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

June 15, 2020 **Refer to NMFS No:** WCRO-2020-00560

Steven Mietz
Superintendent, Redwood National Park
Brett Silver
Deputy District Superintendent, North Coast Redwoods District
Redwood National and State Parks
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 Mill Creek Ecosystem Restoration Program

Dear Misters Mietz and Silver:

Thank you for your letter of March 9, 2020, 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 Mill 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*) and its 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 or adversely modify its designated critical habitat. NMFS expects the proposed action would result in incidental take of SONCC coho salmon and 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 (*O. tshawytscha*), 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 are particularly grateful for the numerous field trips that your staff hosted to help us better understand the proposed Program. We appreciate

your continued efforts to restore the ecosystem upon which ESA-listed salmon depend on for recovery, and we look forward to Program implementation.

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,

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Enclosure

cc: Amber Transou, California Department of Parks and Recreation, North Coast Redwoods
Keith Bensen, National Park Service, Redwood National Park
Copy to ARN File # 151422WCR2020AR00058

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion [and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response, and Fish and Wildlife Coordination Act Recommendations]

Greater Mill Creek Ecosystem Restoration Program (Program)

NMFS Consultation Number: WCRO-2020-00560

Action Agencies: Redwood National and State Parks (RNSP)

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

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:

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Date: June 15, 2020

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1. INTRODUCTION

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

1.1 Background

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

The Redwood National and State Parks (RNSP) complex was formed by the National Park Service (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 Redwood National Park (RNP), Prairie Creek Redwoods, Jedidiah Smith Redwoods, and Del Norte Coast 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 Mill Creek sub-basin on parklands. The Program area is a high priority for ecosystem restoration due to its location in 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 Mill Creek, a tributary of the Smith River in Del Norte County, California.

The Program is within Del Norte Coast Redwoods State Park (DNCRSP) and RNP (Figure 1). The Mill Creek Watershed Management Plan (WMP; CDPR 2011) laid the groundwork for planning and implementation of natural resource restoration and protection activities, including sediment control and reduction, forest recovery directed toward resilient late-seral conditions, and monitoring to assess project progress and direct adaptive management.

Figure 1. Map of the Program area on the North Coast of California (RNSP 2020).

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Arcata, California NMFS office.

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.

Since 2018, 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 evaluate sediment effects from the Program, and began outlining information needs for development of the biological assessment (BA).

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 any required monitoring, reporting and project verification for applicability under the Program.

The RNSP provided drafts of the Program BA for NMFS review during August and December 2019. On March 2, 2020, NMFS and RNSP agreed on the final version of the BA, and on March 9, 2020, 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 and its designated critical habitat.

The consultation was initiated on March 9, 2020. Important information sources include: 1) the Program BA (RNSP 2020), 2) the Synthesis of Science to Inform Land Management within the Northwest Forest Plan Area (Spies et al. 2018), and 3) the Mill Creek Watershed Management Plan (CDPR 2011).

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, a 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 34,080 acres within Mill Creek and Rock Creek watersheds, tributaries to the Smith River, 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. Prior to their removal, old logging

roads will be re-constructed and used to support forest restoration. In addition, permanent roads used for access and log hauling will be improved and maintained. The Program will begin in 2020 or 2021 and will take approximately 30 years to implement. Activities are grouped into implementation phases, which are determined based on 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.

Phase 1 mechanical forest thinning, yarding, and road removal locations have been identified while future phase specific locations have not. Phase 1 will last about 5 to 6 years (RNSP 2020). The activities in future phases will be the same as those in Phase 1, but in different locations. The restoration amount (i.e., acres forest treated, miles of road removed, number of culverts replaced), intensity and spatial arrangement across the program area will also be similar to Phase 1. Wood placement in streams and lop and scatter forest thinning will occur during all phases of the program and locations for these activities have been prioritized for implementation. RNSP proposes to thin and yard a maximum of 2,000 acres of forest per year; thinning units will be spread throughout the Program area in all phases similar to the spatial distribution of Phase 1 (Figure 2).

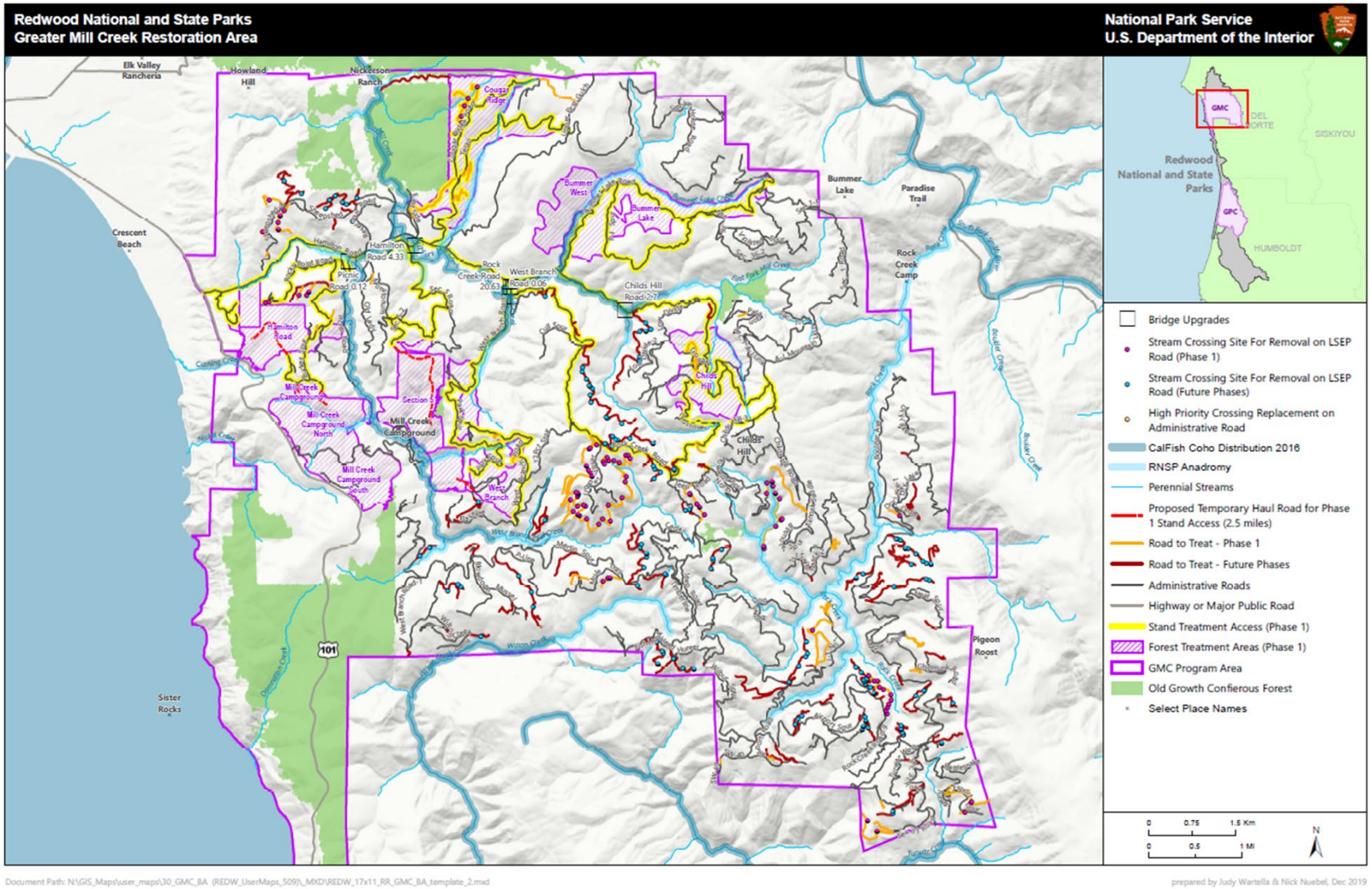

Figure 2. Phase 1 forest thinning and all phases of road removal locations along with coho salmon suitable habitat within the Program area (RNSP 2020).

1.3.1 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 and may be implemented in hardwood-dominated stands to release conifers.
- Conifer cutting in pine savannahs (an uncommon habitat within the Program area) would retain a maximum of 20 percent canopy cover. All conifer seedlings and saplings would be removed to temporarily restrict new recruitment.

Forest thinning treatments would vary in intensity to encourage heterogeneity throughout the Program area. Most treatments would retain more than 100 trees per acre across a treatment unit. In a few cases within older stands, treatments may reduce stem density to less than 100 trees per acre, closer to the number of trees found in old-growth forests. The thinning method would 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, minor species underrepresented). 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).
- While there is no upper limit to implementing forest thinning on steep slopes, geologically unstable areas (identified by park staff geologists) will be marked and left completely untreated to maintain slope stability.

- Bear damage is generally higher in forests thinned at high intensities and which have a larger proportion of smaller trees (i.e., diameter at breast height [DBH] is less than 24 inches); therefore, forests mostly composed of small-diameter trees may need to be thinned at lower intensities to avoid excessive bear damage.

1.3.1.1 Riparian Area Thinning Prescription and Minimization Measures

Thinning prescriptions and canopy retention will vary in riparian areas according to watercourse type (Table 3). Forest thinning within inner zone riparian areas will not decrease conifer canopy cover below an average of 80 percent in anadromous streams or 60 percent in other streams (Table 3) when measured over 1,000 foot reaches. All trees contributing to stream bank stability will not be cut in all riparian areas. Ground based yarding minimization measures in riparian areas, including equipment exclusion zones (EEZs) are presented in Table 3. 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 will not be thinned (i.e., no trees will be cut). Full tree suspension (i.e., two-end suspension) will be used on all cable yarding corridors crossing all stream channels and streambank slopes.

Table 3. Ground-based yarding and forest thinning minimization measures for riparian area.

Watercourse Type	Fish Bearing (may be perennial or intermittent) and Perennial Non-Fish Bearing		Non-fish Bearing and Evidence of Scour or Deposition (intermittent or ephemeral)		
Inner Zone Width[1]	30 feet from confined channel, or channel migration zone		30 feet or break in slope or other feature that prevents sediment delivery to watercourse, whichever is less		
Inner Zone Canopy Cover Retention[2]	80%		60%		
Inner Zone Restrictions	Equipment exclusion zone, no tree removal		Equipment exclusion zone, no tree removal		
Outer Zone Width[1]	130 feet from outer edge of inner zone		20 feet from outer edge of inner zone		
Outer Zone Canopy Retention[2]	60%		60%		
Outer Zone Slope	>35%	<35%	>85%	35% to 85%	<35%
Outer Zone Restrictions	Equipment exclusion zone	Equipment exclusion zone, unless sediment delivery is prevented by a break in slope or another barrier such a bench[3]	Equipment exclusion zone	Equipment exclusion zone, except tethered equipment that does not increase sediment delivery potential over one-end, cable suspension systems	Equipment exclusion zone, unless sediment delivery is prevented by a break in slope or another barrier such as a bench[3]

[1] Zone width measured in slope distance.

[2] Canopy cover averaged across 1,000 foot sections of streams.

[3] If there is a bench or break in slope that is closer and prevents sediment delivery, then the outer zone can be less than 160 feet from the stream channel.

1.3.1.2 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. Three types of operational methods will be used, biomass removal, lop and scatter and fuels reduction (mastication). Figure 2 (RNSP 2020) displays the location of ground-based (less than 40 percent slope), and tethered/skyline cable yarding areas, based on slope gradient (greater than 40 percent slope).

1.3.1.2.1 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 trees will provide space for understory shrubs and young trees to grow unimpeded (RNSP 2020). Wood will not be removed from the Program 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. Excess biomass that is not removed from the site would be lopped and scattered on site. The Program will use four types of biomass removal methods: 1) ground-based yarding operations, 2) tethered harvesting systems, 3) skyline yarding operations, and 4) helicopter operations.

1.3.1.2.1.1 Ground-based Yarding Operations

Ground based operations refers to the use of ground-based mechanized equipment (e.g., tractor, feller-buncher, rubber-tired skidder, shovel harvester/processor) to fell trees and/or skid logs or whole trees from the stump area to the landing or roadside area. Equipment operators will use existing skid trails. At the landing, a processor will limb and buck the material into lengths appropriate for hauling. All limbs and tops (i.e. slash) will be returned to the unit to be scattered on skid roads. Skidders will run over the slash 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 with slopes under 40 percent grade (Figure 3).

Ground based yarding operations will occur during dry conditions in the normal operating season (NOS), 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 immediately post treatment and before winter rains. Heavy equipment will not operate in the spring previous to the NOS on native surface roads.

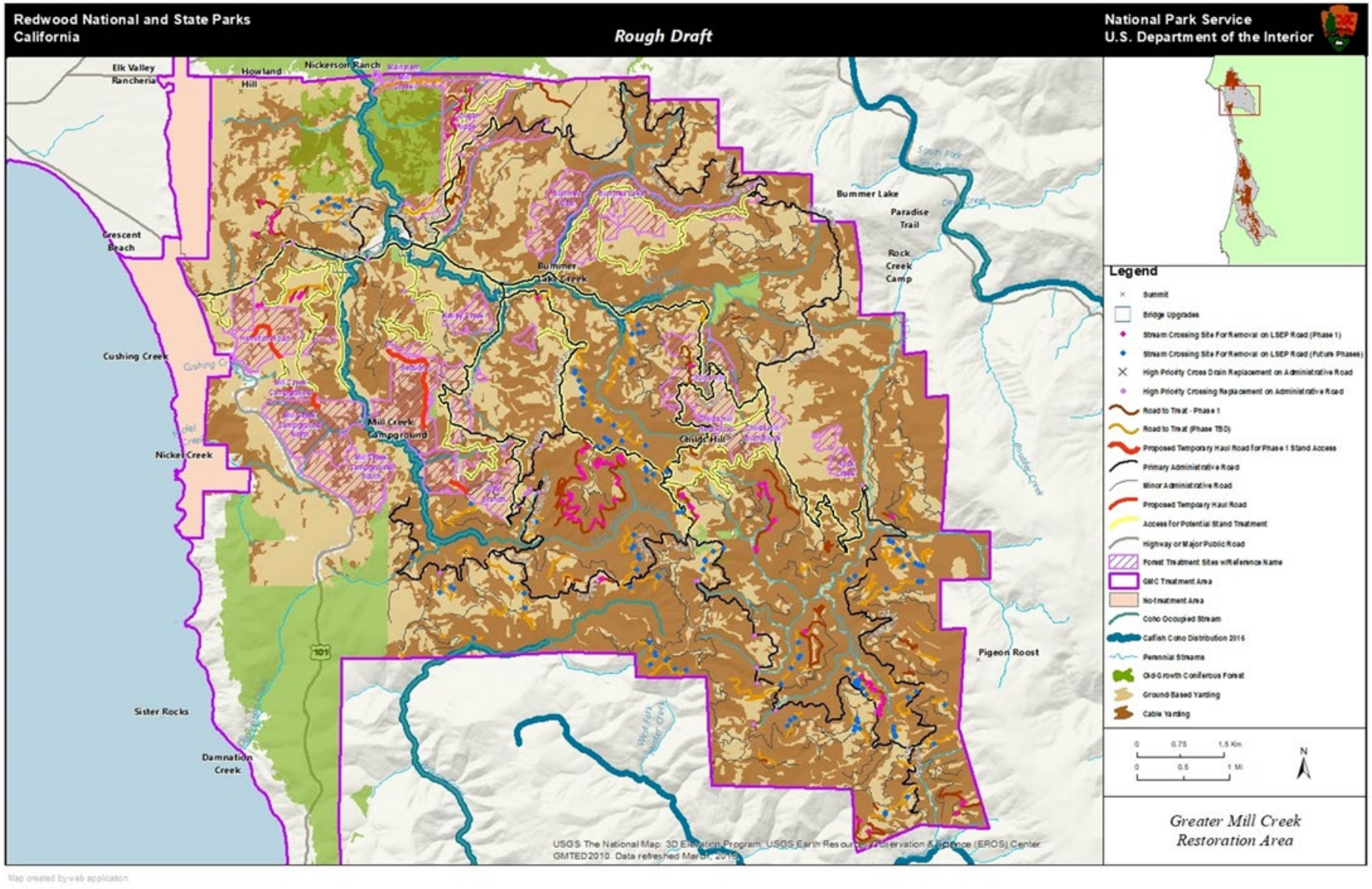

Figure 3. Location of ground-based and tethered harvest/cable yarding areas within the Program area (RNSP 2020).

Tethered harvesting systems, such as cut-to-length, are a variation on traditional ground-based operations. In tethered systems, a winch is mounted to the back of a harvester or a forwarder and secures the equipment to an anchor point. This allows that piece of equipment to lower itself down or climb up steep slopes. These types of systems differ from other ground-based operational methods in that the harvester fells, processes, and bucks the trees at the stump. Tree limbs and tops are placed in front of the harvester and are driven over as the machine moves ahead, minimizing ground disturbance. The forwarder follows in the harvester's trail, loads the cut logs on the machine, and transports the logs to the landing area. Tethered systems could be used on slopes up to 85 percent. Tethered harvesting system 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.

1.3.1.2.1.2 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 in width. All yarding corridors will be fully mulched with slash (tree tops and limbs) before the end of the NOS. Tree removal from skyline operations would generally be restricted to areas with slopes greater than 40 percent grade. All yarded logs or trees will be fully suspended in the air across any stream channels and side slopes of any type. Skyline operations to yard logs to landings and haul logs away may occur outside the NOS (June 15 - October 15) on fully rocked, all season roads and landings.

1.3.1.2.1.3 Helicopter Yarding Operations

In areas that are difficult to access, helicopter operations could be used to remove trees or portions of trees in areas where access by other means is infeasible. Trees would be cut in advance and a ground crew would assist the helicopter crew by securing trees to a cable hanging from the helicopter. The cost of helicopter operations is prohibitive in many circumstances, but may be more feasible when the wood would be used to create instream structures in areas where vehicle access is prohibited.

Helicopters will approach streams from the side during large wood placement, rather than traveling up and down stream corridors. Prior to installing the large wood, the helicopter will hover briefly over the stream to ensure the site location is correct, and then quickly drop the wood for on-the-ground placement by hand crews (Transou 2020).

1.3.1.2.1.4 Winter Log Truck Operations

Log trucks may haul outside of the NOS when operating only on fully rocked, all season roads.

1.3.1.2.2 Non-Biomass Removal

1.3.1.2.2.1 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 use will not occur. 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). Lop and scatter 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. 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 may either be treated with lop-and-scatter operations using the same prescribed silvicultural method described above or left untreated.

1.3.1.2.2.2 Fuels Reduction (Mastication)

Mastication is the process of grinding, shredding, chipping, or otherwise reducing the size of live or dead vegetation to expedite decomposition and alter fire behavior. Treatments use heavy equipment located only on roads that may reach out into a stand or material may be brought to the equipment for processing by hand. Work will only occur during the NOS on native surface roads or along fully rocked roads outside of the NOS.

1.3.2 Aquatic Restoration

Aquatic restoration includes placement of large wood in streams to create complex fish habitat. Wood placement will mostly occur in Mill Creek, East Fork Mill Creek, West Branch Mill Creek, Rock Creek and their tributaries along anadromous reaches (Figure 2) that are proposed for thinning. The first priority for wood placement will be anadromous streams adjacent to forest thinning treatments; wood placement in stream sections where thinning will not occur is a second priority.

In any given year, no more than 20 structures would be placed per sub-watershed. The amount of large wood placed in each stream will be determined by availability, logistical constraints, and access locations. Where appropriate, large wood placement will include a mixture of large, medium, and small volume stems with a target of one to 100 stems per structure. Whole tree material (larger than 15 inches in diameter) will be incorporated between riparian trees or existing large wood structures to mimic natural wood jams. The target size for the large wood is greater than 2 feet in diameter and 50 feet in length, with the rootwad attached to maximize habitat value. Single or multiple pieces of large wood would be wedged between riparian trees or other existing structures to anchor the wood in place. Considerations in selecting locations for large wood locations include: 1) adjacency to thinned stream sides, 2) current stream morphology, 3) spacing, 4) equipment access, and 5) an assessment of effects to the streambed,

floodplain, and downstream infrastructure, such as bridges and roads (RNSP 2020). Where opportunities exist, hardwoods will be placed instream in such a way to promote continued persistence, with some root structure still attached. Large wood will be placed from July 1 to October 15 when streams are at their lowest flow. Four techniques will be used to place large wood in aquatic habitat:

- With heavy equipment: Large wood will be placed in streams using heavy equipment, usually from roads adjacent to stream channels. Crane mats may be used if adjacent road access is lacking and floodplain soil conditions are dry to allow for heavy equipment to carefully cross floodplains to access large wood locations. Heavy equipment will not cross streambanks, or streams. Any soil rutting caused by moving large wood will be fully mulched.
- Without heavy equipment: Entry to streams will be on foot and crews will use chainsaws to drop wood into the channel, or large wood may be pulled into the stream from the banks and/or floodplain with a grip hoist. Any soil rutting caused by moving large wood will be fully mulched.
- By helicopter: Helicopters will place wood in target locations where heavy equipment use and hand placement are not feasible. Sources of large wood will be stockpiled for future placement by helicopter.
- Large alders will be pushed into the channel from the bank with roots remaining within the banks to the extent possible. These trees would remain alive for some time, and their persistence will help recruit additional wood. Selective removal of riparian trees by pushing them into the stream would not create large openings in the canopy. No opening will be longer than 50 feet, nor will openings be adjacent to each other.

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

1.3.3 Road, Landing and Bridge Replacement Activities

Road management activities include: 1) temporary road construction, 2) temporary road re-construction, 3) replacement of five bridges, 4) log landing reconstruction, 5) road removal, and 6) maintenance of permanent roads used for log hauling. Table 4 summarizes total road mileage for temporary roads and existing roads proposed for reconstruction and removal. Table 5 summarizes maintenance on permanent roads required due to log hauling and Figure 2 displays road location by treatment and/or use type.

Table 4. Road type and treatment, total mileage and number of crossings, and maximum mileage or crossings treated per year.

Road Type and/or Treatment	Phase 1 Mill Crk. Total Mileage/ Crossings (Max Mi. or Crossings/Year)	Phase 1 Rock Crk. Total Mileage/ Crossings (Max. Mi. or Crossings/Year)	Future Phases Mill Crk. Total Mileage/ Crossings (Max. Mi. or Crossings/Year)	Future Phases Rock Crk. Total Mileage/ Crossings (Max. Mi. or Crossings/Year)	Total Mileage/ Crossings All Phases
New Temporary Road Construction and Removal	2.5 mi. (<1.25 mi. /year)	0	0	0	**2.5 mi.**
Existing Road Reconstruction and Removal	3.76 mi. (<2.33 mi. /yr.)	0	18.62 mi. (<10 mi. /yr.)	12.16 mi. (<10 mi./yr.)	**34.54 mi.**
Existing Road Removal	11 mi. (<10 mi./yr.)	5.66 mi. (<5.66 mi./yr.)	0	0	**16.66 mi.**
Cumulative Road Removal	17.26 mi. (< 10 mi./yr.) cum. total	5.66 mi.	18.62 mi. (<10 mi./yr.) cum. total	12.16 mi.	**53.7 mi.**
Cumulative Existing Crossings Removal	56 (30)	25 (25)	58 (30)	48 (30)	**187**

Table 5. Permanent road maintenance work associated with log hauling in the Program area.

Treatment Type	Phase 1 Mill Creek Maximum/Year (Average/Year)	Phase 1 Rock Creek Maximum/Year (Average/Year)	Future Phases Mill Creek Maximum/Year (Average/Year)	Future Phases Rock Creek Maximum/Year (Average/Year)	Total Mileage/Crossings All Phases
Road Miles Maintained	20 (20)	0	20 (20)	20 (20)	N/A
Stream Crossing Culverts Replaced	4	0	5 (<2)	5 (<2)	Unknown

1.3.3.1 Temporary Road Construction and Use

Approximately 2.5 miles of temporary roads will be constructed as extensions from existing roads to access forest restoration areas and haul logs. All new road construction is temporary and these roads will be removed as soon as adjacent forest restoration is completed. The 2.5 miles of temporarily constructed roads are all on upper slopes or ridges, outside of all intermittent and larger drainages (Figure 2). Ephemeral drainages will be crossed by new temporary roads. Construction of these temporary roads will occur during the NOS. 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 used as they become available to ensure the project is completed and winterized prior to the onset of wet weather.

All temporary roads will be out-sloped to the maximum extent possible, and road construction alignment would minimize drainage crossings. Where they do occur, culverts will be sized for 100-year flood events if the road will be used for multiple operating seasons. If used for multiple operating seasons, temporary roads will be treated as follows to reduce erosion:

- Grading exposed road and landing surfaces to allow water to drain across them without concentrating or ponding or rilling.
- Installing rolling dips/drains to drain steeper sections of road.
- Clearing clogged drainage ditches or culverts.
- Installing silt fences and other erosion control devices where necessary to convey concentrated water across exposed road and landing surfaces.
- Removing road-stream crossing that do not meet 100-year flood discharge standard for flow, sediment, and debris.
- Mulching exposed soil surfaces.

1.3.3.2 Temporary Road Reconstruction and Use

Abandoned logging road reconstruction will occur during all phases (Table 4) of Program implementation. Approximately 3.76 miles of abandoned logging roads may require re-construction to access areas for restoration in Phase 1. Remaining abandoned logging roads (18.62 miles in the Mill Creek watershed and 12.16 miles in the Rock Creek watershed) may require reconstruction in future phases. Road distances reconstructed in any given year will be variable, from no reconstruction to a maximum of 10 miles of reconstruction in a year. However, it is likely that the 18.62 miles of road reconstruction in the Mill Creek watershed will be distributed across at least 15 years. The reconstructed roads will first be improved to allow vehicles to use them and would then be removed after forest restoration treatments are completed in the area accessed by the roads. Proposed reconstructed roads do not contain culverts that cross anadromous fish bearing stream reaches (Figure 2).

Reconstructed roads will be cleared of vegetation, road surfaces graded, and stream crossings rebuilt where needed. A maximum of 20 non-anadromous stream crossing culverts may be replaced in any given year per watershed (Mill Creek and Rock Creek). The limitation on non-anadromous stream crossing replacements will be shared with the DNCRSP routine road

maintenance program. RNSP estimates (RNSP 2020) that a typical re-constructed abandoned temporary road would require two to six stream crossing replacements. An unlimited number of non-hydrologically connected ditch relief culverts may be replaced in any given year along reconstructed roads.

Single season use roads would be removed at the end of the dry season and would not be reoccupied in following years. Roads needed for multiple years would be constructed using more robust drainage structures, including multi-layer headwalls and tail walls and hardened road surfaces, to facilitate ephemeral drainage. All disturbed soil areas adjacent to multi-season use drainage structures will be fully mulched. Temporary stream crossings on multi-season roads would be sized to pass the 100-year recurrence interval discharge of flow, sediment, and debris and would be capable of holding highway rated loads. All multi-season use native surface roads will be winterized to prevent erosion in the same manner as the temporary roads described in the previous section.

No construction/reconstruction work will occur during the winter or spring before 15 June. 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. Roads will be winterized at the end of the NOS, or during the NOS if significant rains are forecast that may cause exposed roads to erode. If NOAA's National Weather Service Quantitative Prediction Forecasts predict 1-inch or greater rainfall during one or more of their 6-hour prediction windows, then preventative best management practices (BMPs) will be implemented to prevent erosion and operations will temporarily cease during the NOS.

1.3.3.3 Water Drafting Guidelines

If needed (e.g., to control dust from roads) water drafting would be conducted as described in the NMFS Water Drafting Specifications (NMFS 2001). These specifications include the following:

- Screening devices no greater than 3/32 inch used for water drafting pumps to avoid removal of aquatic species, including juvenile fish, amphibian egg masses, and tadpoles, from aquatic habitats.
- Water drafting sites planned to avoid adverse effects to special-status aquatic species and associated habitat, in-stream flows, and depletion of pool habitat.
- All drafting sites would occur outside of occupied coho salmon habitat.
- Seek streams and pools where water is deep and flowing, as opposed to streams with low flow and small isolated pools.
- Pumping rate shall not exceed 350 gallons per minute (gpm).
- The pumping rate shall not exceed 10 percent of the stream flow as measured by a visual observation of water level in relation to a moss line or rock to determine if stream level is dropping due to pumping.
- Operators shall keep a log on the truck containing the following information: Operator's Name, Date, Time, Pump Rate, Filling Time, Screen Cleaned (Y or N), Screen Condition, and Comments.

1.3.3.4 Bridge Installation or Replacement

The five bridges that will be replaced are located in the lower sections of Mill Creek tributaries, within occupied coho salmon habitat (Figure 2). Installation of three bridges along the East Fork of Mill Creek (Picnic 0.12, Hamilton Road 4.33, and Childs Hill 2.7) will likely occur in 2020 or 2021. The other two bridges (Rock Creek 20.63 and West Branch Mill Creek 0.06) will likely be installed in 2023. The existing bridges at all of these sites are either failing, or are not weight rated for log trucks and heavy equipment. Proposed bridges are modular style, prefabricated panel steel bridges (e.g., Bailey Bridge or Acrow Bridge) or precast concrete bridges with steel stringer I-beams (e.g., Kernen Bridge). Bridges will be erected by: 1) launching the bridge (progressive cantilever) from one abutment to another, or 2) hoisting in place by a crane. Bridges, and their engineered abutments, will be sized and located to pass the 100-year recurrence interval discharge of flow, sediment, and debris and would be capable of holding highway rated loads. No in-channel work would occur during bridge or abutment installation. Existing bridges will remain in place or be removed by a crane, and existing roads will be used and built up to approach the newly installed bridges. If existing bridges are removed, the abutments, which are made of cabled old growth log sections, will remain in place to minimize impacts to stream banks.

Bridge installation involves the use of heavy equipment to construct abutments and road approaches and to move and align bridge parts (e.g., steel stringers). Hand tools will be used to assemble the modular bridge on dry ground. The bridges will be moved into place on rollers or by crane, and suspended over the creek, thereby avoiding disturbance to the stream channel. Proposed bridges would extend up to 200 feet to span the channel, and all bridge materials will be kept out of stream channels.

New engineered abutments would be constructed on top of, or through, the existing road on both sides of the stream, outside the 100-year floodway. The existing bridge would be used as access for equipment and tools that are needed during abutment construction. At one site with no existing bridge (Picnic Road 0.12), abutment-building materials would be hand-carried across the stream, and a concrete pump truck would be used to span the reach from the accessible side to pour abutment foundations. No stream bank side excavation is necessary with this abutment design. No concrete will be allowed to enter any stream and all concrete cleaning stations will be contained and away from the active stream channel. No pile driving is necessary at any of the bridges.

For panel style bridges, a building pad would be developed on one side of the stream, away from the stream banks, for a level bridge assembly area. The building pad would extend out from the existing road in alignment with new bridge placement and up to the level of the new abutments for the bridge. Bridge lengths can vary depending on stream widths because of the modular design. Pad height could vary from 4 to10 feet high and from 50 to 200 feet long. Pads would typically be 35 to 40 feet wide to provide a safe and adequate bridge assembly area. Pads will be built with imported gravel, volumes range from 450 to 2,500 cubic yards. The proposed bridges fully span stream channels during construction, and bridge materials will not enter stream channels.

Once new bridges have been launched and/or lifted into place, road approaches would be constructed. Bridge building pads would be regraded to form appropriate road approaches to bring the existing road up to the new bridge decking. Imported aggregate would be used to form approach roads on the opposite side. Bridge approaches would be stabilized to prevent sediment discharge. They would be shaped with an outsloped or crowned profile to allow drainage away from the stream channel. Erosion control (e.g., fiber rolls) would be installed according to specifications described in the California Stormwater Quality Association (CSQA) Stormwater Best Management Practices Construction Handbook.

Old bridges will be dismantled in the opposite order as new bridges are erected. Excess gravel from ramps will be removed and original road grade restored. The new bridges will not require stripping or painting to maintain. All bridgework will be completed during the NOS.

1.3.3.5 Temporary Landing Construction and Reconstruction

Landing construction will occur along the 2.5 miles of new road, and along existing roads in the second growth portion (2,750 acres) of the original DNCRSP. The new temporary roads and landings will be located along the tops of hills or along ridge tops (Figure 2). New road and landing locations avoid geologically unstable areas and will be located outside of equipment exclusion zones. In addition, new landings will be no more than 0.25 acre. The landings will be removed along with the temporary roads immediately after forest restoration activities are completed.

With the exception of the 2,750 acre portion noted above, existing landings are abundant across the Program area along existing permanent/administrative roads and abandoned roads that will be reconstructed. These landings will be used in all areas accessed by those road types. Reconstruction will involve clearing brush and small trees, and minor road surface grading. Most reconstructed roads and landings will be used for one season and removed before October 15. Under rare circumstances when road and landing removal will not be completed during the NOS, roads and landings will be winterized as described previously. All landings will be out sloped.

Some landings may be accessed during winter hauling. Winter operations landings will be winterized (i.e., fully covered in compacted rock sufficient to prevent surface erosion). If the landing occurs on a reconstructed road, it will be removed along with the temporary road once restoration activities are completed.

1.3.3.6 Road Removal

Road removal will occur after forest thinning and aquatic restoration activities are complete in an area accessed by a road. Once road access to an area is no longer needed for restoration, all new, reconstructed and abandoned roads (even those not reconstructed for use in this Program) will be removed. Total road removal mileage during each phase is summarized on Table 4 and shown on Figure 2. Road removal will entail removing fill from stream channels, excavating side cast fill material, and restoring drainage patterns to reduce the potential for material to erode and be deposited in streams. No roads or road-stream crossings slated for removal cross anadromous stream reaches (Figure 2). The number of road-stream crossings to be removed per watershed are shown in Table 4. The approximate number of stream crossings to be removed during road

removal and their distances from anadromy are shown in Table 6. Stream crossings that will be replaced as part of administrative road maintenance to prepare roads for log hauling are described in section 1.3.3.7 below.

Table 6. Approximate number of stream crossings to be removed by watershed. Distances from suitable anadromous habitat are in stream miles.

	Mill Creek	Rock Creek
Approximate number of crossings	114	73
Mean distance from anadromy	0.9	6.9
Standard Deviation distance	0.4	1.3
Range distance	0.04 – 1.5	4.5 – 7.9

For streams with substantial surface flow, water will be diverted away from excavation areas to reduce turbidity and eliminate saturation of the crossing fill as it is excavated. A small cofferdam may be built upstream using water-filled baffles or sand bags filled with on-site material. If a cofferdam would be ineffective due to substantial subsurface flow, a small subgrade collection point will be dug with the excavator bucket. Stream flow is gravity fed or pumped around the worksite and discharged into the stream below the worksite. When necessary, turbid water pumped from within the construction site will be discharged upslope from the channel to allow for filtration before returning to the channel. When stream flow is minor and diversion is not possible (i.e., streams with subsurface seepage or flow too low to pump), filter fabric will be installed downstream of excavation site.

When removing the road-stream crossing, the goal is to uncover the buried natural stream and re-establish the original stream grade. The large wood that is encountered during the excavation is either placed in the channel to augment the natural channel armor, placed on the side slopes, and/or spanned across the newly restored channel for future recruitment.

1.3.3.7 Maintenance of Administrative/Permanent Roads Used For Log Hauling

Approximately 27 miles of primary (i.e., trunk) and 24 miles of minor (i.e., secondary) permanent/administrative roads will be used to haul logs during Phase 1 (Figure 2). Although the exact number of miles of permanent/administrative roads that will be used in Phases 2 and 3 is unknown, approximately 40-50 miles of existing permanent/administrative roads will be used to haul logs (in total) during the 30 year Program.

Maintenance on these permanent roads will include road brushing, road grading, drainage ditch clearing, and stream crossing and ditch relief culvert replacement [described in detail in Appendix B of the BA (RNSP 2020)]. All of the above listed road maintenance activities will occur on approximately 20 miles of administrative road used for log hauling per year. The four stream crossings proposed for replacement in Phase 1 have been identified, but locations for crossing replacement during future phases have not been identified (although the roads have all been inventoried). All of the Phase 1 crossing replacements are within the Mill Creek watershed.

For future phases, a maximum of five, and an average of two crossings would be replaced per watershed, per year (i.e., about two per year in Mill Creek and in Rock Creek) as part of road maintenance for log hauling. In all phases of the Program, none of the stream crossings proposed for replacement on permanent roads are on anadromous streams.

1.3.4 Summary List of Measures to Minimize Impacts to Coho Salmon

- All ground disturbing work including: 1) road and landing construction and reconstruction, 2) crossing improvement or installation, 3) yarding, log hauling, and associated truck and heavy equipment native surface road use, 4) road maintenance, 5) ground based yarding, and 6) road and crossing removal, will occur during the NOS and only during dry soil conditions. No ground disturbing 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 used as they become available to ensure the project is completed or fully winterized prior to the onset of fall rain.
- 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. If NOAA's National Weather Service Quantitative Prediction Forecasts predict 1-inch or greater rainfall during one or more of their 6-hour prediction windows then BMPs will be implemented to prevent erosion and operations will temporarily cease during the NOS.
- Large wood placement in streams will occur during the NOS with the goals of working during low flows when adult coho salmon are not in the Program area. 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. Wood placement would be completed prior to the onset of fall rain and the influx of adult coho salmon into the Mill Creek watershed. The earliest adult coho salmon typically arrive in the Smith River system in early November and are last observed in mid-February (Walkley and Garwood 2017).
- Temporary haul roads and crossings that will be used within one season will be completely removed before the onset of winter rains, and temporary roads that will be used for more than one season will be fully winterized before each winter they remain on the landscape.
- Replaced culverts at multi-season stream crossings will be designed to withstand 100-year flood events.
- An annual maximum of five stream crossing culverts will be replaced per watershed (Mill Creek and Rock Creek).
- A maximum of 30 road-stream crossings per year will be removed per watershed. Most years will be well below this maximum.
- A maximum of 10 miles of road per watershed (Mill Creek and Rock Creek) will be removed per year. Most years will be below this maximum.
- No roads to be reconstructed and/or removed contain culverts that cross anadromous fish bearing stream reaches.

- Bridge abutments (all of which are located on coho salmon occupied stream reaches) will be installed entirely outside of the bankfull stream channel and designed to withstand 100-year flood events.
- 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.
- A maximum of 2,000 acres of forest will be thinned per year. A maximum of approximately 30,000 acres of forest may be thinned over the course of the 30-year restoration program.
- Forest thinning within inner zone riparian areas will not decrease conifer canopy cover below an average of 80 percent (anadromous areas) or 60 percent (other streams) when measured 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 unless tethered harvesting systems are used.
- Variably sized (depending on stream type) heavy equipment exclusion zones will be used on all streams (Table 3) 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 no trees will be cut.
- All ground-based yarding skid trails will be out sloped and fully covered in mulch (slash) immediately after use and before the onset of winter rains. If skid trails are on fall lines or have a steeper linear grade than other prescriptions such as heavy mulch and/or installation of rolling dips at appropriate intervals to reduce runoff accumulation will be used.
- Full tree suspension (i.e., two-end suspension) will be used on all cable yarding corridors fully crossing stream channels and their adjacent stream slopes.
- All cable yarding corridors will be fully covered in mulch (slash) immediately after use and before the onset of winter rains.
- All re-contoured roads and excavated stream crossings will be mulched once completed to decrease post-road/crossing removal sediment yield into streams. Stream crossing sites will be mulched by hand to ensure 80 percent coverage and soil contact using masticated brush derived from the project.
- Replaced culverts are placed at grade thus preventing any outlet area erosion. Outlet stream energy will be dissipated with large rock to prevent sidewall erosion. Excavated fill will be fully mulched when replaced to prevent surface erosion.

1.3.5 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:

- Annual notification of specific restoration actions, including winter operations, that are going to take place, their extent and locations by April 30 of the same calendar year.

Prior to future Program phases, coordination will also occur on:

- Location of forest thinning and road construction, reconstruction and removal work within each year of each phase.
- Specific road and stream crossing reoccupation, use, maintenance, and removal designs not already described in this Proposed Action section, if any.
- Locations of large wood placement in streams and riparian planting.

Monitoring will be conducted in all phases of the Program in East Fork and West Branch Mill Creek and Rock Creek. Monitoring will include stream turbidity (as a proxy for suspended sediment), stream temperature, and flow rates. The specific design of the water quality monitoring program will be discussed and agreed to by all agencies during ICT meetings.

Post project annual verification reporting will include:

- Miles and locations of temporary roads reconstructed and constructed.
- Types, number and locations of temporary crossings reconstructed.
- Miles and locations of roads winterized.
- Miles and locations of administrative roads maintained that will be used for hauling logs.
- Locations and numbers of crossing replaced on administrative roads used for hauling logs.
- 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 will be reported in real time.
- Any non-compliance with best management practices including but not limited to EEZ violations.

1.3.6 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 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 coho salmon (i.e., following or not following a minimization measure would have no effect positive or negative) will be documented in the annual verification reporting. BMPs will always be implemented.

We considered whether or not the proposed action would cause any other activities and determined that it would not.

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

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS 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 as a whole for the conservation of a listed species" (50 CFR 402.02). The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, we add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: 1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species, or 2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of SONCC coho salmon 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 for 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.

2.2.2 Status of Species and Critical Habitat for SONCC Coho Salmon

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 (McElhany 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) to determine the general condition of each population and factors responsible for the current status of the SONCC coho salmon ESU. We use these population viability parameters as surrogates for numbers, reproduction, and distribution, the criteria found within the regulatory definition of jeopardy (50 CFR 402.20).

2.2.2.1 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.

2.2.2.2 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 (Good et al. 2005, Williams et al. 2011, and Williams et al. 2016). Extant populations can still be found in all major river basins within the ESU (70 FR 37160). However, extirpations, loss of brood years, and sharp declines in abundance (in some cases to zero) of SONCC coho salmon in several streams throughout the ESU indicate that the 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.

2.2.2.3 SONCC Coho Salmon Critical Habitat Status

The condition of SONCC coho salmon critical habitat, specifically its ability to provide for 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: overfishing, artificial propagation, 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, 64 FR 24049, 70 FR 37160, 70 FR 52488). Diversion and storage of river and stream flow has dramatically altered the natural hydrologic cycle in many of the streams within the ESU. Altered flow regimes can delay or preclude migration, dewater aquatic habitat, and strand fish in disconnected pools, while unscreened diversions can entrain juvenile fish.

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

The factors that caused declines 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 of SONCC coho salmon (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 this 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 coho salmon subject to this consultation. In the coming years, climate change will influence the ability to recover coho salmon in most or all of their watersheds. Coho salmon is 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 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 43 to 84 cm rise by the end of the 21st century (IPCC 2019). This rise in sea level will alter the habitat in estuaries and either provide 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 coho salmon in Northern California.

As more fully described in the two following sections, the Program area is contained within the Mill Creek and Rock Creek basins of the Smith River watershed. The Smith River watershed contains an independent population of SONCC coho salmon. NMFS' SONCC Coho Salmon Recovery Plan (2014) describes that the Smith River population is core for recovery of SONCC coho salmon, and that in general, the Mill Creek sub-basin: 1) provides good to very good habitat with cool water, 2) is a stronghold for coho salmon, 3) provides an important anchor for species recovery (NMFS 2014), now and into the future, especially when considering climate change.

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 Mill Creek and Rock Creek sub-basins of the Smith River watershed (Figure 1) within RNP and DNCRSP. The action area includes suitable coho salmon stream reaches (approximately 31.5 stream miles) and associated riparian habitat within the Mill Creek watershed, and all potentially suitable coho stream and riparian habitat within the Rock Creek watershed. Coho salmon have not been detected within Rock Creek during numerous surveys over the past 30 years. However, based on occupancy of Chinook salmon and stream gradient as indicators, the most downstream eight stream miles of Rock Creek are considered potentially suitable coho salmon habitat, and is fully accessible to coho salmon as designated critical habitat (RNSP 2020).

The action area is 34,080 acres, encompassing the treated sub-basins and their stream miles (all bed, bank, channel and riparian areas). The action area within Rock Creek extends downstream to its mouth, and within Mill Creek extends downstream about 3 miles past the confluence of East Fork Mill Creek and West Branch Mill Creek, and past the DNCRSP boundary. These distances are the extent to where temporary increases in turbidity may occur (RNSP 2020). The Program area also contains small areas proposed for forest restoration in the upper, headwater portions of Hunter, Wilson, Terwar, Nickel and Damnation creeks, which are all watersheds just over the ridge from either Mill Creek or Rock Creek. These areas are located on ridgetops, not near creeks or riparian areas, and RNSP determined that forest restoration would have no effect on coho salmon or its designated critical habitat in these watersheds, and thus, these areas are not part of the action area considered in this consultation (RNSP 2020).

2.4 Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The Program area is located in the Mill and Rock creek watersheds within RNP and DNCRSP. The area is a high priority for restoration because of its location in context with surrounding old growth forests, and because Mill Creek is a coho salmon stronghold on the North Coast of California. The proposed restoration improves forest structure, species composition, and understory stand development in the action area and accelerates the connectivity of habitat between adjacent large old growth redwood forest patches, as well as directly improving aquatic habitat by additions of large wood. 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 action area, Rattlesnake Ridge, is approximately eight miles from the coast, still within the coastal summer fog zone (http://climate.calcommons.org).

The threat to SONCC coho salmon 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). In future years and decades, we expect that Mill Creek will continue being a refuge for SONCC coho salmon within the Smith River watershed and within the SONCC ESU, and that the critical habitat in the action area has a very high conservation value for coho salmon into the future.

2.4.1 Historical Uses

Portions of the action area were extensively logged from 1908 to 1939 and from 1954 to 2000 when private commercial timber companies owned the land. Over 27,000 acres of forest were intensively harvested, and approximately 290 miles of log haul roads and 29 miles of secondary roads were built (RNSP 2020). The logging operations expanded over the years to include processing redwood on-site and acquisition of the Rock Creek watershed in the 1960s. Most of the logging operations were typical for the region in that they consisted primarily of clear-cuts that were often burned and/or sprayed with herbicides to remove slash and competing vegetation. The planting strategy and site preparation favored Douglas-fir in most areas, although redwoods were also planted. After harvesting, the resulting second- and third-growth plantations were thinned and otherwise managed to maximize growth and site potential until harvest when trees were about 50 years old.

These historical uses degraded aquatic habitat in the action area, in particular, Mill Creek and its large tributaries lack large pieces of wood needed for complex fish habitat, as compared to nearby reference stream (i.e., Prairie Creek) for large wood stream density. However, water quality is good with cool water temperatures and relatively low levels of suspended sediment when compared to other North Coast streams (RNSP 2020). After acquiring most of the action area in 2002, CDPR began restoration efforts in 2003 that are consistent with RNSP planning guidance, and has since thinned approximately 5,470 acres of overly dense forests, removed over 70 miles of roads, and installed 121 large wood habitat structures into streams.

2.4.2 Watershed Description

The Program area, approximately 34,080 acres, is mostly within the stable geology of the Smith River Basin. The Mill Creek watershed can be further subdivided into three primary sub-watersheds: 1) mainstem Mill Creek (5,870 acres), 2) West Branch Mill Creek (7,120 acres), East Fork Mill Creek (10,660 acres). Based on NOAA intrinsic potential stream data (Agrawal et al. 2005), the average stream gradient of mainstem Mill Creek is 0.5 percent. Excluding tributaries, the East Fork average is 1.4 percent and the West Branch average is 1.6 percent.

Aquatic biodiversity within the Program area is high, especially in Mill Creek and its tributaries, due to low stream gradients and proximity to the lower Smith River. Juvenile and adult coho salmon are found throughout the Mill Creek portion of the Program area and numerous native fish, herpetofauna, and freshwater mussels are also present throughout the action area (Walkley and Garwood 2017). Mill Creek, one of the most productive salmonid tributaries of the Smith River, is the most important spawning tributary for coho salmon in the Smith River basin (Walkley and Garwood 2017).

As shown on Figure 2, approximately 31.5 mi. of known spawning and rearing habitat are available to coho salmon in the Mill Creek watershed (Walkley and Garwood 2017). Approximately 9.8 mi of coho salmon habitat are located in the West Branch sub-basin and 10.9 mi in the East Fork sub-basin, with the rest in the mainstem sub-basin. In most of the fish-bearing reaches of mainstem Mill Creek and East Fork Mill Creek, shallow bedrock is present with limited floodplain connectivity due to confinement by bedrock or artificial fill (i.e., roads, berms, and fill at the mill site). The fish bearing reaches of West Branch Mill Creek are predominantly alluvial with a relatively broad active floodplain (RNSP 2020).

2.4.3 Status of Listed Species and Critical Habitat in the Action Area

Coho salmon occurring in the action area belong to the Smith River population of SONCC coho salmon, considered a core population for the species, but likely very close to their depensation threshold of 325 adults (NMFS 2014). Depensation refers to the number of spawners needed for survival of the population, and being near depensation indicates that the population is at a higher risk of extinction. The most recent NMFS status review for coho salmon (NMFS 2016) estimated the number of coho salmon in the Smith River spawning each year is 355, based on 2-years of redd data at the time, but consistent with past estimates suggesting a low, but stable population. The NMFS (2014) SONCC coho recovery plan describes that the Smith River needs 6,800 coho salmon spawners to be at low risk of extinction.

The key limiting stresses for the Smith River population are impaired estuary/mainstem function and lack of floodplain and channel structure, as they have the greatest impact on the population's ability to produce sufficient spawners to support recovery (NMFS 2014). The juvenile life stage is most limited, primarily due to a lack of access to, and decrease in the quantity of high quality winter (NMFS 2014), summer, and estuarine rearing habitat. As previously described, the vast majority of coho salmon in the Smith River spawn and rear in the Mill Creek watershed (NMFS 2014).

2.4.3.1 Coho Salmon in the Action Area

In 2011, the Smith River Alliance (SRA) and the CDFW initiated an intensive coho salmon monitoring program to assess coho salmon adult and juvenile abundance throughout the Smith River basin, including in Mill and Rock Creeks. These surveys confirmed that Mill Creek, and in particular the West Branch and East Fork sub-basins, are the primary producers of coho salmon in the Smith River basin (Walkley and Garwood 2017). Since 2016/2017, CDPR has assisted CDFW and SRA in continuing the surveys. Redd estimates were highest in 2011/2012 at about 475 redds, and lowest in 2016/2017 with about 100 redds (average of 215 redds). These annual variations are exacerbated by drought conditions experienced in California from 2011 to 2017. Walkley and Garwood (2017) found that adult coho salmon typically arrive in the Smith River system in early November and are last observed in mid-February. Run-timing is highly coordinated with winter storm events as prolonged dry periods and low flows likely inhibit coho salmon movement into and within Mill Creek (Walkley and Garwood 2017).

Although the Mill Creek salmonid outmigrant-trapping program is one of California's longest running smolt trapping programs in the SONCC coho salmon ESU, data quality improved in

2014 when one rotary screw trap replaced multiple pipe traps. Since the more accurate trapping began in 2014, juvenile smolt estimates have ranged from about 7,500 to about 9,500 (Walkley et al. 2017.) Additionally, CDFW, SRA, and other partners installed and operated three passive integrated tag (PIT) antennas and conducted fall tagging efforts of juvenile coho salmon to investigate key life-history traits such as overwinter survival rates and early emigration of juvenile coho salmon out of Mill Creek.

Juvenile summer abundance and spatial distribution in the Program area has been derived from snorkel survey counts standardized via either electroshocking (Hankin and Reeves 1988) or multiple independent dive passes (Larson 2013, Walkley and Garwood 2017). The Rellim Redwood Company and the Mill Creek Fisheries Monitoring Program (Larson 2013) generated summer abundance estimates of juvenile coho salmon in the Program area from 1994 through 2011. Population estimates were made for four distinct habitats: slow pools, deep pools, runs and riffles. Excluding years with unreliable estimates, summer juvenile coho salmon estimates ranged from 2,659 (2010) to 24,527 (2005) in the West Branch and 1,556 (2010) to 12,067 (2005) in the East Fork. Summer juvenile coho salmon abundance estimates were higher in the West Branch for all years except 2009 (Larson 2013).

Beginning in the summer of 2012, SRA and CDFW implemented snorkel surveys to estimate summer spatial distribution of coho salmon and other salmonids throughout a randomly selected set of reaches with pools defined as the primary sampling unit (Walkley and Garwood 2017). The sample frame for this effort encompasses the entire Smith River basin, including Mill Creek and Rock Creek, and incorporates both reach-level and pool-level occupancy while accounting for imperfect detection rates. Not all reaches in the Program area are surveyed annually. Figure 4 displays the Mill Creek and Rock Creek sample frame and provides a summary of juvenile salmonid observations made from 2012 through 2016. Note the lack of coho salmon detected in Rock Creek.

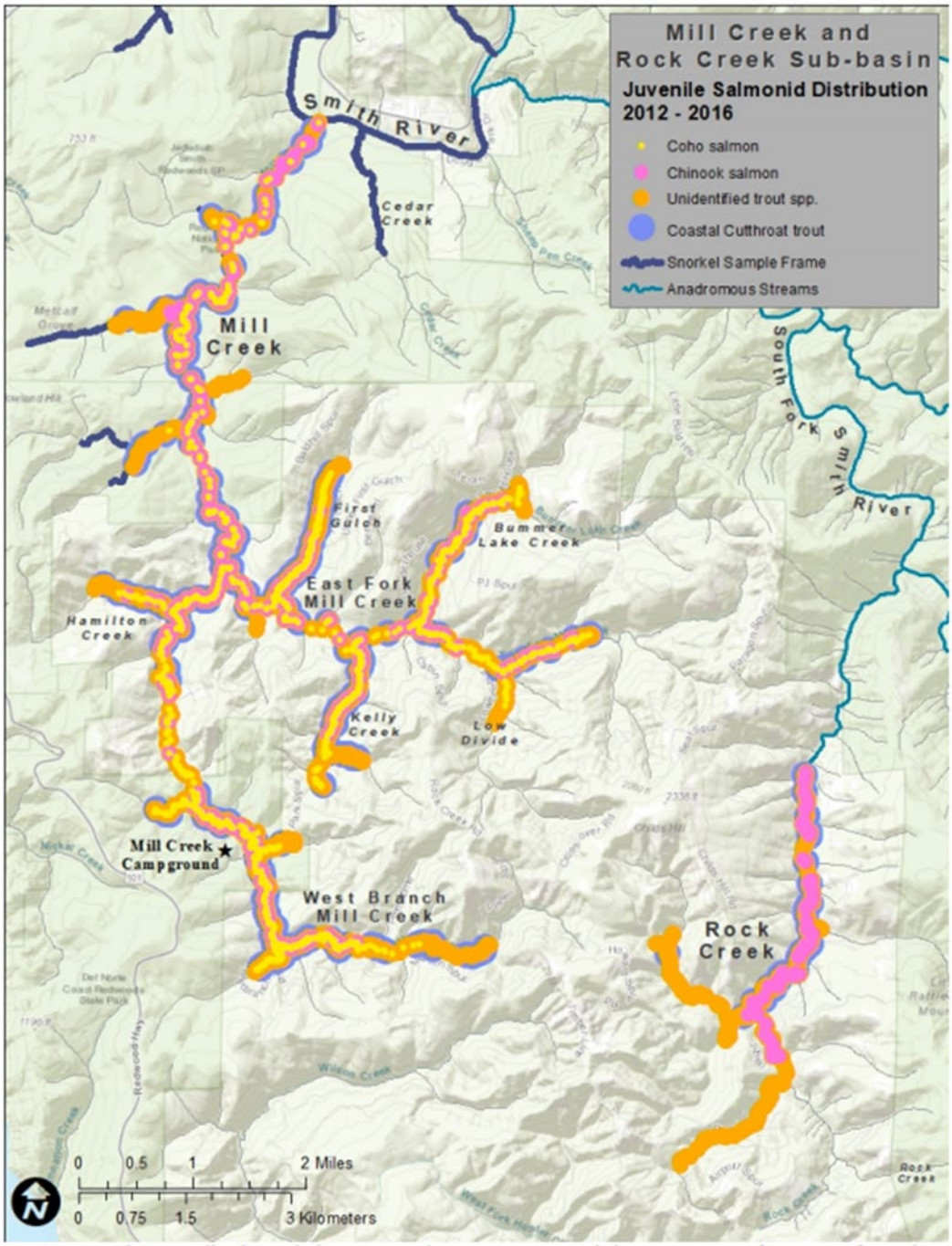

Figure 4. Map showing all salmonid observations during summer snorkel surveys across five years of sampling (2012 – 2016) in Mill Creek and Rock Creek sub-basins (Walkley and Garwood 2017).

2.4.3.2 Critical Habitat in the Action Area

The condition of SONCC coho salmon critical habitat in the action area, 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.

Water quality and quantity in the action area is good to very good. Water temperature data have been collected at various sites on or near the Mill Creek property since 1973 (Winzler and Kelley 1980, Madej et al. 1986). Peak water temperatures in Mill Creek watershed ranged from 18° C to 21° C at various sites during summer sampling that occurred between 1973 and 1980 (RNSP 2020). RNSP staff also collected data near the Mill Creek Campground during the summers of 2006–2009, during which time minimum temperatures reported were 10.79° C in the West Branch and 10.17° C at the mouth of Mill Creek and maximum temperatures reported were 17.03° C in the West Branch and 19.42° C at the mouth of Mill Creek.

The Maximum Weekly Average Temperature (MWAT) is the mathematical mean of multiple, equally spaced, daily temperatures over a period of 7 consecutive days. MWATs range from a low of 13.8° C in upper reaches of West Branch Mill Creek to a high of 18.8° C in lower Rock Creek (RNSP 2020). Most locations in the action area have MWATs 14°-15° C, indicating cool summer water temperatures for coho salmon (RNSP 2020). Dams or large diversions do not impair hydrologic function in the action area.

Pool habitat in the action area is also good to very good in the action area, with the percent of the channel in pools at 64 percent for West Branch Mill Creek and 50 percent in East Fork Mill Creek, as compared to 64 percent in Prairie Creek, used a reference stream. Mean pool depths exceed Prairie Creek in both West Branch and East Fork, and pool spacing compares favorably with Prairie Creek as well (RNSP 2020).

Approximately 170 instream wood structures have been constructed in the East Fork Mill Creek over the last 25 years, 121 of these were installed by CDPR. Results have shown that more complex structures, with a higher volume and piece count of large woody debris (LWD), were more effective than simpler structures in restoring the desired conditions for fish habitat (e.g. more scour pools, larger and deeper pools, accumulation of spawning gravels, and overall habitat heterogeneity). Furthermore, research shows the intended function of these wood loading efforts persist more than ten years after their implementation (Rodriquez 2018). Nevertheless, wood volumes recently documented in the East Fork Mill Creek are still low when compared to reference streams (Garwood and Deibner-Hanson 2017) (Table 7).

Table 7. Summary statistics of large wood (LW) inventories performed in Mill Creek and Prairie Creek (for comparison). Table adapted from Garwood and Deibner-Hanson 2017.

Basin	Reach	Reach Length (km)	Large Wood (LW) Count (pieces)	LW Count (pieces/km)	Volume (m^3)	Volume (m^3/km)	Extra Large LW (pieces/km)
Mill Creek	East Fork Mill	6.5	1551	231.1	496.4	75.9	17.6
	West Branch Mill	9.2	2661	289.5	1049.9	114.2	21.8
	Mainstem Mill	9.3	1033	111.3	862.5	92.9	14.7
	Totals	25.0	5,245	631.9	2408.8	283	54.1
Prairie Creek	Upper Prairie Creek	13.7	3906	284.4	1144.4	83.3	25.8
	Lower Prairie Creek	4.7	1430	304.6	255.1	53.8	8.2
	Totals	18.4	5,336	589	1399.4	137.1	34

The U.S. Geological Survey (USGS) collected suspended sediment, bedload, turbidity, and water flow data at various locations in Mill Creek from water year 1975 to 1981. Flows in the Smith River system from 1975 to 1981 reflected a range of conditions, including extremely dry, dry, normal and critically wet. The wet water year type was the only year type that did not occur during the record period. Using flood recurrence intervals in the range of 1.5 to 2.3 years as a general predictor for bankfull flows (Dunne and Leopold 1978), three of the seven water years examined had near or greater than bankfull discharges (1975, 1976, 1978).

Madej et al. (1986) synthesized sediment transport data collected by USGS from water years 1975–1981 for mainstem Mill Creek, downstream of the confluence of East Fork Mill Creek and West Branch Mill Creek. They reported that the total average sediment yield was 140 tonnes/km^2 (400 tons/mi^2). Of the total load, 60 percent was suspended sediment, 30 percent dissolved load, and 10 percent bedload. Annual suspended sediment yields ranged between 4 and 185 tonnes/km^2 (between 11 and 528 tons/mi^2); a mean annual suspended sediment yield of 70 tonnes/km^2 (200 tons/mi^2) was reported from 1975-1981, a period of record during industrial timber operations (Table 8).

Table 8. Annual suspended sediment yields for Mill Creek 1975 – 1981 (RNSP 2020)

Year	Tonnes/Year	Tonnes/km^2
1975	8,723	120
1976	2,690	35
1977	311	4
1978	13,639	185
1979	3,365	45
1980	5,583	75
1981	2,980	40
Mean	6,610	70

Madej et al. (1986) also reported that a modeling study by Iwatsubo and Washabaugh (1982) found that under natural conditions, suspended sediment yield was approximately 65 tonnes/km2 (187 tons/mi2), although Madej et al. (1986) indicated that the modeling estimate was high based on direct measurements. Madej et al. (1986) also reported that Mill Creek produced one to two orders of magnitude less suspended sediment during a similar period of record compared to other North Coast watersheds (Table 9).

Table 9. Measured and estimated suspended sediment yield at selected gaging stations in northern California (RNSP 2020).

Station	Drainage Area (km^2)	Period of Record (water years)	Suspended Sediment Yield (tonnes/km^2)
Redwood Creek near Blue Lake	175	1954-1980	2,100
Panther Creek (Redwood Creek tributary)	15.7	1980-1984	250
Coyote Creek (Redwood Creek tributary)	20.2	1980-1982,1984	1,900
Lacks Creek (Redwood Creek tributary)	43.8	1981-1984	700
Mill Creek	76.8	1975-1981	70
Smith River	1,577	1978-1979,1981	170

Embeddedness is the measure of the extent to which large particles (i.e., boulders, cobble, and gravel) are surrounded or buried by fine sediment. Substrate embeddedness in Mill Creek is low when compared to other North Coast watersheds of similar size (RNSP 2020). Based on V* surveys, embeddedness along unspecified locations of the West Branch and East Fork were found to be 23 percent and 12 percent, respectively (CDPR 2011).

2.4.4 Research Approvals in the Action Area

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 Mill Creek on an ongoing basis, although funding for the research after 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 on Mill Creek, summer distribution snorkel surveys, 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" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action, and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

The 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.
5. Decreased flows due to water drafting.
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 are present in streams in the action area (RNSP 2020). 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 over a 1,000 foot stream reach post treatment in all riparian areas, and at least 80 percent canopy cover along perennial streams. In addition, 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, and the average hours of summer sunshine are also relatively low (RNSP 2020) and streams in the action area have topographic shading and cool water temperatures. Therefore, due to: 1) the retention of at least 80-60 percent canopy cover (depending on stream type) to provide shade, 2) the presence of topographic shading and cool water, and 3) 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 coho salmon 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 (RNSP 2020). 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 coho salmon occupied and potentially occupied stream reaches where thinning operations will remove trees within the riparian zone. All currently occupied and potentially occupied streams in the action area are proposed for additions of large wood in and near thinning units (section 1.3.2). In addition, all trees will be retained that provide stream bank stability, and that are on unstable or potentially unstable slopes. Bank erosion and landslides have been found to be the dominant mechanisms for tree delivery in tributary streams, while bank erosion and mortality have been found to be the dominant tree delivery mechanism on mainstem streams (Benda et al. 2002).

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 (2020) 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 (RNSP 2020) and potentially be recruited into streams as large wood, along with any trees contributed from natural bank erosion or landslides. Therefore, we expect that riparian forest thinning will have a negligible effect on wood recruitment into all streams within the action area and no reduction in coho salmon individual fitness (all life stages). Additionally, we expect that the placement of large wood in coho salmon streams will improve habitat quality immediately by providing additional velocity breaks for juvenile and adult salmonids during high flows, diversifying habitat, and increasing cover for juvenile salmonids.

2.5.2 Petroleum Products

During the NOS when heavy equipment will be operating, juvenile coho salmon will be rearing in streams in the action area (RNSP 2020). With any heavy equipment and power tool use in the riparian area, there is the possibility that petroleum products may enter the stream network,

through either 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. Spills are unlikely to reach streams due to the heavy equipment exclusion zones in riparian areas and refueling at least 300 feet from streams. Therefore, the potential for exposing juvenile coho salmon to petroleum products is improbable since the Program would adhere to all design features pertaining to containment and prevention of petroleum product spills.

2.5.3 Displacement of Fish

Large wood placement in the Program area will occur when juvenile coho salmon may be present. Instream log placement could crush or injure individual fish. Salmonids have the behavioral response to swim away from noise and movement from above and below the water surface (Popper and Carlson 1998, Knuden et al. 2005), and large wood will not be placed until after June 15 when juvenile coho salmon have developed a flee response. Numerous activities will be occurring along the streambanks during project implementation, prior to wood placement in the stream, which should cause juvenile coho salmon to avoid the active area of instream wood placement and flee the site for less disturbed habitat up or down stream. This disturbance is expected to be minor and very short lived as individual fish can easily move short distances away from the wood placement areas to find cover. Suitable juvenile cover habitat exists throughout Mill Creek (CDPR 2019). In addition, helicopter use to place large wood may cause additional noise and overhead movement. However, during prior helicopter log installations in the East Fork of Mill Creek, the disturbance from helicopters was of short duration and occurred after salmonids were likely displaced from the site due to the presence of on the ground crews preparing the site for large wood additions (Transou 2020).

There are also five locations within the program area where bridges will be installed where coho salmon juveniles may be present. These five bridge sites are the only road-stream crossings that occur within coho salmon habitat in the action area, all culverts to be replaced or removed are outside of coho salmon habitat. 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 bridge is placed over the stream. This disturbance is expected to be minor and very short lived as individual fish can move short distances away from the bridge installation areas to find cover.

Based on: 1) the work window timing, 2) the very small number of juveniles expected at and near each disturbance site due to most juveniles having already fled, and 3) the good to very good habitat upstream and downstream of the instream wood and bridge locations, NMFS does not expect the large wood additions, helicopter noise, or new bridges to crush or affect the fitness of any individuals, or to negatively influence the passage of any juvenile coho salmon.

2.5.3.1 Decreased Flows due to Water Drafting

Water drafting is proposed for tributary streams outside of occupied coho salmon habitat. However, removal of water from upstream of habitat could affect the stream flow and habitat

downstream where coho salmon juveniles are present. Water drafting specifications (NMFS 2001), such as using deep sections of streams, ensuring that the pumping rate does not exceed 10 percent of stream flow, ensuring that the pumping rate shall not exceed 350 gallons per minute, and using visual observations of the water level during pumping, should minimize reductions in streamflow in downstream occupied habitat. Thus, the potential for exposing juvenile coho salmon to decreased stream flow due to water drafting is improbable since the Program would adhere to all water drafting specifications.

2.5.4 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 construction, reconstruction, use, and removal of existing logging roads and log landings, as well as the maintenance of administrative/permanent roads used for log hauling. 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, the frequency and the duration of the exposure is important to consider, and not just the TSS concentration (Newcombe and Jensen 1996).

2.5.4.1 Analysis Methods

A comparative suspended sediment analysis was conducted by CDPR (RNSP 2020) using measured sediment levels from Mill Creek collected by the USGS during the late 1970s and early 1980s when road construction, use, and maintenance intensity were high in the action area compared to road use, maintenance and removal intensity levels proposed for this Program. The USGS collected suspended sediment concentration (SSC), bedload, turbidity, and discharge data at locations in Mill Creek from water years 1975 to 1981. The SSC and discharge data form the baseline for assessing the severity of ill effects values (SEV) to juvenile coho salmon during the 1970s as compared to the proposed Program. The SEV was developed by Newcombe and Jensen (1996), and is based on a dose-duration-response model to estimate potential suspended sediment impacts to aquatic species.

Similar to other recent sediment analyses (RNSP 2019), CDPR focused their analysis on roads as the largest sediment source. Skid trails and cable yarding corridors were not considered as sediment sources. Operating heavy equipment only in dry conditions, mulching all skid trails with tree limb slash, and providing equipment exclusion zones near creeks will decrease

sediment transport from skid trails 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.

CDPR compiled all time and raw data that exceeded 20 Nephelometric Turbidity Units (NTU) for directly measured instantaneous SSC during the mainstem Mill Creek (at the park boundary) gaging period. This level of turbidity (20 NTU) quantifies the initial threshold for impacts to salmonids (Bray 2000). A direct use of the method outlined in Bray (2000) was not possible (due to rating curves being insufficient to extrapolate discharge from the 1-hour interval USGS gage height data from this period). However, the Bray method of using hourly discharge data was combined with the daily discharge-SSC equations from Madej et al. (1986) and applied to all data periods of potential concern (RNSP 2020). This helped fill analysis gaps to see if there were periods that achieved an SEV of eight and above (Table 10). RSNP (2020) noted that the daily discharge-SSC method has the potential to overestimate the duration of SSC thresholds because of the imprecision of the data period and error envelopes associated with the equations.

Table 10. Description scale of the SEV values for juvenile salmonids associated with excess suspended sediment (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

Of the years of SSC data, the 1975 water year had the largest peak discharge event and the 1978 water year produced the greatest water yield. Because water years 1975 and 1978 generated discharges greater than bankfull channel, they were more likely to trigger major sediment delivery from upslope sources than other water years for which SSC data exists (RNSP 2020). These two water years of data, during a time of robust industrial timber operations and road building, and prior to adoption of the forest practice rules, provide a conservative baseline against which proposed Program activities are compared.

2.5.4.2 Analysis

The BA (RNSP 2020) describes how CDPR used a combined analysis of the 1978-81 Madej et al. (1986) equation with the Bray formulas, and calculated the SEV using a conservative method (i.e., one that likely overestimates sediment loads) for a location in mainstem Mill Creek, downstream of the confluence of East Fork Mill Creek and West Branch Mill Creek. CDPR (RNSP 2020) found only one likely minor encroachment beyond SEV of eight for 1975 and 1978 (the water years of highest discharges for which the most data exists). However, CDPR did find numerous SEVs of seven and some SEVs of eight, six and five during the analysis of water years 1975 and 1978, for both 2-day and 7-week durations. Note that the analysis used the sediment data from mainstem Mill Creek, downstream of the confluence of East Fork Mill Creek and West Branch Mill Creek.

During the analysis period of record (1970s), the action area was experiencing intensive commercial timber harvest and associated road building. RNSP (2020) describes that in the 1970s, approximately 125mbf (thousand board feet) of old-growth forest was harvested per acre within the action area, with approximately 660 acres harvested per year. An average log truck in Pacific Northwest forests hauls approximately 4,000 board feet. Therefore, there were, on average, 20,000 truckloads of logs on the roads in the action area, per year in the 1970s. As a comparison, this Program proposes forest thinning that will not remove more than 50 percent of the basal area from any unit, or approximately 10mbf per acre, which is 8 percent of 1970s harvest volumes. The size of the trees and the smaller number of board feet proposed for removal per acre means fewer log trucks per year using the road system, averaging perhaps 5,000 trucks per year if the maximum of 2,000 acres of thinning occurs (15-25 percent of 1970s harvest volumes). RNSP (2020) does not expect the maximum acres thinned to occur often during the Program.

2.5.4.3 Extent and Intensity

The BA (RNSP 2020) also describes other sources of sediment (i.e., road construction, temporary road reconstruction and road removal, and permanent road maintenance associated with log hauling), and compares the extent and intensity of these activities with similar activities in the 1970s. Permanent road construction rates in the action area during the 1970s averaged 7 miles per year, and road construction included the installation of stream crossings across perennial, intermittent and ephemeral streams. Those crossings had exposed, un-mulched streamside fill. Those miles of newly constructed roads, installed every year, presumably contributed most of the sediment measured that changed water quality during the analysis years of record. By comparison, the road construction, re-construction and removal intensity described the *Proposed Action* section will be much less intense; Table 4 summarizes the mileage of temporary road to be constructed or reconstructed, and road removal, and Table 5 summarizes administrative roads maintained for log hauling per phase and per year.

As a comparison, 2.5 miles of temporary roads will be constructed during the proposed action during Phase 1, and no new road construction will occur in other phases and not all of those miles will be built in one year during Phase 1 (RNSP 2020). Those roads may be installed and then removed during one NOS and thus contribute very little sediment to streams. Alternately,

some or all of the temporary roads constructed may remain on the landscape over one or two rainy seasons. All of the new temporary roads will be constructed to handle 100-year flow events if used for more than one season, will be high up in the watershed, and will not cross any perennial or intermittent streams, unlike the roads built in the 1970s. Additionally, the new temporary roads will have mulched ephemeral stream crossing streamside fill.

Temporary road reconstruction will also be much less intense and less extensive than the permanent road construction rates of the 1970s. During Phase 1, 3.75 miles of road will be reconstructed with less than 3 miles per watershed per year over a 5 to 6 year period. Road reconstruction beyond Phase I will be limited to less than 10 miles per watershed per year, though RNSP anticipates that the remaining 18.62 miles of road will be reconstructed at a gradual rate of zero to 5 miles per year. Reconstruction will primarily involve vegetation clearing, grading, and the replacement of stream crossings, as necessary. RNSP (2020) estimated that two to six crossings per mile might need replacement. Reconstructed roads, however, may be reconstructed and then removed during one NOS or remain on the landscape over one or two rainy seasons. All of the stream crossings on temporary reconstructed roads will be designed to accommodate 100-year flow events and will be fully mulched.

Road removal includes up to 10 miles of road removed per year during the proposed Program. About 4 miles, on average, of roads will be removed each year during Phase 1. The maximum proposed road removal of 10 miles per year could result in up to 30 crossings being removed per watershed in a single year, which is likely an overestimate based on how well distributed across the entire Program area the crossings are (Figure 2), with a more likely number of 10-20 crossings removed, rather than 30. In addition, the roads proposed for removal are relatively short, widely distributed and located away from perennial stream reaches and away from anadromous habitat. In addition, RNSP (2020) describes that CDPR (2010) found very little suspended sediment after stream crossing removal done previously within the action area. RNSP (2020) attributed the muted sediment response to the hard rock geology of the Mill and Rock Creek watersheds, as compared to softer rock in the Redwood Creek watershed that adjusted more (Klein 2012) after stream crossing removal.

2.5.4.4 Summary

In summary, an average of 1.7 to 3.2 miles of temporary road construction, reconstruction and road removal will occur per year, as compared to the 7 miles of new road construction that occurred every year in the 1970s. Those miles are not equivalent, however, because the construction style of the 1970s did not have the BMPs minimization measures proposed as part of this Program.

Permanent roads will be maintained to allow for log hauling. Road brushing and grading, drainage ditch clearing and cross drain (ditch relief culverts) will likely cause very little sediment to enter streams due to the lack of a direct hydrological connection to stream channels. In addition, the action area contains abundant vegetation and downed woody material to capture sediment that flows directly off of road surfaces or out of crossings. However, as part of road maintenance, up to 20 stream crossing culverts (all outside of anadromous habitat, only full span bridges will be used within anadromy) may be replaced in Mill Creek and up to 20 in Rock

Creek per year. RNSP (2020) does not expect this limit will be reached in most years and that a more typical replacement rate will be less than two stream crossing culverts per year in total across the Program area (RNSP 2020). Additionally, the 20 maximum culverts per watershed limit is shared with culvert replacement for temporary reconstructed roads, further limiting the number of culverts that can be placed in any given year in the Program area.

In contrast to year round commercial logging that occurred during the 1970s, winter operations will be strictly limited to fully rocked roads and log landings, and will consist of log hauling from rocked and winterized log landings on rocked and winterized roads. No native surface roads will be driven on outside of the NOS, and heavy equipment will not be used on anything other than roads and landings that have been rocked and compacted during the NOS and prior to the winter season (RNSP 2020).

2.5.4.4.1 Timing

Erosion of disturbed ground and sediment delivery to streams may occur during the first winter post-construction, particularly during the first large storms of the first winter (RNSP 2020). Juvenile coho salmon are present in action area streams during winter and will be exposed to increases in TSS. Adults and eggs could also be present in larger tributaries. As described in Newcombe and Jensen (1996), juvenile salmonids are the most sensitive to suspended sediments. 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 (2020) 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 coho salmon adults and eggs may experience exposure, they will not experience an adverse response.

2.5.4.5 Exposure

The total annual number of juvenile coho salmon that could be exposed to elevated TSS during the Program is difficult to estimate because population numbers vary from year to year and individuals are differentially distributed throughout the anadromous reaches (Figure 4). Not all occupied or suitable stream reaches will be affected in any given year of the proposed Program because activities will be occurring in different locations (i.e., different sub-watersheds) and at different treatment intensities. Nevertheless, some portion of juvenile coho salmon and some portion of their habitat will experience elevated TSS from Program activities.

Given this lack of population location specific data, and the variability of activities implemented in any given year, the extent of habitat exposed to elevated TSS is used to describe exposure to juvenile coho salmon. Thirty-one and half miles of suitable coho salmon habitat exists within the Mill Creek watershed. Due to the distribution of ground disturbing activities, RNSP (2020) expects that about 8 miles of suitable coho salmon habitat will experience elevated TSS each year during the Program. Although Rock Creek contains suitable habitat for coho salmon, they have not been observed in over 30 years of intensive stream monitoring, thus we do not expect that coho salmon juveniles will be exposed to elevated TSS in Rock Creek.

2.5.4.6 Response

As previously described in detail above, elevated TSS can result in adverse effects to juvenile coho salmon (Table 10). RNSP (2020) assumes that TSS decreases proportionately to the intensity of road system construction and removal and is also influenced by much improved BMPs and minimization measures over those used in the past. For these reasons, we expect that the increase in TSS within the Program area will be much less than what occurred during the analysis of conditions during the 1970s, and RNSP (2020) predicts an SEV maximum of six in mainstem Mill Creek, downstream of the confluence of East Fork Mill Creek and West Branch Mill Creek, during this Program.

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 to very good habitat within the action area, some exposed individuals will be able to find areas of less turbid water, minimizing or avoiding a response. However, some portion of coho salmon juveniles in up to eight miles (out of 31.5 miles) of habitat per year could be exposed to elevated TSS and SEV. However, we do not expect that eight miles of habitat will be affected by increased TSS each year of Program implementation, and that in some years less habitat will be affected due to the low mileages of proposed road treatments in total over 30 years. We expect that due to good habitat conditions in the action area, about half of the rearing coho salmon juveniles occupying up to 8 miles of affected stream habitat each year would find refuge in clearer water. Of the remaining individuals 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, about one-eighth of all coho salmon juveniles in the affected 8 stream miles will experience short-term reductions in feeding, and/or minor to moderate physiological stress, resulting in a reduction in fitness most years of the 30-year Program of a very small portion of the total juvenile coho salmon population in the action area.

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. The SONCC coho salmon recovery plan (NMFS 2014) describe that roads and sediment are high threats and stresses to the Smith River population. The Program will remove roads from the action area, reducing sediment sources over time, and will add large wood to channels, improving channel structure and complexity.

The recovery plan (NMFS 2014) identifies important areas for restoration and recovery, and emphasizes the importance of continuing to restore the Mill Creek sub-watershed to anchor it as a stronghold for coho salmon, 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, 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, will not affect pool depths, but may temporarily affect substrate quality. However, 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 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

For the State lands in the action area, we expect that permanent roads not used for log hauling will also require routine road maintenance. The maximum number of stream crossing replacements is 20 per year (per Mill and Rock creeks each) for future road construction, reconstruction or maintenance in the action area, regardless of the Program or project that the crossing is implemented under (RNSP 2020). This limit is not expected to be reached in most years and that a more typical replacement rate will be less than five stream crossing culverts per year. Stream crossings on roads not used to haul logs will likely be evenly distributed across the Program area and will include the BMPs and minimization measures for roads described for this Program (RNSP 2020).

Since the action area is within DNCRSP, we expect some recreational and park management activities to occur, especially during the summer at the Mill Creek campground. However, recreational and park management activities are relatively light, consisting of mostly camping and hiking. In addition, most of the State park lands are behind locked gates and not currently used for recreation or other management activities except for the proposed Program.

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 has 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). 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 Smith River population of coho salmon, which is an independent population, and is core to recovery of the species (NMFS 2014).

As explained more fully in the Effects of the Action section, we do not expect juvenile coho salmon to be exposed to petroleum products or to decreases in stream flow from water drafting. In addition, we expect any increase in stream temperature or decrease in large wood to be negligible, and that displacement of coho salmon into nearby habitat during large wood placement will not result in loss of fitness for any individual coho salmon. However, a small number of coho salmon juveniles would be exposed to increased TSS over the 30 year Program, within up to 8 miles of suitable coho salmon stream habitat per year. The maximum increases in sediment are expected to be moderate, with a maximum SEV of six, and typically SEVs of less than six. RNSP (2020) proposes to monitor turbidity and stream flow to track the increases in sediment and corresponding SEV during Program implementation.

Of the 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 the 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 population. Relatively large numbers of coho salmon adults enter the Mill Creek sub-basin 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 sub-lethal sediment effects. The loss of such a small percentage of the juvenile population of coho salmon would not likely reduce future adult returns.

2.7.2 Mill 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 leading to changes in productivity due to changes in freshwater flows, nutrient cycling, and sediment amounts. Given that: 1) the action area is a refuge from climate change, with its coastal setting, shady riparian areas and cool water year round, 2) that this Program would be completed by 2050, 3) that the cumulative effects from additional road maintenance on State lands will produce only small additional amounts of sediment, and 4) that the additions of large wood may daylight additional groundwater, the reduced stream flow is 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 Mill Creek and Rock Creek sub-basins and will promote species recovery. Because of its perennial cold water and robust population abundances, Mill 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 and the Program is unlikely to appreciably diminish the value of designated critical habitat for the conservation of this species.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and its 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, or destroy or adversely modify its designated critical habitat.

2.9 Incidental Take Statement

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

2.9.1 Amount or Extent of Take

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

Up to 8 miles of suitable coho salmon stream habitat in the Mill Creek watershed are expected to experience an increase in TSS during each year of Program implementation, with corresponding increases in SSC and SEV. We expect that due to good habitat conditions in the action area, about half of the rearing coho salmon juveniles occupying up to 8 miles of affected stream would find refuge in clearer water. Of the remaining individuals 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, about one-eighth of all coho salmon juveniles in the affected 8 stream miles per year will experience short-term reductions in feeding, and/or minor to moderate physiological stress, and may not be able to complete their life cycle

during many years of the 30-year Program. However, it is not possible to quantify the amount of individual juvenile coho salmon taken as a result of increased turbidity and SEV in the action area, because it is not possible to meaningfully measure the number of juvenile coho salmon that use the action area during the winter when effects would occur and locating small, dead fish is practically impossible due to predation, decomposition, and poor water visibility. In addition, juvenile distribution is not even across the action area, making it difficult to estimate the number of fish using the up to 8 miles of affected suitable habitat each year.

When NMFS cannot quantify the amount or extent of incidental take in terms of the numbers of individuals, NMFS uses surrogates to estimate the amount or extent of incidental take. Therefore, we will use the expected maximum of 6 SEV in the Mill Creek watershed, as determined in mainstem Mill Creek below the confluence of East Fork Mill Creek and West Branch Mill Creek, as a take surrogate, and up to 8 miles of stream habitat in the Mill Creek watershed that have Program-related increases in suspended sediment per year as another take surrogate. Higher levels of SEV, or additional miles of affected habitat, would result in effects to individual coho salmon from the proposed action that were not considered in this Opinion and take would be exceeded. We expect that SEV levels in Mill Creek will approximate SEV levels in Rock Creek and that SEV levels in Mill Creek will act as a proxy for SEV levels in Rock Creek.

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:

1. Ensure operational methods, minimization measures, and monitoring are properly implemented during Program activities.
2. Ensure that the water quality monitoring (e.g., suspended sediment concentrations) is adequate to assess the level of take.
3. Prepare and submit an annual report regarding the effects of restoration activities. Include the results of water quality monitoring (and corresponding SEV) within the annual report.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the RSNP 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 term and condition implements reasonable and prudent measure 1:
   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.

2. The following terms and conditions implement reasonable and prudent measure 2:
   a) RSNP, while collaborating with NMFS, shall develop a draft water quality monitoring plan by September 15, 2020, and finalize the plan with approval from NMFS by October 15, 2020. The monitoring plan will include a method to calculate SEV levels at or downstream of Program activities in the Mill Creek watershed for each year of the Program.
   b) RNSP shall monitor turbidity and SEV levels at agreed to location(s) during each year of the Program.
   c) RNSP shall calculate and report SEV levels to NMFS when bankfull discharge (approximately 1.5-year return interval storm) is met or exceeded. However, based on water quality monitoring results, a different return interval storm may be used as a threshold to calculate SEV, if agreed to by NMFS.
   d) RNSP shall contact NMFS within 48 hours of discovering that incidental take of coho salmon has been met or exceeded (i.e., SEV of 6 or greater, and 8 miles of habitat, or more). Notify Leslie Wolff or the North Coast Branch Chief at 707-822-7201 to discuss the activities resulting in take and to determine if additional protective measures are required.

3. The following terms and conditions implement reasonable and prudent measure 3:
   RNSP shall provide an annual written report of the previous year's water quality monitoring to NMFS by February 15. The report will include those items as described in the Proposed Action section, specific to monitoring and reporting, and the results of annual suspended sediment concentrations monitoring with an estimate of SEV levels. The annual report shall be sent to NMFS via email to Leslie.wolff@noaa.gov or Leslie Wolff at 1655 Heindon Road, Arcata, CA 95521.

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 recommends continuing to monitor for coho salmon annually in Rock Creek and continuing with juvenile and adult salmonid monitoring in Mill Creek. NMFS also recommends that RSNP monitor SSC in Rock Creek in addition to monitoring SSC in Mill Creek.

2.11 Reinitiation of Consultation

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

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. 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 Mill 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

Coho salmon and Chinook salmon are expected to occur within the action area. The adverse effects to coho salmon 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 Redwood National and State Parks.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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