UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Blvd., Suite 1100
PORTLAND, OREGON 97232-1274

Refer to NMFS No.: WCRO-2019-02002

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December 6, 2019

Cheryl F. Probert
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Nez Perce Clearwater National Forests
903 Third Street
Kamiah, Idaho 83536

Lt. Col. Christian N. Dietz
U.S. Army Corps of Engineers Walla
Walla District
201 North Third Avenue
Walla Walla, Washington 98362-1836

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the End of the World Project, HUCs 1706030507 and 1706020906 Idaho County, Idaho (One Project)

Dear Ms. Probert and Lt. Col. Dietz:

Thank you for the letter dated July 18, 2019 from the Nez Perce Clearwater National Forests (NPCNF) requesting initiation of consultation on the subject action with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.). The enclosed document contains a biological opinion (Opinion) prepared by NMFS on the effects of the End of the World Project. In this Opinion, NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of Snake River Basin steelhead. NMFS also determined the action will not destroy or adversely modify designated critical habitat for Snake River Basin steelhead. Rationale for our conclusions is provided in the attached Opinion. In this Opinion, NMFS concurs with the NPCNF's determination that the proposed action is not likely to adversely affect Snake River spring/summer Chinook salmon or their designated critical.

As required by section 7 of the ESA, NMFS provides an incidental take statement (ITS) with the Opinion. The ITS describes reasonable and prudent measures (RPM) NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the federal agency and any person who performs the action must comply with to carry out the RPM. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition.

Please contact Aurele LaMontagne at NMFS' Boise office at 208-378-5686 or aurele.lamontagne@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Michael P. Tehan
Assistant Regional Administrator
Interior Columbia Basin Office

Enclosure

cc: J. Harris – NPCNF
K. Smith – NPCNF
C. Johnson – USFWS
M. Lopez – NPT
W. Schrader – COE

bcc: SBAO – File copy, Read File, A. LaMontagne, K. Troyer

LaMontagne:Troyer:EOTW:20191203:am:WCRO-2019-02002

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

End of the World Project
HUCs 1706030507 and 1706020906
Idaho County, Idaho

NMFS Consultation Number: WCRO-2019-02002

Action Agencies: Nez Perce-Clearwater National Forests
U.S. Army Corps of Engineers

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Snake River Basin steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	No
Snake River Spring/Summer Chinook Salmon (*O. tshawytscha*)	Threatened	No	No	No

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

Issued by:

Michael P. Tehan
Assistant Regional Administrator

Date: December 6, 2019

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ACRONYMS

ACRONYMS	DEFINITION
µPa	micropascal
BA	Biological Assessment
BMP	Best Management Practices
CE	Cobble Embeddedness
CH	Critical Habitat
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
dB	Decibel
DPS	Distinct Population Segment
DQA	Data Quality Act
ECA	Equivalent Clearcut Area
EOW	End of the World
ESA	Endangered Species Act
ESU	Evolutionarily Significant Units
ft^2	Square Feet
GCS	Grouse Creek-South Fork Clearwater River
HUC	Hydrologic Unit Code
ICTRT	Interior Columbia Basin Technical Recovery Team
ITS	Incidental Take Statement
LWD	Large Woody Debris
MMBF	Million Board Feet
mg/L	Milligrams per liter
$MgCl_2$	Magnesium Chloride
mi^2	Square Miles
MPG	Major Population Group
NLAA	Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NPCNF	Nez Perce Clearwater National Forest
NTU	Nephelometric Turbidity Unit
Opinion	Biological Opinion
PBF	Physical or Biological Features
PCE	Primary Constituent Elements
RHCA	Riparian Habitat Conservation Area
ROS	Rain-on-snow
RPM	Reasonable and Prudent Measures
SA	Sales Administrators

ACRONYMS	DEFINITION
TSZ	Transient Snow Zone
Tribe	Nez Perce Tribe
VSP	Viable Salmonid Population
WBC	White Bird Creek

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

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

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within 2 weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the NMFS Snake Basin Office in Boise, Idaho.

1.2 Consultation History

The Nez Perce-Clearwater National Forest (NPCNF) proposes to treat vegetation, including thinning, harvest, and burning, within the White Bird Creek (WBC) and South Fork Clearwater River drainages in Idaho County.

From September 2017 to July 2019, NMFS discussed the project at Level 1 meetings and commented on the draft biological assessment (BA). Through these discussions it was determined that ESA-listed Snake River steelhead and spring/summer Chinook salmon would be in the action area. On July 17, 2019, NMFS received a request for formal consultation and a final BA. This Opinion is based on information provided in that final BA. The final BA determined that the proposed action would likely adversely affect Snake River Basin steelhead and their designated critical habitat and would not likely adversely affect Snake River spring/summer Chinook salmon and their critical habitat.

On October 8, 2019, NMFS sent a draft of the proposed action section of this Opinion to the NPCNF. On October 15, 2019, the NPCNF returned the draft proposed action with edits and comments.

The U.S. Army Corps of Engineers (COE) may issue a Clean Water Act (CWA) section 404 permit for the project, and this consultation also applies to COE's issuance of the permit. NMFS and the Walla Walla District of the COE have an informal agreement concerning consultations where another federal agency is the lead action agency but for which the action may also require a COE permit. Per this agreement, NMFS includes the COE as an action agency in the consultation and the COE agrees to ensure that any terms which the COE applies to a permit for the action are consistent with the project description and conservation measures in the lead action agency's BA and the terms and conditions in NMFS' Opinion.

Because this action has the potential to affect tribal trust resources, NMFS provided copies of the draft proposed action and terms and conditions for this Opinion to the Nez Perce Tribe (Tribe) on November 6, 2019. On November 20, 2019, the Tribe responded with comments.

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).

The NPCNF proposes the End of the World Project (EOW) to manage vegetation on 60,455 acres of Forest land in both the WBC watershed; 44,042 acres), tributary to the Salmon River, and the Grouse Creek-South Fork Clearwater River subwatershed (GCS; 16,413 acres). The project area is approximately 6 miles south of Grangeville, Idaho (Figure 1).

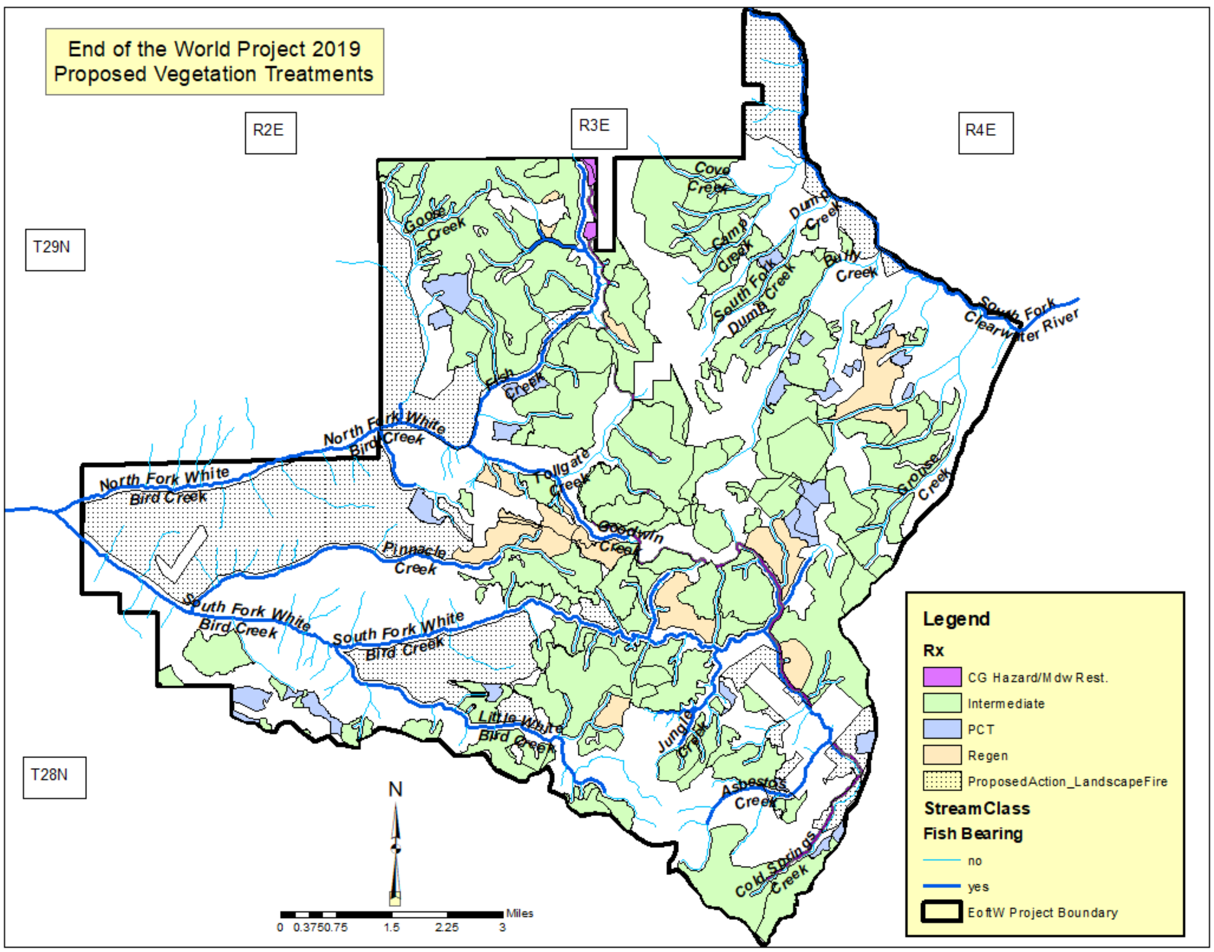

Figure 1. The EOW boundary and vegetation treatments. The Camp Ground Hazard are clearing of hazard trees in campgrounds, Intermediate and Pre-commercial Thinning are various thinning treatments, and Regen is regeneration harvest areas. Dotted areas are prescribed landscape burning.

Project activities will include timber harvest, hazard tree removal, fuel treatments, dry meadow and range maintenance, and prescribed fire treatments. Road activity will include new permanent and temporary road construction, road reconstruction, road maintenance (recondition), and road decommissioning, and dust abatement. In the WBC watershed, the NPCNF will replace five culverts to allow aquatic organism passage.

Proposed activities will begin in 2022 and continue for 20 years. Timber harvest will be implemented through multiple timber sales occurring in the 10-year period 2022 to 2032. Typical timber sale contracts last 4 years, so the harvest and road actions associated with the last sale could take 14 years, or until 2036, to complete. All post-harvest reforestation and site rehabilitation work will conclude in 2036. Because of the specific conditions necessary for burning, landscape burning can take up to 20 years to complete, possibly continuing until 2042.

1.3.1 Proposed Timber Harvest Activities

The NPCNF is proposing 18,360 acres of timber harvest (up to 109 million board feet [MMBF]) in the WBC (13,191 acres) and GCS (5,170 acres) spread over many small watersheds (Table 1; Figure 1). Harvest will occur over a 14-year period.

Table 1. Summary of timber harvest treatments and yarding methods. All numbers are in acres.

Units are in acres	Watershed	Harvest		Method			No Harvest	Prescribed Fire	
Watershed	Total acres	Regen	Intermediate	Ground	Jammer	Skyline	Pre-Comm Hand cut	Landscape	Fuels in units
Whie Bird Creek Total	44,042	1,344	11,847	5,890	6,126	1,174	683	6,691	10,272
Fish Creek	5,756	75	3,356	1,624	1,433	373	157	230	3,354
Goose Creek	3,022	0	883	-	807	76	111	771	765
Tollgate Creek	1,561	0	1,082	921	155	7	-	-	778
Goodwin Creek	715	112	303	170	239	7	-	-	285
North Fork White Bird	10,050	204	170	87	287	-	74	2,214	295
Pinnacle Creek	2,518	279	265	-	545	-	-	1,034	406
South Fork White Bird Creek	13,072	593	3,826	2,325	1,505	587	255	1,977	3,393
Little White Bird Creek	3,425	68	1,118	556	629	-	48	349	377
Jungle Creek (White Bird)	1,155	13	450	53	286	124	28	36	426
Asbestos Creek	1,681	-	394	154	240	-	10	80	193
Cold Springs Creek	1,087	-	-	-	-	-	-	-	-
SF Clearwater River Total	16,413	376	4,793	1,214	2,898	1,058	380	1,033	4,722
Cove Creek	3,606	-	1,157	208	771	179	-	-	1,157
Dump Creek	1,300	-	428	203	225	-	37	-	353
Bully Creek	3,471	-	1,616	314	968	334	131	-	1,457
Jungle Creek (SF Clear)	286	28	40	-	40	28	38	-	28
Bivouc Creek	411	108	28	-	-	136	25	-	108
Grouse Creek	3,556	240	1,524	489	894	381	149	-	1,619
South Fork Clearwater Face 01	3,783	-	-	-	-	-	-	1,033	-
Totals	60,455	1,720	16,640	7,104	9,024	2,232	1,063	7,724	14,994

1.3.1.1 Harvest

Regeneration Harvest

Regeneration harvest (1,720 acres) will be implemented using three techniques: seedtree, shelterwood, and clearcut with reserve trees or reserve islands. This treatment will manipulate patch size, age-class distribution, and species composition. Treatments will emphasize regeneration of seral species and help reduce the spread of insect and disease. The proposed action will create 12 openings over 40 acres in size (range 44 to 287 acres). Regeneration harvest units will be replanted at varying stocking levels depending on biophysical setting and silvicultural prescription.

Seedtree – 112 acres. This treatment will retain eight to 15 trees per acre as residual seed trees for natural regeneration. The actual leave number would be dependent on the diameter of the residual seed trees. The treatment will leave the largest, healthiest trees with the best form. Residual seed trees would be high- quality, high-vigor trees, and desirable for seed production. Regeneration would be accomplished through both natural regeneration and planting of desired species.

Shelterwood **–** 631 acres. This treatment will retain 15 to 40 trees per acre as residual shelter trees. The residual leave number would be dependent on the diameter of the residual shelter trees. The treatment will leave the largest, healthiest trees with the best form. Site preparation may be mechanical or through controlled fire activities. Regeneration would be accomplished through both natural regeneration and planting of desired species.

Clearcut with Reserve Trees or Reserve Islands **–** 977 acres. Clearcut with reserves will remove green merchantable live trees, leaving an average of 6 to 10 large overstory trees per acre. The treatment will leave the largest, healthiest trees with the best form. Reserve trees would be selected based on wind-firmness, diameter size and wildlife characteristics. Preference would also be to clump reserve trees versus scattering of individual trees. Site preparation for regeneration would occur to remove non-merchantable live trees. Site preparation may be mechanical or through controlled fire activities. Site preparation would only occur to meet fuel or regeneration objectives. Coarse woody debris would only be treated to meet post-harvest fuel objective. Regeneration would be accomplished through planting of desired species.

Intermediate Harvest

Intermediate harvest on 16,640 acres will be implemented using three techniques: variable density thinning, commercial thinning, and overstory removal. In addition, 1,063 acres of no-harvest pre-commercial thinning are proposed. Intermediate harvest will thin canopy fuels and create conditions unfavorable for crown fire initiation and persistence. Treatments will favor fire tolerant or species that are resilient to insects and disease.

Variable Density Thinning **–** 10,659 acres. Conduct an improvement thinning, removing the smaller, poorer-quality intermediate and suppressed trees. Leave the largest, best-quality, healthiest trees in the dominant and co-dominant crown classes. The unit can include some relatively small harvested openings (gaps), up to 5 acres in size, created in response to undesirable existing conditions such as insect and disease-affected trees or patches of trees with declining health and vigor. It is also possible that the gaps might exist naturally without a full canopy cover. The thinning treatment outside the gaps will retain about 80–140 trees per acre and an approximate 55–75 percent canopy cover. However, thinning can be conducted down to less canopy cover in small patches if poor stand health so dictates. There may also be some small untreated areas in the unit.

Commercial thinning **–** 6,364 acres. This treatment would “thin from below” to increase the stand’s growth and yield. Removal of the smaller, poorer-quality intermediate and suppressed trees. The treatment will leave the largest, best-quality, healthiest trees in the dominant and codominant crown classes, leaving about 80–140 trees per acre. This equates to a remaining canopy cover of approximately 55–75 percent.

Overstory removal **–** 119 acres. This treatment would be conducted in previously harvested stands which are fully stocked with new seedlings or saplings. Any unhealthy mature overstory trees would be removed to limit infection in the residual stand. Healthy overstory trees would be retained.

Road 221 Fuel Break

This 105-acre treatment would commercially thin stands along Forest Road 221 in order to provide for safe ingress and egress to firefighters and the public in case of a wildfire. This is the primary NPCNF access road between Grangeville and the Salmon River and, within the project area, is paved in its entirety. Emphasis would be on retaining fire-resistant species of the largest size available and removing understory ladder fuels in order to create a shaded fuel break.

Campground Hazard Tree Removal

This 51-acre treatment will remove dead and dying trees within two campgrounds to reduce fuels and increase public safety within the campgrounds.

Yarding

Yarding is the movement of felled trees or logs from the area where they are felled to the landing. Ground-based vehicle (7,104 acres) and jammer (9,024 acres) methods will be used for the majority of harvest due to the low gradient terrain. Ground-based methods use a cable to drag logs to a landing. Skyline yarding is used for steeper terrain and will be used to yard 2,232 acres. During skyline yarding, one end of a log is suspended from a cable when brought to a landing.

Best Management Practices for Harvest Activities

There are design measures, design features, mitigation measures, and best management practices (BMPs) proposed to reduce impacts from implementation of the project; for simplification, all of these will be referred to as BMPs. Although BMPs are listed in specific sections of this Opinion, any BMPs should be used where relevant to avoid or reduce effects on streams and fish. The BMPs are proposed to: restrict activity in riparian habitat conservation areas (RHCAs), minimize soil disturbance and erosion, and minimize sediment delivery to streams.

- No timber harvest will occur within PACFISH RHCAs. The RHCAs include areas within 300 feet of fish-bearing streams, 150 feet of perennial non-fish bearing water and wetlands larger than one acre, 100 feet of intermittent streams, landslide prone areas, and wetlands one acre or smaller.

- Landslide prone areas will be further identified during unit layout, excluded from harvest, and given a 100-foot PACFISH no harvest buffer.

- No ground based skidding will be allowed on slopes over 45 percent.

- Activities will be restricted when soils are wet to prevent soil damage (indicators include excessive rutting, soil displacement, and erosion). Activities include harvest and post-harvest work, road work, and haul.

- Winter logging will be allowed only during frozen conditions. Frozen conditions are defined as 4 inches of frozen ground or a barrier of unpacked snow greater than 2 feet in depth or packed snow 1-foot in depth.

- Skid trails, landings, and yarding corridors will be located prior to activities to minimize the area of detrimental soil effects. Tractor skid trails will be spaced no less than 80 feet apart (edge to edge), except where converging on landings. However, feller bunchers will be used between the 80-foot spacing.

- When utilizing skyline yarding systems, one end of the log will be suspended.

- An average of 7 to 15 tons per acre of coarse woody debris (greater than 3 inches in diameter) will be retained following completion of activities.

- Green tops will be retained and/or returned within units and allowed to over-winter 1-year prior to burning.

- Slash piles (excavator piles) will be kept small (4–10 feet in height).

- To reduce the risk of channelized flow, drainage controls (waterbars, drain ditches) and application of available slash in log yarding corridors (cable or skyline) will be constructed upon completion of harvest activities, or if overwintering, where bare mineral soil is exposed and water flow may be confined.

- Equipment used for post-harvest excavator piling will be restricted to existing trails and/or previously impacted areas.

- Excavated skid trails will be scarified to restore slope hydrology and soil productivity.

- Non-excavated skid trails and landings that are compacted or entrenched 3 inches or more will be scarified to a depth of 6 to14 inches.

1.3.1.2 No-Harvest Cutting

1.3.1.2.1 Pre-commercial Thinning

This treatment would thin “from below”, by cutting and leaving the smaller, poorer-quality intermediate and suppressed trees on 1,103 acres. The treatment will leave the largest, best-quality, healthiest trees in the dominant and codominant crown classes. The treatment will retain approximately 250 to 300 trees per acre. The treatment is not “commercial”, and does not produce products of commercial value, but may be large enough for posts and poles sales. No ground disturbance (yarding or associated skid trails) occurs with this activity.

1.3.1.2.2 Dry Meadow/range Treatments

This treatment includes 82 acres of hand felling in order to remove encroaching small trees on natural dry meadows or openings. The treatment would reduce trees on areas that were historically grasslands. Materials will be scattered and left on site or piled and burned in areas where fuels are of concern.

1.3.1.2.3 Cut and Leave

This treatment will cut and leave 20 riparian trees on Cabin Creek. Trees would be felled in a jackstraw manner adjacent and across the creek to minimize cattle access to a 200-foot portion of Cabin Creek where cattle tend to water and graze. An opening would be retained for cattle watering.

1.3.1.3 Prescribed Fire

1.3.1.3.1 Activity related fuel reductions

Harvest units would occur on up to 14,994 acres. After harvest, activity fuels (slash) would be treated mechanically, hand piled, or left in place and subsequently burned. Areas receiving this treatment are generally where timber harvest, campground hazard tree removal, or meadow restoration would occur.

1.3.1.3.2 Landscape burning

Landscape burning is proposed on approximately 7,724 acres for two types of natural fuels (grass/shrub and timber). A light/moderate surface fire would be used to remove fuel accumulations in areas dominated by grasses, forbs, and brush species (Figure 1). About 90–95 percent of the treatment area would be burned, leaving some small areas untouched by prescribed fire. A light/moderate surface fire would also be used in timbered stands with grass/shrub understories or where heavy surface fuels exist. Some isolated pockets of high-intensity fire are expected in the timbered stands. For burning in timbered stands, it is expected that 60–80 percent of the area would be burned with a goal of less than 15 percent mortality of the large diameter overstory trees.

Treatment acres would be burned as conditions allow and generally burns within an area would happen over a period of several years. Burning will reduce surface and ladder fuels, fuel continuity, and top-killed shrubs. An objective of burning is to create a patchy mosaic that could potentially reduce wildfire size and/severity. The areas to be treated include some areas adjacent to private lands. Some prescribed fires will be ignited by hand, while other areas will require aerial ignition due to dangerous terrain or for efficient burning of large areas.

The BMPs listed below are proposed to restrict prescribed fire activity in RHCAs, and minimize the risk of unintentional high severity burns in RHCAs.

- No ignition will occur in PACFISH buffers.

- Prescribed fire will be allowed to back into RHCAs.

1.3.1.4 Noxious Weeds

Areas most susceptible to weed introduction include roadways, landings, and skid trails. To avoid and minimize the introduction and spread of noxious weeds and invasive plants, all equipment will be cleaned of loose debris prior to entering the action area. The use of herbicides is not proposed. Following activities, project-related exposed soils (i.e., landings, skid trails, temporary roads etc.) will be re-vegetated using certified noxious weed free native seed mix and fertilizer (as necessary) upon project completion. The BMPs for weed treatments include:

- The NPCNF will use approved native plant species or non-native annual species used to meet erosion control needs and other management objectives. The NPCNF will follow regional plant and seed transfer guidelines, require contractors to use certified seed laboratories to test seed against the all state noxious weed list, provide documentation of the seed inspection test to the contract administrator, and apply only certified weed-free seed and mulch.

- The NPCNF will use rock from Forest Service approved sources and certify that rock used for surfacing is free of noxious weed seed.

- The NPCNF will ensure that all mud, soil, and plant parts are removed from off road equipment before moving into project area.

1.3.2 Proposed Road Work and Haul

The NPCNF proposes to build new permanent and temporary roads, reconstruct and recondition (maintenance) roads, decommission roads, install crossdrains, replace culverts for fish passage, and harden stream crossings used by cattle. Table 2 lists temporary road and decommissioning components of the road work, including the culvert removals accompanying road decommissioning. Those and other components of proposed road work are described below.

Table 2. Proposed temporary road and road decommissioning by subwatershed (Hydrologic Unit Code 12). Road columns are in miles and culvert columns are in number of culverts.

Watershed	Temporary Roads (mi)		Decomissioning	
	New	Existing Template	Road Miles	Estimated Culvert Removals (#)
White Bird				
Fish Creek	1.5		1	1
Goose Creek	0.4		2.7	1
Tollgate Creek	0.5	0.2	2.1	0
Goodwin Creek	0.3		0.7	0
NF White Bird	0.3		0.7	0
Pinnacle Creek	0.6		1.1	0
SF White Bird Creek	3.8	0.4	6.7	9
Little White Bird Creek	0.2	0.2	1.7	2
Jungle Creek	1.1		1.2	4
Asbestos Creek	0.7		0.9	0
Cold Springs Creek	0.4		0.5	0
SF Clearwater River				
Cove Creek	0.2		0.9	0
Dump Creek	0.3		0	0
Bully Creek	2.5		4.8	2
Jungle Creek	0.2		0.6	0
Bivouc Creek	0.3		0	1
Grouse Creek	1		1.9	1
Total	**14.3**	**0.8**	**27.5**	**21**

1.3.2.1 New Permanent Road Construction

The NPCNF proposes to construct 0.09 miles (about 500 feet) of new permanent roads (two sections). These roads will be short connections of other permanent roads and will allow for the decommissioning of 0.86 miles of roads in RHCAs.

1.3.2.2 Temporary Roads

The NPCNF proposes 15.1 miles of temporary roads to access timber harvest units. Existing road templates will be used for 0.8 miles of the 15.1 miles, 14.3 miles will be new construction. None of the temporary roads will be in RHCAs or cross streams. An existing road template is maybe a trail, old skid trail or an old non-system road; in their existing state, these templates are unmaintained and covered with vegetation. Temporary roads are usually decommissioned as soon as possible after use and at least within the time period of the timber sale contract (typically 5 years). The following BMPs are proposed to reduce lasting effects from temporary roads:

- All temporary roads will be decommissioned, scarified, and recontoured after use, within the time frame of the timber sale contract (standard contracts are 3 to 5 years).

- Available slash will be applied to recontoured surfaces (slash is considered available where the equipment is able to reach it from the working area where the decommissioning is occurring).

1.3.2.3 Road Reconstruction and Reconditioning

The amount of road preparation needed for haul can vary. System roads currently maintained for haul may require none or very little maintenance. Proposed haul roads that have been closed for decades may be overgrown with trees and require full reconstruction. Road preparation can be partial or discontinuous, and every element of reconditioning or reconstruction will not be needed for the full length of every mile of proposed haul road. Ongoing maintenance of haul routes is commensurate with use.

Reconstruction is proposed for 0.6 miles of road. Road reconstruction on roads that are overgrown with vegetation and require work to the road template such as widening, curve widening, road realignment and repair of major sections of the existing road that has failed. Activities include clearing and grubbing, reshaping the road template by widening or realignment, replacement or installation of new culverts, repairing major slides and slumps, surface gravel placement and surface compaction.

Maintenance. All haul roads (210 miles) will be screened for maintenance prior to haul. During haul, maintenance is commensurate with use. Maintenance includes roadside brushing, blading, ditch cleaning and spot placement of aggregate where currently absent and is designed to provide for safe passage of vehicles and road surface erosion control.

Crossdrains will be added to haul roads to reduce sediment delivery to streams from roads. There are 43 crossdrains proposed for installation. There are 27 proposed for roads on the South Fork Clearwater side of the action area, 11 proposed in the North Fork WBC subwatershed, and five in the South Fork WBC subwatershed. Adding crossdrains minimizes sediment delivery to streams by diverting water to the forest floor where sediment is filtered out. New crossdrains will be placed within 200 feet of stream crossings to minimize the length of road surface draining to stream crossings. Other crossdrains may be added as needed to reduce cumulative ditch flow. Crossdrains would be installed prior to road prism shaping and ditch reconstruction activities that are upslope of the new crossdrain sites, such that sediment generated from these activities would not drain to the stream.

Aquatic organism passage culverts are proposed for replacing five existing undersized impassable culverts. These replacements will result in no remaining known passage barriers to listed fish species in the WBC watershed. All five culverts occur in designated critical habitat for steelhead with fish presence likely but in low densities. These culvert sites will be slowly dewatered, and fish salvaged, prior to culvert replacement. Turbidity monitoring during rewatering of work areas is not proposed. Culvert work and fish salvage BMPs are found in subsequent sections of this Opinion.

1.3.2.4 Road Decommissioning

The NPCNF proposes to decommission 27.5 miles of unneeded roads (Table 2) and remove an estimated 21 stream crossing culverts from these roads. None of the culvert removals are on fish-bearing streams. Decommissioning improves hydrologic and soil function, and decreases soil erosion and sediment delivery to streams. Decommissioning can range from abandonment to obliteration using full recontouring to match the adjacent hillslope.

Each road will receive a site specific prescription depending on characteristics such as the size of cuts and fills, hill slopes, and erosion risks. Prescriptions may, or may not, include the following:

- Removing gates after applying wood and rock debris across the de-compacted road surface to prevent vehicle usage.

- Out-sloping the road surface.

- Removing any metal culverts and other drainage structures and associated fills.

- Pulling up fill material where there are existing or potential failures, or where the fill is determined to be unstable. Treatments along stream crossings require a complete recontour of all fill material and with stream channels restored to natural grade and dimensions.

- Recontouring portions of the road to original contours or the angle of repose of the fill material.

- Cut and fill slopes at stream crossings will be reshaped to natural contours.

- Disturbed soils would be revegetated with local native transplants and/or seed.

- Diverting streams via temporary culvert or non-eroding, water-tight diversion. Settling basins or other methods will be used to ensure that muddy water does not return to the streams. Diversions will be installed, operated, and removed such that erosion and sedimentation are minimized.

1.3.2.5 Culvert Replacement and Removal

The NPCNF will replace or remove culverts to provide fish passage or road decommissioning. To minimize potential adverse effects on ESA-listed species and their critical habitat, the NPCNF and its contractors will integrate the following mitigation measures or BMPs during all road work near and in streams:

- Instream activities in fish bearing streams will occur between July 1 and August 15. These dates may be site-specifically adjusted through coordination with the Central Idaho Level 1 team review and approval.

- Instream or in-channel work will be performed during low-flow conditions.

- Downstream flow will be diverted around the dewatered area when working within a stream channel (e.g., for culvert removal or installation). Stream flow around the work site will be done using a combination of pumping and/or pre-approved alternative methods.

- To minimize sediment movement, diverted flow will be returned to the channel downstream of the work site by slowly releasing water back into the channel.

- When construction is complete, all structures used for stream diversion or dewatering will be removed.

- Sediment controls will be used to minimize sediment delivery to streams.

- Replacement culvert inlets and outlets will be armored to protect stream banks.

- All culvert replacement and removal sites will be constructed or recontoured to match the surrounding stream channel and bank dimensions.

- Available slash will be applied to recontoured surfaces (slash is considered available where the equipment is able to reach it from the working area where the decommissioning is occurring).

1.3.2.6 Haul

There will be 109 MMBF (Table 3, Figure 2) of logs hauled, on approximately 210 miles of road in the action area. This will occur over a period of up to 14 years or until 2036. Table 3 outlines the use of primary haul routes. Table 3 is organized by subwatershed and primary haul road, showing the estimated board feet, percent of total harvest, round trips, and expected years of use. Forest Road 221 in the action area is paved and will route all haul out of the area. Within the project area, there are five primary haul routes that link the harvest units/landings to Forest Road 221. Those five main routes are spread throughout the project area, and each carries 17 percent to 18 percent of the haul (a total of 86 percent of all haul to Forest Road 221). The remaining 14 percent of haul will come from minor routes directly onto Forest Road 221. In addition, Table 3 shows the character of all perennial stream crossings for each primary haul route, designating streams at each crossing as non-fish bearing, or where ESA-listed fish or designated critical habitat (CH) are present. The low number of stream crossings, and those with ESA-listed fish or CH, is reflective of the harvest area and haul routing. Timber harvest and haul are primarily in the upper head water reaches of the subwatersheds.

About 28 miles of all haul roads on Forest managed lands occur within RHCAs and or cross streams. Log haul would occur during dry or frozen conditions with most occurring between the months of June and September. Roads proposed for haul that are currently open or closed will continue their open or closed status following haul. The condition of active haul routes will be checked regularly for safe driving condition, erosion, and conditions that would lead to erosion or sediment delivery to streams. Road conditions will be checked and specific problems corrected within timeframes specified in the timber sale contract. The road monitoring and required responses are further described in Section 1.3.4 Monitoring, below.

Table 3. Primary haul routes and estimated use.

Surface	Subwatershed	Forest Road No.	Haul Road Miles	MMBF Hauled	% of Total Harvest	Estimated No. of Trips	Loads Per Day June-Oct	Assumed Time Period of Use (Years)	Stream Crossings	
									ESA Fish or DCH	Non-fish
Asphalt	Road 221 Asphalt (all haul)	221	15.9	109	100%	21,800		10	2	10
Gravel	NF White Bird	2000	6.7	18	17%	3,600	25	5	2	8
	SF White Bird	642	5	20	18%	4,000	20	5	1	4
	SF White Bird	243	2.2	20	18%	4,000	15	5	0	0
	Grouse-SF Clwtr	279	11.2	18	17%	3,600	20	10	0	21
	Grouse-SF Clwtr	4600	3.8	18	17%	3,600	25	5	1	4
	Gravel Rd Totals		**29**	**94**	**86%**				**4**	**37**

[1.] Round trips are based on a haul truck carrying capacity of approximately 5,000 board feet.

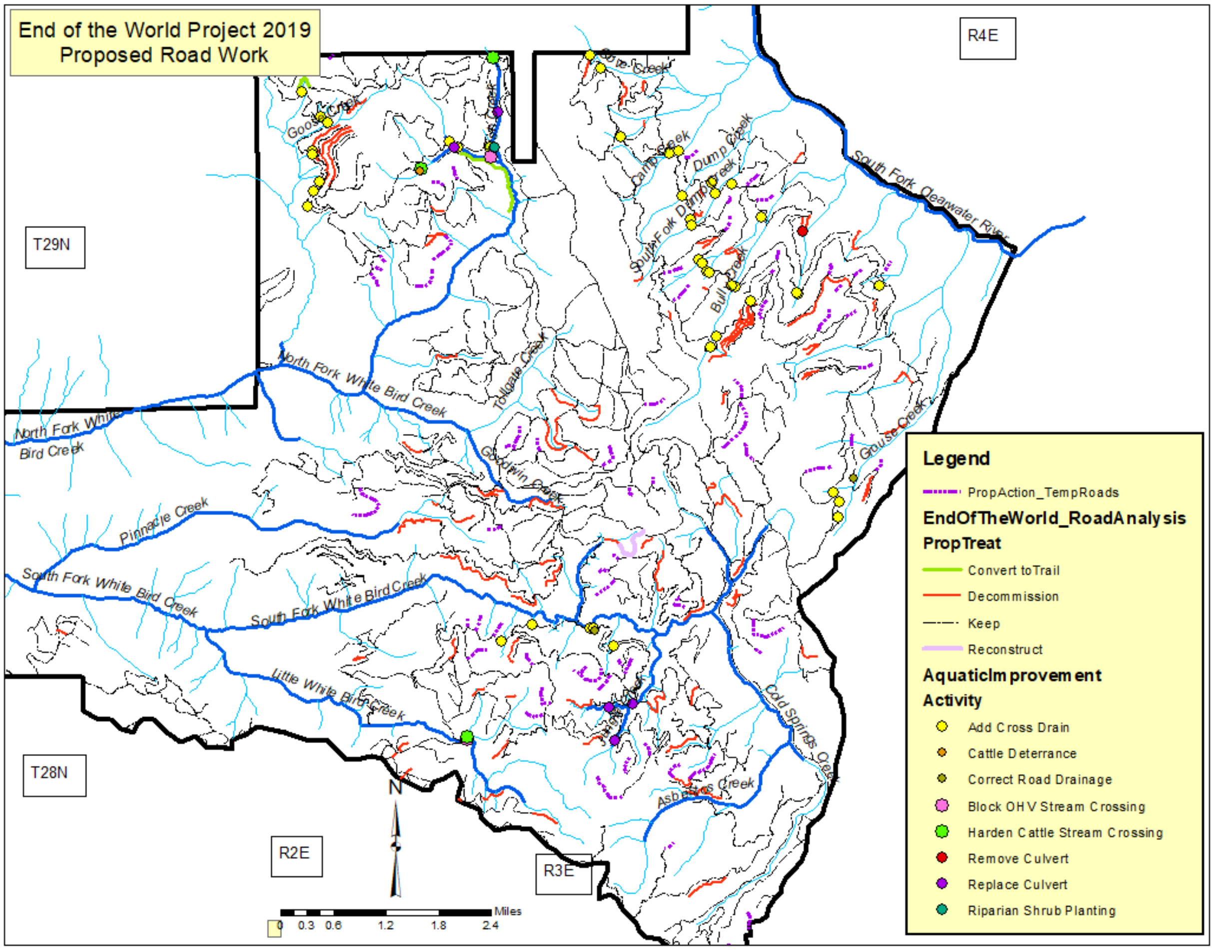

Figure 2. Map of haul routes (black), road and culvert work and road decommissioning. The NPCNF land boundary is in outlined in heavy black.

Dust abatement will be applied to haul routes in any year the road is used for haul. Dust abatement is applied to maintain visibility for drivers and minimize sediment delivery to streams. Magnesium Chloride ($MgCl_2$) and water will be used for dust abatement. Typically, $MgCl_2$ is used for dust abatement on primary graveled haul routes where harvest volumes exceed one million board feet. Because the application of $MgCl_2$ is expensive and water is effective for dust abatement for short durations, haul routes that will be used for short durations with less traffic may receive water for dust abatement. A BMP for the application of $MgCl_2$ includes:

- If the road width allows, a 1-foot no-spray buffer on the edges of the road will be used to minimize overspray into ditches which could contaminate streams.

Water drafting (pumping) in the action area streams may be necessary for providing water for dust abatement. The procedures and BMPs for water pumping from streams are described below in the Water Pumping Section.

1.3.2.7 Water Pumping

There will be water pumped for dust abatement and fire containment, as necessary, in implementing prescribed fire, and for dewatering associated with culvert work. Limited fuel storage for water pumps can occur in RHCAs. Proposed BMPs to minimize impacts to fish from water pumping include:

- Pumping will follow NMFS pumping criteria and screening criteria (NMFS 2011) to isolate the area around the pump intake so fish will not be entrained in the pump or impinged on the intake screen.

- Fish passage will be maintained.

- No more than 20 percent of streamflow will be pumped.

- Undercut banks will not be exposed.

- Fuel containers for the pumps will not exceed 5 gallons (maximum of two containers per site) and absorbent materials will be available on site.

- Fuel containers will be stored on trucks, or placed on absorbent mats, during pumping.

1.3.2.8 Petroleum Fuels and Staging

Machinery is used in harvest and road work activities and will require fuel and maintenance to operate. In addition, vehicles, materials, and other support for construction and other activities will need to be stored onsite. To reduce the chance of petroleum and other products entering the water and causing harm to ESA-listed fish and riparian habitat, the NPCNF proposes the following BMPs:

- Fuels will be stored outside of RHCAs, except in areas where water pumping occurs as described above.

- Storage of fuel, vehicles not in use, and maintenance of vehicles will be in a designated upland staging area located at least 150 feet away from any stream, waterbody, or wetland.

- The NPCNF will ensure that spilled material cannot enter natural or manmade drainage conveyances. The designated fuel storage sites will occur throughout the project area in association with harvest units, road improvement and road decommissioning activities.

- Biodegradable hydraulic fluids will be used in excavators and other machinery when working in water or dewatered areas.

- In the event of a spill, the spill will be contained immediately, the source will be eliminated, and appropriate measures will be deployed to clean and dispose of spilled materials in accordance with federal, state, and local regulations. The Contracting Officer will be notified immediately of hazardous spills.

- The NPCNF will confirm heavy equipment is clean (e.g., power-washed) and that it does not have fluid leaks before mobilization to the project site.

- Equipment and tanks will be inspected for drips or abnormal leaks daily and necessary repairs made within 24 hours.

- Contractors will have spill prevention and containment materials available when working instream, in-channel, or in riparian areas, and during road work to minimize the risk of an accidental spill of petroleum products, as well as to protect water courses and aquatic biota from adverse effects in the event of a spill.

- The loss or fill of wetlands or sensitive aquatic sites will be avoided.

- Construction vehicles and equipment will be restricted to roads and designated work areas.

- All materials and equipment adjacent to work sites will be staged to avoid disturbance to slopes or vegetation.

- Borrow and fill will be located outside of the 100-year floodplain and more than 300 feet from fish-bearing streams.

The NPCNF will obtain any required permits for disturbance of water or wetlands prior to initiating work (Army Corps of Engineers 404 permit, Idaho Department of Water Resources Stream Alteration Permit). All related permit design features, mitigation measures, and BMPs will be incorporated into project plans and contractor specifications.

1.3.2.9 Fish Salvage

Fish salvage may be necessary prior to dewatering/instream work. The following BMPs will be implemented to reduce contact with, or mortality of, ESA-listed fish:

- A qualified and experienced person will be onsite during salvage to ensure that fish crowding, rescue, and removal is conducted to protect the safety of fish.

- Salvage areas will be slowly dewatered to allow fish to volitionally move from these areas prior to salvage.

- Data on the species, condition, and size class of removed fish, will be collected onsite and reported per the proposed monitoring in the Monitoring section (1.3.4) below.

- Electrofishing will follow NMFS electrofishing guidelines (NMFS 2000)

1.3.3 Watershed Improvement Activities

Stream crossing hardening is proposed for three cattle watering locations where stream banks have eroded. Cattle watering sites will be hardened using rock to provide a non-erodible surface for cattle use.

Native shrub planting on 0.1 miles of Fish Creek within a cattle exclosure at the Girl Scout Camp. Native shrubs would be planted to provide future shade and cover over Fish Creek.

Fencing replacement or addition is proposed to exclude cattle from areas needing restoration. Restoration is needed for forest vegetation, meadows and grasslands, and maintaining or improving water quality and aquatic habitats. New fencing may be installed where natural barriers have been removed or additional fencing is needed to provide control of livestock. Fencing may be replaced where is has been removed to facilitate timber harvest. Proposed BMP for fencing include:

- If any pasture fence is removed or breached to facilitate timber harvest, the fence will be re-installed/repaired in the same season.
- All roads and/or skid trails, permanent or temporary, crossing allotment boundaries will have cattle passage barriers installed and maintained.

1.3.4 Monitoring

Harvest

- Harvest areas will be monitored and inspected continuously throughout implementation of the Project.
- Replanted units will be surveyed to certify they are stocked within 5 years.

PACFISH RHCA

The PACFISH RHCA monitoring would be conducted annually by the NPCNF Fisheries Biologist in conjunction with BMP audits. Monitoring would be conducted on randomly selected treatment units throughout the NPCNF. Both implementation and effectiveness of treatments would be monitored. Specific treatments within the project area may be selected for monitoring.

Fish Salvage

Data on the species, condition, and size class of removed fish, will be collected onsite and reported to NMFS.

Road Work and Haul

It is standard practice (and proposed for this action) for the NPCNF Sales Administrators (SAs) to do the following active haul road monitoring when administering timber sales (Personal communication with NPCNF Fish Biologist November 4, 2019):

- Active haul roads are monitored and inspected two to three times a week during haul, before weather fronts, and up to 4 to 5 days a week in the wet shoulder seasons of spring and fall. Precursors to road problems are identified by SAs before damage to a road occurs.

- The SAs will document road conditions on paper and may include pictures. Contractors are notified, before damage to the road occurs, that road surfaces are softening. Contractors will self-regulate while SAs continue to monitor road conditions.

- If an erosion control issue is found, contractors are given 24 hours to fix the problem. For problems in key watersheds (i.e., anadromous fish watersheds), the problem will be fixed immediately.

- If a contractor does not comply, the issue is elevated to the timber sale purchaser.

Under wet conditions, timber purchasers, contractors, or a SA would decide whether to cease haul to avoid road damage which would interrupt haul. When damage has occurred, because of the potential for interruptions in haul, purchasers tend to be timely with fixing identified problems. Only a couple of times in the past has the NPCNF had to use the contract to shut down haul due to noncompliance. Roads tend to deteriorate during the shoulder seasons under wet conditions; a period when SAs may increase inspections to four to five times per week.

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, nor 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 Opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of" a listed species, which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion also relies on the regulatory definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation(s) of critical habitat for (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 ESA 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, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) Directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species; or (2) directly or

indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.

- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species (Table 4) 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' "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 function of the essential PBFs that help to form that conservation value.

Table 4. Listing status, status of critical habitat designations and protective regulations, and relevant Federal Register decision notices for ESA-listed species considered in this Opinion.

Species	Listing Status	Critical Habitat	Protective Regulations
Steelhead (*O. mykiss*)			
Snake River Basin	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160

Note: Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered.

2.2.1 Status of the Species

This section describes the present condition of the Snake River Basin steelhead distinct population segment (DPS). NMFS expresses the status of a salmonid evolutionarily significant units (ESU) or DPS in terms of likelihood of persistence over 100 years (or risk of extinction over 100 years). NMFS uses McElhaney et al.'s (2000) description of a viable salmonid population (VSP) that defines "viable" as less than a five percent risk of extinction within 100 years and "highly viable" as less than a 1 percent risk of extinction within 100 years. A third category, "maintained," represents a less than 25 percent risk within 100 years (moderate risk of extinction). To be considered viable a DPS should have multiple viable populations so that a single catastrophic event is less likely to cause the DPS to become extinct, and so that the DPS may function as a metapopulation that can sustain population-level extinction and recolonization processes (ICTRT 2007). The risk level of the DPS is built up from the aggregate risk levels of the individual populations and major population groups (MPGs) that make up the DPS.

Attributes associated with a VSP are: (1) abundance (number of adult spawners in natural production areas), (2) productivity (adult progeny per parent), (3) spatial structure, and (4) diversity. A VSP needs sufficient levels of these four population attributes in order to: safeguard the genetic diversity of the listed ESU or DPS; enhance its capacity to adapt to various environmental conditions; and allow it to become self-sustaining in the natural environment (ICTRT 2007). These viability attributes are influenced by survival, behavior, and experiences throughout the entire salmonid life cycle, characteristics that are influenced in turn by habitat and other environmental and anthropogenic conditions. The present risk faced by the DPS informs NMFS' determination of whether additional risk will appreciably reduce the likelihood that the DPS will survive or recover in the wild.

2.2.1.1 Snake River Basin Steelhead

The Snake River Basin steelhead was listed as a threatened ESU on August 18, 1997 (62 FR 43937), with a revised listing as a DPS on January 5, 2006 (71 FR 834). This DPS occupies the Snake River basin, which drains portions of southeastern Washington, northeastern Oregon, and north/central Idaho. Reasons for the decline of this species include substantial modification of the seaward migration corridor by hydroelectric power development on the mainstem Snake and Columbia Rivers, and widespread habitat degradation and reduced streamflows throughout the Snake River basin (Good et al. 2005). Another major concern for the species is the threat to genetic integrity from past and present hatchery practices, and the high proportion of hatchery fish in the aggregate run of Snake River Basin steelhead over Lower Granite Dam (Good et al. 2005; Ford 2011). On May 26, 2016, in the agency's most recent 5-year review for Pacific salmon and steelhead, NMFS concluded that the species should remain listed as threatened (81 FR 33468).

Life History. Adult Snake River Basin steelhead enter the Columbia River from late June to October to begin their migration inland. After holding over the winter in larger rivers in the Snake River basin, steelhead disperse into smaller tributaries to spawn from March through May. Earlier dispersal occurs at lower elevations and later dispersal occurs at higher elevations. Juveniles emerge from the gravels in 4 to 8 weeks, and move into shallow, low-velocity areas in side channels and along channel margins to escape high velocities and predators (Everest and Chapman 1972). Juvenile steelhead then progressively move toward deeper water as they grow in size (Bjornn and Rieser 1991). Juveniles typically reside in fresh water for 1 to 3 years, although this species displays a wide diversity of life histories. Smolts migrate downstream during spring runoff, which occurs from March to mid-June depending on elevation, and typically spend 1 to 2 years in the ocean.

Spatial Structure and Diversity. This species includes all naturally-spawning steelhead populations below natural and manmade impassable barriers in streams in the Snake River basin of southeast Washington, northeast Oregon, and Idaho, as well as the progeny of six artificial propagation programs (71FR834). The hatchery programs include Dworshak National Fish Hatchery, Lolo Creek (outplanting location), North Fork Clearwater River, East Fork Salmon River, Tucannon River, and the Little Sheep Creek/Imnaha River steelhead hatchery programs. The Snake River Basin steelhead listing does not include resident forms of *O. mykiss* (rainbow trout) co-occurring with steelhead.

The Interior Columbia Technical Recovery Team (ICTRT) identified 24 extant populations within this DPS, organized into five MPGs (ICTRT 2003). The ICTRT also identified a number of potential historical populations associated with watersheds above the Hells Canyon Dam complex on the mainstem Snake River, a barrier to anadromous fish migration. The five MPGs with extant populations are the Clearwater River, Salmon River, Grande Ronde River, Imnaha

River, and Lower Snake River. In the Clearwater River, the historic North Fork population was blocked from accessing spawning and rearing habitat by Dworshak Dam. Current steelhead distribution extends throughout the DPS, such that spatial structure risk is generally low. For each population in the DPS, Table 5 shows the current risk ratings for the parameters of a viable salmonid population (spatial structure, diversity, abundance, and productivity). The highlighted populations are found in the action area for this Opinion.

Table 5. Summary of viable salmonid population parameter risks and overall current status for each population in the Snake River Basin steelhead DPS (NWFSC 2015). Risk ratings with "?" are based on limited or provisional data series. Boundaries of highlighted populations are found in the action area.

MPG	Population	VSP Risk Parameter		Overall Viability Rating
		Abundance/ Productivity	Spatial Structure/ Diversity	
Lower Snake River	Tucannon River	High?	Moderate	High Risk?
	Asotin Creek	Moderate?	Moderate	Maintained?
Grande Ronde River	Lower Grande Ronde	N/A	Moderate	Maintained?
	Joseph Creek	Very Low	Low	**Highly Viable**
	Wallowa River	N/A	Low	Maintained?
	Upper Grande Ronde	Low	Moderate	**Viable**
Imnaha River	Imnaha River	Moderate?	Moderate	Maintained?
Clearwater River (Idaho)	Lower Mainstem Clearwater River*	Moderate?	Low	Maintained?
	South Fork Clearwater River	High?	Moderate	High Risk?
	Lolo Creek	High?	Moderate	High Risk?
	Selway River	Moderate?	Low	Maintained?
	Lochsa River	Moderate?	Low	Maintained?
	North Fork Clearwater River			*Extirpated*
Salmon River (Idaho)	Little Salmon River	Moderate?	Moderate	Maintained?
	South Fork Salmon River	Moderate?	Low	Maintained?
	Secesh River	Moderate?	Low	Maintained?
	Chamberlain Creek	Moderate?	Low	Maintained?
	Lower Middle Fork Salmon R.	Moderate?	Low	Maintained?
	Upper Middle Fork Salmon R.	Moderate?	Low	Maintained?
	Panther Creek	Moderate?	High	High Risk?
	North Fork Salmon River	Moderate?	Moderate	Maintained?
	Lemhi River	Moderate?	Moderate	Maintained?
	Pahsimeroi River	Moderate?	Moderate	Maintained?
	East Fork Salmon River	Moderate?	Moderate	Maintained?
	Upper Mainstem Salmon R.	Moderate?	Moderate	Maintained?
Hells Canyon	Hells Canyon Tributaries			*Extirpated*

*Current abundance/productivity estimates for the Lower Clearwater Mainstem population exceed minimum thresholds for viability, but the population is assigned moderate risk for abundance/productivity due to the high uncertainty associated with the estimate.

The Snake River Basin DPS steelhead exhibit a diversity of life-history strategies, including variations in fresh water and ocean residence times. Traditionally, fisheries managers have classified Snake River Basin steelhead into two groups, A-run and B-run, based on ocean age at return, adult size at return, and migration timing. A-run steelhead predominantly spend 1-year in the ocean; B-run steelhead are larger with most individuals returning after 2 years in the ocean. New information shows that most Snake River populations support a mixture of the two run types, with the highest percentage of B-run fish in the upper Clearwater River and the South Fork Salmon River; moderate percentages of B-run fish in the Middle Fork Salmon River; and very low percentages of B-run fish in the Upper Salmon River, Grande Ronde River, and Lower Snake River (NWFSC 2015). Maintaining life history diversity is important for the recovery of the species.

Diversity risk for populations in the DPS is either moderate or low. Large numbers of hatchery steelhead are released in the Snake River, and the relative proportion of hatchery adults in natural spawning areas near major hatchery release sites remains uncertain. Moderate diversity risks for some populations are thus driven by the high proportion of hatchery fish on natural spawning grounds and the uncertainty regarding these estimates (NWFSC 2015). Reductions in hatchery-related diversity risks would increase the likelihood of these populations reaching viable status.

Abundance and Productivity. Historical estimates of steelhead production for the entire Snake River basin are not available, but the basin is believed to have supported more than half the total steelhead production from the Columbia River basin (Mallet 1974, as cited in Good et al. 2005). Historical estimates of steelhead passing Lewiston Dam (removed in 1973) on the lower Clearwater River were 40,000 to 60,000 adults (Ecovista et al. 2003), and the Salmon River basin likely supported substantial production as well (Good et al. 2005). In contrast, at the time of listing in 1997, the 5-year mean abundance for natural-origin steelhead passing Lower Granite Dam, which includes all but one population in the DPS, was 11,462 adults (Ford 2011). The most recent 5-year status review (2011–2015) (NWFSC 2015), reports an average of annual average of 30,667 adult wild steelhead passing Lower Granite Dam. However, the average of the last 2 years (2017–18) for natural-origin steelhead passing Lower Granite Dam was 9,078 (ODFW and WDFW 2019), a precipitous drop from the status review average of 30,667. Currently, Idaho Department of Fish Game closed portions of the steelhead sport fishery on September 29, 2019, (https://idfg.idaho.gov/fish/steelhead/rules) due to daily steelhead counts that are even lower than 2017 and 2018.

Population-specific abundance estimates exist for some but not all populations. Of the populations for which we have data, three (Joseph Creek, Upper Grande Ronde, and Lower Clearwater) are meeting minimum abundance/productivity thresholds and several more have likely increased in abundance enough to reach moderate risk. Despite these recent increases in abundance, the status of many of the individual populations remains uncertain, and four out of the five MPGs are not meeting viability objectives (NWFSC 2015). In order for the species to recover, more populations will need to reach viable status through increases in abundance and productivity.

Limiting factors for recovery of the DPS include:

- Adverse effects related to the mainstem Columbia and Snake River hydropower system and modifications to the species' migration corridor.

- Genetic diversity effects from out-of-population hatchery releases. Potential effects from high proportion of hatchery fish on natural spawning grounds.

- Degraded fresh water habitat.
- Harvest related effects, particularly on B-run steelhead.
- Predation in the migration corridor.

The proposed action occurs within the areas occupied by the Clearwater River and Salmon River MPGs, and their South Fork Clearwater River and Little Salmon River populations, respectively. The status of those MPGs and populations is summarized below.

2.2.1.1.1 Clearwater River MPG

Currently, the Clearwater River steelhead MPG does not meet the MPG-level viability criteria. All five extant populations are presently at moderate risk (Lower Mainstem Clearwater, Selway, and Lochsa Rivers) or high risk (Lolo Creek, South Fork Clearwater River) of extinction within 100 years, primarily due to moderate or high abundance and productivity risk. At least three of the MPG's populations must be viable and one must be highly viable for the MPG to meet the viability criteria. The Lower Mainstem Clearwater population is the only extant large population in the MPG and must reach at least low risk status for the MPG to reach viable status.

Part of the proposed action will occur in the South Fork Clearwater watershed, which is occupied by the South Fork Clearwater River steelhead population.

Abundance and Productivity. Current abundance/productivity estimates for the South Fork Clearwater River population exceed minimum thresholds for low risk status, but the population is assigned moderate risk for abundance/productivity due to the high uncertainty associated with the estimate (NWFSC 2015).

Spatial Structure. The South Fork Clearwater River mainstem is one of six major spawning areas for the population. Current spawning is distributed widely across the population and is presumed to occur in all major and most minor spawning areas. Based on the extensive branching of currently occupied habitat, the spatial structure risk for this population is very low, which is adequate for this population to reach its proposed status (NWFSC 2015).

Diversity. Although there is no within-population hatchery program in this population, large numbers of hatchery fish share the mainstem Clearwater migration corridor with this population, and hatchery fish may stray into spawning areas such as the South Fork Clearwater River. There is some diversity risk associated with the high degree of uncertainty regarding the contribution of those hatchery fish to natural spawning. The cumulative diversity risk for this population is low, but the risk rating could be increased to moderate, pending a more in-depth assessment of the potential hatchery-origin component of natural spawners and of selective impacts from recreational harvest. A low diversity risk is adequate for this population to reach its proposed status (NWFSC 2015).

Limiting Factors. Elevated summer water temperatures, low summer stream flows, substrate sedimentation, and loss of habitat complexity generally are likely to be the most significant factors affecting steelhead production in the population area as a whole (NMFS 2017). Other potential limiting factors relevant to the South Fork Clearwater River and the proposed action are degraded floodplain connectivity and function from development (NMFS 2017).

2.2.1.1.2 Salmon River MPG

Currently, the Salmon River steelhead MPG does not meet the MPG-level viability criteria. One population (Panther Creek) remains at high risk of extinction within 100 years and the remaining 11 populations in the MPG are presently at moderate risk of extinction, primarily due to moderate abundance/productivity risk. At least six of the MPG's twelve populations must be viable and one must be highly viable for the MPG to meet the viability criteria. The proposed status for the Little Salmon River population is at least moderate risk for the MPG to reach viable status. A conservative approach of increasing abundance in all 12 populations is warranted given the uncertainty in population estimates and the large variability (including low abundances most recently) in adult returns for the DPS at Lower Granite Dam, as discussed above.

Part of the proposed action will occur in the WBC watershed, which is occupied by the Little Salmon River steelhead population.

Abundance and Productivity. Current abundance/productivity estimates for the Little Salmon River population exceed minimum thresholds for low risk status; however, the population is assigned moderate risk for abundance/productivity due to the uncertainty associated with the estimate, including uncertainty about numbers of hatchery-origin versus natural-origin fish within the population area (NWFSC 2015).

Spatial Structure. The population has one major and four minor spawning areas. The WBC is one of four minor spawning areas for the population. Current spawning is distributed widely across the major and minor spawning areas except for the Rock Creek minor spawning area. Therefore, the spatial structure risk for this population is low, which is adequate for this population to reach its proposed status (NWFSC 2015).

Diversity. Large amounts of hatchery steelhead from both the Hells Canyon and Dworshak Hatcheries, some unmarked, are released into the Little Salmon River annually. Due to these hatchery fish spawning primarily in the Little Salmon River major spawning area, the cumulative diversity risk for this population is moderate, which is adequate for the population to maintain its current, and minimum proposed status to support viability of the MPG and recovery of the DPS (NWFSC 2015).

Limiting Factors. Substrate sediment, migration barriers, low summer stream flows, elevated summer water temperatures, and loss of habitat complexity are the most significant factors affecting steelhead production in the population area as a whole (NMFS 2017).

2.2.2 Status of Critical Habitat

In evaluating the condition of designated critical habitat, NMFS examines the condition and trends of PBFs which are essential to the conservation of the ESA-listed species because they support one or more life stages of the species. Proper function of these PBFs is necessary to support successful adult and juvenile migration, adult holding and spawning, egg incubation, fry emergence and rearing, and the growth and development of juvenile fish. Modification of PBFs may affect freshwater spawning, rearing, or migration in the action area. Generally speaking, sites required to support one or more life stages of the ESA-listed species (i.e., sites for spawning, rearing, migration, and foraging) contain PBF essential to the conservation of the listed species (e.g., spawning gravels, water quality and quantity, side channels, or food) (Table 6).

Table 6. Types of sites, essential physical and biological features, and the species life stage each PBF supports.

Site	Essential Physical and Biological Features (PBF)	Species Life Stage
Snake River Basin Steelhead[a]	**Snake River Basin Steelhead**[a]	**Snake River Basin Steelhead**[a]
Freshwater spawning	Water quality, water quantity, and substrate	Spawning, incubation, and larval development
Freshwater rearing	Water quantity & floodplain connectivity to form and maintain physical habitat conditions	Juvenile growth and mobility
Freshwater rearing	Water quality and forage[b]	Juvenile development
Freshwater rearing	Natural cover[c]	Juvenile mobility and survival
Freshwater migration	Free of artificial obstructions, water quality and quantity, and natural cover[c]	Juvenile and adult mobility and survival

[a] Additional PBFs pertaining to estuarine, nearshore, and offshore marine areas have also been described for Snake River steelhead and Middle Columbia steelhead. These PBFs will not be affected by the proposed action and have therefore not been described in this Opinion.
[b] Forage includes aquatic invertebrate and fish species that support growth and maturation.
[c] Natural cover includes shade, large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

Critical habitat was designated for Snake River basin steelhead on September 2, 2005 (70 FR 52630). Specific stream reaches are designated within the Lower Snake, Salmon, and Clearwater River basins. Critical habitat includes the stream channel and water column with the lateral extent defined by the ordinary high-water line, or the bankfull elevation where the ordinary high-water line is not defined.

Spawning and rearing habitat quality in tributary streams in the Snake River basin varies from excellent in wilderness and roadless areas to poor in areas subject to intensive human land uses (NMFS 2015; NMFS 2017). Critical habitat throughout much of the Interior Columbia (which includes the Snake River and the Middle Columbia River) has been degraded by intensive agriculture, alteration of stream morphology (i.e., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer streamflows, impaired water quality, and reduction of habitat complexity are common problems for critical habitat in non-wilderness areas. Human land use practices throughout the basin have caused streams to become straighter, wider, and shallower, thereby reducing rearing habitat and increasing water temperature fluctuations.

Streamflows are substantially reduced by water diversions (NMFS 2015; NMFS 2017). Withdrawal of water, particularly during low-flow periods that commonly overlap with agricultural withdrawals, often increases summer stream temperatures, blocks fish migration, strands fish, and alters sediment transport (Spence et al. 1996). Reduced tributary streamflow has been identified as a major limiting factor for Snake River Basin steelhead in particular (NMFS 2017).

Many stream reaches designated as critical habitat for these species are listed on the Clean Water Act 303(d) list for impaired water quality, such as elevated water temperature (IDEQ 2011). Some areas, such as some stream reaches in the Upper Grande Ronde, that were historically suitable rearing and spawning habitat are now unsuitable due to high summer stream temperatures. Removal of riparian vegetation, alteration of natural stream morphology, and withdrawal of water for agricultural or municipal use all contribute to elevated stream temperatures. Water quality in spawning and rearing areas in the Snake River has also been impaired by high levels of sedimentation and in some cases by heavy metal contamination from mine waste (e.g., IDEQ and EPA 2003; IDEQ 2001).

The construction and operation of water storage and hydropower projects in the Columbia River basin, including the run-of-river dams on the mainstem lower Snake and lower Columbia Rivers, have altered biological and physical attributes of the mainstem migration corridor. These alterations have affected juvenile migrants to a much larger extent than adult migrants. However, changing temperature patterns have created passage challenges for summer migrating adults in recent years, requiring new structural and operational solutions (i.e., cold water pumps and exit "showers" for ladders at Lower Granite and Lower Monumental dams). Actions taken since 1995 that have reduced negative effects of the hydrosystem on juvenile and adult migrants include:

- Minimizing winter drafts (for flood risk management and power generation) to increase flows during peak spring passage;
- Releasing water from storage to increase summer flows;
- Releasing water from Dworshak Dam to reduce peak summer temperatures in the lower Snake River;
- Constructing juvenile bypass systems to divert smolts, steelhead kelts, and adults that fall back over the projects away from turbine units;
- Providing spill at each of the mainstem dams for smolts, steelhead kelts, and adults that fall back over the projects;
- Constructing “surface passage” structures to improve passage for smolts, steelhead kelts, and adults falling back over the projects; and

- Maintaining and improving adult fishway facilities to improve migration passage for adult salmon and steelhead.

The present condition of PBFs and the human activities that affect PBF trends within the action area are further described in the environmental baseline.

The Doc Denny Vegetation Project (NMFS No.: 2013/10058) borders the GCS portion of the action area for EOW and is currently ongoing. Because the effects determinations for the Doc Denny project are NLAA Snake River Basin steelhead or their critical habitat, the project will also be NLAA the Snake River Basin steelhead critical habitat designation as a whole.

2.2.3 Climate Change Implications for ESA-listed Species and their Critical Habitat

Climate change is one factor affecting the rangewide status of Snake River Basin steelhead and aquatic habitat, including designated critical habitat for Snake River Basin steelhead and essential fish habitat for Pacific salmon. The United States Global Change Research Program reports average warming of about 1.3°F from 1895 to 2011, and projects an increase in average annual temperature of 3.3°F to 9.7°F by 2070 to 2099 (USGCRP 2014). Climate change has negative implications for designated critical habitats in the Pacific Northwest (Climate Impacts Group 2004; Scheuerell and Williams 2005; Zabel et al. 2006; ISAB 2007).

According to the Independent Scientific Advisory Board, those effects pose the following impacts into the future:

- Warmer air temperatures will result in diminished snowpack and a shift to more winter/spring rain and runoff, rather than snow that is stored until the spring/summer melt season;

- With a smaller snowpack, watersheds will see their runoff diminished earlier in the season, resulting in lower stream flows in the June through September period. Winter/early spring river flows in general and peak river flows are likely to increase due to more precipitation falling as rain rather than snow; and

- Water temperatures are expected to rise, especially during the summer months when lower stream flows co-occur with warmer air temperatures.

These changes will not be spatially homogeneous across the entire Pacific Northwest. Low-lying areas are likely to be more affected. Climate change may have long-term effects that include, but are not limited to, depletion of important cold-water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, and increased competition among species.

Climate change is predicted to cause a variety of impacts to Pacific salmon and their ecosystems (Mote et al. 2003; Crozier et al. 2008a; Martins et al. 2012; Wainwright and Weitkamp 2013). The complex life cycles of anadromous fishes, including steelhead, rely on productive freshwater, estuarine, and marine habitats for growth and survival, making them particularly vulnerable to environmental variation. Ultimately, the effects of climate change on salmon and steelhead across the Pacific Northwest will be determined by the specific nature, level, and rate of change and the synergy between interconnected terrestrial/freshwater, estuarine, nearshore, and ocean environments.

The primary effects of climate change on Pacific Northwest salmon and steelhead include:

- Direct effects of increased water temperatures on fish physiology;
- Temperature-induced changes to stream flow patterns;
- Alterations to freshwater, estuarine, and marine food webs; and
- Changes in estuarine and ocean productivity.

While all habitats used by Pacific salmon and steelhead will be affected, the impacts and certainty of the change vary by habitat type. Some effects (e.g., increasing temperature) affect salmon and steelhead at all life stages in all habitats, while others are habitat-specific, such as stream-flow variation in freshwater, sea-level rise in estuaries, and upwelling in the ocean. How climate change will affect each stock or population of steelhead also varies widely depending on the level or extent of change, the rate of change, and the unique life-history characteristics of different natural populations (Crozier et al. 2008b). For example, a few weeks' difference in migration timing can have large differences in the thermal regime experienced by migrating fish (Martins et al. 2011).

Temperature Effects

Like most fishes, steelhead are poikilotherms (cold-blooded animals); therefore, increasing temperatures in all habitats can have pronounced effects on their physiology, growth, and development rates (see review by Whitney et al. 2016). Increases in water temperatures beyond their thermal optima will likely be detrimental through a variety of processes, including increased metabolic rates (and therefore food demand), decreased disease resistance, increased physiological stress, and reduced reproductive success. All of these processes are likely to reduce survival (Beechie et al. 2013; Wainwright and Weitkamp 2013; Whitney et al. 2016).

By contrast, increased temperatures at ranges well below thermal optima (i.e., when the water is cold) can increase growth and development rates. Examples of this include accelerated emergence timing during egg incubation stages, or increased growth rates during fry stages (Crozier et al. 2008a; Martins et al. 2011). Temperature is also an important behavioral cue for migration (Sykes et al. 2009), and elevated temperatures may result in earlier-than-normal migration timing. While there are situations or stocks where this acceleration in processes or behaviors is beneficial, there are also others where it is detrimental (Martins et al. 2012; Whitney et al. 2016).

Freshwater Effects

Climate change is predicted to increase the intensity of storms, reduce winter snow pack at low and middle elevations, and increase snowpack at high elevations in northern areas. Middle and lower-elevation streams will have larger fall/winter flood events and lower late-summer flows, while higher elevations may have higher minimum flows. How these changes will affect freshwater ecosystems largely depends on their specific characteristics and location, which vary at fine spatial scales (Crozier et al. 2008b; Martins et al. 2012). For example, within a relatively small geographic area (the Salmon River basin in Idaho), survival for some Chinook salmon populations was shown to be determined largely by temperature, while in others it was determined by flow (Crozier and Zabel 2006). The largest driver of climate-induced decline in salmon populations is projected to be the impact of increased winter peak flows, which increase scour of the streambed and can thus destroy salmon eggs (Battin et al. 2007). Steelhead will tend to be somewhat less affected than salmon by that change in timing of peak flow, given the later timed and shorter duration of steelhead egg incubation in stream substrates.

Certain steelhead populations inhabiting regions that are already near or exceeding thermal maxima will be most affected by further increases in temperature and, perhaps, the rate of the increases. The effects of altered flow are less clear and likely to be basin-specific (Crozier et al. 2008b; Beechie et al. 2013). However, river flow is already becoming more variable in many rivers, and is believed to negatively affect anadromous fish survival more than other environmental parameters (Ward et al. 2015). It is likely this increasingly variable flow is detrimental to multiple salmon and steelhead populations, and likely multiple other freshwater fish species in the Columbia River basin as well.

Stream ecosystems will likely change in response to climate change in ways that are difficult to predict (Lynch et al. 2016). Changes in stream temperature and flow regimes will likely lead to shifts in the distributions of native species and provide “invasion opportunities” for exotic species. This will result in novel species interactions, including predator-prey dynamics, where juvenile native species may be either predators or prey (Lynch et al. 2016; Rehage and Blanchard 2016). How juvenile native species will fare as part of “hybrid food webs,” which are constructed from natives, native invaders, and exotic species, is difficult to predict (Naiman et al. 2012).

Estuarine Effects

In estuarine environments, the two big concerns associated with climate change are rates of sea level rise and water temperature warming (Wainwright and Weitkamp 2013; Limburg et al. 2016). Estuaries will be affected directly by sea-level rise: as sea level rises, terrestrial habitats will be flooded and tidal wetlands will be submerged (Kirwan et al. 2010; Wainwright and Weitkamp 2013; Limburg et al. 2016). The net effect on wetland habitats depends on whether rates of sea-level rise are sufficiently slow that the rates of marsh plant growth and sedimentation can compensate (Kirwan et al. 2010).

Due to land mass subsidence, sea-level rise will affect some areas more than others, with the largest effects expected for the lowlands, like southern Vancouver Island and central Washington coastal areas (Verdonck 2006; Lemmen et al. 2016). The widespread presence of dikes in Pacific Northwest estuaries will restrict inland estuary expansion as sea levels rise, likely resulting in a near-term loss of wetland habitats for salmon and steelhead (Wainwright and Weitkamp 2013). Sea-level rise will also result in greater intrusion of marine water into estuaries, resulting in an overall increase in salinity, which will also contribute to changes in estuarine floral and faunal communities (Kennedy 1990). While not all anadromous fish species are highly reliant on estuaries for rearing, extended estuarine use may be important in some populations (Jones et al. 2014), especially if stream habitats are degraded and become less productive. Preliminary data indicate that some Snake River Basin steelhead smolts are feeding and actively growing as they migrate between Bonneville Dam and the ocean (Beckman et al. 2018).

Marine Effects

In marine waters, increasing temperatures are associated with observed and predicted poleward range expansions of fish and invertebrates in both the Atlantic and Pacific Oceans (Lucey and Nye 2010; Asch 2015; Cheung et al. 2015). Rapid poleward species shifts in distribution in response to anomalously warm ocean temperatures have been well documented in recent years, confirming this expectation at short time scales. Range extensions were documented in many species from southern California to Alaska during unusually warm water associated with “the blob” in 2014 and 2015 (Bond et al. 2015; Di Lorenzo and Mantua 2016) and past strong El Niño events (Pearcy 2002; Fisher et al. 2015).

Non-native species benefit from these extreme conditions to increase their distributions. Green crab recruitment increased in Washington and Oregon waters during winters with warm surface waters, including 2014 (Yamada et al. 2015). Similarly, Humboldt squid dramatically expanded their range during warm years of 2004–09 (Litz et al. 2011). The frequency of extreme conditions, such as those associated with El Niño events or “blobs” is predicted to increase in the future (Di Lorenzo and Mantua 2016).

Expected changes to marine ecosystems due to increased temperature, altered productivity, or acidification will have large ecological implications through mismatches of co-evolved species and unpredictable trophic effects (Cheung et al. 2015; Rehage and Blanchard 2016). These effects will certainly occur, but predicting the composition or outcomes of future trophic interactions is not possible with current models.

Wind-driven upwelling is responsible for the extremely high productivity in the California Current ecosystem (Bograd et al. 2009; Peterson et al. 2014). Minor changes to the timing, intensity, or duration of upwelling, or the depth of water-column stratification, can have dramatic effects on the productivity of the ecosystem (Black et al. 2015; Peterson et al. 2014). Current projections for changes to upwelling are mixed: some climate models show upwelling unchanged, but others predict that upwelling will be delayed in spring, and more intense during summer (Rykaczewski et al. 2015). Should the timing and intensity of upwelling change in the future, it may result in a mismatch between the onset of spring ecosystem productivity and the timing of steelhead entering the ocean, and a shift toward food webs with a strong sub-tropical component (Bakun et al. 2015).

Columbia River anadromous fish also use coastal areas of British Columbia and Alaska and midocean marine habitats in the Gulf of Alaska, although their fine-scale distribution and marine ecology during this period are poorly understood (Morris et al. 2007; Pearcy and McKinnell 2007). Increases in temperature in Alaskan marine waters have generally been associated with increases in productivity and salmon survival (Mantua et al. 1997; Martins et al. 2012), perhaps because baseline temperatures have generally been below thermal optima for salmon growth and survival (Gargett 1997). Warm ocean temperatures in the Gulf of Alaska are also associated with intensified downwelling and increased coastal stratification, which may result in increased food availability to juvenile salmon along the coast (Hollowed et al. 2009; Martins et al. 2012). Predicted increases in freshwater discharge in British Columbia and Alaska may influence coastal current patterns (Foreman et al. 2014), but the effects on coastal ecosystems are poorly understood.

In addition to becoming warmer, the world's oceans are becoming more acidic as increased atmospheric COR2R is absorbed by water. The North Pacific is already acidic compared to other oceans, making it particularly susceptible to further increases in acidification (Lemmen et al. 2016). Laboratory and field studies of ocean acidification show it has the greatest effects on invertebrates with calcium-carbonate shells, and relatively little direct influence on finfish; see reviews by Haigh et al. (2015) and Mathis et al. (2015). Consequently, the largest impact of ocean acidification on salmon will likely be its influence on marine food webs, especially its effects on lower trophic levels, which are largely composed of invertebrates (Haigh et al. 2015; Mathis et al. 2015). Marine invertebrates fill a critical gap between freshwater prey and larval and juvenile marine fishes, supporting juvenile salmon growth during the important early-ocean residence period (Daly et al. 2009, 2014).

Uncertainty in Climate Predictions

There is considerable uncertainty in the predicted effects of climate change on the globe as a whole, and on the Pacific Northwest in particular, and there is also the question of indirect effects of climate change and whether human "climate refugees" will move into the range of salmon and steelhead, increasing stresses on their respective habitats (Dalton et al. 2013; Poesch et al. 2016).

Many of the effects of climate change (e.g., increased temperature, altered flow, coastal productivity, etc.) will have direct impacts on the food webs that species rely on in freshwater, estuarine, and marine habitats to grow and survive. Such ecological effects are extremely difficult to predict even in fairly simple systems, and minor differences in life-history characteristics among stocks of salmon may lead to large differences in their response (e.g., Crozier et al. 2008b; Martins et al. 2011, 2012). This means it is likely that there will be "winners and losers," meaning some steelhead populations may enjoy different degrees or levels of benefit from climate change while others will suffer varying levels of harm.

Climate change is expected to impact anadromous fish during all stages of their complex life cycle. In addition to the direct effects of rising temperatures, indirect effects include alterations in stream-flow patterns in freshwater and changes to food webs in freshwater, estuarine, and marine habitats. There is high certainty that predicted physical and chemical changes will occur; however, the ability to predict bio-ecological changes to fish or food webs in response to these physical/chemical changes is extremely limited, leading to considerable uncertainty.

Summary

The status of Snake River Basin steelhead is also likely to be affected by climate change. Climate change is expected to impact Pacific Northwest anadromous fish during all stages of their complex life cycle. In addition to the direct effects of rising temperatures, indirect effects include alterations in stream-flow patterns in freshwater and changes to food webs in freshwater, estuarine, and marine habitats. There is high certainty that predicted physical and chemical changes will occur; however, the ability to predict bio-ecological changes to fish or food webs in response to these physical/chemical changes is extremely limited, leading to considerable uncertainty. As we continue to deal with a changing climate, management actions may help alleviate some of the potential adverse effects (e.g., hatcheries serving as a genetic reserve and source of abundance along with natural populations, and increased riparian vegetation to control water temperatures).

Climate change is expected to make recovery targets for steelhead populations more difficult to achieve. Climate change is expected to alter critical habitat by generally increasing temperature and peak flows and decreasing base flows. Although changes will not be spatially homogenous, effects of climate change are expected to decrease the capacity of critical habitat to support successful spawning, rearing, and migration. Habitat action can address the adverse impacts of climate change on steelhead. Examples include restoring connections to historical floodplains and freshwater and estuarine habitats to provide fish refugia and areas to store excess floodwaters, protecting and restoring riparian vegetation to ameliorate stream temperature increases, and purchasing or applying easements to lands that provide important cold water or refuge habitat (Battin et al. 2007; ISAB 2007).

The timeframe for implementing the proposed action will occur while climate change-related effects are expected to become more evident in this and other watersheds within the range of the Snake River Basin steelhead DPS. Climate change may increase the risk of large rain-on-snow (ROS) runoff events (Crozier 2013) which could increase erosion on roads.

2.3 Action Area

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

The action area is within three subwatersheds: 1) The North Fork WBC (National Hydrography Dataset, HUC 170602090602); 2) the South Fork WBC (HUC 170602090601); and (3) the GCS (HUC 170603050703). The action area in the GCS includes on the tributaries that drain from the southwest into the South Fork Clearwater River but does not include the South Fork Clearwater River (Figure 3). Designated critical habitat is found in all larger tributaries in the WBC watershed. There is no designated critical habitat in the action area portion of the GCS (Figure 3). The specific locations of the project activities are detailed in NPCNF's BA for this project.

For this project, the action area includes: (1) Harvest and burning units, associated facilities for skidding and yarding trees, and roads constructed or used for the project; (2) RHCAs and stream channels that are adjacent to those units, facilities, and roads; (3) stream channels up to 600 feet downstream from the lower-most point of the adjacent harvest unit, facility, or road; and (4) stream channels within 600 feet below stream crossings on non-paved (soil or gravel surface) roads on the haul route. The 600-foot limit is the distance that NMFS expects project-generated sediment in streams to become indistinguishable from background levels of instream sediment.

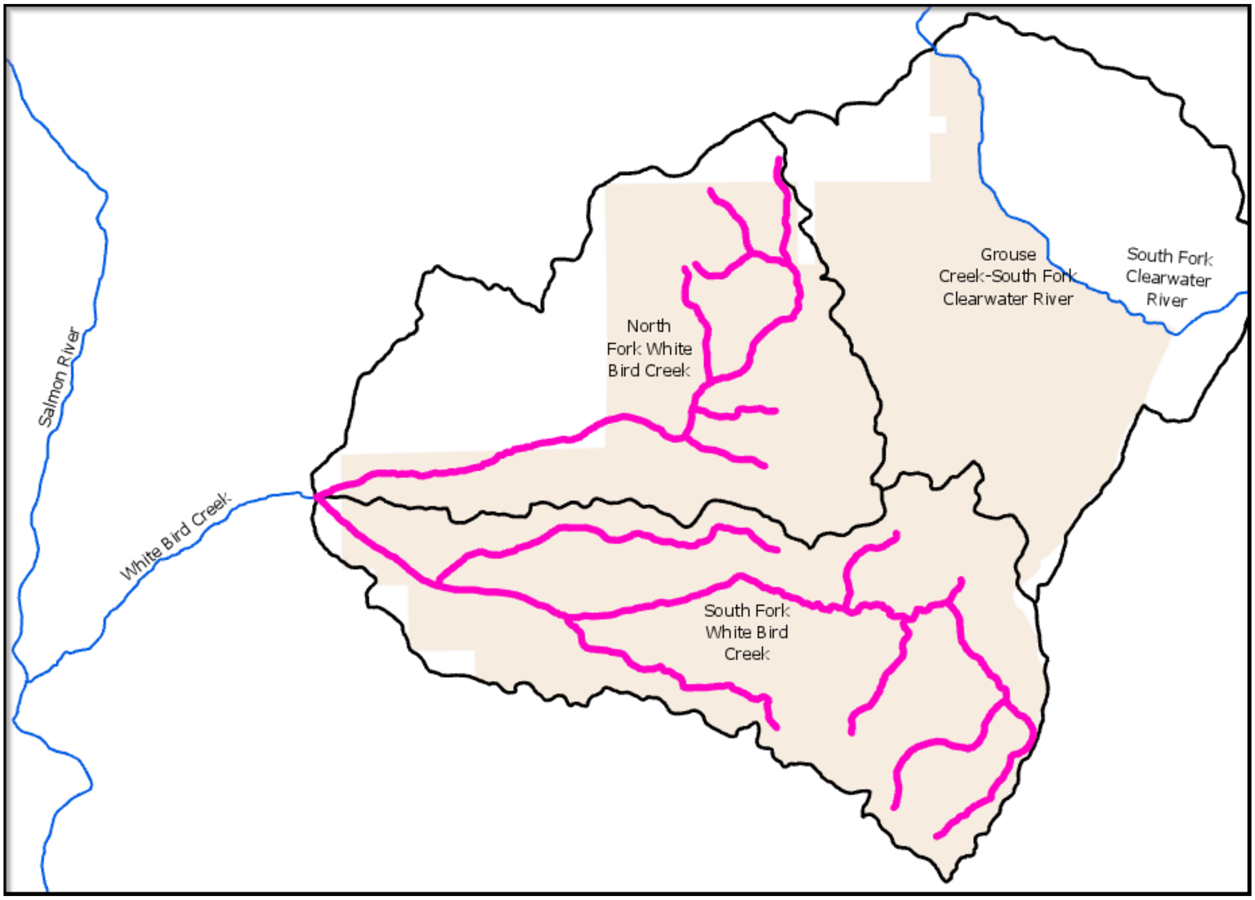

Figure 3. The action area (brown shading) is within three subwatersheds (black outlined areas). Designated steelhead critical habitat in the action area is shown as pink lines. The Salmon and South Fork Clearwater Rivers, and WBC, are designated critical habitat but are not in the action area.

The action area is used by all freshwater life history stages of threatened Snake River Basin steelhead (Figure 3). Designated critical habitat for Snake River Basin steelhead includes specific reaches of streams and rivers, as published in the Federal Register (70 FR 52630).

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).

2.4.1 Watershed Overview

The action area is divided between the WBC watershed draining to the Salmon River, and the GCS draining to the South Fork Clearwater River. The proposed action will occur over approximately 57 square miles (mi^2) or 55 percent of the WBC watershed and 20 mi^2 of the GCS; tributaries in the action area in this subwatershed are found to the west of the South Fork Clearwater River.

The action area is in a transitional snow zone dominated by rain at lower elevations on the White Bird side and snow covered for much of the winter in the upper elevation of the action area.

2.4.2 White Bird Watershed

In the White Bird watershed, landforms vary with elevation. Upper elevations are gentle forested slopes and meadows with low erosive basaltic soils in the North Fork White Bird subwatershed and erosive granitic soils in the South Fork White Bird subwatershed. Mid elevation break lands are steep and forested giving way to grasslands in the lower elevations with low erosive volcanic soils. Average stream gradient for the White Bird watershed is 6.8 percent with reaches of 4 percent or less found in the upper flatter areas and in short segments in the mainstem WBC below the proposed treatment units.

Sediment measures show low to moderate cobble embeddedness (CE) in the upper tributaries to WBC (Table 7). Evidence shows that CE may be related to underlying soil type and stream gradient in this watershed. The CE ranges from 14 percent to 24 percent, and gradient averages 8 percent, in all fish-bearing tributaries with stable basaltic soils. In contrast, in the upper reaches of the South Fork WBC subwatershed, CE is 46 percent in tributaries where stream gradients average 3 percent and there are erosive granitic soils (Jungle, Asbestos, and Cold Springs Creeks). Wildfire does not predict the difference in CE between the basaltic and granitic soil areas because both soil type areas had roughly the same area burned, at 43 percent and 44 percent respectively, in the Burnt Flats Fire. The Burnt Flats Fire occurred in 2000 affecting riparian areas in the White Bird watershed; with time streambanks have grown vegetation and current CE measures indicate instream sediment effects from the fire have passed. In summary, for the Whitebird Creek Watershed, basaltic soils, higher stream gradients, and low CE is found throughout the watershed. The exception is the South Fork WBC drainage which has high CE in areas with erosive granitic soils and low gradient stream reaches (less than 4 percent) which can store sediment for longer periods than higher gradient reaches.

The mainstem of WBC is within the action area and below project activities. Wollman pebble counts for two sites in the mainstem WBC immediately below the NPCNF boundary showed 0 percent and 3 percent fines (IDEQ 2018; https://mapcase.deq.idaho.gov/wq2016/). These sites were lower gradient riffles and run/glides suitable for anadromous fish spawning and rearing. The low levels of fines show that fine sediment is readily transported through the mainstem WBC.

Table 7. Baseline conditions in the action area. The CE measurements were not taken in non-fish-bearing streams during the 2017 surveys.

Stream	Fish Presence	% Cobble Embeddedness	Wildfire 1889–2009 (FS acres only)	Road Density Ave miles per square miles	Grazing Area Allotted
North Fork White Bird HUC 12			***4,660***	4.2	100%
Goose Creek	no fish	NA	1,016		
Fish Creek	no anadromous	20% (1993)	597		
Tollgate Creek	no fish	NA	-		
Goodwin Creek	no fish	no data	-		
North Fork White Bird	ANADROMOUS	16% (2017)	3,047		
South Fork White Bird HUC 12			***11,737***	3.9	
Pinnacle Creek	ANADROMOUS	24% (2017)	1,803		
South Fork WBC	ANADROMOUS	14% (2017)	5,963		
Little WBC	ANADROMOUS	14% (2017)	2,227		
Jungle Creek	no anadromous	54% (2017)	665		
Asbestos Creek	no anadromous	35% (1985)[1]	743		
Cold Springs Creek	no anadromous	49%	336		
Grouse Cr- SF Clwtr River HUC12			***2,709***	4.1	
Bully	no fish	12% (1992)	1,185		
Dump		38% (1992)	64		
Cove		NA	280		
Jungle		NA	240		
Bivouac		NA	35		
Grouse		NA	-		
South Fork Clearwater Face 01		NA	905		

[1.] No CE measure taken in 2017 due to inappropriate channel type with no gravel or cobble.

As expressed in Table 7, Road density is approximately 4 miles per square mile. This high road density is indicative of heavy land management in the past. Timber harvest and road building has been going on since the 1940s with 700 acres of regeneration harvest occurring since 1995 and only 160 acres in the last 10 years. Although Forest roads can be a chronic source of fine sediment, the road system in the action area may only be affecting low gradient reaches of streams found in the South Fork WBC subwatershed as evidenced by CE measurements in this subwatershed (Table 7).

Equivalent clearcut acres (ECA) is a measure of canopy opening, from management activities and roads, that acts as an indicator of change in the hydrologic regime in a watershed. The ECAs for the two subwatersheds, North and South Forks of WBC, are low at 12 percent and 6 percent respectively, indicating well-forested land and little influence on water yield.

All proposed treatment units are allotted for grazing and are actively grazed. Some streams in high meadow areas have been fenced to exclude grazing to prevent further minor damage to stream banks. PACFISH riparian management objectives for large wood are being met in this watershed.

The WBC watershed is part of a minor spawning area for the Little Salmon River steelhead population. Although this population is currently meeting its population target abundance, abundance estimates carry a high uncertainty and adult returns have plummeted in 2017 through 2019. Steelhead are found in the Mainstem, North, and South Forks of WBC and the Little Whitebird and Pinnacle Creeks. Habitat limiting factors in this watershed are passage barriers for migration (NMFS 2017). In the action area there are five culverts that are passage barriers to steelhead and all are in critical habitat.

2.4.3 Grouse Creek-South Fork Clearwater Subwatershed

Tributaries to the South Fork Clearwater River in the action area have different physical conditions and fish presence than the Whitebird watershed tributaries. All of these tributaries are underlain by a highly erosive granitic soil type and steep gradients, and large substrates. Although drainage areas for these tributaries differ to a small degree, all tributaries have an average gradient of 14 percent and no sections less than 4 percent. Despite having high gradients and large substrates indicative of high transport capacity, sediment levels in these tributaries can be moderate, as indicated by the CE measures in Table 7 for Dump Creek. This elevated sediment is likely due to erosive soils and old, unmaintained, legacy roads. None of these tributaries are fish bearing or are designated critical habitat. The ECA for the GCS is 3 percent indicating well forested land and little, if any, influence on water yield.

The Doc Denny Vegetation Project (NMFS No.: 2013/10058) borders the GCS portion of the action area for EOW and is currently ongoing. Because the effects determinations for the Doc Denny project are NLAA Snake River Basin steelhead or their critical habitat, and the Doc Denny and EOW action areas do not overlap, effects from the Doc Denny project will not affect baseline conditions in the EOW action area.

The South Fork Clearwater River steelhead population is currently at moderate to high risk due to a tentative high risk rating for abundance and productivity, based on the ICTRT's average surrogate B-run population passing Lower Granite Dam (NWFSC 2015). In the absence of population-specific data, we assume that improvements in abundance and productivity will need to occur for this population to reach its proposed status of maintained, with moderate risk.

Action area tributaries to the South Fork Clearwater are contained within the boundaries of the South Fork Clearwater steelhead population. However, all of these tributaries are non-fish-bearing. These tributaries, and the South Fork Clearwater River from these tributaries to its mouth, are not part of any major or minor spawning areas for this population. Habitat limiting factors for the South Fork Clearwater River steelhead population are riparian conditions, elevated stream temperatures, migration barriers, sediment, and habitat complexity.

2.4.4 Baseline Summary

The action area is divided between the WBC watershed draining to the Salmon River, and the GCS draining to the South Fork Clearwater River. The majority of the action area, and proposed vegetative treatments, occurs in the WBC watershed. Anadromous fish only occur in the White Bird watershed portion of the action area.

Sediment levels in streams are generally low to moderate. Moderate sediment levels are closely tied to stream gradients and underlying geology. Higher elevation areas have gentle slopes. High gradient streams and low sediment levels are found in the North Fork WBC subwatershed and all tributaries to the South Fork Clearwater. Tributaries in the higher elevation areas of the South Fork WBC subwatershed have less steep gradients, lack transport capacity, and moderate sediment levels. Sediment levels in all streams with anadromous fish are low. Sediment levels overall indicate that legacy and ongoing activities in the action area, including road use, past timber harvest, and grazing, are contributing fine sediment to streams but this fine sediment is readily transported away in high water. The exception to this are low gradient stream reaches in the South Fork WBC subwatershed that lack transport capacity. There, sediment contributions from legacy and ongoing activities may have a larger or more lasting effect. Riparian areas outside the stream channels in the upper areas are recovering from past wildfire and grazing, and are currently well vegetated. Large woody debris generally meets PACFISH standards throughout the action area.

The action area overlays parts of the Little Salmon River, and South Fork Clearwater River steelhead population boundaries., The Little Salmon River population is at a tentative maintained status due to uncertainty in abundance estimates and need to reach a maintained status or higher for species recovery. The South Fork Clearwater population is at high risk and needs to improve abundance to reach at least a moderate risk status. Critical habitat, spawning, and rearing occurs in the White Bird tributaries. Tributaries draining to the South Fork Clearwater are non-fish-bearing streams and are not critical habitat. Limiting factors for the populations, and found in the action area, are passage barriers, sediment, water temperature, and riparian habitat.

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 BA provides an analysis of the effects of the EOW Project on Snake River Basin steelhead and their critical habitat. NMFS uses information in the BA, and additional information, provided by NPCNF for the effects analysis. In addition, NMFS used the best available data and information from databases, government reports, and scientific literature to discuss and evaluate the potential effects of the proposed action on Snake River Basin steelhead and the essential habitat features of their critical habitat in the following sections.

<u>2.5.1 Effects on ESA-listed Species</u>

The proposed action will be implemented over a period of 20 years, with activities being conducted as conditions allow (e.g., timber harvest could occur year round, road work will typically occur from April through November, and prescribed fire will typically occur in the spring and fall). As a reminder, all proposed activities will occur in the first 14 years with burning and road closures continuing for the next 6 years. All life stages (i.e., incubating eggs, alevins, fry, juveniles, and adults) of steelhead are expected to be present in streams within the WBC watershed. Steelhead typically spawn from March to June, and fry emerge by mid-July.

The proposed action has the potential to affect Snake River Basin steelhead due to the following: (1) Construction noise exposure; (2) water withdrawals; (3) chemical contamination; (4) fish salvage (5) addition of suspended sediment (6) addition of deposited sediment; (7) streamflow alteration (ECA); and (8) stream temperature alteration. These potential effects are described in more detail below.

2.5.1.1 Construction Noise

Heavy equipment (e.g., excavator, grader, log truck, and dump truck, etc.) operation on roads near streams will create visual, noise, vibration, and water surface disturbances. Popper et al. (2003) and Wysocki et al. (2007) discussed potential impacts to fish from long-term confined exposure to anthropogenic sounds, predominantly air blasts and aquaculture equipment, respectively. Popper et al. (2003) identified possible effects to fish including temporary, and potentially permanent hearing loss (via sensory hair cell damage), reduced ability to communicate with species members due to hearing loss, and masking of potentially biologically important sounds. These studies evaluated noise levels ranging from 115 to 190 decibels (dB) referenced at 1 micropascal (re: 1µPa). In the studies identified by Popper et al. (2003) that caused ear damage in fishes, all evaluated fish were caged and thus incapable of moving away from the disturbance. Wysocki et al. (2007) did not identify any adverse impacts to rainbow trout from prolonged exposure to three sound treatments common in confined aquaculture environments (115, 130 and 150 dB root mean square re: 1µPa).

The Federal Highway Administration (2008) has found that noise production by a grader, backhoe, and truck ranges between 80 and 85 dB. Because up to 150 dB was not found to harm fish (Wysocki et al. 2007), and expected noise levels from road work are not expected to exceed 85 dB, noise from road work is not expected to harm steelhead. In addition, noise from haul is expected to be less intense than for near-stream or instream work. Therefore, noise-related disturbances from the proposed action are unlikely to result in injury or death. Although noise levels are not expected to injure or kill fish, they may cause fish to move away from the sounds.

If fish move, they are expected to migrate only short distances to nearby suitable areas for a few hours in any given day. Because work or haul noise affecting steelhead will occur at only five culvert replacement sites and six haul road crossings, be sporadic and of low intensity, and at most cause juvenile steelhead to temporarily move away from the noise, juvenile steelhead are unlikely to be harmed by construction noise/vibration or visual disturbances in the action area.

2.5.1.2 Water Withdrawals

Water will be withdrawn from streams for prescribed fire safety, dust abatement, and temporarily pumping/diverting water out of stream channel sections for culvert replacement. The pumping for culvert replacements would occur at the five culvert replacement sites. At those five sites, the temporary diversion of the stream to accomplish culvert work in the dry will maintain streamflow and fish passage below and around the sites during the few days of work. Other BMPs will be employed to reduce sediment delivery and potential for chemical contamination (discussed in sections below). Withdrawing water from streams can impact fish though entrainment in intake hoses, by impingement on fish screens, and by reducing water quality and quantity.

Streamflows are a critical part of fish habitat and viability. Reducing streamflow can adversely affect the amount and quality of habitat accessible, reduce food availability and forage opportunities, and adversely affect water quality. This, in turn, can affect the growth, survival, and productivity of steelhead. Reducing flow could eliminate access of juvenile salmonids to important habitat types such as undercut banks and tributary streams (Brusven et al. 1986; Raleigh et al. 1986). Similarly, reducing the volume of water in streams would reduce the quantity and quality of prey and would limit foraging opportunities and foraging efficiency of salmonids (Boulton 2003; Davidson et al. 2010; Harvey et al. 2006; Nislow et al. 2004; Stanley et al. 1994). In addition to adverse impacts to habitat and forage, reductions in streamflow can adversely impact water quality by increasing summer water temperatures (Arismendi et al. 2012; Rothwell and Moulton 2001).

The equipment used to remove water from a stream or pond will meet NMFS screening criteria. NMFS criteria specify screen mesh size, and maximum intake, velocities covering intake hoses or other intake devices. With NPCNF's application of NMFS screening criteria, fish are unlikely to be adversely affected by the use of intake hoses.

As noted above, there are also potential effects from removing all or a portion of the water in the stream. The water diversion for culvert work will maintain all flow around and below the sites. The water withdrawals from streams for dust abatement and fire suppression are expected to be infrequent and remove only a small portion (i.e., enough to fill a water truck) of the total volume of water at any given time. The NPCNF estimates that it typically takes less than 2 hours of pumping to fill the tank of a water truck. Pumping will be limited no more than 20 percent of the streamflow. Because the flow reductions will be small, infrequent, temporary (i.e., water will not be continually withdrawn), and limited in volume compared to streamflow, juvenile steelhead will not likely be harmed by water withdrawal in the action area.

2.5.1.3 Chemical Contamination

The high volume of road work, timber harvest, and haul, over the extended period of time of this action, increases the risk of chemical contamination of streams in the action area. Fuel will be stored near construction, logging, and pumping equipment. The high volume of log haul traffic increases the risk of accidental spills of fuel, lubricants, hydraulic fluid, and similar contaminants on roadways in RHCAs or directly into the water. If haul trucks chronically leak fuels, etc. onto the roadway, the large number of haul trips on many of the roads could create new chronic inputs of toxic chemicals into streams.

Petroleum-based products (e.g., fuel, oil, and some hydraulic fluids) contain poly-cyclic aromatic hydrocarbons, which can cause lethal or chronic sublethal effects to aquatic organisms (Neff 1985). These products are moderately to highly toxic to salmonids, depending on concentrations and exposure time. Free oil and emulsions can adhere to gills and interfere with respiration, and heavy concentrations of oil can suffocate fish. Evaporation, sedimentation, microbial degradation, and hydrology act to determine the fate of fuels entering fresh water (Saha and Konar 1986). Ethylene glycol (the primary ingredient in antifreeze) has been shown to result in sublethal effects to rainbow trout at concentrations of 20,400 milligrams per liter (mg/L) (Staples et al. 2001). Brake fluid is also a mixture of glycols and glycol ethers, and has about the same toxicity as antifreeze.

The risk of fuel spills from fuel storage and transfer will be minimized with proposed BMPs. Fuel will not be stored in RHCAs except for water pumping activities discussed below. The NPCNF will require spill prevention and containment materials onsite during in-water work to minimize adverse effects to aquatic biota if a spill were to occur. It is standard practice for loggers to refuel all equipment using 40- to 75-gallon slip tanks stored in the back of pickup trucks. Chainsaws are refueled from 5-gallon containers that may be taken into the field. Logging trucks will refuel in town, outside the action area. All on-site fuel storage, fuel transfer, and machinery servicing is governed by the provisions of the sanitation and servicing portion of the timber contract. The timber contract provisions include, for instance, requirements that contractors will maintain all equipment in good repair and free of abnormal leakage of lubricants, fuel, coolants, and hydraulic fluid. Also, for stationary equipment such as yarders and loaders, contractors will be required to have spill prevention and containment materials available on site. For any oil product storage exceeding 1,320 gallons, the contractor is subject to the rules and provisions of Federal Regulation 40 CFR 112 and must submit to the NPCNF a Spill Prevention, Control, and Countermeasure Plan.

Although storage of fuel for water pumping is allowed in RHCAs, fuel storage container size is limited to 5 gallons with a maximum of 10 gallons total storage between all containers, and spill containment will be available on site. In practice, these storage cans are stored in trucks or are placed on top of absorbent pads.

For culvert or in-channel work, the NPCNF require that all mechanical equipment be inspected before coming on site and daily to ensure there are no leaks. Contractors will have spill prevention and containment materials available on site when working in riparian areas or instream to minimize the impact of spills reaching a stream. High volume haul routes could accumulate contaminants from haul trucks. However, as mentioned above, equipment must not have abnormal leakage; therefore, toxic buildup on roads is not anticipated. In addition, crossdrain placement and other aspects of road design and maintenance will minimize the length of roadway from which toxic chemicals can be delivered to streams.

There are 28 miles of haul routes in RHCAs, including less than a mile of roads adjacent to streams. This 28 miles was calculated using the full RHCA buffer widths, for instance a minimum of 600 feet total at each fish bearing stream, and greater length where the road section is not strictly perpendicular to the stream. With existing and added crossdrains shunting water away from stream crossings, the miles of haul road draining to streams at crossings will be a fraction of the 28 miles. Road 221 is the main collector for haul and will be used for all haul leaving the action area. Road 221 is paved and has 12 stream crossings, only two of which are over streams with steelhead. Because Road 221 is paved, the risk of an accidental spill from this route is very low. There are 41 stream crossings on graveled primary haul routes, only four of which are over streams with steelhead and/or critical habitat, and one of these is a bridge. None of the crossings over streams that drain to the South Fork Clearwater River are fish bearing. With only four crossings over steelhead streams, there is very little exposure of steelhead to haul traffic.

The greatest risk of fuel entering streams would be if an accident were to occur at a stream crossing or fuel spilled into a roadside ditch that flowed directly into a perennial stream. If a fuel spill were to occur into a stream, all spawning, rearing, and incubating life stages of fish that are present could be killed or harmed depending on the dilution from a given size of water body. The extent of this effect would vary greatly, depending on the quantity of the spill, and the size and location of the receiving waterbody.

With implementation of standard BMPs including practices such as low speed limits and dust abatement, which improves visibility, there has been a low rate of accidental spills on the NPCNF. The NPCNF reports only one accidental spill during haul of 560 MMBF over many projects in the years 1999 to 2014; and the one spill did not reach a stream. For primary haul routes there are only six stream crossings over streams with steelhead, and 47 stream crossings over non-fish-bearing streams. With this few stream crossing over steelhead-bearing streams, there is little chance of a spill reaching a stream that would directly affect steelhead. Because the NPCNF has a very low incidence of spills and steelhead have very little exposure to haul traffic, there is very little chance that a chemical spill will occur and cause harm to steelhead.

The NPCNF may use magnesium chloride ($MgCl_2$) for dust abatement on major haul routes. The $MgCl_2$ can be carried by road runoff into ditches and streams during a rain event. Chloride concentrations as low as 40 parts per million have been found to be toxic to trout, and concentrations up to 10,000 mg/L have been found to be toxic to other fish species (Foley et al. 1996, and Golden 1991. in Piechota et al. 2004). Salt concentrations greater than 1,800 mg/L have been found to kill daphnia and crustaceans, and 920 mg/L of calcium chloride has been found to be toxic to daphnia (Sanders and Addo, 1993, in Piechota et al. 2004). The $MgCl_2$ for dust abatement can also affect roadside vegetation. In a study in Colorado, (Goodrich et al. 2008), some severely damaged vegetation occurred along most roads regardless of maintenance or $MgCl_2$ treatment procedures; however, a higher occurrence of severe damage was observed on many roadside plant species along roads treated with $MgCl_2$. The study also linked vegetation effects or lack thereof to the sloped position from the road to the vegetation. More vegetation damage occurred where road slope directed runoff containing the abatement chemical.

The exposure of ESA-listed fish to $MgCl_2$ will be kept to a low level with BMPs and specifications found in the Standard Contract for all timber sales. For example, one BMP requires a 1-foot no-spray buffer be left on the edges of the road, if road width allows, to minimize overspray into ditches. The Standard Contract specifies preparation of the road surface prior to application, the rate of application, and that water be applied after the $MgCl_2$. This BMP and three contract specifications are designed to maximize penetration of chemical into road surface, minimize the amount of $MgCl_2$ used, and to minimize the amount of chemical running off the road surface. Those measures, the road reconstruction upgrades to reduce the hydrologic connection of road surfaces to streams, and the position of primary haul routes upstream of fish-bearing waters will reduce to a low level the incidence and concentration of $MgCl_2$ being introduced into streams that have steelhead. For those reasons, $MgCl_2$ usage for this action is unlikely to cause harm to steelhead.

Herbicide use is not proposed for this project. The spread of noxious weeds will be controlled through BMPs specifying the cleaning of equipment before arriving on site and replanting bare soil areas, such as landings with weed-free seed. Given these BMPs, the risk noxious weeds spreading in the action area is low and unlikely to cause adverse effects on steelhead.

2.5.1.4 Suspended Sediment, Dewatering, and Fish Salvage

Diverting the stream during culvert replacements to dewater work areas first requires fish salvage from the work area. The goal of the fish handling conservation measures is to capture fish using non-lethal methods, and then release or relocate them downstream with minimal handling. Following the conservation measures will minimize the risk of injury and mortality to listed fish to the extent possible. However, capturing and handling fish causes short-term stress for all individuals (Frisch and Anderson 2000; Olla et al. 1995) and is likely to cause harm or death to some individuals, particularly those exposed to electrofishing (McMichael et al. 1998; Nielson 1998). Additionally, a small number of fish may not be found by the fish capture crew and could end up stranded.

Electrofishing can cause spinal injury to individual fish, which can lead to slower growth rates (Dalbey et al. 1996). Following the NMFS (2000) electrofishing guidelines will minimize the levels of stress and mortality related to electrofishing. McMichael et al. (1998) found a 5.1 percent injury rate for juvenile middle Columbia River steelhead captured by electrofishing in the Yakima River subbasin. A literature review by Nielson (1998), on the other hand, suggests that 25 percent of the total number of fish electrofished could be injured.

To account for possible harm or death of these steelhead, NMFS has taken a conservative approach and has calculated the number of steelhead that could be present and affected by dewatering and turbidity plumes at the 5 sites culvert replacement sites. Surveys of juvenile steelhead density done in 2001 in the WBC watershed found an average density of 1.5 steelhead per 100 square feet (ft^2) of stream. Because steelhead numbers were generally low at this time, NMFS will double the expected density to 3 steelhead per 100 ft^2. For the five culvert sites, the average stream width is seven feet. NMFS assumes that the area dewatered will be 50 feet upstream and downstream of each culvert site (100 feet). With a 100-foot length, a stream area of 700 ft^2 per site could be affected. Multiplying the area by an average fish density of three steelhead per 100 ft^2, NMFS estimates that 21 juvenile steelhead could be handled at each site with a total of 105 for all five sites. Based on a conservative approach to electroshocking injury rates, and accounting for fish that escape capture and are stranded, NMFS expects 25 percent of steelhead in total for the five sites (26 steelhead) could be killed or injured. The remaining 79 steelhead may experience short-term stress which would be inconsequential to their survival. As described above, NMFS expects affects to fish from dewatering, handling, or electrofishing can range from short-term stress to death from stranding or electroshocking.

Given mean smolt-to-adult return rates of 1.6 percent from 1997–2012 (Comparative Survival Study Oversight Committee and Fish Passage Center 2015), approximately one out of 63 steelhead smolts would return to spawn. Assuming the injury or loss of 26 juvenile steelhead, it would mean a one-time loss of less than one adult equivalent returning to spawn in the Little Salmon River population.

During rewatering of isolated work sites, juvenile steelhead are expected to be exposed to elevated turbidity. Concentration of suspended sediment in the water column is often measured as turbidity (i.e., scattering of light due to suspended sediment in the water column) in nephelometric turbidity units (NTU). The NTUs are often used as an alternative to turbidity measurements expressed in milligrams of sediment per liter of water (mg/L) because readings can be taken instantaneously on-site and, for any project, actions can be altered if readings approach thresholds harmful to fish. The most critical aspects of a suspended sediment (turbidity) effects analysis are timing, duration, intensity and frequency of exposure (Bash et al. 2001).

Suspended sediment can affect fish through a variety of direct pathways: abrasion (Servizi and Martens 1992), gill trauma (Bash et al. 2001), behavioral effects such as gill flaring, coughing, and avoidance (Berg and Northcote 1985; Bisson and Bilby 1982; Servizi and Martens 1992; Sigler et al. 1984), interference with olfaction and chemosensory ability (Wenger and McCormick 2013), and changes in plasma glucose levels (Servizi and Martens 1987). These effects of suspended sediment on salmonids generally decrease with sediment particle size and increase with particle concentration and duration of exposure (Bisson and Bilby 1982; Gregory and Northcote 1993; Servizi and Martens 1987, Newcombe and Jensen 1996). The severity of sediment effects is also affected by physical factors such as particle hardness and shape, water velocity, and effects on visibility (Bash et al. 2001). Although increased amounts of suspended sediment cause numerous adverse effects on fish and their environment, salmonids are relatively tolerant of low to moderate levels of suspended sediment. Gregory and Northcote (1993) have shown that moderate levels of turbidity (35 to 150 NTU) can accelerate foraging rates among juvenile Chinook salmon, likely because of reduced vulnerability to predators (camouflaging effect).

Salmon and steelhead tend to avoid suspended sediment above certain concentrations. Avoidance behavior can mitigate adverse effects when fish are capable of moving to an area with lower concentrations of suspended sediment. To avoid turbid areas, salmonids may move laterally (Servizi and Martens 1992) or downstream (McLeay et al. 1987). Avoidance of turbid water may begin as turbidities approach 30 NTU (Sigler et al. 1984; Lloyd 1987). Servizi and Martens (1992) noted a threshold for the onset of avoidance at 37 NTU (300 mg/L total suspended sediment). However, Berg and Northcote (1985) provide evidence that juvenile coho salmon did not avoid moderate turbidity increases when background levels were low, but exhibited significant avoidance when turbidity exceeded a threshold that was relatively high (>70 NTU). For the proposed culvert replacements, some fish may respond by moving downstream to less turbid areas.

A summary analysis from 20 culvert, diversion, and road replacement or removal projects from the NPCNF (A. Connor, NPCNF hydrologist, unpublished data 2014) show that there were spikes in turbidity at the onset of dewatering and rewatering at each monitoring site. Results can be generalized and show that these spikes extended between 100 and 600 feet downstream, 50 percent of the spikes exceeded 50 NTU, with a maximum of 250 NTU, for less than 2 hours. Based on the intensity and duration of turbidity exposure for those projects, and effects thresholds summarized in Newcombe and Jensen 1996, it is likely that juvenile steelhead would have experienced non-lethal physiological harmful effects in the areas below the culvert work sites. Expected temporary (up to 2 hours) effects would have included behavioral effects such as volitional movement and/or reduced or increased feeding, and physiological effects including coughing. Because the five proposed culvert replacements will occur on similar sized streams, at a similar time of year, effects to steelhead that may be present are expected to be similar to those indicated by the NPCNF's prior assessment of culvert work and defined by Newcombe and Jensen 1996. Juvenile steelhead will likely respond to such short-term turbidity plumes by trying to avoid the plume and temporarily seeking refuge nearby. Juvenile steelhead that do not avoid the sediment plumes will be exposed to the sub-lethal impacts described above.

NMFS estimated the number of juvenile steelhead that could be exposed to adverse effects from a turbidity plume. NMFS assumed the same stream width and juvenile steelhead densities of three juvenile steelhead per 100 ft^2 as above for fish salvage and turbidity plumes extending 600 feet. With these assumptions, NMFS estimates 126 at each of the five sites, or 630 total, juvenile steelhead are likely to be present in the turbidity plume and thus exposed to sub-lethal impacts from turbidity.

Other proposed activities that may generate turbidity in fish-bearing streams include road reconditioning, reconstruction, and decommissioning, and log haul. As discussed above, the low number of stream crossings with steelhead presence, and crossdrains presently in place, or added prior to other road work, will minimize the amount of road draining to streams. In addition, sediment BMPs (surface gravelling, revegetation, and sediment filtering structures) should reduce sediment delivery from road surfaces and ditches to streams. With these sediment reduction measures at and near stream crossings, road work and road use is expected to generate significantly less turbidity, per crossing, than from direct streambed disturbance or rewatering of isolated work areas. In general, sediment mobilization from road work areas to streams would occur during high water events when stream turbidity is high and added sediment from roads blends with this background turbidity. Or, during smaller precipitation events without high stream flow, sediment is delivered from roads to streams but is deposited close to the source without creating turbidity at high enough levels to have adverse effects to steelhead. The following section, Deposited Sediment, discusses the effects of the deposited sediment, which has the same sources as, but different duration than suspended sediment.

2.5.1.5 Deposited Sediment

All freshwater steelhead life stages (i.e., adult migration and spawning, and juvenile development from egg to smolt emigration) will be present at various times for the duration of the project. The proposed action has the potential to affect steelhead spawning and rearing through increasing sediment deposition in stream substrates.

Proposed harvest, burning, and road activities disturb soils or road prisms which makes fine sediment more available for transport from hillslopes and road prisms to streams. These proposed activities can deliver sediment through the common pathway of soil disturbance, increased surface erosion and transport during precipitation events, and delivery of fine sediment (<2-millimeter diameter) to action area streams. Once delivered to streams, fine sediments are suspended and transported, then begin to deposit in a graded pattern with larger particles settling out first and smaller particles settling out farther downstream (Foltz 2008); this excess fine sediment can cause harm to steelhead.

Sediment levels in the action area indicate that past land management activities may be contributing sediment, but higher levels of sediment are found mainly in lower gradient stream reaches that tend to store sediment for longer periods of time. Where steelhead are present, fine sediment levels, or CE, are generally low to moderately low (<20 percent; NMFS 1996). This deposited sediment analysis starts with an overview of possible effects from excess fine sediment to fish, and then steps through proposed harvest, burning, and road related actions, and their mitigation measures which are designed to minimize short-term impacts from these proposed activities and improve long-term sediment levels in the action area.

When suspended sediment settles out of suspension, it can cause detrimental effects on spawning and rearing habitats by filling interstitial spaces between gravel particles (Anderson et al. 1996; Suttle et al. 2004). Sedimentation can: (1) Bury salmonid eggs or smother embryos; (2) destroy or alter prey habitat; and (3) destroy or alter spawning and rearing habitat (Spence et al. 1996). Excessive sedimentation can reduce the flow of water and supply of oxygen to eggs and alevins in redds. This can decrease egg survival, decrease fry emergence rates (Bash et al. 2001; Cederholm and Reid 1987; Chapman 1988), delay development of alevins (Everest et al. 1987), reduce growth and cause premature hatching and emergence (Birtwell 1999), and cause a loss of summer rearing and overwintering cover for juveniles (Bjornn et al. 1977; Griffith and Smith 1993; Hillman et al. 1987). Through the implementation of recent forest management BMPs, (i.e. such as proposed by the NPCNF), there is little potential for sediment delivery to streams from timber harvest and prescribed burning, but there is a greater potential for delivery from road work and road use (Brown et al. 2013) because road-generated sediment can enter streams directly at stream crossings.

Sediment modeling

The NPCNF performed a sediment yield analysis in their National Environmental Protection Act (NEPA) and BA documents using NEZSED and FISHSED models to determine if the proposed action would cause sediment yield increases in any of the prescription watersheds that would exceed the thresholds for B and C channels. These models are used to compare alternative actions during the NEPA process. Because of low baseline sediment levels, all modeled watersheds are predicted to remain within NPCNF Plan objectives except Jungle Creek in the WBC watershed which would exceed the NPCNF Plan objective by 2 percent. The NPCNF's trend analysis highlighted the high baseline CE in Jungle, Asbestos, and Cold Springs Creeks in the WBC watershed--creeks without anadromous fish presence. These models were designed for comparison of project alternatives prior to implementation and were not intended for quantitative analysis of sediment delivery. Because these models were not intended for quantitative analysis, and baseline sediment levels are generally low, NMFS' sediment analysis will rely on baseline conditions, the project action and BMPs, and the best available information to assess project effects to ESA-listed fish and critical habitat.

Timber Harvest

The NPCNF proposes 1,720 acres of regeneration harvest and 16,640 acres of intermediate harvest (Table 1). The majority of treatments are intermediate harvest (commercial thinning) and prescribed fire, with 72 percent of harvest and 87 percent of prescribed landscape burning occurring in the WBC watershed. Harvest units will be sold in several sales over 10 years which will distribute sediment effects over space and time, as well as concentrate downstream effects where sales overlap in subwatersheds.

Sediment delivery to streams from timber harvest areas will be minimized with implementation of the following BMPs: (1) No harvest within PACFISH RHCAs, including in and adjacent to landslide prone areas; (2) slash will be applied to skid trails and yarding corridors to reduce erosion and risk of sediment delivery to streams; and (3) implementation monitoring/adaptive management. Retaining the trees in the PACFISH RHCAs helps prevent overland sediment delivery from timber harvest areas to streams, and maintains slope stability. In Cabin Creek, and likely in the fuel break along Road 221 and hazard tree cutting in campgrounds. There will be tree cutting in RHCAs. However, this cutting is expected to be minimal and not impair the RHCA's function in filtering sediment or impair other functions of the RHCAs.

PACFISH buffers are very effective at preventing action-generated sediment delivery to streams. During Clearwater National Forest annual monitoring of BMPs (including PACFISH buffers) from 1990 to 2002, sediment delivery to streams was observed in only 77 of 3,524 observations (2 percent) with the majority of delivery originating from the roads (USFS 2004). During onsite harvest unit layout, planned harvest areas sometimes are revised or dropped to accommodate PACFISH buffering, and this typically results in a 20–35 percent reduction in harvest area. This reduction in harvest area simply reduces the area of soil disturbance and sediment available for erosion and delivery. In addition, PACFISH buffers preclude harvest in and along landslide prone areas, thus timber harvest should not increase the risk of mass wasting from landslide prone slopes. Annual monitoring, as reported in the BA, shows PACFISH buffers to be very effective at preventing sediment from reaching streams.

Skid trails and landings

Skid trails, including skyline yarding corridors, and landings can compact soils, decrease infiltration rates and may lead to increased erosion and channelized flow, with hill slope being a predictor for formation of channelized flow (Croke and Mockler 2001). Skid trail and landing BMPs will be implemented to minimize soil disturbance, erosion, channelized flow, and sediment delivery. These BMPs include avoiding ground-based skidding on steep slopes over 45 percent, restricting skidding activities in wet soil conditions, locating trails and landings outside of RHCAs, and using existing skid trails and landings to minimize compacted soil area. Adding drainage features such as waterbars and slash immediately after use to skid trails and yarding corridors is proposed to reduce bare soil area after harvest. Following use, skid trails and landings will be decompacted and large woody debris (LWD) will be applied to bare soils to increase infiltration and minimize erosion.

The harvest BMPs and PACFISH buffers to be implemented on this project have been extensively monitored on the NPCNF and have been shown to be very effective in preventing sediment delivery into streams from timber harvest units. These findings are supported by a literature review by Sweeney and Newbold (2014) who found a 100-foot vegetated buffer removes 84 percent of fine sediment entering from upslope overland and channelized flow. In addition, almost all sediment greater than 0.05 millimeters (e.g., includes fine sand that is found in spawning gravel) is removed in the first 30 feet of the buffer (Sweeney and Newbold 2014). With implementation of these BMPs and PACFISH buffers, NMFS does not expect fine sediment from harvest areas to be delivered to streams and deposited in substrates in concentrations that would impair the function of substrates or be harmful to steelhead.

Prescribed Fire Treatments

Project actions include prescribed (landscape scale) and pile burning. There are 6,691 acres of prescribed landscape burning to reduce fuels and control invasive weeds, and 10,272 acres of fire prescribed to reduce fuels in harvest units.

Bêche et al. (2005) found that sediment was not affected and macroinvertebrates communities recovered in watershed streams a year after prescribed fire (with ignition in riparian areas) of low to moderate intensity. For 3 years following a prescribed burn in ponderosa pine forest, Arkle and Pilliod (2010) found no detectable changes in sediment, riparian or stream habitats, macroinvertebrates, and fish.

Prescribed fire effects from this project are expected to be similar to those observed by Bêche et al. (2005) and Arkle and Pilliod (2010). The most important prescribed fire BMPs for minimizing the risk of moderate to high severity burns, soil disturbance, and sediment delivery include no ignition in RHCAs and burning under conditions that favor low intensity fires. The design features and BMPs to be implemented on this project have been extensively monitored on the NPCNF and have been shown to be very effective in preventing sediment movement into streams from prescribed burn areas. With implementation of the BMPs and design features, sediment delivery increases, and thus effects to stream substrate and steelhead, are expected to be negligible from prescribed burning.

Roads

The NPCNF roads have significant potential to increase erosion and sedimentation (Patric 1976; Swift and Burns 1999; Aust and Blinn 2004; Grace 2005). The NPCNF roads can alter hillslope hydrology by creating compact and less permeable surfaces (Megahan 1972), decreasing infiltration (Grace 2005), and increasing drainage networks with road surfaces and ditches (Wemple et al. 1996; Croke et al. 2001; Croke and Mockler 2001; Jackson et al. 2005), thus resulting in increased overland flow, erosion, and sedimentation during rain events. Erosion rates or yield, have been shown in monitoring and research studies to be higher from roads and log landings than from adjacent harvested and undisturbed areas (Yoho 1980; Rothwell 1983; Arthur et al. 1998). Sediment yield is the amount of sediment produced or passing a point from an area or feature, sediment delivery is the amount of sediment reaching a stream (Luce et al. 2001). Controls on sediment yield from roads include road slope and length, surface material/condition, soil texture, and vegetative cover (Luce et al. 2001), with surface condition being affected by traffic and maintenance levels (Luce and Black 2001) and delivery dependent on precipitation duration and intensity.

The proposed temporary road construction, and road reconstruction, reconditioning, and decommissioning will be implemented to facilitate timber harvest and reduce permanent roads on the landscape (Table 2). These actions will add 38 crossdrains and replace five undersized culverts with aquatic organism passage culverts on haul routes. In addition 27.5 miles of roads and 21 culverts will be decommissioned (Table 2). The decommissioning will -reduce the long-term risk of road and culvert failure, and its consequent large delivery of fine sediment. Common to all of the proposed road work is ground disturbance that has the potential to increase short-term sediment delivery, and upgrades or decommissioning that will reduce long-term sediment delivery. The following analysis will consider each type of road work and its contribution to short- and long-term sediment delivery.

Temporary road construction

Temporary roads will be constructed (14.3 miles) or current roads reopened (0.8 miles) to harvest currently inaccessible harvest units. Temporary roads are narrower and require only minimal construction compared to standard engineered permanent roads. The BMPs that prevent sediment delivery to streams from temporary roads include: (1) Temporary roads will not be in RHCAs; (2) temporary roads are built on or very near ridge tops and not on landslide prone slopes; and (3) temporary roads will be constructed and obliterated within 5 years, which is the term of a typical timber sale contract. In practice temporary roads are obliterated as soon as possible after use in 1 to 5 years. Obliteration includes recontouring, decompaction, addition of woody material for soil productivity, and erosion protection. Because temporary roads will not be in RHCAs and will be located on or very near ridge tops, they will have no direct surface connection to the stream network below, and are not expected to be sources of sediment delivery. Field reviews and monitoring of temporary roads with these design features and ridge top locations have shown no sediment delivery to streams. The proposed temporary roads are not expected to create any short-term pulses or long-term chronic inputs of sediment to streams.

New permanent roads (500 feet) are to replace sections of existing roads through RHCAs. These new short road sections will be out of the RHCAs and will pose little risk of sediment delivery to streams. The roads being replaced will be decommissioned and the risk of sediment delivery from these roads will be greatly reduced.

Road Reconstruction and Reconditioning

Road reconstruction (0.6 miles) and reconditioning, or maintenance (210 miles; all haul roads), are designed to prepare roads for increased haul traffic. Both reconstruction and reconditioning can include culvert installation or replacement. Important BMPs that will reduce the potential for sediment delivery from the road system are the addition of crossdrain structures and culvert replacements, application of surface aggregate gravel materials, or outsloping during reconstruction. Realignment and reshaping may include reopening grown-over roads. Cut and fill slopes have significant areas of ground disturbance and may capture groundwater which in turn can increase erosion rates. During reconstruction and reconditioning, ground or road surface disturbing activities will increase bare soil area and make more fine sediment available for transport (yield) with only a portion being delivered in the short term. Although sediment yield will increase with an increase in bare soil area, most of the mobilized sediment will not be delivered to streams, in part because of the position of the work in the drainage network and also from application of BMPs such as sediment control devices and stabilizing bare soil areas by replanting vegetation. Sediment yield will decrease over 2 years by 70 percent to 90 percent while vegetation reestablishes on bare soil areas, road shoulders, and ditches (Black and Luce 1999; Megahan et al. 1991). The long-term effects from additional crossdrains, culvert upgrades, and the application of surface gravel are discussed in the following paragraphs.

Crossdrains can effectively capture and disperse water and sediment from roads. Road surfaces are important hydrologic pathways which affect the volume and distribution of overland flow, and alter the channel network extent, pattern, and processes (Croke et al. 2005). Water control structures, such as ditches with crossdrains, broad based dips, water bars, and turnouts, are used to drain insloped road surfaces and minimize the travel length of overland flow and divert water to the forest floor (Keller and Sherar 2003). Brown et al. (2013) found that road segments with excessive lengths between water control structures and inadequate vegetative surface cover delivered the most sediment. In addition, Luce and Black (1999) found that ditch cleaning can produce greater sediment yields than road grading. Increasing the number of crossdrains immediately reduces upslope drainage area that collects water, reduces erosion, and reduces surface water connectivity from road segments to streams (Brown et al. 2013). Crossdrains direct water to the forest floor where sediment is filtered out while the water infiltrates into the soil. If the distance from a crossdrain outfall to a stream is too short for complete filtering, sediment is delivered to the stream. Damian (2003) found that sediment delivery from roads is minimized by placing crossdrains within 200 feet of stream crossings and as close as possible to maintain complete filtering of sediment.

A key BMP of the project for minimizing short-term sediment delivery from road preparation and haul is the addition of 43 crossdrain culverts near stream crossings prior to other upslope road work and haul. On reconstructed road segments, crossdrains would be installed prior to road prism shaping and ditch reconstruction activities that are upslope of the new crossdrain sites, such that sediment generated from subsequent activities would be de-coupled from the stream. Crossdrains will be installed within 200 feet from live streams to minimize sediment delivery to streams from road surfaces and ditches. These crossdrains will remain on the road system to facilitate long-term reductions in sediment delivery to streams. The proposed action includes implementation monitoring of road reconstruction and reconditioning activities in particular to verify that crossdrains are installed first in the reconstruction process and effectively disconnect most of the ground disturbance associated with road preparation from the stream network. Following crossdrain work, and due to primary haul routes already at a high maintenance level with crossdrains already being present, a small percent of the haul road network will drain to stream crossings. With crossdrain spacing optimized prior to haul, only a small portion of the haul road network can deliver sediment at stream crossings.

Culvert work will mobilize and deposit fine sediment into the stream channel. During culvert work, most of the sediment is remobilized from the stream channel or from bedding material placed in the channel during culvert installation (Foltz et al. 2008). Culvert work on small streams in Idaho during low flow resulted in fine sediment deposits in channels and pools, but these deposits were transported away by annual peak flows (Foltz et al. 2008). Following culvert work, Bakke et al. (2002) found that during subsequent peak flow periods, channel incision, lateral scour, and channel readjustments can add more sediment to the stream than during culvert work itself, but those effects also occur during periods of high sediment transport and redistribution. For long-term sediment control, adding rock adjacent to culvert outfall areas will reduce the risk of erosive gullying and incision below the culverts (Megahan and Ketchusen 1996). Foltz et al. (2008) found that using sediment control BMPs during culvert work resulted in a 96 percent reduction of added sediment when compared to no sediment controls.

There are five culverts proposed for replacement on haul roads. All of the sites are likely to have steelhead present. As discussed above during rewatering of culvert sites, fine sediment is expected to deposit in channels or pools at detectable levels a maximum of 600 feet downstream and likely to remain until the next high water. The BMPs and a low flow work window will be used to minimize fine sediment mobilization and deposition. If juvenile steelhead were present in the deposition zones, they would be in very low numbers and free to move to other areas of the streams with more favorable substrate conditions (passage will be maintained except when initially watering a bypass channel). In the short term, channel adjustments will mobilize channel sediments that will deposit, in an attenuated fashion (Foltz et al. 2008), for 600 feet downstream. In the long term, the new culverts will be sized to allow fish passage to over 4 miles of steelhead critical habitat, arrest any further channel erosion caused by the current undersized culverts, and reduce future risk of culvert failure and accompanying sediment delivery.

The use of road surface gravel aggregate (i.e., 3 to 6 inches depth of coarse gravel) helps minimize soil erosion on active roads, and greatly reduces fine sediment introduction to streams at crossings (Brown et al. 2013). Graveling of road surfaces reduces sediment production (erosion) by reducing the surface area of soil exposed to raindrop impact, tire friction, and adverse effects of vehicular weight (Megahan et al. 1991). Graveling of roads and ditches increases surface roughness which decreases water velocity, runoff, sheet erosion, and sediment transport from the road surface (Appelboom et al. 2002). Brown et al. (2013) found that bare soil roads generated 7.5 times more sediment than graveled roads. Following road grading, reductions in fine sediment delivery are concurrent with increases in plant cover on the roadside (Megahan et al. 1991). Following the application of aggregate, when surface fines have washed away, the road surface stabilizes, and becomes "armored" (Megahan et al. 1991; Luce and Black 1999). Immediate consequences of graveling can vary from short term increases in sediment yield that continue through the winter (Megahan et al. 1991; Swift 1984) to first year reductions of 67 percent to 79 percent (Appelboom 2002; Burroughs et al. 1985 [cited in Burroughs and King 1989]; MacDonald 2005; Swift 1984). Other studies found that sediment yield reductions were complete after 3 years (Luce and Black 1999) or delivery reduced by 53 percent to 88 percent within 4 years (Appelboom 2002; Kochenderfer and Helvey 1987; Megahan 1991). In summary, graveling roads can create an immediate increase in sediment delivery due to surface disturbance but significant reductions in fine sediment delivery, when compared to native soil roads, will occur within 1 to 4 years.

All of the project roads are either paved or graveled, but there are some areas that will need new applications of gravel in preparation for increased use. Gravel will be applied to all stream crossings and other road sections where and when needed during haul. Road preparation and conditions will be inspected before haul and continuously during haul, with increased inspections after wet weather. Short-term sedimentation from a gravel application is caused by road surface disturbance and may last through the first winter. Gravel applications can result in a 53 percent to 88 percent reduction in fine sediment delivery from treated roads within 5 months to 4 years. These reductions in fine sediment yield simply compared to the existing road condition may be realized post-project; however, during the project, substantial haul on the main routes will somewhat counteract the sediment-reducing effect of the graveling. In any case, added gravel at stream crossings and other sections will help mitigate the sediment production from substantial increases in haul traffic and will help provide long-term reductions of road surface fine sediment from the most problematic existing road segments involved with this project.

Haul

Log haul can generate sediment as a result of road surface erosion and dust. Where ditchlines terminate at stream crossings, this generated sediment can be delivered to streams. Large amounts of haul, or hauling in wet conditions, can cause rutting of roads. Ruts are channels that can route water and sediment past crossdrains or outsloped sections of road to stream crossings. This rutting can also accumulate flow which accelerates erosion of fine sediments from the road surface and adds more fine sediment to streams.

As proposed, 109 MMBF will be hauled from the action area (Table 2). All of the haul will exit the action area on paved Road 221. Road 221 will receive haul from main gravel routes (86 percent), and minor gravel or native surface roads (14 percent) (Table 2). Haul will be equally distributed between main haul routes found in the North and South Fork WBC, and GCS subwatersheds (Table 2). The main routes are U.S. Forest Service system roads which are/will be fully graveled, sized, and designed to resist damage from this rate and duration of haul. Major haul routes will access individual timber sales and will carry an estimated 15 to 25 round trips a day, which is about average for a system road during a timber sale. Graveled Forest Service roads are designed to withstand that amount of haul.

There are approximately 200 stream crossings on all haul routes. Sediment delivery can occur at stream crossings but there are only six crossings on main haul routes over streams with ESA-listed fish or critical habitat. Two of these crossings are on paved Road 221 and another is a bridge. The paved road has little potential to deliver fine sediment to streams. There are an additional 37 crossings on main haul routes over non-fish-bearing streams which are not expected to have substantial effects on steelhead or critical habitat. Sediment delivery to streams from haul will occur but is expected to be minor/localized generally, and expected to have very limited potential to affect steelhead for the following reasons:

1. There are a limited number of stream crossings on primary haul routes and other haul routes will receive limited amounts of haul and for shorter time frames;

2. There are only four stream crossings on unpaved main haul routes that are over streams with steelhead present or critical habitat;

3. With existing and added crossdrains and gravel, little of the haul road network will drain or deliver sediment to streams at stream crossings;

4. Timber sales and haul on unpaved roads will be dispersed over time and space; and

5. The terrain over which haul will occur is relatively flat which reduces the power for road runoff to transport sediment to stream crossings.

6. Standard practices by NPCNF SAs and timber sale contractors will greatly reduce the risk (low risk) of road damage, and consequent sediment delivery, from the road system. These practices include the following:

    a. Active haul roads are monitored and inspected 2 to 3 times a week during haul, before weather fronts, and up to 4 to 5 days a week in the wet shoulder seasons;

    b. Precursors to road problems are identified by SAs before damage to a road occurs; and

    c. Road problems that occur are usually fixed immediately or within 24 hours.

Considering those factors and the general location of stream crossings, overlapping sales, and extended time of haul, NMFS expects the majority of sediment effects from haul to be small and detectable in stream substrates a maximum of 600 feet below each source site. Within this distance, NMFS expects only minor, and temporary (days to months) deposition of fine sediment in substrates which could cause behavioral effects to steelhead in the four stream reaches below the unpaved crossings. The behavioral effects would likely be minor and may include fish moving upstream or downstream into areas with lesser levels of substrate sediment and associated greater abundance of invertebrate prey. Appreciable fine sediment accumulations below haul crossings are expected to be transported downstream in the next high water, resulting in more diffuse sediment resettling and likely undetectable effects in substrates farther downstream.

The analysis for these local effects assumes roads are in a well maintained condition free of damage or deterioration. In the event of damaged or deteriorated roads, or road drainage conditions, fine sediment delivery and adverse effects to stream substrate and steelhead will increase until the damage is repaired. The NPCNF BA for this project proposed non-specific monitoring of roads and did not include reporting. However, it is standard practice (and assumed to be part of the proposed action based on clarification from NPCNF to NMFS) for NPCNF timber sales administrators to visit active haul roads at least once a week and after wet periods to check that haul roads and their drainage are functioning and free of damage that would need mechanical repair. If the function of the road is compromised to the point of needing mechanical repair, the contractor responsible for the road is notified and must make the repair.

The NPCNF has proposed to monitor haul road condition through the usual and standard practices of sales administrators. Because sales administrators will be monitoring haul roads for damage, and there are only a few crossings where steelhead are present, adverse effects from road damage sediment delivery are unlikely to extend further downstream than the 600-foot section below the crossings. As a result, the effects on steelhead are expected to be minor. The NPCNF noted that SAs and contractors are proactive in detecting and addressing road damage before it compounds, and that implementation of past timber projects has shown that damage occurs on less than 5 percent of haul roads. However, the longer a road segment draining to a stream crossing remains in disrepair and increases sediment delivery, the greater the potential or realized adverse effects to substrate and steelhead.

Sediment from multiple stream crossings can combine in the downstream reaches in steelhead occupied and/or critical habitat including the mainstem WBC. However, the larger stream size, steeper gradients, large substrates, and lack of fines in the baseline found in downstream reaches in WBC indicate that fine sediment is unlikely to accumulate to levels that would appreciably alter the substrate conditions and affect steelhead.

Tributaries in the GCS area are expected to experience effects similar to those described above for WBC, with some addition of sediment to substrates below stream crossings on main haul routes. However, steelhead do not occur in the action area within GCS, and steelhead farther downstream (e.g., in South Fork Clearwater River) will not be affected by the project activities in GCS. Project generated sediment in these tributaries will eventually travel downstream into streams with steelhead (SFCR and farther downstream); however, the small additions from the project would not likely result in detectable changes in substrate or effects on steelhead in those downstream areas. Although there have been activity-generated elevated levels of sediment in the past for these GCS tributaries, those were likely the result of past logging/road practices that generated and delivered much more sediment than will the present, proposed designs and standards.

Road Decommissioning

Road decommissioning is a ground-disturbing activity that results in short-term increase in sediment yield but reduces long-term chronic sediment delivery and landslide risk (Switalski et al. 2004). Ripping and recontouring alleviates most of the risks resulting from concentrated flow including gullying, mass wasting, and increases in peak flows (Luce et al. 2001). However, the unconsolidated material retains some risk of failure, especially on lower slope locations (Madej 2001). In addition, channel adjustment (erosion) may occur following crossing removals, with erosion risk increasing with drainage area, stream gradient, and the volume of fill removed (Madej 2001). As with all ground disturbing decommissioning activities, rapid regrowth of vegetation (Foltz et al. 2008), and in particular tall trees for recontoured slopes, is essential for the success of the decommissioning (Luce et al. 2001). Where soil organic matter is lacking following decommissioning, soil amendments and/or plantings are recommended (Luce et al. 2001).

Proposed road decommissioning (27.5 miles; 21 culverts removed) includes activities that result in the stabilization and restoration of unneeded roads to a more natural state. Approximately 70 percent of road decommissioning will occur in the WBC drainage, some of which is adjacent to steelhead critical habitat. Most roads proposed for decommissioning would be fully recontoured and all would be permanently closed. Local short-term increases are expected in sediment delivery and deposition in substrate from soil disturbance and stream crossing removal. The NPCNF will plant shrubs and seed where necessary as erosion control and to facilitate the reestablishment of vegetation to promote rapid regrowth and stabilization of disturbed areas. Reductions in fine sediment content in downstream substrates are expected to be evident in 1 to 2 years and continue into the long-term. On larger scales, studies have linked increased road density to increased sediment delivery (Luce et al. 2001), reduced fish abundance (Eaglin and Hubert 1993), and limited fish occurrence (Dunham and Rieman 1999). Reduction in density of road and stream crossings is expected to have the opposite effect. Proposed road decommissioning is expected to have a small long-term benefit on stream substrate condition and steelhead production in WBC.

Deposited Sediment Summary

Harvest, burning, road work, and haul will all cause soil disturbance making sediment more available for short-term sediment delivery to streams over the period of this action and a few years beyond until soils and road surfaces stabilize. Any fine sediment delivered to streams will decrease the utility of substrates for steelhead until the fine sediment clears through successive high flows. The NEZSED sediment modeling shows modest increases in sediment delivery and FISHSED modeling predicts little effect to stream substrates from project related sediment increases. Because of sediment model limitations, sediment analysis in this Opinion focuses on BMPs that will minimize sources of sediment delivery from project actions. Past effectiveness monitoring shows that PACFISH buffering of streams is very effective at preventing sediment delivery from harvest and prescribed burn treatment areas. In addition, burning is restricted to times and conditions that are likely to result in low intensity mosaic patterns with minimal impact to riparian areas.

Installing crossdrains prior to other road work and haul, culvert replacements, locating temporary roads near ridgetops, and road decommissioning will minimize the amount of road surface draining directly to streams and will reduce the risk of culvert failure. For road actions, following a 1- to 3-year stabilization period for soil and road surface, the mitigation measures will reduce short- and long-term chronic sediment delivery, and risk of larger episodic, sediment delivery, from the road system. Roads will be upgraded a year prior to a sale and haul will continue for about 4 years during a sale. Stream reaches in or near a sale boundary are likely to have increases in short-term sediment delivery for the duration of haul and a couple of years following haul. However, early installation of crossdrains will greatly limit the amount of road surface draining to streams. There are very few haul route crossings over streams with steelhead or critical habitat, with most over non-fish-bearing streams. In addition, expected SA monitoring of active haul routes will insure damaged roads with the potential for, or active, sediment delivery will be fixed as soon as possible (hours to days).

Steelhead spawning and rearing are widely distributed in the WBC watershed, providing some resilience with respect to disturbance in localized areas. The localized temporary minor adverse effects (e.g., fish movement to less affected nearby habitat) from sediment generated by road preparation and haul will be greatest at the subwatershed scale (e.g., area of active harvest units and haul routes). At this scale, there will be no passage barriers and fish are free to seek more suitable habitat near these localized areas. Tributaries in the GCS area are non-fish-bearing and are not expected to transport measurable amounts of fine sediment to the South Clearwater River. In the stream reaches immediately below the five culvert replacements, and to a smaller degree culvert removals, road reconstruction, and road use near streams, steelhead may be present and may experience minor adverse effects from sedimentation of substrates.

2.5.1.6 Changes to Streamflow from Harvest (Equivalent Clearcut Area)

Canopy removal from timber harvest and road building has the potential to cause changes to water yield from the landscape. Removal of canopy reduces evapotranspiration, reduces loss of moisture from interception of precipitation, and alters snow accumulation and melt patterns, all of which can increase water yield (average annual or monthly flow) from the landscape and increase peak stream flows. Increases in peak flows can cause stream channel scour and bank erosion resulting in an increase in fine sediment supply to streams, with potential adverse effects to stream substrates and steelhead.

In considering the effects of timber harvest on peak flow and effects of those peak flow increases on stream channels and fish habitat, prior studies have identified key points, including the following:

(1) Increases in flow are proportional to increased area harvested (Bosch and Hewlett 1982; Keppler and Ziemer 1990; Grant et al. 2008).

(2) Peak flow increases of 10 percent represent the lower limit of detection (Grant et al. 2008).

(3) For small watersheds less than 10 square kilometers (<2,470 acres), changes in peak flows generally become detectable for transient snow zone (TSZ) watersheds when >15 percent of a basin is harvested (Grant et al. 2008).

(4) Effects will be greatest on smaller first and second order drainages because flow paths are shorter and more synchronized when compared to larger drainages (NMFS 2005).

(5) Riparian buffers serve to reduce harvest area, contribute LWD, and maintain bank stability and resilience during floods (NMFS 2005).

(6) It is difficult to separate peak streamflow effects of timber harvest from roads because road ditches capture groundwater and shorten flow paths (Megahan 1972; Wemple et al. 1996).

(7) Harvest induced changes in peak flows will occur in relatively moderate peak flows of <1- to 5-year recurrence intervals (Harr 1976, 1986, Ziemer 1998, Beschta et al. 2000, Grant et al. 2008).

(8) It is unclear if changes to peak flow from timber harvest alone have significant effects on salmonid habitat and populations if riparian areas and floodplains are functioning and roads are kept hydrologically disconnected from the stream system (NMFS 2005).

(9) Flows must have sufficient force to move bed-load material to affect a channel's physical structure (Grant et al. 2008).

(10) Peak flows changes associated with harvest will have little effect on channels with either cobble and larger substrates or gradients over 10 percent (Grant et al. 2008).

(11) Harvest induced peak flow effects on channel morphology should be confined to channels with gradient equal to or less than 2 percent and streambeds and banks of gravel or finer material (Grant et al. 2008).

(12) If channels have beds of fine gravel or sand, including those with gradients over 2 percent, a much closer hydrologic and geomorphic analysis is warranted (Grant et al. 2008).

As a general guideline for third to fifth order streams, NMFS' Matrix of Pathways and Indicators (NMFS 1996) specify a <15 percent ECA as low risk for changes in peak flows. Grant et al. (2008) cites a 10 percent change in peak flows as the lower detection limit for changes in peak flows. In addition, Grant et al. (2008) developed a linear relationship between percent of area harvested and average percent change in streamflow for the TSZ (the proposed harvest activities are in the TSZ). Using the relationship developed in Grant et al. (2008), an ECA of 15 percent equates to a 10 percent change in peak flow. Grant et al. (2008) also emphasizes that peak streamflow response to ECA can vary with site conditions. The NPCNF cites several studies that support ECAs of 20 percent to 30 percent for third to fifth order streams before a 10 percent change in peak flows can be detected (NPCNF 2015).

A paired watershed study by Gerhardt (1998) in the Selway River watershed (within the NPCNF), illustrates the need for ECA analysis at multiple scales including first and second order stream drainages. In the study, road building and clearcutting resulted in an ECA of 15 percent for a third order stream and up to 80 percent in upstream first and second order streams. Although there was no change in flow patterns in the third order stream (King 1998), peak flows increased 15 percent to 36 percent in the first and second order streams. In addition, following high flow events 3 to 7 years after harvest, sediment traps showed greater gravel and cobble movement when compared to the non-harvested control watershed. The consensus at the time was that the greater movement of sediment was caused by ECA related flow increases and consequent channel scour in the first and second order streams. This study demonstrated that, to capture the full effects of ECA, ECA changes to flow and sediment supply should include analysis at the scale of first and second order stream drainages.

The NPCNF used an ECA analysis model to estimate effects on water yield caused by canopy removal from harvest and roads at the third to fifth order stream scale. The analysis was performed on the three subwatersheds in the action area, which is in the transitional snow zone (TSZ), including the GCS, South Fork WBC, and North Fork WBC. The ECA analysis predicts final ECAs for the respective watersheds of 14 percent, 29 percent, and 23 percent. For the GCS, 14 percent is below NMFS threshold for detectable changes in peak flow and additional scour is unlikely. For the WBC subwatersheds, ECA analysis indicates the potential for a small increase in moderate peak flows.

Grant et al. (2008) address treatments less intense than clearcutting; as an example, he cites a 40 percent thinning over 100 percent of an area in the TSZ (similar to the proposed action) would result in a flow increase of 14 percent. Grant et al. (2008) also qualifies the likelihood of peak flow changes based on certain attributes of the affected area. Attributes that reduce the likelihood for peak flow changes include riparian buffers, thinning as a treatment, and lack of road connectivity to streams (with higher road densities generally increasing the connectivity). All of those attributes of the haul roads and proposed treatments are present in the case of this project. Although road densities are moderate to high generally, as noted above the road length connected to streams is/will be quite limited.

With those factors somewhat reducing peak flow effects, there may be marginally detectable increases in moderate peak flows for first through third order streams found in the action area in the WBC watershed. These changes would be at the threshold of additional scour and sedimentation in stream reaches with gradients less than 2 percent and with finer substrates (Grant et al. 2008). Action area streams with these low gradient fine substrate conditions include some reaches in the upper granitic areas of the South Fork WBC subwatershed. These reaches are on Jungle, Asbestos, and Cold Springs Creeks which have high baseline CEs; however, anadromous fish are not present in these three creeks. If additional scour or sedimentation were to occur in these reaches, it would be at low levels and be expected to move down through the system in high water. Such ECA-associated sediment additions would be attenuated if detectable at all in the sections of WBC where steelhead occur. The attenuated sediment additions might have small, localized effects on stream substrate conditions in steelhead habitat, but would likely be too small to affect steelhead growth and survival in any way.

2.5.1.7 Stream Temperature

Steelhead require cold water to successfully spawn and rear. Stream shading helps to maintain cold stream temperatures, and as shade increases, water temperature decreases (Murphy and Meehan 1991). Project activities that remove or alter vegetation that provides shading to streams have the potential to increase solar insolation and in turn increase stream temperatures. Brazier and Brown (1973) determined that an 80-foot buffer strip provided maximum shading on small coastal streams and Steinblums (1977) concluded that an 85-foot buffer strip provided stream shade similar to that of an undisturbed canopy. DeWalle (2010) found buffer widths of approximately 60 to 66 feet provided approximately 85 to 90 percent of total shade to streams.

No timber harvest, new roads, or landings will occur in RHCAs; therefore, those activities will not affect stream shading. Existing haul roads cross streams through RHCAs and will require removal of vegetation to clear running surfaces, meet width requirements, and replace culverts. For road preparation, the removal of vegetation affecting stream shade is expected to be limited to small areas; therefore, no detectable increase in stream temperatures is expected from road work near or at stream crossing sites. There will be a small amount of tree felling in RHCAs for cattle exclusion, campground clearing, and roadside fuel breaks that will cause small localized reductions in shade without appreciable effects on stream temperatures. Vegetation may be removed for access and recontouring during road decommissioning. Although 27.5 miles of road will be decommissioned, the vast majority does not involve the stream or streamside shade. There will be 21 culvert removals dispersed across the action area. Reduced shade from clearing at decommissioning sites will be minimal and dispersed, and is not expected to cause stream warming.

Prescribed fire will be allowed to back into RHCAs increasing the potential for tree and stream shade loss. As noted in the BA, observations made by the Clearwater National Forest Fisheries Biologist, Pat Murphy, noted little change or effects to streams on the North Fork Clearwater District after the Elizabeth and Snow Fires of 2000 and Boundary Junction Fire in 2007. These fires were natural fire starts without suppression, burned at low intensity, and burned less than 5 percent of riparian areas. Prescribed fires will not be ignited in RHCAs, but will be allowed to back into RHCAs. Burns are done in spring and fall when fire is expected to be low intensity and proceed in a mosaic pattern based on varying humidity in riparian areas and proximity to streams.

Seasonal prescribed burning with implementation of BMPs may result in reductions of trees or other vegetation and loss of stream shading in localized areas. These incremental and localized reductions in shading are not expected to result in any detectable change in water temperatures at the local or subwatershed scale. Incidental prescribed fire in RHCAs may provide long-term benefits by increasing stand vigor resulting in long-term increases in shade.

In summary, the proposed actions related to harvest, road work, prescribed burning, and other activities may result in small, localized reductions in streamside vegetation and shade without measurable effects to stream temperatures or steelhead.

2.5.1.8 Stream Crossing Hardening and Fencing

Other aspects of the proposed action will have similar effects to those described above but at a much lower intensity and duration. Stream crossing hardening for cattle and fencing meadow areas may include short periods (hours to a day) of work below the ordinary high water mark or work in riparian areas. Only one crossing hardening has steelhead present. The BMPs used for other activities to minimize sediment delivery, or risk of fuel contamination, will be employed during these activities. Turbidity and deposited sediment are expected to be minor and temporary without adverse effects to steelhead or critical habitat. Other effects from grazing have already been considered in past ESA consultations on the grazing allotments and were considered in the baseline of this Opinion. The proposed cattle crossing and fencing activities, accomplished as part of the EOW project, will tend to reduce the effects of the grazing allotment.

2.5.2 Effects on Critical Habitat

The action area contains designated critical habitat for Snake River Basin steelhead. The proposed action has the potential to affect the following steelhead PBFs of designated critical habitat (Table 6): (1) Water quality; (2) water quantity; (3) substrate; (4) forage; (5) natural cover/shelter; and (6) passage. Any modification of these PBFs may affect freshwater spawning, rearing, or migration in the action area. Proper function of these PBFs is necessary to support successful adult and juvenile migration, adult holding, spawning, rearing, and the growth and development of juvenile fish.

2.5.2.1 Water Quality

Road reconditioning, reconstruction, and decommissioning, increased road use, and crossing removal and/or replacement are expected to generate periodic turbidity pulses. The intensity and duration of these turbidity pulses will be minimized by implementing various BMPs (e.g., appropriate sediment erosion control measures, dewatering culvert work areas, crossdrains, and gravelling). As discussed in the species effects section, five culvert replacements are in designated critical habitat (WBC watershed), and the associated turbidity pulses are expected to be temporary and of low magnitude. Sediment delivery and turbidity from road reconstruction and road use is expected to be even more limited in concentration and extent, particularly with implementation of crossdrains that limit the length of road that drains into streams, gravelling and sediment control structures to reduce and contain erosion near stream crossings, and monitoring/response to potential ecological damage at stream crossings.

The proposed action involves the storage and use of petroleum products and the use of equipment and vehicles in RHCAs. In addition, the high amount of logging-related traffic creates a greater potential for fuel spills near streams. As described in Section 2.5.1.3, above, the NPCNF has a long history of avoiding spills and has included minimization measures/BMPs to reduce the risk of spill reaching a stream. Because of the history and proactive BMPs, a spill that would have adverse effects on the water quality PBF is unlikely in the action area.

Contractors may spray magnesium chloride on roads to control dust. As discussed above in Section 2.5.1.3, above, proper application of the chemicals as required by NPCNF personnel and contractors, as well as road work that directs sediment and other road-related chemicals away from streams, will help keep dust abatement chemicals from entering streams at levels harmful to the water quality PBF in the action area.

Stream crossing hardening may cause brief periods of turbidity and sediment deposition. Only two of the crossings are in critical habitat. As analyzed in Section 2.5.1.8, any turbidity caused by these activities would be brief and of low intensity without impairing the function of the water quality PBF.

Considering the information summarized above and described in more detail in the species effects section, the proposed action is not expected to affect the function and conservation value of the water quality PBF within the action area.

2.5.2.2 Water Quantity

The proposed action has the potential to alter streamflow through the removal of forest cover and water withdrawals for prescribed fire and dust abatement. Effects of moderate peak flow increases from forest cover removal were discussed previously in Section 2.5.1.6, above. Critical habitat is coincident with third or greater order streams in the WBC watershed. Moderate increases in ECA at the third to fifth order stream scale (i.e., middle and upper reaches of steelhead habitat) are expected to cause undetectable to marginally detectable increases in peak and base flow in steelhead critical habitat. Those effects are not expected to be of sufficient magnitude to significantly alter the water quantity PBF in steelhead critical habitat in the action area.

As described in Section 2.5.1.2, above, the proposed action is authorizing the withdrawal of water to support fire suppression and control road dust. These withdrawals are expected to be infrequent and are expected to remove only a small portion (i.e., enough to fill a water truck, which requires less than 2 hours of pumping) of the total volume of water at any given time. In addition, a fish biologist or hydrologist will designate the locations for water withdrawals to maintain streamflow. Because the flow reductions will be small, infrequent, and temporary (i.e., water will not be continually withdrawn), they are not expected to appreciably alter the water quantity PBF in steelhead critical habitat in the action area.

In summary, the proposed action is not expected to change the function or conservation value of the water quantity PBF in the action area.

2.5.2.3 Substrate

As discussed Section 2.5.1.5, above, increased sediment yield and delivery to streams in the action area is expected to occur in the short term. Although soil erosion from timber harvest activities and prescribed burning will increase, sediment delivery to streams from those activities should be effectively avoided or reduced to very small amounts through implementation of PACFISH buffers and other sediment control BMPs.

This action is most likely to affect sediment delivery and stream substrate conditions through activities involving roads. Road work, stream crossing work, and increased road traffic will add to road-generated sediment movement in the short term. Prior to other road work and increased use of the roads, the installation of crossdrains will help disconnect most of the road area surface flow from the stream network so that most of the road-related erosion and sediment movement will not result in delivery to streams. Road BMPs including outsloping, crossdrains, gravelling, sediment control measures, and dust abatement, along with monitoring/response to road maintenance at stream crossings, are expected to minimize new sediment inputs and reduce existing sediment delivery from roads to streams.

Data are not available to determine the extent to which the action's reduction in existing sediment deliveries from roads will offset new inputs of sediment from reconstruction and road use near streams. Precipitation events, road preparation, culvert removals and replacements, haul, and road decommissioning will cause sediment delivery and deposition directly downstream of stream crossings in the action area. Sediment that is delivered to streams is expected to settle out on substrate in localized low velocity areas (i.e., pools, stream margins, or low gradient spawning and rearing habitats) within a short distance downstream of stream crossings. At the stream crossings over critical habitat, road generated fine sediment will settle on substrates for up to 600 feet downstream and remain until the next high water. The five culvert replacement sites are within steelhead critical habitat. Effects on stream substrate at and below these sites will be short distance and single season. There are only four gravel road crossings on main haul routes that intersect with steelhead critical habitat; therefore, detectable road sediment effects on the substrate PBF will be both limited in length and few in number.

In the short-term, the fine sediment will move downstream (in <1- to 4-year intervals) becoming more diffuse before settling in the next depositional reach or leaving the watershed. The areas of harvest activity and road work in the WBC subwatersheds are somewhat separated in space and time, such that both sediment additions from new activities (to the extent that these are not minimized or offset on site) and sediment reductions from road removals and repairs a year or more earlier, would converge in mainstem WBC Creek. Because of that distribution of activity effects, and the minimization of effects at the sources and delivery points as noted above, substrate conditions are not expected to change appreciably in WBC in the short-term.

As discussed in Section 2.5.1.6, above, certain levels of ECA increases can affect peak flow detectably and can cause channel scour that would affect stream substrate. The ECAs of 14 to 29 percent for third to fifth order streams in the South Fork WBC, North Fork WBC, and GCS subwatersheds are not likely to result in increases in moderate peak flows that would initiate significant channel scour. Because thinning treatments have a consistent effect on ECA throughout the harvest units, and thinning coverage is greater around lower order streams, flow and scour effects are expected to be similar to but scaled up for first and second order streams as for third order streams. This scour would cause fine sediment to move downstream into critical habitat in third or greater order reaches. This sediment is expected to be of limited quantity and dispersed in time and space in designated critical habitat. As a result, there will likely only be minor adverse effects to the substrate PBF and conservation value of steelhead critical habitat for the duration of the project.

In the long-term, the proposed action is expected to reduce the sediment yield and delivery to streams in the action area as a result of the addition of crossdrains, other road improvements, road decommissioning, and stream crossing removal. In summary, possible short-term additions of sediment to stream substrates are expected to result in small, localized effects to the function of the substrate PBF, and project actions are expected to somewhat improve the function and conservation value of the substrate PBF in the long-term in the action area.

Stream crossing hardening may cause brief periods of turbidity and sediment deposition. Only two of the crossings are in critical habitat. As analyzed in section 2.5.1.8, any turbidity and sediment deposition caused by these activities would be brief and of low intensity without impairing the function of the substrate PBF.

2.5.2.4 Forage

Macroinvertebrate forage may be affected by fine sediment deposited in substrates and may also be affected by road dust abatement chemicals that enter the stream.

As discussed in Section 2.5.2.3, above, the project may generate sediment pulses below stream crossings in the short term. Project road improvements and BMPs are expected to offset to some extent, and otherwise substantially minimize sediment deliveries such that effects on stream substrate are expected to be small, localized, and temporary. In a study with moderate levels of sediment increase from road improvements in a headwater stream drainage, little change in biomass of invertebrates was found (Kreutzweiser et al. 2005). Also, because sediment deposition may be localized, insect drift through the affected areas may be similar to unaffected areas (Bjornn et al. 1977).

Road reconstruction BMPs to reduce length of road with runoff into streams, and $MgCl_2$ application techniques favoring chemical penetration into the road surface will tend to limit the instream concentration of $MgCl_2$ and limit its effects on invertebrates to small areas near the crossings. Therefore, fine sediment deposition and dust abatement chemical effects to the forage PBF are expected to be small, localized, and temporary.

The removal of vegetation in the riparian area can reduce the amount of terrestrial habitat for insects near the stream environment. Very little riparian vegetation will be killed or removed during roadwork, culvert work, or prescribed fire activities. Following this work, bare soil areas will be revegetated. In addition, timber harvest activities will not occur in riparian areas and prescribed fire will only be allowed to back into the riparian areas. For these reasons, any effects to riparian vegetation and associated insects from the proposed action are not expected to reach levels that will adversely affect the forage PBF. The action as a whole is not expected to change the function or conservation value of the forage PBF in the action area.

2.5.2.5 Natural Cover/Shelter

The proposed action has the potential to affect channel and riparian indicators that contribute to natural cover/shelter. Channel indicators include pool frequency and quality, width/depth ratio, and off-channel habitat. Sediment and channel adjustments from stream crossing replacement or removal may cause short-term effects to stream cover.

Sediment introductions from this work will be minimized through implementation of project BMPs. Sediment pulses are not expected to be of sufficient magnitude to cause geomorphic changes to the stream or fill pools and gravels. Therefore, no changes are expected to pool frequency and quality, channel width-to-depth ratios, and off-channel habitats at the local and watershed scales. Because project effects to channel structure and associated cover for steelhead are likely to be minor and short term, the project is not expected to reduce the conservation value of the cover PBF at the local to watershed scales.

The proposed action may reduce the amount of LWD in a given location during select road activities (i.e., road reconstruction and culvert work) and when prescribed fires back into RHCAs and consume some down wood and perhaps a few live trees. Prescribed fires that back into RHCAs are expected to result in little tree mortality; however, if trees are killed, they will become more readily recruitable as LWD to streams. Arkle and Pilliod (2010) found no effect on LWD after prescribed fire (with no direct ignition in RHCAs) in a ponderosa pine forest. Road activities in RHCAs will result in limited, if any, tree removal. If trees are removed from work sites, they will be placed on the ground in the RHCA. Considering the very limited areas that will be impacted coupled with the limited amount of existing or potential future LWD that could be removed, the proposed action is expected to have a minimal effect on LWD recruitment and related instream cover/shelter in the action area. In summary, project actions are not expected to have adverse effects on the natural cover and shelter PBF in the action area.

2.5.2.6 Unobstructed Passage

The replacement of five culverts will improve passage and will increase access to over 4 miles of critical habitat and decrease the likelihood of culvert failure that would obstruct future passage. Because this is a long-term beneficial effect, the proposed action is expected to maintain, and slightly improve this PBF within the upper WB watershed. During the replacement process, passage to upstream and downstream habitats will be obstructed for 1 day while the stream is moved to a temporary channel. Once the stream flows through the artificial channel, there will be temporary passage. This is a short-term effect as culvert replacements on these small streams will take approximately 5 days to complete, at which point the natural channel will be rewatered and fish passage conditions restored. Thus, only small, short-term adverse effects to the “free of artificial obstructions” PBF are expected, and in the long-term the action will increase the function of this PBF in the upper WB watershed.

2.5.2.6 Climate Change

Project actions that last more than 10 years may cause adverse effects that are amplified by climate change. Although all timber sales will be sold within 10 years, implementation of the harvest may extend beyond 10 years with continued prescribed burning and decommissioning of temporary roads. In addition, prescribed burning may continue for over 10 years. Climate change is predicted to change water temperatures, precipitation patterns, and snow runoff timing. The five culvert replacements will allow access to over 4 miles of higher elevation critical habitat where water temperatures may be more suitable for steelhead in the face of rising water temperatures due to climate change.

Change in precipitation patterns, or an increase in ROS (Leung et al. 2004; Musselman et al. 2018) events has potential to amplify effects of the project. With each year of the project, the chance of an ROS event increases. Road obliteration and prescribed burning will continue to create bare soil areas in a mosaic of small patches. These areas have a greater chance of erosion and consequent sediment delivery than vegetated areas. An increase in the frequency of ROS would increase the risk of erosion in the bare soil areas. However, as discussed above, project-related cleared or burned areas are expected to revegetate within 1 to 2 years and PACFISH buffers would leave riparian areas vegetated and capable of filtering eroded sediment from burn areas. If eroded sediment from these patches were delivered to streams, it would likely be to a small number of streams in the action area and be transported out of the action area during the powerful high flows associated with ROS events. During an ROS event, temporary roads do not have a considerable risk of sliding resulting in sediment delivery because they are located on or near ridge tops and have no direct connection to the stream network.

2.5.3 Summary of Effects on Steelhead and Critical Habitat

The action will have localized adverse effects on fish and habitat in the short term. Direct effects from fish salvage at the five culvert replacement sites may harm or kill up to 105 juvenile steelhead with an additional 630 steelhead affected by turbidity. Localized, short-term increases in deposition of sediment on substrates below stream crossings may result in harm of fish through direct exposure, displacement from current habitat, and reduction in stream functions that can affect fish growth and survival. Other modes of effects from exposure to toxins, visual and noise disturbance, prescribed fire, water drafting, ECA-related changes to streamflow (water quantity), and stream temperature changes are expected to be minor and not likely to result in harm to steelhead.

This action will result in small, temporary decreases in the condition of critical habitat PBFs within the action area in the short-term, and will improve the condition of some PBFs in the long-term. The action involves increased application of $MgCl_2$ salt to roads and a great deal of movement of vehicles containing fuels and other toxic chemicals through the action area creating a risk of chemical contamination of streams. Truck, equipment, and haul BMPs, and actions that will reduce road connectivity to streams will minimize the risk and amount of those effects on the water quality PBF in the action area.

Project-related sediment mobilization and inputs will reduce water quality temporarily, most notably after rewatering following culvert work. Sediment inputs from road and culvert work, and from haul may also reduce stream substrate condition in areas below stream crossings. In addition, ECA increases may have minor influences on moderate peak flows leading to some scour in a small number of stream reaches with consequent minor downstream sediment deposition. These sediment impairments would continue for the time period between implementation of the activity (culvert work, road reconstruction near streams, heavy road use at stream crossings), and the time road surfaces stabilize 1 to 2 years later. In the longer term, sediment delivery should be reduced and substrate PBF conditions improved through road decommissioning and addressing existing sediment sources on roads. Culvert replacements should decrease the risk of future culvert failure and associated sedimentation, and impairment of fish passage conditions. The replacement of five culverts will allow access to over 4 miles of critical habitat which is a benefit to the passage PBF. Effects on the forage, natural cover/shelter, and water quantity PBFs are expected to be very small and not likely to change the condition of those PBFs in the action area.

Climate change could increase the frequency of ROS events and increase water temperatures in the action area. The ROS events are not expected to amplify project-related effects because bare soil areas are transient in time, and thus sediment erosion and delivery, are limited to small isolated areas at any given point in time. Culvert replacements will allow access to higher elevation habitat and more suitable water temperatures as streams temperatures rise due to climate change.

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 due to continuing non-federal activities and climate effects that would still occur in the absence of those continuing activities. Therefore, the relevant future climate-related environmental conditions and trends as we presently understand them were discussed as a whole in Section 2.2.4 above, and were also considered again in terms of how climate change may interact with the effects of the action (Section 2.5.2.6, above).

In the action area, there is mostly private land in the WBC watershed below the NPCNF boundary, and very little in the GCS. The U.S. Census Bureau report (https://www.census.gov/quickfacts/idahocountyidaho) shows that between 2010 and 2018 the population of Idaho County, Idaho increased by only 1.5 percent with a population density of two people per square mile. With this low population growth rate and density, activities on private land, and associated environmental effects, are likely to increase only slightly over the life of the project.

Recreation activities such as camping, hunting, fishing, firewood cutting, and trail use will likely continue at approximately the same rate and may have localized adverse effects on riparian vegetation, streambank stability, and cause delivery of sediment and petroleum products from some sites.

There is no State land in the action area.

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 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.

The action area includes both the Little Salmon River and South Fork Clearwater River steelhead populations. Although the Little Salmon River population is currently meeting its population target abundance of viable, estimates of the population carry a high uncertainty and adult returns have plummeted in 2017 through 2019. Critical habitat is widely distributed in the WBC watershed portion of the action area and is a part of a minor spawning area. Approximately 76 percent of proposed harvest and landscape burn acres will occur within the WBC watershed and Little Salmon River population boundaries.

The South Fork Clearwater River steelhead population is currently at high risk due to a tentative high risk rating for abundance and productivity. Improvements in abundance and productivity will need to occur for this population to reach its proposed status of maintained. Approximately 24 percent of proposed harvest and landscape burn acres will occur in tributaries draining to the South Fork Clearwater River. These tributaries are not part of major or minor spawning areas, do not have ESA-listed fish present, and are not critical habitat.

Baseline sediment levels in action area streams are generally low. Recent CE measures are low at below 21 percent with higher measurements in tributaries to the South Fork WBC. This area is underlain by erosive granitic soils and tributaries have lower gradient than other parts of the action area. The remaining creeks in the action area can be characterized as having steep gradients and large substrate indicative of high energy streams that actively transport fine sediment. In addition, consistently low sediment levels throughout the action area indicate that episodic and chronic sediment from past wildfire, legacy land management activities and roads, and the current road system, is being transported out of action area streams.

The most likely climate effect combining with project effects would be an increase in rain on snow events that would cause excess erosion to bare soil areas resulting in increased sediment delivery to streams. This effect is likely to be minor as road work will be completed in the early stages of the project, harvest will be completed in about 10 years, and harvest and landscape burning will be staggered in time so vegetative recovery will limit the amount of bare soil areas at any given point in time. In addition, with both air and water temperatures expected to rise, the replacement of five culverts will allow passage to over 4 miles of critical habitat at higher elevations where water temperatures may suitable for a longer period of time.

Cumulative effects are not expected to substantially increase or exacerbate project effects during the 20-year implementation of the proposed action (approximately 10 years of timber harvest and up to 20 years of prescribed landscape burning). Idaho County has a low annual growth rate of 1.5 percent, so ongoing recreational activities and development in the action area will likely increase only slightly. Private land is downstream of project activities where project effects will be greatly attenuated. There is no State land in the action area.

As noted in the effects section (Section 2.5), implementation of the proposed action and BMPs will affect Snake River Basin steelhead and designated critical habitat in several ways:

- Five culvert replacement sites will include fish salvage and dewatering. NMFS estimates that 26 juvenile steelhead could be harmed or killed during fish salvage of the five sites. During dewatering, NMFS expects a turbidity plume to extend no more than 600 feet downstream at each of the five sites for more than 2 hours. NMFS estimates that 630 juvenile steelhead in total for the five sites will be displaced by or exposed to the turbidity plumes. Displaced and exposed steelhead are likely to experience temporary reductions in foraging efficiency and/or predator avoidance or minor physiological responses.

- Passage will be restored at the five culvert replacement sites resulting in no man-made obstacles to fish passage in the action area. This eliminates the passage limiting factor for the WBC watershed and allows passage to over 4 miles of steelhead critical habitat.

- Log haul will exit the top of the watersheds minimizing downstream interaction with ESA-listed species and critical habitat. All haul will exit the action area on paved Road 221 with two stream crossings over occupied critical habitat. Primary haul routes are fully maintained gravel roads that feed into Road 221 and collectively have only four stream crossings over occupied and/or critical habitat and a small number (37) of crossings over non-fish-bearing streams.

- New ground disturbance and heavy use of roads during project implementation are expected to result in localized short-term increases in sediment delivery and sedimentation of substrates at and immediately below each gravel road stream crossing. Only four of those short, temporarily affected stream sections contain steelhead and/or their critical habitat. Forty-three crossdrains will be added to the existing road drainage system to minimize the amount of road draining to stream crossings. Active haul roads will be monitored regularly and after wet periods to insure damage to the road, or road drainage system, is repaired quickly. Increased sediment delivery at stream crossings will continue for a period of 1 to 4 years following road upgrades or until active haul ceases, whichever is greater.

- In the short term, after a pulse of sediment from road work, the reduced road length, larger culverts, and graveling will reduce delivery when compared to baseline. In the long term, road and drainage improvements, and road decommissioning are expected to reduce fine sediment delivery from roads when compared to baseline.

- Initial deposition of sediment from crossings will be within 600 feet downstream from crossings. Beyond 600 feet, effects will be delayed and attenuated depending on distance downstream from crossings. Stream reaches downstream from haul routes and stream crossings in harvest areas have higher gradients, large substrates, and very low baseline fine sediment indicating high sediment transport capacity. With these characteristics, fine sediments are unlikely to accumulate in downstream occupied critical habitat.

- For timber harvest and yarding activities, the use of PACFISH buffers, exclusion of landslide prone areas from harvest, and other measures to avoid creating channelized flow to streams are expected to minimize any fine sediment delivered to streams to immeasurable levels.

- The NPCNF and NMFS analyses show that a peak flow response from ECA for first to third order streams in the action area would be unlikely or minor to undetectable, unlikely to scour, and unlikely to cause adverse effects to substrate and steelhead.

- Prescribed fire treatments, dust abatement chemicals, equipment/truck leaks, spills of fuels, water withdrawals, temporary fish passage obstructions, vegetation removals at near-stream work sites, and construction/haul noise all have the potential to adversely affect steelhead and critical habitat. However, the NPCNF will employ numerous precautionary measures/BMPs that NMFS expects will reduce the occurrence of those effects and limit the effects to those that will not harm steelhead.

The Recovery Plan for Snake River Spring/Summer Chinook and Snake River Basin steelhead (NMFS 2017) has noted that substrate sedimentation is one of the limiting factors to tributary habitat production for populations in the action area. The proposed action is expected to have short-term minor adverse effects on stream substrate in steelhead habitat, with associated effects on juvenile steelhead, in a few small areas of the WBC watershed over the life of the project. During and after the project, the project road work will likely combine with other work underway in the watershed to decrease sediment delivery from roads and eventually help reduce fine sediment levels in the stream substrate. The action, therefore, is not expected to appreciably reduce habitat function or substantially reduce steelhead production for this population in the short term, and in the long term will improve stream substrate conditions and improve fish passage, enabling steelhead to recover access to more than 4 miles of stream in the WBC watershed.

The project effects on the Little Salmon River steelhead population will not hinder, and may in a small way help to maintain the moderate risk status of the population. Maintaining or improving the present status of the population can assist in supporting eventual viability of the Salmon River MPG and recovery of the DPS. The project effects in the GCS watershed do not overlap with areas occupied by steelhead of the South Fork Clearwater River population (Clearwater Basin MPG). Because the project effects are not likely reduce the survival and recovery of the Salmon and Clearwater MPGs, project actions are not expected to reduce the recovery and survival of the Snake River Basin steelhead DPS.

Considering the potential effects of the proposed action with the status of critical habitat, baseline condition, potential effects of climate change, and cumulative effects in the action area, NMFS concludes that the proposed action is not expected to appreciably reduce the conservation value of critical habitat in the short term, and may increase the long-term conservation value of critical habitat in the WBC watershed. Since the conservation value of designated critical habitat for Snake River Basin steelhead in the action area will not likely be reduced, it will also not be reduced for the designation as a whole.

2.8 Conclusion

After reviewing the current status of the listed species and their designated critical habitats, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of Snake River Basin steelhead, or destroy or adversely modify their designated critical habitat.

2.9 Incidental Take Statement

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "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. NMFS is reasonably certain the incidental take described here will occur because: (1) Recent, and historical surveys indicate ESA-listed species are known to occur in the action area; and (2) the proposed action includes instream work activities that could harm or kill juvenile steelhead (e.g., fish salvage, dewatering, rewatering/turbidity). In the Opinion, NMFS determined that incidental take would occur as follows:

(1) Short-term stress to death of juvenile steelhead during channel dewatering and fish salvage for culvert replacements and removals;

(2) Harm of juvenile steelhead as a result of temporary turbidity plumes associated with construction activities for culvert replacements;

(3) Harm of juvenile steelhead from sedimentation of substrate below stream crossings associated with culvert replacements and haul.

Incidental Take from Channel Dewatering and Fish Salvage

As described in the species effects analysis, NMFS was able to quantify the take associated with the five culvert replacements (i.e., take from channel dewatering, fish salvage, and turbidity plumes). NMFS estimated the total number of steelhead that may experience adverse effects, ranging from short-term stress to death, if steelhead are captured and handled at any of these five culvert replacement sites. NMFS estimates that up to a total for the five sites of 105 steelhead may be handled during dewatering and fish salvage with up to 26 of these killed by electroshocking and stranding. NMFS will consider the extent of take exceeded if more than a total of 105 steelhead are captured and handled at the five culvert replacement sites.

Incidental Take from Turbidity Plumes

NMFS estimated that up to 630 juvenile steelhead could be temporarily exposed to and/or displaced by elevated turbidity levels resulting from instream work at five culvert replacements. Because it is not feasible to observe fish fleeing the area or determine physiological effects on the fish that remain in the plume, NMFS will use the extent and duration of the turbidity plumes as a surrogate for take. Because turbidity is the direct cause of take of steelhead, and it is known what levels of turbidity can cause adverse effects to steelhead, monitoring turbidity is an excellent surrogate for this take pathway. NMFS will consider the extent of take exceeded at any of the five sites if a visual turbidity plume extends beyond 600 feet downstream of the culvert replacement for more than 2 consecutive hours.

Incidental Take from Sedimentation of Substrate

NMFS expects there will be increased levels of deposited sediment below five culvert replacement sites and four stream crossings associated with heavy road use that could affect steelhead and or critical habitat. The areas of appreciable substrate sedimentation will also likely be contained within the 600-foot stream section directly below the crossings, as described above. However, due to the high variability that occurs when measuring deposited sediment in stream substrates (Leonard 1995), it is not practicable to assess changes in deposited sediment through direct measurements. The type of sampling design and number of samples required to detect a statistically significant change would be prohibitive. In addition, take cannot be quantified because steelhead presence and density is highly variable due to natural factors such as seasonal water temperature or flow, or channel conditions. For this reason, NMFS will use the condition of the road at the stream crossings as a surrogate for take from sedimentation of substrate.

Road condition is a reasonable surrogate for take because of the causal relationship between disrepair of roads and consequent sediment delivery to streams and substrate. Because road surface and drainage condition affect the amount of erosion and fine sediment delivery from the road to stream substrates, and excess fine sediment in substrates can cause harm to steelhead, monitoring road surface and drainage conditions is a reasonable surrogate for this take pathway. The NPCNF monitors the road surface and drainage condition while administering timber sales looking for any damage or deterioration that is significant enough to require mechanical repair. Because of the potential for erosion and sedimentation of substrates downstream from road segments exhibiting damage or deterioration and draining to stream crossings, it is important that these areas be identified and repaired as quickly as possible after damage or deterioration develops. The NPCNF has proposed non-specific but regular inspections and monitoring of active haul roads. In practice, the NPCNF inspects active haul roads two to three times a week during haul, before weather fronts, and up to 4 to 5 days a week in the wet shoulder seasons. With these inspections, NPCNF documents when potential damage or damage is great enough to warrant repair. The NPCNF notifies contractors of needed repairs, and repairs are completed within 24 hours.

NMFS will consider the extent of take to be exceeded if damage, or potential damage, as documented by an SA meets any of these conditions:

(1) Damage, or potential damage, is present at 25 percent or more of the stream crossings on active haul routes within 2 days of roads being reopened following a wet period where haul ceases;

(2) Damage, or potential damage, is present at 25 percent or more of all of the five culvert replacement crossings and four graveled stream crossings over streams with steelhead or critical habitat within 2 days of roads being reopened following a wet period where haul ceases; or

(3) Damage, or potential damage, on active haul routes is not corrected within 4 days after a contractor has been notified to repair damage to a road.

NMFS uses 10 percent damage, or potential damage, at stream crossings as a threshold of take not to be equaled or exceeded because it would represent (on average) need for mechanized repairs at 10 percent or more of active haul crossings of fish-bearing streams or a more-than-infrequent occurrence of effects on non-fish bearing streams that could be sources of eventual sediment movement into areas with steelhead. Effects in excess of that percentage would seem to indicate a prevalence of design/maintenance execution problems and/or rain events that were more intense than planned through design and maintenance. Although these effects would be addressed quickly under the action, their temporary presence could indicate future erosion issues and a greater source of sediment delivery at these crossings, and more take in the stream reaches below the crossings, than NMFS anticipated.

2.9.2 Effect of the Take

In the 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 Snake River Basin steelhead or destruction or adverse modification of their 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).

The NPCNF and COE (for those measures relevant to the CWA section 404 permit) shall comply with the following RPMs:

1. Minimize the potential for incidental take from culvert replacements, road reconstruction, and haul.

2. Ensure completion of a monitoring and reporting program to confirm that the terms and conditions in this ITS were effective in avoiding and minimizing incidental take from permitted activities and ensuring amount/extent of incidental take defined herein is not exceeded.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the NPCNF, COE, or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The NPCNF, COE, 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) To implement RPM 1, the NPCNF and COE (for those measures relevant to the CWA section 404 permit) shall ensure that:

    a) The proposed action, including all described conservation measures and BMPs, will be implemented as described in the BA and Proposed Federal Action section of this Opinion.

    b) Sediment sources on reconstructed roads and haul routes will be identified and eliminated or minimized prior to log haul activities for each of the planned timber sales. Correction of these sediment sources will be field verified through implementation monitoring prior to haul.

2) To implement RPM 2 (monitoring and reporting), the NPCNF and COE (as relevant to the CWA section 404 permit) shall ensure that:

    a) All steelhead handled, injured, or killed shall be identified, counted, and recorded with the date of occurrence. These data will be reported in the annual project report.

    b) If project take (capture and handling) of steelhead (total of 105 fish captured or handled, or 26 killed) from fish salvage and dewatering is exceeded at the five culvert replacement sites, work will be suspended and NMFS will be called to discuss reinitiation of consultation.

    c) Turbidity monitoring shall be conducted for the five culvert replacements. After a turbidity plume begins at the work site, visual turbidity shall be noted and recorded after 2 hours at 600 feet downstream. If a plume is visible, the downstream extent of the plume will also be recorded. Results of this monitoring will be reported in the project annual report. If a visible plume is visible at 600 feet downstream after 2 hours, NMFS will be called to discuss reinitiation of consultation.

d) The NPCNF shall inspect all active haul road drainage systems for signs of damage or deterioration at least once weekly during active haul and after precipitation events intense enough to cause excessive rutting, damage, or abnormal deterioration of the road surface. Contractors will be notified and repairs made according to the standard practices of the NPCNF and defined in the Proposed Action Section of this Opinion. Damage or deterioration of active haul roads, requiring mechanical repair, and draining to perennial streams, must be repaired no more than 6 days after the damage or deterioration is found and roads become drivable by the Sales Administrator's vehicle. The NPCNF will keep a log of identified needed repairs and contractor compliance times. If there are no incidences of repair, this will be noted in the annual report. Log entries will be summarized, in table or text format, and submitted in the Project annual report.

e) If the extent of take described above (for steelhead mortality, turbidity, harvest, or road damage or potential damage) is exceeded, the NPCNF shall cease take-causing activities and contact NMFS within 72 hours.

f) Annual reports summarizing the results of all monitoring shall be submitted to NMFS by December 31. These annual reports shall be submitted every year until all proposed harvest and burning activities are complete. The annual project reports shall also include a statement on whether all the terms and conditions of this Opinion were successfully implemented.

g) The post-project reports shall be submitted electronically to: nmfswcr.srbo@noaa.gov. Hard copy submittals may be sent to the following address:

National Marine Fisheries Service
Attn: Ken Troyer
800 Park Boulevard
Plaza IV, Suite 220
Boise, Idaho 83712-7743

h) NOTICE: If a steelhead or salmon becomes sick, injured, or killed as a result of project-related activities, and if the fish would not benefit from rescue, the finder should leave the fish alone, make note of any circumstances likely causing the death or injury, location and number of fish involved, and take photographs, if possible. If the fish in question appears capable of recovering if rescued, photograph the fish (if possible), transport the fish to a suitable location, and record the information described above. Adult fish should generally not be disturbed unless circumstances arise where an adult fish is obviously injured or killed by proposed activities, or some unnatural cause. The finder must contact NMFS Law Enforcement at (206) 526-6133 as soon as possible. The finder may be asked to carry out instructions provided by Law Enforcement to collect specimens or take other measures to ensure that evidence intrinsic to the specimen is preserved.

2.10 Conservation Recommendations

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

1. As part of PACFISH implementation and effectiveness monitoring, monitor instream sediment and water temperature where ESA-listed fish are present at primary haul crossings in the EOW project area.
2. To mitigate the effects of climate change on ESA-listed salmonids, the NPCNF and COE should implement protective measures to protect or restore riparian buffers, wetlands, and floodplains; remove stream barriers; and to ensure late summer and fall tributary streamflows.

Please notify NMFS if the NPCNF or COE, or another entity, carries out these recommendations so that we will be kept informed of actions that minimize or avoid adverse effects and those that benefit listed species or their designated critical habitats.

2.11 Reinitiation of Consultation

This concludes formal consultation for the End of the World Project. 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 Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 Not Likely to Adversely Affect Determinations

Spring/summer Chinook salmon adult and juvenile presence in the vicinity of the project is limited to the lower reaches of the WBC watershed. Because spring/summer Chinook salmon are downstream of potential effects, NMFS finds the project effects on spring/summer Chinook salmon insignificant and concurs with the not likely to adversely affect (NLAA) determination.

As described in the critical habitat analysis, initial short-term deposition of sediment from crossings will be within 600 feet downstream from crossings. These localized areas are in habitat unoccupied by spring/summer Chinook salmon. Beyond 600 feet in the lower stream reaches of the action area, effects to stream PBFs will be delayed and attenuated. These lower stream reaches downstream from haul routes and stream crossings, have higher gradients, large substrates, and very low baseline fine sediment indicating high sediment transport capacity. Because of these physical characteristics and attenuated sediment effects, sediment is unlikely to accumulate in these reaches. Therefore, effects to PBFs will be insignificant and NMFS concurs with the NLAA determination.

3. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

3.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this document are the NPCNF, its representatives, its contractors, and the COE. The format and naming adheres to conventional standards for style.

3.2 Integrity

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

3.3 Objectivity

Information Product Category: Timber Harvest, Prescribed Burning, and Road Construction, Maintenance, and Repair.

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 NMFS’ ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the Magnuson-Stevens Fishery Conservation and Management Act implementing regulations regarding essential fish habitat, 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 contains more background on information sources and quality.

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

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

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