all locations that fish can move into easily, short distances away from the wood placement areas.

In addition, juvenile coho salmon and steelhead may be present during crossing removal and reconstruction at up to three stream crossing sites on tributary streams during the NOS over the life of the Program. To minimize effects to juvenile fish, fish will be relocated to nearby suitable habitat, and the stream will be diverted around the work site temporarily. Passage of redistributing juveniles may be limited by the diversions; however, the proposed work window minimizes exposure and avoids peak timing of juvenile redistribution. Fish will be temporarily excluded from re-entering the work area by blocking the stream channel above and below the work area with fine-meshed net or screens. Mesh size would be no greater than 1/8 inch and the bottom edge of the net or screen would be completely secured to the channel bed to prevent fish from re-entering the work area. Exclusion fencing would be placed in areas of low water velocity to minimize the impingement of fish, and screens would be checked daily and cleaned of debris to permit the free flow of water. Stream diversions would be kept to the minimum length possible.

There are also six locations within the program area where temporary road bridges will be installed where coho salmon or steelhead juveniles may be present. No bridge structures or equipment will be located in or enter the bank full stream width. Individual fish may be flushed

from cover areas when abutments are placed near the streams or the temporary bridge is placed over the stream. This disturbance is expected to be minor and temporary as individual fish can move short distances away from the bridge installation areas to find suitable habitat and cover.

Based on: 1) the work window timing, 2) the minimization measures for exclusion screening, 3) the small number of juveniles expected at and near each crossing site, and 4) the good to very good habitat upstream and downstream of the construction area, NMFS does not expect the large wood additions, stream diversions, exclusion fencing, or temporary bridges to affect the fitness of any individuals, or to negatively influence the passage of any juvenile coho salmon or steelhead.

### 2.5.4 Fish Relocation

Juvenile coho salmon and steelhead may be present at the Davison Road at Streelow Creek stream crossing replacement site, and at two additional stream crossings within the action area during the NOS. Fish relocation will occur if juvenile fish are present when crossing removal and installation is occurring. Removing fish from the stream crossing construction sites will reduce the number of fish potentially injured or killed since in the absence of fish relocation, juvenile salmonids would be exposed to dewatering, thermal stress, desiccation, and physical injury from construction equipment. However, the stress of relocation can cause injury or mortality in juvenile salmonids (Reynolds 1983, Habera et al. 1996, Habera et al. 1999, Nielsen 1998, Nordwall 1999). The amount of unintentional injury or mortality attributable to fish removal varies depending on the method used, ambient conditions, and the expertise and experience of the field crew. Fish collecting gear, whether passive or active poses some risk to individuals, including stress, disease transmission, injury, or death (Hayes et al. 1996). In addition, relocated fish may have to compete with other fish for available resources such as food and habitat, and the growth rate of fish can be slowed when population density is high (Ward et al. 2007). The fish relocation protocol described in the *Proposed Action* section will greatly reduce the risk of harm or mortality, but not completely eliminate it.

RNSP staff electroshocked 27 sites throughout the action area and surrounding sub-basins while conducting fish presence/absence surveys in September 2016 (NPS 2017). The maximum number of coho salmon caught at any one site was 30 individuals, while the maximum number of steelhead caught at any one site was 20 individuals. Thus, NMFS expects no more than 30 coho salmon juveniles, and no more than 20 steelhead juveniles will be captured at each of the three relocation sites, for a maximum of 90 coho salmon and 60 steelhead captured during the 15 year Program.

Data on fish relocation efforts from water diversion activities since 2004 shows most average mortality rates are below three percent for salmonids. Given the measures that would be implemented to avoid and minimize impacts to fish during relocation efforts, NMFS expects no more than three percent of all relocated fish would be subject to potential injury or mortality. However, other analyses have used a more conservative estimate of three percent mortality.

If the maximum kill/injury rate of three percent is applied to the 30 coho salmon caught per site, then 0.9 coho salmon juveniles could be harmed or killed during relocation efforts per site, for a total of 2.7 individuals. If the maximum kill/injury rate of three percent is applied to the 20

steelhead caught per site, the maximum number of steelhead juveniles killed or injured would be 0.6 individuals per site, for a total of 1.8 individuals. Considering the quality of the habitat in open tributaries in the action area (see *Environmental Baseline* section), and that the number of relocated individuals will be low relative to available habitat, NMFS does not expect the relocated individuals to contribute to overcrowding or increased competition to a level that would decrease individual fitness or survival.

### 2.5.5 Increased Sediment and Turbidity

Short term increases in suspended sediment and turbidity are anticipated during a number of Program activities. These activities include the temporary reconstruction, maintenance, use, and removal of existing logging roads and log landings. Increases in suspended sediment or turbidity can affect water quality, which in turn can affect fish health and behavior. Salmonids typically avoid areas of higher suspended sediment, which means they displace themselves from their preferred habitat in order to seek areas with less suspended sediment. Fish unable to avoid suspended sediment can experience negative effects from exposure, including changes in feeding and territorial defense (Berg and Northcote 1985, UBFM 2001, Gregory and Northcote 1993, Harvey and White 2008).

Research has shown that length of exposure to total suspended solids (TSS) plays a more dominant role than TSS concentration (Anderson et al. 1996). Long term exposure to elevated TSS conditions may cause an endocrine stress response (elevated plasma cortisol, glucose, and hematocrits), suggesting an increased physiological burden that could influence growth, fecundity, and longevity (Redding et al. 1987). Therefore, when considering the effects of TSS on listed fish, it is important to consider the frequency and the duration of the exposure, not just the TSS concentration (Newcombe and Jensen 1996).

#### 2.5.5.1 Analysis Methods

Two analyses were used to determine sediment effects from Program activities. First, a cumulative watershed effects (CWE) modeling analysis was conducted in order to estimate the volume of sediment that could potentially be transported to streams within the Program area from exposed road surfaces and excavated stream crossings [Appendix B in the BA (RNSP 2019)]. As noted earlier, temporary reconstruction, maintenance, use, and removal of existing logging roads and log landings were the sources of sediment that were used in the model. Skid trails cable yarding corridors were not added to the model as sediment sources. Operating heavy equipment only in dry conditions, mulching all skid trails with tree limb slash and heavy, and providing equipment exclusion zones near creeks will decrease sediment transport skid trail to negligible levels. Cable yarded units will fully suspend all logs across the riparian area (one-tree height distance), thereby reducing potential sediment transport from yarding corridors to negligible levels, as well.

The second method used was a severity of ill effects analysis using the Newcombe and Jensen (1996) dose-duration-response model to estimate potential suspended sediment impacts to juvenile salmonids using suspended sediment data collected in a proxy watershed [Appendix C in the BA (RNSP 2019)]. Road use and removal occurred in the Lost Man Creek watershed from

2002 to 2011 and continuous suspended sediment was monitored on the mainstem of Lost Man Creek and its tributaries over seven years. Larry Damm Creek, located just outside of the Program area was used as an analog for the Program area due to the similar rainfall pattern, past logging history, watershed size, geology, road re-construction/use/removal methods and rates, and road re-construction removal methods [Appendix C in the BA (RNSP 2019)].

The sedimentation severity of ill effects values (SEV) measured in Larry Damm Creek were in the sub-lethal range for the years following road re-construction, use and removal. The maximum SEV ranged from 5.6 to 7.6 and average SEV ranged from 4.4 to 6.2. SEV effects to juvenile salmonids are shown in Table 6.

Table 6. Description scale of SEV from Newcombe and Jensen (1996).

| SEV | Description of Effect |
|---|---|
| Nil Effect | |
| 0 | No behavioral effect |
| Behavioral Effects | |
| 1 | Alarm reaction |
| 2 | Abandonment of cover |
| 3 | Avoidance response |
| Sub-lethal Effects | |
| 4 | Short term reduction in feeding rates; short term reduction in feeding success |
| 5 | Minor physiological stress; increase in rate in coughing, increase respiration rate |
| 6 | Moderate physiological stress |
| 7 | Moderate habitat degradation; impaired homing |
| 8 | Indications of major physiological stress; long term reduction in feeding rate; long term reduction in feeding success; poor condition |

2.5.5.2 Timing

Erosion of disturbed ground and sediment delivery to streams will occur during the first winter post-construction activities, particularly during the first large storms of the first winter (Klein 2012). Juvenile coho salmon, Chinook salmon and steelhead are present in action area streams during winter and will be exposed to increases in TSS. Adults and eggs of all three species could also be present in larger tributaries. As described in Newcombe and Jensen (1996), juvenile salmonids are the most sensitive to suspended sediments, hence the concentration of research into effects to that life stage. Adult salmonids and eggs could also be affected by suspended sediments, and Lloyd (1987) summarizes sedimentation effects studies to all salmonid life

stages. Studies completed by RNSP (2019) showed that effects to adult salmonids and eggs begin well above the expected suspended sediment levels from Program activities during any phase of the Program, and thus while adults and eggs of all species may experience exposure, they will not experience an adverse response.

#### 2.5.5.2.1 Population Density

Juvenile population density for each species (individual per occupied stream mile) was estimated using smolt population estimates based on outmigrant trap data collected near the mouth of Prairie Creek between 2011 – 2104 (Sparkman et al. 2015). RNSP (2019) chose the population estimates for 2011-2014 to estimate the density because the population estimate for Chinook salmon was between the higher number for 2011-2016, and the lower number for 2011-2015. As described in the *Environmental Baseline* section, population estimates for Chinook salmon are more variable than those for coho salmon and steelhead.

The RNSP (2019) estimated population density for Chinook salmon, coho salmon, and steelhead to be approximately 108, 357, and 140 individuals per occupied stream mile, respectively, based on total population estimates of an average of 39,996 Chinook salmon, an average of 17,804 coho salmon, and an average of 7,059 steelhead juveniles. Density estimates were assumed to be uniform across all occupied stream miles within the Prairie Creek watershed and, thus within the action area. Adverse effects were assumed to occur within the occupied tributaries of mainstem Prairie Creek, because the dilution of suspended sediments within mainstem Prairie Creek would lower suspended sediment to below the adverse level (RNSP 2019) during the winter season when flows are high.

#### 2.5.5.2.2 Exposure

The RNSP (2019) density estimates provide a rough guide to how many juvenile fish could be exposed to elevated TSS during each of the approximately five year phase of the Program (Table 7). During phases 1 and 2, juvenile Chinook salmon would not be exposed because their tributary distribution in the action area is limited to May and Little Lost Man creeks, both of which will not be treated until Phase 3. Based on the density estimates, about 775 Chinook salmon juveniles could be exposed to increased TSS during Phase 3, with 155 Chinook salmon juveniles exposed each year (assuming that exposure is the same each year, and dividing the total 775 exposed juveniles by five years, equals 155 juvenile Chinook salmon juveniles exposed per year).

Table 7. Estimated number of individuals of each species that could be exposed to elevated TSS during each five year phase of the Program (RNSP 2019).

| Phase | Chinook Salmon | Coho Salmon | Steelhead |
|---|---|---|---|
| 1 | 0 | 2,170 | 850 |
| 2 | 0 | 2,760 | 940 |
| 3 | 775 | 2,570 | 1,008 |

Juvenile coho salmon and steelhead would be exposed during all Program phases. Assuming that exposure is equal during each year of each phase, and dividing the total exposure estimate for each phase by five, provides an annual exposure range for juvenile coho salmon of 434 to 552 individuals, and for steelhead ranges of 170 to 202 individuals (RNSP 2019). An estimated 0.39 percent of the juvenile Chinook salmon population in the Prairie Creek sub-basin could be exposed annually for five years, and about 2.8 percent of juvenile coho salmon and about 2.6 percent of juvenile steelhead in the Prairie Creek sub-basin could be exposed annually for 15 years.

2.5.5.2.3 SEV Levels and Response

We note that the SEV, and resulting adverse effects, would likely be less in Program area streams than in Larry Damm Creek for a number of reasons (RNSP 2019). First, tributaries in the Larry Damm Creek watershed were unimpeded by woody debris. Water flow to the main channel and sediment generated during road use and post-road removal transported directly to stream channels and was not stored instream behind wood debris. In contrast, many of the tributary streams in the Program area are completely buried by woody debris, and some have high levels of instream woody debris that will assist with sediment storage, and will delay sediment transport downstream, providing a metering effect. This is particularly true for Streelow Creek, the largest tributary watershed in the program area, where all upper watershed stream channels are buried. Second, minimization measures on main haul roads (e.g., rocking road sections near crossings and on steeper road sections) will decrease road surface erosion as compared to the all-native surface and non-rocked road conditions present within the Larry Damm Creek watershed (RNSP 2019). For these reasons, we expect that the increase in TSS within the Program area will be closer to the average increase, or below it, for Larry Damm Creek, that is, an SEV maximum of 6 (Table 6).

Not all exposed individuals will experience a response to the increase in TSS, nor will responses to the increase in TSS be the same for all individuals. Considering the generally good habitat within the action area, some exposed individuals (of all species) will be able to find areas of less turbid water, minimizing or avoiding a response. In addition, emergence timing will delay the exposure of Chinook salmon juveniles to later in the winter, past the first winter storms of the season when most of the erosion will occur (Klein 2012), when TSS values would be less, and the response lower on the SEV scale. For these reasons, we expect that about half of the exposed juveniles will be able to find areas of clear water, and a very small number (less than half of the

estimated 155 exposed fish annually) of Chinook salmon juveniles will experience short term reductions in feeding, and/or minor to moderate physiological stress, resulting in a reduction in fitness for a very small number of juveniles during five years of Program implementation.

We expect that a greater number of juvenile coho salmon and steelhead will be exposed to an increase in TSS due to their longer instream residency times and greater occupancy within the action area. Based on the good to very good habitat within the action area about half of these individuals will be able to avoid turbid waters, and minimize their response to an abandonment of cover and avoidance. We expect that a portion of the individuals that cannot find clear water will experience a greater response, such as short term reductions in feeding and/or minor to moderate physiological stress, resulting in a reduction in fitness for a small number of individuals during 15 years of Program implementation.

### 2.5.6 Effects to Critical Habitat

NMFS expects long-term improvement to the quality and quantity of critical habitat due to the proposed Program. Recovery plans (NMFS 2014, 2016) describe that roads and sediment are very high, or high, threats and stresses to these populations. The Program will remove roads from the action area, reducing sediment sources over time, add will add large wood to channels, improving channel structure and complexity.

The recovery plans (NMFS 2014, 2016) identify important areas for restoration and recovery, and emphasize the importance of continuing to restore the Prairie Creek sub-watershed to anchor it as a stronghold for salmon and steelhead, especially when considering its important source of cool water during climate change. Given the amount of road removal, second growth forest restoration, large wood additions and riparian planting, the Program will have a positive impact on species through habitat restoration.

As described in the previous section, we expect that water temperatures will not change. However, increases in TSS will result in temporary reductions in water quality through increased turbidity. We expect that the increase in TSS will either stay in suspension, or be deposited behind large wood in channels, and will not affect pool depths, and may temporarily affect substrate quality. But, due to reductions in sediment sources during and after the Program, we expect long-term improvements in substrate and pool quality, and increased pool formation through additions of large wood. The riparian area will be improved by planting where necessary and thinning to enhance late seral characteristics and larger wood recruitment over time.

## 2.6 Cumulative Effects

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

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area’s future environmental conditions caused by global climate change that are properly part of

the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

NMFS is not aware of any non-Federal activities planned for the action area that would result in an adverse effect to listed salmonids or their habitat. For the state lands in the action area, we do not expect management activities of visitor services or old growth forests in Prairie Creek Redwoods State Park to result in adverse effects. While the proposed RNSP Orick Visitor Center and Prairie Creek Restoration Project, which is being planned and funded on lands owned by Save the Redwoods League, will include stream channel and floodplain restoration along an approximately 0.75 mile reach near the mouth of Prairie Creek, this project has a Federal nexus with the Army Corps of Engineers, and the NOAA RC so that its effects will be considered in a future section 7 consultation.

## 2.7 Integration and Synthesis

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

### 2.7.1 Context and Expectations

SONCC coho salmon, CC Chinook salmon, and NC steelhead have all declined to a large degree from historic abundance levels, with reductions in productivity and diversity as well. However, the Program is located in a sub-watershed that has generally good to very good habitat conditions with high levels of species abundance and productivity. We expect a reduction in sediment sources over time, improvements in channel structure and in the riparian area, all important recovery actions (NMFS 2014, 2016). Overall, the Program is expected to improve the status of critical habitat in the action area during and after implementation, which will positively affect population abundance and productivity for the Redwood Creek populations of listed salmonids, all of which are independent populations, and are core or essential to recovery of the species (NMFS 2014, 2016).

As explained more fully in the *Effects of the Action* section, the Program will result in harm or mortality to juvenile coho salmon and steelhead from relocation activities. During fish relocation activities, as many as 90 juvenile coho salmon and 60 steelhead may be captured and relocated during the 15 year Program. NMFS expects that up to 3 coho salmon and 2 steelhead juveniles could be injured or killed during the relocation activities over the 15 year Program.

Additionally, a small number (about 2.6 to 2.8 percent of Prairie Creek sub-basin population estimates) of coho salmon and steelhead juveniles would be exposed to increased TSS over the 15 year Program. Of these exposed juveniles, a smaller percentage (conservatively, about half)

would experience reductions in fitness due to changes in feeding or minor physiological stress, because many fish will be able to avoid sediment effects by seeking areas of clearer water. Due to overall good habitat conditions in the action area, NMFS expects that a smaller portion (conservatively about a quarter) of these affected individuals may not attain size or overall fitness to complete their life cycle. However, this would be a very small percentage of the annual juvenile populations, likely less than one percent for both species. Relatively large numbers of coho salmon and steelhead adults enter the Prairie Creek sub-basin to each year to spawn, with large numbers of juveniles produced by each spawning pair, so that spawning in future years would be expected to produce enough juveniles to replace any that are lost due to relocation or sub-lethal sediment effects. It is unlikely that the loss of such small percentages of the juvenile populations of coho salmon and steelhead would reduce future adult returns.

In addition, a very small number (less than 0.39 percent of Prairie Creek sub-basin population estimate) of Chinook salmon juveniles would be exposed to increased TSS over five years of the Program. Of these exposed juveniles, a smaller percentage (about half) would experience reductions in fitness due to changes in feeding or minor physiological stress, because many fish will be able to avoid sediment effects by seeking areas of clearer water. NMFS expects that a smaller portion (conservatively, about a quarter) of these affected individuals may not attain size or overall fitness to complete their life cycle. However, the juvenile and adult Chinook salmon populations in the action area are robust (e.g., Prairie Creek produces about 40,000 Chinook salmon juveniles per year) such that spawning in the Prairie Creek sub-basin in future years would be expected to produce enough juveniles to replace any that are lost due to sub-lethal sediment effects. Therefore, it is unlikely that the loss of a very small percentage of the annual juvenile population would affect future adult Chinook salmon returns.

### 2.7.2 Prairie Creek as a Stronghold

The action area could be subject to higher average summer air temperatures and lower total precipitation levels in the future as a consequence of climate change. Higher air temperatures are not likely to warm stream temperatures due to abundant shade and protected status as park lands. Reductions in the amount of precipitation may reduce stream flow levels and the estuary may also experience changes in productivity due to changes in freshwater flows, nutrient cycling, and sediment amounts. Given that the action area is a refuge from climate change, with its coastal setting, shady riparian areas and cool water year round, that this Program would be completed by 2034, and that NMFS is not aware of cumulative effects, the reductions in precipitation are unlikely to be detected within the Program time frame. The short-term effects of Program implementation would have completely elapsed prior to changes in stream flow from climate change driven decreased precipitation.

Restoring the ecosystem within the action area is expected to increase the carrying capacity of the Prairie Creek sub-basin and will promote species recovery. Because of its perennial cold water and robust population abundances, Prairie Creek is a stronghold for salmonids in the face of climate change effects. Therefore, the Program is unlikely to appreciably reduce the likelihood of survival and recovery of SONCC coho salmon, CC Chinook salmon, and NC steelhead, and the Program is unlikely to appreciably diminish the value of designated critical habitat for the conservation of these species.

## 2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, 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 SONCC coho salmon, CC Chinook salmon, or NC steelhead, or destroy or adversely modify their designated critical habitats.

## 2.9 Incidental Take Statement

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

### 2.9.1 Amount or Extent of Take

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

*Fish Relocation Activities*
Take of juvenile coho salmon and steelhead in the form of capture is expected during fish relocation activities. Up to 90 juvenile coho salmon and 60 juvenile steelhead are expected to be captured and relocated during the 15 year Program. Because injury and mortality resulting from relocation activities, including netting and electrofishing, is estimated to be about three percent, up to three juvenile coho salmon and two juvenile steelhead mortalities are expected during the 15 year Program.

*Increases in Sediment*
Approximately 155 Chinook salmon juveniles will be exposed to elevated TSS each year for five years during Phase 3 of the Program. Of these 155 exposed individuals per year, we expect that due to good habitat conditions in the action area, about half would find refuge in clearer water. Of the 78 individuals per year that cannot find refuge, and considering the overall good quality of habitat in the action area, about a quarter would not be able to find enough food to rear successfully. Thus, up to 20 juvenile Chinook salmon per year for five years would not complete their life cycle, resulting in the take of 100 Chinook salmon juveniles over the life of the Program.

Approximately 493 coho salmon, and 186 steelhead juveniles will be exposed to elevated TSS each year, during 15 years of Program implementation. Using the same reasoning as that for

Chinook salmon above, up to 62 juvenile coho salmon and 23 juvenile steelhead per year for 15 years would not complete their life cycle, resulting in the take of 930 juvenile coho salmon and 345 juvenile steelhead over the life of the Program

*Total Amount of Take*
Combined, there are 100 CC Chinook salmon juveniles, 933 SONCC coho salmon juveniles and 347 NC steelhead juveniles expected to either be killed, or unable to successfully complete their life cycle over the 15 year Program duration.

### 2.9.2 Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

### 2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02). NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of SONCC coho salmon, CC Chinook salmon, and NC steelhead:

1. Undertake measures to ensure that harm and mortality to threatened coho salmon and steelhead resulting from fish relocation is low.
2. Ensure operational methods, minimization measures, and monitoring are properly implemented during restoration activities.
3. Prepare and submit an annual report regarding the effects of fish relocation and restoration activities. Include the results of turbidity monitoring within the annual report, and compare levels of turbidity to those measured in Larry Damm Creek.

### 2.9.4 Terms and Conditions

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

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

    a. Qualified biologists with expertise in the areas of anadromous salmonid biology shall conduct fish relocation activities. RNSP will ensure that all biologists working on the Program are qualified to conduct fish relocation in a manner which minimizes all potential risks to salmonids.
    b. RNSP, or their contractor performing fish relocation, shall first use a seine to herd fish out of the work site, if practicable, before using electrofishing techniques. Herding fish out of the work site with a seine prior to electrofishing will reduce the number of fish exposed to electrofishing activities and reduce the number of

fish captured and subject to risks of mortality. Herding fish by using an electrofisher shall not be attempted.

c. Salmonids shall be handled with extreme care and kept in water to the maximum extent possible during rescue activities. All captured fish must be kept in cool, shaded, and aerated water protected from excessive noise, jostling, or overcrowding or potential predators any time they are not in the stream, and fish will not be removed from this water except when released. Captured salmonids will be relocated as soon as possible to an instream location in which suitable habitat conditions are present to allow for adequate survival for transported fish and fish already present. Fish will be distributed between multiple pools if biologists judge that overcrowding may occur in a single pool.
d. RNSP or their contractor shall monitor any screens used to block fish access on a daily basis, or more frequently if necessary, to ensure that no impingement occurs.
e. If any salmonids are found dead or injured, the biologist will contact NMFS hydrologist Leslie Wolff or the North Coast Branch Chief by phone immediately at (707) 822-7201. The purpose of the contact is to review the activities resulting in the take and to determine if additional protective measures are required. All salmonid mortalities will be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location, fork length, and be frozen as soon as possible. Frozen samples will be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than the NMFS Northern California Office in Arcata, California without obtaining prior written approval from the North Coast Branch Chief.

2. The following terms and conditions implement reasonable and prudent measure 2:
   a. RNSP shall allow any NMFS employee(s) or any other person(s) designated by NMFS, to accompany field personnel to visit the Program area during activities described in this opinion.
   b. RNSP shall contact NMFS within 24 hours of meeting or exceeding take of listed species prior to Program completion. Notify Leslie Wolff or the North Coast Branch Chief at 707-822-7201. This contact acts to review the activities resulting in take and to determine if additional protective measures are required.
   c. If it is necessary to move additional juvenile fish while monitoring exclusion screens, RNSP will contact NMFS immediately to determine whether screens need to be removed to allow continued migration.
   d. RNSP shall ensure that project designs for the Streelow Creek at Davison Road crossing allows for full passage of all life stages of listed salmonids and that NMFS verifies the design prior to construction.

3. The following terms and conditions implement reasonable and prudent measure 3:
   a. RNSP shall provide a written report to NMFS by January 15 of each Program year. The report will include those items as described in the *Proposed Action* section, specific to monitoring and shall be sent to NMFS via email to Leslie.wolff@noaa.gov or Leslie Wolff at 1655 Heindon Road, Arcata, CA

95521. The report shall also contain the results of annual turbidity monitoring with a comparison to TSS levels in Larry Damm Creek.

### 2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02). NMFS does not have additional conservation recommendations for this Program.

### 2.11 Reinitiation of Consultation

This concludes formal consultation for Greater Prairie Creek Ecosystem Restoration Program. 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 ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on 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 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

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

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

### 3.1 Essential Fish Habitat Affected by the Project

Essential Fish Habitat is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802[10]). "Waters" include aquatic areas

and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle. The term "adverse effect" means any impacts which reduce the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrates and loss of, or injury to, benthic organisms, prey species, and their habitats, and other ecosystem components. Adverse effects may be site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.910). The EFH consultation mandate applies to all species managed under a Fishery Management Plan (FMP) that may be present in the action area.

There is suitable habitat for juvenile salmon rearing, and adult salmon spawning in Prairie Creek and many of its tributaries within the action area. Habitat Areas of Particular Concern (HAPC) are described as complex channel and floodplain habitat, spawning habitat, thermal refugia, estuaries, and submerged aquatic vegetation. HAPCs exist in the action area as spawning habitat complex channel and floodplain habitat, and as thermal refugia.

### 3.2 Adverse Effects on Essential Fish Habitat

Both Chinook salmon and coho salmon are expected to occur within the action area. The adverse effects to Chinook and coho salmon and Chinook and coho salmon critical habitat have already been described more fully in the *Effects of the Action* section. The adverse effect to EFH and HAPCs in the action area is a temporary reduction in water quality caused by an increase in suspended sediment and turbidity.

### 3.3 Essential Fish Habitat Conservation Recommendations

The anticipated adverse effects from the proposed action are temporary and relatively minor. The Program is designed to improve habitat conditions both immediately by adding large wood to stream channels, over time by reducing the risk of future sediment delivery to streams, and by promoting late seral characteristics in the riparian areas. NMFS has determined that all desirable and feasible habitat improvements are incorporated into the Program. Therefore, NMFS has no EFH recommendations at this time.

### 3.4 Supplemental Consultation

RNSP must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that effects the basis for NMFS' EFH Conservation Recommendations (50 CFR600.920(1)).

# 4 DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

## 4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the National Park Service (NPS), and the California Department of Parks and Recreation (CDPR). Other interested users could include Save the Redwoods League, and the California Department of Fish and Wildlife. Individual copies of this opinion were provided to the NPS and the CDPR. The format and naming adheres to conventional standards for style.

## 4.2 Integrity

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

## 4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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