



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
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<https://doi.org/10.25923/78xr-6b72>

Refer to NMFS No: WCRO-2020-01560

December 15, 2020

Ms. Linda Jackson
Forest Supervisor
Payette National Forest
500 N. Mission Street
McCall, ID 83638

Lieutenant Colonel Richard T. Childers
U.S. Army Corps of Engineers
Walla Walla District
201 North Third Avenue
Walla Walla, Washington 99362-1826

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens
Fishery Conservation and Management Act Essential Fish Habitat Consultation for the
Payette National Forest Programmatic Activities (Seven Forest-wide Activities)

Dear Ms. Jackson and Lt. Col. Childers:

Thank you for your letter of May 13, 2020, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Payette National Forest (PNF) proposal to conduct seven programmatic activities. Implementation of actions under the Road Maintenance and under the Trails, Recreation, and Site Operation and Maintenance programmatic activities may entail placement of fill material below the ordinary high water mark. The U.S. Army Corps of Engineers (COE) will issue a Clean Water Act Section 404 permit for these actions, and is considered a secondary action agency to this consultation. The PNF submittal included a final biological assessment that analyzed the effects of the proposed action on Snake River spring/summer and fall Chinook salmon (*Oncorhynchus tshawytscha*), Snake River sockeye salmon (*O. nerka*), and Snake River Basin steelhead (*O. mykiss*) and their designated critical habitats that are present in the action area. The submittal package was deemed complete with our subsequent receipt of the Resource Advisory map on June 1, 2020. Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action.



In your submittal, the PNF determined that the proposed action was not likely to adversely affect Snake River fall Chinook salmon, Snake River sockeye salmon, and their designated critical habitats. NMFS concurs with your determination and has included our rationale in the attached document. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016). In the enclosed biological opinion (Opinion), NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of Snake River spring/summer Chinook salmon and Snake River Basin steelhead or result in the destruction or modification of their critical habitats. Rationale for our conclusions is provided in the attached Opinion.

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 PNF, COE, and any permittee who performs any portion of 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.

This document also includes the results of our analysis of the action's effects on EFH pursuant to section 305(b) of the MSA, and includes ten Conservation Recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. These Conservation Recommendations include a subset of the ESA Terms and Conditions. Section 305(b)(4)(B) of the MSA requires federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH Conservation Recommendations, the PNF or COE must explain why the recommendations will not be followed, including the justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many Conservation Recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, in your statutory reply to the EFH portion of this consultation, NMFS asks that you clearly identify the number of Conservation Recommendations accepted.

Please contact Johnna Sandow, Fish Biologist in the Southern Snake Branch, at (208) 378-5737 or at johnna.sandow@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael Tehan".

Michael Tehan
Assistant Regional Administrator
Interior Columbia Basin Office

Enclosure

cc: C. Nalder – PNF
K. Hendricks – USFWS
E. Kenison – USFWS
M. Lopez – NPT
R. Armstrong – NPT
C. Colter – SBT

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

*Payette National Forest Programmatic
Activities (Seven Forest-wide Activities)*

NMFS Consultation Number: 2020-01560

Action Agency: USDA Forest Service, Payette National Forest

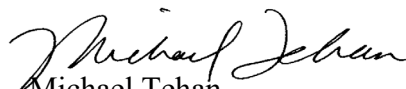
Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Snake River spring/summer Chinook salmon (<i>Oncorhynchus tshawytscha</i>)	Threatened	Yes	No	Yes	No
Snake River fall Chinook salmon (<i>O. tshawytscha</i>)	Threatened	No	N/A	No	N/A
Snake River sockeye salmon (<i>O. nerka</i>)	Endangered	No	N/A	No	N/A
Snake River Basin steelhead (<i>O. mykiss</i>)	Threatened	Yes	No	Yes	No

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

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

Issued By:


Michael Tehan
Assistant Regional Administrator

Date: December 15, 2020

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ACRONYMS

ACRONYM	DEFINITION
a.e.	Acid Equivalent
a.i.	Active Ingredient
ATV	All-Terrain Vehicles
BA	Biological Assessment
BLM	Bureau of Land Management
BMPs	Best Management Practices
CFR	Code of Federal Regulations
CHARTs	Critical Habitat Analytical Review Teams
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
DNA	Deoxyribonucleic Acid
DNR	Department of Natural Resources
DPS	Distinct Population Segment
DQA	Data Quality Act
ECA	Equivalent Clearcut Area
eDNA	Environmental Deoxyribonucleic Acid
EDRR	Early Detection and Rapid Response
EECs	Estimated Environmental Concentrations
EFH	Essential Fish Habitat
EFSFSR	East Fork South Fork Salmon River
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
EUPs	End Use Products
FA	Functioning Appropriately
FAR	Functioning At Risk
FCRNRW	Frank Church River of No Return Wilderness
FEMAT	Forest Ecosystem Management Assessment Team
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FR	Federal Register
ft ²	square feet
FUR	Functioning At Unacceptable Risk
GLEAMS	Groundwater Loading Effects of Agricultural Management Systems
GSI	Genetic Stock Identification
HQ	Hazard Quotient
HUC	Hydrologic Unit Code
ICTRT	Interior Columbia Technical Recovery Team
IDEQ	Idaho Department of Environmental Quality

ACRONYM	DEFINITION
IDFG	Idaho Department of Fish and Game
ips	Inch Per Second
ISAB	Independent Science Advisory Board
ITS	Incidental Take Statement
lb	pound
LC	Lethal Concentration
LRMP	Land and Resource Management Plan
LRMP Matrix	Land and Resource Management Plan Matrix of Pathways and Indicators
LSR	Little Salmon River
LWD	Large Woody Debris
MFSR	Middle Fork Salmon River
mg/L	Milligrams Per Liter
mi/mi ²	mile per square mile
MPGs	Major Population Groups
Mph	miles per hour
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSSE	Main Salmon Southeast
MSSW	Main Salmon Southwest
MSO	Methylated Seed Oil
MUP	Manufacturing Use
NFS	National Forest System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAEC	No Observed Adverse Effect Concentration
NOAEL	No Observed Adverse Effect Levels
NOEC	No Observed Effect Concentration
NOS	Not Otherwise Specified
NTU	Nephelometric Turbidity Units
NWFSC	Northwest Fisheries Science Center
<i>O.</i>	<i>Oncorhynchus</i>
OHWM	Ordinary High Water Mark
Opinion	Biological Opinion
PAHs	Polycyclic Aromatic Hydrocarbons
PBFs	Physical or Biological Features
PCE	Primary Constituent Elements
PDFs	Project Design Features
PFMC	Pacific Fishery Management Council
PNF	Payette National Forest
POEA	Polyoxyethylene Tallow Amine

ACRONYM	DEFINITION
psi	Pounds Per Square Inch
RCAs	Riparian Conservation Areas
READs	Resource Advisors
RPM	Reasonable and Prudent Measures
SERA	Syracuse Environmental Research Associates
SFSR	South Fork Salmon River
SPTH	Site Potential Tree Height
SRB	Snake River Basin
SRF	Snake River Fall
SRKW _s	Southern Resident Killer Whales
SRS	Snake River Spring/Summer
TEA	Triethylamine Salt
TGAI	Technical Grade Active Ingredient
TMDL _s	Total Maximum Daily Loads
USC	United States Code
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VSP	Viable Salmonid Population
WCI	Watershed Condition Indicator
WCR _s	Water Contamination Rates
WDFW	Washington Department of Fish and Wildlife

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, as amended.

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

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) [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Snake Basin office in Boise, Idaho.

1.2 Consultation History

Historically, the programmatic activities included in this consultation were part of seven separate Section 7 Watershed¹ Biological Assessment Consultations for Ongoing and New Actions on the Payette National Forest (PNF). Those consultations expired on December 31, 2017. The PNF began discussing reinitiation of consultation for the programmatic activities with NMFS and the U.S. Fish and Wildlife Service (USFWS) in 2017. Rather than continue with the Section 7 watershed consultation format, the PNF elected to combine all programmatic activities that are conducted forest-wide into a single biological assessment (BA). Between 2017 and 2020, NMFS and the USFWS reviewed multiple drafts of the BA. On May 13, 2020, NMFS received the PNF's request to initiate consultation; however, the electronic submittal did not include all of the information referenced in the request. On June 1, 2020, NMFS received all of the information intended for inclusion in the submittal package. On June 12, 2020, NMFS sent a letter to the PNF informing them the submittal package was complete and that formal consultation was initiated on June 1, 2020.

On July 23, 2020, and August 10, 2020, NMFS requested the PNF further clarify a number of statements in the proposed action section of the BA. The PNF responded to our inquiry via letter dated August 20, 2020. In this letter, the PNF modified the proposed action to incorporate a 10-year review process that will be used to assess whether reinitiation of consultation is warranted

¹ A Section 7 watershed may be a hydrologic watershed or a grouping of watersheds that have historically been used by the Payette National Forest for the purpose of ESA section 7 consultation.

in the future. The purpose of this modification was to acknowledge their commitment to implementing a regularly scheduled review of the activities and their effects on ESA-listed resources. Other clarifications or modifications made are incorporated into the proposed action description in Section 1.3 and Appendix A of this Opinion.

On September 14, 2020, NMFS requested additional information regarding the herbicide products used by the PNF. The PNF provided additional clarification on products to NMFS on September 30, 2020. In this same timeframe, the PNF and NMFS discussed the lack of clarity in the descriptions specific to implementation of aerial water withdrawal for fire suppression. As a result of these discussions, the PNF provided NMFS with modifications to the aerial dipping mitigations via email dated October 1, 2020.

The species and designated critical habitats subject to this consultation include Snake River spring/summer (SRS) Chinook salmon (*Oncorhynchus tshawytscha*), Snake River fall (SRF) Chinook salmon (*O. tshawytscha*), Snake River sockeye salmon (*O. nerka*), Snake River Basin (SRB) steelhead (*O. mykiss*), and designated critical habitats for all four species. In addition, the PNF requested EFH consultation for Pacific salmon (Chinook salmon).

On October 2, 2020, NMFS provided a copy of the proposed action and terms and conditions sections of the draft Opinion to the PNF, Nez Perce Tribe, and Shoshone Bannock Tribes. NMFS received comments from the PNF on October 9, 2020. In response to those comments, NMFS clarified language in terms and conditions in the ITS. No comments were received from either the Nez Perce Tribe or the Shoshone Bannock Tribes.

In preparing this Opinion, NMFS relied on information from the following sources:

- BA (PNF 2020) and supporting documentation.
- Published scientific literature.
- Other scientific literature (government reports).

The above information provided the basis for our determinations as to whether the PNF can ensure that its proposed action is not likely to jeopardize the continued existence of ESA-listed species, and is not likely to result in the destruction or adverse modification of designated critical habitat.

1.3 Proposed Federal Action

Under the ESA, “action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). Under the MSA, a “Federal action” means any action authorized, funded, or undertaken, or proposed to be authorized, funded or undertaken by a Federal agency (50 CFR 600.910). The proposed Federal action that is the subject of this consultation is the PNF’s seven programmatic activities that are performed annually as part of their forest management. The seven activities included in this consultation are: (1) Road Maintenance; (2) Trails, Recreation, and Administrative Site Operation and Maintenance; (3) Fire Management; (4) Invasive Weed Management; (5) Timber

Harvest and Precommercial Thinning; (6) Miscellaneous Forest Products; and (7) Aquatic and Riparian Ecosystem Monitoring.

Actions performed under the Road Maintenance or Trails, Recreation, and Administrative Site Operation and Maintenance programmatic activities may include the placement of fill material below the ordinary high-water mark (OHWM); therefore, they may require a Clean Water Act (CWA) permit from the U.S. Army Corps of Engineers (COE). Therefore, the COE has been identified as a secondary action agency, and their issuance of CWA permits for these actions has also been considered and analyzed in this Opinion.

The proposed action does not have an expiration date; instead, the PNF will revisit the BA by December 31, 2030, and every 10 years afterwards, to determine if reinitiation of consultation is needed. As part of this evaluation, the PNF will prepare a document that contains the following information: (1) Whether and if the Federal action should change; (2) whether the environmental baseline conditions have changed which could cause effects not previously evaluated; (3) whether any of the consultation reinitiation triggers have been met; and (4) if and how the existing effects analysis remains sufficient (e.g., are there any new pathways of effect not previously considered as a result of changing baseline conditions, does new science suggest the magnitude of effects are different from what was previously considered, etc.). This document will be reviewed by the Level 1 Team, and the Level 1 Team will determine whether reinitiation of consultation is warranted.

A brief summary of the types of activities included in each programmatic activity is presented in Table 1 below. The table also summarizes the activities excluded from coverage and provides a list of activities requiring approval from the Level 1 Team prior to implementation. Table 2 describes the proposed annual limitations of actions that may be implemented under each programmatic activity. Table 3 provides a brief summary of the required mitigations and best management practices (BMPs) that will be employed to avoid or minimize adverse effects to aquatic resources. For purposes of brevity, these required mitigations and BMPs will hereinafter collectively be referred to as project design features (PDFs). It is important to note this table is not a complete listing, but rather highlights a few of the key PDFs. Complete descriptions of the programmatic activities and PDFs, as presented in the BA and in the proposed action clarification letter sent to NMFS on August 21, 2020, are included in Appendix A.

We considered whether or not the proposed action would cause any other activities (i.e., consequences of the proposed action) and determined that recreational use of developed and undeveloped facilities and use of administrative facilities are considered to be consequences of operation and maintenance of those facilities.

Table 1. Summary of the types of actions for each programmatic activity on the Payette National Forest that are allowed, not allowed, and allowed to be implemented only after receiving Level 1 Team approval.

Programmatic Activity	Allowed Actions	Excluded Actions	Actions Requiring Level 1 Team Approval
Road Maintenance	<p><i>Routine Road Maintenance</i></p> <ul style="list-style-type: none"> ● Surface blading, rolling, and rock raking. ● Ditch clearing. ● Brushing along roadway. ● Deadfall removal and felling of hazard trees. ● Landslide and slough removal. ● Maintaining, installing, and removing cross drain culverts. ● Maintaining, and replacing stream crossing structures on dry intermittent channels. ● Road resurfacing. ● Dust abatement. ● Snow removal. <p><i>Infrequent/Extreme Road Maintenance</i></p> <ul style="list-style-type: none"> ● Replacement of up to 500 feet of full prism road normally maintained by the PNF that is severely damaged or eroded by flood, fire, or other natural events. This may include up to 100 feet of riprap placement below the OHWM. ● Cut and fill stabilization activities; up to 100 linear feet of fill material may be placed below the OHWM. ● Re-alignment and curve widening of up to ¼-mile of road. ● Removal of large wood from the stream channel. ● Removal of ice jams from the stream channel. ● Blasting to break up large boulders or fall hazard trees. 	<ul style="list-style-type: none"> ● Culvert and bridge replacement or installations within occupied² habitat that are covered under the Restoration Activities at Stream Crossings consultation (Scaife and Hoefer 2011; NMFS Tracking Number (2011/05875) ● Road maintenance activities occurring with mineral projects where the mineral activities have a may affect, likely to adversely affect determinations on an ESA-listed species or critical habitat. ● Maintenance activities covered under the Trails, Recreation, and Administrative Site Operation and Maintenance programmatic activity. 	<ul style="list-style-type: none"> ● Use of existing or new borrow sources within riparian conservation areas (RCAs). ● Extreme or infrequent activities. ● Use of the mobile rock crusher. ● Instream work in occupied or critical habitat. ● All stream crossing maintenance work within critical habitat, or in ESA occupied reaches (or presumed occupied) or within 600 feet of occupied reaches. ● Use of chemicals other than MgCl₂ or CaCl₂ salts or lignin-based chemicals such as lignin sulfonate.

² For the purposes of this Opinion, “occupied” means anadromous species and/or designated critical habitat are known or suspected to be present.

Programmatic Activity	Allowed Actions	Excluded Actions	Actions Requiring Level 1 Team Approval
Road Maintenance (Cont.)	<p><i>Stream Crossing Maintenance</i></p> <ul style="list-style-type: none"> ● Riprap placement for culvert inlet and outlet protection and bridge repairs can occur if limited to a cumulative linear distance of 100 feet or less at an individual site and after approval by a fisheries biologist. ● In kind repairs of bridges and abutments. ● Removal, replacement, and installation of asphalt wearing surface on bridge decks and approaches. ● <p>In addition, on <u>non-fish bearing</u> streams:</p> <ul style="list-style-type: none"> ● Hardening streambeds at fords or armoring approaches. ● Culvert/bridge installations, including replacements, extensions and new installations, clearing, cleaning and repair. <p><i>Road Decommissioning</i></p> <ul style="list-style-type: none"> ● Reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation. ● Blocking or removing the entrance to a road or installing water bars. ● Removing culverts, reestablishing drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed. ● Completely eliminate the roadbed by restoring natural contours and slopes. 		

Programmatic Activity	Allowed Actions	Excluded Actions	Actions Requiring Level 1 Team Approval
Trails and Recreation/Administration Site Operation and Maintenance	<p><i>Trail Maintenance</i></p> <ul style="list-style-type: none"> ● Reconstruction or relocation of trail segments if potential effects to stream channels are maintained or reduced. ● Maintenance of trail tread. ● Brushing of vegetation to maintain trail width and height. ● Minor streambank stabilization; work will be performed by hand. ● Blasting may be used to remove rocks, stumps, or hazard trees. <p><i>Stream Crossing Maintenance</i></p> <ul style="list-style-type: none"> ● Riprap may be placed for culvert inlet and outlet protection and bridge repairs, although it is limited to no more than 100 linear feet at a site. ● In kind repairs of bridges and abutments. ● Removal, replacement, and installation of asphalt wearing surfaces on bridge decks and approaches. ● Hardening streambeds or approaches to fords on non-fish bearing streams. ● Stream crossing structure replacement or installations on non-fish bearing streams. <p><i>Administrative/Recreation Site Facilities</i></p> <ul style="list-style-type: none"> ● Hazard tree removal. ● Brushing and pruning of vegetation. ● Campsite regrading and leveling. ● Surface material replacement. ● Beaver pond leveler installation and maintenance. 	<ul style="list-style-type: none"> ● New recreation/administrative facilities such as campgrounds or new motorized or non-motorized trails. ● Improving dispersed areas such as installing fire rings, picnic tables, outhouses, etc. when they currently do not exist at a dispersed area. ● Stream crossing replacement and/or removal activities within occupied habitat are not covered under this consultation but may be covered under the Restoration Activities at Stream Crossing Biological Assessment (Scaife and Hoefer 2011). ● Maintenance activities requiring equipment on motorized trails > 50" in width or greater. These activities are covered in the "Road Maintenance Programmatic" activity. 	<ul style="list-style-type: none"> ● Trail reconstruction or relocations greater than 500 feet in length. ● Streambank stabilization and rock/log retaining wall installation within the OHWM. ● Stream crossing replacement or removal on non-fish bearing streams, but that are within 600 feet upstream of fish-bearing streams ● All stream crossing work in, or within 600 feet of, occupied habitat.

Programmatic Activity	Allowed Actions	Excluded Actions	Actions Requiring Level 1 Team Approval
Fire Management	<p><i>Fire Suppression</i></p> <ul style="list-style-type: none"> ● Fireline construction which may be done by hand or with heavy equipment and may include “opening” existing, closed or unauthorized roads (these roads may also be used for access to the fire). ● Ground- and aerial-based water drafting. ● Burnout operations. ● Ground application of retardant, foams, and surfactants. ● Creation and maintenance of camps, helibases, helispots, and other operational facilities used during fire suppression. ● Fire mop-up. ● Rehabilitation activities (camps, fireline, etc.). ● Transport of fuel and other chemicals. <p><i>Prescribed Fire</i></p> <ul style="list-style-type: none"> ● Ignitions may occur within the RCA, but not within one site-potential tree height. ● Fireline construction may be done only with hand tools. ● Non-commercial, ladder-fuel thinning. 	<ul style="list-style-type: none"> ● Aerial application of fire retardants. 	<ul style="list-style-type: none"> ● Prescribed burns proposed to increase equivalent clearcut area (ECA) above 15% in any 6th level hydrologic unit code (HUC). ● Prescribed burns that exceed the proposed annual treatment acreages. ● Ignitions in moderate to high hazard landslide prone areas.
Invasive Weed Management	<p><i>Mechanical Control</i></p> <ul style="list-style-type: none"> ● Use hand-operated power tools to cut, clear (pull, grub or dig out), mow, or prune weeds. <p><i>Biological Control</i></p> <ul style="list-style-type: none"> ● Release insects or pathogens that are parasitic and “host specific” to target weeds. <p><i>Cultural Control</i></p> <ul style="list-style-type: none"> ● Implement measures to prevent weed introduction or minimize the rate of weed spread (e.g., clean equipment before and after use, use only weed-free seed and mulch material, etc.). 	<ul style="list-style-type: none"> ● Weed Treatment in the Frank Church River of No Return Wilderness (FCRNRW). ● Use of active ingredients not included in the consultation. ● Aerial application of herbicides. ● Aquatic application of herbicides. 	<ul style="list-style-type: none"> ● Use of new end-use-products (EUPs). ● Use of new adjuvants.

Programmatic Activity	Allowed Actions	Excluded Actions	Actions Requiring Level 1 Team Approval
Invasive Weed Management (Cont.)	<p><i>Chemical Control</i></p> <ul style="list-style-type: none"> ● Allows for the use of 14 active ingredients (Appendix A, Table A-11). ● Allows for the use of specific adjuvants (Appendix A, Table A-13). <p><i>Rehabilitation</i></p> <ul style="list-style-type: none"> ● Seed treated areas to reestablish native vegetation and have prevent erosion. <p><i>Adaptive Management, Monitoring, and Reporting</i></p> <ul style="list-style-type: none"> ● Assess the effectiveness of the weed treatment program and adjust accordingly. ● Provide a list of project descriptions and maps annually for informal review and approval by the Level 1 Team. ● Provide an annual summary report of treatment activities to the Level 1 Team. 		
Timber Harvest and Pre-commercial Thinning	<ul style="list-style-type: none"> ● Green timber sales. ● Salvage and/or sanitation harvest. ● Pre-commercial thinning. ● Construction of temporary road (new route or existing unauthorized route). 		<ul style="list-style-type: none"> ● All projects with activities in RCAs. ● Construction of temporary roads within one site potential tree height (SPTH) of perennial streams. ● Campsites within RCAs
Miscellaneous Forest Products	<ul style="list-style-type: none"> ● Public harvest/collection of fuelwood, posts and poles, Christmas trees, mushrooms, and plants/seeds. ● Fuelwood cutting is allowed in RCAs, but only upslope of open roads. 		<ul style="list-style-type: none"> ● Changes to RCA diagrams in the Personal Use Fuelwood Brochure. ● Campsites in RCAs. ● Use of any equipment above typical hand tools (e.g., cable yarding).

Programmatic Activity	Allowed Actions	Excluded Actions	Actions Requiring Level 1 Team Approval
Aquatic and Riparian Ecosystem Monitoring	<ul style="list-style-type: none"> • Fish surveys using snorkeling, seining, electrofishing, or hook and line sampling methods. • Tagging for mark-recapture purposes. • Collection of fin clips. • Environmental DNA (eDNA) sampling. • Riparian and instream habitat monitoring. • Stream substrate monitoring, including core sampling. • Temperature monitoring. • Aquatic invertebrate sampling. 	<ul style="list-style-type: none"> • Direct or incidental handling of ESA-listed species for the purpose of research that is not specifically needed for forest management as described in Appendix A. 	

Table 2. Summary of the proposed annual limitations for actions that may be performed under the programmatic activities on the Payette National Forest.

Programmatic Activity	Action	Annual Limitations
Road Maintenance	Road Prism Replacement	4 projects per year
Fire Management	Prescribed Fire	1,000 – 15,000 acres (per Section 7 Watershed)
Weeds	Manual	5 – 25 acres (per Section 7 Watershed)
	Biological	0 – 5 (number of release sites)
	Chemical	100 – 1,000 (100 – 500 per Section 7 Watershed)
	Rehabilitation	0 – 200 (~10 acres per Section 7 Watershed)
	CWMA	4 acres
Timber Harvest and Precommercial Thinning	Green Harvest	≤ 70 acres
	Timber Salvage/ Sanitation Harvest	≤ 250 acres
	Temporary Road Construction	≤ ½ mile
Aquatic Monitoring	Snorkel	20 surveys/year
	Electrofishing	30 sites/year
	Hook & Line	4 surveys/year
	Seining	1 survey every 3 years
	Genetic sampling	30 fin clips per species every 3 years
	Tagging	1 survey every 3 years

Table 3. Summary of key required mitigations and best management practices (collectively referred to as project design features [PDFs]) proposed to be implemented for each programmatic activity.

Activity	Key PDFs Minimizing Effects ¹
Programmatic Applicable to Numerous Programmatic Activities	<ul style="list-style-type: none"> ● Heavy equipment will operate from existing road prisms whenever possible. ● Use non-explosive or micro-explosive alternatives such as Betonamit® whenever possible. ● No detonation will occur below ground or over/in the water. ● Adhere to the buffer restrictions outlined in the blasting setback table (refer to Table A-2 in Appendix A). ● All pump intakes will be screened to meet NMFS' (2011) screening criteria. ● Deeper and faster-flowing streams and pools will be selected for pump intakes when available. ● Streams will not be dewatered. ● Fuel storage will be located outside of RCA where possible. ● Containment, capable of holding 100 percent of the stored volume will be provided. ● Chemical leaks on equipment will be controlled and fixed. ● Erosion and sediment control BMPs will be implemented for ground disturbing activities, as appropriate. ● Newly placed riprap will not extend farther into the channel than what previously existed, unless an exception is agreed to by the Level 1 Team.

Activity	Key PDFs Minimizing Effects ¹
Road Maintenance	<ul style="list-style-type: none"> ● Do not sidecast material, over-clean ditches, or excessively brush vegetation. ● Dust abatement chemicals will be applied in a manner to avoid run-off. ● All work will be performed during the inwater work windows. ● Dewater or partially dewater work areas, as appropriate. ● Where work must occur outside of the work window, conduct spawning surveys prior to the activity and proceed only where no staging or spawning is observed in the vicinity of the project. ● Delay any projects where migrating or spawning ESA-listed fish or redds are observed within or 600 feet downstream of the project area prior to implementation. ● If avoidance by timing is not possible, use recent redd survey data where available, and survey the area for adults and redds prior to removing wood. ● A fish biologist will be present during large woody debris (LWD) removal and work with the equipment operator to minimize downstream effects such as elevated turbidity, sediment, etc. Only the minimum amount of LWD will be removed. ● All large wood will remain in the riparian area and may be placed in a manner to help dissipate energy and deflect water away from the road. ● Equipment will not ford fish-bearing streams. ● Heavy equipment, aside from the excavator bucket, will not enter wetted channels in fish-bearing streams.
Trail and Recreation/Administrative Site Operation and Maintenance	<ul style="list-style-type: none"> ● All work must be completed by hand. ● All treated wood will be produced, used, and disposed of in compliance with guidelines and BMPs issued by the Western Wood Preservers Institute (2006) and NMFS (2009). ● Hazard trees felled within the RCA will be left in the RCA if possible.
Fire Management	<ul style="list-style-type: none"> ● Conducting activities in RCAs will be avoided as much as possible. ● If RCA activities are unavoidable, resource advisors (READs) will develop mitigation measures to avoid or minimize the potential for fish disturbance. These measures will be regularly communicated to appropriate personnel. ● Firelines will be constructed in a way to minimize the collection, concentration, and delivery of water and sediment into nearby waterways. ● Fireline will be constructed using the minimum width and depth needed to safely accomplish the desired task. ● Heavy equipment use for fire line construction within RCAs or landslide-prone areas in drainages with ESA-listed fish species will be approved by a resource specialist, READ, or fish biologist prior to construction. ● Heavy equipment will not be allowed to ford or work within stream channels that are occupied or that are within 600' of occupied habitat. ● Prescribed fire severity within RCAs will be minimized. ● Fire suppression chemicals will not be used in areas where there is potential for direct waterway contamination. ● The PNF has identified streams where dipping may not occur. No-dip maps will be provided to incident management teams and aircraft working on the PNF. READs will be available to direct air operations and crews to dipping locations where ESA-listed fishes are not present. ● All roads that are opened during fire suppression activities shall be returned to pre-fire administrative status once all fire suppression actions and suppression repair treatments are complete, including effectively closing to unauthorized use.

Activity	Key PDFs Minimizing Effects ¹
Weed Treatment	<ul style="list-style-type: none"> ● Herbicide applications will comply with applicable laws, policy, guidelines, and product label directions. ● Herbicide applications will comply with the buffer restrictions in Table A-11. ● Low pressure and larger droplet size will be used to the extent possible, to minimize herbicide drift during broadcast spraying. ● Mixing/filling will be limited to locations where drainage will not allow runoff or spills to move into live water and in locations where potential contamination of groundwater will not occur. ● No ester formulations of 2,4-D or triclopyr-butoxyethyl ester will be used. ● The polyoxyethylene tallow amine adjuvant will only be used in uplands where there is no potential for movement into aquatic systems. ● Invasive weed treatment with the potential for ground disturbance will be conducted only in areas where a 25-foot vegetated buffer strip can be maintained. Proper erosion and sediment control BMPs will be employed.
Timber Harvest and Pre-commercial Thinning	<ul style="list-style-type: none"> ● No commercial vegetation treatments, pre-commercial thinning, or post and pole sales will occur with RCAs without agreement of a fish biologist, hydrologist, and approval of the Level 1 Team. ● Any activities in RCAs must not degrade nor retard attainment of properly functioning riparian functions and processes. ● Constructed temporary roads will have appropriate erosion control measures and will be fully decommissioned within two operating seasons.
Miscellaneous Forest Products	<ul style="list-style-type: none"> ● All fuelwood permits are accompanied by a Personal Use Fuelwood Brochure which provides descriptions of RCA and locations where firewood cutting is prohibited.
Aquatic and Riparian Ecosystem Monitoring	<ul style="list-style-type: none"> ● Areas with spawning fish will be avoided. ● Sampling in known spawning areas will be performed prior to August 15. ● Electrofishing will be performed in accordance with NMFS (2000) guidelines. ● Crews will be trained in redd identification, identification of good redd habitat, and methods to avoid stepping on redds or delivering fine sediments to redds. ● Only single, barbless hooks and artificial lures will be used for hook and line sampling. ● Adult Chinook salmon and steelhead will not be targeted for any type of survey.

¹This is not an exhaustive list of all the PDFs. For a complete list of the PDFs, refer to the BA and Appendix A.

The vast majority of actions that will be conducted under the programmatic activities will be in upland locations, although some activities will be allowed to occur within riparian conservation areas (RCAs). A select few activities will require instream activities, some of which may be in occupied habitat. Instream activities that may occur in occupied habitat include streambank stabilization along roads and trails that need repair, culvert cleaning, placement of riprap to protect stream crossing infrastructure, and aquatic ecosystem monitoring. These activities are also permissible in unoccupied habitat, along with culvert removal and installation and ford improvement.

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

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the

continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an Opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The PNF determined the proposed action is not likely to adversely affect Snake River sockeye salmon, SRF Chinook salmon, and their designated critical habitats. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.12).

2.1 Analytical Approach

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

This Opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02). Direct or indirect alterations "may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

The designations of critical habitat for SRS Chinook salmon (58 FR 68543) and SRB steelhead (70 FR 52630) use 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 Opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, 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 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. The Federal Register notices and notice dates for the species and critical habitats listings considered in this Opinion are included in Table 4.

The status of each species and designated critical habitats are described further in Sections 2.2.1 and 2.2.2, respectively. One factor affecting the status of ESA-listed species considered in this Opinion, and aquatic habitat at large, is climate change. The impact of climate change on species and their designated critical habitat is discussed on Section 2.2.3.

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

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (<i>Oncorhynchus tshawytscha</i>)			
Snake River spring/summer-run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Steelhead (<i>O. mykiss</i>)			
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.

2.2.1 Status of the Species

For Pacific salmon and steelhead, we commonly use the four “viable salmonid population” (VSP) criteria (McElhany et al. 2000) to assess the viability of the populations that, together, constitute the species. These four attributes (abundance, productivity, spatial structure, and diversity) encompass the species’ “reproduction, numbers, or distribution” as described in 50 CFR 402.02. A brief explanation of each attribute is provided below.

“**Abundance**” generally refers to the number of naturally-produced adults (i.e., the progeny of naturally-spawning parents) in the natural environment (e.g., on spawning grounds).

“**Productivity**” refers to the entire life cycle (i.e., the number of naturally-spawning adults produced per parent). When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining.

“**Spatial structure**” refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population’s spatial structure depends on habitat quality and spatial configuration, and the dynamics and dispersal characteristics of individuals in the population.

“**Diversity**” refers to the distribution of traits within and among populations. These range in scale from DNA (deoxyribonucleic acid) sequence variation in single genes to complex life history traits (McElhany et al. 2000).

A VSP needs sufficient levels of these attributes in order to: safeguard the genetic diversity of the listed Evolutionarily Significant Unit (ESU) or Distinct Population Segment (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 life cycle, characteristics that are influenced in turn by habitat and other environmental and anthropogenic conditions.

The condition of these four attributes informs NMFS’s determination of a species status. NMFS expresses the status of an ESU or DPS in terms of likelihood of persistence over 100 years (or risk of extinction over 100 years). NMFS uses McElhany et al.’s (2000) description of a VSP that defines “viable” as less than a 5 percent risk of extinction within 100 years (low risk of

extinction) and “highly viable” as less than a 1 percent risk of extinction within 100 years (very low risk of extinction). A third category, “maintained,” represents a less than 25 percent risk within 100 years (moderate risk of extinction). For salmonids to be considered viable, an ESU/DPS should have multiple viable populations so that a single catastrophic event is less likely to cause the ESU/DPS to become extinct, and so that the ESU/DPS may function as a metapopulation that can sustain population-level extinction and recolonization processes (ICTRT 2007). The risk level of the ESU/DPS is based upon the aggregate risk levels of its component individual populations and major population groups (MPGs).

The latest status review for these species was published in 2016 and was based on abundance and productivity data through 2014. This information, along with more recent adult abundance estimates that are available, is summarized below. The next 5-year status review will be completed in 2021.

2.2.1.1 Snake River Spring/Summer Chinook Salmon

Before 2015, natural origin abundance increased over the levels reported in the 2011 status review for most populations in this ESU. Although the increases were not substantial enough to change viability ratings, the risk trend for the ESU was considered to be stable (NWFSC 2015). However, since the last status review, observations of coastal ocean conditions suggested that the 2015-2017 outmigrant year classes experienced below average ocean survival during a marine heatwave and its lingering effects. This led researchers to predict a corresponding drop in adult returns through 2019 (Werner et al. 2017). In fact, the best scientific and commercial data available with respect to the adult abundance of SRS Chinook salmon indicate a substantial downward trend in the abundance of natural-origin spawners at the ESU level from 2014 to 2019 (Figure 1). The lowest returns since 1999 have occurred in the past 3 years (2017 through 2019).

Estimates of natural-origin and total (natural- plus hatchery-origin) spawners through 2018 for MPGs that may be affected by the proposed action are shown in Table 5. These data show recent and substantial downward trends in abundance of natural-origin and total spawners for most of the populations when compared to the 2009 to 2013 period. All populations except Chamberlain Creek remain considerably below the minimum abundance thresholds established by the Interior Columbia Technical Recovery Team (ICTRT) and are at a high risk of extinction. For many populations, the total spawner counts include substantial numbers of hatchery-origin adults. Exceptions are the entirety of the Middle Fork MPG and several populations in the Upper Salmon MPG, where there are no hatchery fish included in the spawner counts.

The recent downturn in adult abundance is thought to be driven primarily by marine environmental conditions and a decline in ocean productivity, because hydropower operations, the overall availability and quality of tributary and estuary habitat, and hatchery practices have been relatively constant or improving over the past 10 years. Increased abundance of sea lions in the lower Columbia River could also be a contributing factor.

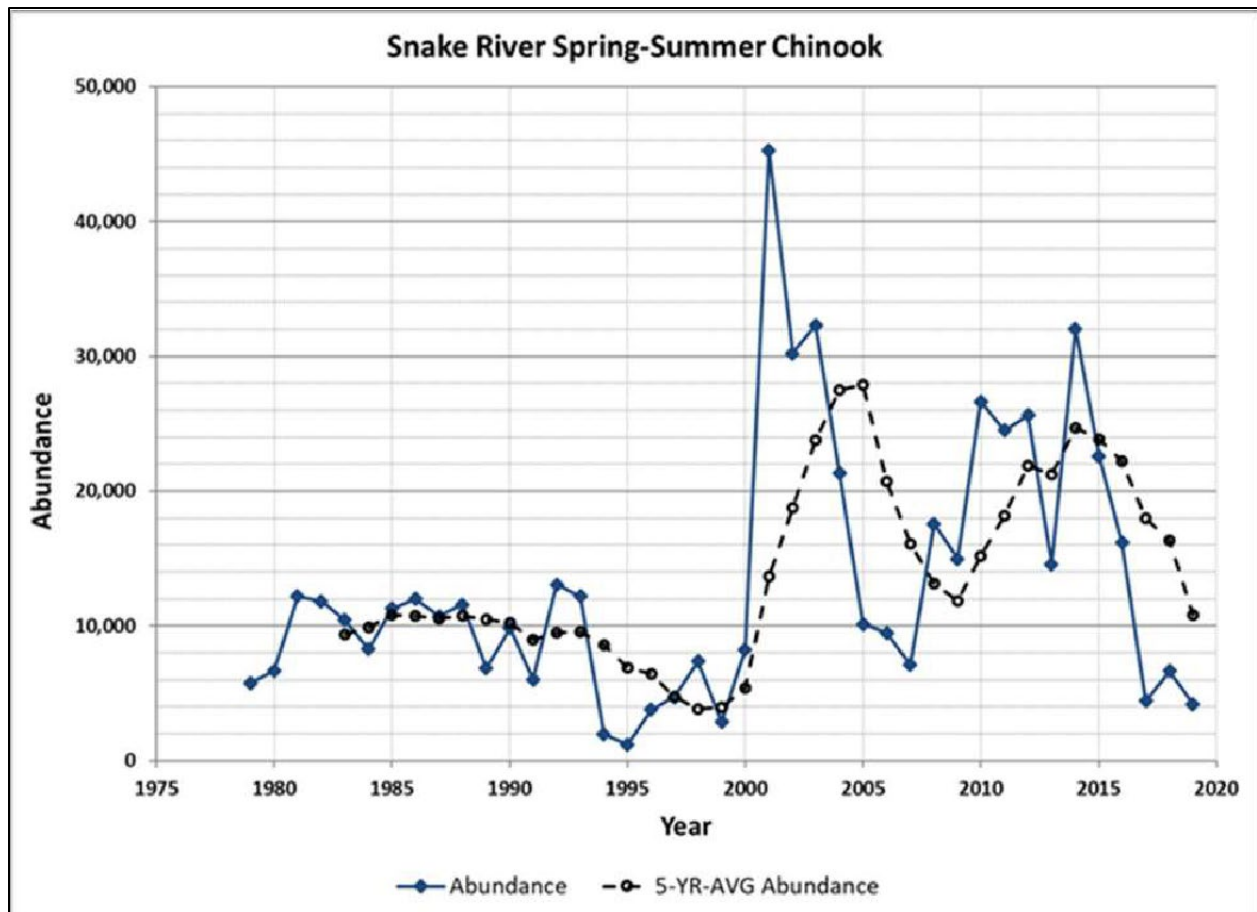


Figure 1. Annual abundance and 5-year average abundance estimates for the Snake River spring/summer Chinook salmon ESU (natural-origin fish only and excluding jacks), including Lower Granite Dam passage and Tucannon River escapement estimates from 1979 to 2019. Data are obtained from the 2020 Join Staff Report on Stock Status and Fisheries (ODFW and WDFW 2020)

Table 5. Five-year geometric mean of natural-origin spawner counts for Snake River spring/summer-run Chinook salmon, excluding jacks. The 5-year geometric mean of total spawners is in parenthesis.

MPG	Population	Minimum Abundance Threshold ¹	Current Status ²	Spawner Counts (5-year Geometric Mean)		% Change
				2009-2013	2014-2018	
South Fork Salmon River (SFSR)	South Fork Salmon River	1,000	High Risk	759 (1,058)	241 (615)	-68 (-42)
	East Fork South Fork Salmon River (EFSFSR)	1,000	High Risk	338 (646)	317 (556)	-6 (-14)
	Secesh River	750	High Risk	781 (798)	481 (501)	-38 (-37)
	Little Salmon River (LSR)	750	High Risk	NA	NA	NA
Middle Fork Salmon River (MFSR)	Bear Valley Creek	750	High Risk	618 (618)	373 (373)	-40 (-40)
	Big Creek	1,000	High Risk	257 (257)	129 (129)	-50 (-50)
	Camas Creek	500	High Risk	31 (31)	53 (53)	71 (71)
	Chamberlain Creek	750	Maintained	748 (748)	693 (693)	-7 (-7)
	Loon Creek	500	High Risk	58 (58)	42 (42)	-28 (-28)
	Marsh Creek	500	High Risk	374 (374)	311 (311)	-17 (-17)
	Upper Middle Fork Salmon River Mainstem	750	High Risk	76 (76)	75 (75)	-1 (-1)
	Lower Middle Fork Salmon River Mainstem	500	High Risk	NA	4 (4)	NA
	Sulphur Creek	500	High Risk	71 (71)	52 (52)	-27 (-27)

Note: Populations that occur within the action area are shaded gray. Data obtained from Williams 2020a.

¹Minimum abundance thresholds represent the number of spawners needed for a population of a given size category to achieve a low risk (viability) at a given productivity (ICTRT 2007).

²Population status is based on viability criteria: highly viable (less than 1% risk of extinction in 100 years), viable (5% or less risk of extinction), maintained (6 to 25% risk of extinction), high risk (more than 25% risk of extinction).

2.2.1.2 Snake River Basin Steelhead

In the most recent status review (NMFS 2016), the abundance of natural-origin steelhead at Lower Granite Dam had increased relative to the prior review. The 2011–2014 geometric mean of natural-origin A-Index steelhead at Lower Granite Dam was over twice the corresponding estimate for the prior review, and the updated B-Index geometric mean was over 50 percent higher than for the prior review (NWFSC 2015). The overall status of the SRB steelhead DPS remained threatened, with four of the five MPGs in the DPS not meeting their recovery plan objectives. In the Salmon River MPG, all extant populations were considered maintained (NWFSC 2015; NMFS 2016). However, since the last status review, observations of coastal ocean conditions suggested that the 2015-2017 outmigrant year classes experienced below average ocean survival during a marine heatwave and its lingering effects. This led researchers to predict a corresponding drop in adult returns through 2019 (Werner et al. 2017). In fact, the best scientific and commercial data available with respect to the adult abundance of SRB

steelhead indicate a substantial downward trend in the abundance of natural-origin spawners at the DPS level from 2014 to 2019 (Figure 2). The lowest returns since 1999 have occurred in the past 3 years (2017 through 2019).

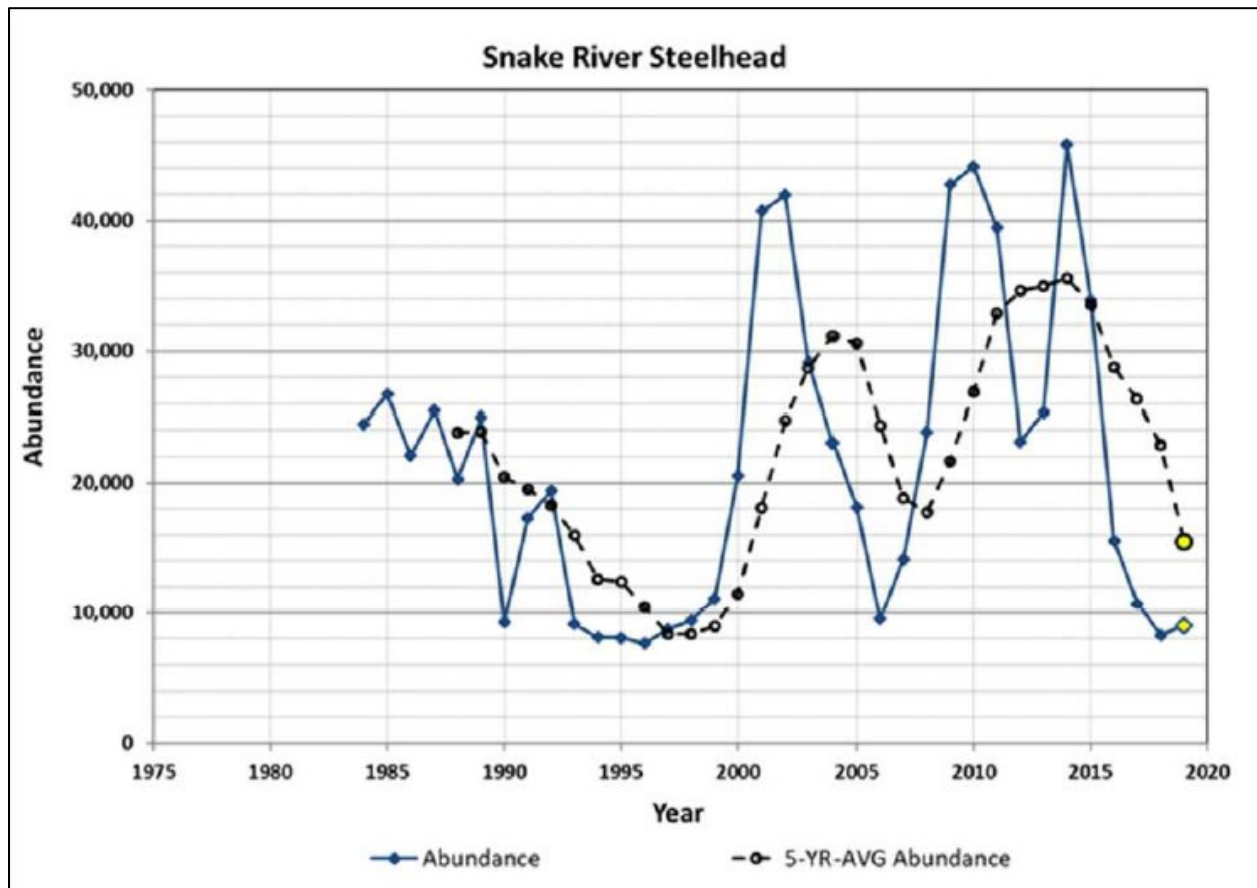


Figure 2. Annual abundance and 5-year average abundance estimates of natural-origin Snake River Basin steelhead at Lower Granite Dam. Data for year X include passage counts occurring from July 1 of year X to June 30 of year X+1. Data for years 2019-2020 are a projection. (ODFW and WDFW 2020; Hebdon 2020)

The six SRB steelhead populations that have the potential to be affected by the proposed action include the LSR, SFSR, Secesh River, Chamberlain Creek, Lower Middle Fork Salmon River, and Upper Middle Fork Salmon River. At this time, estimates of natural-origin abundance are not available at the population level for populations within the action area. Instead, tissue samples collected from adult steelhead trapped at Lower Granite Dam are used to assign fish to genetic stock identification (GSI) groups. The GSI groups are broader than spawning populations, but fit within the MPGs. The most recent 5-year geometric means for GSI groups that may be affected by the proposed action are summarized in Table 6. These estimates indicate large decreases in natural-origin abundance for most of the genetic stocks/MPGs. Natural-origin abundance in 2019 was much lower than the 2014 to 2018 geometric mean.

Table 6. Five-year geometric means of natural-origin abundance for GSI groups of SRB steelhead that may be affected by the proposed action.

GSI Group	2009 – 2013	2014 – 2018	% Change	2019
Lower Salmon	1,403	580	-59	154
Middle Fork Salmon	3,246	1,643	-49	454
South Fork Salmon	1,441	831	-42	210

Note: Data obtained from Williams 2020b.

The species structure, life history, recovery strategy, current status, and limiting factors for each species addressed in this Opinion is summarized in Table 7. More detailed information about these species can be found in their respective recovery plans, latest status reviews, and 5-year reviews. These documents are available on [NMFS West Coast Region website](http://www.westcoast.fisheries.noaa.gov/) (<http://www.westcoast.fisheries.noaa.gov/>).

Table 7. Summarized species structure, life history, recovery strategy, status summary, and limiting factor information for Snake River spring/summer-run Chinook salmon and Snake River Basin steelhead, the two species considered in this Opinion.

Species, Recovery Plan Reference, Most Recent Status Review	Species Structure; Life History	Recovery Strategy	Limiting Factors
Snake River spring/summer-run Chinook salmon NMFS 2017 NMFS 2016d	<p>This ESU includes all naturally spawning populations of spring/summer Chinook in the mainstem Snake River (below Hells Canyon Dam) and in the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins (57 FR 23458), as well as the progeny of 15 artificial propagation programs (70 FR 37160). The ESU is comprised of five MPGs: Lower Snake River, Grande Ronde/Imnaha Rivers, SFSR, MFSR, and Upper Salmon River.</p> <p>Juvenile SR spring/summer Chinook salmon exhibit a stream-type life history strategy. Juveniles typically spend a full year in spawning habitat and migrate downstream in early to mid-spring as age-1 smolts. Depending on tributary and site-specific habitat conditions, juveniles may migrate extensively from natal reaches into alternative summer-rearing or overwintering areas.</p> <p>Adult SRS Chinook salmon typically spend 2 to 3 years in the ocean. They return to the Columbia River and pass Bonneville Dam between April and August (50% of the run typically passes before the end of June).</p>	<p>There are a variety of scenarios under which recovery can be achieved and the possible recovery scenarios are outlined the recovery plan (NMFS 2017). At a minimum, at least one population in each MPG should achieve a very low risk of extinction.</p> <p>Currently, all except one extant population (Chamberlin Creek) are at high risk of extinction (NWFSC 2015). Most populations will need to see increases in abundance and productivity in order for the ESU to recover. Several populations have a high proportion of hatchery-origin spawners—particularly in the Grande Ronde, Lower Snake, and South Fork Salmon MPGs—and diversity risk will need to be lowered in multiple populations in order for the ESU to recover (NWFSC 2015).</p> <p>Improvements have been made in operations and fish passage at tributary dams and at the Columbia River dams, numerous habitat restoration projects have been completed in many tributaries, and many regulatory mechanisms have been improved and updated. However, a substantial amount of work remains to address the factors that are limiting recovery of the species.</p>	<ul style="list-style-type: none"> • Degraded freshwater habitat • Effects related to the hydropower system in the mainstem Columbia River, • Altered flows and degraded water quality • Harvest-related effects • Predation
Snake River Basin steelhead NMFS 2017 NWFS 2016d	<p>This species includes all naturally-spawning anadromous <i>O. mykiss</i> 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</p>	<p>There are varieties of scenarios under which recovery can be achieved and the possible recovery scenarios are outlined in the recovery plan (NMFS 2017). At a minimum, at least one population in each MPG should achieve a very low risk of extinction.</p>	<ul style="list-style-type: none"> • Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded freshwater habitat • Increased water temperature

Species, Recovery Plan Reference, Most Recent Status Review	Species Structure; Life History	Recovery Strategy	Limiting Factors
	<p>propagation programs (71 FR 834). The ICTRT (2003) identified 24 extant populations within this DPS, organized into five MPGs. The five MPGs with extant populations are the Clearwater River, Salmon River, Grande Ronde River, Imnaha River, and Lower Snake River.</p> <p>SRB steelhead exhibit a stream-type life history. Most juveniles migrate to the ocean after 2 years in freshwater; however, freshwater residency may range anywhere from 1 to 5 years. Downstream migration occurs from March to mid-June. Most steelhead spend 2 years in the ocean (range of 1 to 4 years) prior to returning to freshwater. Adult steelhead reenter freshwater from late June to October. Adults tend to hold in larger rivers over the winter, and spawn in tributary streams from March through May.</p>	<p>Of the 24 populations within this DPS, two are at high risk, 15 are rated as maintained, three are rated between high risk and maintained, two are at moderate risk, one is viable, and one is highly viable. Four out of the five MPGs are not meeting the specific objectives in the draft recovery plan based on the updated status information available for this review, and the status of many individual populations remains uncertain. A great deal of uncertainty still remains regarding the relative proportion of hatchery fish in natural spawning areas near major hatchery release sites within individual populations. In terms of risk, the recent trend for the DPS is considered to be stable/improving (NWFSC 2015).</p> <p>Substantial improvements in abundance and productivity are required in order to achieve recovery. Improvements have been made in operations and fish passage at tributary dams and at the Columbia River dams, numerous habitat restoration projects have been completed in many tributaries, and many regulatory mechanisms have been improved and updated. However, a substantial amount of work remains to address the factors that are limiting recovery of the species.</p>	<ul style="list-style-type: none"> ● Harvest-related effects, particularly for B-run steelhead ● Predation ● Genetic diversity effects from out-of-population hatchery releases

2.2.2 Status of Critical Habitat

In evaluating the condition of designated critical, 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 of the life stages of the species. Proper functioning of these PBFs is necessary to support successful adult and juvenile migration, adult holding, spawning, incubation, rearing, and growth and development of juvenile fish. Modification of these 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, foraging, estuarine areas, nearshore marine areas, and offshore marine areas) contain PBFs essential to the conservation of the listed species (e.g., spawning gravels, water quality and quantity, side channels, or food).

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. In addition, critical habitat for SRS Chinook salmon includes the adjacent riparian zone, which is defined as the area within 300 feet of the line of high water of a stream channel or from the shoreline of the standing body of water (58 FR 68543). The riparian zone is critical because it provides shade, streambank stability, organic matter input, and regulation of sediment, nutrients, and chemicals.

Designated critical habitat for SRS Chinook salmon consists of river reaches of the Columbia, Snake, and Salmon Rivers, and all tributaries of the Snake and Salmon Rivers (except the Clearwater River) presently or historically accessible to this ESU (except reaches above impassable natural falls and Hells Canyon Dam). For SRS Chinook salmon, PBFs include spawning gravel, water quality, water quantity, food, riparian vegetation, water temperature, substrate, water velocity, cover/shelter, space, and safe passage.

Designated critical habitat for SRB steelhead encompasses specific stream reaches within the Lower Snake, Salmon, and Clearwater River basins. The PBFs for this species include water quality, water quantity, spawning substrate, floodplain connectivity, forage, natural cover, and passage free of artificial obstructions.

For most salmon and steelhead, NMFS critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

The status of critical habitat throughout the designation area is described in the recovery plan for each species (NMFS 2017), which is incorporated by reference here. Across the designations,

the current ability of PBFs to support these two species varies from excellent in wilderness and roadless areas to poor in areas of intensive human land use (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Urbanization, mining, timber harvest, grazing, and recreation use continue to impact species throughout their range. For both of these species, 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 for juveniles and adults. However, several actions taken since 1995 have reduced the negative effects of the hydrosystem on juvenile and adult migrants. Examples include providing spill at each of the mainstem dams for smolts, steelhead kelts, and adults that fall 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.

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

Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. The U. S. 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 in the Pacific Northwest (Mote et al. 2014). According to the Independent Science Advisory Board (ISAB) (ISAB 2007), climate change will cause the following:

- 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 flows in the June through September period, while more precipitation falling as rain rather than snow will cause higher flows in winter, and possibly higher peak flows.
- Water temperatures are expected to rise, especially during the summer months when lower flows co-occur with warmer air temperatures.

These changes will not be spatially homogeneous across the entire Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote et al. 2014; Mote et al. 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague et al. 2013; Mote et al. 2014).

Climate change is predicted to cause a variety of impacts to Pacific salmon (including steelhead) and their ecosystems (Mote et al. 2003; Crozier et al. 2008a; Martins et al. 2012; Wainwright and Weitkamp 2013). Examples of long-term impacts 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. The complex life cycles of anadromous fishes, including salmon, 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 fishes 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 fishes include:

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

While all habitats used by ESA-listed fish will be affected, the impacts and certainty of the change vary by habitat type. Some effects (e.g., increasing temperature) affect all life stages in all habitats, while others are habitat-specific, such as streamflow variation in freshwater, sea-level rise in estuaries, and upwelling in the ocean. How climate change will affect each stock or population of salmon 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. Salmon, steelhead, eulachon, and green sturgeon 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). Salmon 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, flow is already becoming more variable in many rivers, and this increased variability 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 to other freshwater fish species in the Columbia River basin.

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 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 upward estuary expansion as sea levels rise, likely resulting in a near-term loss of wetland habitats (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 SRB

steelhead smolts actively feed and grow as they migrate between Bonneville Dam and the ocean (Beckman 2018), suggesting that estuarine habitat is important for this DPS.

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 (Percy 2002; Fisher et al. 2015). For example, recruitment of the introduced European green crab (*Carcinus maenas*) increased in Washington and Oregon waters during winters with warm surface waters, including 2014 (Yamada et al. 2015). Similarly, the Humboldt squid (*Dosidicus gigas*) dramatically expanded its range northward 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), further altering food webs and ecosystems.

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 fish entry into the ocean, and a shift toward food webs with a strong sub-tropical component (Bakun et al. 2015).

Columbia River anadromous fishes also use coastal areas of British Columbia, 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; Percy 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), thought to result from temperatures that are normally below thermal optima (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 carbon dioxide 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 that it has the greatest effects on invertebrates with calcium-carbonate shells, and has 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 the influence on marine food webs, especially the effects on lower trophic levels (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).

Summary. Considering all of the potential impacts described above, climate change is expected to make recovery targets for ESA-listed fish more difficult to achieve. Recovery actions can address the adverse impacts of climate change and improve resilience of species as their habitats change. 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).

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). As described in Section 1.3, the proposed action includes implementation of seven programmatic activities across the entire PNF. Lands administered by the PNF extend across portions of ten subbasins, three of which do not support anadromous species and/or their critical habitats (i.e., Weiser, Brownlee, and North Fork Payette). As such, the action area is restricted to the seven watersheds that are considered to be occupied (Table 8) (Figure 3). As previously mentioned, “Occupied” means anadromous species and/or designated critical habitat are known or suspected to be present. Because the actions can occur across the landscape, the entirety of PNF administered lands in occupied watersheds are considered to be part of the action area.

The action area is used by all freshwater life history stages of threatened SRS Chinook salmon and SRB steelhead. The life stage and extent to which species use the action area are described in the environmental baseline. The action area, except for areas above natural barriers to fish passage, is also EFH for Chinook salmon (PFMC 2014) and is in an area where environmental effects of the proposed project may adversely affect EFH for this species.

Table 8. Section 7 watersheds and component 5th field HUCs that support anadromous species and/or their designated critical habitat and overlap the Payette National Forest.

Section 7 Watershed	HUC Number	HUC Name
Deep Creek	1706010101	Granite Creek – Snake River
Middle Fork Tributaries	1706020508	Marble Creek
	1706020605	Upper Big Creek
	1706020606	Middle Big Creek
	1706020607	Monumental Creek
	1706020608	Rush Creek
	1706020609	Lower Big Creek
Main Salmon Southeast	1706020702	Cottonwood Creek – Salmon River
	1706020703	Chamberlain Creek
	1706020705	Big Squaw Creek – Salmon River
	1706020707	Big Mallard Creek – Salmon River
Main Salmon Southwest	1706020708	Warren Creek
	1706020711	Sheep Creek – Salmon River
	1706020901	French Creek
	1706020902	Partridge Creek – Salmon River
South Fork Salmon River	1706020802	Upper East Fork South Fork Salmon River
	1706020803	Lower East Fork South Fork Salmon River
	1706020804	Upper South Fork Salmon River
	1706020805	Secesh River
	1706020806	Lower South Fork Salmon River
Little Salmon River	1706021001	Upper Little Salmon River
	1706021002	Middle Little Salmon River
	1706021003	Hazard Creek
	1706021004	Rapid River
	1706021005	Lower Little Salmon River

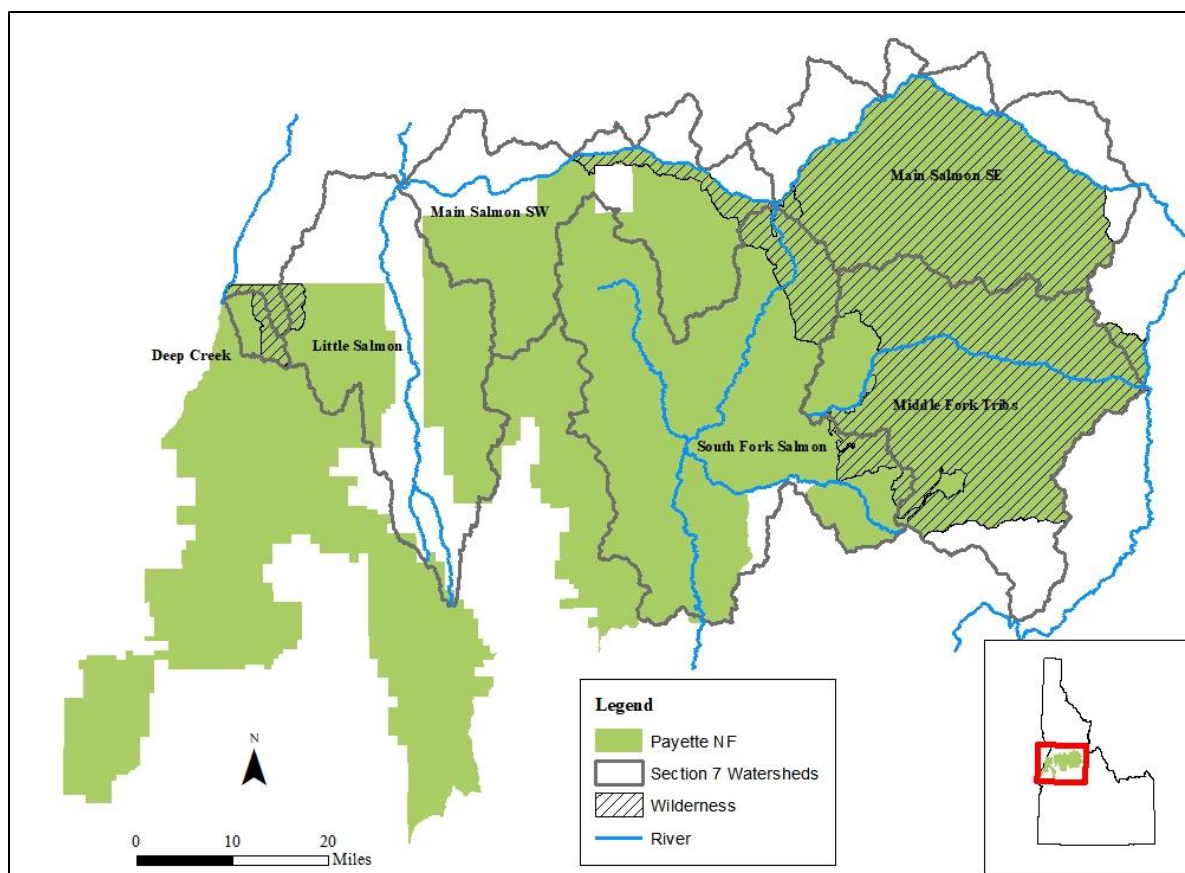


Figure 3. Overview of the action area for the Payette National Forest’s programmatic activities.

2.4 Environmental Baseline

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

The PNF has previously consulted on Federal land management activities included in this consultation as well as travel management, special use permits (e.g., road easement, easement for water diversion facilities), and plans of operations for mineral exploration, to name a few. The PNF maintains a list of past federal actions that have undergone consultation for each Section 7 watershed, which was included in their initiation submittal for this consultation. This list includes the name of the BA, author, year, a brief federal action description, and a status summary (i.e., complete, closed and not implemented, ongoing, new consultation, etc.). The impacts of these federal actions are included in the description of the environmental baseline.

To describe the environmental baseline, we first provide a general overview of the physical condition of the action area and of activities that have an impact on ESA-listed resources. NMFS then describes the environmental baseline in terms of the biological requirements for habitat features and processes necessary to support all life stages of each listed species within the action area (i.e., the PBFs described in Section 2.2.2 of this Opinion). The SRS Chinook salmon and SRB steelhead reside in and migrate through the action area. Thus, the biological requirements are the PBFs essential to spawning, rearing, and freshwater migration.

All of the PBFs for Chinook salmon and steelhead are represented to varying degrees in the PNF's Land and Resource Management Plan (LRMP) Matrix of Pathways and Watershed Condition Indicators (hereinafter referred to as the LRMP Matrix) (USFS 2003a, Appendix B). A watershed condition indicator (WCI) is a particular aquatic, riparian, or hydrologic measure that is relevant to the conservation of ESA-listed salmonids. In some instances, a WCI is synonymous with a PBF, temperature being a prime example. In other instances, many WCIs comprise a PBF. For example, the LWD, pool frequency and quality, large pools/pool quality, and off-channel habitat WCIs provide insight into the natural cover and cover/shelter PBFs.

The PNF uses the LRMP Matrix as a tool for assessing environmental baseline conditions and evaluating the potential effects of an action on WCIs, which as described above are representative of the PBFs essential for the conservation of ESA-listed species. The WCIs are described in terms of their functionality, that is, functioning appropriately (FA), functioning at risk (FAR), or functioning at unacceptable risk (FUR). A watershed comprised of WCIs that are FA is considered to be meeting the biological requirements of listed anadromous species (whereas WCIs that are FAR or FUR suggest that the relevant PBF is not adequately provided for).

The PNF evaluated the baseline conditions of the action area using the LRMP Matrix. The PNF tiered their analysis to the BAs completed in 2007 for ongoing and new actions on the forest, updating specific elements as needed. The analysis performed by the PNF represents some of the best available science in regards to the environmental baseline within the action area. A summary of environmental baseline conditions for each Section 7 watershed within the action area is provided in Table 9. Chapters 2 and 4 of the BA contain more detailed descriptions of the environmental baseline for individual WCIs in each section 7 watershed, and are herein incorporated by reference. Within the action area, habitat-related limiting factors include degraded riparian conditions and instream habitat complexity, excess sediment, passage barriers, low summer flows, and high water temperatures (NMFS 2017).

As described in Section 2.2.3, climate change will affect baseline conditions in the future. Climate change is expected to alter hydrologic processes through decreased snowpack, earlier spring runoff, greater frequency of winter flooding, and lower summer baseflows (Rieman and Isaak 2010). These projected changes may have far-reaching effects on aquatic ecosystems, especially as frequency of drought and large-scale wildfire increases. Chinook salmon, whose eggs overwinter in streambed gravels, could be especially impacted by increased winter flooding and greater movement of streambed gravels and cobbles during winter rain-on-snow events. Lower summer base flows and higher water temperatures will likely impact all ESA-listed fish species in the action area as perennial streams shrink during the summer dry period, forcing fish

into smaller wetted channels and less diverse habitats. These changes to habitat conditions driven by climate change will likely occur during the life of the proposed action.

Table 9. Summarized environmental baseline conditions and species use of habitat within Payette National Forest Section 7 watersheds.

Section 7 Watershed	Baseline Conditions	Species Presence
Deep Creek	<p>The subwatershed is predominantly undeveloped with relatively few road and trail miles. A variety of land uses occur on NFS lands, including recreation, forage production, and some timber management, although no timber harvest has occurred on NFS lands in this watershed since 1993. Large fires, both natural and prescribed, have occurred in the subwatershed, resulting in an ECA of roughly 26 percent. Mining has occurred in the past; no mines are currently operational.</p> <p>Water quality in the subwatershed is excellent, with the exception of influences from the Red Ledge Mine, which is located on private property about two miles from the confluence with the Snake River. Adit drainage from the mine contains high levels of iron, copper, zinc, and manganese. While efforts have been made to plug the adits and contain the drainage, additional work is needed. The lower two miles of Deep Creek is impacted by the mine and the lower segment of Deep Creek is on the 303(d) list as not supporting aquatic life beneficial uses. While the cause of the impairment is unknown, metal contamination is suspected (IDEQ 2018).</p> <p>Overall, WCIs are generally FA. The WCIs rated FAR include: chemical contamination/nutrients, physical barriers, substrate embeddedness, refugia, streambank condition, and disturbance regime.</p>	<p>The SRS Chinook salmon and SRB steelhead have been documented in the lower portion of Deep Creek (Olson and Burns 2007; Hogen and Wagoner 1999). Considering its relatively steep and confined nature, spawning and rearing habitat is generally scarce in Deep Creek. A natural barrier consisting of a 20- to 30-foot bedrock falls is located approximately three miles upstream from the mouth.</p>
Little Salmon River (LSR)	<p>The upper half of the watershed consists of a broad-valley surrounded by heavily forested mountain slopes. The valley narrows at about the midpoint of the watershed, and from that point the LSR flows through a steep, narrow canyon to its confluence with the main Salmon River. Highway 95, a main travel way connecting north and south Idaho, is adjacent to the LSR for most of its length. The watershed is predominantly rural and sparsely populated, though rural housing development has increased substantially in recent years. Fifty-six percent of the watershed is NFS land (Payette and Nez Perce-Clearwater National Forests). Human activities on Federal and non-federal lands in the watershed include logging, road construction, water withdrawal, agriculture, livestock grazing, and other activities. These activities have reduced vegetation, increased sedimentation, altered stream channels and water flows, and contributed to elevated downstream water temperatures. There is a large network of roads in the LSR subbasin, with roughly 1,001 miles of road. Chinook salmon and steelhead fishing occurs seasonally in the mainstem LSR.</p> <p>The Idaho Department of Environmental Quality (IDEQ) has developed total maximum daily loads (TMDLs) for temperature, sediment, nutrients, and/or bacteria for the upper segment of the LSR and its tributaries. Below Round Valley Creek, the LSR is not fully supporting its</p>	<p>Both SRS Chinook salmon and SRB steelhead inhabit the LSR watershed. A scarcity of suitable habitat, natural impairments, and barriers has limited historic and current distribution of these species. More habitat is available to steelhead as they migrate to spawning areas when flows are higher. In general, anadromous species are limited to areas below the barrier falls in the LSR (River Mile 21). Most natural spawning occurs in the mainstem LSR and some of the larger tributaries (e.g., Rapid River above the hatchery, Boulder Creek, Hard Creek). Although some natural passage barriers still exist in the subbasin, all known manmade fish passage barriers on NFS</p>

Section 7 Watershed	Baseline Conditions	Species Presence
	<p>cold water aquatic life beneficial use due to physical substrate and habitat alteration (IDEQ 2018). Since 2007, restoration actions, including riparian fencing, riparian planting, irrigation upgrades (e.g., improved water conveyance), improved grazing management, road closures, and road obliteration have been implemented on private and/or NFS lands (IDEQ 2012; ISWCC 2016).</p> <p>Habitat conditions vary greatly across the Little Salmon River subbasin. Rapid River is a relatively pristine (unroaded) watershed with few management activities. The majority of WCIs are FA in this watershed, with only the sediment and substrate embeddedness WCIs being rated as FAR. Across the remainder of the Section 7 watershed, overall watershed function is impaired with many WCIs FAR. The WCIs identified by the PNF as the biggest limiting factors in the subbasin include substrate embeddedness (associated with road-related sediment), road location/density, and disturbance regime. Overall road density in watersheds reach 1.2 miles per square mile (mi/mi²), with the LSR watershed having 35.5 miles in the RCA. Disturbance history has been degraded through past and current activities, indicated by substantially reduced habitat quality/diversity/complexity in the mainstem LSR and some of its tributaries.</p>	<p>lands have been replaced with aquatic organism passage structures, opening up access to over five miles of habitat for fish.</p>
South Fork Salmon River (SFSR)	<p>Ninety-eight percent of the land in the subbasin is managed by the PNF, with roughly 68,000 acres of designated wilderness. An important physical characteristic of the watershed is that its geology is dominated by granitic rocks of the Idaho batholith with soils that are relatively infertile and lack cohesion. This characteristic leads to high erosion potential when the land is disturbed. Spawning and rearing habitat conditions have historically been severely impacted by high sediment delivery resulting from human activities.</p> <p>A variety of land uses have occurred in the drainage, including limited timber harvest, mining, recreation, and road use and maintenance, and recreation. Timber harvest and associated road building were the largest disturbances in the subbasin in the mid-1900s; however, the PNF issued a moratorium on logging and road construction in much of the subbasin that remained in effect until the early 1980s (Nelson and Burns 2005). Mining also played a major role in influencing the environmental baseline in the subbasin, particularly in the EFSFSR watershed. Reclamation efforts have been made at the Cinnabar and Stibnite mining areas; however, sediment delivery and chemical contamination (e.g., mercury and arsenic) continue to impair water quality in the area. Extensive mineral exploration has occurred in the Stibnite area, which required development of housing facilities, fuel storage facilities, a rock quarry, and water supply wells on private and NFS lands. These activities were conducted in a manner that minimize impacts to aquatic resources. Wildfires have been the largest disturbance mechanism in the SFSR subbasin in recent years. Since 2007, over 250,000 acres have burned within the administrative boundary of the PNF. Other environmental impacts in the watershed</p>	<p>All life stages of both SRS Chinook salmon and SRB steelhead inhabit the SFSR watershed. Historically, the SFSR produced up to 70 percent of Idaho's summer Chinook salmon (Hassemer 1998; IDFG 2001). The most important spawning grounds for Chinook salmon are found in the upper SFSR from Phoebe Creek to Stolle Meadows and in the Secesh drainage in Lake Creek and Summit Creek.</p> <p>For steelhead, most of the mainstem spawning occurs in the Upper SFSR, between the EFSFSR and Cabin Creek. Principal spawning areas in the SFSR are located near Stolle Meadows, from Knox Bridge to Penny Spring, Poverty Flat, Darling Cabins, the Oxbow, and Glory Hole. Steelhead spawning has been documented in the lower SFSR</p>

Section 7 Watershed	Baseline Conditions	Species Presence
	<p>stem from recreation such as of motorized and non-motorized access, fishing, hunting, rafting, and camping. Recreational fishing for Chinook salmon in the SFSR can occur, but only during years when returns are deemed sufficient to support the fishery.</p> <p>Restoration actions have occurred in the watershed since 2007 and include obliteration of about 50 miles of road, graveling of roads, and restoration of dispersed camping and fishing trails along the SFSR in order to reduce sediment contributions. In addition, a ford in spawning habitat that was being used by recreational vehicles was restored and motorized use is no longer feasible. Instream sediment monitoring in the SFSR has shown that conditions have improved over time (Zurstadt et al. 2016).</p> <p>Overall, habitat conditions are FAR in the SFSR watershed, with the Secesh River generally in the best condition and the EFSFSR generally in the worst habitat condition. Notable WCIs that are FAR include refugia, floodplain connectivity, disturbance history, and physical barriers. The WCIs that are FUR include chemical contaminants, road density and location, and RCA. Road densities range from 0.5 mi/mi² to 1.1 mi/mi², and road miles within the RCA range from 27 to 58. Water temperatures are elevated above desired conditions for anadromous fish. The temperature WCI is rated as ranging between FUR and FAR, depending on the watershed. A temperature TMDL for the SFSR was completed by IDEQ and approved by the U.S. Environmental Agency (EPA) in 2012. The extensive fire occurrence since 2007 has likely impacted stream temperatures in the basin by burning riparian and upland vegetation that once shaded the streams.</p>	<p>(downstream of the EFSFSR) (Thurrow 1987). Steelhead also spawn in the tributaries to the SFSR, including the EFSFSR, Lick Creek, and the Secesh River.</p>
Middle Fork Salmon River (MFSR)	<p>This Section 7 watershed includes the Big Creek watershed and the PNF portion of the Marble Creek watershed (which includes the upper 6 miles of Marble Creek). The PNF manages about 99 percent of the Section 7 watershed, the majority of which is within the boundaries of the FCRNRW. Human activities have influenced aquatic habitats primarily in the upper portions of Big Creek and its tributary Monumental Creek, and the headwaters of Marble Creek. Activities include historical and present mining, private summer residences, outfitter lodges, water diversions, hydropower sites, airstrips, recreation, and U.S. Forest Service (USFS) guard stations. Mining and related activities such as road building have been most influential. Numerous placer and lode deposits were prospected in the Big Creek watershed, but most are abandoned now. Scattered mining disturbance in the upper Big Creek area dates back almost a century and abandoned mining debris has been left in or near streams. Remnant mining developments (tailings materials, retention ponds, etc.) continue to pose a risk to watershed conditions. In the past few years the PNF and other entities have implemented storm damage risk reduction measures on roads, decommissioned roads, and placed roads in long term storage. In addition, dispersed recreation sites adjacent to Big Creek have been decommissioned or rehabilitated to limit use. Implementation of these activities will reduce</p>	<p>Chinook salmon spawn throughout the mainstem of Big Creek, with a large proportion of fish spawning in upper Big Creek. Chinook are known to spawn and rear in Monumental Creek as far upstream as Roosevelt Lake. Juvenile Chinook are occasionally observed upstream of the lake. They have also been observed in Crooked Creek, West Fork Crooked Creek, Rush Creek, and Beaver Creek. Finally, juveniles have been documented in Marble Creek up to Big Cottonwood Creek.</p> <p>Steelhead are able to access more habitat than Chinook; as such, they spawn and</p>

Section 7 Watershed	Baseline Conditions	Species Presence
	<p>ongoing sediment delivery, improve riparian vegetation conditions, and reduce the potential for direct impact to fish from recreating individuals.</p> <p>The vast majority of the MFSR Section 7 watershed is designated wilderness and habitat conditions are generally FA and considered to be near natural. In areas impacted by human activities, the following WCIs are generally FAR: substrate embeddedness, temperature, physical barriers, road density, and RCA. Because NMFS' preferred recovery scenario for the SRS Chinook salmon targets the Big Creek population to achieve a highly viable status (NMFS 2017), preserving habitat conditions that are FA and improving habitat conditions that are FAR is vitally important for the recovery of the species. In addition, this high elevation area may serve as an important "climate shield" over time in the face of climate change.</p>	<p>rear up into the headwater areas of the Big Creek and Marble Creek drainages. Monumental Creek supported the largest numbers of steelhead spawners in the Big Creek subwatershed in 1983 (Thurrow 1985). Densities were the largest observed in any Middle Fork tributary from 1981 to 1983. Between 2003 and 2014, the Idaho Department of Fish and Game (IDFG) observed juvenile steelhead throughout Monumental Creek including upstream of Roosevelt Lake.</p> <p>In Marble Creek, extensive spawning areas are available throughout the subwatershed, including several smaller tributaries. Optimal spawning areas are found up as far as Safety Creek (Thurrow 1985). Spawners and redds were observed slightly upstream from Canyon Creek.</p>
Main Salmon Southeast (MSSE)	<p>The MSSE Section 7 watershed includes the Chamberlain Creek watershed and other smaller tributaries that flow north into the Salmon River between the SFSR and MFSR. This Section 7 watershed is located entirely within the FCRNRW. Because the watershed is entirely within wilderness, ground-disturbing activities generally do not occur. The area is not roaded, although there are 93.1 miles of open, non-motorized trails located within RCAs in this watershed. Human activities that have potential to impact aquatic ecosystems include outfitter operations and other actions occurring in recreation and administration areas (e.g., Chamberlain Guard Station and airstrip). Fires are the most significant source of disturbance. Within the last 30 years, the largest fires included a 78,000-acre burn in 1988, a 95,346-acre fire in 2000, and a 90,050-acre fire in 2017 that re-burned much of the 2000 fire area. Habitat conditions in this Section 7 watershed are FA. Chamberlain Creek and West Fork Chamberlain Creek are the most important spawning and rearing streams in the watershed. Trends in long-term sediment monitoring data for West Fork Chamberlain Creek and Chamberlain Creek do not show significant increases in sediment deposition in spring/summer Chinook salmon spawning areas following the fires (Zurstadt 2017). The stream temperature in Chamberlain Creek appears to be on a long-term increasing trend. It is possible that wildfire effects on riparian vegetation are playing a part in stream temperatures, but other factors such as increased air temperatures could be influential.</p>	<p>All life stages of SRS Chinook salmon occupy Chamberlain Creek, West Fork Chamberlain Creek, and McCalla Creek. Other tributaries are thought to be too steep and small to provide important spawning or rearing. Similarly, all life stages of steelhead occupy the same areas as Chinook salmon. Steelhead have also been documented in other tributaries such as Whimstick Creek.</p>

Section 7 Watershed	Baseline Conditions	Species Presence
Main Salmon Southwest (MSSW)	<p>The MSSW Section 7 watershed is a grouping of several tributaries of the main Salmon River extending from the mouth of the SFSR downstream to the mouth of the LSR. The Federal government (Bureau of Land Management [BLM] and USFS) manages 94 percent of the watershed, the State of Idaho manages 1 percent of the land, and the remaining 5 percent is privately owned. Private land is primarily located in the lower portion of the watershed with some inholdings in the upper portions of a few tributary watersheds (e.g., Warren Creek) where historic mining operations occurred. Large wildfires occurred in the area in 1994 and 2000.</p> <p>Land uses across the watershed include timber harvest, grazing, localized areas of mining, recreation, and maintenance of roads and trails; however, some portions of the MSSW are isolated by their steep terrain and have relatively few human influences. In general, these activities result in ground disturbance and vegetation removal and increase the potential for erosion and sediment delivery to stream channels. Mining has altered the natural characteristics of the Warren Creek subwatershed in particular where much of the valley floor was extensively dredged for gold. Removal of shading vegetation has resulted in localized increases in stream temperatures. Timber harvest is limited, but some areas have been salvage logged since fires in 1994. Recreational all-terrain vehicle (ATV) use is popular in some areas and ground disturbance, fording of streams and creation of new, unauthorized ATV trails have led to resource damage in areas. There are approximately 357 miles of road in the MSSW Section 7 watershed, although road density is relatively low at 0.69 mi/mi².</p> <p>Habitat conditions in the MSSW Section 7 watershed vary greatly, ranging from FA to FUR. The Warren Creek subwatershed is the most degraded considering the extent of historical mining activities and many WCIs are FUR (e.g., refugia, floodplain connectivity, temperature, peak/base flows, RCA, and road density/location). Where human activities have occurred in the watershed, temperature is FUR and the following WCIs are FAR: refugia, streambank condition, road density/location, and RCA. Habitat conditions in the lower Salmon River and lower SFSR are affected by excess fine sediment and reduced riparian vegetation from land use activities on adjacent lands and in upstream areas (NMFS 2017).</p>	<p>In general, salmon and steelhead are restricted to the lower sections of tributaries to the Salmon River by steep gradients and natural passage impairments (e.g., large, steep alluvial deltas that lack a defined channel). Juvenile Chinook salmon have been documented in the lower portions of Lake Creek, Fall Creek, and Warren Creek. A barrier near the PNF boundary on French Creek is thought to block passage to upstream habitat. Similarly, Fall Creek has a complete barrier approximately 0.25 miles from the confluence with the Salmon River. Juvenile steelhead have been documented in the same streams as Chinook in addition to other streams in the action area. Resident forms of the species occupy habitats above barriers in these tributaries, and can occasionally produce downstream migrants that go through smoltification (Hayes et al. 2012).</p>

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 PNF estimated the degree to which certain activities may be implemented across the forest. For example, the PNF estimated that up to four extreme or infrequent road maintenance activities per year may be conducted and that these activities could all occur within a single Section 7 watershed or be spread across multiple section 7 watersheds. Our analysis relied upon the programmatic activity implementation estimates/limitations provided by the PNF, as described in Section 1.3. An important assumption made in our effects analysis is that all of the PDFs listed in the proposed action will be implemented, without exception, where actions could affect ESA-listed fish or designated critical habitat. This is particularly important when non-USFS entities perform some of these programmatic activities (e.g., herbicide application, road or trail maintenance, timber harvest, etc.). Therefore, NMFS expects that the PNF will incorporate the PDFs into easements, special use permits, contracts, and other authorizations. An additional level of protection is the requirement for the PNF to obtain Level 1 Team approval prior to implementation of certain activities. In these circumstances, NMFS will have an opportunity to ensure those actions fit within the program description and that the effects are consistent with the analysis in this Opinion.

Table 10 includes a summary of the various pathways of potential effect for each programmatic activity. The nature of effects resulting from implementing these activities are similar for steelhead and salmon because these species have similar life history requirements and similar behaviors. As such, the following effects analysis applies equally to both species, and any differences are noted. Similarly, because the designated critical habitat PBFs are nearly identical between the two species, we have discussed the designated critical habitat impacts together. Many of the programmatic activities have similar effects pathways. As such, we have organized this section according to effects pathway rather than by programmatic activity type. Furthermore, only the activities requiring instream work, herbicide application, aerial dipping, and fish handling have reasonable expectation of any consequences that could rise to the level of killing, injuring, or harassing ESA-listed fish. As such, discussions regarding these pathways are more substantial than other pathways of effect. Climate change is not expected to amplify any of the potential effects that may occur as a result of implementing the programmatic activities. As such, climate change is not further discussed in this section.

Each pathway of effect is discussed in Sections 2.5.1 through 2.5.9. Within these sections there is a description of the effect, how each programmatic activity contributes to the effect, and how BMPs avoid or minimize the effect. Finally, a summary of the consequences to ESA-listed species and designated critical habitats is discussed in Sections 2.5.10 and 2.5.11, respectively.

Table 10. Summary of potential pathways of effect associated with each Payette National Forest programmatic activity.

Activity	Actions associated with one or more effects pathways	Pathways of Effect								
		Fish Handling	Fish Disturbance	Turbidity/Sediment Deposition	Chemical Contaminants	Temperature	Riparian Disturbance	Instream Habitat Alteration	Hydraulic Alteration	Forage Reduction
Road Maintenance ¹	Use of heavy equipment in or near water; ground disturbance, removal of riparian vegetation and LWD, hardening of streambanks, use of chemicals near water, work area isolation and fish removal, dewatering, and blasting.	✓	✓	✓	✓	✓	✓	✓	✓	✓
Trail Maintenance ² and Administrative and Recreation Facility Operation and Maintenance	Ground disturbance, vegetation removal, streambank stabilization, presence or use of chemicals near water, and blasting.		✓	✓	✓	✓	✓	✓	✓	
Fire Management	Construction in RCAs; water withdrawal; ground application of fire retardants; removal of vegetation; ground disturbance.		✓	✓	✓	✓	✓		✓	
Invasive Weed Management	Use of chemicals near water and in upland areas, removal of vegetation.			✓	✓	✓	✓			✓
Timber Management	Use of heavy equipment near water and ground disturbance.			✓	✓	✓	✓			✓
Miscellaneous Forest Products	Ground disturbance			✓						
Aquatic Monitoring	Handling of fish, presence of humans in or near water, and use of chemicals near water.	✓	✓	✓	✓					

¹Instream construction work using heavy equipment (e.g., streambank stabilization, LWD removal) may occur in occupied habitat. Maintenance of stream crossing structures, including riprap placement, may occur in occupied habitat.

² The only instream activities allowed in occupied habitat are streambank stabilization or riprap placement to protect crossing structures. Heavy equipment may not be used.

2.5.1 Fish Handling

This proposed action allows for fish capture for the purposes of salvage and relocation or for baseline surveys to document the present/absence of fish or estimate abundances. Methods used to capture fish include electrofishing, seining, or hook and line sampling. Subsequent handling for the purposes of identifying the species, collecting physical measurements, or collecting fin clips may also occur.

2.5.1.1 Effects of Fish Handling

General Handling. Captured fish are typically transferred to buckets for holding and/or relocation. The fish can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding. Stress and death from handling also occurs because of differences in water temperature and dissolved oxygen between the river and transfer buckets, as well as physical trauma and the amount of time that fish are held out of the water. Stress on salmon and steelhead increases rapidly from handling if the water temperature exceeds 64°F, or if dissolved oxygen is below saturation.

Electrofishing. Effects of electrofishing on fish are associated with exposure to an electric field, or through capture by netting and handling of fish during their transfer to an alternate location. Harmful effects of electrofishing are detailed by Snyder (2003) and can potentially include internal and external hemorrhaging, fractured spines, and death. The primary contributing factors to stress and death from handling are differences in water temperatures (between the river and the holding tank), dissolved oxygen concentrations, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 64°F (17.8°C) or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in tanks if the tanks are not emptied on a regular basis. Electrofishing may also harm embryos, particularly early in their developmental stage. Injury and stress may also reduce short-term growth (Snyder 2003) which may result in lower survival for salmonids during migrations to the ocean and back.

Most of the studies on the effects of electrofishing have been conducted on adult fish greater than 12 inches in length (Dalbey et al. 1996). The relatively few studies that have been conducted on juvenile salmonids indicate that spinal injury rates are substantially lower than they are for large fish. Smaller fish intercept a smaller head-to-tail potential than larger fish (Sharber and Carothers 1988) and may therefore be subject to lower injury rates (Dalbey et al. 1996; Thompson et al. 1997). The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Sharber and Carothers 1988; Dalbey et al. 1996; Dwyer and White 1997). Continuous direct current or low-frequency (equal or less than 30 Hertz) pulsed direct current have been recommended for electrofishing because lower spinal injury rates, particularly in salmonids, occur with these waveforms (Fredenberg 1992; Dalbey et al. 1996; Ainslie et al. 1998). Only a few recent studies have examined the long-term effects of electrofishing on salmonid survival and growth (Ainslie et al. 1998; Dalbey et al. 1996). These studies indicate that although some of the fish suffer spinal injury, few die as a result. However, severely injured fish grow at slower rates and sometimes they show no growth

at all. In addition to injury, electrofishing may cause elevated stress leading to increased plasma levels of cortisol and glucose (Frisch and Anderson 2000; Hemre and Kroghdahl 1996), and short-term handling may cause reduced predatory avoidance for up to 24 hours (Olla et al. 1995).

When electrofishing long-term index reaches, McMichael et al. (1998) found that up to five percent of sampled fish can be injured and or die, including delayed mortality. Although some listed salmonids may die from electroshocking, the majority of captured fish will only be exposed to the stress caused by biological sampling/handling once. Fish experiencing stress are expected to recover fairly rapidly.

Seining. Fish may experience stress and have the potential to be injured or killed when captured in seines. Organic or inorganic material caught in the net can crush fish or cause other injuries (e.g., descaling) and handling fish may lead to injury or mortality. Processing time increases if the net contains substantial amounts of organic or inorganic matter such as algae and substrate. Leaving the seine in the water will help reduce stress on fish captured in the net. While a few studies examining seining impacts on adults were found, we did not find any studies reporting impacts of seining on juveniles. Scientists with the Northwest Fisheries Science Center (NWFSC) have recorded mortality rates of juvenile Chinook salmon and steelhead captured using seining methods ranging from zero to 0.4 percent (Jesse Lamb, March 12, 2018, personal communication).

Fin Clipping. On rare occasions fin clipping will be used (one time every three years, with a maximum of 30 samples per sampled species taken) to obtain tissue samples for genetic analysis. The caudal, pelvic, or pectoral fins may be clipped for samples. Studies comparing the growth of clipped and unclipped fish generally have shown no differences between them (e.g., White and Brynildson 1967). Moreover, wounds caused by fin clipping usually heal quickly—especially those caused by partial clips.

Mortality among fin-clipped fish is generally low. There is a small risk of immediate mortality during the clipping process, especially if fish have been handled extensively. Delayed mortality depends, at least in part, on fish size; small fishes have often been found to be susceptible to it and Coble (1967) suggested that fish shorter than 90 millimeters (mm) are at particular risk. Recovery rates are generally higher for adipose- and pelvic-fin-clipped fish in comparison to those that are clipped on the pectoral, dorsal, and anal fins (Nicola and Cordone 1973). Stolte (1973) showed that adipose- and pelvic-fin-clipped coho salmon fingerlings have a 100 percent recovery rate. Given handling procedures to minimize fish stress, and the small amount of tissue to be collected for genetic analysis, no immediate or delayed mortality is expected from genetic sampling (i.e., above any effects already associated with fish capture and handling). Studies comparing the growth of clipped and unclipped fish generally have shown no differences between them (e.g., White and Brynildson 1967). Moreover, wounds caused by fin clipping usually heal quickly, especially those caused by partial clips.

Hook and Line Sampling. Fish that are caught with hook and line and released alive may still die because of injuries and stress they experience during capture and handling. The likelihood of killing a fish varies widely, based on several factors including the type of hook used (barbed vs barbless), the type of bait used (natural vs artificial), the water temperature, anatomical hooking

location, the species, and the care with which the fish is released (level of air exposure and length of time needed for hook removal). Available information indicates that hook and release mortality when using barbless hooks and artificial bait is low. Artificial lures or flies tend to superficially hook fish, allowing expedited hook removal with minimal opportunity for damage to vital organs or tissue (Muoneke and Childress 1994). In the compendium of studies reviewed by Mongillo (1984), mortality of trout caught and released using artificial lures and single barbless hooks was often reported at less than 2 percent. Nelson et al. (2005) reported an average mortality of 3.6 percent for adult steelhead that were captured using barbless hooks and radio tagged in the Chilliwack River, British Columbia. The authors also note that there was likely some tag loss and the actual mortality might have been lower. Hooton (1987) found catch and release mortality of adult winter steelhead with barbless hooks and artificial lures was 2.9 – 3.8 percent. Based on these studies, mortality of all species of fish captured during hook and line angling is expected to be three percent or less of all captured fish.

2.5.1.2 Programmatic Activities with Fish Handling

Two of the programmatic activities, road maintenance and aquatic monitoring, may involve handling of ESA-listed fish. Capture and relocation of ESA-listed fish may be appropriate for extreme road maintenance activities in cases where dewatering is necessary or fish are abundant.

The PNF is proposing to allow up to four extreme road maintenance activities per year. We have assumed that all of these will require fish salvage in streams occupied by both steelhead and Chinook salmon. Fish salvage most often utilizes electrofishing methods; however, a seine may be used in limited circumstances. To estimate the number of fish that may be impacted as a result of fish salvage activities, we used snorkel survey data reported in the IDFG's Standard Stream Survey database. More specifically, data collected from 2000 to 2019 in the LSR and SFSR drainages was used to calculate fish densities at surveyed reaches. The average estimated density of juvenile Chinook salmon and steelhead per 100 square feet (ft²) was 1.2 (range of 0.002 to 47) and 0.7 (range of 0.003 to 8.7), respectively.

Though it is unknown where individual projects will occur, and though the range of observed densities is quite large, using the average density for the effects analysis is appropriate because road reconstruction work is most likely to occur in moderately to heavily disturbed areas (i.e., adjacent to an encroaching road segment or potentially eroded segment). Fish densities in these areas are not expected to be high. The proposed action allows for up to 100 linear feet of riprap to be placed below the OHWM. We have also assumed that work area isolation and dewatering will only be necessary where work below the OHWM is needed. Assuming the wetted width of the area to be isolated or dewatered is equal to 10 feet and assuming that an additional 10 feet above and below the construction area needs to be added as a construction buffer zone, approximately 1,200 ft² of instream habitat may be subject to fish salvage at each project site (120 linear feet of work area isolation per project x 10 feet wide). This means that about 15 juvenile Chinook salmon and nine juvenile steelhead may be subject to capture at each site.

All work requiring significant in-channel activity will require at least partial dewatering to isolate the area from erosive stream energy and reduce the number of fish exposed. Monitoring reports from other habitat restoration projects that required fish salvage indicate that a

combination of gradual dewatering and actively driving fish out successfully moved at least 50 percent of Chinook salmon and steelhead out of the project areas. Based on these estimates, roughly eight and five juvenile Chinook salmon and steelhead, respectively, could be subject to electrofishing or seining for each project. Based on the estimated number of juvenile Chinook salmon and steelhead that will be captured during salvage operations, and injury rates described by McMichael et al. (1998), NMFS estimates that no more than one juvenile Chinook salmon and one juvenile steelhead will be killed due to dewatering and salvage at each project location. Given that the PNF is allowing for up to four of these projects to occur per year, no more than four juvenile Chinook salmon and four juvenile steelhead are expected to die annually from these types of projects.

The proposed action also includes up to 30 electrofishing surveys per year for aquatic monitoring purposes. Between 1993 and 2018, the PNF conducted 1,292 electrofishing surveys across the forest. Juvenile Chinook salmon were not recorded in any of the surveys; and juvenile steelhead were documented in 10 of the surveys. Considering only these 10 surveys, an average of 7.8 juvenile steelhead were captured per 100 meters of stream surveyed. For the purpose of abundance monitoring, the PNF typically avoids electrofishing areas where juvenile Chinook salmon occur. This explains why there are no documented juvenile Chinook salmon. Although the PNF will take care to electrofish in streams where Chinook salmon have not been previously documented, it is possible for a survey to be inadvertently conducted in an area where Chinook salmon presence was not previously known. In these instances, if the PNF were to incidentally electrofish Chinook salmon, they will cease electrofishing and employ other survey methods (C. Nalder, pers. comm., PNF Forest Fish Biologist, September 23, 2020).

Considering the average number of each species documented within past surveys along with the proposed 30 surveys included in the Federal action, NMFS estimates that up to 234 steelhead may be handled annually. Although no Chinook salmon have been previously captured, it is not prudent to discount the potential for incidental encounters with Chinook salmon during electrofishing. Given this potential, we estimate that up to 10 juvenile Chinook salmon may be captured during electrofishing surveys. Coupling these estimates with the injury rates described by McMichael et al. (1998), no more than 12 juvenile steelhead and 1 juvenile Chinook salmon will be killed annually as a result of electrofishing for the purposes of gathering presence or population density information.

The PNF may conduct one seining effort every three years for a variety of purposes. It is unknown how many individuals would be targeted but based on past PNF practices, it is unlikely more than 100 juvenile fish would be needed for either mark recapture efforts, genetic samples, or species densities. Assuming a seining mortality rate of 0.4 percent, there is potential for the loss of up to four Chinook salmon and four steelhead every three years.

The PNF may use hook and line sampling over other methods due to access issues, or when this method is less impactful than other methods. Up to four hook and line surveys may be conducted per year. The PNF will require the use of single, barbless hooks and artificial lures. There was no information to assess the number of fish that would be caught during hook and line sampling. As such we will assume that no Chinook salmon and no more than 50 juvenile steelhead will be captured annually using this methodology. We have assumed no Chinook

salmon will be captured because the gear used will not be sufficiently sized to target small yearling Chinook salmon that may be present in the sampling area. Steelhead, however, may rear in freshwater for multiple years and grow to a size that is capable of striking at the hooks and lures used. We have assumed that up to two juvenile steelhead may be killed annually as a result of capture with hook and line.

On rare occasions, the PNF will collect fin clips (one time every three years, with a maximum of 30 samples per sampled species taken) to obtain tissue samples for genetic analysis. The caudal, pelvic, or pectoral fins may be clipped for samples. Delayed mortality associated with fin clipping is not expected to occur. We assume that genetic samples will be collected from fish that were captured during one of the sampling efforts previously described; therefore, potential mortality associated with capturing these individuals has already been accounted for.

As described above, adverse effects from fish handling are likely to occur; however, practices will be employed to limit the effects and minimize the potential for immediate or delayed mortality. The PNF will continue to avoid electrofishing (for presence or abundance estimate purposes) in known juvenile Chinook salmon habitat; however, electrofishing for salvage purposes may occur in habitat with Chinook salmon. Fish salvage will only occur during instream work windows (typically between July 15 and August 15) in Chinook salmon and steelhead habitat. Some exceptions to these work windows may be given if justified and approved by the Level 1 Team. In these instances, spawning surveys will be performed to see if spawning fish and/or redds are present within 600 feet downstream of the work site. If present, the work will either not occur or additional mitigation measures, as identified by the Level 1 Team, will be implemented to ensure no adverse impacts to redds or spawning fish.

Whenever electrofishing is employed, the PNF will follow NMFS electrofishing guidelines (2000), which are designed to minimize consequences to fish. Some of the protection measures included in the guidelines are listed in Appendix A of this Opinion. In addition, the PNF will follow the requirements included in the IDFG sampling permit, one of which is to complete fish sampling prior to active Chinook salmon spawning (August 15) in known spawning areas. No sampling in the immediate area of redds or redds in progress will take place. If spawning activity is observed during sampling, crews will cease surveying, document the location, and avoid the area. To minimize adverse effects from hook and line sampling, the PNF will not target adult fish and will only use single, barbless hooks and artificial lures. When collecting tissue samples, the PNF will target the caudal fin and will collect as small a sample as possible.

2.5.1.3 Summary of Fish Handling Effects

Adult fish will not be handled; however, juvenile Chinook salmon and steelhead will be handled. Even with implementation of BMPs to reduce adverse effects juvenile fish are likely to be injured or killed as a result of salvage and survey activities. For purposes of our evaluation, we have assumed that all injured fish will eventually die. Table 11 summarizes the anticipated loss of juvenile fish. In total, NMFS estimates that up to nine juvenile Chinook salmon and 22 juvenile steelhead may be killed in a given year.

Table 11. Estimated loss of juvenile Chinook salmon and steelhead as a result of fish capture associated with Payette National Forest programmatic activities.

Purpose	Methodology	# of Projects	Chinook Salmon (# mortalities)	Steelhead (# mortalities)	Loss Timeframe
Fish Salvage	Electrofishing	4	4	4	Annual
Fish Surveys	Electrofishing	30	1	12	Annual
	Seining	1	4	4	Once every 3 years
	Hook and Line	4	0	2	Annual
	Fin Clipping ¹	N/A	0	0	Once every 3 years

¹Potential mortality associated with the capture of individuals used for genetic sampling is accounted for in the seining and/or electrofishing sampling methodologies. No mortality is expected as a result of collecting a small fin clip.

2.5.2 Fish Disturbance

The following actions associated with programmatic activities have the potential to disturb individual fish: construction activities adjacent to or within a stream channel; removing and/or placing riprap in wetted channels; blasting; removing large wood; breaking up ice; water drafting; and aquatic ecosystem monitoring.

2.5.2.1 Effects of Fish Disturbance

Human activities near streams will cause some level of fish disturbance and could even result in fish injury or death. Disturbance can lead to behavioral changes resulting in indirect effects through altered feeding success, increased exposure to predators, and/or displacement into less suitable habitat. Several studies have shown that juvenile salmonids are sensitive to overhead movements and usually hide under cover when approached by observers (Hoar 1958; Chapman and Bjornn 1969). The key question is how long will fish be displaced and will the displacement be frequent enough to significantly alter normal behavior patterns (e.g., breeding, feeding, and sheltering). Grant and Noakes (1987) concluded that younger fish are less wary than older fish and thus take more risks while foraging to maximize growth. Grant and Noakes (1987) also showed that smaller fish returned to foraging locations faster than larger fish, usually within about 10 minutes of the disturbance. These studies suggest that while smaller fish quickly move into adjacent habitat after each disturbance, they are more likely to remain in areas with limited cover to maximize forage. Smaller fish are also less wary of disturbances and return to foraging sites faster after each disturbance with no long-term displacement.

Blasting near streams has the potential to cause mortality to fish, eggs, and fry from concussion transmitted through rock and soils. Blasting produces post-detonation compression shock waves that can damage the swim bladder of fish (Wright and Hopky 1998). Vibrations can also alter fish behavior and can cause damage to incubating eggs (Wright 1982). Swim-up fry will die if exposed to shock wave pressures exceeding 2.8 pounds per square inch (psi) (Bishai, 1961; Rasmussen, 1967). The Alaska Department of Fish and Game observed no mortality in chum and coho salmon at 2.7 psi (Bird and Robertson 1984). Smirnov (1955) found significant mortality of eggs resulting from ground vibrations at 1 inch per second (ips). The Alaska Department of Natural Resources (DNR) and Canadian Fisheries do not allow explosives that will result in a peak particle velocity greater than 0.5 ips in spawning areas during incubation

(Wright and Hopky 1998; Alaska DNR 1991). This ips level (0.5) is one quarter of the peak ground vibration velocities observed for mortality in incubating eggs. Lesser effects from blasting include disturbance of fish from concussion and flying debris. Normally such disturbances would have no long-term effects on fish, but where adults are staging prior to spawning or where spawning activity has commenced, repeated disturbance may cause fish to abandon redds, cease spawning activity, or disrupt migration to preferred spawning areas.

Drafting of water from streams using portable pumps or water tenders can disrupt essential feeding, breeding, or sheltering of juvenile and adult fish. It can also result in entrainment of juvenile fish if performed without adequate screens. The risk of fish capture during aerial dipping is proportional to the size of the water body, the bucket size and the fright/flight responses of the fish (Jimenez and Burton 2002; Kellett and Bandolin 2006; USFS 2003b). Jimenez and Burton (2002) determined that there is little potential for capturing salmonids with helicopter buckets in lakes, reservoirs, and ponds; however, flow conditions in rivers and streams would affect the potential for fish to drift into buckets or affect their ability to disperse. In 2003, the USFS and University of Idaho conducted a helibucket entrainment study in central Idaho. Out of 145 dips, only two sculpin (*Cottus sp.*) were entrained, indicating a very low risk of capturing salmonids while dipping (Pyron and Gamett 2003).

Rotor wash from the helicopter should cause fish to disperse from the dip site but the extent (spatial and temporal) of displacement is not known. Such displacement, especially if repeated multiple times in a day, can result in physical and behavioral responses. Those responses may include adverse changes in feeding, metabolic rates, osmoregulatory processes, avoidance behavior, and immune system functions and disease (Kelsey et al. 2002; Price and Schreck 2003; Sigismond and Weber 1988; Barton 2002; Kellett and Bandolin 2006). Stress-induced behavior changes in fish may lead to a higher risk of predation. Along with alterations in avoidance behavior, cover-seeking time was found to increase for juvenile Chinook salmon when exposed to multiple acute handling stressors (Sigismond and Weber 1988), potentially exacerbating the potential for increased predation. Feeding activity of salmonids was also found to decrease when exposed to several stressors (Price and Schreck 2003). Concentrations of plasma cortisol, glucose, and lactate were found to increase in fish subjected to multiple stressors and pre-stress levels did not return for 6-24 hours. These physiological changes correlated with a reduced ability to avoid predators (Mesa 1994). Dipping-related disturbance of adult fish can further deplete the energy reserves of adult salmon, with consumption being positively related to disturbance frequency. This, in turn, may lead to premature death or diminished reproductive success. Adult Chinook salmon and juvenile Chinook salmon and steelhead are present in the action area during times when this activity will occur. Adult steelhead are not anticipated to be impacted given the timing of their presence in the action area.

2.5.2.2 Programmatic Activities with Fish Disturbance

A number of the programmatic activities allow for actions that could disturb fish as described above including road maintenance, trail and administrative/recreation site operation and maintenance, fire management and aquatic monitoring. Fish disturbance is expected to occur as a result of turbidity-related impacts during construction (this is discussed in Section 2.5.3), presence of heavy equipment or people in or near streams, placement of riprap or other materials

in streams, removal of LWD and/or ice jams, blasting, and withdrawing water (both ground and aerial based). Operation of heavy equipment near streams creates noise, water disturbance (e.g., as the excavator bucket removes or places material within the water along the bank, as hazard trees splash into streams when they are felled) and visual stimulus. Visual stimulus is also created when field crews wade or snorkel in streams during data collection activities. A brief review of actions that could cause fish disturbance and the PDFs to avoid or minimize the potential for disturbance effects are provided in Table 12. Detailed discussions of the more impactful activities are below.

Work involving the presence of equipment or vehicles in a wetted channel or involving the removal or replacement of riprap material with heavy equipment is likely to not only result in disturbance of individuals, but may also result in injury or mortality of some individuals that are unable to escape or that seek refuge in the immediate vicinity of the work. The PNF did not specify a limit on the number of stream crossing protection projects that may be implemented per year on roads (or motorized trails included in the road maintenance programmatic activity) using heavy equipment. The PNF estimated up to 10 projects may occur in occupied habitat per year on trails. NMFS assumes this limit is a reasonable estimate of the number of crossing protection projects that may occur on roads or motorized trails included under the road maintenance programmatic. Assuming 100-linear feet of wetted channel may be impacted at each site, and assuming the encroachment into the wetted channel is no more than 2 feet, a total of approximately 200 ft² per site may be impacted. As previously described, the average estimated density of juvenile Chinook salmon and steelhead per 100 ft² across the PNF is 1.2 (range of 0.002 to 47) and 0.7 (range of 0.003 to 8.7), respectively. Considering this information, up to three Chinook salmon and two steelhead may be impacted by riprap placement at each location. If ten projects were implemented each year, an annual loss of 30 juvenile Chinook and 20 juvenile steelhead may occur, assuming none of the fish successfully flee to nearby habitat.

For dipping during firefighting, the PNF concluded that compliance with the no dip maps will adequately reduce the potential for dipping from streams with spawning and rearing ESA-listed fish and thus will minimize the potential for dipping-related consequences to occur. The no dip map disallows dipping from mainstem streams and rivers including, but not limited to, the Secesh River, Lake Creek, Summit Creek, SFSR, EFSFSR, LSR, Rapid River, and Big Creek. The excluded streams are those that are heavily used by Chinook salmon for spawning and early rearing. Tributaries to these streams are not excluded from dipping and are likely used for rearing and may be used for spawning. It is important to note that dipping may occur in the no dip streams where it is deemed necessary to protect life or property. There have been instances where dipping has occurred within no dip streams/rivers, largely due to misunderstandings or lack of communication and/or there was an immediate need for rapid suppression responses. For example, in 2020, approximately 5,740 gallons of water (19 helicopter buckets) were collected from the LSR in August to fight the Elk Lake Fire. In October of 2019, about 170 dipping events (removing an estimated 29,064 gallons of water) occurred at the same location in Summit Creek over the course of two days battling the Nethkar Fire.

Although the PNF strives to limit withdrawals from streams occupied by ESA-listed fish, especially those streams that are heavily used by Chinook salmon for spawning, it is possible that withdrawal may still occur, particularly if safety concerns, loss of human life, or structure loss

becomes imminent and rapid response is necessary. While the number of dipping events and locations cannot be predicted, it is possible that dozens to hundreds of dips could occur in a short amount of time. We assume the potential for harassment of juvenile fish and the potential for flight-induced predation increases as the number of dips increases, especially in smaller streams where deep water habitat is limiting. We generally assume that helicopter dipping will occur outside of core Chinook salmon spawning areas because resource advisors (READs) will direct air operations and crews to dipping locations with the least risk of impacts to ESA-listed fish species. When dipping occurs in these sensitive areas, we anticipate adult fish will rapidly flee upstream to the next available holding location away from the disturbance. The frequency of dipping from a sensitive area (e.g., a holding pool near spawning habitat) is expected to be minimized because READs will identify alternative, less impactful locations as needed. Because the frequency of dipping from sensitive areas is expected to be minimized through compliance with the no dip map and READ direction, the potential fleeing response of adults is not anticipated to occur frequently enough such that premature death or reduced spawning success occurs.

As previously mentioned, it is not possible to predict the number of dipping events that will occur in the future. Wildfires and associated dip sites will be widely scattered across the action area in the future. As such, effects to individual populations of Chinook salmon and steelhead will vary from year to year. There is some risk of juvenile fish mortality and there is some risk for reduced spawning success by Chinook salmon, but the PDFs will adequately minimize the potential for and severity of harassment and mortality. The most likely response fish will experience is short-term behavioral modifications. This, coupled with the dispersed nature of the activity, leads us to conclude aerial dipping will not cause any reductions in the abundance or productivity of affected populations.

Table 12. Summary of Payette National Forest programmatic actions that may cause fish disturbance and the project design features to minimize potential disturbance.

Programmatic Activity	Actions Causing Disturbance	Key PDFs Minimizing Disturbance-Related Effects
Road Maintenance	Instream construction work such as repair of roads damaged by floods or avalanches, streambank stabilization, stream crossing abutment protection. Up to four extreme road repair events, each up to 500 linear feet, are allowed per year. In addition, up to 100 linear feet of riprap may be placed below the OHWM per year to protect abutments at each stream crossing.	<ul style="list-style-type: none"> ● All work will be performed during the inwater work windows. ● Equipment will not ford fish-bearing streams. ● Where work must occur outside of the work window, conduct spawning surveys prior to the activity and proceed only where no staging or spawning is observed in the vicinity of the project. ● Delay any projects where migrating or spawning ESA-listed fish or redds are observed within or 600 feet downstream of the project area prior to implementation. ● Heavy equipment, aside from the excavator bucket, will not enter wetted channels in fish-bearing streams.
	Large woody debris may need to be removed from stream channels and ice jams in the stream channel may need to be broken up to prevent damage to a road, bridge, or other infrastructure. The need for removal of large wood and breaking up of ice jams is sporadic and infrequent. For example, since 2011, NMFS is aware of one effort where wood was removed from a flowing stream for the purposes of protecting the adjacent road infrastructure. NMFS is not aware of implementation of any ice jam removal projects on the PNF, suggesting this activity is also unlikely to occur very frequently.	<ul style="list-style-type: none"> ● Time the work to avoid the spawning period when possible. ● If avoidance by timing is not possible, use recent redd survey data where available, and survey the area for adults and redds prior to removing wood. ● Conduct snorkel surveys prior to removal of the debris. If ESA-listed fish are observed in the vicinity, discuss methods for avoiding adverse effects with the Level 1 Team. ● A fish biologist will be present during LWD removal and work with the equipment operator to minimize downstream effects such as elevated turbidity, sediment, etc. ● Pick up LWD one piece at a time and do not skid material from the log jam. ● Only remove the minimum amount of LWD, which will be agreed to by the responsible road maintenance entity, operator, and PNF fisheries biologist. ● All large wood will remain in the riparian area and may be placed in a manner to help dissipate energy and deflect water away from the road. ● For ice removal, the minimal amount of work necessary will be performed to break up ice so it can begin flowing downstream.
	Blasting used to fall trees or break up large boulders typically occurs once or twice a year. Charges averaging 0.5-2 lbs. would be placed on top or on the side of the debris to be removed.	<ul style="list-style-type: none"> ● Use non-explosive or micro-explosive alternatives such as Betonamit® whenever possible. ● No detonation will occur below ground or over/in the water. ● Adhere to the buffer restrictions outlined in the blasting setback table (refer to Table A-2 in Appendix A).

Programmatic Activity	Actions Causing Disturbance	Key PDFs Minimizing Disturbance-Related Effects
Road Maintenance (cont'd)	Water drafting may be needed for some road maintenance activities (i.e., surface blading, dust abatement, and compaction of road surfaces). Water is typically pumped from accessible waterbodies directly into a water tender.	<ul style="list-style-type: none"> ● Draft from pre-identified locations to avoid spawning or rearing areas. ● All pump intakes will be screened to meet NMFS' (2011) screening criteria. ● Deeper and faster-flowing streams and pools will be selected for pump intakes when available. ● Streams will not be dewatered.
Trail and Recreation/Administrative Site Operation and Maintenance	<p>Construction may be performed in or near stream channels. The only instream activities allowed within occupied habitat is placement of riprap material for stream crossing abutment protection and for trail/streambank stabilization. Placement of riprap materials will occur by hand only. Riprap placement for stream crossing protection will be limited to 100 linear feet at each site. Streambank stabilization in occupied habitat is limited to no more than ten sites per year across the PNF.</p> <p>Maintenance of stream crossing structures on fish bearing and non-fish bearing streams may occur. Stream crossing removal or replacement may only occur on non-fish bearing streams.</p>	<ul style="list-style-type: none"> ● All work must be completed by hand. ● Level 1 Team approval is required prior to performing streambank stabilization and placement of any material below the OHWM. For example, riprap placement and maintenance of stream crossings on fish-bearing streams. ● Level 1 Team approval is required for stream crossing removal and/or replacement on non-fish bearing streams.
	Blasting may be used for trail realignment, maintenance, and reconstruction.	<ul style="list-style-type: none"> ● Use non-explosive or micro-explosive alternatives such as Betonamit® whenever possible. ● No detonation will occur below ground or over/in the water. ● Adhere to the buffer restrictions outlined in the blasting setback table.
Fire Management	Fireline construction, or placement of operational facilities within RCAs may lead to fish disturbance due to heavy equipment and people working near streams.	<ul style="list-style-type: none"> ● Conducting activities in RCAs will be avoided as much as possible. ● If RCA activities are unavoidable, READs will develop mitigation measures to avoid or minimize the potential for fish disturbance. These measures will be regularly communicated to appropriate personnel. ● Heavy equipment will not be allowed to ford or work within stream channels that are occupied or that are within 600' of occupied habitat.
	Blasting may be used for fireline construction.	<ul style="list-style-type: none"> ● Use non-explosive or micro-explosive alternatives such as Betonamit® whenever possible. ● No detonation will occur below ground or over/in the water. ● Adhere to the buffer restrictions outlined in the blasting setback table.

Programmatic Activity	Actions Causing Disturbance	Key PDFs Minimizing Disturbance-Related Effects
Fire Management (Cont.)	Water withdrawal and aerial dipping may be used in fire suppression efforts.	<ul style="list-style-type: none"> • All pump intakes are required to be fitted with screens that meet NMFS' (2011) screening criteria. • Deeper and faster-flowing streams and pools will be selected for pump intakes when available. • Streams will not be dewatered. • The PNF has identified streams where dipping may not occur. No-dip maps will be provided to incident management teams and aircraft working on the PNF. The READs will be available to direct air operations and crews to dipping locations where ESA-listed fishes are not present.
Aquatic and Riparian Ecosystem Monitoring	The PNF annually conducts instream and riparian habitat monitoring and 30 electrofishing and 20 snorkeling surveys for fish presence/absence data. Occasionally (no more than once every three years), seining and hook and line sampling may also be used.	<ul style="list-style-type: none"> • Areas with spawning fish will be avoided. • Sampling in known spawning areas will be performed prior to August 15.

2.5.2.3 Summary of Fish Disturbance Effects

Behavioral modifications, such as avoidance behaviors and escape reactions, are expected to occur during implementation of the proposed action. Considering most actions are expected to be temporary, (many of the actions will be completed in a short time from hours to days) and implementation of PDFs will minimize project impacts, such disturbances are expected to be brief and fish will return to normal behavior after the disturbance mechanism is no longer present. However, aerial withdrawal of water could harass fish, especially if the activity is repeated multiple times at the same location in a relatively short period of time. The number and location of dipping events cannot be predicted with any certainty; these events will vary from year to year and will be widely scattered across the action area. The proposed mitigations adequately minimize the risk for death; and the greatest effect is likely to be short-term behavioral modifications. This effect, coupled with the dispersed nature of the activity leads us to conclude aerial dipping will not cause any reductions in the abundance or productivity of affected populations.

Adherence to the blasting setback distances (see Table A-2 in Appendix A) identified in the proposed action will effectively minimize the risk of lethal and sublethal effects to all life stages of fish. Placing riprap and other materials by hand in a wetted channel is not expected to injure or kill fish due to the slow nature of placing the riprap, size of material used, and lack of compaction. However, placing riprap or other material in a wetted channel with heavy equipment has a greater likelihood of injuring or killing juvenile fish. This is because larger material is moved and there is potential for compacting the material in place. It is possible that some juveniles may flee into cover where riprap is placed and not move from other project related disturbances. If this occurs, individual fish could be crushed. NMFS assumed that up to ten stream crossing protection projects per year may occur in occupied habitat on roads or motorized trails included in the road maintenance programmatic. Furthermore, we assumed that encroachment into the wetted channel would be no more than two feet because heavy equipment, aside from the excavator bucket, will not enter wetted channels in fish-bearing streams. Based on these assumptions, and assuming our estimated fish densities are accurate, implementation of this activity may result in the loss of 30 juvenile Chinook and 20 juvenile steelhead annually.

2.5.3 Turbidity and Sediment Deposition

Activities that either resuspend fine particles within stream channels or that cause ground disturbance near or adjacent to surface water can lead to water column turbidity and subsequent sediment deposition.

2.5.3.1 Effects of Suspended Sediments and Turbidity

Sediments suspended in the water column reduce light penetration, increase water temperature, and modify water chemistry. Once in streams, fine sediment (particles smaller than 6.3 mm in diameter) is transported downstream and is ultimately deposited in slow water areas and behind obstructions. Sediment deposition can locally alter fish habitat conditions through partly or completely filling pools, increasing the width to depth ratio of streams, and changing the distribution of pools, riffles, and glides. In particular, fine sediment has been shown to fill the

interstitial spaces among larger streambed particles, which can eliminate the living space for various microorganisms, aquatic macroinvertebrates, and juvenile fish (Bjornn and Reiser 1991). Potential problems associated with excessive sediment have been recognized in a variety of salmonid species and at all life stages, and include: possible suffocation and entrapment of incubating embryos (Peterson and Metcalfe 1981; Irving and Bjornn 1984; Tagart 1984; Reiser and White 1988; Newcombe and Jensen 1996); loss of summer rearing and overwintering cover for juveniles (Hillman et al. 1987; Griffith and Smith 1993); and reduced availability of invertebrate food (Cederholm and Lestelle 1974; Bjornn et al. 1977; Alexander and Hansen 1986; Spence et al. 1996).

Sediment deposited on salmonid redds can impact incubating eggs and pre-emergent fry by reducing oxygen delivery or waste removal, or by physically entrapping fry due to formation of sediment caps (Fudge et al. 2008). A number of authors have found that survival of embryos to the hatched stages is significantly reduced when fine sediments infiltrate redds (Greiga et al. 2005; Julien and Bergeron 2006; Levasseur et al. 2006). Models developed by Newcombe and Jensen (1996) suggested that even short duration and low intensity exposures to suspended sediment will cause egg mortality. Greiga et al. (2005) found that 0.5 grams of clay particles in a 50 milliliter sample (i.e., approximately 1 percent) reduced oxygen consumption of eggs to near zero; and Levasseur et al. (2006) found that above a threshold of 0.2 percent very fine sand and silt, egg to emergent survival dropped sharply below 50 percent.

Turbidity is a measure of water clarity, which is a function of the amount of particulate matter (both organic and inorganic) that is suspended in the water column. Turbidity may have detrimental or beneficial effects on fish, depending on the intensity, duration and frequency of exposure (Newcombe and MacDonald 1991). Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are adapted to such high pulse exposures. Adult and larger juvenile salmonids may be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjorn and Reiser 1991), although these events may produce behavioral effects, such as temporary displacement from preferred habitat, gill flaring and feeding changes (Berg and Northcote 1985). Chronic, moderate turbidity can harm newly-emerged salmonid fry, juveniles, and even adults by causing physiological stress that reduces feeding and growth and increases basal metabolic requirements (Redding et al. 1987; Lloyd 1987; Bjornn and Reiser 1991; Servizi and Martens 1992; Spence et al. 1996). Juveniles avoid chronically turbid streams, such as glacial streams or those disturbed by human activities, unless those streams must be traversed along a migration route (Lloyd et al. 1987). Older salmonids typically move laterally and downstream to avoid turbid plumes (McLeay et al. 1984, 1987; Sigler et al. 1984; Lloyd 1987; Scannell 1988; Servizi and Martens 1992). Although turbidity may cause stress, Gregory and Northcote (1993) have shown that moderate levels of turbidity accelerated foraging rates among juvenile Chinook salmon, likely because of reduced vulnerability to predators (camouflaging effect). Predation on salmonids may be reduced in waters with turbidity equivalent to 23 Nephelometric Turbidity Units (NTU) (Gregory 1993, Gregory and Levings 1998), an effect that may improve overall survival.

2.5.3.2 Programmatic Activity and Sediment Delivery

All of the programmatic activities have the potential for ground disturbance. The activities that pose the greatest risk to aquatic resources are those ground-disturbing activities that are instream, near surface water, or are on steep slopes. Activities associated with trail and recreation/administrative site operation and maintenance, invasive weed management, aquatic and riparian ecosystem monitoring, and miscellaneous forest products are expected to have little ground disturbance and are anticipated to generate only minor amounts of sediment that can be delivered to or resuspended in streams. The fire suppression and timber harvest programmatic activities have the potential for more substantial ground disturbance within RCAs due to fireline construction and or road construction/reconstruction activities. Road maintenance activities pose the greatest potential for substantial amounts of sediment entering streams.

The PNF, and all entities authorized to conduct road maintenance activities, will follow the PDFs described in the BA and in this Opinion (see proposed action section as well as Appendix A). A select few of the notable PDFs include:

- Do not sidecast material or overclean ditches.
- Do not conduct maintenance activities when the ground is saturated.
- Conduct instream work during the low-water work windows.
- Dewater or partially dewater work areas, as appropriate.
- Pump turbid water to an upland sump or vegetated area where it can be filtered.
- Use clean riprap material.
- Remove LWD one piece at a time, and lift it from the channel rather than skid it across the channel bottom.
- Remove only the minimum amount of LWD necessary to prevent further damage or risk to infrastructure.
- Operate heavy equipment from existing road prisms whenever possible.
- Locate fire operations outside the RCA whenever possible; and rehabilitate these areas after they are no longer needed.
- Minimize prescribed fire severity in RCAs in order to maintain sediment filtering capacities.
- Activities within RCAs (e.g., fireline and road reconstruction) must be approved by a READ or equivalent. Rehabilitation plans will include implementation of erosion and sediment control BMPs.

- Invasive weed treatment with the potential for ground disturbance will be conducted only in areas where a 25-foot vegetated buffer strip can be maintained. Proper erosion control techniques will be employed when conducting mechanical treatments that disturb the ground.
- No commercial vegetation treatments, pre-commercial thinning, or post and pole sales will occur within RCAs without agreement of a fish biologist, hydrologist, and approval of the Level 1 Team.
- Temporary roads (limited to ½ mile) built in association with timber harvest activities are required to have erosion control and will be fully decommissioned within two operating seasons.

Implementation of the PDFs will minimize erosion potential at construction sites and minimize the amount of sediment that is delivered to nearby waterbodies. Overall, these PDFs are expected to effectively reduce the potential for negative sediment-related effects from the following programmatic activities: trail and recreation/administration site operation and maintenance; fire management; invasive weed management; timber harvest and precommercial thinning; miscellaneous forest products; and aquatic and riparian ecosystem monitoring. More specific rationale supporting this conclusion is provided in Chapter 2 of the BA, which is herein incorporated by reference. Actions performed under the road maintenance programmatic activity that involve more substantial ground disturbance and instream activities are more likely to cause localized, temporary turbidity pulses that can negatively impact individual fish.

As described in the baseline, roads and trails on the PNF contribute substantial amounts of sediment per year to streams, which is in part reflective of existing maintenance. Because the proposed action does not have an expiration date, it is reasonable to conclude there will be a need for additional or more frequent maintenance in the future as a result of population growth in nearby counties. This in turn may lead to an increase in sediment delivery in the temporary (0-3 years) timeframe, but is expected to reduce overall sediment delivery in the short- (3-15 years) to long-term (>15 years) timeframes. The amount of fine sediment that a road contributes to streams is generally proportional to the frequency, timing, and intensity of maintenance, a road's location on the landscape, and the quality and effectiveness of its drainage (i.e., ditchline extension, number of stream crossings, etc.).

Road maintenance activities are designed to prevent the deterioration of roads due to regular use and natural erosion and to reduce the potential for catastrophic loss of road prisms. In particular, regular road maintenance helps to limit sediment input and turbidity from road systems over time; however, maintenance activities themselves can contribute sediment to streams. While regular blading and gravel placement keeps roads in good condition and minimizes sediment delivery to waterways (Furniss et al. 1991; Yee and Roelofs 1980), it can contribute sediment to streams in the temporary timeframe. Luce and Black (2001) documented a four-fold increase in erosion following general road maintenance such as surface grading and ditch cleaning. The authors noted that these increases in sediment yield occurred within 1 to 2 years following the ground disturbance. Similarly, regular cleaning of culverts can prevent plugging and subsequent overtopping by flood flows leading to road damage, channel realignment, and severe sediment

delivery. However, during culvert cleaning, sediment will likely be delivered to the stream channel.

Temporary spikes in turbidity are expected to occur during maintenance activities or in association with rainstorms following activity implementation. These turbidity increases will occur immediately adjacent to and downstream of individual projects. The magnitude, duration, and extent of turbidity pulses is dependent upon the type and extent of work being performed along with the PDFs implemented. Instream work should be completed within a few hours (i.e., placement of a few rocks) to a week (e.g., more extensive road repair and/or rock placement along 500 feet of streambank, with up to 100 feet of riprap being placed below the OHWM). Because PDFs will be implemented, turbidity pulses associated with routine road maintenance are expected to be localized, low-intensity, infrequent, and last for only minutes to hours. Only the more extreme road repair and streambank stabilization projects involving instream work are expected to generate turbidity plumes of sufficient magnitude and duration for fish to experience biologically meaningful behavioral changes or ill-effects as previously described. Turbidity plumes associated with instream work (e.g., repair of roads damaged by floods or avalanches, culvert cleaning, stream crossing replacement) are anticipated to travel up to 600 feet downstream (USFWS 2004) prior to dissipating to levels that are no longer harmful to aquatic species. These plumes are expected to be short-lived (lasting only a matter of minutes to hours). Up to four extreme maintenance activities may occur each year. The PNF did not specify the number of stream crossing protection projects that may be implemented per year on roads or motorized trails using heavy equipment. As previously described, NMFS has assumed the PNF will implement no more than 10 stream crossing protection projects on roads and motorized trails (vehicles > 50 inches) per year using heavy equipment.

Localized sediment deposition is expected to continue to occur and may increase; however, it is not expected to measurably impact gravel embeddedness in spawning or rearing habitat due to the minor amount of sediment potentially generated and the dispersed nature of maintenance activities. In the short- and long-term timeframes, road maintenance will help minimize the amount of sediment deposition caused by erosion from roads and road related infrastructure. Sediment deposition may occur as a result of extreme road maintenance activities that require work in the stream channel or on the streambanks. As previously described, suspended sediments will be deposited downstream, and could be deposited on redds, if present. The PNF will conduct extreme road maintenance activities during the inwater work window (July 15 – August 15), which will minimize overlap with the spawning season. However, the PNF recognized that site-specific exceptions to the work window may be provided. In these instances, the PNF will conduct spawning surveys prior to project implementation. If redds are observed within 600 feet of the project site, the PNF will work with the Level 1 Team to determine whether the project can proceed and whether additional mitigations will be necessary to reduce any risk to redds.

2.5.3.3 Summary of Turbidity and Sediment Deposition Effects

Increased sediment delivery and associated turbidity pulses, associated with trail and recreation/administrative site operation and maintenance, invasive weed management, aquatic and riparian ecosystem monitoring, miscellaneous forest products, and routine road maintenance are expected to be of low intensity, short-duration, and localized. This is because these projects are anticipated to be dispersed across the landscape, will include implementation of PDFs to

reduce erosion and sediment delivery or resuspension, and will be relatively short. More extreme road repair and streambank stabilization projects involving instream work are expected to generate turbidity plumes of sufficient magnitude and duration for fish to experience biologically meaningful behavioral changes or ill-effects as previously described. Turbidity plumes associated with instream work (e.g., repair of roads damaged by floods or avalanches, culvert cleaning, stream crossing replacement) are anticipated to travel up to 600 feet downstream (USFWS 2004) prior to dissipating to levels that are no longer harmful to aquatic species. These plumes are expected to be short-lived (lasting only a matter of minutes to hours). It is likely turbidity spikes associated with this type of work will cause fish to find refuge away from the turbid water. Those fish that cannot escape could see short-term behavioral changes described above.

Although individual fish may experience sublethal effects, turbidity pulses created by implementation of the proposed action are not expected to reduce the current productivity of any of the Chinook salmon or steelhead populations. In addition, sediment introduced into and subsequently deposited in action area streams as a result of the proposed action is not expected to measurably affect gravel embeddedness nor reduce the abundance or productivity of any of the Chinook salmon or steelhead populations that occupy streams in the PNF. This is primarily because: (1) Sediment generated from all activities will not be delivered to streams simultaneously; rather, sediment will be delivered over segregated periods of time; (2) sediment delivery (and its associated turbidity plumes) will be sporadic in nature and will be short-lived; (3) sources of sediment will be dispersed along the stream network so not all of the sediment will end up in a single location within the stream channel; (4) PDFs will be implemented to eliminate or reduce erosion or sediment delivery; and (5) Level 1 Team approval is required for all extreme road maintenance activities and whenever there is a proposal to depart from the instream work windows.

2.5.4 Chemical Contamination

Chemical contamination of surface waters may occur as a result of heavy equipment use in or near streams; infrastructure repair involving the use of concrete, asphalt, or treated wood near streams; dust abatement chemical application on roads adjacent to streams; ground-based fire retardant application; and herbicide application. Chemical contaminants that have the potential to enter surface water as a result of implementing the programmatic activities included in this consultation include, but are not limited to: fuel, oil, lubricants, hydraulic fluid, brake fluid, antifreeze, dust suppressants, concrete, asphalt, metals, fire retardants, chloride salts, herbicides, and adjuvants.

The PNF has proposed numerous PDFs to minimize the potential for chemical contaminants to enter waterbodies. A brief summary of key PDFs are included in Table 3 of this Opinion and more thorough descriptions are included in Chapter 1 of the BA and Appendix A of this Opinion. The only chemical contaminants anticipated to enter surface water in concentrations sufficient to harm ESA-listed species are related to herbicide application. Section 2.5.4.1 provides a more detailed discussion of this effect pathway. Chemical contamination associated with other proposed action activities are briefly summarized in the following paragraphs. More detailed discussions of these potential effect pathways are included in Chapter 2 of the BA (PNF 2020).

The use of heavy equipment, water withdrawal pumps, fire suppression equipment (e.g., helicopters, water tenders, etc.), and infrastructure repair materials (e.g., concrete or asphalt) near waterbodies all create a risk of accidental spills of fuel, lubricants, hydraulic fluid, coolants, and other contaminants. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain polycyclic aromatic hydrocarbons (PAHs), which can be acutely toxic to salmonid fish and other aquatic organisms at high levels of exposure and can cause sublethal adverse effects to aquatic organisms at lower concentrations (Heintz et al. 1999; Incardona et al. 2005; Incardona et al. 2004; Incardona et al. 2006). Equipment will have regular inspection and cleaning before operation to ensure the vehicles remain free of external oil, grease, mud, and other visible contaminants. Storage and refueling of equipment will occur outside of RCAs whenever possible. Spill containment equipment will be in place to minimize the risk of accidental spills and to ensure rapid response to contain any spills that may occur. These measures will effectively minimize the risk of these types of chemicals from entering surface water in sufficient concentrations to cause lethal or sublethal effects.

The proposed action allows for pavement repairs and resurfacing of bridge decks and stream crossing approaches with asphalt. Routine maintenance only involves patching small road segments with potholes. Asphalt will not be applied during rain events or if precipitation is predicted. In addition, measures will be taken to prevent material from entering the stream during asphalt removal and installation. These measures will effectively minimize the risk of contaminants in asphalt from reaching surface water.

The proposed action allows for the use of dust abatement materials (i.e., calcium chloride, magnesium chloride, and lignin sulfonates) on road surfaces. These materials have low toxicity and will be applied in a manner that prevents chemical entry into waterways. For example, chemicals will only be applied to drivable surfaces and will be kept out of ditchlines. Application will only occur during dry conditions and will not be applied when rain is forecasted. When roads are within 25-feet of the stream channel, they will be applied in one swath along the road centerline so that all of the chemical will be absorbed into the road material and will not leave the road surface.

Treated wood may also be used when maintaining roads, trails, and recreation/administrative facilities. The extent of treated wood use across the forest will be low, and treated wood will not be used below the OHWM. Furthermore, the PNF will implement the treated wood BMPS (see Appendix A of this Opinion) for selection, removal, installation, and disposal activities. As such, the risk of treated wood contaminants entering surface water in concentrations sufficient to elicit lethal or sublethal effects to fish is extremely low.

Although uncommon, ground-based application of fire retardants may occur during fire suppression. Norris et al. (1991) summarized the toxicity of various fire retardants. Fire retardant chemicals cause an immediate spike in ammonia concentrations when they initially enter a stream (NMFS 2019). The area affected and peak of the spike depends on many factors such as the volume of water and turbulence in the stream and the volume of retardant that enters the stream (NMFS 2019). Fire suppression chemicals will not be used in areas where there is potential for direct contamination of surface water. Application of fire retardants within RCAs will be coordinated with a READ in order to ensure any necessary practices to reduce the risk of

surface water contamination are identified and implemented. This consultation does not cover aerial application of fire retardants. For the reasons summarized above, the risk of fire suppression chemicals entering surface water in concentrations sufficient to elicit lethal or sublethal effects to fish is extremely low.

2.5.4.1 Herbicide Application

The PNF proposes to use 14 different active ingredients (Table A-11) and inert ingredients and adjuvants (Table A-13) used in specified herbicide formulations. The proposed action would allow for the application of herbicides on up to 1,000 acres across the PNF per year, with no more than 500 acres of chemical application in any Section 7 watershed. If the maximum allowable acreage was treated in any Section 7 watershed, that would equate to herbicide being applied to anywhere from 0.1 to 2.6 percent of the total area within that watershed. Historically, the PNF has applied chemicals to at most 45 acres within a given watershed. Between 2010 and 2019, the total number of acres receiving chemical application across the PNF ranged from 40 to 125, with an average of 78. This small number of acres is spread out over a large geographical area and represents a small area relative to the immense action area. Furthermore, less than 5 percent of the annual treatment area was located within 100 feet of live water for all years since 2008.

The PNF regularly issues special use permits or other authorizations to individual applicants that often contain requirements for controlling invasive plants on right-of-ways, easements, worksites, or following special events. The proposed action included a conservation measure stating the PNF will “ensure that contracts and agreements include all of these design criteria as a minimum.” NMFS interpreted this statement as being applicable to all permittees that apply for and are ultimately authorized to perform any type of invasive plant control on PNF lands. For this reason, non-USFS staff are likely to be applying herbicides within the action area. Although it is possible applicants may have appropriate backgrounds and knowledge to successfully apply the PDFs, such experience is unlikely to be possessed by all applicants. For this reason, there is at least the potential for applicants to be more likely to fail to understand or fail to apply some PDFs for some sites. Such failure may lead to increased risk of contamination of nearby streams. However, the PNF will have the opportunity to review all applicants’ future proposals and gage their ability to appropriately apply herbicides, as well as evaluate appropriateness of proposed herbicides. In addition, consultation on easements and special use permits should occur, offering NMFS the opportunity to ensure applications of herbicides are directed to be performed and reported in accordance with this consultation.

Effects Analysis Methodology. The analysis of the effects of herbicides on salmonids is evaluated in this Opinion by: (1) Assessing the likelihood that listed fish and other aquatic organisms will be exposed to the herbicides; (2) reviewing the toxicological effects of the herbicides, inert ingredients, and adjuvants on ESA-listed fish and other aquatic organisms; and (3) assessing the ecological risk qualitatively based on the exposure risk and toxicity. The analysis considers the:

- Life history stages (and any associated vulnerabilities) of the ESA-listed species present in the action area.

- Known or suspected mechanisms of toxicity for the active ingredients, EUPs, inert ingredients, or known adjuvants.
- The PDFs, chemical application rates, amount of chemical use, location, application methods, and other factors that determine the likelihood of chemicals reaching the water.
- Possibility for antagonistic, additive, or synergistic interactions between active ingredients within formulations and with other chemicals that may enter surface waters as a result of parallel or upstream land use activities.

Under the proposed action, the risks to salmon and steelhead from herbicides are likely to occur primarily through the direct toxicological effects of the herbicides and adjuvants on the fish, rather than indirectly through physical changes in fish habitat or effects on aquatic vegetation or prey species. However, both types of effects may occur and are considered in this Opinion. Unfortunately, the toxicological effects and ecological risks to aquatic species, including ESA-listed fish, are not fully known for all of the active ingredients, end use products (EUPs), and adjuvants in the proposed action.

Due to concerns about the uncertainty of effects of pesticides on ESA-listed fish, the EPA was directed by the Ninth Circuit Court of Appeals (*Washington Toxics Coalition v. EPA*, 413 F.3d 1024(2005)) to consult with NMFS on the effects of pesticides used in the states of Washington, Oregon, and California. On August 1, 2008, NMFS entered into a settlement agreement to complete consultations on 37 active ingredients on or before June 30, 2013. To date, NMFS has completed eight Opinions, covering 31 active ingredients (<https://www.fisheries.noaa.gov/national/consultations/pesticide-consultations>). Of those active ingredients, one (2,4-D) is proposed for use by the PNF. Results of the national consultation on the registration of 2,4-D are incorporated in this Opinion. None of the remaining six active ingredients included in the settlement agreement are proposed for use in this action.

Risk of Exposure. Weed treatments typically occur between April and November, depending on elevation. During this period, all life stages of Chinook salmon and steelhead could potentially be exposed to herbicides, including incubating eggs, rearing juveniles, and migrating/holding adults.

Herbicides can enter surface water in the following ways: (1) direct application; (2) drift; (3) overland flow; (4) groundwater; and (5) spills or leaks (Norris et al. 1983). The risk of surface water entry from these exposure pathways is summarized below.

Water Contamination by Direct Spray. The PNF is not proposing to apply herbicides directly to water. Direct application is likely to occur only when a ground applicator inadvertently directs the nozzle toward the water to spray weeds located near the water's edge and a portion of the spray stream misses the target plant. This type of contamination is unlikely to involve significant amounts of chemicals at any one time, given only spot spraying or wiping/painting is allowed near streams. Marker dyes will be used to monitor where sprays are landing; consequently, operators will be capable of quickly adjusting their aim away from the water if they observe the

spray stream hitting the water or streambank. However, Berg (2004) noted that direct spray or drift of herbicide onto water sources was the most commonly noted BMP failure. Contamination risk from over-spraying will be reduced by the PDFs listed below.

1. Require a certified herbicide applicator oversee all spray projects.
2. Restrict herbicide application near water to spot-spraying with a single nozzle by hand.
3. Require that no broadcast application methods be used in RCAs.
4. Require daily checks of local weather conditions, and monitoring site-specific conditions during herbicide application for wind thresholds.
5. Required spot spraying or hand-application techniques when applying herbicides within 100 feet of live water.
6. Not applying herbicide if wind conditions exceed 5 miles per hour (mph) in riparian areas or in any wind conditions exceeding product label directions.

Direct delivery of herbicide to surface water is expected to be rare, of low intensity when/if it occurs, and isolated to individual project sites that are geographically scattered when the above measures are routinely implemented. As a result, in-water herbicide concentrations are expected to be minor.

Water Contamination by Wind Drift. Rates of contamination by wind drift are largely dependent on droplet size, elevation of the spray nozzle, wind speed, and weather conditions (heat and humidity) that can cause the water droplets to evaporate, leaving the chemicals suspended in the air (Rashin and Graber 1993). Even under extreme heat and low humidity, volatilization is unlikely to be a significant cause of wind drift, since there is little opportunity for the spray to evaporate when applied by hand with the nozzle close to the target or by broadcast spraying within four feet of the ground.

During periods when there is virtually no wind, little vertical air mixing occurs, and drift can travel long distances. Wind speeds less than 2 mph may be approaching temperature inversion conditions, which make it easy for spray drops to remain suspended in the air and move slowly downwind. Because of this risk, the 2,4-D registration Opinion (NMFS Tracking #2004/02673) contains a term and condition specific to broadcast spraying under specific wind conditions. That term and condition requires the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) labels of all pesticide products containing 2,4-D to have the following statement: “Do not broadcast spray when wind speeds are below 2 mph or exceed 10 mph, except when winds in excess of 10 mph will carry drift away from salmonid-bearing waters.” Since label adherence is required under the action, these measures are expected to be applied by the PNF and will reduce wind drift of at least 2,4-D. Other active ingredients have not all undergone EPA registration consultations and thus do not contain the same label restrictions. Thus, drift of some herbicides could occur if broadcast spraying is performed under the described wind conditions if other measures do not otherwise eliminate the risk.

Of the application methods proposed, broadcast spraying has the greatest potential for wind drift due to being applied further from the ground and increased amount of spray used. However, the proposed action does not allow broadcast spraying to occur within 100 feet of live water. Felsot (2001) reported that over 99.9 percent of the applied herbicide was deposited within 100 feet downwind of units treated with a boom spray ground applications at 4-feet high. This suggests that only a small fraction of herbicide applied in the RCA using broadcast application techniques will drift to surface water. A range of droplet sizes may be present when using spot spraying techniques with a single nozzle. Although the majority of the material in a spray stream delivered by hand with a marker dye typically hits the target, a fraction of the droplets may be small enough to be blown off-target and into the water.

Certain herbicides may readily bind to mineral or organic particles in soils, and the contaminated soils can subsequently be blown into streams. Wind-blown soil particles can be a significant source of water contamination in agricultural settings, where large contiguous blocks of land are tilled to bare soils and exposed to winds. Within the action area, bare soil areas are typically small and interspersed with abundant vegetative cover, which blocks wind and filters dust. These conditions make the contamination risk from wind-blown soils low. In addition, only a small fraction of herbicide contaminants reside on the soil surface, and contaminated soils may not be subjected to winds before herbicides become immobilized through absorption by plants or downward movement into the soils.

The sites most susceptible to generate contamination from wind-blown soils are recently burned areas, unsurfaced parking or storage areas, roadside drainage ditches, and undeveloped recreation sites next to streams. When treated with herbicides, these types of locations can produce small amounts of herbicide-laden dust that could be blown into streams. However, the amount of contamination from this pathway is likely to be immeasurable unless extensive burned areas are sprayed in the same year in which the fire occurred. Historically, the Forests have not treated extensive burned areas with herbicide in the same year a burn occurs. In general, a reseedling strategy is implemented to treat burned areas. Considering these factors, the risk of contaminating surface waters from wind-blown soil contamination is minimal for this action.

While the risk of herbicides drifting into waterbodies during ground-based spot and broadcast herbicide application is low because large areas of bare soil are unlikely to be treated and herbicides will be applied directly to plants or close to the ground, spray drift is not likely to be completely eliminated. Water contamination from wind drift will be further reduced by: (1) Ensuring a certified herbicide applicator oversees all spray projects; (2) applying chemical-specific buffer zones for application methods within RCAs (Table A-11); (3) prohibiting herbicide spraying within RCAs when sustained wind speeds exceed 5 mph or in any wind conditions exceeding product label directions; (4) following label directions, recommendations, and guidelines to reduce drift potential (i.e., nozzle size and pressure, additives, wind speed); (5) obtaining a weather forecast prior to initiating spraying to ensure no precipitation or wind events could occur during or immediately after (at least 24 hours) spraying that could allow drift into surface waters; and (6) using a marker dye to provide the operator the ability to accurately see the locations where herbicides are applied.

In summary, drift of herbicide to surface water is expected to be rare, of low intensity when/if it occurs, and isolated to individual project sites that are geographically scattered when the above measures are routinely implemented. As a result, in-water herbicide concentrations are expected to be low.

Water Contamination by Overland Flow. Overland flow occurs when the rate of precipitation or snowmelt exceeds the rate of infiltration. It can transport herbicides that wash off plants or that are present on or near the ground surface to nearby streams. Broadcast applications would result in some application of herbicide directly to the ground. This application technique can be applied in uplands and in RCAs outside of a 100-foot buffer zone of live water. Broadcast application can also be used to treat dry ephemeral channels or roadside ditches that do not have water. Spot-spraying applications are designed to target specific plants, with limited application directly to the ground. These applications can occur in RCAs, ephemeral channels, and dry intermittent channels.

Herbicide uptake by plants, as well as ultraviolet and microbial breakdown of herbicides applied, would in many cases limit the amount of herbicide that could be mobilized by the first runoff event following application, depending on the persistence and mobility of the herbicide. Furthermore, contaminants are filtered out of the water to varying degrees by sorption onto plants, debris, and soils encountered in the flow path. In general, the amount of filtering increases with the distance surface runoff travels before reaching a stream and with increasing dispersal of the flow. Herbicides can be completely removed from surface runoff that trickles a long distance through vegetation and organic debris, while little or no filtering might occur in runoff that is quickly concentrated into a channel or ditch. Due to the effects of filtering and greater residence time, vegetative buffers are generally effective in controlling water contamination (Berg 2004).

Herbicides such as clopyralid and picloram, which have high water solubility and low sorption coefficients, have the greatest potential for being mobilized by overland flow; while herbicides, such as glyphosate, with high sorption coefficients, are unlikely to be mobilized by overland flow. The contribution from runoff will also vary depending on site and application variables, although the highest pollutant concentrations generally occur early in the storm runoff period when the greatest amount of herbicide is available for dissolution (Stenstrom and Kayhanian 2005; Wood 2001). Lower exposures are likely when herbicide is applied to smaller areas, when intermittent stream channel or ditches are not completely treated, or when rainfall occurs more than 24 hours after application. Herbicide application is not allowed if rain is forecasted to occur immediately after treatment. This required mitigation decreases the potential for herbicide mobilization from runoff. In most cases, the levels of remaining herbicide are expected to be very small by the time the first runoff occurs after treatment.

Herbicides with long persistence in soil have the potential to be mobilized by overland flow occurring weeks or even months after application (Tu et al. 2001). The majority of active ingredients proposed for use will not remain persistent in soils beyond the season of application, with all but only a few persisting for more than 50 days. Although aminopyralid, imazapic, imazamox, imazapyr, and picloram tend to be most persistent, only imazapyr is expected to persist beyond the year of application. Imazapyr is proposed for both upland and riparian

treatments. Even though persistent in soils, it is not expected to affect fish long-term as it is rapidly degraded by sunlight in solution should it reach action area waters; and imazapyr itself is practically non-toxic to fish (Appendix B).

Research suggests that ground-based herbicide applications following label requirements are not likely to impair surface waters. After application of 1 pound per acre of picloram on study plots adjacent to streams in Texas grasslands, Haas et al. (1971) measured concentrations of picloram of 55 to 184 micrograms per liter in surface runoff collected adjacent to a treated area at two weeks following application. Picloram was not detected in an adjacent stream 0.5 miles downstream of the treatment area. In a study of the environmental fate of picloram used for roadside invasive plant control in Montana, Watson et al. (1989) detected no concentrations of picloram in adjacent streams during the 90 days following application and suggested that after application to a small portion of the watershed (0.15%), increased streamflows volume following storms would dilute any picloram mobilized to streams to low levels.

Compliance with the PDFs and label instruction will help ensure maximum efficiency of herbicide applications. Generally, small infestations will be treated and the percentage of any watershed that is treated will be very small. For these reasons, herbicide concentrations in runoff is expected to be diluted in most situations.

Water Contamination by Groundwater. Leaching of herbicides through the soil could potentially result in groundwater contamination. Movement of a pesticide can be described in terms of the relationship between the sorption coefficient and the half-life (Vogue et al. 1994). Herbicides with a low sorption coefficient and a long half-life, such as chlorsulfuron, dicamba, metsulfuron-methyl, and picloram, have the greatest ability to leach through soils and reach groundwater. Herbicides mobilized by subsurface flows can enter a nearby stream by contaminating the hyporheic aquifer that mixes with surface flows in a stream, or they can contaminate more distant streams if the runoff reaches deeper aquifers and then emerge as springs. Contamination by subsurface flows through the hyporheic zone occurs more gradually over an extended period of time following a storm, with timeframes highly variable, typically ranging from hours to weeks, depending on the soil type, physical properties of the aquifer, and distance from the point of contamination to the stream.

As herbicides move through groundwater, some of the herbicides are lost to chemical breakdown and metabolism by plants and other organisms. Contaminants may also be filtered out of subsurface runoff as the runoff percolates through the soil. Soils with large fractions of fine particles and organic materials have a large filtering capacity and coarse soils that lack organic material have little or no filtering capacity. At some point, distance from water also becomes the dominant influence on the amount of water-soluble chemicals that reach a stream, and in general, the greater the distance between treated areas and the water table or nearest stream channel, the smaller the potential for water contamination.

Herbicide persistence in soil depends on a number of factors including microbial decomposition, hydrolysis, photodegradation, and volatilization. In the action area, herbicide decomposition likely varies with soil composition, landtype, aspect, and elevation. Arid slopes with thin soils would favor photodegradation over microbial decomposition. Riparian valley bottom soils

would be more favorable to microbial decomposition. Of the herbicides considered under the proposed action, picloram has the highest potential for leaching into soil and contaminating groundwater due to its high leachability, long persistence, and high solubility. Other herbicides with low sorption coefficients and moderate leachability, such as 2,4-D, have a much lower potential for leaching through soils. Radosevich and Winterlin (1977) studied the persistence of 2,4-D in soil after ground-based application in chaparral vegetation in California. They found that although 50 percent of the recovered herbicide was found on the soil surface litter, only 0.1 to 0.2 percent of the recovered herbicide was found in the soil, and no herbicide was found below 5 centimeters soil depth. In this study, herbicide residues decreased rapidly within 30 days following treatment.

Under the proposed action, herbicide applications will be unlikely to enter groundwater by way of leaching through soils. Spot treatments will result in minimal contact of herbicide with soils, while some contact will occur through ground-based broadcast applications. Research suggests that with the exception of herbicides applied over shallow water tables, leaching is an unlikely mechanism for herbicides to enter water due to limited chemical mobility and relatively short persistence (Norris et al. 1983). Under the proposed action, ground-based application of herbicides over shallow aquifers will be minimal. Shallow aquifers are limited within the project area to narrow bands below riparian areas along primarily narrow valley floors, and no ground-based broadcast application will occur within 100 feet of streams or ponded waterbodies.

Water Contamination by Accidental Spills or Leaks. Most of the herbicides in the proposed action will be applied in a liquid solution, which requires transferring liquids from one container to another and occasional mixing of different chemicals in the field. In general, minor amounts of herbicide leakage are likely to occur throughout the spray season from dripping while using spray equipment, but this type of leakage will occur at concentrations far below the target application rate, and it will not cause any meaningful increase in water contamination over the amount expected based on the target rate. Although the likelihood of accidents is unknown, the risks of accident-related spills can be reduced through PDFs. Implementation of the following PDFs will substantially lower the risk of accidental spills or leaks:

- Mixing, container transfer, or storage of herbicides or application equipment will not occur within 100 feet of live water.
- Mixing and container transfer will be limited to locations where drainage will not allow runoff or spills to move into live water or where contamination of shallow groundwater could occur.
- Only the quantity of herbicide and adjuvants needed for a given project will be transported. Chemicals will be transported in U.S. Department of Transportation-approved containers, which are likely to withstand minor accidents without spillage.
- A spill cleanup kit will be available during transportation of herbicides.
- Equipment used for treatments will be inspected for leaks and repaired before entering areas that drain directly to streams or wetlands.

Consequently, spills and leakage from the use and transportation of herbicides are not likely to be a significant source of routine water contamination of surface water.

Estimated Environmental Concentrations. Even though the annual treatment area will be small relative to the managed area and numerous PDFs will be implemented, there is uncertainty that herbicide delivery to surface water can be eliminated given the potential for human error and/or unpredicted post-treatment storm events. Descriptions of the exposure pathways above support NMFS' conclusion that potential for herbicides to reach streams exists, although that potential diminishes as the distance from the herbicide application to surface water increases and as application methods change.

Water contamination (and subsequent fish exposure to herbicides) is most likely to occur under the proposed action in occasional circumstances: (1) Where chemicals are applied close to water, in dry channels, dry road-side ditches, or on coarse alluvial soils and are mobilized by surface runoff or leaching after application; (2) when operator errors occur, such as spilling chemicals during transportation, or accidentally spraying herbicides into water; or (3) when unexpected weather conditions occur during or shortly after spraying. Beyond these occasional circumstances, chemical contamination of water from the proposed action is unlikely to occur given the properties of the herbicides, the small amounts of chemicals used, the short persistence in soil and lack of soil mobility for most active ingredients, and implementation of PDFs that minimize or avoid water contamination (such as use of hand application and wind speed criteria).

The early detection and rapid response (EDRR) and adaptive management strategies are considered key elements in avoiding or minimizing effects as well as modifying treatment methods during and/or after initial effort to treat a site. To most effectively avoid/minimize potential effects to ESA-listed fish or designated critical habitat, all PDFs designed to reduce the likelihood of surface runoff or groundwater contamination need to be applied in or immediately upstream from watersheds currently occupied by ESA-listed fish species or designated as critical habitat.

Site-specific estimates of potential fish exposure are not known since the exact treatment locations, the amount and type of chemicals that will be applied, water volume of contaminated streams, and weather conditions are not known ahead of time. Species, life-stage, number or health of exposed fish also cannot be determined. Thus, a quantitative estimate of fish exposure to individual proposed herbicides (hereinafter referred to as estimated environmental concentrations [EECs]) was evaluated for a generalized "worst-case" scenario.

The EECs are a product of the water contamination rates (WCRs) found in the most recent U.S. Forest Service risk assessments prepared by the Syracuse Environmental Research Associates, Inc. (SERA) and the maximum label application rates. Although a variety of models can be used to estimate contamination rates of surface water after pesticide applications, SERA relies heavily upon the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model. The GLEAMS model is a root zone model that can be used to examine the fate of chemicals in various types of soils under different meteorological and hydrogeological conditions. The WCRs extrapolated from SERA were generally GLEAMS model results; however, some WCRs selected for this Opinion came from field studies. A discussion about how the EEC was derived

for each of the active ingredients is included in Appendix B. Herbicide WCRs and EECs are summarized in Table 13, along with their persistence/mobility in soils.

Our worst-case scenario differs from the PNF's assessment. We applied the upper range of the expected peak WCRs found in the most recent SERA document multiplied by the maximum label application rate. The PNF relied upon the assessment conducted by the SNF (2017), which completed site-specific analysis using the online SERA program – Worksheet Maker 6.0. While the two approaches are similar, NMFS' use of the WCR values provided in the SERA risk assessments produces higher EECs due to use of upper bounds of WCR modeling results rather than central or 'representative' bounds. The PNF adopted the SNF (2017) approach and used the central bound because the calculation of upper bound hazard quotients do not account for factors such as timing and method of application, or implementation of design criteria.

NMFS' approach is conservative, and likely overstates EECs and potentially inflates the potential risk to species exposed during the action for most applications. However, given the current baseline condition for the affected species, and unknowns regarding site-specific environmental conditions at application sites, we elected to present the worst-case scenario in this Opinion. This is consistent with recent consultations on similar actions NMFS has completed (NMFS 2012; NMFS 2013; NMFS 2016b; NMFS 2016c, NMFS 2017) and ensures consideration of maximum potential exposure of ESA-listed species considered in the analysis. Inclusion of both the worst-case and typical scenarios allows easy comparison of each potential situation. Overall conclusions regarding effects of the action do not meaningfully differ between our analysis and that of the PNF. The EECs produced by both methods are displayed in Table 13.

Table 13. Physical properties, application rates, and estimated environmental concentrations for herbicides proposed for use on the Payette National Forest.

Active Ingredient	Persistence in Soil ¹ (days)	Mobile in Soil	Maximum (and Typical) Application Rates ² (pounds [lb] active ingredient [a.i.] or acid equivalent [a.e.] per acre)	Upper WCRs ³ (mg/L) ⁴	Central WCRs (mg/L) ⁴	Upper Bound EEC ⁵ (mg/L) ⁴	Representative EEC ⁶ (mg/L) ⁴
2,4-D amine	10	Yes	4.0 (1.0 – 2.0) lb ae/acre	0.44	0.02	1.76	0.08
Aminopyralid	103	Yes	0.11 (0.078 – 0.11) lb ae/acre	0.6	0.1	0.066	0.011
Chlorsulfuron ⁷	40 (28-42)	No	0.12 (0.01 – 0.02) lb ai/acre	0.167	0.21	0.024	0.025
Clopyralid	40	No	0.5 (0.1 – 0.5) lb ae/acre	0.07	0.02	0.035	0.01
Dicamba	7 – 42	Yes	2.0 (0.5 – 2.0) lb ai/acre	0.01	0.003	0.02	0.006
Fluroxypyr	36	Yes	0.5 (0.25) lb ae/acre	0.08	0.022	0.04	0.011
Glyphosate	47	No	4.0 (0.5 – 3.0) lb ae/acre	0.083	0.011	0.332	0.044
Imazapic	7-150	No	0.19 (0.09 – 0.16) lb ai/acre	0.002	0.0005	0.0003	0.00009
Imazapyr	2,150 (313-2,972)	Yes	1.5 (1.0) lb ae/acre	0.26	0.02	0.39	0.03
Imazamox	81	Yes	0.5 (0.5) lb ae/acre	0.19	0.011	0.095	0.0055
Metsulfuron-methyl	30 (7-28)	No	0.15 (0.01 – 0.02) lb ai/acre	0.002	0.002	0.0003	0.0003
Picloram ⁷	90 (20-300)	Yes	1.0 (0.25 – 1.0) lb ai/acre	0.18	0.011	0.18	0.011
Sulfometuron-methyl	20-28	No	0.38 (0.09 – 0.38) lb ai/acre	0.02	0.001	0.008	0.0004
Triclopyr triethylamine salt (TEA) ^{9, 10}	30	Yes	2.0 (1.0 – 2.0) lb ae/acre	Acid: 0.24 TCP: 0.028	Acid: 0.003 TCP: 0.0009	Acid: 0.48 TCP: 0.056	Acid: 0.006 TCP: 0.0018

¹Soil half-life values for herbicides are from Herbicide Handbook (Ahrens 1994). Pesticides considered non-persistent are those with a half-life of less than 30 days; moderately persistent herbicides are those with a half-life of 30 to 100 days; pesticides with a half-life of more than 100 days are considered persistent.

²Maximum application rates are those on the product labels. Typical application rates are those used by the Forests.

³The water contaminations rates (WCR) were obtained from the most recent [SERA risk assessments](https://www.fs.fed.us/foresthealth/protecting-forest/integrated-pest-management/pesticide-management/pesticide-risk-assessments.shtml): <https://www.fs.fed.us/foresthealth/protecting-forest/integrated-pest-management/pesticide-management/pesticide-risk-assessments.shtml>.

⁴Units of measure are in mg a.i./L or mg a.e./L, as indicated by the application rate column.

⁵The estimated environmental concentrations (EEC) were derived by multiplying the maximum label application rate by the WCR.

⁶Representative EECs were calculated by the Sawtooth National Forest (SNF) (2017) and applied central WCR values from the most recent version of SERA's Worksheet Maker (Version 6.0).

⁷The central WCR included in the PNF BA reflected information from an older SERA risk assessment. The information here represents information in the latest risk assessment (SERA 2016).

⁸Maximum application rate for picloram is 1 lb a.e./acre; rates may be higher for smaller portions of the acre, but the total use on the acre cannot exceed 1 lb a.e./acre/year.

⁹Maximum proposed rate of 2.0 lb a.e./acre is less than label maximum allowable rate of 9.0 lbs a.e./acre.

Summary. The PNF may treat up to 500 acres within each section 7 watershed, which equates to a very small proportion (0.1 to 2.6 percent) of the overall acres in each watershed. This small number of acres is spread out over a large geographical area and represents a small area relative to an immense action area. Under the proposed action, some formulas of herbicide can be applied within the bankfull elevation of streams, in some cases up to the water's edge (with hand application techniques). Any juvenile fish in the margins of those streams are more likely to be exposed to herbicides as a result of overspray (highly unlikely to occur with hand application only within the buffer), inundation of treatment sites, percolation, surface runoff, or a combination of these factors. Overspray and inundation will be minimized through the use of dyes or colorants and restrictions on application method. Although the potential for exposure will be minimized to the greatest extent possible, localized exposure to herbicides may still occur.

Herbicide Toxicity. Herbicides (including the active ingredient, inert ingredients, and adjuvants) can potentially harm³ fish directly or indirectly. Herbicides can directly affect fish by killing them outright or causing sublethal changes in behavior or physiology. Indirect effects to fish may occur when herbicides alter the aquatic environment by way of causing changes in cover, shade, runoff, and prey availability (Scholz et al. 2005).

Herbicide exposure may directly result in one or more of the toxicological endpoints identified below. These endpoints are generally considered to be important for the fitness of salmonids, and include:

- Direct mortality at any life history stage.
- An increase or decrease in growth.
- Changes in reproductive behavior.
- A reduction in the number of eggs produced, fertilized, or hatched.
- Developmental abnormalities, including behavioral deficits or physical deformities.
- Reduced ability to osmoregulate or adapt to salinity gradients.
- Reduced ability to tolerate shifts in other environmental variables (e.g., temperature or increased stress).
- An increased susceptibility to disease.
- An increased susceptibility to predation.
- Changes in migratory behavior.

³ NMFS defines harm as “an act which actually kills or injures fish or wildlife.” Such an act may include significant habitat modification or degradation which 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).

The ecological significance of sublethal toxicological effects to individual fish depends on the degree to which essential behavior patterns are impaired, and the number of individuals exposed to harmful effects. Sublethal effects could compromise the viability and genetic integrity of wild populations if the effects are widespread across an entire DPS or ESU, or if localized exposures result in the concentrated loss of fish in a geographic area occupied by a local population with unique genetic traits. Scholz et al. (2000) and Moore and Waring (1996) indicated that environmentally relevant exposures to diazinon can disrupt olfactory capacity in the context of survival and reproductive success of Chinook salmon, both of which are key management considerations under the ESA (Scholz et al. 2000). The likelihood of population effects from sublethal effects of the chemicals in the proposed action are largely undocumented, but appreciable population effects can be ruled out if the potential exposure to harmful effects is limited to small numbers of fish and a spatial pattern that is not likely to cause the loss of a unique genetic stock.

Weis et al. (2001) reviewed published literature on consequences of changes in behavior of fish from exposure to contaminants and noted studies reporting impaired growth and population declines from altered feeding behavior and impaired predator avoidance. Potential sublethal effects, such as those leading to a shortened lifespan, reduced reproductive output, or other deleterious biological outcomes are a potential threat to ESA-listed species from the proposed action. Anadromous fish in the Snake River basin are exposed to multiple physiological sublethal stressors with apparent cumulative effects (e.g., Ebel et al. 1975; Matthews et al. 1986; Coutant 1999). Cumulative exposure to multiple sublethal stressors associated with the Snake River hydropower system has been attributed to delayed mortality in Snake River salmon (Budy et al. 2002). Mortality resulting from a history of multiple physiologically sublethal stressors is referred to as “ecological death” (Kruzynski et al. 1994; Kruzynski and Birtwell 1994). Cumulative effects of multiple stressors are thought to be the cause of declines in some fish populations, even though the effects of any single stressor appeared to be insignificant (Korman et al. 1994). Although exposure to pesticides is not a reported factor in delayed mortality of fish, one can reasonably assume that physiological stress created from sublethal exposure to herbicides, or potential impacts to primary production, could contribute to reduced growth of juveniles. Baldwin et al. (2009) found evidence that juvenile growth reductions caused by exposure to popular pesticides (organophosphate and carbamate classes), led to modeled reductions in population productivity. The proposed action does not include the same class of pesticides, and herbicide exposure is likely to be of lower duration and less chronic than evaluated by Baldwin et al. (2009), suggesting the proposed action will not lead to widespread growth reductions and decreased productivity.

In addition to consequences resulting from direct exposure to contaminants, ESA-listed fish may also be affected as a result of contaminant impacts on the aquatic environment and non-target species. Due to the paucity of information, there are uncertainties associated with the following factors: (1) Fate of herbicides in streams; (2) resiliency and recovery of aquatic communities; (3) site-specific foraging habits of salmonids and the vulnerability of key prey taxa; (4) effects of pesticide mixtures that include adjuvants or other ingredients that may affect species differently than the active ingredient; and (5) mitigating or exacerbating effects of local environmental conditions. Where uncertainties cannot be resolved using the best available scientific literature,

the benefit of the doubt should be given to the threatened or endangered species in question [H.R. Conf. Rep. No. 697, 96th Cong., 1st Sess. (1979)].

Indirect effects of contaminants on ecosystem structure and function are a key factor in determining a chemical's cumulative risk to aquatic organisms (Preston 2002). Moreover, aquatic plants and macroinvertebrates are generally more sensitive than fish to acute toxic effects of herbicides. Therefore, chemicals can potentially affect the structure of aquatic communities at concentrations below thresholds for direct impairment in salmonids. Because the integrity of the aquatic food chain is an essential biological requirement for salmonids, the possibility that herbicide applications will limit the productivity of streams and rivers is an unknown risk of the proposed action.

Juvenile salmon feed on a diverse array of aquatic invertebrates, with terrestrial insects, aquatic insects, and crustaceans comprising the large majority of the diets of fry and parr in all salmon species (Higgs et al. 1995). Prominent taxonomic groups in the diet include Chironomidae (midges), Ephemeroptera (mayflies), Plecoptera (stoneflies), Tricoptera (caddisflies), and Simuliidae (blackfly larvae); as well as amphipods, harpacticoid copepods, and daphniids. Chironomids in particular are an important component of the diet of nearly all freshwater salmon fry (Higgs et al. 1995). In general, insects and crustaceans are more acutely sensitive to the toxic effects of environmental contaminants than fish or other vertebrates. However, with a few exceptions (e.g., daphnids), the impacts of pesticides on salmonid prey taxa have not been widely investigated.

Factors significantly affecting prey species are likely to affect the growth of salmonids, which is largely determined by the availability of prey in freshwater systems (Mundie 1974). Food supplementation studies (e.g., Mason 1976) have shown a clear relationship between food abundance and the growth rate and biomass yield of juveniles in streams. Therefore, herbicide applications that kill or otherwise reduce the abundance of macroinvertebrates in streams can also reduce the energetic efficiency for growth in salmonids. Less food can also induce density-dependent effects, such as increased competition among foragers as prey resources are reduced (Ricker 1976). These considerations are important because juvenile growth is a critical determinant of freshwater and marine survival (Higgs et al. 1995). Zabel and Williams (2002) studied size-selective mortality in Chinook salmon from the Snake River) and found that naturally reared wild fish did not return to spawn if they were below a certain size threshold when they migrated to the ocean. There are two primary reasons mortality is higher among smaller salmonids. First, fish that have a slower rate of growth suffer size-selective predation during their first year in the marine environment (Parker 1971; Healey 1982; Holtby et al. 1990). Growth-related mortality occurs late in the first marine year and may determine, in part, the strength of the year class (Beamish and Mahnken 2001). Second, salmon that grow more slowly may be more vulnerable to starvation or exhaustion (Sogard 1997).

It is possible that the action may also cause detrimental effects when non-target plants are killed by herbicides. Herbicide spraying in riparian areas can kill non-target plants that provide streambank stability, shade, and cover for fish. Spraying can also increase surface runoff by creating areas of bare soil devoid of any vegetation. This is particularly true for non-selective herbicides that kill all plants, such as glyphosate. However, non-target species killed by

herbicides tend to be mostly forbs, grasses, and legumes, which are capable of reestablishing themselves within a few growing seasons. Although shrubs and trees are also susceptible to herbicide effects, the quantity of herbicide applied during spot spraying in riparian areas is not likely to kill mature shrubs or trees that have matured beyond the pole stage. In addition, PNF employees will conduct site assessments prior to spraying to determine the most appropriate spray patterns, herbicides, and application rates to use to further reduce the potential for injuring or killing non-target species.

In contrast to the potential for non-target plant impacts to negatively influence fish growth and survival, eradication or control of invasive plants may produce some beneficial effects to fish. Beneficial effects may result from reestablished desirable vegetation and associated potential for reduced sediment delivery as infested site acreage is reduced (Herron et al. 2001; Larson 2003). These types of beneficial effects could be significant, particularly in localized areas where existing infestations are high and currently impairing riparian health and function or contributing to stream sedimentation, both of which can reduce salmonid survival and or growth. Invasive plant expansion is recognized as a threat in NMFS' recovery plan, so successful treatment of existing and prevention of future infestations should assist with reducing threats to the recovery and survival of affected fish populations, even if only to a minor level.

Available Toxicity Information. There are limitations to how herbicides are evaluated, and there are limitations in the information that is available. Both of these limitations are briefly described below. This is then followed by a discussion of the available toxicity information.

Active Ingredients, EUPs, and Adjuvants. Toxicological effects of herbicides must be assessed before they can be registered for use. The EPA registers several types of chemicals and chemical formulations under FIFRA: pure (or nearly pure) active ingredients TGAI, MUP, and EUP. The TGAI is the component, which kills/controls the target species. A MUP is any pesticide product other than a EUP. It may consist of just the technical grade active ingredient, or a combination of the TGAI along with inert ingredients such as stabilizers or solvents. A EUP is a product that may be any combination of TGAIs, MUPs, and additional inert ingredients. A EUP may not be used to manufacture or formulate other pesticide products, and it must have a label specifying the directions for use. Each TGAI registered by EPA may have more than one registered MUP, which in turn may have more than one registered EUP. By 1997, approximately 890 active ingredients and more than 20,000 EUPs were registered under FIFRA (Aspelin and Grube 1999).

The MUPs or EUPs containing the same active ingredient may have different toxicities to aquatic organisms. This is because they have different formulations (i.e., different proportion of active ingredient, different inert ingredient composition, or different proportions of each inert ingredient). The designation as "inert" does not mean an additive is chemically inactive, and it does not convey any information about the toxicity of the ingredient (Tu et al. 2003). In addition to increasing the herbicidal effect of the active ingredient, inert ingredients can have toxic properties in and of themselves. Because many manufacturers consider inert ingredients proprietary, they do not list specific chemicals. In some cases, the toxicity of the inert ingredient may be greater than the toxicity of the active ingredient (Solomon and Thompson 2003).

The EPA's registration process does not require that all EUPs be tested for their toxicity. Rather, EUPs that are similar in their formulation and their use may be "batched." Batching the registration process allows manufacturer(s) to select a representative EUP and conduct toxicity tests on that single EUP. The other EUPs within that batch are assumed to have similar toxicities; therefore, there are some EUPs whose toxicological effects have not been directly tested. Because not all EUPs have been directly tested, evaluating the risk to ESA-listed fish requires NMFS to examine whether EUPs can be considered similar. The best way to assess the similarity of EUPs is to examine their labels and SDS to see the form of active ingredient, proportion of active ingredient, and type/composition of inert ingredients.

In addition to not having toxicity information for all EUPs, there is generally little, if any, toxicity information available for adjuvants and EUP mixtures. Adjuvants are generally defined as any substance added separately to a pesticide EUP (typically as part of a spray tank mixture) to enhance the activity of the herbicide or assist with the application. Adjuvants can increase the effectiveness of an herbicide, sometimes by as much as 5 or 10 times, as well as the selectivity of an herbicide (Tu et al. 2001). These factors could result in less herbicide being required for a specific application. Adjuvants can also decrease the potential for herbicides to wash off plant leaves after application, reducing the amount of herbicide that could migrate off target and eventually enter water.

Adjuvants most commonly used on the PNF are surfactants and dyes. When a formulation doesn't contain a surfactant, the product label will often indicate that a nonionic surfactant must or should be added to the field solution prior to application. Some surfactants are toxic by themselves and have been documented to increase the toxicity of formulations in comparison to technical grade active ingredients (SERA 2011a; Stark and Walthall 2003). The increase in toxicity is not necessarily additive, but depends on the type of surfactant used as well as the proportion of surfactant in the formulation or tank mixture.

Limitations of Available Toxicity Information. Although toxicity data are needed to register active ingredients and EUPs, much of the available information still only addresses toxicity of the active ingredient, and does not address all individual EUPs (including their inert ingredients) and adjuvants. Furthermore, much of the available toxicity information focuses on direct lethality from the active ingredient and little published chronic toxicity data is available to assess the risk of herbicides on fish (Fairchild et al. 2009a; Fairchild et al. 2009b). This may be due to their limited toxicity in available acute tests (ENTRIX 2003). The lethal endpoint has little predictive value for assessing whether pesticide exposure will cause sublethal neurological and behavioral disorders in wild salmon (Scholz et al. 2000; Weis 2014). Many of the toxicological endpoints identified in this section (see "Direct Effects") have not been investigated for the herbicides used in the proposed action (Stehr et al. 2009). Although Stehr et al. (2009) did not find evidence of early life history developmental impacts on salmonid surrogates exposed to six forestry herbicides (each proposed in this action) at higher concentrations than anticipated under this action, there is little information available on the sublethal effects (e.g., reduced growth, decreased swimming stamina, inhibited predator avoidance, decreased prey capture, increased physiological stress, etc.) or ecological effects (e.g., effects on fish behavior, prey composition or availability) of the active ingredients, EUPs, and tank mixtures (Baldwin et al. 2009; Weis 2014).

Most toxicity studies are performed in laboratory settings, with strictly controlled environmental conditions. Baseline environmental conditions are not controlled and in many locations are functioning at risk or unacceptable risk – typically in the form of higher sediment levels, elevated water temperatures, reduced space, and simplified habitats. Test conditions also lack exposure to predators, reduced competition (Jones et al. 2011), some pathogens and other natural hazards. Some authors have suggested laboratory bioassays may provide poor predictions of a toxicant's effects on natural populations when considered at an ecosystem level (Kimball and Levin 1985; Cairns 1983) while others, when evaluating metals toxicity, suggest there may be little differences between lab and natural condition impacts on fish (Larson et al. 1985). Laetz et al. (2014) found elevated temperature alone increased toxicity of mixed pesticides. In the event field conditions are more stressful to fish or their prey, herbicide exposure may have different effects than produced under laboratory conditions. It is also possible that environmental factors such as sediment availability or sunlight may bind or degrade herbicides at different rates than under laboratory conditions and thus present lower toxicity. Given there is some uncertainty in extrapolating laboratory effects of herbicide exposures directly to field conditions some level of caution is warranted to ensure protection of ESA-listed fish.

Available Toxicity Information. The information presented in this section represents the best scientific or commercially available data that will be used in our risk assessment. Tables 14 and 15 summarizes the toxicity information for active ingredients and surfactants proposed for use, respectively. Table 16 summarizes the available information for potential EUPs the PNF may potentially use relative to each active ingredient.

Manufacturers of many of the EUPs proposed for use by the Forests recommend addition of a surfactant. There are numerous surfactants available on the market, some having reported toxicity (i.e., acute lethality) information. The lethal concentrations that killed 50 percent of the test organisms (LC₅₀ values) reported for surfactants commonly added to glyphosate field solutions typically range from 1 to 10 milligrams per liter (mg/L) (SERA 2011a). Haller and Stocker (2003) found the ethoxylated tallow amine surfactants to be the most toxic of 19 surfactants tested on juvenile bluegill sunfish (*Lepomis macrochirus*). These are the most toxic of all the proposed surfactants, according to available information. Some proposed surfactants are considered slightly toxic (LC₅₀ values ranging from >10–100 mg/L), like R-11 and LI 700. Practically non-toxic (LC₅₀ values greater than 100 mg/L) products include Methylated Seed Oil (MSO) and Bronc Max. In order to reach concentrations that are slightly toxic in product evaluations, herbicide and surfactant mixtures were applied directly to water and at higher concentrations than proposed. Thus, for most applications, it is unlikely that surfactants will reach streams in concentrations large enough to result in a toxic response by fish.

As identified previously, the PNF identified 15 surfactants (Table 15) that may be used. These surfactants have reported toxicity from 0.56 mg/L (polyoxyethylene tallow amine [POEA]) to 485 mg/L MSO. These surfactants are not hazardous nor are they categorized by EPA as List 1 (inert ingredients of toxicological concern) or List 2 (potentially toxic other ingredients/high priority for testing inerts) compounds when used as intended and label directions are followed (CH₂MHILL 2004). The toxicities of mixtures of these surfactants with the EUPs are largely unknown. Mitchell et al. (1987) tested the toxicity of Rodeo with and without a surfactant. Without the surfactant, the 96-hour LC₅₀ for rainbow trout was 429 mg a.e./L. With the

surfactant X-77, the 96-hour LC_{50} ranged from 96.4 mg a.e./L (rainbow trout) to 180.2 mg a.e./L (Chinook salmon). The addition of X-77 altered the toxicity of the formulation by up to four times. The SERA (2011a) assessment on glyphosate reports formulations with the POEA surfactant are many times more toxic than formulations without a surfactant and that non-POEA surfactants can also increase the toxicity of the active ingredient, but to a lesser degree than POEA surfactants. Knowing that the addition of a surfactant can increase the toxicity of an EUP is taken into account when evaluating the risk to ESA-listed species. As identified in the required mitigations, the PNF proposes to use only Washington State aquatic-certified adjuvants within riparian areas. Use of these aquatic certified adjuvants will further reduce potential impacts of surfactant use near water.

Table 14. Toxicity of active ingredients proposed for use by the Payette National Forest.

Active Ingredient	Rainbow Trout 96-hour LC ₅₀ (mg/L) ¹	Lowest Sublethal Effect Threshold (mg/L) ²	Daphnid 48-hour LC ₅₀ (mg/L) ¹
2,4-D amine	162 ³	4.78 ⁴	25
Aminopyralid	>100 ⁵	50 ⁶	>100
Chlorsulfuron	40 ⁷	30 ⁷	>100
Clopyralid	103.5 ⁸	5.175 ⁸	225
Dicamba	28 ⁹	1.4 ⁹	100
Fluroxypyr	16 ¹⁰	0.06 ¹¹	100
Glyphosate (more toxic forms)	1.3 – 429	0.05 ¹²	1.5–62
Glyphosate (less toxic formulations)	10 – 429	0.5 ¹³	>200
Imazamox	>115 ¹⁴	89.2 ¹⁵	115
Imazapic	>100 ¹⁶	100 ¹⁶	>100
Imazapyr	21 ¹⁷	10.4 ¹⁸	350
Metsulfuron-methyl	150 ¹⁹	10 ¹⁹	>150
Picloram	4.8 ²⁰	0.19 ²¹	48
Sulfometuron-methyl	>148 ²²	>7.3 ²³	>150
Triclopyr	Acid: 117 ²⁴	Acid: 20 ²⁴	Acid: 132.9
	TCP: 1.5 ²⁵	TCP: 0.075 ²⁵	TCP: 10.9

Color-coding: The toxicity values are color-coded, based on EPA's toxicity classifications for acute risk to aquatic organisms: Red = <0.1 (very highly toxic); Orange = 0.1-1 (highly toxic); Yellow = >1-10 (moderately toxic); Blue = >10-100 (slightly toxic); and White = >100 (practically non-toxic).

¹ Lowest available LC₅₀ values for salmonids, obtained from the most recent SERA risk assessments. For triclopyr, the values presented are for the formulated product and a metabolite. For Glyphosate a range is presented, please see SERA 2011a due to extreme variability between EUP, adjuvants, and studies. For fluroxypyr, 14.3 was for bluegill, and was the only LC₅₀ for a known formulation. However, it is above the solubility of fluroxypyr in water and actual concentration in water will be much lower than nominal concentration, making adverse effects unlikely.

² Either the no observable effect concentration (NOEC) or no observed adverse effect concentration (NOAEC) (as reported in SERA assessments) or 1/20th of the lowest LC₅₀ for freshwater fish.

³ Mayes et al. 1989c reported in USFS 2006.

⁴ LC₅₀ = 95.6 mg/L for carp (SERA 2006a) ÷ 20 = 4.78 mg/L.

⁵ SERA 2007.

⁶ Marino et al. 2001a, MRID 46235814 in SERA 2007.

⁷ Grande 1994 for brown trout, in SERA 2016.

⁸ Dow Chemical 1980e in SERA 2004a LC₅₀ = 103.5 mg/L (÷20 = 5.175). NOEC for chronic exposure is 10. Hazard quotient (HQ) = 0.0004

⁹ Johnson and Finley 1980 in SERA 2004b; LC₅₀ = 28 mg/L (÷20 = 1.4)

¹⁰ Wan et al 1992 in SERA 2009.

¹¹ Boeri et al. 1996a in SERA 2009.

¹² US EPA 2008. LC₅₀ = 1 mg/L (÷20 = 0.05)

¹³ Wan et al. 1989 in SERA 2011a. LC₅₀ = 10 mg/L (÷20 = 0.5)

¹⁴ Yurk and Wisk 1994b MRID 43193231 in SERA 2010.

¹⁵ Olivieri et al. 1998a MRID 44565201 for sheepshead minnow in SERA 2010.

¹⁶ SERA 2004c.

¹⁷ Toxicity of the Arsenal formulation to trout reported by Cohle and McAllister 1984c in SERA 2011d.

¹⁸ SERA 2011d; NOAEC is 4 for chronic exposures with a hazard quotient (HQ) of 0.009.

¹⁹ Hall 1984a in SERA 2004d.

²⁰ Johnson and Finley 1980 in SERA 2011b.

²¹ Woodward 1979 for cutthroat trout reported in and adjusted by SERA 2011b.

²² Muska and Driscoll 1982 on fathead minnow in SERA 2004e.

²³ Brown 1994a MRID 43501801 in SERA 2004e.

²⁴ Value based on Triclopyr TEA (triethylamine) as reported in SERA 2011c.

²⁵ Wan et al. 1987 in SERA 2011c. LC₅₀ = 1.5 mg/L (÷20 = 0.075).

Table 15. Toxicity of surfactants proposed for use by the Payette National Forest.

Surfactant	Rainbow trout 96-hour LC ₅₀ (mg/L)	Daphnid 48-hour LC ₅₀ (mg/L)
<i>Ethoxylated fatty amines</i>		
Entry™ II (POEA)	4.2 ¹	2.0 ¹
	0.65–7.4 ²	2.0
<i>Alkylphenol ethoxylate-based wetter/spreaders</i>		
Activator 90	1.4 ¹	2.0 ¹
R11	3.8 – 6 ³ NOEC = 1	5.7 – 19 ³ NOEC = 0.25
Spreader 90	18 ⁴	9.4 ⁴
Super Spread 90 ¹	NA	9.3 -31.4
<i>Acidifiers</i>		
LI 700	17–130 ^{3, 5}	170–190 ⁵ NOEC 100
Super Spread 7000 ¹	NA	NA
<i>Oils</i>		
MSO	35 ⁴	18 ⁴
Renegade	42 ⁴	25 ⁴
<i>Blends of vegetable oils and silicone based surfactants</i>		
Syl-Tac	45 ⁴	137.5 ⁴
Phase	NA	NA
<i>Colorants</i>		
Highlight	NA	NA
Bullseye	NA	35,747
<i>Other</i>		
Bronc Max	>100 NOEC = 50 ⁶	100 NOEC >100 ⁶
Choice Weather Master	NA	100

Color-coding: The toxicity values are color-coded, based on EPA's toxicity classifications for acute risk to aquatic organisms:

Red = <0.1 (very highly toxic); Orange = 0.1-1 (highly toxic); Yellow = >1-10 (moderately toxic);

Blue = >10-100 (slightly toxic); and White = >100 (practically non-toxic).

Bolded surfactants may be used within riparian areas.

¹McLaren/Hart Environmental Engineering Corporation 1995.

²Fomar et al. 1979 in SERA 2011.

³Smith et al. 2004.

⁴Washington Department of Agriculture 2017.

⁵LI 700 SDS.

⁶Bronc Max SDS.

Table 16. Characteristics of end use products that may be used by the Payette National Forest.

Active Ingredient	EUP ¹	EPA Registration Number	Manufacturer	% a.i. (other a.i.s in EUP)	% Other Ingredients	Rainbow trout LC ₅₀ (mg a.e./L) ²
2,4-D amine*	2,4-D Amine 4	1381-103	WinField Solutions	47.3	Not Otherwise Specified (NOS) (52.7%)	Not Reported
	2,4-D Amine 4 (Agri Star)	42750-19	Albaugh, Inc.	46.8	NOS (53.2%)	Not Reported
	Weedar 64 Base Camp 2,4-D Amine 4	71368-1 71368-1-2935	Nufarm Americas Wilbur-Ellis	46.8	NOS (53.2%)	250 (a.i.); 208 (a.e.)
Aminopyralid	Milestone	62719-519	Dow AgroSciences	40.6	Water (59.4%)	>100
Chlorsulfuron	Telar XP	432-1561	Bayer	75	NOS (25%)	>122 (a.i.)
Clopyralid*	Transline	62719-259	Dow AgroSciences	40.9	Isopropanol (5%) Polyglycol (1%) NOS (53.1%)	103.57 ³
	Clean Slate	228-491	Nufarm Americas	40.9	NOS (59.1)	104
Dicamba*	Banvel	66330-276	Arysta Lifescience North America	48.2	NOS (51.8%)	>1,000 (a.i.); >350 (a.e.)
Fluroxypyr	Vista Ultra, Vista XRT Starane	62719-586 62719-577	Dow AgroSciences	45.52	NOS 54.48%	>100
	Spotlight (Vista)	62719-308	Dow AgroSciences			Not Reported
Glyphosate	Roundup ®	524-445	Bayer	41	NOS (59%)	8.2
	Roundup Original 2K	524-539	Bayer	48.7	51.3	Not Reported ⁴
	Roundup PowerMax	524-549	Bayer	48.7	51.3	Not Reported ⁴
	Roundup Pro	524-475	Bayer	41	NOS (59%)	5.4
	Rodeo	62719-324	Dow AgroSciences	53.8	Water (46.2%)	>2,500 (a.i.); >430 (a.e.)
	Accord®	62719-324	Dow AgroSciences	53.8	NOS (46.2%)	>2,500
	Accord SP	62719-322	Dow AgroSciences	41	NOS (59%)	Not Reported
	Accord XRT	62719-517	Dow AgroSciences	53.6	NOS (46.4%)	>1,000
	Aqua Star	42750-59	Albaugh, Inc.	53.8	NOS (46.2%)	> 1,000
	Aquaneat	228-365	Nufarm Americas	53.8	NOS (46.2%)	86 ⁵
Imazamox	Beyond® Raptor®	241-441 241-379	BASF Corporation	12.1	NOS (87.9%)	Not Reported
Imazapic	Plateau®	241-365	BASF Corporation	23.6	NOS (76.4%)	>100 (a.i.); >94 (a.e.)

Active Ingredient	EUP ¹	EPA Registration Number	Manufacturer	% a.i. (other a.i.s in EUP)	% Other Ingredients	Rainbow trout LC ₅₀ (mg a.e./L) ²
Imazapyr	Arsenal	241-346	BASF Corporation	27.8	NOS (72.2%)	21 (a.e.)
	TVC Total Vegetation Control	81927-23-53883	Alligare, LLC	27.8	NOS (72.2%)	Not Reported
	Chopper®	241-296	BASF Corporation	27.6	NOS (72.4%)	> 100
	Chopper Gen2	241-430	BASF Corporation	27.6	NOS (72.4%)	> 100
	Chopper RTU	241-330	BASF Corporation	3.6	NOS (96.4%)	Not Reported
Metsulfuron methyl	Escort XP	352-439	Du Pont	60	NOS (40%)	>150
	Rometsol	83100-2-83979	Rotam North America, Inc.	60	NOS (40%)	>150
	Amtide MSM 60 DF	84229-42	Tide International, Inc.	60	NOS (40%)	>150
Picloram*	Tordon™/Outpost 22K	62719-6	Dow AgroSciences	24.4	Polymer (1.7%) NOS (73.9%)	Not Reported
Sulfometuron methyl	Oust XP/DPX-T5648	432-1552	Bayer	75	NOS (25%)	>148
	Oust Extra	432-1557	Bayer	56.25 (15.0%)	NOS (28.75%)	Not Reported ⁶
Triclopyr TEA*	Garlon3A®, Element 3A®	62719-37	Dow AgroSciences	44.4	Ethanol (2.1%) NOS (50.5%)	286

*These active ingredients (a.i.) are no longer under patent and are now produced generically by various manufacturers, including the original manufacturer.

¹EUP shown here represents brands most commonly used by the PNF, although other product brands of identical or substantially similar formulations may be added or substituted in the future.

²The LD₅₀/LC₅₀ is the dose/concentration of a chemical that kills 50 percent of the test organisms.

³Value is for the 3,6-dichloropicolinic acid and not the EUP. The Rainbow trout LC₅₀ for the Monoethanolamine salt (a.i.) of clopyralid is 700 mg a.e./L.

⁴Toxicity to the common carp (*Cyprinus carpio*) for a similar formulation is 4.0 mg/L. Formulation toxicity to rainbow trout is not reported on the safety data sheet.

⁵Toxicity data for TGAI.

⁶Toxicity data reported for sulfometuron methyl (>148 mg/L) and metsulfuron methyl (>150 mg/L); mixture toxicity not reported on safety data sheet.

Assessment of Ecological Risk. As demonstrated by the previous discussions, assessing the potential ecological risk associated with the use of pesticides is a complicated task. This is in part because there are numerous active ingredients, EUPs, adjuvants, and mixtures that can be applied on the ground. There is also limited available information upon which to evaluate the risk of pesticide use on the survival and recovery of endangered species.

To assess the risk of herbicides on ESA-listed species and critical habitats, we first compared the EECs to the available LC₅₀. Because exposures causing fifty percent mortality (i.e., LC₅₀) are a poor measure to ensure protection of threatened and endangered fish, particularly from sublethal effects, we also used reported no observed adverse effect levels (NOAEL), or no observed effect concentrations (NOEC) to evaluate potential sublethal effects to fish from upper bound EECs. When NOEC or NOAEL values were not available, we used the lowest available LC₅₀ for freshwater fish and applied an uncertainty factor of 20 to approximate an NOAEL (SERA 2014). Dividing the EEC by the NOEC or NOAEL produces a ratio dubbed the Hazard Quotient (HQ). A HQ less than 1.0 suggests potential exposure has low risk to cause an adverse effect. When HQs are greater than 1.0 higher, risk exists and adverse effects are more likely. Because EECs are not available for surfactants, we did not calculate HQs, rather, when evaluating the risk of herbicide application overall, we considered their risk categorization. Surfactants proposed for use within riparian areas have relatively low toxicity risk to aquatic animals.

Comparing EECs to LC₅₀ values (Table 17) indicates that peak herbicide EECs should typically be a small fraction of lethal concentrations. Peak EECs of all but four herbicides are less than 1 percent of the lowest reported LC₅₀. The original formulation of glyphosate (i.e., Roundup) and the custom glyphosate formulation (no surfactant) had peak EEC values equivalent to 33 and 3.8 percent of the reported LC₅₀ values, respectively. Picloram and the acid degradate of Triclopyr TEA had peak EEC values equivalent to 3.8 and 2.7 percent of the reported LC₅₀ values. The Arsenal formulation of imazapyr had peak EEC values equivalent to almost 2 percent of the reported LC₅₀ values. The EEC estimations are presumed to represent conditions that will generally not be encountered in the action area. This, coupled with the anticipated effectiveness of the PDFs in preventing delivery of herbicide to water, leads us to conclude there is an extremely low potential for lethal exposures.

The PNF's BA included HQs calculated by the Sawtooth and Boise National Forests, but those HQs used central bound EECs (SNF 2017; PNF 2020). We utilized the upper bound EEC to calculate HQs. For three herbicides (2,4-D, clopyralid, and dicamba) the HQs presented by the PNF appear to have been calculated using uncorrected LC₅₀ values (Table 30 in PNF 2020). The HQs for fish and invertebrates are included in Tables 17 and 18, respectively, for all proposed active ingredients at both central and upper bound EECs, with the correction factor applied to the three noted active ingredients' reported LC₅₀s.

With the exception of glyphosate (Roundup original formulation), the upper bound and representative or central sublethal HQs are all below one, with most being several orders of magnitude lower. The more toxic formulation of glyphosate (Roundup original formulation) will only be used in upland areas where there is no potential for delivery to surface water. The low HQs suggest that under even worst-case WCR conditions and max-label application rates, sublethal effects are unlikely to occur.

Table 17. Calculated fish hazard quotients from herbicides proposed for use by the PNF.

Active Ingredient and Product Name	Upper Bound Peak EEC (mg/L)	Central Estimate Peak EEC (mg/L)	Lowest 96-hour LC ₅₀ (mg/L)	Lowest Sublethal Effect Threshold (mg/L)	Upper Bound Sublethal Hazard Quotient ¹	Central Bound Hazard Quotient ¹
2,4-D amine	1.76	0.08	162	4.78	0.37	0.017
Aminopyralid	0.066	0.011	>100	50	0.001	0.0002
Chlorsulfuron	0.024	0.025	40	30	0.0008	0.0008
Clopyralid	0.035	0.01	103.5	5.175	0.007	0.002
Dicamba	0.02	0.006	28	1.4	0.014	0.004
Fluroxypyr	0.04	0.011	16	0.06	0.667	0.183
Glyphosate (with surfactant)	0.332	0.044	1	0.05	6.64	0.88
Glyphosate (no surfactant)	0.332	0.044	10	0.5	0.664	0.088
Imazamox	0.095	0.0055	115	89.2	0.001	0.00006
Imazapic	0.0003	0.00009	>100	100	0.000003	0.0000009
Imazapyr	0.39	0.03	21	10.4	0.038	0.003
Metsulfuron-methyl	0.0003	0.0003	150	10	0.00003	0.00003
Picloram	0.18	0.011	4.8	0.19	0.95	0.06
Sulfometuron methyl	0.008	0.0004	148	7.3	0.001	0.00005
Triclopyr TEA	Acid: 0.48 TCP: 0.04	Acid: 0.006 TCP: 0.0009	Acid: 117 TCP: 1.5	Acid: 20 TCP: 0.075	Acid: 0.024 TCP: 0.533	Acid: 0.0003 TCP: 0.012

¹HQ values are calculated by dividing the respective EEC by the lowest sublethal effects threshold.

The acute toxicity HQs for invertebrates are well below the LOC of 1.0 for all herbicides, with the exception of the more toxic formulations of glyphosate. Impacts from runoff and other exposure pathways for these herbicides pose a low risk to aquatic invertebrates. If contaminated runoff enters streams, and if any effects occur, they are expected to be localized since the contaminated runoff would further dilute as it mixes with a larger waterbody. These localized effects should not result in significant changes in the food web over a large portion of the stream. Furthermore, if these extreme case scenarios occurred they would be infrequent pulse events and invertebrate species would be expected to quickly recolonize any impacted areas.

Table 18. Calculated invertebrate hazard quotients from herbicides proposed for use by the Payette National Forest.

Active Ingredient and Product Name	Upper Bound Peak EEC (mg/L)	Central Estimate Peak EEC (mg/L)	Daphnid 48-hour LC ₅₀ (mg/L)	Most Sensitive Aquatic Invertebrate Endpoint (mg/L)	Upper Bound Sublethal Hazard Quotient ¹	Central Bound Hazard Quotient ¹
2,4-D amine	1.76	0.08	25	25	0.07	0.003
Aminopyralid	0.066	0.011	>100	95.6	0.0007	0.0001
Chlorsulfuron	0.024	0.025	>100	10	0.002	0.003
Clopyralid	0.035	0.01	225	23.1	0.002	0.0004
Dicamba	0.02	0.006	100	3.8	0.005	0.002
Fluroxypyr	0.04	0.011	100	0.39	0.10	0.03
Glyphosate (with surfactant)	0.332	0.044	1.5	0.075	4.4	0.59
Glyphosate (no surfactant)	0.332	0.044	>200	2.7	0.12	0.02
Imazamox	0.095	0.0055	115	89.3	0.001	0.00006
Imazapic	0.0003	0.00009	>100	100	0.000003	0.0000009
Imazapyr	0.39	0.03	350	41	0.01	0.0007
Metsulfuron-methyl	0.0003	0.0003	>150	150	0.000002	0.000002
Picloram	0.18	0.011	48	2.15	0.08	0.005
Sulfometuron methyl	0.008	0.0004	>150	75	0.0001	0.000005
Triclopyr TEA	Acid: 0.48 TCP: 0.04	Acid: 0.006 TCP: 0.0009	Acid: 132.9 TCP: 10.9	Acid: 25 TCP: 0.55	Acid: 0.02 TCP: 0.07	Acid: 0.0002 TCP: 0.002

¹HQ values are calculated by dividing the respective EEC by the lowest sublethal effects threshold.

As previously described, there is uncertainty with the available toxicity information in translating laboratory assays to field conditions and an individual organism's response. Not all sublethal biological endpoints have been evaluated for each ingredient, and most evaluations only consider technical grade material and not EUPs or mixtures with adjuvants. As such, there is potential for sublethal effects that have not been observed during reported testing. This concern is also present in the literature, with many authors recognizing NOECs as a limitation in the available science (Crane and Newman 2000; Iwasaki et al. 2015; Mebane 2015). Nonetheless, NOECs remain the best available information from which to evaluate the action and they were utilized in both the PNF (2020) and NMFS' analyses as screens for potential risk to ESA-listed fish.

Additionally, traditional chemical evaluations have not routinely considered fish in impaired baseline habitat settings, which exist in portions of the action area. Environmental stressors (e.g., high temperatures) and other chemicals that co-occur with the applied herbicide (known as environmental mixtures) can increase the adverse effects of contaminants, but the degree to which these effects are likely to occur for various herbicides is largely unknown. This uncertainty contributes to our conclusion that some sublethal effects are likely to occur from the proposed action. However, proposed mitigations are expected to greatly reduce both the

frequency and magnitude of exposures to infrequent and brief events in isolated locations. It is important to note that the highest HQs are tied to worst-case WCRs, which are unlikely to actually occur. Since the majority of HQs do not exceed one, even when considering worst-case WCRs, and the PNF will implement effective PDFs during treatments, NMFS has increased confidence that most exposures will occur at reasonably safe levels. Glyphosate, picloram, and fluroxypyr likely pose the greatest threat given they have the highest HQs of the active ingredients evaluated. However, all products are assumed to have potential, albeit minor, to cause harm for short periods of time under the right delivery and environmental conditions.

2.5.4.2 Summary of Effects

Implementation of PDFs will effectively reduce the risk of chemical contamination associated with road maintenance, trail and recreation/administrative site operation and maintenance, and fire management. Only herbicide application activities have reasonable potential to result in chemical contamination of surface water of sufficient magnitude to cause sublethal effects to fish.

Application of many herbicides proposed for use could potentially drift to waterways or leach into soils, contaminate groundwater, and eventually show up in streams where listed fish spawn and rear. This risk depends on a number of variables, including but not limited to the rate of application, concurrent precipitation, herbicide degradation, solubility, and distance to water. Identified design criteria minimize risks of these occurrences. Accidental spill of herbicides directly to waterways could result in conditions toxic to salmonid fish species and result in harm/death of listed fish.

In spite of the PDFs, herbicides (and adjuvants) cannot be kept entirely out of the water. Although direct lethal effects are not expected, the types of chemicals used are ones that can be capable of causing harmful sublethal effects. It is possible that individual or smaller groups of fish could be exposed and experience sublethal effects. Herbicide applications will not occur over large contiguous areas, and most of the action area will not be subjected to spraying in any given year. Considering the low level of effects that may occur coupled with the very small impact area, we do not expect there to be any realized reductions in the abundance or productivity of any potentially affected populations.

2.5.5 Temperature

Direct solar radiation is the primary factor influencing stream temperatures in the summer (Beschta et al. 1987; Chamberlin et al. 1991; Johnson 2004). Riparian vegetation maintains stream temperatures; as shade increases, water temperature decreases particularly in smaller streams (Murphy and Meehan 1991). Activities that remove or alter vegetation-shading streams have the potential to increase solar radiation and in turn increase stream temperatures. The following programmatic activities may involve vegetation removal: road maintenance, trail and recreation/administrative site operation and maintenance, fire management, timber harvest, and miscellaneous forest products.

Maintenance of roads and trails involves brushing of vegetation encroaching on the road right-of-ways or the trail management clearing width. While brushing includes cutting of sapling and seedling trees and shrubs as close to the ground as possible, it does not involve removal of larger overstory trees that provide shade. Excessive brushing of vegetation providing shade is prohibited, and crews are to leave as much of a vegetated buffer between roads or trails and streams as possible. Maintenance also includes repair of road segments (up to 500 linear feet) and stabilization of streambanks around stream crossing structures (up to 100 linear feet at each location). These activities involve placement of riprap material that will preclude establishment of riparian vegetation of sufficient size to provide stream shading. These activities are expected to be performed at previously disturbed sites, so the impact on existing vegetation is expected to be minimal. Maintenance may also include trail or road realignments and reroutes. Fish biologists will review realignment and reroute projects prior to implementation to ensure the project reduces long-term resource impacts.

Constructing firelines, reopening closed roads, constructing temporary roads, and implementing prescribed burns or backburns in RCAs may result in vegetation removal. In the case of fire management activities, coordination with a READ will occur prior to fireline construction in RCAs to minimize the potential for excessive vegetation removal. Roads that are reopened for fire suppression purposes or temporary roads constructed (limited to ½ mile) for timber management purposes will be rehabilitated post fire or within 2 years of construction, respectively.

Prescribed fire may be ignited to within one site-potential tree height of perennial streams and would be allowed to back further into RCAs. Fire is expected to back into the RCAs in a mosaic pattern, but as moisture content increases with proximity to streams, fire is expected to eventually stop. Fire intensities in RCAs, whether associated with backburns or prescribed burning, will be minimized in order to preserve the vegetative integrity. Areas in the RCA that have a higher risk of undesirable effects to overstory and understory vegetation will be identified in field reviews prior to implementation. Prescribed fires will not be allowed to back into these higher risk areas. The seasonal timing of burning (generally occurring either in the spring or fall), as well as the higher relative humidity and soil moisture in RCAs is expected to support lower intensity fires.

Prescribed fire research on the PNF by Arkle and Pilliod (2010) found minimal riparian effects. Prescribed burning conducted in the spring has resulted in either natural effects in riparian areas, or no observable evidence that fire had burned into riparian areas more than minor amounts (Zurstadt 2018; Arkle and Pilliod 2010; PNF 2020). Field reviews of past prescribed burns in the Rapid River drainage in 2000, 2001, and 2003 found that where burning had occurred in riparian areas, it had been in a mosaic pattern, had been of low intensity and severity as new understory growth could be seen, had killed very few trees, and had virtually no impact on vegetation directly adjacent to streams (PNF 2020). Controlled burning in riparian areas would stimulate regeneration of some riparian species that may have become decadent due to fire exclusion (Dwire et al. 2016; Halfosky and Hibbs 2009). Additionally, rapid regeneration of burned riparian areas has been observed on the PNF after prescribed fire (Zurstadt 2018) and even in wildfire areas where burn severity was much higher (Zurstadt 2019).

Thinning of vegetation in RCAs for timber harvest, pre-commercial thinning, or ladder-fuel treatment will be performed in a manner that limits impacts to the shading capacity of RCAs. Timber harvest and pre-commercial thinning in RCAs are required to receive approval from the Level 1 Team on a case-by-case basis prior to implementation. The Level 1 Team will only approve those projects that do not degrade nor retard attainment of properly functioning riparian functions and processes. Ladder fuel thinning involves the removal of small trees and ladder fuels and is limited to the outer edge of the RCA, that is, outside a buffer equivalent to one site-potential tree height from the stream. Given the size and location of these fuels, they are not expected to contribute to stream shading.

Hazard trees within RCAs and along roads, trails, or within administrative or recreational sites may be removed; however, few hazard trees are expected to be cut in any given year. Furthermore, hazard trees are typically those that are dead or dying and either do not or will not provide shade in the near future. Fuelwood cutting is generally prohibited within RCAs; however, where there is a road within the RCA, fuelwood collection may occur on the upslope side of the road. Only dead trees, which provide very little stream shading to begin with, are to be cut for fuelwood.

Overall, incremental reductions in stream shading may occur in localized areas as a result of implementing these activities. These localized areas are expected to be small and dispersed throughout the action area. Therefore, such limited vegetation reductions are not anticipated to result in measurable changes in stream temperature.

2.5.6 Riparian Disturbance

Activities in RCAs can cause disturbance of vegetation and soils that support floodplain and riparian function, such as delivery of large wood and particulate organic matter, shade, development of root strength for slope and bank stability, and sediment filtering and nutrient absorption from runoff (Darnell 1976; Spence et al. 1996). These disturbances can lead to changes in stream temperatures, decreases in LWD recruitment, increased sediment delivery, decreased streambank stability, and reduced forage. Streambank hardening with riprap is known to cause adverse effects to natural fluvial processes, ecological diversity, fish habitat, and fish populations (Schmetterling et al. 2001). Riprap often negatively affects channel conditions and morphology (Schmetterling et al. 2001; Garland et al. 2002). The addition of riprap prevents stream lateral migration and modifies hydraulic regimes by transferring hydraulic energy, which can lead to increased erosion on opposite streambanks downstream. With certain hardening treatments, nearshore topography may be scoured, critical fish habitats can be degraded or destroyed, terrestrial/riparian habitat can be lost, and erosion of downstream streambanks can be accelerated (WDFW et al. 2002). Riprap also diminishes establishment of riparian vegetation that provides shade, organic matter, and forage to aquatic ecosystems. Water velocities in the channel may be increased with placement of riprap, creating barriers to fish migration. As reported by the Washington Department of Fish and Wildlife (WDFW) et al. (2002), juvenile life stages of salmonids are especially affected by bank stabilization projects. In low flows, juveniles depend on cover provided by undercut banks and overhanging vegetation to provide locations for resting, feeding, and protection from predation. During periods of high streamflow, juveniles

often seek refuge in low velocity microhabitats, including undercut banks and off-channel habitat.

The following programmatic activities can lead to riparian disturbances: road maintenance, trail and recreation/administrative site operation and maintenance, fire management, invasive species management, timber harvest and precommercial thinning, miscellaneous forest products, and aquatic and riparian ecosystem monitoring. Creation of new roads, trails, stream crossings, or recreation/administrative sites is not covered under this programmatic consultation. As described in Sections 2.5.5 (Temperature) and 2.5.3 (Turbidity and Sediment Deposition), implementation of the proposed programmatic activities is expected to result in minimal, localized RCA impacts.

Under the proposed action, riprap may be placed along the streambank to repair road or trail segments damaged by floods or other events or to protect stream crossing structures on roads and trails. Within the scope of this programmatic, riprap placement is limited to culvert installation/replacement along non-fish-bearing streams, extreme road maintenance activities that require slope stabilization (limited to no more than four projects per year with a maximum of 500 linear feet of road prism replacement per project), streambank stabilization along trails (limited to 100 linear feet and hand-placement of material only) and along culvert and bridge abutments (maximum of 100 linear feet at no more than 20 sites per year). Assuming the PNF implements the maximum allowable streambank stabilization, up to 4,000 linear feet of streambank may be armored each year, of which 400 linear feet may extend below the OHWM.

This armoring will decrease the habitat function in these localized areas, harming adult and juvenile fish by denying normal use of the action area for rearing, feeding, or migration. Impacts to juveniles are expected to be most dramatic, because bank armoring diminishes the formation of microhabitats for juvenile fish to seek refuge during high stream flows. Although riprap will be used, riparian disturbance in most locations will be minimal because streambanks have already been disturbed by previous rock placement (stream crossing structures), road encroachments, or shifting of stream channels due to avalanches or other environmental disturbances. Typically, damaged banks offer low quality rearing habitat. Placing riprap in these areas will have less pronounced impacts than riprap placements on native streambanks, and most projects will simply replace already degraded habitat (pre-flood). Repair projects will also: (1) Use material with a low likelihood of future erosion, reducing the potential for repeat encroachments on stream channels; and (2) ensure that repairs maintain the pre-existing road prism characteristics (i.e., not allow for expansion of prism width). Furthermore, a vitally important mitigation to reduce impacts to instream habitat is the requirement to ensure newly placed riprap that does not extend farther into the channel than what previously existed. Exceptions to this requirement may only be granted by the Level 1 Team on a case-by-case basis. Proposed repair of damaged road and trail segments will require Level 1 Team review and approval.

Ultimately, placement of riprap will artificially harden streambanks in the action area, locking these section of streambank in place for the foreseeable future, and preventing the natural expression of geomorphic processes (i.e., channel migration, pool formation/maintenance and LWD recruitment) that are essential for healthy fish habitat over time. Riprap placement can be

particularly harmful to juvenile salmonids (WDFW et al. 2002) because it largely simplifies habitats that juvenile fish rely upon. Although adherence to all of the PDFs incorporated into the proposed action should aid in minimizing impacts to riparian areas, long-term adverse impacts to fish associated with streambank armoring will still occur in small, localized areas scattered throughout the action area.

Generally, aquatic and riparian monitoring does not substantially disturb the RCA. Core sampling is among the most intensive monitoring efforts implemented, occurring along the streambank of a sampling grid. During the time core sampling takes place (1-2 days/per core site) trampling of vegetation occurs; however, vegetation begins to recover within a couple of weeks of sampling (PNF 2020). To mitigate long-term effects to streambanks, crews move processing areas each season, avoid undercut banks, and try to process the samples on gravel bars whenever possible. Given the temporary nature of this localized disturbance, RCA processes and functions will not be measurably impacted.

2.5.7 Instream Habitat Alteration

Fish require complex instream habitat types that consist of pools, LWD, and overhanging riparian vegetation. Pools provide thermal refuge, protective cover, resting habitat, and provide spawning areas (generally in pool tails). Large woody debris is an important source of cover and habitat for fish in streams and influences stream channel formation, pool formation, and sediment transport and deposition (Bragg et al. 2000; Fausch and Northcote 1992; Sullivan et al. 1987; MacDonald et al. 1991; Quigley and Arbelbide 1997). Stream margins are also very important to fish because those areas often provide shallow, low-flow conditions, may have a slow mixing rate with mainstem waters, and may be a site where cooler subsurface flow is introduced. Juvenile salmon and steelhead, particularly recently emerged fry, often use low-flow areas along stream margins. Wild Chinook salmon rear near stream margins until they reach about 60 mm in length (Bottom et al. 2005; Fresh et al. 2005). As juveniles grow, they migrate away from stream margins and occupy habitats with progressively higher flow velocities. Nonetheless, stream margins continue to be used by larger salmon and steelhead for a variety of reasons, including nocturnal resting, summer and winter thermal refuge, predator avoidance, and flow refuge.

The programmatic activities may impact instream habitat by altering pool quantity and quality, affecting the quantity and quality of LWD, and altering stream margin habitat. Large amounts of sediment can fill pools and reduce the number and depth of pools in an area (Quigley and Arbelbide 1997). As described in Section 2.5.3, implementation of the programmatic activities is not expected to result in sediment delivery to streams in sufficient quantities to fill in pools or increase cobble embeddedness to a degree that impairs the aquatic ecosystem.

As described in Section 2.5.5, removal of live vegetation that can ultimately become LWD will be minimized and will be dispersed throughout the action area. Removal of instream LWD for the protection of infrastructure is not expected to occur very often. Furthermore, a fisheries biologist will be onsite to ensure only the minimum amount of LWD is removed. Infrastructure protection can often be provided by only removing a portion of the LWD complex. Dead trees are a major source of LWD to streams. Removal of dead trees (standing or that have already

fallen) for firewood is generally prohibited in RCAs; however, exceptions to this general rule occur where there is a road in an RCA. In these areas, fuelwood may be collected on the upslope side of the road.

To determine the potential risk of fuelwood collection to LWD recruitment, the PNF determined the number of acres that occurred within one site potential tree height (SPTH) of streams (both intermittent and perennial, as mapped in the high-resolution national hydrography dataset). The PNF used a buffer equivalent to one SPTH in their analysis based on information from McDade et al. (1990) and Forest Ecosystem Management Assessment Team (FEMAT 1993), which suggested that buffer widths of one SPTH retained most of the LWD functions. To calculate the acres available for potential fuelwood collection, the PNF assumed that roads within the RCA were immediately adjacent to the stream. This assumption maximized the estimated area upslope of a road, yet still within one SPTH of a stream. The calculated percent of RCA acres (within one SPTH of streams) where collection of fuelwood can occur ranged from less than 0.1 percent to 1.2 percent of the total RCA acres (within one SPTH of stream) in a watershed. While dead trees are often a major source of LWD in a stream, collection of fuelwood is limited to a very small fraction of the overall action area. Considering this, and considering that dead trees on the upslope side of roads are unlikely to become instream LWD, fuelwood collection is not expected to lead to a reduction in LWD recruitment.

As described in Section 2.5.6, riprap placement is limited to culvert installation/replacement along non-fish-bearing streams, repair/realignment of flood-damaged roads, streambank stabilization along roads and select motorized trails, streambank stabilization along trails, and along culvert and bridge abutments. Many of these actions will occur along areas that have already been disturbed, and most projects are expected to be of minor scope. Exceptions to this general rule of thumb are projects that are designed to repair extensively damaged roads or select motorized trails. These activities may involve armoring up to 500 linear feet of streambank, of which 100 linear feet may be below the OHWM. In these situations, bank stabilization is likely to negatively affect channel conditions and morphology at the project site. The PNF is proposing to allow up to four extreme road maintenance projects each year in the action area.

2.5.8 Streamflow Alterations

The proposed action has the potential to alter streamflow through withdrawing water for fire suppression and road maintenance activities, dewatering instream project areas, and removal of forest cover.

Withdrawing water from small streams during times of drought can reduce flows, potentially impacting redds in shallower habitat or confining fish into diminished habitat. Water drafting occurs most frequently during late summer when road grading and fires are more prevalent. Water withdrawals for road maintenance or fire suppression purposes are expected to be infrequent and are expected to remove only a small portion of the total volume of water at any given time. For example, most water tenders have a capacity of between 1,000 and 4,000 gallons and pump at a flow rate of between 200 and 300 gallons per minute (0.45 – 0.67 cubic feet per second). Effects of temporary flow reductions will be minimized by: (1) Not drafting from streams with low flows to avoid stream dewatering and stranding of fish; (2) using only pre-

identified locations within streams that support ESA-listed fish species to avoid spawning and key rearing areas; (3) utilizing deeper and faster-flowing streams and pools for pump intakes when available; and (4) taking care to not dewater streams. Dewatering of project areas will result in fully or partially dewatering a small area of stream. Construction projects requiring work area isolation and dewatering are expected to be completed within a week or less and only the smallest area necessary for completing the work will be dewatered. Impacts from water drafting and work area dewatering will be temporary (i.e., water will not be continually removed from the stream), infrequently implemented, and limited to a small area of the stream.

The hydrologic characteristics of a watershed may be altered by removing forest cover and by increasing the drainage network. 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. The disturbance history WCI takes into account the ECA of a watershed. The ECA is a measure of canopy opening, from management activities, roads, and wildfire that acts as an indicator of change in the hydrologic regime in a watershed. Watersheds with an ECA of less than 15 percent and disturbances not concentrated in landslide prone or riparian areas are considered to be FA. In considering the effects of forest cover removal on peak flow and effects on those peak flow increases on stream channels and fish habitat, prior studies have identified key points, including the following:

- Increases in flow are proportional to increased area harvested (Bosch and Hewlett 1982; Keppler and Xiemer 1990; Grant et al. 2008).
- Peak flow increases of 10 percent represent the lower limit of detection (Grant et al. 2008).
- For small watersheds less than about 2,500 acres, changes in peak flows generally become detectable for transient snow zone watershed when >15 percent of the watershed is harvested (Grant et al. 2008).
- As a general guideline for third to fifth order streams, a <15 percent ECA is low risk for changes in peak flows (NMFS 1996; USFS 2003a).

Fireline construction, fire suppression (reopening closed roads and conducting backburns), prescribed fire, timber harvest (including construction of up to ½ mile of temporary road), and pre-commercial thinning will remove vegetation from the landscape. However, these activities are not expected to substantially alter the ECA. Road-reconstruction for fire suppression will not affect ECA because roadbeds that are proposed for reconstruction already exist on the landscape and are part of the baseline conditions. Fire intensities associated with prescribed fire and burnout operations will be minimized as much as possible and as such are not expected to alter more than 20 percent of the canopy within the impacted unit. This impact would not measurably change the ECA of a watershed (USFS 1974). Incremental increases in ECA may occur from timber harvest and its associated temporary road construction; however, the projects will be small in scale (i.e., the maximum allowable acres that may be harvested is 250, which represents 1 or 2 percent of the total subwatershed area) and under no circumstances will the watershed

ECA be allowed to exceed 15 percent ECA as a result of timber harvest activities. Considering the small-scale nature of potential harvest activities coupled with the requirement to ensure ECA in the 6th level HUC remains below 15 percent, measurable changes in the hydrologic character of the watershed are unlikely to occur.

Similarly, the drainage network within any given watershed is not expected to change substantially. Skid trails and temporary roads (i.e., limited to $\leq \frac{1}{2}$ mile per timber sale) used for vegetation treatments may incrementally increase the drainage network and channelize runoff. However, this increase will only be temporary as skid trails and temporary roads are required to be decommissioned after their use. Because ECA will not increase to above 15 percent and because drainage network increases will be small and temporary, the peak and baseflow characteristics of a watershed will not be altered to any detectable degree.

In summary, incremental increases in the ECA within any given 6th level HUC may occur; however, the ECA will not exceed 15 percent, which is generally interpreted to be a threshold indicating measurable changes in the hydrological regime. Even when coupled with potential small, temporary increases in the drainage network, these impacts are not expected to result in any discernible change to the hydrologic regime within any subwatershed.

2.5.9 Reduced Forage

The proposed action has the potential to reduce forage available to salmonids as a result of dewatering of work areas, placement of riprap along the stream margins, delivering sediments to surface water, chemical contamination from accidental spills or mechanical equipment leakage, and application of herbicides.

Invertebrates can be killed by elevated suspended sediment, dewatering, or by contaminants that enter the water in sufficient concentrations. These pathways of effect, including measures to minimize their impact on the environment are discussed in the Turbidity and Sediment Deposition, Chemical Contamination, and Streamflow Alterations sections of this Opinion. The PDFs to minimize the impacts of water withdrawal (e.g., limit the size of dewatered areas, withdraw water from larger streams where there is no risk of dewatering the stream, etc.) and elevated suspended sediment (e.g., implement erosion control BMPs, conduct work during the low-water work window, etc.) will minimize impacts on aquatic invertebrates. Minor spills of fuel or lubricants can kill aquatic invertebrates, as many species are highly sensitive to these substances. Implementation of PDFs to contain hazardous material and prevent contaminants from heavy equipment entering the stream will effectively minimize the risk of any accidental spills in concentrations sufficient to kill aquatic invertebrates. The PDFs for herbicide application will minimize the risk for accidental spills and will reduce the risk of herbicides entering streams through spray drift, groundwater, and overland flow. While application methods will minimize the potential for herbicides to enter streams, it is still possible that some localized contamination may occur, and there may be localized impacts to aquatic communities.

Any reductions in invertebrates in these localized areas of dewatered stream segments or stream segments impacted by herbicides may result in a temporary loss of forage for salmonids;

however, recolonization by invertebrates from both upstream and downstream areas is expected to happen relatively quickly.

2.5.10 Summary of Effects to ESA-listed Species

The purpose of the proposed programmatic activities is for the PNF to effectively manage NFS lands within their administrative boundaries. Actions performed under these programmatic activity categories by the PNF and authorized entities will be implemented as proposed, with full adherence to the PDFs. Given this, the potential for adverse effects to ESA-listed species are generally expected to be minimal. Only the activities requiring fish handling, construction near or within streams, armoring of streambanks, aerial withdrawal of water, and herbicide application are anticipated to have reasonable expectation of harassing, harming, or killing juvenile fish. These effects are briefly summarized below and are considered together when scaling the potential for adverse effects at the individual level up to the population level.

Fish handling will be performed during routine surveys and as part of work area isolation. Adult fish will not be handled; however, juvenile Chinook salmon and steelhead will be handled. Even with implementation of BMPs to reduce adverse effects (e.g., following NMFS electrofishing guidelines, using barbless hooks, etc.), juvenile fish are likely to be injured or killed as a result of salvage and survey activities. For purposes of our evaluation, we have assumed that all injured fish will eventually die. Table 19 summarizes the anticipated loss of juvenile fish due to handling.

Extreme road repair and streambank stabilization projects involving instream work are expected to generate turbidity plumes of sufficient magnitude and duration for juvenile fish to experience biologically meaningful behavioral changes or ill effects (e.g., temporary displacement from preferred habitat, gill flaring, and/or feeding changes). Turbidity plumes associated with instream work (e.g., repair of roads damaged by floods or avalanches, culvert cleaning, stream crossing replacement) are expected to be short-lived (lasting only a matter of minutes to hours) and localized (e.g., will dissipate to levels no longer harmful within 600 feet downstream). Adult fish will not be meaningfully impacted by turbidity pulses because instream work will typically be performed during the appropriate work window. If work needs to be conducted outside of the appropriate work window, precautions will be taken to minimize impacts to adults. Furthermore, because they are capable of readily swimming to other nearby habitat, adults are expected to easily escape undesirable turbidity plumes. Redds are also not expected to be negatively impacted. If instream work needs to be performed outside of the instream work windows, the PNF will perform spawning surveys. If redds are observed within 600 feet of the project area, the work will not proceed without approval from the Level 1 Team. The purpose of this approval is to identify the risk of adverse effects to redds, and to identify additional mitigations that could be implemented to eliminate or reduce the risk for adverse effects such that the project may proceed under this consultation. Projects that have the potential for suspended sediment to settle on a constructed redd and cause the death of incubating embryos are not authorized to occur under this programmatic consultation.

Placement of riprap or other material in a wetted channel with heavy equipment is reasonably certain to kill or injure fish. Adult fish will not be injured or killed by placing riprap in stream

channels because they are capable of and likely to avoid project activities by swimming to other habitat either upstream or downstream of the disturbance. Juvenile fish, on the other hand, may seek cover along stream margins within the wetted project area rather than fleeing upstream or downstream. Based on the assumptions described in section 2.5.2, placement of riprap in live water in occupied habitat may result in the loss of approximately 30 juvenile Chinook and 20 juvenile steelhead annually (Table 19).

Table 19. Estimated loss of juvenile Chinook salmon and steelhead as a result of implementing the proposed programmatic actions on the Payette National Forest.

Purpose	Methodology	# of Projects	Chinook Salmon (# mortalities)	Steelhead (# mortalities)	Loss Timeframe
Fish Salvage	Electrofishing	4	4	4	Annual
Fish Surveys	Electrofishing	30	1	12	Annual
	Seining	1	4	4	Once every 3 years
	Hook and Line	4	0	2	Annual
Riprap Placement for Stream Crossing Protection	Heavy Equipment in Live Water	10	30	20	Annual

Artificially armoring up to 4,000 linear feet of streambank will lock these sections of streambank in place for the foreseeable future, preventing the natural expression of geomorphic processes (i.e., channel migration, pool formation/maintenance and LWD recruitment) that are essential for healthy fish habitat over time. Riprap placement can be particularly harmful to juvenile salmonids (WDFW et al. 2002) because it largely simplifies habitats that juvenile fish rely upon. Although adherence to all of the PDFs incorporated into the proposed action should aid in minimizing impacts to riparian areas, long-term adverse impacts to fish associated with streambank armoring will still occur in small, localized areas scattered throughout the action area.

Aerial withdrawal of water is reasonably certain to harass juvenile fish, as well as adult Chinook salmon, especially if the activity is repeated multiple times at the same location in a relatively short period of time. The proposed mitigations (e.g., identification of no-dip streams and READs will direct crews to less sensitive areas) adequately minimize the risk of death; and the greatest effect is likely to be short-term behavioral modifications. Both juvenile and adult fish that are exposed to aerial dipping are expected to return to normal behavior after the disturbance mechanism is no longer present.

Herbicide application is reasonably certain to result in chemical contamination of surface water. However, herbicide applications will not occur over large contiguous areas, and most of the action area will not be subjected to spraying in any given year. This will limit the extent of potential contamination. Furthermore, implementation of the PDFs, are expected to minimize the amount of herbicides that reach surface water. The anticipated EECs are expected to be well below levels that will kill fish; however, the types of chemicals used are ones that can be capable of causing harmful sublethal effects. There is substantial uncertainty regarding the sublethal toxicity of active ingredients, surfactants, and mixtures. Considering this uncertainty, along with the uncertainty about the degree to which environmental stressors exacerbate toxicity, we believe

it is reasonably certain that individual or smaller groups of fish could be exposed to herbicides in sufficient concentrations to cause sublethal effects.

It is impossible to predict with any certainty when and where the proposed activities described above may occur. Actions completed each year are expected to be spread across the action area and will vary from year to year. Assuming the PNF implements the maximum allowable extreme road maintenance and stream crossing structure protection projects as well as fully implements the electrofishing survey activities, we have estimated that a total of 39 juvenile Chinook salmon and 42 juvenile steelhead could be killed once every three years. Up to 34 juvenile Chinook salmon and 38 juvenile steelhead may be killed annually, when seining is not implemented. We do not anticipate fish to be killed through any other pathway, and the vast majority of fish experiencing sublethal effects are expected to recover and resume normal activities once the disturbance subsides.

Given the size of the action area, it is unlikely that all of the potential loss associated with implementation of the proposed action will be concentrated within a single population for each species. Nonetheless, our analysis assumes that these effects will be concentrated within a single population for each species. Assuming a smolt-to-adult return rate of 1.2 and 2.8 percent for natural-origin fish (Columbia River DART 2020), this effect would reduce annual Chinook salmon and steelhead returns by approximately 0.5 and 1.2 individuals, respectively. The death of these fish, even when coupled with the sublethal effects that may result from other exposure pathways, are not expected to reduce the current abundance or productivity of any of the SRS Chinook salmon or SRB steelhead populations that are present in the action area. Because the likely effects of any projects implemented under these programmatic activities will not individually or collectively adversely affect the VSP characteristics of any salmon or steelhead population, the projects also will not have any measurable negative effect on species-level abundance, productivity, or ability to recover.

2.5.11 Summary of Effects to Designated Critical Habitat

Designated critical habitat for SRS Chinook salmon and SRB steelhead occurs throughout the action area. The 5th field HUCs within the action area that contain designated critical habitat are identified in Table 8. While the extent of designated critical habitat throughout the action area varies by species, both Chinook salmon and steelhead have similar freshwater habitat requirements. As such, the following designated critical habitat analysis is applicable to both species.

The PBFs necessary to support freshwater spawning, rearing, and migration are discussed in Section 2.2.2. Many of the impacts to Chinook salmon and steelhead described in Sections 2.5.3 through 2.5.10 are a result of impacts to critical habitat. For this reason, those previous sections are incorporated by reference here, with this section providing a brief summary of how designated critical habitat may be affected and our overall conclusions about those potential effects. The critical habitat PBFs that could potentially be affected by the proposed action include water quality, temperature, water quantity, water velocity, forage, riparian vegetation, cover/shelter, and spawning substrate. Each of these effect pathways is briefly summarized below. All of the potential effects are then taken together to evaluate how implementation of the

programmatic activities could impact the conservation value of critical habitat within the action area.

Water Quality. Implementation of projects under the programmatic activities will result in ground disturbance that can contribute sediment to, or re-suspend sediment within, streams. As described in Section 2.5.3, turbidity plumes associated with suspended materials are expected to temporarily degrade local areas used for migration and rearing. These negative impacts will be localized and are expected to last no more than a few days.

Water quality may also be impacted by herbicide use within the action area. As described in Section 2.5.4, concentrations of herbicides in surface waters will depend on the rate of application, application methodology, treatment area location, environmental factors leading to transport of the herbicide away from the treatment area, and size of receiving stream. Effects associated with herbicide contamination are likely to be short-term with attenuation, dilution, and chemical degradation. Furthermore, herbicide applications will not occur over large contiguous areas, and most of the action area will not be subjected to spraying in any given year.

Considering that any potential impacts to water quality will occur in small, localized areas and will be temporary in nature, the conservation value of the water quality PBF will not be diminished in the action area.

Temperature. The potential impacts to stream temperatures are described in Section 2.5.5. Overall, incremental reductions in stream shading may occur in localized areas as a result of implementing these activities. These localized areas are expected to be small and dispersed throughout the action area. Therefore, such limited vegetation reductions are not anticipated to result in measurable changes in stream temperature.

Water Quantity. Temporary reductions in water quantity may occur as a result of water withdrawal. As described in Section 2.5.8, the effects of temporary flow reductions will be minimized because only small amounts of water will be withdrawn and under no circumstances will streams be dewatered. Ultimately, these temporary reductions will not meaningfully impact water quantity at any timescale. As such, the conservation value of the water quality PBF in the action area is not expected to be diminished.

Water Velocity. Extreme road maintenance activities involving streambank stabilization or stream crossing protection projects may require work area isolation and dewatering. Placement of cofferdam structures in streams will concentrate flow into a narrower portion of the channel. The resultant increase in water velocity is expected to be very small and is not expected to impair upstream fish migration. These minor increases will be temporary and are not expected to last longer than a week.

Forage. As described in Section 2.5.9, dewatering streams and herbicide contamination have the potential to kill aquatic invertebrates. Any reductions in invertebrates in these localized areas of dewatered stream segments or stream segments impacted by herbicides may result in a temporary loss of forage for salmonids; however, recolonization by invertebrates from both upstream and downstream areas is expected to happen relatively quickly (i.e., within one to two

seasons). Because these reductions will be limited to small areas, scattered throughout the action area, the conservation value of the forage PBF will not be diminished.

Riparian Vegetation and Cover/Shelter. These two PBFs are discussed together primarily due to potential for armoring up to 500 linear feet of streambank at four locations across the action area annually with rock riprap. Armoring banks destroy desirable habitat features and prevent the formation of desirable habitat features such as undercut banks, riparian vegetation, scour pools, etc. Armoring banks can also eliminate shallow, low flow stream margin areas that offer important refuge for juvenile fish. These types of extreme maintenance events will occur when roads or motorized trails have been destroyed by floods, avalanches, or that have been eroded away over time. These locations will most often be where roads currently exist adjacent to the stream and offer little desirable habitat features to begin with. However, we anticipate some projects will be in areas where riparian buffers previously existed before a major event shifted the stream channel. In addition, up to 2,000 linear feet of streambank may be armored to protect stream crossing structures each year; however, these areas are expected to already be degraded because the purpose of the activity is to repair failing abutment protections.

Additional actions may be performed under the various programmatic activities and may impact riparian vegetation and shelter/cover PBFs (refer to Sections 2.5.6 and 2.5.7 for more discussion). The limited scope of these actions is expected to keep most effects within the actual project footprints, resulting in only localized effects to riparian vegetation. Implementation of the PDFs will minimize impacts. As described above, long-term alterations and adverse effects to riparian habitat and instream cover/shelter are expected where riprap is placed in areas where riprap did not previously exist (e.g., channel realignment post avalanche or flooding). Large wood may be removed from streams, causing local degradation of the cover PBF; however, this is expected to occur in very limited circumstances, and only after approval from the Level 1 Team. The small size and number of projects expected to affect riparian vegetation and their wide geographic distribution prevents chronic large scale effects to riparian vegetation from occurring. Road decommissioning, road and trail rerouting, and weed treatment activities in RCAs are expected to ultimately improve riparian conditions in the future through decompaction of soils and establishment of native vegetation. Similarly, removal of large wood will not occur very often and will only be allowed in limited circumstances. For these reasons, the conservation value of the riparian vegetation and cover/shelter PBFs within the action area is not expected to be meaningfully degraded.

Spawning Substrate. Implementation of projects under the programmatic activities may introduce sediment into streams that ultimately will be deposited downstream. Deposition of sediment can negatively impact spawning substrates by filling interstitial spaces. As described in Section 2.5.3, we recognize the programmatic activities will occur in perpetuity and that some activities (i.e., road and trail maintenance) may increase in frequency over time in response to increasing use. As a result of the increasing future use and maintenance of routes, sediment delivery is expected to slightly increase. The potential effects to critical habitat are only expected to be moderate because: (1) The amount of use is not expected to drastically change in the future and past levels have produced medium levels of sediment; (2) we do not expect the frequency or magnitude of mass failure or washout events to increase significantly; (3) the PNF will maintain routes which will cause sediment discharges in the temporary timeframe, but will function in the short- to long-term to lower sediment contributions.

Ultimately, sediment introduced into and subsequently deposited in action area streams as a result of the proposed action is not expected to measurably affect spawning substrates. This is primarily because: (1) Sediment generated from all activities will not be delivered to streams simultaneously; rather, sediment will be delivered over segregated periods of time; (2) sediment delivery (and its associated turbidity plumes) will be sporadic in nature and will be short-lived; (3) sources of sediment will be dispersed along the stream network so not all of the sediment will end up in a single location within the stream channel; and (4) PDFs will be implemented to eliminate or reduce erosion or sediment delivery. As such, the conservation value of the spawning substrates PBF in the action area is not expected to be diminished.

Summary. Projects implemented under the programmatic activities that are most likely to measurably degrade designated critical habitat PBFs include extreme road maintenance and herbicide application. The PBFs most likely to be measurably impacted include water quality, riparian vegetation, and cover/shelter. Turbidity and herbicide impacts to the water quality PBF will be temporary and localized in small areas. Armoring of streambanks will impact the riparian vegetation and cover/shelter PBFs and will be limited to localized areas, many of which are already in a degraded state due to the presence of road or trail infrastructure. Implementation of PDFs, in particular limiting herbicide use within 100 feet of live water will minimize the impacts to these PBFs.

As previously mentioned, it is impossible to predict with any certainty when and where projects will occur. Projects completed each year are expected to be spread across the action area and will vary from year to year. It is unlikely that all of the potential impacts to designated critical habitat will be concentrated within a single Section 7 watershed; however, even if they were, the extent of the potentially impacted areas is a very small fraction of the overall watershed. Considering their limited scope and because implementation of the PDFs will minimize impacts to the greatest extent possible, NMFS concludes that the function and conservation role of the water quality, riparian vegetation, and cover/shelter PBFs within the action area will not be appreciably diminished. By extension, the function and conservation role of the PBFs at the critical habitat designation scale will not be appreciably diminished.

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.

The vast majority of the action areas is managed by the PNF, with substantial amounts of land encompassed in wilderness areas that have little to no human influence. Other ownership/management in the action area includes scattered BLM, state, Boise National Forest, and privately-owned lands. The privately-owned land is concentrated in the LSR subbasin and along the lower Salmon River. New Meadows is the largest town, with a population around 470 based on a 2014 census (<https://www.idaho.gov/cities/>); however, its population has declined almost 11 percent since 2000. In other watersheds, private land is either concentrated in small rural communities (e.g., Yellow Pine, Warren, etc.) or sporadically distributed across the

landscape (e.g., patented mines). Urbanization in the action area is not expected to change dramatically in the foreseeable future.

Non-federal land use in the action area includes agriculture, timber harvest, road construction/maintenance, development, recreation, mining, and grazing. These activities will likely continue to influence water quality, quantity, and habitat conditions for anadromous fish in the action area. Some water contamination likely occurs as a result of the use of chemical fertilizers on agricultural land and use of pesticides on private or state lands and along roadways. Riparian corridors have been negatively impacted by roads and these impacts will continue in the future as work is performed to protect infrastructure. Maintenance and repair of roads managed by non-federal entities will continue to contribute sediment and prevent or delay channel and floodplain restoration where roads are near streams.

The impacts of these activities on the current condition of ESA-listed species and designated critical habitats within the action area was described in the Status of the Species, Status of Critical Habitat, and Environmental Baseline sections of this Opinion. Current levels of these uses are likely to continue into the future and are unlikely to be substantially more severe than they currently are.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline vs. cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the rangewide status of the species and critical habitat (Section 2.2).

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 diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.7.1 Species

As described in Section 2.2, individuals belonging to many different populations within the SRS Chinook salmon ESU and Snake River Basin steelhead DPS use the action area to fully complete the migration, spawning and rearing parts of their life cycle.

The SRS Chinook salmon ESU is currently at a high risk of extinction. All but one of its component populations occupying the action area are also at a high risk of extinction. Since the last status review, there has been a substantial downturn in adult abundance. This downturn is

thought to be driven primarily by marine environmental conditions and a decline in ocean productivity. Very large improvements in abundance will be needed to bridge the gap between the current status and proposed status for many of the populations to support recovery of the SRS Chinook salmon ESU.

The SRB steelhead DPS is not currently meeting its VSP criteria and is at a moderate risk of extinction. All of the component populations occupying the action area are also at a moderate risk of extinction. Similar to SRS Chinook salmon, adult steelhead abundance has taken a substantial downturn since the last status review. Large improvements in abundance and productivity are needed to support recovery of this species.

Critical habitat overall for both of the species across the designation, as well as within the action area ranges from excellent in wilderness areas to degraded in areas of human activity. Historic mining pollution, sediment delivery from historic logging practices, and degraded riparian conditions from past grazing were major factors in the decline of anadromous fish populations in the action area. Habitat-related limiting factors for recovery of populations within the action area include degraded riparian conditions and instream habitat complexity, excess sediment, passage barriers, low summer flows, and high water temperatures. Climate change is likely to exacerbate several of the ongoing habitat issues, in particular, increased summer temperatures and decreased summer flows.

The regional tributary habitat strategy set forth in the final recovery plans (NMFS 2017) is to protect, conserve, and restore natural ecological processes at the watershed scale that support population viability. Ongoing actions to support recovery of SRS Chinook salmon and SRB steelhead include, but are not limited to, conserving existing high quality habitat and restoring degraded (and maintaining properly functioning) upland processes to minimize unnatural rates of erosion and runoff. Natal habitat recovery strategies and actions for populations within the action area include: (1) Reduce road-related impacts (e.g., sediment delivery) on streams; (2) inventory stream crossings and replace any that are barriers to passage; (3) reduce floodplain and channel encroachment; and (4) restore floodplain function.

The environmental baseline incorporates effects of restoration actions implemented to date. It also reflects impacts that are and have occurred as a result of travel management, and implementation of all the programmatic activities that are the subject of this consultation. In addition, impacts from existing state and private actions are reflected in the environmental baseline. Cumulative effects from state and private actions in the action area are expected to continue into the future and are unlikely to be substantially more severe than they currently are.

The proposed Federal action allows the PNF to implement the following programmatic activities: (1) Road maintenance; (2) Trails, Recreation, and Administrative Site Operation and Maintenance; (3) Fire Management; (4) Invasive Weed Management; (5) Timber Harvest and Precommercial Thinning; (6) Miscellaneous Forest Products; and (7) Aquatic and Riparian Ecosystem Monitoring. In response to population growth in nearby urban centers, the use of trails, roads, and recreation sites on the PNF is expected to increase to a small degree in the future. Although the type of maintenance activities on roads, trails, and recreational facilities

will not change, there will likely be an increase in the frequency of routine maintenance due to the increased use.

Actions performed under these programmatic activity categories by the PNF and authorized entities will be implemented as proposed, with full adherence to the PDFs. Given this, the potential for adverse effects to ESA-listed species are generally expected to be minimized. As described in the Effects of the Action section (Section 2.5), only the activities requiring fish handling, construction near or within streams, armoring of streambanks, aerial withdrawal of water, and herbicide application are reasonably expected to kill, injure, or otherwise harass ESA-listed fish. Effects from these activities will range from sublethal effects such as displacement of individuals from preferred habitat to death of juvenile individuals. Death of individuals is only expected to arise when fish are handled or when riprap is placed in the wetted channel of an occupied stream. Because only a few projects will be completed each year, only a small number of individuals are anticipated to be killed (i.e., an estimated 39 juvenile Chinook salmon and 42 juvenile steelhead).

Sublethal effects experienced by individual fish due to chemical contamination, turbidity plumes, or aerial water withdrawal are expected to last only for as long as the stressor is present, which in most cases will not be longer than a week. Armoring of streambanks will create an overall decrease in habitat function that will harm adult and juvenile fish by denying them normal use of the action area for reproduction, rearing, feeding, or migration. The vast majority of locations where streambank stabilization occurs are expected to be already degraded by previous rock placement (stream crossing structures), road encroachments, or shifting of stream channels due to avalanches or other environmental disturbances. Typically, damaged banks offer low quality rearing habitat. Placing riprap in these areas will have less pronounced impacts than riprap placements on native streambanks. In addition, the required mitigation of maintaining the pre-existing road prism characteristic will help minimize the potential for additional loss of habitat, although exceptions to this requirement may be granted by the Level 1 Team on a case-by-case basis. Although adherence to all of the PDFs incorporated into the proposed action should aid in minimizing impacts to riparian areas, long-term adverse impacts to fish associated with streambank armoring will still occur in small, localized areas scattered throughout the action area.

Effects to individual fish may potentially affect the attributes associated with a VSP (i.e., abundance, productivity, spatial structure, and genetic diversity that support the species' ability to maintain itself naturally at a level to survive environmental stochasticity). Activities will be spread across the entire action area, and it is unlikely all impacts will bear on a single population of either species in a given year. Even if we were to assume all impacts would bear upon a single population, the anticipated low level of effects to individual fish from implementation of the programmatic activities are not anticipated to result in tangible impacts to SRS Chinook salmon or SRB steelhead at the population level. This is due to the small number of fish that are expected to be killed (i.e., an estimated 39 juvenile Chinook salmon and 42 juvenile steelhead) or otherwise adversely affected in a year.

When considering the status of the species, and adding in the environmental baseline, and cumulative effects, implementation of the programmatic activities will not appreciably reduce the likelihood of survival and recovery of SRS Chinook salmon or SRB steelhead.

2.7.2 Critical Habitat

Critical habitat throughout much of the SRS Chinook salmon and SRB steelhead designations 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; dam construction, operation, and maintenance; road construction and maintenance; logging; mining; and urbanization.

The action area includes those watersheds within the PNF that support anadromous fish and/or critical habitat. The PNF manages the majority of the action area, and a large portion of this land is designated wilderness. Small parcels of private property are scattered throughout the action area, with the exception of a few rural communities. Timber harvest, road construction and maintenance, development, recreation, mining, and grazing are the predominant land uses. These activities will likely continue to influence water quality, quantity, and riparian and instream habitat conditions in the action area. The current ability of PBFs to support the species varies from excellent in wilderness areas to poor in areas of intensive human land use. Habitat-related limiting factors include degraded riparian conditions and instream habitat complexity, excess sediment, passage barriers, low summer flows, and high water temperatures (NMFS 2017).

The impacts of Federal and non-Federal land use activities on critical habitat are reflected in the environmental baseline section of this document. Current levels of these uses are likely to continue into the future and are unlikely to be substantially more severe than they currently are. It is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline versus cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline.

Because these programmatic activities have been implemented for many years, their impacts are reflected in the environmental baseline. Future recreation and use of roads, trails, and recreational facilities are expected to slowly increase over time. In response, we anticipate that regular maintenance of infrastructure supporting recreational uses may also increase in frequency. However, we do not anticipate the increased frequency of regular maintenance to lead to any additional effects beyond those included in this analysis.

The proposed action has the potential to adversely affect the water quality, riparian vegetation, and cover/shelter PBFs. Our analysis of effects to these PBFs are summarized in Section 2.5.11 and described more thoroughly in our analysis of effects to ESA-listed species (Sections 2.5.3, 2.5.4, 2.5.6, and 2.5.7). By implementing the programmatic activities as described, including strict adherence to the PDFs, effects to critical habitat PBFs are expected to be limited to small, localized areas scattered throughout the action area. Considering the limited scope of impacts relative to the action area, NMFS concludes that the function and conservation role of the water

quality, riparian vegetation, and cover/shelter PBFs within the action area will not be appreciably diminished.

When considering the status of the species, environmental baseline, effects of the action, and cumulative effects, NMFS concludes that the PNF's implementation of these seven programmatic activities will not appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of both species.

2.8 Conclusion

After reviewing the current status of the listed species, 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 SRS Chinook salmon and SRB steelhead, and it is not likely to result in the destruction or adverse modification of designated critical habitat for these two species.

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 results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. For this consultation, we interpret "harass" as to create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. 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

Capture of fish, implementation of road maintenance, aerial withdrawal of water and application of herbicides will take place within or adjacent to streams that are reasonably certain to be occupied by SRS Chinook salmon and SRB steelhead. As described below, implementation of these programmatic activities is reasonably certain to cause incidental take of one or more individuals of these two species. Juvenile life stages are most likely to be affected, although adults will sometimes also be present if exceptions to work windows are made. In some instances, NMFS was able to quantify the amount of take; however, where available information precluded our ability to quantify take, we used surrogates to describe the incidental take pursuant to 50 CFR 402.14 [I].

Capture of Fish. As described in the Fish Handling analysis (Section 2.5.1) NMFS was able to quantify the take associated with fish surveys and fish salvage efforts. Given the likely timing of project activities and implementation of PDFs, it is unlikely that adults or incubating embryos will be

impacted by these activities. However, juvenile fish are expected to be handled. NMFS anticipates the capture of at most, 132 salmon and 404 juvenile steelhead annually. Of the captured fish, NMFS anticipates that up to nine juvenile Chinook salmon and 22 juvenile steelhead may be killed in any given year. The amount of take of juvenile Chinook salmon and steelhead is summarized in Table 20 and the assumptions underlying our analysis are described in Section 2.5.1.

Table 20. Number of fish handled and amount of take expected to occur associated with programmatic activities on the Payette National Forest.

Purpose	Methodology	# of Projects	Chinook Salmon (juvenile)		Steelhead (juvenile)		Loss Timeframe
			Total # Handled	Total # Killed	Total # Handled	Total # Killed	
Fish Salvage	Electrofishing	4	32	4	20	4	Annual
Fish Surveys	Electrofishing	30	10	1	234	12	Annual
	Seining	1	100	4	100	4	Once every 3 years
	Hook and Line	4	0	0	50	2	Annual

Crushing of Fish Due to Riprap Placement in Wetted Channels. As described in Section 2.5.2, it is reasonable to conclude that juvenile salmon or steelhead may be crushed when heavy equipment is used to place riprap in the wetted channel of occupied habitat. Instream work will generally be performed during the in-water work window, minimizing the potential effect to redds or adults. However, exceptions may be granted by the Level 1 Team on a case-by-case basis. If adults are present, they are expected to readily flee the disturbance and will not be harmed. It is unlikely that redds will be present at the location where riprap will be placed; however, redd surveys will be performed and work will only be allowed if redds will not be adversely affected. In order to calculate an amount of take, we made a number of assumptions (Section 2.5.2), one of which was the conservative assumption that juvenile fish would not be able to successfully flee the areas where riprap is being placed. Based on these assumptions, NMFS estimated that up to 30 juvenile Chinook and 20 juvenile steelhead may be killed annually by placement of riprap in occupied habitat with heavy machinery.

Harm Due to Habitat-related Effects. Take caused by the habitat-related effects (turbidity pulses and streambank armoring) associated with road maintenance activities cannot be accurately quantified as a number of fish. The distribution and abundance of fish within the action area is dependent upon a number of environmental factors that vary over time and space. We cannot predict where road maintenance activities will occur, nor can we predict the number of fish that might be present in individual project areas. Furthermore, it is not possible to monitor the number of fish that may be displaced by turbidity plumes or that may be harmed by the loss of habitat. In these circumstances, NMFS can use the causal link established between the activity and the likely changes in habitat conditions affecting the listed species to describe the extent of take as a numerical level of habitat disturbance.

The best available indicators for the extent of take due to construction-related disturbance of streambank and channel areas are the total length of stream reach that will be modified by construction each year and the extent of turbidity plumes in the receiving water. These variables

are proportional to the amount of harm that the proposed action is likely to cause through long-term alteration of streambank and shallow-water habitat and through short-term degradation of water quality. The PNF is proposing to authorize up to four extreme road maintenance activities, and the most extensive action, replacement of damaged road prism, allows for a maximum of 500 linear feet of streambank protection, of which 100 feet may be below the OHWM. In addition, we estimated that up to ten stream crossing structure protection projects may occur each year. Each of these projects may armor up to 100 linear feet of streambank in order to protect culvert and bridge abutments. Therefore, the extent of take for construction-related disturbance of streambanks and shallow-water areas is 5,000 linear feet per year throughout the action area.

Elevated suspended sediment levels are expected to occur during and shortly following instream construction activities. Within 600 feet downstream of the project area, sediment levels are expected to rapidly peak and then steadily decrease in intensity. Effects will range from indicators of major physiological stress to moderate habitat degradation and impaired homing to minor physiological stress and increased rates of coughing and respiration. Effects are expected to decrease with the decreasing sediment intensity. Although we recognize the limitations of using turbidity as a surrogate for suspended sediment, it is a reasonable and cost effective measure that can be readily implemented in the field. Most of the time turbidity measurements take 30 seconds, can be done on site, and therefore allow for rapid adjustments in project activities if turbidity approaches unacceptable levels. For these reasons, we have chosen turbidity as a surrogate for incidental take from suspended sediment-related effects. Monitoring shall verify NTU values meet Idaho state water quality standards for NTUs (50 NTU instantaneous over background levels [IDAPA 58.01.02]) 600 feet downstream of the project. NMFS will consider the extent of take exceeded if turbidity plumes (characterized as having turbidity concentrations greater than 50 NTU above background) extend beyond 600 feet downstream of the project area or if the plumes fail to dissipate (within the 600 feet affected area) to concentrations less than 50 NTU above background within two hours following rewatering. Literature reviewed in Rowe et al. (2003) indicated that NTU levels below 50 generally elicit only behavioral responses from salmonids thereby making this a suitable interim surrogate for sublethal incidental take monitoring.

The take indicators described above function as effective reinitiation triggers because they can be calculated and monitored on an annual basis, and thus will serve as a regular check on the proposed action.

Harassment Due to Aerial Withdrawal of Water. Aerial withdrawal of water is reasonably certain to harass juvenile fish, as well as adult Chinook salmon, especially if the activity is repeated multiple times at the same location in a short period of time. We cannot predict where or when aerial dipping will occur, nor can we predict the number of fish that might be present at dipping locations. Furthermore, it is not possible to monitor the number of fish that may be displaced by aerial dipping. For these reasons, and because the scale of the consequence is related to the frequency of dipping, we have chosen the duration of dipping at a site occupied by ESA-listed fish as a surrogate for incidental take from aerial withdrawal of water. We have also considered the following two core PDFs in establishing the extent of take for this pathway:

(1) dipping is not allowed from no dip streams; and (2) READs are to direct helicopter pilots to areas where ESA-listed fish are not present. Although we recognize the PNF intends to prevent dipping from no dip streams, the proposed action acknowledges that dipping from these streams may occur in very limited circumstances. Past experiences demonstrate that dipping from these streams is sometimes necessary for protection of life or property. Considering that dipping from occupied habitat may occur, we have elected to tier the dipping duration based on the location of the dipping site. The incidental take associated with dipping for each individual fire is defined as follows:

- Dipping from no dip streams is authorized for up to 24-hours from the time at which it is determined that dipping at a no dip site is necessary for protection of life or property.
- Dipping from all other stream and rivers (excluding the Salmon and Snake Rivers), containing ESA-listed species is limited to a 48-hour period per fire.

Harm Due to Herbicide Application. Application of herbicides may lead to contamination of surface water, which could then harm individual fish. Herbicides applied by the PNF are not expected to reach streams in concentrations that kill fish; however, concentrations may be of sufficient magnitude to elicit short-term sublethal effects. Despite the use of best scientific and commercial data available, NMFS cannot quantify the specific amount of incidental take of individual fish. The amount of take from the proposed action depends on the circumstances at the specific times and locations that weed treatments will occur, such as environmental conditions that influence drift or runoff (e.g., rainfall, wind, humidity) and proximity of the treatment area to individual fish.

Similarly, it is difficult for NMFS to quantify the extent of take for the action as proposed. The action generally restricts use of herbicides near water to those formulations with the lowest known toxicity, and implementation of the PDFs identified in the proposed action will minimize the frequency and severity of incidental take that occurs. However, the PDFs do not completely eliminate incidental take since herbicides will be used in sites where they can reasonably be expected to reach waters where ESA-listed fish are present.

Because take is directly related to the amount of chemical reaching a stream, NMFS selected “chemically treated” or “applied” acres (pounds of herbicide active ingredient applied divided by the application rate (pounds of active ingredient per acre)) as a more informative measure of the amount of take that may occur. Chemicals are more likely to accidentally reach streams when applied close to water or over areas with shallow groundwater. We selected a 300-foot distance as it likely accounts for all treatments having potential to result in some level of contamination and it represents those areas where chemicals are most likely to harm listed fish. Consequently, the chemically-treated acreage (i.e., applied acres) within 300 feet of live water is used to describe the extent of incidental take in this ITS. There is no practical alternative to using proximity to water and treatment acreage as a surrogate measure of take without knowing ahead of time the precise locations where herbicides will be used, and without consideration of weather following herbicide application, along with site-specific features affecting herbicide transport and concentration in waterbodies.

Based on past practices, we estimate that future treatments within 300 feet of live water could reach approximately 100 acres per Section 7 watershed annually. This treatment level represents the extent of take authorized for this consultation. In the event the PNF treats more than the established limit in a given year, reinitiation of consultation will be required.

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 the species or destruction or adverse modification of critical habitat.

2.9.3 Reasonable and Prudent Measures

“Reasonable and prudent measures” are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02). NMFS believes the RPMs described below are necessary and appropriate to minimize the likelihood of incidental take of ESA-listed species due to implementation of the proposed action. The PNF and COE, where applicable, shall:

1. Minimize incidental take associated with fish capture.
2. Minimize incidental take associated with road maintenance activities.
3. Minimize incidental take associated with herbicide applications.
4. Ensure the completion of a comprehensive monitoring and reporting program for all projects carried out under the aquatic ecosystem monitoring, road maintenance, and invasive weed management programmatic activities.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the PNF, COE, or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The PNF and COE 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 PNF, COE, or any applicant does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The terms and conditions listed below implement RPM 1. The PNF and any authorized entities shall:
 - a. Follow all PDFs described for fish salvage and fish surveys in the BA and in Appendix A of this Opinion.

- b. Reduce the potential number of fish hazed, captured, handled, or electrofished during fish salvage operations by reducing streamflow and encouraging volitional movement away from the project area *prior* to fish salvage operations.
 - c. Follow all appropriate mitigations included in NMFS Electrofishing Guidelines (2000 or any published revisions to the guidelines).
 - d. Utilize a three-pass method to ensure the greatest level of fish salvage unless previously approved by the appropriate Level 1 Team to perform more or fewer passes.
 - e. Minimize handling of fish to the maximum extent practicable, and release all captured fish in a safe location as quickly as possible.
 - f. Maintain a record of the number of steelhead/rainbow trout captured in a season. Cease hook and line sampling once the annual cumulative hook and line capture of steelhead/rainbow trout reaches 50 individuals.
2. The terms and conditions listed below implement RPM 2.
- a. The PNF and the COE as applicable shall ensure all PDFs described in the BA and in Appendix A of this Opinion are followed. This includes obtaining Level 1 Team approval whenever it is required.
 - b. The PNF shall annually review the allowable maintenance activities and PDFs with all entities that will perform maintenance activities on NFS roads. The allowable maintenance activities and PDFs shall be incorporated as required elements in the operation and maintenance plans accompanying the easements, special use permits, or other authorizations.
 - c. The PNF and the COE as applicable shall perform the following activities for all road repair projects involving bank stabilization along streams supporting ESA-listed salmon and steelhead:
 - i. Review engineering designs of all repair projects on roads maintained by the PNF or another authorized entity (e.g., counties, highway districts, private land owners, etc.) and ensure that:
 - 1. The amount of riprap used in streambank stabilization projects is minimized to the extent practicable.
 - 2. Projects incorporate bioengineering into the design whenever it is practicable to do so.
 - 3. The base of the road prism fill slope does not extend farther into the channel than what previously existed unless otherwise

permitted by the Level 1 Team. Aerial photography as well as representative road prism characteristics above and below the project area may be used to determine the extent of the previous road prism.

- ii. Prior to implementation of bank armoring, ensure the allowable extent of stabilization and placement of fill material has been appropriately marked on the ground. Conduct site inspections during project implementation to ensure the repairs are being constructed as designed. Conduct a site inspection at the end of construction to ensure the project was implemented as designed. Immediately notify the Level 1 Team for discussion should construction design inconsistencies be determined.
 - d. If turbidity levels exceed 50 NTU above background for more the three consecutive samples at a downstream location (see Term and Condition 5.d for monitoring requirements), then work will be halted to allow time for the turbidity plume to dissipate.
3. The terms and conditions listed below implement RPM 3. The PNF and any authorized entities shall:
- a. Follow all PDFs relevant to aerial dipping described in the BA and in Appendix A of this Opinion.
 - b. Ensure READs and helicopter pilots are adequately informed of no dip streams/lakes.
 - c. Ensure no dip information is readily available and clearly communicated to staff responsible for overseeing, coordinating, and implementing initial attack.
 - d. Ensure READs are able to readily identify streams, beyond those identified as no dip, that are known to be occupied by ESA-listed fish in order to adequately re-locate dipping areas in unoccupied habitat.
 - e. The PNF should initiate emergency consultation procedures if dipping from no dip streams/lakes for the expressed purposes of protection of life and property is necessary for more than 24 hours or if dipping from other occupied streams is necessary for more than 48 hours.
4. The terms and conditions listed below implement RPM 4. The PNF and any entities authorized to apply herbicides on NFS lands shall:
- a. Follow all applicable PDFs described in the BA and in Appendix A of this Opinion.

- b. Develop herbicide spill plans that meet requirements of USFS directives (FSH 2109.14, Chapter 60). The PNF will review the plans with all applicators, including permittees, prior to herbicide applications. Maintain an appropriate spill cleanup kit on-site during all applications.
- c. Ensure that herbicides and surfactants selected for use within 300 feet of water have the lowest toxicological profile to anadromous fish while still being able to meet desired treatment objectives.
- d. The PNF invasive weeds manager, or other qualified staff, shall review all applicants' pesticide use proposals for consistency with the proposed action and this Opinion's terms and conditions prior to authorizing third party plant treatments.
- e. Ensure all chemical storage, chemical mixing, transportation, and post-application equipment cleaning is completed in such a manner as to prevent the potential contamination of any riparian area, perennial or intermittent waterway, ephemeral waterway, hydrologically connected road ditch, or wetland.
- f. The PNF will notify the Level 1 Team when adding new adjuvant(s) to its weed treatment program. NMFS will evaluate the products to ensure effects are likely to be consistent with the analysis conducted for this Opinion.
- g. The PNF shall obtain Level 1 Team approval to use any new EUP. At a minimum, the PNF will provide the Level 1 Team with the name, active ingredient, and EPA registration number of the EUPs. The Level 1 Team shall agree that the new EUPs are substantially similar to formulations identified in this Opinion and that potential effects are likely to be consistent with the analysis in this Opinion. Should a concern be raised regarding a EUPs potential to affect ESA-listed fishes and critical habitats, the Level 1 Team member raising the concern will provide documentation, research or best available science supporting why the EUP should not be used. All parties shall work to conclude discussions in a timely manner so as not to delay treatments.
- h. The PNF shall present annual weed treatment proposals by April 1, prior to applications. The proposals will include the methods (for chemical treatments, include the EUP name, active ingredient, and EPA registration number), treatment objectives, locations, projected treatment acres within 300 feet of anadromous waters, and any special mitigation measures Forest specialists determine necessary.
 - i. In the unlikely event the PNF anticipates treatments may approach extent of take limits, the PNF will complete a mid-season calculation of chemically applied acres within 300 feet of anadromous waters and take appropriate measures to ensure extent of take limits are not exceeded prior

to the end of the season, including potential curtailment of proposed treatments.

- i. Maintain daily application logs that contain the following information:
 - i. The applied acres within 300 feet of live water within any of the 5th level HUCs identified in Table 8.
 - ii. The EUP names, including adjuvants and surfactants, used.
 - iii. The herbicide application rate and method of application.
 - iv. Wind speed and air temperature at the time of application.
5. The following terms and conditions implement RPM 4:
 - a. The PNF, and any entities authorized to implement these actions, shall conduct monitoring to ensure the extent of take is not exceeded. Information gathered as part of this monitoring shall include: (1) the number of Chinook salmon and steelhead captured annually; (2) the number and extent of streambank stabilization projects implemented annually, including a summary of the linear extent of riprap placement below OHWM and the degree to which it extended into the channel from the OHWM; (3) a summary of the turbidity measurements (location, date and time the readings were taken, and the measured NTUs); and (4) a summary of herbicide applications within 300 feet of live water. The PNF is responsible for including monitoring information collected by authorized entities into their annual report(s).
 - b. The PNF shall report the number of juvenile Chinook salmon and steelhead captured, injured, and killed each year. This report shall be submitted to NMFS by December 31 of the implementation year and shall include the following information for each capture event:
 - i. The purpose of the capture event (i.e., salvage or survey).
 - ii. Location of the event.
 - iii. Number Chinook salmon and steelhead captured, injured, and killed.
 - c. The PNF shall provide NMFS with an annual report summarizing the number and extent of all bank stabilization projects performed under the road maintenance programmatic activity. This report shall be submitted to NMFS by December 31 of the implementation year and shall include the following information for each project:

- i. Location (e.g., 5th level HUC, stream name, and geographic coordinates).
 - ii. Linear extent of bank armoring.
 - iii. Linear extent of riprap placed below the OHWM.
 - iv. Extent to which riprap extends into the stream channel, as measured from the OHWM.
 - v. Summary statement regarding whether the riprap encroached farther into the channel than what previously existed.
- d. Each year, the PNF shall monitor and report the downstream extent of turbidity plumes (utilizing NTU measurements) for one extreme road maintenance activity that involves instream work, if this activity occurs. Turbidity monitoring will assess the intensity and duration of turbidity pulses to verify the extent of take exempted in this ITS. The NTU values shall not exceed the Idaho water quality turbidity standard (50 NTUs instantaneous over background) at a location that is 600 feet downstream of the project site. This report shall be submitted to NMFS by December 31 of each reporting year.
 - i. NTUs will be recorded at the following locations relative to the project work site: (a) Upstream, above any project influences; (b) immediately downstream; and (c) approximately 600 feet downstream.
 - ii. NTU measurements shall be recorded at the following times: (a) Prior to instream construction activities commencing; and (b) at 30-minute intervals during construction, including when the channel is re-watered. The upstream measurement shall be collected one time each day instream work is conducted.
 - iii. Monitoring of NTUs shall continue until values have decreased below the state standard, or for 4 hours, whichever is achieved first.
- e. For each fire that involves aerial dipping in the action area, the PNF shall provide NMFS with the following information for any dipping performed in no dip streams/lakes:
 - i. Location of aerial dipping sites.
 - ii. Duration of site use and quantity of water withdrawn.
- f. The PNF shall provide NMFS with an annual report containing the herbicide application information listed below. This report shall be submitted to NMFS by April 1 of the year following herbicide applications.

- i. Acres of applied herbicide treatments within 300 feet of streams within each fifth level HUC identified in Table 8 (including any acres treated by permittees).
 - ii. The active ingredient, EUPs, EPA registration number, and adjuvants used.
 - iii. The herbicide application rate and application method.
 - iv. Any spills and spill response that may have occurred.
 - v. A statement affirming the Forests (including any permittees) successful implementation of the action, all PDFs, and mandatory terms and conditions.
- g. If the results of any monitoring effort indicate that the extent of take may have been exceeded, then the action agencies shall coordinate with the Level 1 Team to determine if further action or additional monitoring efforts may be necessary.
 - h. The reporting requirements identified in term and conditions 5.b, 5.c, 5.d, and 5.e must be submitted electronically to: NMFSWCR.SRBO@noaa.gov with a carbon copy to the appropriate Level 1 Team member. The electronic submittal shall include the following NMFS Tracking Number: WCRO-2020-01560.

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). The following recommendations should be carried out by the PNF and/or COE to achieve these purposes:

1. To mitigate the effects of climate change on ESA-listed salmonids, follow recommendations by the ISAB (2007) to plan now for future climate conditions by implementing protective tributary and mainstem habitat measures. In particular, implement measures to protect or restore riparian buffers, wetlands, and floodplains; remove stream barriers; and to ensure late summer and fall tributary streamflows.
2. Review recovery plans and implement identified recovery strategies and management actions whenever possible.
3. Provide educational outreach (e.g., pamphlets, educational kiosks, social media posts, etc.) to forest users about the presence of ESA-listed fish and designated critical habitat

and how to recreate in a manner that minimizes potential impacts to these protected resources.

4. Reroute problem roads and trails to reduce or eliminate long-term effects on riparian and aquatic habitats whenever it is practicable to do so.
5. Ensure activities contributing to the ECA are not concentrated in landslide or landslide prone areas, refugia, or RCAs.
6. Maintain and where appropriate increase efforts to prevent invasive plant introductions.

2.11 Reinitiation of Consultation

This concludes formal consultation for the PNF's seven programmatic activities.

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

2.12 “Not Likely to Adversely Affect” Determinations

The proposed action is summarized in Section 1.3 of this Opinion and described in more detail in Appendix A of this Opinion and in Chapter 1 of the BA. The proposed action may affect SRF Chinook salmon, Snake River sockeye salmon, and their designated critical habitats. The listing status of each of these species, critical habitat designations and protective regulations are presented in Table 21. Impacts to these species and their designated critical habitats are described in Sections 2.12.1 and 2.12.2.

Table 21. Listing status, status of critical habitat designations and protective regulation, and relevant Federal Register decision notices for ESA-listed species considered in this section.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (<i>Oncorhynchus tshawytscha</i>)			
Snake River fall-run	T 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
Sockeye (<i>O. nerka</i>)			
Snake River	E 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	ESA section 9 applies

Note: Listing status: ‘T’ means listed as threatened under the ESA.

2.12.1 Snake River Fall Chinook Salmon and Designated Critical Habitat

Snake River fall Chinook salmon occur within the action area. More specifically, fall Chinook salmon occur within the Salmon River, which borders segments of the northern portion of the PNF boundary. They also occur in the Snake River, along the Deep Creek Section 7 watershed. The SRF Chinook salmon ESU was originally listed as threatened on April 22, 1992 (57 FR 14653) and was reaffirmed as threatened under the ESA in 2005 (70 FR 37160). The Salmon River, downstream of French Creek and the Snake River, are designated critical habitat for SRF Chinook salmon. The PNF determined that the action as proposed may affect, but is not likely to adversely affect SRF Chinook salmon and its designated critical habitat.

Adult and juvenile SRF Chinook salmon migrate, spawn, and rear in both the Snake and Salmon Rivers. Spawning takes place from October through early December, and fry emerge from the gravels in March and April of the following year. The majority of individuals in this species exhibit an ocean-type life history, where they migrate downstream soon after emergence and reach the ocean by winter (Connor and Burge 2003; Coutant and Whitney 2006).

Impacts from the proposed action on fish species and designated critical habitat are described in Section 2.5.3. Lands administered by the PNF abut the Salmon River from its confluence with the MFSR confluence downstream to about French Creek. Downstream of French Creek, private land separates PNF lands from the Salmon River. The USFS lands abutting the Salmon River are part of the FCRNRW. No instream construction activities and no fish surveying will be performed in the Salmon River. Given its wilderness designation, very few projects will be carried out under the programmatic activities in this portion of the action area. As such, any potential effects of the proposed action are associated with sediment or chemical contaminants that are introduced to tributaries and transported downstream to the Salmon River.

Sediment or chemical contaminants introduced to streams could impact the water quality PBF in the Salmon River, which could in turn impact individual fish migrating through or spawning within the area. However, we anticipate that increased sediment and potential chemical contamination will have insignificant impacts on designated critical habitat and fall Chinook salmon for the following reasons: (1) The Salmon River is a large river and introduced sediment will not be of sufficient quantity to produce harmful turbidity plumes or negatively impact spawning habitat; and (2) chemical contaminants will not be present in concentrations sufficient to elicit adverse effects because they will be limited by proposed PDFs designed to control their input into action area streams, and will be substantially diluted as they are transported downstream. Based on this analysis, NMFS concurs with the PNF that the proposed action is “not likely to adversely affect” SRF Chinook salmon or their designated critical habitat.

2.12.2 Snake River Sockeye Salmon and Designated Critical Habitat

Snake River sockeye salmon occur within the action area. More specifically, sockeye salmon migrate through the Salmon River, which borders segments of the northern portion of the PNF boundary. The Snake River sockeye salmon ESU was first listed as endangered under the ESA in 1991, and the listing was reaffirmed in 2005 (70 FR 37160). The Salmon River is designated critical habitat for Snake River sockeye salmon. The PNF determined that the action as proposed

may affect, but is not likely to adversely affect Snake River sockeye salmon and its designated critical habitat.

Adult and juvenile Snake River sockeye salmon migrate through the action area. Juvenile sockeye salmon do not spend much time within the action area. They move quickly through the Salmon River after leaving their natal lakes in the spring and early summer, often arriving at Lower Granite Dam in about 7 days (NMFS 2015). Adult sockeye salmon migrate upstream through the river in late summer, returning to the Sawtooth Valley in August and September. Adult sockeye salmon likely utilize temperature refugia at the mouths of tributary streams during their upstream migration.

Impacts from the proposed action on fish species and designated critical habitat are described in Section 2.5.3 and are summarized in Section 2.12.1. Sediment or chemical contaminants introduced to streams could impact the water quality PBF in the Salmon River, which could in turn impact individual fish migrating through the area. However, we anticipate that increased sediment and potential chemical contamination will have insignificant impacts on designated critical habitat and sockeye salmon for the following reasons: (1) The Salmon River is a large river and introduced sediment will not be of sufficient quantity to produce harmful turbidity plumes; and (2) chemical contaminants will not be present in concentrations sufficient to elicit adverse effects because they will be limited by proposed PDFs designed to control their input into action area streams, and will be substantially diluted as they are transported downstream. Based on this analysis, NMFS concurs with the PNF that the proposed action is “not likely to adversely affect” Snake River sockeye salmon or their designated critical habitat.

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

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

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

developed by the Pacific Fisheries Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The proposed action and action area for this consultation are described in Sections 1.3 and 2.3, of this document, respectively. The action area includes areas designated as EFH for various life-history stages of Chinook salmon. Because the action has the potential to affect all freshwater habitats, the action area includes all of the following habitat areas of particular concern for salmon: complex channel and floodplain habitat, spawning habitat, thermal refugia, estuaries, and submerged aquatic vegetation.

3.2 Adverse Effects on Essential Fish Habitat

Based on information provided by the action agency and the analysis of effects presented in the ESA portion of this document, NMFS concludes that the proposed action will have adverse effects on EFH designated for Pacific Coast salmon in freshwater.

1. Water Quality (spawning, rearing, and migration). Projects implemented under road maintenance and weed management programmatic activities have the potential to cause short-term habitat effects. As described in Sections 2.5.3 and 2.5.4, these effects may include increased suspended sediment and chemical contaminants. Implementation of the PDFs and conservation measures such as erosion control measures, working in the dry, and restricting the types of herbicides and application methods in riparian areas will minimize effects to water quality.
2. Cover/Shelter (rearing and migration). Natural cover will be degraded in localized areas due to extreme road maintenance projects that involve riparian and channel disturbance, as described in Sections 2.5.6, 2.5.7, and 2.5.11. These areas will be small in size and scattered throughout the action area.

3.3 Essential Fish Habitat Conservation Recommendations

Because the properties of EFH that are necessary for the spawning, breeding, feeding, or growth to maturity of managed species in the action area are the same or similar to the biological requirements of ESA-listed species as analyzed above, NMFS has provided ten conservation recommendations. The following conservation recommendations are necessary to avoid, mitigate, or offset the impact of the proposed action on EFH:

1. The PNF and the COE, as applicable, should ensure all PDFs described in the BA and in Appendix A of this Opinion are followed. This includes obtaining Level 1 Team approval whenever it is required.
2. The PNF should annually review the allowable maintenance activities and PDFs with all entities that will perform maintenance activities on NFS roads. The allowable maintenance activities and PDFs should be incorporated as required elements in the

operation and maintenance plans accompanying the easements, special use permits, or other authorizations.

3. The PNF and the COE, as applicable, should perform the following activities for all road repair projects involving bank stabilization along streams supporting ESA-listed salmon and steelhead:
 - a. Review engineering designs of all repair projects on roads maintained by the PNF or another authorized entity (e.g., counties, highway districts, private land owners, etc.) and ensure that:
 - i. The amount of riprap used in streambank stabilization projects is minimized to the extent practicable.
 - ii. Projects incorporate bioengineering into the design whenever it is practicable to do so.
 - iii. The base of the road –prism- fill -slope does not extend farther into the channel than what previously existed unless otherwise permitted by the Level 1 Team. Aerial photography as well as representative road -prism characteristics above and below the project area may be used to determine the extent of the previous road prism.
 - b. Prior to implementation of bank armoring, ensure the contractor has appropriately marked the allowable extent of stabilization and placement of fill material. Conduct site inspections during project implementation to ensure the repairs are being constructed as designed. Conduct a site inspection at the end of construction to ensure the project was implemented as designed. The Level 1 Team should be immediately notified for discussion should construction design inconsistencies be determined.
4. The PNF should ensure herbicide spill plans that meet requirements of USFS directives (FSH 2109.14, Chapter 60) are developed and that an appropriate spill cleanup kit is maintained on-site during herbicide applications. The PNF should review the plans with all applicators, including permittees, prior to herbicide applications.
5. The PNF should ensure that herbicides and surfactants selected for use within 300 feet of water have the lowest toxicological profile to anadromous fish while still being able to meet desired treatment objectives.
6. The PNF invasive weeds manager, or other qualified staff, should review all applicants' pesticide use proposals for consistency with the proposed action and this Opinion's terms and conditions prior to authorizing third party plant treatments.
7. The PNF should ensure all chemical storage, chemical mixing, transportation, and post-application equipment cleaning is completed in such a manner as to prevent the potential

contamination of any riparian area, perennial or intermittent waterway, ephemeral waterway, hydrologically connected road ditch, or wetland.

8. The PNF should ensure that herbicides are not broadcast sprayed in riparian areas when wind speeds are less than 2 mph and the potential for temperature inversions exists.
9. The PNF should obtain Level 1 Team approval when adding new adjuvant(s) to its weed treatment program.
10. The PNF should obtain Level 1 Team approval to use any new EUPs for treatments within 300 feet of anadromous waters.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, to the designated EFH for Pacific Coast salmon in the action area.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the PNF and COE must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least ten days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the federal agency have agreed to use alternative timeframes for the federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this Opinion are the PNF and COE. Other interested users could include the entities that the PNF authorizes to conduct projects that fall within the scope of these programmatic activities. Individual copies of this Opinion were provided to the PNF and COE. The document will be available within 2 weeks at the [NOAA Library Institutional Repository](https://repository.library.noaa.gov/welcome) [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan.

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

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

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

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

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6. APPENDIX A—DETAILED PROPOSED ACTION DESCRIPTIONS

The Payette National Forest (PNF) is proposing to implement the following seven programmatic activities annually as part of their forest management: (1) Road maintenance; (2) Trails, Recreation, and Administrative Site Operation and Maintenance; (3) Fire Management; (4) Invasive Weed Management; (5) Timber Harvest and Pre-commercial Thinning; (6) Miscellaneous Forest Products; and (7) Aquatic and Riparian Ecosystem Monitoring. The following sections provide an overview of each programmatic activity, including measures that will be implemented to avoid or minimize the potential for adverse effects to Endangered Species Act (ESA) listed species and critical habitats.

Road Maintenance

This programmatic activity authorizes specific maintenance activities on National Forest System (NFS) roads, motorized trails open to vehicles 50 inches or larger, and unauthorized routes. Maintenance activities are conducted to ensure the road or road system is in a safe and properly functioning condition for the user and level of use identified by the road use objective and maintenance level. Within funding constraints, the maintenance level assigned to a road along with level of use dictates the frequency and extent of maintenance work performed on a particular road, or section of road. Roads assigned a higher maintenance level are traveled more often and therefore receive more maintenance more frequently. Maintenance levels also provide a way to classify forest roads according to their assigned use, so that the road will perform as planned (USFS 2005). Maintenance of trails open to motorized vehicles greater than 50 inches in width is included in this programmatic activity because the treatment types and equipment used for maintenance on these trails is similar to that of roads. The National Forest road system and trails open to motorized vehicles greater than 50 inches wide on the PNF is displayed in Figure A-1. This map represents the most current information available and may change as additional information becomes available.

Maintenance activities may be performed by Forest engineering staff or other authorized Forest personnel, contractors, permittees, or cooperators (e.g., counties) who have written agreement [e.g., cost-share agreements, Forest Roads and Trails Act (FRTA) easements, special use permits, etc.] with the Forest to perform maintenance. Maintenance activities conducted by others are required to meet PNF standard operating procedures which are included through operation and maintenance plans or stipulations of those authorizations. Road maintenance crews, contractors, permittees, and cooperators (e.g., Valley County) will be given direction by the PNF prior to operation, regarding the potential for effects to ESA-listed species and designated critical habitat, and what maintenance practices are mandatory and appropriate.

Road maintenance can include work below the ordinary high water mark (OHWM); therefore, may require a Clean Water Act (CWA) Section 404 permit from the U.S. Army Corps of Engineers (COE).

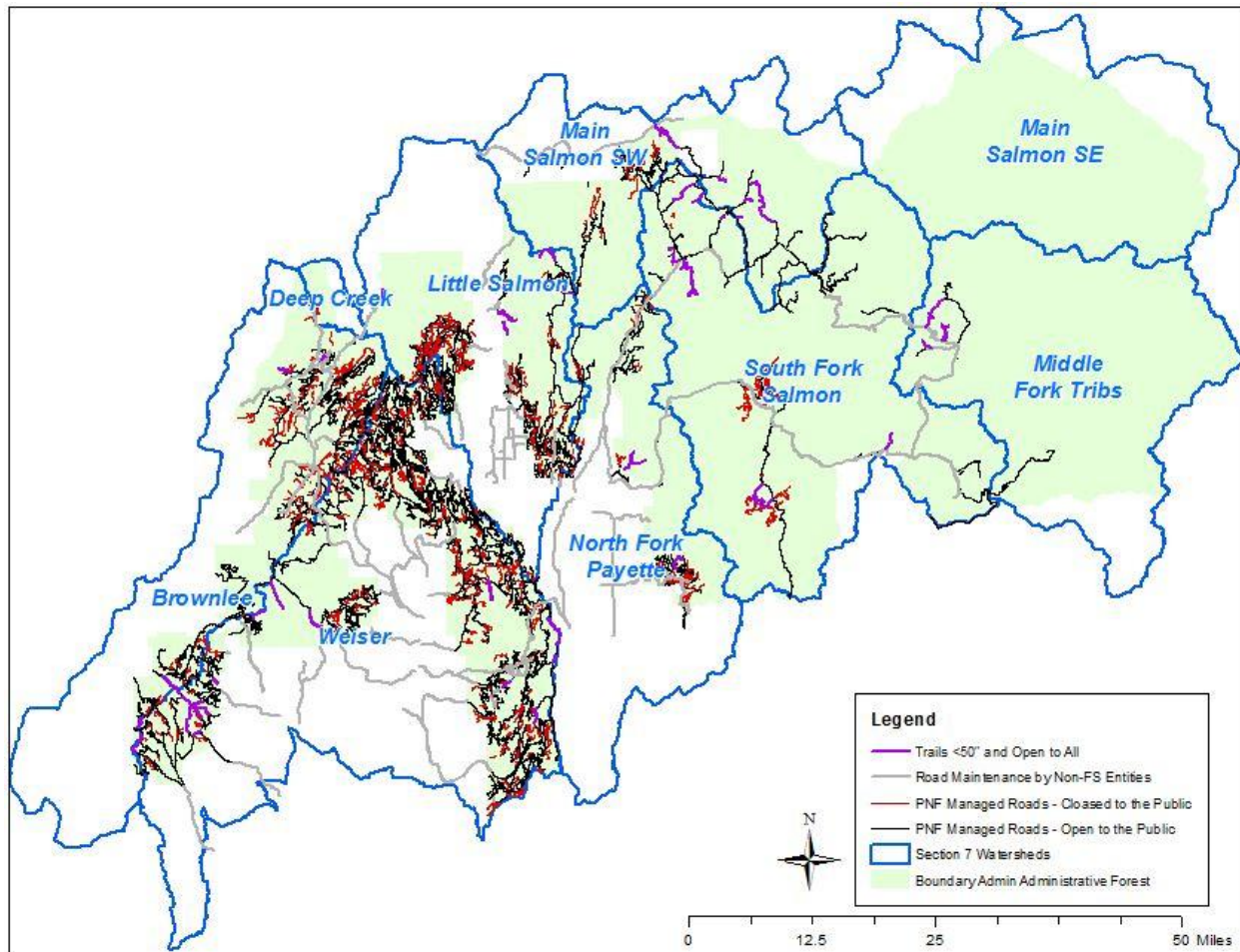


Figure A-1. Map of National Forest road system and motorized trails open to vehicles greater than 50 inches in width on the PNF.

This programmatic activity excludes the following actions:

- Culvert and bridge replacement or installations within occupied⁴ habitat that are covered under the Restoration Activities at Stream Crossings consultation (Scaife and Hoefer 2011; NMFS Tracking Number 2011/05875).
- Road maintenance activities occurring with mineral projects where the mineral activities have a may affect, likely to adversely affect determinations on an ESA-listed species or critical habitat.
- Maintenance activities covered under the Trails, Recreation, and Administrative Site Operation and Maintenance programmatic activity.

Emergency situations such as bridge and culvert failures, slides, and road failures are evaluated and prioritized according to the maintenance level of the road and the potential for damage to other resources. Problems on roads of either maintenance levels 1 (closed) or 2 are usually given

⁴ For the purposes of this Opinion, “occupied” means anadromous species and/or designated critical habitat are known or suspected to be present.

a lower priority than more heavily used roads of levels 3, 4, or 5. Emergency maintenance problems are usually corrected within 1 to 10 days, depending upon the priorities of the road maintenance crew. Problems threatening ESA-listed fishes or their designated critical habitat will be addressed immediately. If Forest road crews are unable to respond immediately (e.g., because of equipment problems or location), the work will be contracted and supervised by Forest personnel, including a fisheries biologist, soil scientist, or hydrologist.

The PNF implements the following road maintenance activities: (1) Routine road maintenance; (2) extreme or infrequent road maintenance; (3) stream crossing maintenance; and (4) road decommissioning. Each of these are briefly described below. In addition, the PNF implements mitigation, or best management practices (BMPs), to help reduce the adverse effects of road maintenance on the environment. The practices incorporate the recommended maintenance practices found in Furniss et al. 1991 (pages 311–312) and are described in more detail below.

Routine Road Maintenance Activities

Regular maintenance keeps roads in good functioning condition and allows for identifying and correcting problems promptly. Routine road maintenance is anticipated/planned on an annual basis with some activities, such as road resurfacing or culvert and bridge replacements, occurring less frequently than on an annual basis. Examples of routine road maintenance activities are listed below. Although the list is not all-inclusive, it contains those activities that are most frequently implemented on the PNF.

- Surface blading, rolling, and rock raking.
- Ditch clearing.
- Brushing along roadway.
- Tree deadfall removal and felling of hazard trees.
- Landslide and slough removal.
- End-hauling all large rocks, slides, and other material that ends up on the road to disposal areas.
- Changing road template to an out slope.
- Maintaining, installing, and removing cross drain culverts.
- Maintaining, and replacing stream crossing structures on dry intermittent channels.
- Installing or maintaining rolling dips, and other surface drainage measures to improve water drainage and reduce sediment delivery to stream channels.
- Road resurfacing with new or preexisting materials, including the use of mobile rock crushers, gravel placement, pavement patching and sealing including bituminous surface treatments, seal coats, and similar measures. Road surfaces may be upgraded to reduce

erosion and sedimentation so long as cut and fill-slopes are not enlarged; for example, a native surface road may be upgraded to pit-run gravel or crushed aggregate.

- Aggregate crushing, and hauling, and excavation and hauling of large rock and road fill can occur from existing or new borrow sites.
- Applying dust abatement chemicals [typically magnesium chloride (MgCl_2) or calcium chloride (CaCl_2) salts or lignin-based chemicals such as lignin sulfonate]. Concentrations of the dust abatement mixtures are between 30–40 percent MgCl_2 or CaCl_2 .
- Snow removal from roadways.
- Installation, replacement, and maintenance of structures and devices designed to limit access to closed roads (gates, tank traps, berms, boulders, etc.)
- Install and maintain cattle guards.

Some road maintenance activities (e.g., dust abatement, surface blading, and compacting road surfaces) require the use of water. Water is typically pumped from accessible lakes or streams into a water tender. Two or three loads of water may be applied, depending on the condition of the road and maintenance objective. Typically, surface blading and compacting occur when roadways still retain enough moisture from rain or snow. However, water is applied when roads require maintenance but lack adequate moisture for successful blading.

Extreme or Infrequent Road Maintenance Activities

Extreme or infrequent maintenance activities are not expected to occur often and generally occur in response to damage caused by natural events. Instream work may be necessary to repair road fill damaged by high water or repair stream crossings including replacing damaged structures and placing riprap armor. The following extreme or infrequent maintenance activities may occur:

- Replacement of up to 500 feet of full prism road normally maintained by the PNF that is severely damaged or eroded by flood, fire, or other natural events.
 - Repairs due to natural events may involve alignment shifting to reduce encroachments of riparian conservation areas (RCAs) and floodplains.
 - Road prism repair can include placement of up to 100 feet of riprap below the OHWM and can include instream work when necessary.
- Cut and fill stabilization activities:
 - Minor concrete work (i.e., small headwalls).
 - Riprap slope protection (100 linear feet of riprap may be placed below the OHWM).

- Retaining walls (up to 100 linear feet of fill material may be placed below the OHWM).
- Planting vegetation (e.g., trees or shrubs) or placing structures such as gabions, trees, wooden grids, and soil cementing techniques (hydromulch and seed).
- Realignment and curve widening may occur for up to one-quarter mile where the project results in a reduction of long-term resource impacts. Additional lengths may also occur. These actions will be approved by the Level 1 Team prior to implementation.
- Removal of large wood from stream channels may occur if the wood is diverting flow and causing, or has the potential to cause, damage to a road, bridge, or other infrastructure. Large wood will be removed with heavy equipment, such as an excavator or backhoe, or by hand. This typically occurs by lifting or grabbing a piece of large wood, working it out of the log jam and relocating it to the side or downstream.
- Removal of ice jams from stream channels may occur if the ice jam has the potential to damage a road, bridge or other infrastructure. Ice jams will be broken up with heavy equipment such as an excavator or backhoe. Ice jams occur in winter when flows are low and cold weather has caused ice buildup.
- Blasting or use of non-explosive or micro explosive methods may be used to breakup large boulders or to top or fall hazard trees.
- Emergency activities may be covered under this programmatic as long as they are consistent with the programmatic description and approved by the Level 1 Team.

All extreme or infrequent road maintenance activities will be presented to and will require approval of the Level 1 Team, including emergency activities that are consistent with this programmatic activity description. The PNF may conduct up to four extreme or infrequent road maintenance activities per year. These activities may occur within a single Section 7 watershed or across multiple Section 7 watersheds. What constitutes a single project will be determined in coordination with the Level 1 Team, and could include repairs of multiple locations along one road.

The PNF will approve all extreme or infrequent maintenance to be performed by other road maintenance entities (including activities on FRTA roads). If a CWA Permit is needed, the PNF will work with the road maintenance entity prior to the entity submitting a CWA Section 404 permit application to the COE.

Stream Crossings

The objective of stream crossing maintenance is to ensure road drainage structures are performing as intended and impacts to aquatic resources are minimized as much as possible. Examples of stream crossing maintenance activities include:

- Riprap placement for culvert inlet and outlet protection and bridge repairs can occur if limited to a cumulative linear distance of 100 feet or less at an individual site and after approval by a fisheries biologist.
- In-kind repairs of bridges and abutments.
- Removal, replacement, and installation of asphalt wearing surface on bridge decks and approaches.

Additionally, the following stream crossing maintenance activities may occur on non-fish bearing streams:

- Hardening streambeds at fords or armoring approaches.
- Culvert/bridge installations, including replacements, extensions and new installations, clearing, cleaning and repair.
- Temporary bridge placement (including abutments) or permanent bridge replacement.

Road Decommissioning

The objective of road decommissioning is to restore unneeded roads to a more natural state. Decommissioning includes applying various treatments, including one or more of the following:

- Reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation.
- Blocking or removing the entrance to a road or installing water bars.
- Removing culverts, reestablishing drainages, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed.
- Completely eliminating the roadbed by restoring natural contours and slopes.
- Other methods designed to meet the specific conditions associated with the unneeded road.

System roads that are placed into long-term closure (e.g., maintenance Level 1) will be stable and drain properly without maintenance. This usually requires earthwork for removing culverts or "dishing out" crossings that have high potential for diversion and shaping the road for long-term stability. Where high-value fisheries are at risk from abandoned roads, more extensive obliteration (recontouring) of roads should be considered. Unauthorized routes that are no longer needed or temporary roads that are not on the system, also typically receive more extensive obliteration type treatments.

Required Mitigation

The PNF has proposed numerous mitigation measures and BMPs to avoid or minimize adverse effects to aquatic resources. Those practices are listed in Table A-1. It is important to note that exceptions to select practices may be allowed on a case-by-case basis if approved by the Level 1 Team. Practices that allow for exceptions are identified in italics in Table A-1.

The PNF will provide an overview of upcoming and existing road maintenance projects to the Level 1 Team on an annual basis. In addition, specific activities require Level 1 Team approval prior to implementation. Those activities include:

- Use of existing or new borrow sources within RCAs.
- Extreme or infrequent activities.
- Use of the mobile rock crusher.
- Instream work in occupied or critical habitat.
- All stream crossing maintenance work within critical habitat, or in ESA-occupied reaches (or presumed occupied) or within 600 feet of occupied reaches.
- Use of chemicals other than MgCl_2 or CaCl_2 salts or lignin-based chemicals such as lignin sulfonate.

Table A-1. Required mitigations and best management practices that will be implemented to avoid or minimize potential consequences associated with road maintenance activities on the Payette National Forest.

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
General—All Activities	Heavy Equipment Operation, Fuel and Other Contaminants	<ul style="list-style-type: none"> ● Heavy equipment will remain on existing roads unless off-road travel is approved by a fisheries biologist; although equipment will not enter the stream. ● Locate fuel storage areas outside of riparian conservation areas (RCA) where possible. ● Provide facilities to contain 110% of fuel volume. ● Monitor and control leaks of motor oil and hydraulic fluids from heavy equipment to prevent water contamination. ● Control and fix chemical leaks from heavy equipment.
Routine Road Maintenance	Erosion and Sediment Control	<ul style="list-style-type: none"> ● Do not attempt road maintenance when surface material is saturated with water and erosion problems could result. ● Do not leave berms along the outside edge of roads, unless an outside berm was specifically designed to be a part of the road and low-energy drainage is provided for. ● Grade and shape roads to conserve existing surface material. Road grading and shaping should maintain, not destroy, the designed drainage of the road, unless modification is necessary to improve drainage problems that were not anticipated during the design phase. ● Do not side cast excess material onto the fill when blading and shaping roads. ● End haul all excess fine material that cannot be bladed into the surface. ● Inspect ditches and culverts frequently, as appropriate to the maintenance level, and clean them out when necessary. Do not over-clean them (to the extent possible, leave established grass and other vegetation not interfering with the ditch function and maintain a “green” buffer between the maintained ditch and culver inlet). ● Do not "undercut" cutslopes when cleaning inside ditches.
	Vegetation & Large Woody Debris (LWD) ¹	<ul style="list-style-type: none"> ● Do not excessively "brush" (cutting vegetation) along roads where the vegetation is stabilizing slopes or providing shade to a stream or river channel. ● When present on roads within RCA, LWD will be moved intact (to the extent possible) to down slope of the road, subject to site-specific considerations. Movement down-slope will be subject to the guidance of a fisheries biologist; that guidance will be provided for road crews and on a site-by-site basis as necessary.
	Fish Protection	<ul style="list-style-type: none"> ● Avoid road maintenance activities during times in which ESA-listed fish eggs or alevins are in gravels near enough downstream to the disturbance to possibly be affected by the action. A fisheries biologist will determine this time period and whether the action is near enough to the fish to warrant this protection.
	Dust Abatement	<ul style="list-style-type: none"> ● Apply dust-abatement additives and stabilization chemicals so as to avoid run-off of applied dust abatement solutions to streams. ● When the road is within 25 feet of stream channels, dust abatement chemicals will be applied with one swath (approximately 10 feet wide) centered in the road so that all of the chemical is absorbed and does not leave the road surface. ● Spill containment equipment will be available during chemical dust abatement application.

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
Routine Road Maintenance (Cont.)	Drafting Water	<ul style="list-style-type: none"> • Do not dewater streams; do not draft from streams with low flows to avoid stream dewatering and stranding of fish. • Use only pre-identified locations within streams that support ESA-listed fish species to avoid spawning and key rearing areas. • Ensure pump intake screens meet NMFS' screening criteria (NMFS 2011). • <u>Draft from deeper and faster-flowing streams and pools for pump intakes when available.</u>
	Snow Removal	<ul style="list-style-type: none"> • Snow removal shall be conducted in a manner that protects roads, ensures safe and efficient transportation of materials, and prevents erosion damage to roads, streams, and adjacent lands. • Remove snow, ice, and debris caused by snowplowing activities from drainage features so that the drainage system will function efficiently at all times. • Deposit all debris, except snow and ice, removed from the road surface and ditches at approved locations and away from stream channels. • Side casting of snow will be avoided where there is a potential for snow or ice damming in adjacent streams. • Create and maintain openings in snow berms as required for surface drainage. Space drainage holes appropriately to obtain satisfactory surface drainage without discharge on erodible fills.
	Snow Removal	<ul style="list-style-type: none"> • Leave a minimum of 2 inches of snow on native and/or gravel surfaced roads during plowing operations to protect the road surface from mechanical disturbance. Removing snow to the native and/or gravel surfaced road is not allowed. • Promptly remove snow from paved roads during or after all significant storms to prevent excessive icing of the road surface. Gravel with particles greater than 3/8" diameter can be placed on short sections of road. Gravel that readily decomposes into sand shall not be used. • Do not apply sodium or other melting additives to the road surface. • Restore any damage resulting from snow removal in a timely manner. Examples of this are damage or excessive erosion of the road surface, damage to cross drain structures, and damage or excessive erosion on cut and fill surfaces. • Do not use roads with native road surfaces, during the snowmelt period until the surface is sufficiently dry for vehicle use.

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
Extreme or Infrequent Road Maintenance	Instream Work in Occupied Habitat	<ul style="list-style-type: none"> ● Newly placed riprap will not extend farther into the channel than what previously existed. <i>Exceptions may be made on a case-by-case basis if approved by the Level 1 Team.</i> ● In some cases, partial dewatering or site isolation of the channel adjacent to repair site will be necessary to minimize turbidity and direct effects to ESA-listed fish. In other situations, placement of riprap, large wood, or other repair material will create only minor turbidity, but ESA-listed fish, especially juveniles, may be present requiring special precautions. ● In cooperation with the Level 1 Team, mitigations will be developed specific to the project and may include: <ul style="list-style-type: none"> ○ If necessary, to minimize turbidity the channel would be completely or partially dewatered using various types of cofferdams, pumps, and bypass systems. ○ When necessary to minimize adverse effects fish will be relocated before dewatering or working instream. Block nets will be used to prevent fish from entering the work area. Electroshockers will be used to capture fish for relocation. ○ Instream work will typically occur near base flows, between July 15 and August 15 in Chinook salmon and steelhead spawning habitat, and prior to August 15 in bull trout spawning habitat. <i>See the exceptions for work windows in the bullet below.</i>
	Instream Work in Occupied Habitat	<ul style="list-style-type: none"> ○ Electrofishing will be performed in accordance with NMFS (2000) guidelines. ○ Prior to working in stream, spawning surveys will be conducted for at least 600 feet downstream of the work site. If spawning Chinook salmon, steelhead, or bull trout, or redds are observed within 600 feet downstream of the work site, activities will be halted and the Level 1 will be consulted to determine the course of action. <i>The Level 1 can give exceptions to work windows if spawning surveys show that spawning fish and redds are not present within 600 feet of the work site.</i> ○ Mitigations to minimize turbidity could include working at the lowest flows practicable, partial or full dewatering of the work site, and using sumps to pump turbid water into a bag or vegetation filter. ○ At a minimum, turbidity will periodically be monitored at the work site and 600 feet downstream of the worksite. Monitoring can be ocular, photographic, or with a turbidity meter.
	Erosion Control	<ul style="list-style-type: none"> ● Place erosion control at the work site prior to any construction so as to reduce sediment delivery to the stream to the extent possible. Erosion control mitigations described for the Road Decommissioning activity will be implemented as appropriate.
	Blasting	<ul style="list-style-type: none"> ● Blasting requiring mechanized or hand drilling will adhere to the distances and charges stated in Table A-2. ● Non-explosive or micro-explosive alternatives such as Betonamit® should be used where possible to reduce resource impacts.
	Ice Jam Removal	<ul style="list-style-type: none"> ● A fisheries biologist will be present during the removal work to monitor turbidity. ● The minimum amount of work will occur necessary to alleviate the damming effect and minimize any impacts to streambanks or the streambed.

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
Extreme or Infrequent Road Maintenance (Cont.)	Large Woody Debris Removal	<ul style="list-style-type: none"> • Where available, the most recent Chinook salmon and bull trout redd data will be used to mitigate potential effects. • A fish biologist will be present during large wood removal and work with the equipment operator to minimize downstream effects. • Timing when there will be the least impact to individuals or redds as determined by a fisheries biologist. • Snorkel surveys will be conducted prior to removal of the debris and if ESA-listed fish are observed in the vicinity, methods for avoiding adverse effects will be discussed with the Level 1 Team.
	Large Wood Removal	<ul style="list-style-type: none"> • All large wood will remain in the riparian area and could be placed in a manner to help dissipate energy and deflect water away from the road. • The minimum amount of large wood will be removed, and this will be agreed to by the responsible road maintenance entity, operator, and fisheries biologist. • Large wood pieces will be picked up and not skidded from the log jam. • Heavy equipment will remain on existing roads unless approved by a fisheries biologist or hydrologist.
Stream Crossing Maintenance	All Stream Crossings	<ul style="list-style-type: none"> • All instream work will follow the instream work requirements described for the “Extreme or Infrequent Road Maintenance” activity. • Newly placed riprap will not extend farther into the channel than what previously existed. <i>Exceptions may be made on a case-by-case basis approved by the Level 1 Team.</i>
		<ul style="list-style-type: none"> • All treated wood for bridge repairs shall be produced, removed, and used in compliance with guidelines and BMPs issued by the Western Wood Preservers Institute (2006) and NMFS (2009). • Measures will be taken to prevent asphalt from falling into the water during replacement and installation. Operators will use diligence to prevent spills. Typically, new bridges have a metal retainer at the edge of the deck which retains roadbed material including asphalt. • Asphalt will not be applied if precipitation is predicted. • If stream crossing maintenance is performed on a fish-bearing stream, fish isolation and salvage may occur.
	Stream Crossings on Non-Fish Bearing Streams	<ul style="list-style-type: none"> • Remove fill from around existing structure and store at a stable location. • If necessary, to minimize turbidity in channels with live water a dewatering plan will be submitted and approved by a hydrologist or fisheries biologist before activities commence. The stream will then be dewatered according to the plan before any instream activities begin. • Slowly rewater the channel to minimize turbidity, remove any temporary structures, and reestablish disturbed areas. • Seed with native plants and mulch disturbed areas, remove sediment collected by erosion control material as specified by a hydrologist, soil scientist, or fisheries biologist.
	Stream Crossings on Non-Fish Bearing Streams	<ul style="list-style-type: none"> • Additional site-specific measures, including modifications to mitigations because of site-specific conditions, may be identified and approved by a fisheries biologist, soil scientist, or hydrologist.

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
Road Decommissioning	Erosion Control	<ul style="list-style-type: none"> ● The highest level of additional mitigation (water control devices, mulch or erosion control matting, vegetation, and grass seed and fertilizer) will be implemented when the construction site is within the RCA buffers or on slopes greater than 45 percent, or where necessary to minimize effects. ● A moderate level of erosion control (mulch, grass seed and fertilizer) will be used on other areas. Generic practices that can be used include: <ul style="list-style-type: none"> ○ Silt fence and filter barriers; straw rolls; straw bale dikes; slash filter windrows. ○ Erosion control blankets and mats. ○ Hydromulching; mulching; brush layering. ○ Waterbars and rolling dips. ○ Temporary sediment basins. ○ Shrub planting. ○ See mitigations for instream work.

¹LWD is defined as wood that is > 30 feet in length and >12 inches in diameter.

Table A-2. Relationship between explosive charge weight in substrates and minimum setback distances (feet) from a waterbody occupied or assumed occupied by listed fish species.

Substrate	Explosive Charge Weight in Pounds								
	0.5	1	2	5	10	25	100	500	1000
<i>Setback distances to stay below the 7.3 psi overpressure for individuals</i>									
Rock	17	15	35	55	78	123	247	552	780
Frozen Material	16	22	31	50	70	111	222	195	701
Stiff clay, gravel, ice	13	19	27	42	60	94	189	422	596
Clay silt, dense sand	12	17	24	39	54	86	172	385	544
Medium to dense sand	9	13	19	30	42	67	133	298	420
<i>Setback distances to stay below the 2.0 in/s velocity for embryos</i>									
All	10	14	20	32	45	71	142	318	450

Note: Data from Timothy 2013; Buster 2019.

Trails and Recreation/Administrative Site Operation and Maintenance

This programmatic activity authorizes the operation and maintenance of existing trails, recreation, and administrative facilities on the PNF. The following activities are excluded:

- New recreation/administrative facilities such as campgrounds or new motorized or non-motorized trails.
- Improving dispersed areas such as installing fire rings, picnic tables, outhouses, etc., when they currently do not exist at a dispersed area.
- Stream crossing replacement and/or removal activities within occupied habitat are not covered under this consultation but may be covered under the Restoration Activities at Stream Crossing Biological Assessment (BA) (Scaife and Hoefer 2011).
- Maintenance activities requiring equipment on motorized trails >50 in. in width or greater. These activities are covered in the “Road Maintenance Programmatic” activity.

Trails

Trail maintenance on NFS trails (motorized and non-motorized) will occur to keep them in a condition suitable for use and to minimize resource impacts from the trail. Trail maintenance is typically performed by PNF employees, but it may also be performed by partners (e.g., Idaho Parks and Recreation, Central Idaho Mountain Bike Association, counties, outfitters and guides, etc.) or volunteers. When maintenance is performed by outside parties in agreement with the PNF, mitigations and BMPs, as described in the BA (PNF 2020), will be adhered to. Trail characteristics and use levels vary with the location and destination of the trail. Maintenance on these trails are performed after: (1) Maintenance needs have been identified from condition and prescription surveys; and (2) an Annual Maintenance Plan is developed (within funding constraints). Table A-3 identifies the typical type of maintenance activity and specifies its frequency of implementation and intensity of work. More specifically, trail operation and maintenance may include any of the following activities:

- Reconstruction or relocation of trail segments (to improve trail function, for resource protection or other management needs) if potential effects to stream channels are maintained or reduced (i.e., by moving trails away from stream channels, reducing trail grade, etc.)
- Trail tread maintenance includes but is not limited to removal of loose rock, roots, slough and berms, slides and fallen trees. Waterbars and drainages dips will be installed and maintained. Borrow (fill) may be used to maintain the tread.
- Trail heights and widths will be maintained with brushing.
- Hazard trees will be cut.
- Minor streambank stabilization (100 feet per site) will occur where the stream has eroded portions of the trail bed and there are no options to reroute short sections of trail. Stabilization will consist of bringing in material (i.e., rock, small trees, etc.) and placing it by hand along the streambank. Along low gradient channels, stabilization will emphasize methods to reestablish natural, deep-rooted vegetation. Rock may be added and adjusted by hand annually as needed. More extensive work on or near streams should be coordinated in advance with the appropriate district specialists. These will be limited to 10 sites per year across the PNF in ESA-occupied or critical habitat streams.
- Rock/log retaining walls/barriers could be installed, replaced and maintained. If used for minor streambank stabilization (below the OHWM), this will adhere to the limits above. Any placement of materials in live water will be completed by hand.
- Trail maintenance may also include use of handheld motorized equipment (i.e., chainsaws, etc.) for trail construction.
- Construction of puncheon or corduroy structures over wet areas, springs, or placement of culverts to direct water under trail tread.
- Blasting may be used to remove rocks, stumps, and hazard trees and will adhere to the distances and charges listed in Table A-2.

Stream Crossings. The objective of stream crossing maintenance is to ensure structures are performing as intended and impacts to aquatic resources are minimized as much as possible. Stream crossing replacement and/or removal within ESA-occupied habitat are excluded from this programmatic. Crossings within 600 feet above fish bearing streams will be approved by the Level 1 Team. Examples of stream crossing maintenance activities include:

- Riprap placement for culvert inlet and outlet protection and bridge repairs can occur if limited to a cumulative linear distance of 100 feet or less at an individual site and after approval by a fisheries biologist.
- In-kind repairs of bridges and abutments.

- Removal, replacement, and installation of asphalt wearing surface on bridge decks and approaches.

Additionally, the following stream crossing maintenance activities may occur on non-fish bearing streams:

- Hardening streambeds at fords or armoring approaches.
- Culvert/bridge installations, including replacements, extensions and new installations, clearing, cleaning and repair.
- Temporary bridge placement (including abutments) or permanent bridge replacement.

Table A-3. Examples of trail maintenance activities, maintenance concern being addressed, and their typical implementation frequencies.

Activity	Concern	Frequency
Loose rock removal	Tread	Routine
Rock and root removal	Tread	Routine
Slough and berm removal	Tread, erosion, water management	Routine, intense
Slide maintenance	Tread, erosion, slope stabilization	Routine, intense
Borrow (fill)	Tread	Routine, intense
Drainage maintenance	Erosion	Routine, intense
Waterbar maintenance	Erosion	Routine, intense
Culvert maintenance	Erosion	Routine, intense
Stream ford maintenance	Erosion	Routine, intense
Gully crossing maintenance	Erosion	Routine, intense
Drainage dip maintenance	Erosion	Routine, intense
Fallen tree removal	Trailway	Routine
Brush cutting	Trailway	Routine
Slope re-vegetation	Trailway, erosion	Intense
Rock/log retaining wall/barrier maintenance	Erosion, trailway, structure	Intense
Rock/log retaining wall/barrier construction	Erosion, trailway, structure	Intense
Bridge maintenance	Erosion, structure	Intense

Administrative/Recreation Facilities (U.S. Forest Service workstations, airstrips, and developed recreation sites) and Dispersed Recreation Areas

Table A-4 identifies the types of activities and their typical implementation frequencies, associated with the operation, maintenance, and repair of administrative/recreation facilities such as workstations and campgrounds. This action also includes the replacement, maintenance, improvement, and installation of new structures (e.g., outhouses, fences, docks, boat ramps, water tanks, signs, septic systems, and parking areas) at developed recreation and administrative sites to maintain site function, serve site users, provide for user's health and safety, and for resource protection. Developed recreation is recreation that requires facilities that in turn result in concentrated use of an area (e.g., a campground or picnic area). This is in contrast to dispersed recreation areas, which typically do not have facilities. Treatments at dispersed areas may include hardening (surface treatments such as placing aggregate), barrier rock placement and other forms of rehabilitation (e.g., slash dispersal, decompacting, seeding, planting, etc.)

Table A-4. Examples of the types of activities and their typical implementation frequencies that occur at administrative/recreation facilities.

Activity	Frequency
Hazard tree removal	Annual, or as needed
Rock and stump removal	Annual, or as needed
Brushing and pruning	Annual
Campsite regrading and leveling	As needed
Campsite furniture maintenance and replacement	As needed
Campsite furniture disposal	As needed
Borrow (fill)	As needed
Drainage maintenance including minor culvert repairs	Annual
Surface material replacement and maintenance	As needed
Fence and gate maintenance	Annual, or as needed
Barrier rock placement	As needed
Parking barrier and curbs replacement	5 year cycle, or as needed
Drinking water system repairs and maintenance	Annual, or as needed
Electrical distribution system repairs and maintenance	As needed
Erosion control device maintenance	Annual, or as needed
Septic system repairs and maintenance	Annual, or as needed
Painting	Annual, or as needed
Garbage removal	Biweekly during season of operation
Buildings and structure repairs and maintenance	Annual
Building or structure disposal	As needed
Vault toilet replacement	As needed
Vault toilet pumping	Monthly during season of operation
Kiosk and sign repairs and installs	As needed
Boat dock repairs and maintenance	Annual
Boat ramp repairs and maintenance	Annual, or as needed
Boat dock replacement (Big Bar on Hells Canyon)	As needed
Pedestrian bridge maintenance	Annual, or as needed
Pond levelers	As needed

Maintenance is defined as “The act of keeping fixed assets in acceptable condition. It includes preventive maintenance normal repairs, replacement of parts and structural components, and other activities needed to preserve a fixed asset so that it continues to provide acceptable service and achieves its expected life. When an asset such as a fire ring, picnic table, bridge, etc., is irreparable, replacement may be necessary and is included in this activity. Maintenance excludes activities aimed at expanding the capacity of an asset or otherwise upgrading it to serve needs different from, or significantly greater than those originally intended.” Replacement is “the substitution or exchange of an existing fixed asset or component with one having essentially the same capacity and purpose. The decision to replace a fixed asset or component is usually reached when replacement, rather than repair or rehabilitation, is more cost effective and/or more environmentally sound. The size or capacity of the existing fixed asset is not significantly expanded in a replacement. Replacement of an asset or component usually occurs when it nears or has exceeded its useful life.”

Airstrips

The types of maintenance activities at airstrips includes leveling, smoothing, removing surface hazards; protecting surface from erosion; watering; mowing; raking rocks; grading; applying fill dirt; re-seeding; maintaining/cleaning drainage features including culverts and ditches; installing pond levelers (to control the size of beaver ponds or to prevent beavers from constructing dams near culverts or cross drain pipes); and felling of hazard trees and encroaching trees.

Required Mitigation

The PNF has proposed numerous BMPs to avoid or minimize adverse effects to aquatic resources. Those practices are listed in Table A-5. It is important to note that exceptions to select practices may be allowed on a case-by-case basis if approved by the Level 1 Team. Practices that allow for exceptions are identified in italics in Table A-5.

The PNF will provide an overview of planned trail, recreation, and administrative site work to the Level 1 Team on an annual basis. In addition, specific activities require Level 1 Team approval prior to implementation. Those activities include:

- Trail reconstruction or relocation greater than 500 feet in length. Approval will only occur if potential effects to stream channels are maintained or reduced.
- Streambank stabilization and rock or log retaining wall installation within the OHWM.

Table A-5. Required mitigations and best management practices that will be implemented to avoid or minimize potential consequences associated with operation and maintenance of trails, recreation, and administrative facilities on the Payette National Forest (PNF).

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
General—All Activities	Compliance	<ul style="list-style-type: none"> • All non-PNF entities authorized to conduct activities will follow the PNF requirements.
	Erosion and sediment control	<ul style="list-style-type: none"> • Ground disturbing activities within riparian conservation areas (RCAs) will be mitigated by applying soil erosion mitigation measures (e.g., using silt fencing, straw bales, erosion control matting, seed, mulch, fertilizer, placement of wood, etc.) • Seeding will be done with certified weed free native seed mixes.
	Contaminants	<ul style="list-style-type: none"> • Where possible locate fuel storage areas outside of RCAs. • Provide facilities to contain 110% of fuel volume. • Monitor and control leaks of motor oil and hydraulic fluids from heavy equipment. • Refuel equipment as far from streams as is practical, and on ground where a fuel spill would be easily contained. • Spill containment equipment will be available. • Inspect all equipment periodically and prior to working adjacent to water to ensure good working order and fix any chemical leaks.
Trails	Erosion and sediment control	<ul style="list-style-type: none"> • Do not side cast materials (e.g., soil/sediment, rocks, etc.) from trails directly into stream channels or within a deliverable distance. Do not side cast material (<1 inch diameter fine inorganic material) along trails within one-quarter mile of perennial streams and from roads onto fill slopes having a slope greater than 45 percent. • Locate rolling dips/waterbars such that water and material potentially moving down trails is directed off the trail and filtered by intervening vegetation. Rolling dips and/or waterbars will be placed as needed in newly constructed and existing trails and near stream crossings to minimize water travel lengths and erosion. • To dissipate surface runoff, place woody debris (>3 inch diameter) perpendicular to the downhill end of rolling dips and/or waterbars. • Route trails away from crossings to minimize length of trail sections perpendicular to streams that may direct sediment toward streams. • Reclaim abandoned trails to prevent continued use and erosion. A fish biologist or hydrologist will be involved in reclamation of abandoned trails.
	Protection of riparian conservation areas	<ul style="list-style-type: none"> • Minimize brushing near streams, wetlands, and other water features by leaving as much of an uncut buffer as possible. Brushing will not retard attainment of RCA objectives. • Do not ‘borrow’ stream gravels and cobbles from any RCA where it would affect watershed condition indicators (WCIs). Use of material within an RCA requires approval from a fish biologist.
	Streambank stabilization	<ul style="list-style-type: none"> • Activities will be conducted by hand. • Streambank stabilization sites will each be limited to less than 100 linear feet.
	Blasting	<ul style="list-style-type: none"> • Implement the best management practices (BMPs) identified in the Road Maintenance Programmatic Activity mitigations.

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
Trails (Cont.)	Trail stream crossings	<ul style="list-style-type: none"> ● Riprap placement around bridge abutments will be limited to less than 100 linear feet. ● Riprap will be placed by hand. ● Minimize sediment entering streams by using silt-fence, or certified weed-free straw bales between abutments and stream, by avoiding abutment construction, or by using keystone blocks or native rock type material that avoid generating erosion/sedimentation. ● Bridge abutments will span bankfull width and accommodate 100-year flows where possible. A fisheries biologist or hydrologist will determine bankfull width. ● If native stringers must be taken from RCAs, they will be removed by hand. Generally three to six trees are needed for a native stringer bridge. ● When maintaining asphalt wearing surfaces, measures will be taken to prevent asphalt from falling into the water during replacement and installation. Operators will use diligence to prevent spills. Typically, new bridges have a metal retainer at the edge of the deck which retains roadbed material including asphalt. ● Where practicable, construct short approach inclines on ends of bridges to prevent water movement from trail onto bridge. ● During bridge construction, mechanized equipment will be restricted to operation on streambanks, and may not enter streams without approval from a fisheries biologist. ● Stream fording will be minimized as much as practicable.
	Trail stream crossings	<ul style="list-style-type: none"> ● On non-fish bearing streams: <ul style="list-style-type: none"> ○ Crossing structures will meet PNF Land and Resource Management Plan standards. ○ Store removed fill at a stable location. ○ If dewatering is necessary, a dewatering plan will be submitted for approval by a hydrologist or fisheries biologist before activities begin. Stream dewatering will be performed in accordance with the approved plan. ○ The channel will be slowly rewatered to minimize turbidity. ● Additional site-specific measures, including modifications to mitigations because of site-specific conditions, may be identified and approved by a fisheries biologist, soil scientist, or hydrologist.
	Treated wood	<ul style="list-style-type: none"> ● All treated wood used shall be produced and used in compliance with guidelines and BMPs issued by the Western Wood Preservers Institute (2006) and NMFS (2009). These BMPs address design and purchasing; transportation; inspection, acceptance, and rejection; storage; guidelines for treating wood in the field; installation; demolition; and disposal. Notable BMPs are listed below. ● Material selection will consider potential background concentrations of contaminants [e.g., Polycyclic aromatic hydrocarbons (PAH), copper] in the aquatic environment at the project site, density of product installation, location of other treated wood structures, and use of habitat by ESA-listed fish species (e.g., spawning, rearing, migration). Alternatives (e.g., concrete, metal, silica-based wood preservation, etc.) to pesticide-treated wood will be considered for use. ● When treated wood products are to be used over or adjacent to aquatic environments, those with the lowest amount of copper will be prioritized for use. Creosote-treated wood will not be used in, near, or adjacent to aquatic environments.

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
Trails (Cont.)	Treated wood (Cont.)	<ul style="list-style-type: none"> • Defective products (e.g., presence of residues or bleeding) will be rejected from installation and the treating company will be contacted immediately for corrective action. • When field treating by brushing, spraying, dipping or soaking do so in such a manner that the preservative does not drip or spill into the environment. Conduct the application so that any overspray or drippage of preservative can be recovered or retained. • Whenever possible, apply field treatments, and allow treatments to dry/cure, prior to assembling the structure over the body of water or wetland environment. • Perform field cutting, drilling, or fabrication away from the water or wetland area to the degree practical. Collect and properly dispose of all waste, including sawdust. • If cutting, drilling, treating, etc., is required to be performed over water, then tarps, plastic tubs or similar devices will be used to capture debris, spills, or drips. A vacuum may also be used during construction to capture debris. Any material that falls into the stream will be promptly removed. Wipe off any excess preservative. No applications will be made when it is raining. • Treated wood materials will not be installed below the ordinary high water mark on streams. • Onsite material will be stored away from the water until it is needed for installation. When preservative-treated wood is stored onsite for an extended period and/or there is a threat of the material being exposed to precipitation, the material will be stacked above the ground. The area where the material is to be stacked will be free of debris, weeds and dry vegetation and will have adequate drainage to prevent the material from being subjected to standing water. Also, if warranted, all stacked material designated to be removed from service should be covered for disposal and material designated for use should remain covered until used. • Remove existing treated wood structures from aquatic and wetland environments with care to minimize the potential for treated debris to enter the environment. • All scraps and sawdust from the demolition should be collected and removed for appropriate disposal. In aquatic applications absorbent booms should be used to control drift of scrap materials from the work area or to control sheens which may develop with the disturbance. • Remove piles whenever practical. If possible, remove piles by pulling them out of the stream, preferably with a vibratory pile driver. If complete removal is not possible, treated wood pilings will be cut, preferably below the bottom surface of the stream channel. Holes left by the pilings will be filled with clean, native sediments. • Treated wood scraps and sawdust as well as material for disposal that is not reused must be disposed of appropriately, in compliance with applicable requirements, in a timely manner.
Administrative/ Recreation Facilities	Protection of riparian conservation areas	<ul style="list-style-type: none"> • Hazard trees felled within RCAs will be left in the RCA if possible but may be removed if approved by a fish biologist. This can occur with forest crews or under a contract. If with a contract, the requirements for Timber harvest and Pre-Commercial Thinning Activity will be used. • New infrastructure within RCAs at existing, developed recreation sites will be approved by a fisheries biologist or hydrologist.

Fire Management

This programmatic activity authorizes fire management on the PNF that ranges from full suppression to those managed for resource objectives (or a combination thereof). Also included is prescribed burning. Wilderness fire management objectives may be met by permitting lightning-caused fires to play, as nearly as possible, their natural ecological role within wilderness. Lightning-caused fires in non-wilderness lands that allow wildland fire use [as described in the PNF Land and Resource Management Plan (LRMP)] may be managed to accomplish resource objectives. Prescribed fires, using either aerial or ground ignitions, may be implemented to restore and maintain ecosystem health and resilience, to reduce undesired material from vegetation treatments, and to reduce fuels in the wildland urban interface.

The PNF has fire suppression responsibility on areas outside the administrative boundary on Bureau of Land Management and private lands in the Brownlee, Weiser, Little Salmon, and Main Salmon SW Section 7 watersheds. Southern Idaho Timber Protective Association has fire suppression responsibility on a portion of PNF lands in the Little Salmon River, North Fork Payette, and Weiser Section 7 Watersheds (Figure A-2).

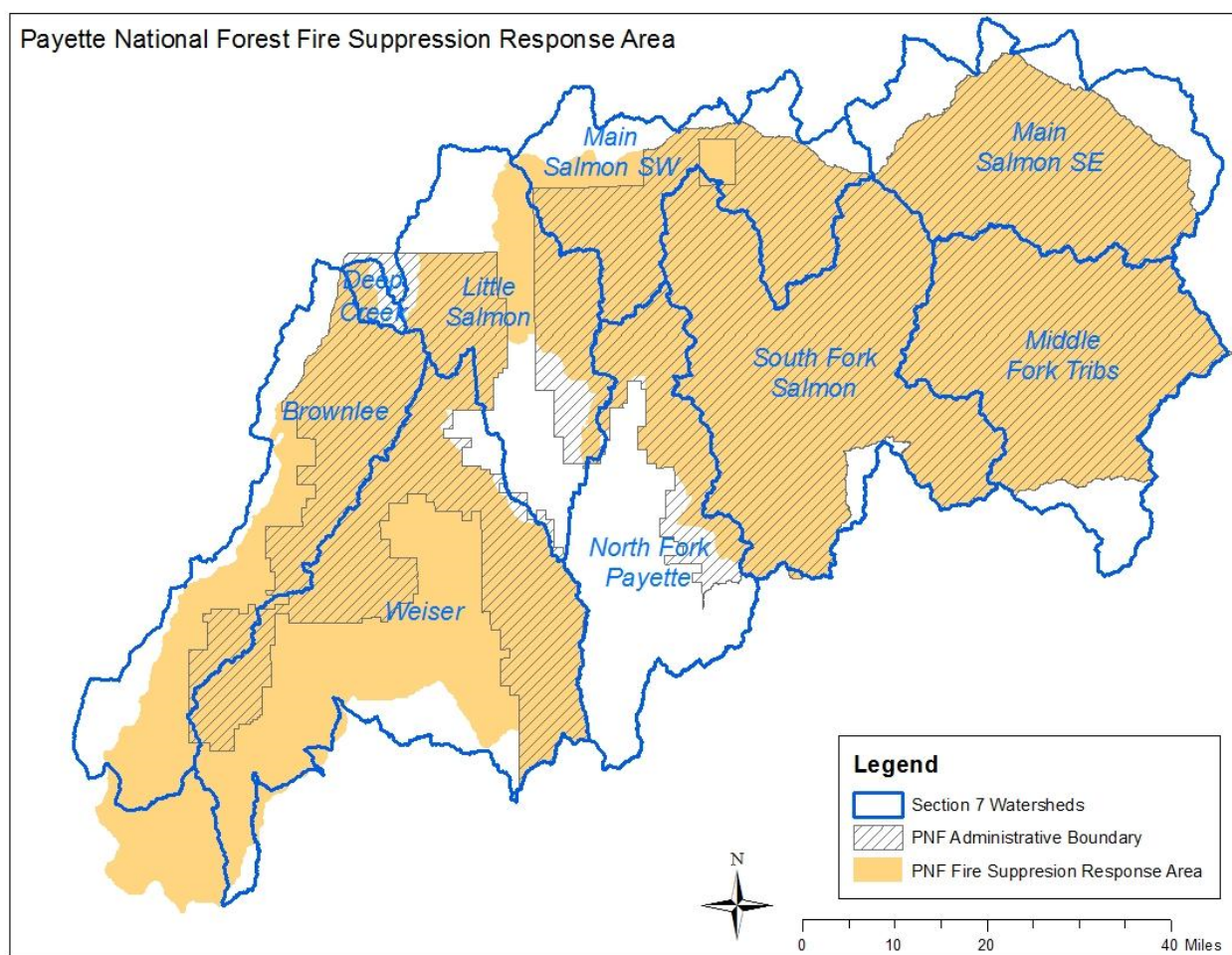


Figure A-2. Payette National Forest fire suppression response area.

This programmatic activity excludes aerial application of fire retardants. Consultation for aerial application of fire retardants was completed at the national level (WCR-2018-9167). The PNF has developed and uses the Resource Direction and Guidelines for Fire Operations desk key and Resource Protection Maps to provide guidance on how to minimize fire operations impacts on species and critical habitats. The PNF has also developed Resource Direction and Guidelines for Fire Operations maps for a visual display of what is in the desk key. Both the desk key and the resource protection maps can be found in Chapter 4 of the BA (PNF 2020). These documents are used during initial attack (first 72 hours of suppression) by fire personnel and then used extensively by the Resource Advisor (READ) during longer duration events. Fire suppression operations, prescribed fire operations, and the mitigations and BMPs that will be implemented to minimize effects are described below.

Fire Suppression Operations

A number of operations may take place when suppressing fires, including fireline construction; water drafting; helicopter and aerial dipping; burnout and firing operations; ground application of retardant foams, and surfactants; creation and management of camps, helibases, helispots and other operational facilities; mop up; suppression repair; road reconstruction; and transport and use of fuel and other chemicals. Each of these are described below.

Fire Line Construction. Fire lines are used as a means for controlling the spread of a fire and are constructed by clearing a path, removing all flammable material, and scraping a line clear to mineral soil wide enough to stop the spread of fire. A cup trench may be used across the bottom of steep slopes of the fire to catch rolling debris. Most often, hand tools and chainsaws are used for line construction, though heavy equipment (including, but not limited to dozers, tracked excavators, feller-bunchers, log skidders, skid-geons) or explosives may also be used. Fuel characteristics, fire behavior, topography, access, and suppression strategy(ies) dictate the type and size of fire line constructed. In some instances, a wet line using a hose lay with pump and water source or cold trailing the fire's edge may be sufficient. Natural barriers are used whenever possible, including rock outcrops, areas of little or no fuel, and streams, rivers, or lakes. Existing routes (including open, closed, decommissioned and unauthorized routes) may be modified or re-opened temporarily (generally using heavy equipment) for use as fireline and/or to provide access to parts of the fire (road reconstruction is additionally described below). Depending on the suppression strategy being implemented, this will generally include scraping the road surface to mineral soil and removing vegetation from roadsides, either to allow vehicle access or to provide a fuel break. This may require the use of machinery (such as a feller-buncher) or the use of hand tools and chainsaws. Any route opened will be returned to pre-fire conditions during fire suppression rehabilitation activities.

Cooling the fire and knocking down the hotspots can include separating burning heavy fuel and using dirt, or water to cool them down. Some felling and burning snags or hazard trees (those determined to be a likely threat of falling and striking fire personnel) and bucking of down logs may be required using hand tools or a chainsaw.

Water Drafting. Water application is a common method for fire suppression and is typically applied aerially or by a hose from a tender, directly pumped from a lake/stream, or by backpack.

Water is transported to fires by a water tender and/or tank truck, fire engine, and/or by portable pumps with a network of hoses. For portable pump operations, the pump size varies with site conditions. If an adequate water source is not available, portable storage tanks may be set up and filled by water tenders to supply needs near a fire line.

The type of pumps used to draft water varies with the size of the water source and stream flows. If the water source has inadequate flow for effective pumping, a portable tank may be used or occasionally a sump may be created. A sump may be constructed by hand using native materials, plywood, and/or plastic. These sites are usually (but not always) located in small, steep, low-order headwater streams.

Helicopter and Aerial Dipping. Helicopter buckets/snorkels or fixed-wing aircraft capable of “scooping” water may be used to collect water. The amount of water that could be collected at one time varies from 75 gallons to more than 2,000 gallons, depending on the allowable aircraft payload. Water is dipped (or snorkeled, which is considered synonymous with dipping) by helicopters from lakes, rivers, streams, or portable tanks that are located as close to the incident as possible unless they are identified as closed. Streams and areas closed for dipping or snorkeling are identified on the Resource Protection Maps. Areas shown as closed to dipping will only be used when necessary to provide protection for life or property. Snorkeling may be used if the snorkel is appropriately screened and the location avoids spawning fish. A suitable dip (or snorkel) site is located according to specific criteria that include safety considerations for the helicopter, water depth, and water surface area. Dipping (or snorkeling) generally occurs from lakes and large rivers. Sometimes dipping occurs in smaller streams; the size of the stream used is limited by the pool size available.

During suppression, local water sources such as lakes and streams are generally used. However, depending upon the location and conditions, helicopters and aerial tankers may deliver water to fires from remote locations, such as existing tanker bases in Boise, McCall, and Twin Falls. Fixed wing aircraft capable of “scooping” water may also be used to deliver water to wildfires. Due to limitations of those aircraft, they are limited to drawing water from large lakes/reservoirs identified on the Water Sources Used for Scooper Operations During Fire Management Activities map.

Burning Out Operations. Burning out is used to strengthen the fire line by setting a fire inside a control line to consume fuel between the edge of the control line and the fire. Burning out is commonly used to consume unburned islands of fuel to provide for firefighter safety and reduce the potential for uncontrolled spread where there is not a continuous burn pattern. Burning out removes the danger of flare-ups in unburned fuel near the fireline to prevent spotting across the fireline and facilitate containment. Equipment used to light these burnouts are handheld drip torches (filled with a mixture of diesel and gasoline), fuses, flare guns, terratorches (truck mounted flame throwers), helitorches (helicopters with suspended tanks of gelled fuel and applicators), and aerially applied plastic spheres (filled with potassium permanganate mixed with liquid ethylene glycol) that combust upon delivery to the ground.

Ground Application of Retardant, Foams, and Surfactants. Chemical fire retardants, foams, and other surfactants may be used to increase the effectiveness of water in checking the spread of

fire, to support burnout and/or prescribed fire operations, and during mop-up. Although fairly uncommon, fire retardant may be applied to infrastructure (buildings, power poles, wooden bridges, etc.) using ground-based equipment such as (but not limited to) all-terrain vehicles or truck-mounted pumps, weed sprayers, or applying by hand using paintbrushes or similar methods. Incident-specific mitigation measures will be developed on a case-by-case basis with READs to mitigate potential contamination of surface water.

Camps, Helibases, Helispots, and other Operational Facilities. Camps, helibases, staging areas, and helispots are areas used to camp or stage personnel and equipment and places to land and park helicopters. Camps vary in size and impacts from “coyote” camps for two people with minimal equipment and comforts to large camps for several hundred personnel camped in one area. Large camps have areas for sleeping, eating, showering, staging supplies and equipment, fueling equipment, and for Incident Management Teams (IMTs) to work. Large camps may be located on private property, although they must adhere to all requirements for federal land. Helibases are areas where helicopters can be fueled, loaded, parked, and maintained. One to several helicopters can be stationed at a helibase. Helispots are areas where personnel and equipment can be loaded or unloaded from a helicopter. Helicopters are usually only at helispots long enough to drop or pick up a load. Staging areas are places where personnel and equipment are placed for rapid deployment on large fires. These areas have sanitation facilities and places to safely park personnel carriers and equipment. Some fueling and light maintenance may be performed on equipment in staging areas. Food and sleeping facilities are normally not provided at staging areas. Staging areas are short-term and for temporary use only.

Mop-Up. Mop-up begins once some of the fire spread is stopped and involves ensuring that portion of the fire is out. This includes cold trailing, a process by which a bare hand is used to feel for heat along the edge of “the black” on larger fires or throughout the entire area of smaller fires, in search of hotspots. When hotspots are found, they are extinguished with hand tools, dirt, and water. Surfactants, such as foam, may be used during mop-up.

Reconstructed Roads. System and unauthorized roads that have been overgrown or closed are often reopened for fire suppression activities and are used as a fireline, as an access route to the fire, or both. These roads may be improved if needed to allow for heavy equipment and vehicles. This improvement may be as simple as brushing the road prism with chainsaws to using a bulldozer to remove vegetation and reestablish the drivable prism. Any route opened will be returned to pre-fire conditions during fire suppression repair activities.

Suppression Repair Activities. After the fire is controlled (or otherwise deemed appropriate by the IMT, rehabilitation of the fire line, roads, camps, and other areas used, will be planned and completed as necessary in close coordination with one or more of the Forest’s READs. Suppression repair actions will be provided to the IMT in a Suppression Repair Plan approved by the Line Officer [and/or other appropriate responsible official(s)]. Specific instructions may also be provided in the daily Incident Action Plan.

Actions associated with suppression repair will include measures such as, but not limited to:

- Construction of water bars and covering the fireline with debris.

- Firelines constructed with the use of heavy equipment usually require extensive rehabilitation (using a tracked excavator), and these areas may be seeded in addition to water bars and debris placement.
- Seeding and decompacting areas such as camps, parking areas, staging areas, and helispots/helibases.
- Restoration of streambanks where firelines cross streams by adding rock and debris in the disturbed area.
- Restoration of roads opened during suppression actions to pre-fire conditions.
- Scattering slash or other deposits of wood/vegetation created during suppression actions.
- Restoration of any trails used for suppression actions to a pre-fire condition.

Transport and Use of Fuel and Other Chemicals. Petroleum based fuels (generally unleaded gasoline and diesel) are used in a variety of fire suppression equipment from portable pumps and chainsaws to heavy equipment such as dozers and tracked excavators. Drip torches used for burnout operations and prescribed fire use a mixture of diesel and unleaded gasoline. Portable pumps are fueled by either an attached tank or a portable fuel tank attached with a rubber fuel line. Fuel is generally transported and stored in either portable 5-gallon cans, trailer-mounted fuel tanks, or on large incidents, contracted fuel tenders. Two-cycle oil (mixed with gasoline for portable pumps and chainsaws), miscellaneous lubricants, and other synthetic or petroleum based products [including, but not limited to: Jet-A, Class A foam (Silv-ex®), Class B foam (AFFF), antifreeze, propane hydraulic fluid, motor oil, lead-acid batteries] may also be stored and used to service or maintain various equipment during fire situations.

Prescribed Fire

The programmatic activity would authorize the PNF to burn between 1,000 and 15,000 acres annually, depending on the Section 7 watershed (Table A-6).

Table A-6. Proposed acreage to be treated annually in each Section 7 Watershed of the Payette National Forest.

Section 7 Watershed	Total Potential Area Treated with Prescribed Fire Annually (acres)
Brownlee Reservoir	1,000
Weiser River	5,000
Deep Creek	1,000
Little Salmon River	7,000
Main Salmon River SW	1,000
Middle Fork Tributaries and Main Salmon River Tributaries SE	15,000
South Fork Salmon River	15,000

Burn units will be ignited aerially either by dispensing plastic spheres from a helicopter, with a helitorch, and/or with some areas hand-ignited with drip torches, terra torches or other devices.

The spheres contain potassium permanganate (3 grams each) and are injected with 0.75–1.5 cc of glycol (i.e., antifreeze) just prior to release to cause ignition. Ignition typically occurs after about 20 seconds, after the sphere has landed on the ground.

Prescribed burning operations could occur at any time of the year, depending on favorable fuel and weather conditions. Fire may be applied to tree wells in winter or early spring to reduce fuel accumulation and reduce the potential for tree mortality during regular broadcast burning. The creation of openings, similar to what natural fire might produce is anticipated. Prescribed fire will move forested and non-forested vegetation towards conditions that more closely represent historic distribution, structure, and function. A prescribed burn of low to moderate severity is intended to reduce surface and ladder fuels in order to mitigate future high severity, stand replacement fires and will increase opportunities to manage naturally occurring wildland fires. This treatment will be used to mimic historic vegetative characteristics by reintroducing early stages of succession, altering species composition, and reducing unusually high stand densities.

Areas identified for application of prescribed fire may also be evaluated for ladder fuel thinning to minimize tree mortality from prescribed fire, improve control lines and boundaries, and aid in moving vegetation towards desired conditions. Non-commercial thinning will generally cut trees less than 8 inches diameter at breast height and prune residual trees, when practical, up to 6 feet in height. In areas targeted for prescribed fire treatments (see below) non-commercial thinning will be completed where necessary to:

- Expand the opportunity for application of prescribed fire by changing the fuel profile.
- Reduce the potential for undesired fire effects (i.e., mortality of legacy trees).
- Aid in the retention of desired leave trees.

Individual prescribed burn projects may range from approximately 100 to thousands of acres, depending on site-specific objectives and the available prescription window. Burning of piled material from either harvest of forest products or pre-commercial thinning may also occur. Hand-piling (and burning those piles) in RCAs may occur when agreed to by both a hydrologist and fisheries biologist. Hydrologist and fisheries biologist will designate a distance hand piles must be from streams or other waters on a project-specific basis.

Existing barriers to fire spread (natural and human-caused, from streams and barren ridgelines to roads and trails) will be used where possible to contain prescribed burns within specified boundaries. In areas where existing barriers are insufficient to control fire spread, fireline will be constructed. Hand-constructed fireline will be limited to use only where necessary. No mechanical fire-line construction is proposed. The integrity of existing trails and roads will be considered in the application of fire and damage caused by these actions will be repaired. Constructed fireline will be rehabilitated after use. Contingencies will be identified should an escaped fire warrant line construction. Natural barriers to fire movement such as moist riparian areas, changing fuel conditions, and topographic breaks will be used to confine the prescribed fires.

All burning will follow LRMP Standards and Guidelines and adhere to national and state ambient air quality standards. Specific conditions under which burning can occur will be developed through a prescribed fire plan. Prior to ignitions, district resources specialists will review planned ignitions.

Required Mitigation

The PNF has proposed numerous BMPs to avoid or minimize adverse effects to aquatic resources. Those practices are summarized in Table A-7.

An important mitigation that is employed is the assignment of a READ to serve as a liaison between the home unit and the IMT. A READ is generally a resource specialist (i.e., fish biologist, hydrologist, wildlife biologist, etc.) that helps develop suppression strategies and tactics to minimize or mitigate the effects of fire and suppression actions on natural resources. They anticipate impacts on resources as fire operations evolve; communicate requirements for resource protection to the Incident Commander or IMT; ensure that planned mitigation measures are carried out effectively; and provide input in the development of short- and long-term natural resource and cultural rehabilitation plans. More specific roles of the READ include:

- Assist in the development of the Wildland Fire Decision Support System (WFDSS) product to identify areas where there is potential to affect ESA-listed species or their habitats. PNF resource management direction is integrated into WFDSS development.
- Assist with selecting locations for camps, staging areas and helibases, which is done early during the incident. Locations will be approved either during pre-suppression planning or on a case-by-case basis.
- Brief IMTs about listed species present including direction applicable to suppression tactics as early as possible (at the Forest/IMT in-briefing) and at regular intervals throughout the incident.
- Review Operational Period Plans (wildfire suppression) to assess the potential effects of the planned actions.
- Monitor implementation of wildland fire management guidance stated within this consultation.
- Inform IMTs of incident-related RCA resources and issues.
- The Forest Service will update, as needed or requested, the status of wildfires/consultation and provide real-time reporting of compliance with this consultation to the Level 1 Team [and shared with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS)] for all wildland fire management actions conducted under this programmatic BA that may affect ESA-listed species or their habitats. Requirements under the Migratory Bird Treaty Act, along with related federal acts (i.e., Bald and Golden Eagle Protection Act), will also be addressed.

The PNF will select one prescribed fire and one large fire (>10 acres) to monitor and report annually. The Fire Suppression and Prescribed Fire Programmatic Checklists [found in Chapter 4 of the BA (PNF 2020)] will be used to document fire management compliance with the programmatic activity description.

Table A-7. Required mitigations and best management practices for fire management activities that will be implemented to avoid or minimize potential consequences associated with fire suppression activities conducted by the Payette National Forest (PNF).

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
General	Level 1 Team Coordination	<ul style="list-style-type: none"> ● When resource advisor maps are updated, they will be shared and approved by the Level 1 Team. ● The PNF Level 1 Team members or district/zone biologists will periodically update the Level 1 Team to the status of wildfire incidents. A primary goal of this update will determine whether this programmatic consultation can cover the incident or whether an emergency consultation needs to be initiated.
	Aquatic Invasive Species	<ul style="list-style-type: none"> ● The PNF will follow the <i>Guide to Preventing Aquatic Invasive Species Transport by Wildland Fire Operations</i> (NWCG 2017) to minimize spread of aquatic invasive species. Examples of best management practices included in those guidelines include: <ul style="list-style-type: none"> ○ Fill tanks from municipal water sources whenever possible. ○ Avoid drafting from waterbodies with known infestations of aquatic invasive species, whenever possible. ○ Avoid transferring water between drainages or between unconnected waters within the same drainage. Do not dump water from one waterbody (e.g., stream, lake, or reservoir) into another waterbody. Do not allow water from fold-a-tanks or pumpkins to drain into nearby waterways if the fold-a-tank was filled with water from a different drainage. Dispose of excess water over uplands. ○ Avoid sucking organic and bottom material into water intakes when drafting from shallow water. Use screens. If collapsible tanks can be filled with municipal water, draft from those tanks instead of untreated water sources. ○ Avoid entering (driving through) waterbodies or wet areas when possible. ○ Remove all plant parts and mud from external surfaces of gear and equipment after an operational period. ○ Avoid obtaining water from multiple sources during a single operational period unless drafting/dipping equipment is decontaminated or changed out with clean equipment between sources. ○ If contamination of equipment with untreated water or mud/plants is unavoidable, see “Decontaminating Ground Equipment” and “Decontaminating Aviation Equipment” sections of the NWCG (2017) document.
Fire suppression operations	Fireline construction	<ul style="list-style-type: none"> ● Utilize minimum impact management techniques in areas where there is potential to damage ESA-listed fishes or critical habitat. Every effort should be made to minimize stream course disturbance, sedimentation, and actions that will result in increased water temperatures. ● Heavy equipment use for fire line construction within riparian conservation areas (RCAs) or landslide-prone areas in drainages with ESA-listed fish species will be approved by a resource specialist, Resource Advisor (READ), or fish biologist prior to construction. ● Heavy equipment cannot cross streams designated as critical habitat, occupied by an ESA-listed species, or less than 600 feet upstream of occupied habitat. ● Firelines will be constructed in a way to minimize the collection, concentration, and delivery of water and sediment into nearby waterways.

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
Fire suppression operations (Cont.)	Fireline construction (Cont.)	<ul style="list-style-type: none"> ● Fireline will be constructed using the minimum width and depth needed to safely accomplish the desired task. ● Explosives for fireline construction and removal of hazard trees will adhere to the distances and charges stated within Table 4 of this opinion. ● Once a wildfire decision support system (WFDSS) has been approved, heavy equipment shall not be used to construct fire lines within RCAs unless the line officer or designee determines that imminent safety to human life or protection of structures is an issue; or the incident READ determines and documents an escaped fire would cause more degradation to RCAs than would result from the disturbance of heavy equipment [Land and Resource Management Plan (LRMP) FMST01]. ● Trees or snags that are felled within RCAs shall be left intact unless resource protection (e.g., during fire line construction leaving the material in place risks not meeting wildland fire management objectives) or public safety requires bucking them into smaller pieces. ● Felling/bucking of trees or snags must not result in a measurable change in any of the watershed condition indicators (WCIs).
	Water drafting	<ul style="list-style-type: none"> ● Drafting equipment used in ESA-occupied and potentially occupied waters will be screened to meet National Marine Fisheries Service screening criteria. ● <u>Drafting equipment will be inspected for proper screening when it arrives and prior to deployment on a fire.</u> ● Pump intake screens shall have openings not exceeding 3/32-inch diameter and a surface area proportionate to the pump intake capacity. The objective is to provide a positive barrier to fish entrainment and maintain a velocity of no more than 0.2 feet per second (fps) at the surface of the intake screen to avoid impingement. ● The following formula will be used to calculate the required screen surface area: $Q = V \times A \times SF \text{ where:}$ <ul style="list-style-type: none"> Q = Pump Intake Rate [cubic feet per second (cfs)]; V = Velocity at screen surface (0.2 fps); A = Area of the screen [square feet (ft²)] and, SF = Safety Factor of 10% (by multiplying by 1.1). ● The screen area accounts for the entire area of the screen and does not count screen mesh as an occlusion. This requires a screen porosity of greater than 27%. Number ten wire mesh has a screen porosity of 56.3%. If the percent open area of the screen material is less than 27%, then calculation of the required total screen area must account for occlusion by structural members. Larger surface areas are recommended where debris buildup is anticipated, and where stream depth is inadequate to fully submerge the screen. Screen mesh must be in good condition and present a sealed, positive barrier-effectively preventing entry of fish into the intake. ● The pump intake screen shall be placed longitudinally or parallel to the river velocity. ● The pump intake screen shall be placed to have a minimum clearance of one screen radius or depth to all natural and constructed features. ● The pump intake screen shall be cleaned as necessary to prevent buildup of material.

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
Fire suppression operations (Cont.)	Water drafting (Cont.)	<ul style="list-style-type: none"> • READs will monitor drafting operations to ensure that pumps stationed within the RCA have appropriate containment and that the amount of water being withdrawn from streams does not visually reduce stream flows.
	Helicopter and aerial dipping	<ul style="list-style-type: none"> • Dipping will follow the direction from the Resource Direction and Guidelines for Fire Operations desk key Resource Protection Maps (hereinafter referred to as maps) and be consistent with LRMP standards. These maps display where dipping cannot occur. • After the initial 48 hours from a fire start, READs (or appropriate resource specialist) will direct fire crews and helicopter pilots to dip locations where ESA-listed fish are not present. Dipping may occur in occupied waters after the initial 48 hours when necessary (i.e., when alternative locations close enough to afford the same water transport efficiency are not available) to provide protection for life or property. • Dipping may only occur in waterbodies closed to dipping on the maps when necessary. (i.e., when alternative locations close enough to afford the same water transport efficiency are not available) to provide protection for life or property. • Helicopter bucketing directly from streams will not occur if chemical products are injected into the bucket. Helicopter bucketing can occur only after chemical injection systems have been removed, disconnected, or rinsed clean. • Scooping is limited to the areas described on the Scooper Map.
	Burning out operations	<ul style="list-style-type: none"> • Suppression tactics (backburns or burnouts) should minimize fire severity in RCAs. • Fire will only be ignited within RCAs if it is necessary to meet wildland fire management (suppression) objectives.
	Ground application of retardants, foam, and surfactants	<ul style="list-style-type: none"> • Fire suppression chemicals will not be used in areas where there is potential for direct waterway contamination. • Injecting chemicals while pumping directly from waterways will not be conducted without appropriate mitigation. In cases where chemicals are needed, water will be pumped from a fold-a-tank or a backflow check valve will be used. • When retardant is applied using ground-based equipment, READs and a fisheries biologist will develop specific mitigations measures to prevent contamination of waterways.
	Camps, helibases, helispots, and other operation facilities	<ul style="list-style-type: none"> • Operational facilities will be located outside of RCAs to the extent possible. Coyote or spike camps will only be allowed within RCAs if there are no other suitable sites and they will minimize vegetation disturbance (e.g., clearing and cutting of trees), follow pack it in/pack it out practices, and adhere to sanitation procedures found in the Forest Health and Safety Code Handbook. Guidance from District or Forest Resource Specialists will also be followed. • Helicopter landing sites and refueling areas will be located outside of the RCAs. • Gray water will be removed from camps and disposed of properly. • Facilities to be located in RCAs in drainages with ESA-listed fish will be approved by a resource specialist, READ, or fish biologist prior to activities taking place. If adjacent to occupied habitat, the Level 1 team will be updated on actions taken for suppression repair. • Once a WFDSS has been approved, all operational facilities will be located outside RCAs unless the only suitable location for such activities is determined and documented by the line officer or designee to be

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
Fire suppression operations (Cont.)	Camps, helibases, helispots, and other operation facilities (Cont.)	<p>within an RCA. Should camps, staging areas, or other operational facilities be located in RCAs, measures will be developed with the incident READ to mitigate potential effects.</p> <ul style="list-style-type: none"> ● If in RCAs, READs will be contacted prior to set up and will assist in laying out the camp to avoid adverse effects to WCIs. Measures they may use include flagging no-entry zones, educating personnel at morning and evening briefings about measures to protect streams and fish. READs will regularly visit the camp and ensure problems are fixed quickly. ● Each Forest district should identify locations to wash equipment. These areas will be located where they are easily accessible and usable; on gravel or well-drained soils; where runoff will not directly enter stream or carry seeds/organism away from site, where they may be used repeatedly so that these areas can be monitored and treated for established weeds as needed. ● Portable weed-wash stations used on fire incidents are generally self-contained and collect effluent, which is disposed of off-site.
	Reconstructed roads	<ul style="list-style-type: none"> ● If closed roads are opened within RCAs, the READ shall identify any associated erosional problems and recommend rehabilitation treatments needed to minimize or avoid sediment delivery to waterbodies and intermittent streams. ● Treatments identified by the READ will be incorporated in the Rehabilitation Plan and rehabilitation treatments within the RCA will be prioritized for early implementation. The agency administrator shall ensure that rehabilitation of all effects of fire suppression is addressed by the IMT. ● All road reconstruction activities shall be discussed with the READ prior to implementation in order to minimize or avoid potential adverse effects. ● Road reconstruction actions will require the use of erosion-control structures to capture any sediment that may be caused through implementation.
		<ul style="list-style-type: none"> ● All roads that are opened during fire suppression activities shall be returned to pre-fire administrative status once all fire suppression actions and suppression repair treatments are complete, including effectively closing to unauthorized use. ● Temporary crossings (bridges or culverts) or fording cannot occur with vehicles or machinery if the stream is critical habitat or are occupied by ESA-listed fishes.
	Mop-up	<ul style="list-style-type: none"> ● Utilize minimum impact suppression tactics in areas where there is potential to damage ESA-listed fishes or critical habitat. Every effort should be made to minimize stream course disturbance, sedimentation, and actions that will result in increased water temperatures. ● Trees or snags that are felled within RCAs shall be left intact unless resource protection (e.g., during fire line construction leaving the material in place risks not meeting wildland fire management objectives) or public safety requires bucking them into smaller pieces.
	Suppression rehabilitation actions	<ul style="list-style-type: none"> ● Suppression rehabilitation measures will be completed for all fires where Wildland Fire Management Tactics are implemented. ● All erosion control materials will be certified weed free in order to prevent the spread of noxious weeds. ● The READ will review the Wildland Fire Management Tactics and rehabilitation efforts to ensure that they successfully avoid or mitigate adverse effects to listed species and critical habitat.

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
Fire suppression operations (Cont.)	Suppression rehabilitation actions (Cont.)	<ul style="list-style-type: none"> ● A separate Burn Area Emergency Response (BAER) Team may be formed as appropriate for a wildfire but burn area rehabilitation is not part of the wildland fire suppression action. That team will have to initiate emergency consultation should any BAER actions be recommended that may affect ESA-listed species or critical habitat (that are not covered under existing programmatic consultation). To improve efficiencies and maintain consistency, consultation on BAER activities should attempt, whenever appropriate and practical, to tier to existing programmatic coverage's wherever appropriate (e.g., Weed Treatment Programmatic, Stream Crossing Replacement/Removal Programmatic, etc.)
	Transport and use of fuel and other chemicals	<ul style="list-style-type: none"> ● Do not authorize storage of fuels and other toxicants or refueling within RCAs unless there are no other alternatives. Storage of fuels and other toxicants or refueling sites within RCAs shall be approved by the responsible official and have an approved spill containment plan commensurate with the amount of fuel. ● Spill containment equipment will be readily available and used. ● Petroleum products will be contained in impermeable devices of sufficient size to contain amount of fuel/oil stored. Examples of fuel containers requiring containment are fuel trucks (including those at helibases), portable pumps and their fuel, portable generators and their fuel, fuel stored in cans at camps. ● The Forest will develop a contingency plan identifying procedure to be initiated should a chemical spill or contamination occur. ● During initial and extended attack, fueling of equipment may occur within RCAs if there are no other suitable locations. Refueling or storage of over 5 gallons of fuel should occur outside of RCAs. If this is not physically possible, refueling and storage shall be located as far away from surface water as possible and will occur no closer than 100 feet from waterbodies. If drip torches or pumps are fueled in the RCA, or fuel mixtures or other petroleum products are stored in the RCA, a containment basin or absorbent pad of adequate size to contain the potential spill volume will be used. ● All water drafting operations will have pumps and fuel setup within an adequate and appropriate containment system. READs will monitor water drafting operations and other fuel-related storage locations within the RCA to ensure appropriate controls are in place that are sufficient to contain potential chemical spills and prevent delivery to perennial and intermittent waterbodies.
Prescribed fire	General	<ul style="list-style-type: none"> ● Burn plans will address required elements as discussed in Forest Service Manual (FSM) 5140 and the Interagency Prescribed Fire Planning and Implementation Procedures Guide (PMS 484). ● A fish and a wildlife biologist will review planned ignitions prior to line officer approval. ● No new roads will be built to access prescribed burns and no roads will be re-opened that are presently closed and vegetated.

Activity	Category	Practices to Avoid or Minimize Potential Adverse Effects
Prescribed fire (Cont.)	General (Cont.)	<ul style="list-style-type: none"> ● Ignition of prescribed fire may occur within RCAs. For broadcast burning, ignition will not occur within one site-potential tree height (slope distance) of perennial streams. Fire that further “backs” toward streams (within one site-potential tree height) will be allowed to burn. For pile burning, ignition of hand piles may occur within one site-potential tree height of perennial stream channels, if riparian vegetation is sparse, and if agreed to by a hydrologist and fisheries biologist. If riparian vegetation is multi-strata and includes trees and shrubs, piles must be placed well outside of the potential burn zone. The objective of pile burning will be to consume the pile and limit spread from it. In all cases, hand piles will be placed in areas that do not contain riparian vegetation. ● Ignition in moderate to high hazard landslide prone areas will not be allowed, unless approved by a journey-level hydrologist or soil scientist with site-specific knowledge of the area in question. The hydrologist/soil scientist will participate in development of burn plans for these areas and minimize the potential for destabilizing these sensitive areas with prescribed fire. Projects which propose the use of prescribed fire in these areas will be brought to the Level 1 Team for review and determination as to whether ESA consultation is required. ● Approved spill prevention containment and countermeasure plans will be used for prescribed fire. Plans will include direction for transporting, storing, and use of toxic materials, such as spheres and drip torch fuels, to minimize risk of accidental spills and/or introduction into live water. ● While taking action to contain the spread of undesired fire, direction from the fire suppression programmatic description will be used. ● The prescribed burn will not increase equivalent clearcut area (ECA) above 15% in the corresponding 6th level hydrologic units unless project-scale analysis demonstrates it would not retard the attainment of soil, water, riparian, and aquatic (SWRA) resource desired conditions. This will be approved by the Level 1 Team. ● A post-burn visual assessment will be conducted by fire personnel and a fisheries biologist via a walk-through of selected stream corridors. This will assess implementation of the burn and associated mitigation in riparian areas.

Invasive Weed Management

This programmatic activity allows for implementation of the noxious weed program on the PNF. This weed management program entails awareness/education, prevention/early detection, inventory, an array of weed treatment practices, monitoring, and rehabilitation (i.e., seeding, planting). Known invasive weed locations have been mapped into a geographic information system (Figure A-3). This map is continually updated as known locations are verified or new locations are discovered. The total number of acres of known weed locations within each Section 7 watershed are summarized in Table A-8.

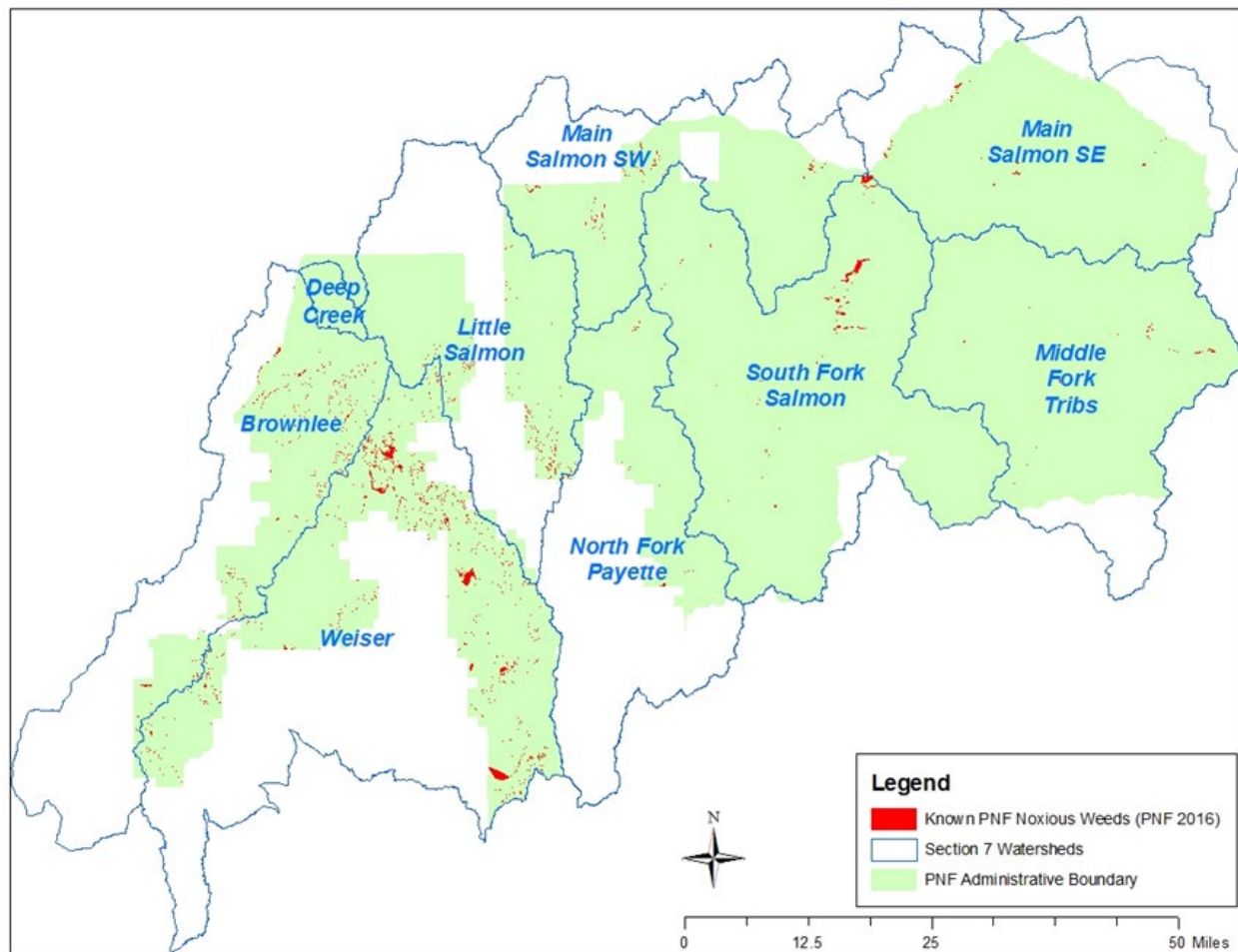


Figure A-3. Known locations of invasive weeds on the Payette National Forest as of 2016 (PNF 2020).

The PNF is a cooperative partner in four Cooperative Weed Management Areas (CWMAs): Adams County, Frank Church Wilderness, Lower Weiser, and Upper Payette River. The cooperative partnerships undertaken through these CWMAs make individual and cooperative efforts more effective. Partners include federal, state, county, private organizations, and private landowners. The CWMAs provide an opportunity for coordinating weed control efforts within a specific project area and provide a more efficient method of control, restoration, and monitoring. When the PNF is a cooperator in CWMAs, it does not necessarily mean the PNF is the action

agency for non-federal lands. However, it does provide the PNF the opportunity of identifying potential private land ESA concerns and issues and recommending noxious weed control BMPs that would reduce risk to listed species and their habitats.

This programmatic activity covers weed management activities on the PNF that are performed by other entities, as authorized by their easements, agreements, special use permits, plans of operations, etc.) Those entities must perform weed management activities in accordance with the requirements of this PNF weed management program.

Table A-8. Acreages of known invasive weeds in each Section 7 Watershed of the Payette National Forest as of 2016 (PNF 2020).

Section 7 Watershed¹	Acres
Brownlee Reservoir	3,983
<i>Deep Creek</i>	0
<i>Little Salmon River</i>	1,608
<i>Main Salmon River SW</i>	1,167
<i>Main Salmon River Tributaries SE</i>	670
<i>Middle Fork Salmon River Tributaries NW</i>	546
North Fork Payette River	301
<i>South Fork Salmon River</i>	2,503
Weiser River	11,567

¹Italicized Section 7 Watersheds contain anadromous ESA-listed fish and their designated critical habitat.

The following activities are not covered by this programmatic activity:

- Weed treatment within the Frank Church River of No Return Wilderness.
- New herbicide active ingredients.
- Aerial application.
- Aquatic application.

Introduced noxious weeds and non-native species are found in many plant community types and at many locations. Weed management efforts may be necessary on rangelands, in timber harvest areas, along roads and road rights-of-way, along trail routes, at dispersed recreation sites, on developed recreation sites, and at other disturbed sites (i.e., fires, flood events). Noxious weeds are plant species that have been designated “noxious” by law. In addition to noxious weeds, additional plant species may be identified and treated over the course of the consultation. The word “noxious” simply means deleterious by definition. Some examples of noxious weeds and other weedy species that may be present on the PNF and require control measures are listed below [the BA contains a more complete listing (PNF 2020)]. Bolded names indicate priority target species for the PNF.

The noxious weed program on Forest Service lands is based on weed management objectives and priorities that are influenced by weed infestations and site susceptibility. These criteria provide focus and direction for the noxious weed program and allow for site specific and adaptive decision-making. Table A-9 identifies the operational objective and priorities used for noxious

weed control on PNF lands. The intent of containment is to prevent the spread of the weeds to beyond the existing infestation perimeter. The control objective is to reduce the infestation through time; some level of infestation may be tolerated. The eradication objective is total elimination of all weeds.

- Canada Thistle (*Cirsium arvense*)
- **Dalmation Toadflax (*Linaria genistifolia*)**
- **Diffuse Knapweed (*Centaurea diffusa*)**
- **Hoary Cress (*Cardaria draba*)**
- **Leafy Spurge (*Euphorbia esula*)**
- Musk Thistle (*Cardus nutans*)
- Purple Loosestrife (*Lythrum salicaria*)
- **Rush Skeletonweed (*Chondrilla juncea*)**
- **Scotch Thistle (*Onopordum acanthium*)**
- **Spotted Knapweed (*C. maculosa beibersteinii*)**
- St. John's Wort (*Hypericum perforatum*)
- Sulfur Cinquefoil (*Potentilla recta*)
- Tansy Ragwort (*Senecia jacobaea*)
- **Yellow Starthistle (*C. solstitialis*)**

Table A-9. Weed treatment prioritization and objectives used for noxious weed control on Payette National Forest lands.

Operational Objectives	Operational Priorities
<p>Eradicate: The weed is treated to the extent that no viable seed is produced over the entire infestation and all plants (above ground portions) have been eliminated during the current field season.</p> <p>Control: Portions of the infestation or outbreak are treated to the extent that overall infestation area diminishes because no viable seed is produced and/or plants have been eliminated.</p> <p>Contain: Portions of the infestations are treated to the extent that the weed is not expanding beyond the established treatment zones. The main body of the infestations may be left untreated.</p> <p>Reduce: The infestation is treated to the extent that densities and/or rate of spread are reduced to an acceptable level.</p>	<p>Critical: Urgent actions due to a combination of outside funds and/or invasive weeds found in susceptible and relatively intact habitats.</p> <p>High: Important actions associated with outbreaks of invasive weeds along key spread-vectors and/or linked to a combination of treatment strategies.</p> <p>Moderate: Moderately important actions associated with invasive weeds in somewhat susceptible but disturbed habitats.</p> <p>Low: Actions associated with non-invasive weeds or in areas of low susceptibility where rapid spread is unlikely. May not need immediate (current year) attention.</p>

All vegetation treatments conducted for control of noxious weeds are done in accordance with established policy, regulations, and product labels. The U.S. Forest Service (USFS) policy requires the use of specific design features when in close proximity to sensitive areas to ensure vegetation treatments do not have an adverse impact on non-target plants or animals. Weed treatment methods include mechanical controls (hand pulling or digging), biological treatments, cultural control, and herbicide application. Each of these methods, including rehabilitation, are described below. Adaptive management, monitoring, reporting, and the required mitigations and BMPs are also described. The method used to address noxious weed issues depends on the area being considered and the particular weed situation; management objectives may range from containment to control and eventually to eradication.

Table A-10 summarizes the extent of the proposed annual weed treatment activities. The PNF will provide a list of site-specific project descriptions and maps annually (separate from this

document) for informal review and approval by NMFS and USFWS Level 1 Team members before the projects are implemented. Unknown sites found during project implementation may be treated following the guidelines within the BA (PNF 2020), and will be mapped and reported annually.

Table A-10. Annual noxious weed control program for the Payette National Forest.

Control Method	Acres
Manual	5–25 per Section 7 Watershed
Biological	0–5 (number of release sites)
Chemical ¹	100–1,000 (100–500 per Section 7 Watershed)
Rehabilitation	0–200 (~ 10 acres per Section 7 Watershed)
CWMAs ²	4

CWMAs = Cooperative Weed Management Areas

¹Actual acres where chemical is applied.

²These include the Upper Payette River, Lower Weiser River, Adams, and Frank Church Wilderness CWMAs.

Mechanical Control

Mechanical control involves the use of hand-operated power tools and hand tools to cut, clear, mow, or prune herbaceous and woody species. In manual treatments, workers could cut plants above ground level; pull, grub, or dig out plant root systems to prevent subsequent sprouting and growth; scalp at ground level or remove competing plants around desired vegetation; or place mulch around desired vegetation to limit the growth of competing vegetation.

Hand tools such as the handsaw, axe, shovel, rake, machete, grubbing hoe, mattock (combination of axe and grubbing hoe), brush hook, and hand clippers are used in manual treatments. Axes, shovels, grubbing hoes, and mattocks can dig up and cut below the surface to remove the main root of plants that have roots that can quickly sprout in response to surface cutting or clearing. Workers also may use power tools such as chain saws, power brush saws, and line trimmers (i.e., weed eaters). A less common method that may be used is mowing of weeds, and typically involves hand/motor-powered mowers or tractor mowers.

The manual method of vegetation treatment is labor intensive and costly when compared to herbicide application. However, it can be extremely species selective and can be used in areas of sensitive habitats. Manual control may occur in a variety of areas and is often used in sensitive areas to avoid adverse effects to non-target species or water quality. All noxious weed disposals will be in accordance with proper disposal methods. Noxious weeds that have developed seeds will be bagged and burned.

Biological Control

Biological methods of vegetation treatment use living organisms to selectively suppress, inhibit, or control herbaceous and woody vegetation. This method is viewed as one of the more natural processes because it requires the proper management of plant-eating organisms and may be used in combination with other control methods within a general area, such as chemical treatments and mechanical removal. Biological weed control activities include the release of insect agents which are parasitic and “host specific” to target noxious weeds. This activity includes the

collection of beetles/insects, development of colonies for collection, transplanting parasitic beetles/insects, and supplemental stocking of populations.

Insects and pathogens would be used as biological control methods generally in conjunction with other control methods (i.e., herbicides), although at present these methods can control few plant species. Insects are the main biological control method currently being utilized. Other natural enemies include mites, nematodes, and pathogens. This treatment method will not eradicate the target plant species but will reduce the target plant densities to more tolerable levels. This method also reduces competition with the desired plant species for space, water, and nutrients. This treatment method will be used on larger sites where the target plant has become established and is strongly competitive (e.g., yellow star thistle) or in remote locations.

Particular insects, pathogens, or combinations of these biological control agents may also be introduced into an area of competing or undesired vegetation to selectively feed upon or infect those target plants and eventually reduce the target plant density to the desired level of control. Therefore, in most situations, a complex of biological control agents is needed to reduce the target plant density to a desirable level. But even with a complex of biological control agents, often 15 to 20 years are needed to bring about an economic control level. In most circumstances, biological control agents will not control weeds. They are utilized specifically as stressors for weeds.

Cultural Control

Cultural control includes preventing weed introduction and/or minimizing rate of spread by requiring the following actions on public lands:

- Clean all ground disturbing equipment prior to moving into and out of weed-infested areas before and after use (applies to both USFS and contract equipment).
- Use only certified, noxious weed-free grains, hay, or pellets for feeding domestic animals and wildlife; and inspect all feeding sites during and following use.
- Use only certified noxious weed-free seed, along with hay, straw, mulch, or other vegetation material for site stability and vegetation projects.
- Use only noxious weed-free gravel and fill material from inspected sites.
- Vegetate disturbed areas as soon as practical; use temporary fencing if required assuring new seedling establishment.
- Evaluate current and proposed vegetation management practices (i.e., livestock grazing, prescribed burning, and seeding), and implement practices to restore desired plant communities.

Chemical Control

Herbicide treatments will be conducted in accordance with USFS procedures found in Pesticide-Use Management Forest Service Handbook (FSH) 2109, and Noxious Weed Management (FSM 2080). The chemicals can be applied by many different methods, and the selected technique depends on a number of variables. Examples of selection variables that may be considered are: (1) Treatment objective (removal or reduction); (2) accessibility, topography, and size of the treatment area; (3) characteristics of the target species and the desired vegetation; (4) location of sensitive areas in the immediate vicinity (potential environmental impacts); (5) anticipated costs and equipment limitations; and (6) meteorological and vegetative conditions of the treatment area at the time of treatment.

Herbicide treatment occurs annually from April through September. Treatments are scheduled and designed to minimize potential impacts to non-target plants and animals, while remaining consistent with the objectives of the vegetation treatment program. The rates of application [i.e., pounds of active ingredient per acre (lb a.i./acre)] depend on the target species, the presence, and condition of non-target vegetation, soil type, depth to the water table, presence of other water sources, riparian areas, special status plants, and the requirements of the herbicide label. The majority of treatments are expected to occur along travel corridors.

Ground-based herbicide treatment may be performed using hand-wicking, spot spraying, or broadcast spraying. Hand-wicking targets individual plants where the herbicide is wiped onto the plant. It is rarely used; however, it can be used around sensitive resources such as water or other sensitive plant species. Spot spraying is the most common herbicide application method; it targets individual plants and the immediate area around them. Most spot spraying is usually done with a backpack sprayer; however, it may also be performed using a hose from a truck-mounted or off-highway vehicle (OHV) mounted tank, or tanks mounted on pack animals. Broadcast spraying applies herbicides to an area of ground rather than individual plants. This method may employ a spray system mounted on a truck or OHV. Broadcast applications are used in areas where invasive plants occupy a large percentage of plant cover on the site, making spot spraying impractical.

The PNF proposes to use 14 different active ingredients (Table A-11) plus inert ingredients and adjuvants used in specified herbicide formulations. These 14 active ingredients proposed for use are included on the list of approved herbicides for use on USFS lands. Herbicides formulations that could potentially be used must be approved by the USFS, only contain active ingredients included in this consultation, and be U.S. Environmental Protection Agency (EPA)-registered and approved. The PNF will continue to evaluate new herbicide formulations [end use products (EUPs)] for use on the forest. New formulations being considered must contain active ingredients included in this consultation.

Inert Ingredients and Adjuvants. Adjuvants are specially designed chemicals that are added to an herbicide solution to modify the performance of the total spray mixture. Adjuvants are not regulated by the EPA in the same way that pesticides are. The EPA does not register or approve the labeling of spray adjuvants. Field testing is generally completed by the adjuvant manufacturer (Bakke 2007). Labels accompanying adjuvants describe their properties and

prescribe use rates. Information on types of adjuvants to use can also be found on herbicide labels and in publications by university extension services (Prather et al. 2011; Zollinger 2012).

Adjuvants perform various functions, including: enhanced plant uptake of the herbicide; better mixing of otherwise incompatible herbicides; increased adhesion of the spray to plant surfaces; and reduced spray drift. In many herbicide products, adjuvants are included as part of the pre-mixed formulation as purchased. Applicators can also add adjuvants to spray mixtures prior to application. For many pesticide products containing adjuvants as part of the formulation, the compounds are not explicitly identified on the label or the Material Safety Data Sheet. Unless they are on one of EPA's lists of more toxic chemicals, they do not have to be identified. The identity of these ingredients in a pesticide or adjuvant product is legally protected from full disclosure as "Confidential Business Information."

The BA (PNF 2020) provides more detailed information about adjuvant functions (i.e., activator or utility modifier) and category types [e.g., non-ionic surfactant (NIS), methylated or ethylated vegetable (seed) oil (MSO), nitrogen sources, etc.] Table A-12 summarizes the recommended adjuvants for each herbicide and Table A-13 lists the adjuvants proposed for use on the PNF.

Table A-11. Herbicides proposed for use by the Payette National Forest, application rates, and buffers from water.

Herbicide ¹ (Active Ingredient)	Commonly Used Brand Names ²	Maximum Application Rate (pounds active ingredient or acid equivalent per acre)	Typical Application Rate (pounds active ingredient or acid equivalent per acre)	Ground Application Buffer from ordinary high water mark (feet)		
				Broadcast Spray	Spot Spray	Hand Wicking
2,4-D amine	Amine 4, Weedar® 64	2.0 lb ae/acre/app 4.0 lb/ae/acre/year	1.0–2.0 lb ae/ac	100	OHW	OHW
Aminopyralid	Milestone®	0.11 lb ae/acre/year	0.078–0.11 lb ae/ac	100	OHW	OHW
Chlorsulfuron	Telar®	0.02 product/acre/year (0.12. lb ai/acre/year)	0.01–0.02 lb ai/ac	100	50	15
Clopyralid	Transline®	0.5 lb ae/acre/year	0.1–0.5 lb ae/ac	100	50	15
Dicamba	Banvel®	1.0 lb ai/acre/app 2.0 lb ai/acre/year	0.5–2.0 lb ai/ac	100	50	15
Fluroxypyr	Vista® XRT®, Starane®, Spotlight®	0.5 lb ae/acre/year	0.25 lb ae/ac	100	50	15
Glyphosate	Rodeo®, Roundup®, Accord®	1.7 lb ae/acre/app 4.0 lb ae/acre/year	0.5–3.0 lb ae/ac	100	100 (OHWM for aquatic-approved products)	100 (OHWM for aquatic-approved products)
Imazamox	Beyond®, Raptor®	0.5 lb ae/acre/year	0.5 lb ae/ac	100	OHW	OHW
Imazapic	Plateau®	0.1875 lb ai/acre/year	0.09–0.16 lb ai/ac	100	15	OHW
Imazapyr	TVC Total Vegetation Control®, Assault®, Chopper®, Arsenal®	1.5 lb ae/acre/year	1.0 lb ae/ac	100	OHW	OHW
Metsulfuron-methyl	Escort®	0.15 lb ai/acre/year	0.01–0.02 lb ai/ac	100	50	OHW
Picloram	Tordon™	1.0 lb ai/acre/year	0.25–1.0 lb ai/ac	100	50	50
Sulfometuron methyl	Oust Weed Killer® DPX 5648	0.03–0.281 lb ai/acre/app 0.03–0.38 lb ai/acre/year	(0.09–0.38 lb ai/ac)	100	50	15
Triclopyr TEA: triethylamine salt	Element 3A®, Garlon 3A®	2.0 lb ae/acre/year	1–2.0 lb ae/ac	100	OHW	OHW

OHW = ordinary high water mark.

¹ Aquatic formulations of 2,4-D amine, glyphosate, imazamox, imazapyr, and triclopyr TEA shall be used.

² Other product brands of identical or “substantially similar” formulation may be added or substituted in the future (reference to EPA Pesticide Registration Manual and 40 CFR 152.113) as described above.

Table A-12. Recommended adjuvant type by herbicide (Prather et al. 2011 and product labels), proposed for use on the Payette National Forest.

Herbicide	Recommended adjuvant types
2,4-D	NIS, Nitrogen sources, MSO
Aminopyralid	NIS
Chlorsulfuron	NIS, MSO, organosilicone
Clopyralid	NIS, MSO
Dicamba	Any as allowed by label
Fluroxypyr	No specific adjuvants are recommended
Glyphosate	NIS
Imazamox	NIS, MSO, organosilicone
Imazapic	NIS, MSO, organosilicone
Imazapyr	NIS, MSO
Imazamox	NIS, Nitrogen sources, MSO, petroleum/crop oil concentrate
Metsulfuron methyl	NIS, MSO, organosilicone
Picloram	None needed; can add as per surfactant manufacturer's label
Sulfometuron methyl	Any allowed by label
Triclopyr triethylamine salt (TEA)	NIS

NIS = non-ionic surfactant; MSO = methylated or ethylated seed oils

Table A-13. Adjuvant type, class, product, manufacturer, principle functioning agents, and use ranges, proposed for use on the Payette National Forest.

Adjuvant Function	Category Type	Product Name ¹	Product Manufacturer	Principle Functioning Agents	Use Range	Signal Word	Comments
Activator	NIS	Activator 90	Loveland	Alkylphenol ethoxylate, alcohol ethoxylate and tall oil fatty acid	0.125–0.5%	Caution	Low foam, biodegradable, non-flammable
		R-11	Wilbur-Ellis	Alkylphenol ethoxylate, butyl alcohol, dimethylpolysiloxane	0.063–1%	Warning	Spreader, activator
		Spreader 90	Loveland	Alkylpolyethoxy ethers and ethoxylated derivatives	8–64 oz/100 gal	Warning	Spreader
		Super Spread 90	Wilbur-Ellis	Alkyl aryl polyoxyethylene glycols and free fatty acids	0.25–0.5%	Caution	Spreader
Activator	Basic Blend <i>and</i> MSO <i>and</i> NIS <i>and</i> Nitrogen Source	Renegade	Wilbur-Ellis	Modified vegetable oil, ammonium solution, nonionic surfactant	1–2.5%	Warning	Unique blend, high load of Nitrogen
Activator	MSO	MSO with Leci-Tech	Loveland	Methylated seed oils plus emulsifying surfactants	1–2 pt/A	Caution	MSO and non-ionic
Activator	MSO <i>and</i> Organosilicone Surfactant	Syl-tac	Wilbur-Ellis	Organosilicone/modified vegetable seed oil	0.125–0.375%	Caution	
		Phase	Loveland	Methylated seed oil plus organosilicone surfactant	0.125–0.5%	Caution	
Activator <i>and</i> Utility Modifier	NIS <i>and</i> Buffering Agent or Acidifier	Super Spread 7000, LI 700	Wilbur-Ellis	Alkyl aryl polyoxyethylene, ethoxylated alcohols, aliphatic polycarboxylate	0.25–4 pt/100 gal	Caution	
Utility Modifier	Colorant	Hi-Light	Becker-Underwood	Proprietary blue colorant	6–32 oz/100 gal	Caution	
		Bullseye	Milliken Chemical	Proprietary blue colorant	0.5 oz/gal	None	
Utility Modifier	Water Conditioning Agent <i>and</i> Buffering Agent or Acidifier	Bronc Max	Wilbur-Ellis	AMS/ammonium alkyl aryl sulfonates, polycarboxylic acid	0.125–1%	Caution	Ammonium sulfate (AMS) replacement
Utility Modifier	Water Conditioning Agent	Choice Weather Master	Loveland	Blend of salts of polyacrylic, hydroxy carboxylic, propionic acids, phosphate ester, ammonium sulfate	0.25–0.5%	Caution	AMS, water conditioner

¹Products proposed for use. For information on the process for adding adjuvants to the list, see the adaptive management discussion.

Polyoxyethyleneamine (POEA) is a surfactant used in the original formulation of RoundUp® and is known to pose hazards to aquatic organisms. This surfactant is more toxic to aquatic life than the active ingredient glyphosate. The POEA adjuvant (Roundup Pro) will only be used in uplands where there is no potential for movement into aquatic systems. Within or near aquatic systems, only products labeled for aquatic application will be used.

Adjuvants with low toxicity to wildlife include modified seed oils, alkyl ethoxylates, and silicones. The most commonly used adjuvant is marker dye and it is analyzed in “Use and Assessment of Marker Dyes Used with Herbicides” (Pepling et al. 1997). Colorants or dyes make it easier to see where the herbicide has been applied and whether/where it has dripped, spilled, or leaked. They also make it easier to detect missed spots and to avoid spraying a plant or area more than once.

Rehabilitation

Noxious weeds commonly invade areas that have vegetation that cannot compete with aggressive invasive species. Consequently, after weeds are controlled on a site, it is beneficial to establish desirable, native vegetation that will compete with noxious weeds, restrict or prevent additional infestations, and help prevent soil erosion and further soil nutrient loss. These treatments may involve ground or aerial application of seeds.

Adaptive Management, Monitoring, and Reporting

The noxious weed control program is a long-term endeavor to control weeds where/when practical. However, because there are areas of scientific and management uncertainty, management actions will need to be refined over time to meet the basic objective of noxious weed control activities of systematically reducing weed abundance, extent and spread throughout the PNF. Annual site-specific monitoring will assess the effectiveness of specific control measures on weed species relative to application rate, method, and area. Management actions may require refinement or change over time as data from specific effectiveness monitoring is analyzed. If adaptive management has the potential to change the effects of this action to ESA-listed species, the Level 1 Team will be involved. Information from weed inventories and results from treatments will be mapped spatially, and the PNF will use this information to assess the noxious weed program objectives and update baseline conditions for future consultations.

Early detection and rapid response (EDRR) allow for treatment of invasive plant infestations located outside of currently identified infested areas. Infestations outside of currently identified areas may include new sites of noxious weeds known to exist, invasive plant species previously unknown on the PNF, or sites that currently exist, but have not been identified in PNF inventories to date. The intent of EDRR is to allow timely control, so that new infestations can be treated when they are small, preventing establishment and spread, while reducing the costs, potential side effects of treatment, and impacts from the invasive plant. EDRR is based on the premise that the impacts of similar treatment methods are predictable, even though the exact location or timing of the treatment may be unpredictable.

The proposed action, which incorporates EDRR, contains an adaptive management strategy to deal with invasive plant infestations that are constantly changing. An adaptive management strategy offers the means to describe and evaluate the consequences of changing or new invasive plant infestations and new treatment options. Provided that the result of treating new infestations and the impacts of new treatment methods remain within the effects described, then the results of this analysis remain valid. The adaptive management strategy consists of three principle components: (1) quickly and effectively treat new infestations; (2) utilize new treatment technologies; and (3) conduct monitoring. The EDRR and Adaptive Management Decision Tree are presented in Figure 6 of the BA (PNF 2020).

In order to quickly and effectively treat newly discovered invasive plant infestations while still addressing other resource concerns, a flowchart based on infestation size, location, site characteristics, and consultation with specialists will be used to select treatment methods. All new sites will be mapped and inventoried. Appropriate design criteria must be applied to any invasive plant treatment.

New technology, biological controls, herbicide formulations, and supplemental labels are likely to be developed within the lifetime of this project. These new treatments would be considered when their use would be consistent with or less than the effects of those analyzed in this process. The Adaptive Management Strategy will allow incorporation of these new treatment methods if they meet the following criteria:

- The herbicide must have an EPA approved herbicide label.
- A risk assessment must be completed for the active ingredient by the Natural Resources Conservation Service, U.S. Department of Agriculture (USDA) Agriculture Research Station, EPA, USFS, or other federal land management agency. For clarification, no new active ingredients can be used under this consultation except those active ingredients identified in Table 14.
- New biological agents must be approved by USDA Animal, Plant Health Inspection Service, and the state of Idaho prior to their introduction. This approval indicates that the agent is determined to be detrimental to the target plants while at the same time being virtually harmless to native or desirable non-native plants.

The PNF will monitor the effectiveness of the noxious weed program on both a site-specific treatment level and on a landscape level. Site-specific treatment level monitoring will involve assessing the effectiveness of the treatment agent or control method on a specific patch of noxious weeds. Follow-up treatments will occur as staffing and funding allow. Monitoring may involve multiple years to determine effectiveness. Monitoring of physical, cultural, and chemical control methods will be conducted on randomly selected sites (approximately one site per Section 7 watershed) within 1 to 2 months of treatment through visual observation of target species' relative abundance/site dominance compared to pre-treatment conditions. Sequential monitoring of these sites will occur in subsequent years. Inventorying and monitoring is expected to reveal new populations of noxious weeds, which will be mapped and evaluated for control or

eradication. Management of these newly discovered sites will occur under the guidelines as described in the preceding proposed action.

Weed coordinators will prepare project proposals (with methods, objectives of treatment, location, map of treatment area, acreage, proposed dates to be started and completed, sensitive areas, and special mitigation) for chemical treatment of noxious weeds. The proposals will be submitted to PNF biologists by April 1 of each year. Project proposals will be reviewed for compliance with this consultation (PNF 2020). The PNF biologists or weed staff will provide a list of project descriptions and maps annually (or as identified) for informal review and approval by the Level 1 Team before the projects are implemented (i.e., before the weed spraying season). All projects will be reviewed and approved by NMFS and the USFWS before herbicide application occurs.

An annual summary of treatments will be prepared for land treatments that took place during the treatment season. The report will document treatments that took place, methods used, location, map, acreage, evaluation of achievement of objectives, a brief summary of environmental effects, and an evaluation of compliance with the approved Noxious Weed Program. This summary report will be completed and submitted to the Level 1 Team, annually.

Based on annual treatment evaluations and with the likely development of new control methods and technology, changes in existing or use of new noxious weed treatments (including new herbicides) may be authorized and warranted. Any changes to the proposed action, as described in the BA, will be analyzed for impacts to listed/proposed species and critical habitat, and consultation will be reinitiated as appropriate.

Required Mitigation

The PNF has proposed numerous BMPs to avoid or minimize effects to aquatic resources. Those practices are summarized in Table A-14 below.

Table A-14. Required mitigations and best management practices for invasive weed management activities that will be implemented to avoid or minimize potential effects on the Payette National Forest.

Treatment Method	Category	Mitigations and Best Management Practices
Chemical	General	<ul style="list-style-type: none"> • Contracts and agreements will include all of these design criteria as a minimum. • Annual reports and plans will be presented to the Level 1 Team. • New end use products that meet the Adaptive Management Strategy criteria will be presented to the Level 1 Team for herbicide use approval.
	Application	<ul style="list-style-type: none"> • Herbicide application shall comply with applicable laws, policy, guidelines, and product label directions. • A state certified applicator will oversee all herbicide applications. • Applicators will read and follow label directions, including instructions for herbicide use, application rates, equipment and techniques, personal protective equipment for applicators and mixers, and container disposal. • Program managers will ensure proper permitting is in place prior to implementation. • Material safety data sheets, safety plans, spill prevention plans, and clean-up kits will be available to applicators and mixers. • Wind speed and direction and equipment and spray parameters will be monitored throughout herbicide application. • Herbicides will not be applied when sustained wind conditions exceeding 5 miles per hour in riparian areas or 8 miles per hour in upland areas. • Herbicides will not be applied if the weather forecast predicts precipitation within the next 24 hours. • Accurate and detailed application records will be kept. • Practical measures to restrict access to herbicides, adjuvants, and spray equipment by unauthorized personnel will be implemented. • The 5-Year Herbicide Safety Plan will be updated with completion of this consultation and implemented during herbicide use. • Indicator dye will be used in the herbicide mix to visually ensure uniform coverage and minimize overlapped or skipped areas and treatment of non-target areas. • Low pressure and larger droplet sizes will be used to the extent possible, to minimize herbicide drift during broadcast operations. • Appropriate nozzles designed for herbicide application will be used. • Herbicides will be applied to infestations containing biological control agents at times when the effects of herbicides to the host plants will not interfere with the agent's life cycle, to the extent practicable. • Spray pattern that avoids applying herbicide to non-target species will be used.
	Equipment	<ul style="list-style-type: none"> • Conduct equipment and personnel inspections and equipment maintenance and calibration, as needed, to ensure proper herbicide application and to meet regulatory requirements. Make repairs and replace parts promptly. • All equipment used for treatments will be cleaned of external oil, grease, dirt and mud, and leaks repaired, before entering areas that drain directly to streams or wetlands. Spill packs will also be on hand for minor leaks/spills. • Fuel storage and/or refueling will not occur within riparian conservation areas (RCAs). Engine and hydraulic fluids will be monitored for leaks.

Treatment Method	Category	Mitigations and Best Management Practices
Chemical (Cont.)	Application Near Water	<ul style="list-style-type: none"> ● Applicators are required to use more risk-averse application methods in sites that are close to stream channels. Key provisions include using the least toxic chemicals to aquatic resources near water, and more precise herbicide application methods in stream side areas, such as wicking, wiping, or hand spraying with a single nozzle. ● Within or near aquatic systems, only products labeled for aquatic application will be used. ● No broadcast spray applications will occur within 100 feet of live water. ● No chemical herbicides will be used within a 100-foot radius of any potable water spring development. ● Dyes will be used in riparian areas to provide visual evidence of treated vegetation. Water-soluble colorants, such as Hi-Light blue dye, will be used within 100 feet of water and other situations, as needed, to enable applicators and inspectors to properly apply herbicides.
	Transport	<ul style="list-style-type: none"> ● Transport only the quantity of herbicide and adjuvants needed for a project. Transport secured containers in such a way as to prevent the likelihood of spills and make periodic checks en route to help avoid spillage. When supplies need to be transported over water by boat, raft, or other watercraft, carry herbicides and adjuvants in watertight, floatable containers. ● Use off-highway vehicles (OHVs), which are administratively allowed to travel off designated motorized routes, to transport or spray herbicides. Do not take OHVs off designated routes if damage to soils could occur due to wet conditions. Take care to ensure disturbance to desirable vegetation is minimized and no visible “trail” creation occurs.
	Mixing	<ul style="list-style-type: none"> ● Water used for mixing will be obtained prior to going into the field. ● Water may be transported via back-pack sprayers, saddle tanks, or portable containers to mixing site in the backcountry locations. ● Where herbicides are mixed, mixing/filling, storing of sprayers will not occur within 100 feet of live water. ● Mixing/filling will be limited to locations where drainage will not allow runoff or spills to move into live water, and in locations where potential contamination of ground water will not occur.
	Chemical Specific	<ul style="list-style-type: none"> ● No ester formulation of 2,4-D or triclopyr-Butoxyethyl Ester will be used. ● The polyoxyethylene tallow amine adjuvant (e.g., Roundup Pro) will only be used in uplands where there is no potential for movement into aquatic systems. ● No more than one application of picloram (trade names: Tordon 22K, Grazon, Pathway, Tordon 101) will occur on a given site in any given year unless the cumulative amount applied is less than or equal to the maximum label rate for a single application to reduce the potential for picloram accumulation in the soil. Before multiple applications are administered, a soil scientist and/or hydrologist should survey the treatment area to determine a very low possibility of delivery to surface or groundwater. ● Picloram will not be used within 50 feet of any stream for any reason and will generally not be used within a 100-foot buffer unless other herbicides are not considered effective in controlling certain weed species, such as leafy spurge or rush skeletonweed. ● Picloram will not be used where soils are highly permeable (i.e., silt loam and sand soils), and in floodplains or where there are shallow water tables. ● Allow only one application of chlorsulfuron per growing season, except for industrial use sites, where total pounds applied per year may not exceed 0.125 lb ai/ac.

Treatment Method	Category	Mitigations and Best Management Practices
Chemical (Cont.)	Chemical Specific (Cont.)	<ul style="list-style-type: none"> • Telar (Chlorsulfuron) will not be used within an annual floodplain or where the water table is within 6 feet of the surface. • Clopyralid and Imazapic should not be applied where soils have a rapid to very rapid permeability throughout the profile (such as loamy sand to sand) and the water table is shallow. Imazapic should only be applied where there is level terrain and a well-developed vegetative buffer strip between areas to which this product is applied and surface water.
Manual	General	<ul style="list-style-type: none"> • Treatments in RCAs will only be accomplished using hand tools (e.g., hand clippers, hoes, rakes, shovels, etc.) or mechanical tools that do not disturb the soil (e.g., chainsaws, power brush saws, line trimmers, etc.) • Mechanical treatments will occur on slopes less than 45%, a maximum of 25 acres per project and landtype erosion hazard ratings to low or moderate. • A 25-foot vegetative buffer will be maintained next to live water for all treatments that cause ground disturbance. • Minimize soil disturbance as much as possible to minimize germination of invasive plant seeds and bare soil. • Avoid non-target species damage to the extent practicable. • Select mechanical methods to effectively control the target species (e.g., grubbing/hoeing is inappropriate for rhizomatous species and may increase the density of the invasive plant population as root fragments sprout and become new plants). • Apply mechanical treatments at the proper stage of plant growth when treatment will be most effective at controlling the target invasive plant. • Thoroughly inspect and clean all equipment and clothing to remove invasive plant seeds or vegetative propagules to prevent the movement of the invasive plant to another site. • To the extent practicable, conduct clipping and removal of seed stalks prior to seed maturity to reduce inputs to the seed bank or when seeds are easily picked up and transported by vectors such as wind, humans, or animals. • Specific to aquatic invasive plants, hand-pulling and/or smothering may be used when an infestation is very limited in extent and occurs close to the shoreline of a waterbody but has not yet infested deeper waters. • Mechanical treatments should not occur on any slopes where excessive erosion to waterbodies (e.g., slope fall lines to lakes, streams, etc.) and resource damage will occur. Proper erosion control techniques will be utilized on steep slopes to prevent excessive erosion and resource damage from occurring.
Biological	General	<ul style="list-style-type: none"> • Use only biological control agents approved by the U.S. Department of Agriculture Animal, Plant Health Inspection Service, and the state of Idaho. • Use Forest Service protocols for documentation of releases and monitoring and share release information with the Idaho State Department of Agriculture. • To the extent practicable, collect biological control agents locally or from areas with similar climatic and weather conditions, land and soil types, and cover types to maximize successful establishment. • Distribute biological control agents at the optimal season and life cycle stage to optimize the likelihood of successful establishment. Distribute quantities sufficient to optimize successful short-term establishment. • For those agents that self-disperse poorly, actively assist the distribution throughout target infestations by redistribution (collecting and moving the agent to new locations).
Rehabilitation	General	<ul style="list-style-type: none"> • Seed mixes or plant species will be approved a U.S. Forest Service botanist. • Wheeled or tracked equipment used for rehabilitation will be kept outside the RCAs.

Timber Harvest and Pre-commercial Thinning

This programmatic activity allows for the sale of small volumes of timber (less than 70 acres annually of green harvest) as well as timber salvage and sanitation harvest (up to 250 acres each) to reduce competition, reduce small tree densities, and/or to control insect or disease. As part of these actions, up to one-half mile of temporary road (i.e., a new route or an existing, unauthorized route) may be constructed for each type of timber harvest. Any constructed route will be fully obliterated/fully recontoured after use. Pre-commercial thinning (i.e., removal of non-commercial sized trees, typically less than 8 inches in diameter) could occur to reduce competition among trees in merchantable timber stands. Most stands to be pre-commercially thinned are plantations. Previously harvested stands are pre-commercially thinned 15–25 years after a timber sale to reduce stand densities.

The PNF has proposed numerous BMPs to avoid or minimize adverse effects to aquatic resources that have the potential to occur when implementing timber harvest or pre-commercial thinning activities. Those practices are listed below. In addition, certain actions require review and approval by the Level 1 Team prior to implementation. Those actions include: (1) all projects with proposed activities in RCAs; (2) location of temporary roads that occur within one site potential tree height of perennial streams; and (3) location of any campsites within RCAs.

- Timber harvest, pre-commercial thinning, hazard tree and blowdown removal, and related activities (temporary road construction) may occur in RCAs where designated by the District Ranger and agreed to by both a journey level fisheries biologist and hydrologist. All treatments within RCAs, must not degrade nor retard attainment of properly functioning riparian functions and processes and will be presented to the Level 1 Team for approval. When evaluating riparian functions and processes, the following criteria will be used:
 - Where trees do not provide essential shade to a perennial stream during any part of the day or year.
 - Where trees to be thinned are not required to meet WCIs (i.e., to contribute to potential LWD recruitment).
 - Where tree removal or tree felling will not impact streambanks, springs, seeps or other wetlands.
 - Where vehicles will remain on existing open roads.
 - Where trees will not be felled or brought across any road cutslope.
 - Where a riparian area exists for effective sediment filtering.
 - Where trees are located away from streams upslope, uphill, from an existing open road.

- Heavy equipment (larger than hand tools) will be fueled and parked overnight outside RCAs.
- Activities will be conducted to ensure that ECA is not increased over 15 percent in any 6th-field subwatershed.
- Construction of temporary roads for green timber and salvage sales will not exceed one-half mile per associated sale. Temporary roads may occur in the RCA but will need fish biologist approval which will make sure WCIs are maintained. Temporary roads will be fully decommissioned within two operating seasons.
- Treatments will occur to storm proof temporary roads prior to winter.
- Campsites related to implementation of these activities will be located outside of RCAs unless approved by a fisheries biologist and hydrologist, which will include any necessary mitigations to avoid effects to WCIs. Large campsites will have site plans completed with necessary mitigation measures. Gray water will be removed from camp and disposed of properly. At locations where camps will encroach on RCAs, a fisheries biologist or hydrologist will assist in laying out the camp to avoid effects to WCIs. Measures used to avoid effects to streams and WCIs may include flagging no-entry zones to maintain a desired distance between camp and streams, maintaining a close dialog with campers as to resource concerns, gray and black water management, and regular visits to camp(s) by a fisheries biologist, hydrologist, or contract administrator.

Miscellaneous Forest Products

This programmatic activity allows the PNF to issue permits to the public for harvest of miscellaneous forest products such as, but not limited to, fuelwood, posts and poles, mushrooms, Christmas trees, and plants and their seeds (or other parts thereof). These actions are generally conducted from NFS roads or trails using chainsaws, hand tools and/or collection of materials on foot, but under certain circumstances could occur with equipment such as cable yarding.

The PNF has proposed numerous BMPs to avoid or minimize adverse effects to aquatic resources that have the potential to occur as a result of implementing this program. In addition, certain actions require review and approval by the Level 1 Team prior to implementation. Those actions include: (1) changes to the RCA diagrams accompanying the fuelwood permits; (2) changes to the RCA direction in the annual Personal Use Fuelwood Brochure; (3) location of any campsites (typically associated with commercial activities) within RCAs; and (4) use of equipment to collect materials. Finally, the PNF will identify several areas across the forest to monitor fuelwood collection within the RCA but upslope of the road. This data will be used to determine compliance with Forest Plan Standard TRST07 to ensure harvest is not degrading riparian and related aquatic resources. This data will be shared every 5 years with the Level 1 Team.

The following mitigations and BMPs will be implemented:

- All fuelwood permits are accompanied by a Personal Use Fuelwood Brochure which provides descriptions of RCAs and locations where firewood cutting is prohibited.
- Fuelwood cutting is allowed within RCAs, but only upslope of open roads.
- If there are sensitive areas where firewood collection upslope of a road could be a concern, those areas will be closed. These prohibited areas will be displayed on the Personal Use Fuelwood Brochure given out with all firewood collection permits and will be signed on the ground.
- Signs will be used (in site-specific areas) to emphasize areas closed to fuelwood (or other product) harvest.
- Mitigations for fish and wildlife resources for post and pole contracts/sales will be identical to those described for the Timber Harvest Activity.
- Activities within RCAs will maintain soil, water, riparian, and aquatic resources (defined by the WCIs in Appendix B of the Forest Plan).
- Any campsites related to implementation of these activities (generally for commercial activities) will be located outside of RCAs unless approved by the Level 1 Team, which will include any necessary mitigations to avoid effects to WCIs.
- "Forest officers" who can approve cable yarding of any products identified as part of this action (i.e., firewood harvest) will be limited to line officers or persons authorized to sign permits and contracts.
- Use of equipment to collect materials will be approved by the District Ranger and the Level 1 Team.

Aquatic and Riparian Ecosystem Monitoring

This programmatic activity entails annual collection of fish and fish habitat data across the PNF in order to meet LRMP monitoring requirements and to describe habitat, habitat conditions, and species presence/absence during early project development as identified in LRMP guideline TEGU02. All data is entered into databases. The PNF may authorize other entities to collect data to support National Environmental Policy Act or ESA consultation. These authorizations typically come with recommendations/requirements from the PNF on what, how, when, and where to collect the data. Additionally, this will cover external requests for habitat data collection as long as the below requirements are followed, and impacts are similar to those analyzed in this consultation. Table A-15 provides annual estimates of the use of the different survey methods.

Table A-15. Estimates of the number of surveys that will be conducted annually on the Payette National Forest as part of the programmatic actions.

Method	Average Length (meters)	Estimated Number of Annual Surveys
PIBO	200	50
Core Sampling	N/A	240
Free Matrix/Cobble Embeddedness	N/A	70
Temperature	N/A	75
Macroinvertebrate	N/A	occasional
Snorkel	250	20
Electrofishing ¹	100	30 ¹
eDNA	N/A	125
Hook & Line	N/A	4
Less common fish surveys (tag, fin clip, seining)	N/A	<p>1 every 3 years</p> <ul style="list-style-type: none"> • 30 fin clips samples for all species • 1 seine effort (100 individuals for all species) • 1 tag effort (100 individuals for all species)

¹The number of surveys include four electrofishing salvage efforts for extreme road maintenance activities.

Habitat Surveys. Streams will be surveyed to produce quantitative assessments of fish habitat using a variety of methods. The Pacfish/Infish Biological Opinion Monitoring Protocol (PIBO) involves walking within stream channels, measuring channel and habitat dimensions, and involves the use of stadia rods, measuring tapes, or surface fines grids. Stream substrate surveys include cobble embeddedness, percent surface fines, free matrix measures, and core sampling. Measurement of cobble embeddedness involves removing cobble-sized rocks from the stream bottom, measuring, then replacing them back to the stream channel they were removed from. The cobbles are returned to the site after measurements are taken. Measurement of percent surface fines entails visual estimation that involves no disturbance other than that caused by the presence of the crews in the stream channel. Determination of free matrix measures involves randomly placing a sampling hoop and counting the number of non-embedded rocks within the hoop; this action requires disturbing all loose rocks within the hoop. Core sampling requires removing from the stream all substrate within the substrate samples, which may be taken from any part of the habitat. Most core samples will be done with a McNeil Sediment Core Sampler. Stream temperature monitoring also occurs and involves placing thermographs in stream bottoms. These thermographs are programed to record stream temperatures at set intervals. Periodically these thermographs are retrieved to download the data.

Fish Surveys. Fish surveys are performed to document, observe, identify, and count fish using a variety of methods (i.e., snorkeling, electrofishing, eDNA, mark recapture, hook and line, and other techniques agreed to by the Level 1 Team). Snorkeling surveys typically involve one or two snorkelers and someone walking behind recording data. This can occur either day or night. Electrofishing surveys typically involve a two- to three-person crew with a backpack electroshocker to shock and collect fish over a certain distance, typically 100 meters. Electrofishing can be implemented as a spot check, single pass, or can include block nets and multi-pass depletion to estimate species presence and abundance. Tagging may be used, but is used but less frequently and only for abundance estimates using mark/recapture methods. This typically involves marking the fish by clipping a fin, releasing the fish, and attempting to

recapture the fish using the same methods as the initial capture. Electrofishing, hook and line, seine netting may be used to collect fish. Fin clip samples for genetics analysis is used but less frequently. This data is typically used to determine species and hybridization occurring within a stream. Fish are collected using electrofishing, hook and line, or seine netting, and a small piece of fin is collected and preserved for laboratory analysis. eDNA is a new technology that is being used more extensively on the PNF for species distribution. It involves collecting a water sample ran through filter paper, the filter preserved, with lab analysis to determine fish species presence at the location of the sample.

The PNF is required to have an Idaho Department of Fish and Game Collection Permit for electrofishing, tagging, and fin clipping. The length of the surveyed reaches vary and depend on the objective of the survey. The expected number of surveys to be conducted each year are presented in Table A-15.

Aquatic Invertebrate Sampling. Aquatic invertebrate sampling will occur on some streams to determine aquatic invertebrate presence and abundance. Invertebrates will be sampled with a Hess sampler, Surber sampler, or kick nets. Aquatic invertebrate sampling is typically performed during the base flow period (e.g., July through September).

The PNF has proposed numerous BMPs to avoid or minimize adverse effects to aquatic resources that have the potential to occur as a result of implementing this program. Those include:

- NMFS' Electrofishing Guidelines (2000) will be followed for all electrofishing surveys.
- Electrofishing will be used during the coolest time of day, only after other means of fish capture are determined to be not feasible or ineffective.
- Do not electrofish when the water appears turbid, e.g., when objects are not visible at depth of 12 inches.
- Do not intentionally contact fish with the anode.
- Use only direct current (DC) or pulsed DC within the following ranges:
 - If conductivity is less than 100 microsecond (μ s), use 900 to 1,100 volts.
 - If conductivity is between 100 and 300 μ s, use 500 to 800 volts.
 - If conductivity greater than 300 μ s, use less than 400 volts.
- Begin electrofishing with a minimum pulse width and recommended voltage, then gradually increase to the point where fish are immobilized.
- Immediately discontinue electrofishing if fish are killed or injured, i.e., dark bands visible on the body, spinal deformations, significant de-scaling, torpid or inability to maintain

upright attitude after sufficient recovery time. Recheck machine settings, water temperature and conductivity, and adjust or postpone procedures as necessary to reduce injuries.

- Electrofishing will be avoided in areas of known Chinook salmon habitat and if sampling needs to occur, other methods such as seining or snorkeling will be used.
- Fish handling times will be monitored to prevent additional stress on fish.
- If buckets are used to transport fish:
 - Minimize the time fish are in a transport bucket. Check condition of fish in the bucket frequently.
 - Keep buckets in shaded areas or, if no shade is available, covered by a canopy.
 - Limit the number of fish within a bucket; fish will be of relatively comparable size to minimize predation.
 - Use aerators or replace the water in the buckets at least every 15 minutes with cold, clear water.
 - Release fish in an area upstream with adequate cover and flow refuge; downstream is acceptable provided the release site is below the influence of construction.
 - Be careful to avoid mortality counting errors.
 - Ensure water levels in buckets is low enough to prevent fish from jumping out of the bucket or cover the bucket with a wet towel.
- Annually report the number of fish handled per year to USFWS/NMFS.
- Enter data into PNF databases annually.
- Time fish and fish habitat surveys to avoid spawning fish and redds to the extent possible.
- Crews will be trained in redd identification, identification of good redd habitat, and methods to avoid stepping on redds or delivering fine sediment to redds.
- If redds or spawning Chinook, steelhead, or bull trout are observed at any time, the habitat surveyors will step out of the channel and walk around the habitat unit on the bank at a distance from the active channel and take all precautions to avoid any harassment of individuals.

- If continuing to survey while avoiding Chinook, steelhead, or bull trout is not possible the crew will step out of the active stream channel and walk around the habitat unit at a distance from the stream.
- While conducting stream substrate surveys or aquatic invertebrates, redds, and areas immediately above redds will not be sampled in order to avoid disturbing or delivering sediment to redds.
- All non-PNF entities authorized to collect data will follow the PNF requirements.
- Only single, barbless hooks and artificial lures will be used for hook and line sampling.
- When clipping fish for tagging or to collect genetic samples, the caudal fin will be targeted and as small a sample as possible will be removed.
- Adult Chinook salmon and steelhead trout will not be targeted for any type of survey.
- Decontamination of equipment occurs at a minimum of when crews travel between the east zone and west zone of the PNF or weekly.

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7. APPENDIX B—TOXICOLOGICAL EFFECTS OF HERBICIDES

2,4-D (AMINE SALT ONLY)

Exposure. The herbicide 2,4-D is highly soluble in water, but it rapidly degenerates in most soils, and is rapidly taken up in plants. 2,4-D ranges from being mobile to highly mobile in sand, silt, loam, clay loam, and sandy loam (EPA 2005a). Consequently, 2,4-D may readily contaminate surface waters when rains occur shortly after application, but is unlikely to be a ground-water contaminant due to the rapid degradation of 2,4-D in most soils and rapid uptake by plants. Most reported 2,4-D ground-water contamination has been associated with spills or other large sources of 2,4-D release. 2,4-D may remain active for 1 to 6 weeks in the soil and will degrade to half of its original concentration in several days. Soils high in organic matter will bind 2,4-D the most readily. 2,4-D is degraded in soil by microorganisms and degradation is more rapid under warm, moist conditions. Some forms of 2,4-D evaporate from the soil.

Transport of 2,4-D into rivers by storm runoff is likely to occur from rain events within or shortly following the spray season, based on documented studies. The Washington Department of Ecology collected 32 stream samples downstream from a helicopter application of 2,4-D conducted according to Washington State best management practices (BMPs). 2,4-D was found in all samples collected and in highest concentrations following a rainstorm the day after the spraying (Rashin and Graber 1993). In a national study of surface water quality, 2,4-D was found in 19 of 20 basins sampled throughout the United States [U.S. Geological Survey (USGS) 1998]. In the USGS (1998) study, 2,4-D was found in 12 percent of agricultural stream samples, 13.5 percent of urban stream samples, and in 9.5 percent of the samples from rivers draining a variety of land uses.

The Syracuse Environmental Research Associates (SERA) (2006a) identified a peak estimated rate of contamination of ambient water associated with the normal application of 2,4-D as 0.44 mg a.e./L at an application rate of 1 pounds acid equivalent per acre (lb. a.e./acre). Typical application rates for 2,4-D in the proposed action range from 1.0 to 2.0 lb. a.e./acre, and the maximum label application rate is 4 lb. a.e./acre. At the maximum application rate of 4 lb. a.e./acre, the peak concentrations of 2,4-D in ambient water, using the modeled water contamination rate (WCR) in SERA (2006a), would be 1.76 mg a.e./L. Considering the project design features (PDF) that will be implemented, it is likely that water concentrations of 2,4-D will be far less than modeling estimates performed by SERA.

End-Use Products. The herbicide 2,4-D is available in a variety of chemical forms (e.g., esters, amine salts, and acids) with different toxicities to fish. For this consultation, the Payette National Forest (PNF) is proposing to use the amine salt forms of 2,4-D and has identified four end use products (EUPs). The active ingredient in these EUPs is the 2,4-D dimethylamine salt (DMA).

All of the EUPs proposed for use consist of approximately 47 percent 2,4-D DMA. Unspecified, inert ingredients comprise the remaining 53 percent of the product. 2,4-D Amine 4 and its substantially similar EUPs include 47.3 percent 2,4-D DMA and 52.3 percent of unspecified inert ingredients. The most recent SERA risk assessment (2006a) included these products in the effects analysis.

Toxicity – Fish. The PNF is not proposing to use the ester formulation, which is more toxic to fish than the other forms. Instead, the PNF proposes to use the amine form, which has the lowest toxicity among the various 2,4-D formulations. Toxicities for the acid and amine salts of 2,4-D indicated that both forms are practically non-toxic to freshwater or marine fish, with LC₅₀s ranging from more than 80.24 mg a.e./L to 2,244 mg a.e./L (EPA 2005a). Of the EPA-required studies, the most sensitive results were obtained for rainbow trout exposed to the Triisopropanolamine (TIPA) salt (96-hour LC₅₀ of 162 mg a.e./L). The comparable most tolerant results of the EPA-required studies were obtained with rainbow trout (*Oncorhynchus mykiss*) exposed to the DMA salt (96-hour LC₅₀ of 830 mg a.e./L). These values are similar to the LC₅₀ values of 362 mg a.e./L (Martinez-Tabache et al. 2004) and 358 mg a.e./L (Alexander et al. 1985) obtained when rainbow trout were exposed to 2,4-D acid.

Most of the potential sublethal effects from exposure to 2,4-D have not been investigated for endpoints important to the overall health and fitness of salmonids. Exposure to 2,4-D has been reported to cause changes in schooling behavior, red blood cells, reduced growth, impaired ability to capture prey, and physiological stress (NLM 2012; Gomez 1998). Tierney et al. (2006) found modifications in electro-olfactogram response when exposing juvenile coho salmon (*O. kisutch*) to 100 mg a.e./L of 2,4-D. Little et al. (1990) examined behavior of rainbow trout exposed for 96 hours to sublethal concentrations of 2,4-D acid and observed inhibited spontaneous swimming activity (at 5 mg/L), swimming stamina (at 50 mg/L), predator avoidance (50 mg/L), and prey capture (5 mg/L).

Early life-state tests evaluating the effects of various forms of 2,4-D on growth and larval survival of the fathead minnow (*Pimphales promelas*) were submitted to EPA as part of the registration process. For the acid and salts, the reported no observed effect concentrations (NOECs) for survival and reproduction ranged from 14.2 mg a.e./L (DMA) to 63.4 mg a.e./L (2,4-D acid). The lowest observed effect concentration (LOEC) values associated with these results are 23.6 mg a.e./L (length) and 102 mg a.e./L (larval survival), respectively (SERA 2006a).

Toxicity – Other Aquatic Organisms. The EPA (2005a) classifies the acid and amine salts of 2,4-D as slightly toxic to practically non-toxic to aquatic invertebrates. *Daphnia* was the most sensitive species of freshwater species exposed to the 2,4-D acid, with a 48-hour LC₅₀ of 25 mg a.e./L (Alexander et al. 1985). When *Daphnia* were exposed to the DMA of 2,4-D, the reported 48-hour LC₅₀ values range from 153¹ mg a.e./L (Alexander et al. 1985) to 642.8 mg a.e./L (EPA 2005a). Some chronic studies (21-day) have been conducted to evaluate the effects of 2,4-D formulations on survival and reproduction. Ward (1991) reported a 21-day LC₅₀ of 75.7 mg a.e./L for *Daphnia* from exposure to the DMA form of 2,4-D. A NOEC was not reported.

2,4-D is an effective herbicide that adversely affects aquatic plants. Based on the data available, it appears that the vascular plants are more than two orders of magnitude more sensitive than the non-vascular plants (EPA 2005a). The SERA (2006a) reported the 5-day effect concentration where 50 percent of the organisms exhibited toxic effects (EC₅₀s) (algal cell growth) for 2,4-D

¹ The SERA risk assessment (2006) reports a LC₅₀ of 184 mg a.e./L; however, the Alexander et al. (1985) paper specifically states that results are reported as the technical product and not as acid equivalents. NMFS used a conversion factor of 0.831 to convert from technical product to acid equivalents.

acids and salts as ranging from 3.88 mg a.e./L (a corresponding NOEC of 1.41 mg a.e./L) to 156 mg a.e./L (a corresponding NOEC of 56.32 mg a.e./L). The most sensitive species was *Navicula pelliculosa* (a freshwater diatom), and the least sensitive species was a freshwater blue-green alga, *Anabaena flos-aquae*. Aquatic macrophytes appear to have a greater range of toxicity values, with target species having lower tolerances. Roshon et al. (1999) reported 14-day EC₅₀ toxicity values for common water milfoil (*Myriophyllum sibiricum*), a target species, of 0.018 mg/L (shoot growth) and 0.013 mg/L (root length). Sprecher et al. (1998) report no effects on sago pondweed (*Potamogeton pectinatus*), a non-target species, at concentrations of up to 2 mg/L of WEEDAR 64.

NMFS Pesticide Registration Opinion. Chemical concentrations examined in the in the 2011 registration biological opinion (opinion) (NMFS Tracking # 2004/02673) did not vary drastically from those summarized here. The 2,4-D registration opinion reported acute toxicity data for rainbow trout ranging from 162 mg a.e./L (2,4-D TIPA salt) to 2,244 mg a.e./L (2,4-D isoproylamine). For the 2,4-D DMA, the acute toxicity information ranged from >100 mg a.e./L to 807 mg a.e./L. Information presented in the 2011 opinion for EPAs registration of 2,4-D does not suggest a different endpoint as being more appropriate than that which was used in this opinion.

The registration opinion concluded there was no overlap between the estimated environmental concentrations (EECs) for forestry uses and the fish and invertebrate toxicity endpoints for amine, salt, and acid forms of 2,4-D. Generally, the toxicity endpoints were several orders of magnitude higher than the EECs. There was some overlap with the algal and aquatic vascular plant endpoints with the floodplain estimate EEC. The registration opinion concluded that use of 2,4-D in terrestrial applications was not likely to result in mortality of fish; however, it may result in some sublethal effects.

AMINOPYRALID

Exposure. The half-life of aminopyralid in soils ranges from 32 to 533 days, with a typical time of 103.5 days (EPA 2005b). Microbes and sunlight break it down and, in aquatic systems; the primary route of degradation is through sunlight (photolysis), with laboratory experiments yielding a product half-life of 0.6 days. In another experiment, aminopyralid photolyzed moderately slowly on a soil surface, with a half-life of 72 days. A laboratory Freundlich absorption isotherm study with eight United States and European soils yielded absorption values at 1.05 to 24.3 milliliter per gram (mL/g), which shows that aminopyralid is weakly sorbed to soil (EPA Aminopyralid Fact Sheet August 10, 2005). This also represents moderate mobility in the environment with a moderate potential to leach through soils and into groundwater. Aminopyralid is “rainfast” within 2 hours, leaving less potential for runoff during a rain event. Aminopyralid does not bioaccumulate through the food chain and is absorbed through the leaves and the roots where it is transported to other parts of the plant. Fish and aquatic insect exposure to aminopyralid occurs primarily through direct contact with contaminated surface waters.

SERA (2007) identified a peak estimated rate of contamination of ambient water associated with the normal application of aminopyralid as 0.6 milligrams acid equivalent/liter (mg a.e./L) at an application rate of 1 lb. a.e./acre. Typical application rates for aminopyralid in the proposed action range from 0.078 to 0.11 lb. a.e./acre, and the maximum label application rate is 0.11 lb. a.e./acre. At the maximum application rate of 0.11 lb. a.e./acre, the peak concentrations of aminopyralid in ambient water, using the modeled WCR in SERA (2007), would be 0.066 mg a.e./L. Considering the PDF that will be implemented, it is likely that water concentrations of aminopyralid will be far less than that estimated from modeling performed by SERA.

End Use Products. Aminopyralid is a pyridine carboxylic acid herbicide. The PNF has identified Milestone as the EUP for use, although we recognize that substantially similar EUPs may also be used after Level 1 review. Milestone contains the TIPA salt of aminopyralid (approximately 41 percent active ingredient). These formulation contain no inert ingredients other than water. Aminopyralid is considered in the same class of herbicides as clopyralid and picloram, which are described below, but lacks the carcinogen hexachlorobenzene or other chlorinated benzenes.

Toxicity – Fish. Because aminopyralid is a relatively new pesticide, very little information is available regarding its toxicological effects to endangered species act (ESA)-listed fish or other aquatic species. The information on the toxicity of aminopyralid comes from studies that have been submitted to EPA as part of the registration package for the chemical. The toxicity studies performed to date have used the technical grade aminopyralid; no toxicity studies in fish are available for the TIPA formulation of aminopyralid. In the available studies, aminopyralid has been shown to be practically non-toxic to fish and aquatic invertebrates, and slightly toxic to algae and aquatic vascular plants (SERA 2007). Aminopyralid is not expected to bioaccumulate in fish tissue (SERA 2007).

The SERA (2007) summarized several acute exposure studies that reported no mortality to organisms exposed to aminopyralid in concentrations up to 100 mg/L. Aminopyralid has a low order of acute toxicity to aquatic animals, with acute NOEC values falling within a narrow range of 50 to 100 mg a.e./L, depending on the fish species. Only one of the studies documented

sublethal effects in trout. In the study conducted by Marino et al. (2001a in SERA 2007), approximately seven percent of rainbow trout exposed to 100 mg a.e./L for 96 hours experienced a partial loss of equilibrium. However, this result was not statistically significant relative to the control group using the Fisher Exact test ($p = 0.2457$). As such, the Environmental Fate and Effects Division of EPA classified the 100 mg/L exposure as a NOEC. National Marine Fisheries Service (NMFS) has used this value as the lowest sublethal effect threshold.

Only one chronic toxicity study is available for aminopyralid, and it involves the fathead minnow (Marino et al. 2003 in SERA 2007). The NOEC of 1.36 mg a.e./L was derived from this egg to fry study. In this study, the percent larval survival and growth (wet weight and length) were significantly ($p < 0.05$) reduced at 2.44 mg a.e./L relative to controls. Sublethal effects such as pale coloration, immobility, deformed or underdeveloped bodies, and scoliosis (curvature of the spine) were also observed at concentrations at or exceeding 2.44 mg a.e./L. The EPA (2005b) classified the LOEC as 2.44 mg a.e./L.

The sublethal effects of aminopyralid and its end-use products (EUPs) on ESA-listed fish are unknown. Due to the relatively low toxicity and low application rates for aminopyralid, the estimated risks to fish and aquatic invertebrates from the USFS' use patterns or accidental exposure are estimated to be low. However, due to this chemical's fairly new emergence on the market, the overall effects whether sublethal or lethal are uncertain. Future research may reveal additional effects associated with the use of this herbicide.

Toxicity – Other Aquatic Organisms. Aminopyralid has been shown to be practically non-toxic to aquatic invertebrates, and slightly toxic to algae and aquatic vascular plants (EPA 2005b). Similar to fish, acute toxicity values for amphibians and aquatic invertebrates fall within 50 mg a.e./L to 100 mg a.e./L. *Daphnia magna* did not exhibit mortality or sublethal effects when exposed to a measured 98.6 mg a.e./L concentration for a 48-hour exposure period (Marino et al. 2001b in SERA 2007). Aquatic invertebrates are much less sensitive to chronic exposures to aminopyralid than fish. In a daphnid study, no adverse effects on adults, offspring, or reproductive parameters were observed in concentrations up to 102 mg a.e./L. As such, EPA (2005b) classified 102 mg a.e./L as the NOEC. In a separate study using midges, the NOEC was 130 mg a.e./L based on mean measured water column test concentrations and 82 mg a.e./L based on pore water concentrations.

Algae and aquatic macrophytes are only somewhat more sensitive than fish and aquatic invertebrates with NOEC values for algae in the range of 6 mg a.e./L to 23 mg a.e./L and a single NOEC of 44 mg a.e./L for an aquatic macrophyte. No chronic toxicity tests were reported (SERA 2007).

CHLORSULFURON

Exposure. Chlorsulfuron has a soil half-life of 1 to 3 months, with a typical half-life of 40 days. Soil microbes break down chlorsulfuron and can break it down faster in warm, moist soils (WSDOT 2017). Alternatively, EPA (2005b) describes soil half-life ranging from 14 to 320 days. The Washington Department of Transportation (WDOT) reported that chlorsulfuron has a high potential to contaminate groundwater, with contamination potentially resulting from application drift, surface runoff, and/or leaching through soil into groundwater (WDOT 2006). The EPA (2005b) also describes chlorsulfuron as likely to be persistent and highly mobile in the environment, transported to non-target areas by surface runoff and/or spray drift.

The SERA (2016) identified a peak estimated rate of contamination of ambient water associated with the normal application of chlorsulfuron at 0.167 mg a.i./L at an application rate of 1 lb a.i./acre. The maximum application rate listed in the proposed action is 0.12 lbs a.i./acre; consequently, maximum peak exposure would be approximately 0.073 mg a.i./L. For longer-term exposures, average estimated rate of contamination of ambient water associated with the normal application of chlorsulfuron is 0.009 ($5e^{-8}$ to 0.0009) mg a.i./L at an application rate of 1 lb a.e./acre.

End-Use Products. The product formulation of chlorsulfuron proposed for use is Telar XP. The XP formulation is the same formulation as previously registered and now obsolete Telar DF, but it has a different granule shape to improve mixing properties. The manufacturer requested a new registration number for Telar XP for internal tracking purposes. Telar XP contains 25 percent inert ingredients that have not been disclosed publicly. None of the inert ingredients are classified as toxic by the EPA (SERA 2016).

Toxicity – Fish. The EPA (2005b) describe chlorsulfuron as “practically non-toxic” to fish, and it does not bioaccumulate in fish (WSDOT 2017). The 96-hour LC_{50} value for rainbow trout has been reported as greater than 250 parts per million (Smith 1979). Although full dose-response curves have not been generated (due to limited water solubility of chlorsulfuron), fish do not appear to be susceptible to chlorsulfuron toxicity. The LC_{50} values in most species exceed the limit of solubility for chlorsulfuron (SERA 2016). Grande et al. (1994) exposed brown trout (*Salmo trutta*) to Glean (a product formulation consisting of 75 percent chlorsulfuron) and reported a 96-hour LC_{50} of 40 mg/L. Because the formulated product was tested, we cannot rule out the possibility that some of the toxicity may be due to the inert ingredients. There was not a paired study done on chlorsulfuron alone.

Pierson (1991) is the only study available regarding the toxicity of long-term (77 days) exposure of chlorsulfuron to fish or fry. Survival of rainbow trout embryos and alevins was not affected at concentrations up to 900 mg/L. However, fingerlings experienced 40 percent mortality at 900 mg/L. No mortality of fingerlings occurred in groups that were exposed to concentrations less than 900 mg/L (Pierson 1991). The NOEC for growth (as measured at the end of the study) was determined to be 32 mg/L and the LOEC was reported as 66 mg/L (Pierson 1991).

These studies indicate that outright mortality from exposure to the active ingredient is unlikely from the proposed action since peak estimated exposure from SERA (2016) is about three orders

of magnitude lower than the reported LC₅₀ for brown trout and approximately four orders of magnitude lower than the reported LC₅₀ for rainbow trout. Because there are limited studies available, there is substantial uncertainty surrounding potential sublethal effects of chlorsulfuron and Telar XP. There is no assurance that the proposed action will not cause lethal or sublethal effects to ESA-listed fish if the fish are exposed to the product in any appreciable amount.

Toxicity – Other Aquatic Organisms. The effects of chlorsulfuron on aquatic plants and invertebrates are limited to assays reported for *Daphnia* and several species of plants. Chlorsulfuron is described by EPA (2005b) as “practically non-toxic” to aquatic invertebrates, with 48-hour LC₅₀ values for *Daphnia* greater than 100 mg/L. Chlorsulfuron does not bioaccumulate in aquatic invertebrates (WSDOT 2017).

SERA (2016) summarized standard toxicity bioassays in *Daphnia* (Goodman 1979; Ward and Boeri 1989) and mysids (Ward and Boeri 1991) to assess the effects of chlorsulfuron on aquatic invertebrates. Mysids and daphnia had similar LC₅₀ values. The 96-hour LC₅₀ and NOEC (for lethality) values for *Mysidopsis bahia* were reported as 89 mg/L and 35 mg/L, respectively (Ward and Boeri 1991). The reported 48-hour LC₅₀ value in *Daphnia pulex* ranged between 32 and 100 mg/L, and the reported NOEC (for lethality) was 32 mg/L (Hessen et al. 1994). *D. magna* appear to be more resistant to chlorsulfuron toxicity based on a 48-hour LC₅₀ value range of >100 to 370.9 mg/L. The reported NOEC for lethality was 10 mg/L (Goodman 1979). For reproductive effects, a NOEC of 20 mg/L was reported in a 21-day exposure study in *D. magna* (Ward and Boeri 1989).

Studies have demonstrated that aquatic plants are far more sensitive than aquatic animals to chlorsulfuron, with studies occurring for both algae and aquatic macrophytes. Study results summarized by SERA (2016) revealed substantial differences in the response of algae and various cyanobacteria to chlorsulfuron. However, due to the many variations in experimental protocols, including the duration of exposure and the specific variables used to determine EC₅₀ values, identifying the species most sensitive and most resistant to chlorsulfuron is difficult. *Selenastrum capricornutum* is fairly sensitive to chlorsulfuron toxicity, with reported EC₅₀ values ranging from 0.05 mg/L to 0.8 mg/L (Abdel-Hamid 1996; Blasberg et al. 1991; Fairchild et al. 1997; Kallqvist and Romstad 1994). *Selenastrum* is an algal species that occurs in lakes and ponds, and it is used as a toxicity test species because it is sensitive to toxins. *Selenastrum* is generally not found in mountain streams and rivers, but it is a general indicator of potential algal responses in freshwater habitats. Results of a standard toxicity bioassay in *S. capricornutum* yield a NOEC of 0.01 mg/L (exposure duration of 120 hours) (Blasberg et al. 1991), which is consistent with the NOEC of < 0.019 mg/L reported by Fairchild et al. (1997). Fairchild et al. 1997 also reported an LOEC in *S. capricornutum* of 0.019 mg/L. *Cryptomonas pyrenoidifera*, another freshwater algal species, has an EC₅₀ of 213 mg/L (Nystrom et al. 1999). The longest chlorsulfuron exposure duration for laboratory studies in algae was 92 hours; with no laboratory studies with longer exposure durations identified.

Chlorsulfuron can cause changes in phytoplankton communities at concentrations as low as 0.010 mg/L (Kallqvist et al. 1994). A decrease in biomass development was observed following exposure to chlorsulfuron concentrations of 0.010 mg/L for 13 days. A dose-dependent decrease in species diversity (based on the Shannon-Weiner diversity index) was also observed, with the

lowest values recorded on the second and last days of the exposure period. With these low concentrations where changes have been observed, the proposed use of chlorsulfuron is likely to alter the algal communities in locations where it reaches water. However, any community effect is likely to be transient, and localized, since exposure is likely to occur through discrete runoff events or spillage with limited duration, and any such incidents are likely to be widely scattered.

Only three studies were identified by SERA (2016) regarding the toxicity of chlorsulfuron to aquatic macrophytes: a 96-hour exposure study and a 7-day exposure study in duckweed (Fairchild et al. 1997; Peterson et al. 1994); and a 4-week exposure study in sago pondweed (Coyner et al. 2001). The 96-hour EC₅₀ value for growth inhibition based on biomass in duckweed is reported as 0.0007 mg /L, with an NOEC value of 0.0004 mg/L and an LOEC of 0.0007 mg/L (Fairchild et al. 1997). Exposure of duckweed to 0.02 mg/L for 7 days resulted in 86 percent inhibition of growth (Peterson et al. 1994). Results of the 4-week exposure in sago pondweed yield an LC₅₀ value of 0.001 mg/L, with 100 percent plant death following a 96-hour exposure to 0.002 mg/L (Coyner et al. 2001). No field studies assessing the effects of chlorsulfuron in aquatic plants have been identified.

Very little information is available regarding the toxicity of chlorsulfuron degradation products to aquatic plants or algae. Based on a single study described by SERA (2016), comparing chlorsulfuron and two chlorsulfuron degradation products in *Chlorella pyrenoidosa*, chlorsulfuron breakdown products appear to be considerably less toxic than chlorsulfuron; EC₅₀ values for the degradation products are at least 100-fold greater than for chlorsulfuron (Wei et al. 1998).

CLOPYRALID

Exposure. Clopyralid's half-life in the environment averages 1 to 2 months and ranges up to 1 year. It is degraded almost entirely by microbial metabolism in soils and aquatic sediments, and is not degraded by sunlight or hydrolysis. Clopyralid is highly soluble in water, does not adsorb to soil particles, is not readily decomposed in some soils, and may leach into ground water. Clopyralid is extremely stable in anaerobic sediments, with no significant decay noted over a 1-year period (Hawes and Erhardt-Zabik 1995; Tu et al. 2001). Because clopyralid does not bind with sediments readily, it can be persistent in an aquatic environment, where clopyralid half-life ranges from 8 to 40 days (Tu et al. 2001). Clopyralid is stable in water over a pH range of 5 to 9 (Woodburn 1987), and the rate of hydrolysis in water is extremely slow with a half-life of 261 days (Concha and Shepler 1994).

Clopyralid does not bind tightly to soil and has a high potential for leaching. While clopyralid will leach under conditions that favor leaching (e.g., sandy soil, a sparse microbial population, and high rainfall), the potential for leaching or runoff is functionally reduced by the relatively rapid microbial degradation of clopyralid in soil (Baloch-Haq et al. 1993; Bergstrom et al. 1991; Bovey and Richardson 1991). A number of field lysimeter studies and the long-term field study by Rice et al. (1997) indicate that leaching and subsequent contamination of groundwater are likely to be minimal. This conclusion is also consistent with a short-term monitoring study of clopyralid in surface water after aerial application (Leitch and Fagg 1985).

SERA (2004a) estimated peak rates of contamination of ambient water associated with the normal application of clopyralid to be 0.07 mg a.e./L at an application rate of 1 lb a.e./acre. For longer-term exposures, average estimated rate of contamination of ambient water associated with the normal application of clopyralid is 0.007 (0.001 to 0.013) mg a.e./L at an application rate of 1 lb a.e./acre.

End-Use Products. Clopyralid is available in two forms (acid and amine salt). The PNF proposes to use Transline and Clean Slate, which contain 40.9 percent clopyralid as the monoethanolamine salt. They also contain 59.1 percent inert ingredients. Two of the inert ingredients in Transline include: isopropyl alcohol (5 percent) and a polyglycol (1 percent), neither of which are classified by EPA as toxic.

Toxicity – Fish. Little information is reported for toxic effects of clopyralid. The acid and amine forms of clopyralid have different toxicities to fish. The monoethanolamine salt of clopyralid appears to have lower toxicity compared to the acid formulation present in some other products. Toxicity of the acid formulation of clopyralid for a 96-hour LC₅₀ is reported in SERA (2004a) to be 103.5 mg a.e./L, using an unspecified life stage of rainbow trout. For the monoethanolamine salt form used in the proposed action, SERA (2004a) reported a 96-hour LC₅₀ of 700 mg a.e./L. Fairchild et al. (2008) exposed rainbow trout and bull trout (*Salvelinus confluentus*) to clopyralid and reported 96-hour LC₅₀ values of 700 mg a.e./L and 802 mg a.e./L, respectively. The authors also used accelerated life testing procedures in EPA's Acute-to-Chronic Estimation with Time-Concentration-Effect Models program to estimate chronic lethal concentrations resulting in 1 percent mortality (LC₁) at 30-days. The reported chronic LC₁ was 477 mg a.e./L, with a 95 percent confidence interval of 53 mg a.e./L to 900 mg a.e./L.

Only one longer-term toxicity study for clopyralid was available. Fairchild et al. (2009) conducted 30-day chronic toxicity tests with juvenile rainbow trout. No mortality was observed at the highest concentrations tested (273 mg a.e./L). They found no significant effects on growth of juvenile trout after 15 days of exposure to clopyralid at concentrations up to 256 mg a.e./L. However, both length and weight of trout were significantly affected after exposure to clopyralid for 30-days, with a calculated LOEC of 136 mg a.e./L. The 30-day NOEC value was reported as 68 mg a.e./L. No other longer-term toxicity studies are available on the toxicity of clopyralid.

Toxicity – Other Aquatic Organisms. Toxic effects on aquatic invertebrates are reported only for *Daphnia*, which has an LC₅₀ of 350 mg a.e./L for the monoamine salt and 225 mg a.e./L for the acid LC₅₀ (SERA 2004a). Results from a single, standard chronic reproduction bioassay exposing *Daphnia* to the monoethanolamine salt of clopyralid indicate a NOEC value of 23.1 mg a.e./L (SERA 2004a). If other invertebrates respond similarly to *Daphnia*, then lethal effects on aquatic invertebrates are unlikely.

Aquatic plants are more sensitive to clopyralid than fish or aquatic invertebrates (SERA 2004a). The EC₅₀ for growth inhibition in duckweed, an aquatic macrophyte, is 89 mg/L. However, at lower concentrations, in the range of 0.01 to 0.1 mg/L, growth of other aquatic macrophytes is stimulated (Forsyth et al. 1997). From information reported in SERA (2004a) it appears that there could be potential losses in primary productivity from algae killed by clopyralid, based on an EC₅₀ for algae of 6.9 mg/L. However, concentrations lethal to algae are unlikely to occur unless clopyralid is directly added to water, or if a rainfall washes the chemical into a stream shortly after it is applied.

DICAMBA

Exposure. Dicamba is highly mobile in and poorly adsorbed by most soil types. It is also highly soluble in water, so its transport is influenced by precipitation. At low rainfall rates, dicamba dissipation had a half-life of about 20 days. At high rainfall rates using modeled runs, virtually all the dicamba was washed from the soil. The environmental fate of dicamba has been extensively studied. In general, dicamba is very mobile in most soil types, with the only reported exception being peat, to which dicamba is strongly adsorbed (Grover and Smith 1974). For many soil types, the extent of soil adsorption is positively correlated with and can be predicted from the organic matter content and exchangeable acidity of the soil (Johnson and Sims 1993). In a monitoring study by Scifres and Allen (1973), dicamba levels in the top 6 inches of soil dissipated at a rate of about 0.22-day⁻¹ ($t_{1/2}$ =3.3 days) over the first 2 weeks following application. After 14 days no dicamba was detected, with the limit of detection of 0.01 mg/kg, in the top 6 inches of soils. The rates of dissipation in clay and loam were essentially identical.

Available monitoring data indicate that ambient water may be contaminated with dicamba after standard applications of the product. The range of average to maximum dicamba levels in water, reported in a monitoring study by Waite et al. (1992), are from approximately 0.1 to 0.4 microgram per liter. SERA (2004b) estimated peak rates of contamination of ambient water associated with the normal application of dicamba to range from less than 0.00001 mg a.e./L to 0.0005 mg a.e./L at an application rate of 1 lb a.e./acre. The estimated WCR for an accidental direct spray of a stream was reported as 0.01 mg a.e./L. Because dicamba has been detected in surface water at concentrations higher than those modeled by groundwater loading effects of agricultural management systems (GLEAMS), SERA (2004b) opted to use the 0.01 mg a.e./L as the peak WCR in their risk assessment.

End-Use Products. Dicamba is available as a diglycolamine (DGA) salt and DMA. The EUP listed for use by the PNF includes Banvel. Banvel is formulated with the DMA of dicamba, with roughly 52 percent inert ingredients.

Toxicity – Fish. There is wide variation in the reported acute toxicity of dicamba to fish, with 96-hour LC₅₀ values ranging from 28 mg/L (rainbow trout) to 465 mg/L [mosquito fish (*Gambusia affinis*)]. Although limited data are available, salmonids appear to be more sensitive to dicamba than other freshwater fish. Rainbow trout had the lowest reported 96-hour LC₅₀ value. The reported 96-hour LC₅₀ value for cutthroat trout (*O. clarki*) was more than 50 mg/L (Woodward 1982). For coho salmon, reported 48- and 144-hour LC₅₀ values were 120 mg/L and more than 109 mg/L, respectively (Bond et al. 1965; Lorz et al. 1979). In a study by Lorz et al. (1979), yearling coho mortality was observed at 0.25 mg/L during a seawater challenge test which simulates their migration from rivers to the ocean.

There are limited studies on sublethal effects from acute or chronic exposures. The only study providing histopathologic evaluation is that of Lorz et al. (1979) using coho salmon. In this study, non-lethal concentrations of dicamba at a concentration of 100 mg/L were associated with histopathological changes in the liver but not in the kidneys or gills. Acute NOEC values have been reported for bluegill sunfish (*Lepomis macrochirus*) (56 mg/L in Vilkas 1977a; 100 mg/L in McAllister et al. 1985a), rainbow trout (56 mg/L in McAllister et al. 1985b), and sheephead

minnow (*Cyprinodon variegatus*) (>180 mg/L from Vilkas 1977b). However, these NOEC values are based on relatively gross endpoints—i.e., no mortality and no behavioral changes. A significant issue with these values is the fact that some reported NOEC values are greater than values reported to cause an adverse effect. For example, as noted above, McAllister et al. (1985b) report an NOEC of 56 mg/L in rainbow trout. While this is consistent with the LC₅₀ value of 320 mg/L reported by Bond et al. (1965) in rainbow trout, Johnson and Finley (1980) report an LC₅₀ of 28 mg/L in rainbow trout. These sorts of discrepancies are not uncommon with compounds for which many studies are conducted at different times by several different laboratories. The reported NOEC values for dicamba will not be used directly in this opinion because they may not fully encompass sublethal toxicity and because some of the reported NOEC values exceed other reports of concentrations that are associated with lethality.

Toxicity – Other Aquatic Organisms. The range of toxicity values of dicamba to aquatic invertebrates suggests wide variation among species. The lowest reported 48-hour LC₅₀ is 5.8 mg/L for *Gammarus lacustris* (Sanders 1969). While *Daphnia magna*, a common test species, appears to be relatively tolerant to dicamba with reported 48-hour LC₅₀ values from 100 mg/L to >1000 mg/L (Johnson and Finley 1980; Forbis et al. 1985). *Daphnia pulex* is much more sensitive with a 48-hour LC₅₀ value of 11 mg/L (Hurlbert 1975). As with fish, no longer-term studies are available on the lethal and sublethal toxicity of dicamba to aquatic invertebrates.

Algae species are more sensitive to dicamba than aquatic animals (SERA 2004b). The most sensitive species on which data are available is the freshwater algae, *Anabaena flos-aquae*, with a 5-day EC₅₀ of 0.061 mg/L (Hoberg 1993a). The aquatic macrophyte, *Lemna gibba*, had reported 14-day NOEC and LOEC values of 0.25 mg/L and 0.51 mg/L, respectively (Hoberg 1993b). A higher 4-day NOEC of 100 mg/L was reported for *Lemna minor* (Fairchild et al. 1997). Whether this value reflects a true difference in species sensitivity or whether it simply reflects a shorter duration of exposure is unknown.

FLUROXYPYR

Exposure. Because surface runoff potential is high, and potential for loss on eroded soil is low, Fluroxypyr has the potential to leach to groundwater. Fluroxypyr is moderately mobile in and poorly adsorbed by most soil types. At single point concentration of 0.066 mg/L in soil, fluroxypyr is very mobile in silt loam, sandy loam, loam, and silty clay (Lehmann et al. 1988). In field studies, Bergstrom et al. (1990) found concentrations in soil were either undetectable or at very low levels within three months after the application of fluroxypyr. A typical half-life for fluroxypyr in the soils is 36 days. Fluroxypyr is broken down by microbes and sunlight. WCRs are complex as fluroxypyr is poorly soluble and the upper bound of measured concentrations exceeds the water solubility. SERA (2009) reported peak WCR of 0.08 mg/L per lb/acre applied.

End Use Products. The PNF proposed to use four EUPs with fluroxypyr as the active ingredient: Vista Ultra, Vista XRT, Starane, and Spotlight. Two formulations of fluroxypyr are specifically considered in the SERA (2009) risk assessment: Vista Specialty Herbicide and Vista XRT. Both of these formulations contain the 1-methylheptyl ester of fluroxypyr as well as two listed inerts: naphthalene and 1 methyl-2-pyrrolidinone. The Vista XRT formulation contains a greater concentration of the fluroxypyr ester and much lower concentrations of the listed inerts. Fluroxypyr is the only active ingredient (26.2 percent) in the herbicide Vista. According to the product label, Vista also contains 73.8 percent other ingredients (unspecified).

Toxicity – Fish. Fluroxypyr does not bioconcentrate through the food chain. The SERA Risk Assessment (2009) classifies fluroxypyr-acid as slightly toxic to practically nontoxic to fish, based on acute toxicity. Acute toxicity tests evaluated by EPA indicate that fluroxypyr is slightly toxic to practically non-toxic to freshwater fish. For bluegill sunfish, a 96-hour $LC_{50} > 14.3$ mg/L was reported. For rainbow trout, 96-hour LC_{50} values ranged from 13.4 mg/L to > 100 mg/L. In studies by Wan et al. (1992), the 96-hour LC_{50} for Chinook salmon ranged from 10 to 17 mg/L and sockeye salmon (*O. nerka*) ranged from 10 to 15 mg/L. However, the Wan et al. (1992) study was for unidentified formulations with no relation to proposed formulations. Those results were not applied in the SERA (2009) assessment. The NOEC values for fish used in the 2009 risk assessment are taken as 0.060 mg a.e./L for sensitive species, including salmonids, and 0.49 mg a.e./L for tolerant species. The fluroxypyr literature does not include chronic fish bioassays. The U.S. Environmental Protection Agency/Office of Pesticide Programs (EPA/OPP) waived the requirement for chronic testing because of the low acute toxicity of both fluroxypyr acid and fluroxypyr-MHE to fish. Fluroxypyr has limited solubility in water and SERA (2009) indicated that solvents used in toxicity studies may influence reported toxicity levels. In addition the only LC_{50} values found were for unidentified formulations that were not covered by the Forest Service risk assessment (SERA 2009). They even state, “available fish bioassays submitted to the EPA suggest the unlikelihood of adverse effects resulting from fluroxypyr exposure, and the development of a hazard quotient is unwarranted.” This is likely due to nominal concentrations (a product of volume herbicide added to volume water) are always several orders of magnitude higher than measured concentrations of fluroxypyr, because of the solubility properties. SERA (2009) stated that, “it is not clear that fluroxypyr-MHE would cause adverse effects under any plausible set of conditions.”

Toxicity – Other Aquatic Organisms. Results from toxicity testing conducted on *Daphnia magna* indicate that fluroxypyr is practically non-toxic to this species of invertebrate. The 48-hour EC₅₀ for this toxicity test was >100 mg/L. The EPA did not require a chronic study in aquatic invertebrates because of the low toxicity of fluroxypyr acid to this group of organisms; however, Jones (1984) conducted a standard life cycle study which was submitted to the EPA in support of the registration of fluroxypyr. This study reports an effect on reproduction parameters but does not identify an LOEC based on immobility at 100 mg. The NOEC reported in the study is 56 mg/L. Eastern oysters, however, appear to be more sensitive to fluroxypyr-MHE. Based on the EC₅₀ of 0.068 mg ester/L [measured concentration equivalent to 0.042 mg a.e./L] for shell deposition (Boeri et al. 1996), fluroxypyr-MHE is classified as very highly toxic (EPA/OPP 1998). The Forest Service has elected not to base toxicity values on estimates of an EC₅₀ or LOEC. The EPA/OPPTS (2004), on the other hand, uses EC₅₀ values, but interprets risk with levels of concern of 0.5 for acute risk and 0.05 for endangered species. To maintain compatibility with the EPA, the Forest Service elected to divide an EC₅₀ by a factor of 20 to approximate a NOEC. Using this approach, the EC₅₀ of 0.068 mg/L is used to estimate a NOEC of 0.0034 mg/L. This concentration is below the reported LOEC by a factor of about 15 [0.05 mg/L ÷ 0.0034 mg/L ≈ 14.71]. When the NOEC of 0.0034 mg/L is converted to acid equivalents, the acute toxicity value used for sensitive species of aquatic invertebrates is about 0.002 mg a.e./L [0.0034 mg a.i./L x 0.694 a.e./a.i. = 0.00236].

Fluroxypyr-MHE is much more toxic to aquatic plants than to aquatic animals, as is true for most herbicides. For algae, the available NOEC values range from 0.03 mg a.i./L (*Anabaena flos-aquae*, from Milazzo et al. 1996a) to 0.199 mg a.i./L (*Selenastrum Capricornutum*) from Milazzo et al. (1996b). When converted to acid equivalents (0.694 a.e./a.i.), these concentrations correspond to about 0.021–0.14 mg a.e./L and are used for sensitive and tolerant species, respectively.

For macrophytes, only two studies are available, and both were conducted using *Lemna gibba*, duckweed (Kirk et al. 1996; Kirk et al. 1998). The 7-day NOECs from these studies are 0.412 mg/L (Kirk et al. 1998) and 1.22 mg/L (Kirk et al. 1996). Kirk et al. (1998) also report a 14-day NOEC of 0.437 mg/L. The study by Kirk et al. (1996) is classified as Core by U.S. EPA/OPP (1998). The later study by Kirk et al. (1998) is not cited in EPA/OPP (1998) and may not have been available at the time the risk assessment was prepared. For the current risk assessment, the lowest NOEC, 0.412 mg/L reported by Kirk et al. (1998) is used for tolerant species. When adjusted for acid equivalents, the toxicity value is about 0.29 mg a.e./L [0.412 mg a.i./L x 0.694 a.e./a.i. = 0.285928 mg a.e./L]. No dose-response assessment is proposed for sensitive species of aquatic macrophytes.

GLYPHOSATE

Exposure. Glyphosate strongly binds to most soils, but dissolves easily in water. Glyphosate remains unchanged in the soil for varying lengths of time, depending on soil texture and organic matter content. The half-life of glyphosate can range from 3 to 249 days in soil and from 35 to 63 days in water (USFS 2000a). Soil microorganisms break down glyphosate and the potential for leaching is low due to the soil adsorption. However, glyphosate can move into surface water when the soil particles to which it is bound are washed into streams or rivers (EPA 1993). Studies examined glyphosate residues in surface water after forest application in British Columbia with and without no-spray streamside zones. With a no-spray streamside zone, very low concentrations were sometimes found in water and sediment after the first heavy rain (USFS 2000a). Although glyphosate is chemically stable in pure aqueous solutions, it is degraded relatively fast by microbial activity, and water levels are further reduced by the binding of glyphosate to suspended soil particulates in water and dispersal (SERA 2011a).

Biodegradation represents the major dissipation process. After glyphosate was sprayed over two streams in the rainy coastal watershed of British Columbia, glyphosate levels in the streams rose dramatically after the first rain event, 27 hours after application, and fell to undetectable levels in 96 hours (NLM 2012). The highest residues were associated with sediments, indicating that they were the major sink for glyphosate. Residues persisted throughout the 171-day monitoring period. Suspended sediment is not a major mechanism for glyphosate transport in rivers, but glyphosate sprayed in roadside ditches could readily be transported as suspended sediment and cause acute exposures following rain events.

The SERA (2011a) estimated peak rates of contamination of ambient water associated with the normal application of glyphosate to be 0.083 mg a.e./L at an application rate of 1 lb a.e./acre. For longer-term exposures, average estimated rate of contamination of ambient water associated with the normal application of glyphosate is 0.00019 (0.000088 to 0.0058) mg a.e./L at an application rate of 1 lb a.e./acre. Peak contamination rates in a stream after a direct spray were modeled to be 0.091 mg a.e./L.

End-Use Products. Glyphosate is available in a variety of formulations that contain the ammonium, DMA, isopropylamine (IPA), or potassium salts of glyphosate. Some formulations contain only one of these salts as an aqueous solution (e.g., Accord, AquaNeat, and Rodeo), and other formulations (e.g., Roundup®) contain surfactants. The PNF proposes to use a variety of EUPs, and they also propose to use Roundup formulations. Products formulated as salts in water with no added surfactants that are proposed for use include: Rodeo, Accord Concentrate (and other Accord EUPs that are similar), Aqua Star, and AquaNeat. All of these EUPs have the same proportion of the IPA salt of glyphosate. Manufacturers of these EUPs recommend that a surfactant be added to the formulation in a tank mix prior to application. The PNF also proposed to use Roundup formulations that are all similar.

Toxicity – Fish. The EPA (1993) classified glyphosate (technical grade) as slightly toxic to practically non-toxic to fish. The rainbow trout 96-hour LC₅₀ values for glyphosate acid and the IPA salt of glyphosate range from 10 mg a.e./L to 240 mg a.e./L. Wan et al. (1989) found the toxicity of glyphosate is affected by pH. The authors tested the toxicity of glyphosate to various

salmonids (rainbow trout, coho salmon, chum salmon [*O. keta*], Chinook salmon [*O. tshawytscha*], and pink salmon (*O. gorbuscha*) in water with pH values ranging from 6.3 to 8.2. Rainbow trout were the most sensitive to pH variance, with 96-hour LC₅₀ values ranging from 10 mg a.e./L (pH 6.3) to 197 mg a.e./L (pH 8.2).

The various formulations of glyphosate have different toxicities to fish (rainbow trout 96-hour LC₅₀ values ranging from 1.3 mg a.e./L to 429 mg a.e./L), which highlights the role of inert ingredients in toxicity (SERA 2011a). Of the glyphosate formulations tested, both Rodeo and Accord (and other equivalent formulations) are the least toxic. These formulations consist of only the active ingredient and water; however, the manufacturer recommends the EUP be mixed with a surfactant prior to applying the herbicides. Mitchell et al. (1987) tested the toxicity of Rodeo with and without a surfactant. Without the surfactant, the 96-hour LC₅₀ for rainbow trout was 429 mg a.e./L. With the surfactant X-77, the 96-hour LC₅₀ ranged from 96.4 mg a.e./L (rainbow trout) to 180.2 mg a.e./L (Chinook salmon). For this opinion we applied the values reported by SERA (2011a) for 96-hour LC₅₀— (1) Most toxic formulations = 1 to 10 mg a.e./L; and (2) less toxic formulations = 10 to 429 mg a.e./L.

The most toxic formulation tested was Roundup® Original and its apparently equivalent formulations (Honcho, Gly Star Plus, and Cornerstone). These Roundup® formulations contain glyphosate IPA and the polyoxyethyleneamine (POEA) surfactant MON 0818. The reported range of 96-hour LC₅₀ values for Roundup® formulations that appear to contain this POEA surfactant is 0.96 mg a.e./L to 10 mg a.e./L (SERA 2011a). Other formulations with the trade name of Roundup® have been found to be much less toxic (i.e., rainbow trout LC₅₀ of 800 mg a.e./L for Roundup® Biactive) than standard Roundup® formulations (SERA 2011a). The decreased toxicity of these formulations is likely due to the use of different surfactants.

Of the numerous surfactants that may be used in glyphosate EUPs, POEA is the most important class of surfactants. The POEA is commonly used to designate surfactants used in some glyphosate formulations; however, it is not a single surfactant. POEA surfactants are mixtures, and not all POEA surfactants used in glyphosate formulations are equivalent (even among formulations provided by the same manufacturer). Data indicate that some POEA surfactants may be equally toxic or more toxic than glyphosate itself.

The surfactant MON0818® in Roundup® formulations has been studied most extensively (of all the surfactants used with glyphosate products). It is considered highly toxic to fish (typical LC₅₀ values ranging from about 1 to 3 mg/L). MON0818® is more toxic than glyphosate by factors of 3.1 (i.e., pink salmon at pH 6.3) to 135.6 (i.e., pink salmon at pH of 8.2) (SERA 2011a). Unlike technical grade glyphosate, the toxicity of MON0818® increases with increasing pH. Toxicity (LC₅₀) values reported for other surfactants added to glyphosate field solutions typically range from 1 to 10 mg/L (SERA 2011a). However, there are some surfactants that are considered slightly toxic (LC₅₀ values ranging from >10 to 100 mg/L) to practically non-toxic (LC₅₀ values greater than 100 mg/L). The surfactants Agri-Dex, LI 700 and Geronol CF/AR have LC₅₀ values greater than 100 mg/L (McLaren/Hart 1995).

As noted previously, the surfactants can substantially alter the toxicity of a formulation (e.g., toxicity increased four times when X-77 was added to Rodeo). The PNF identified 15 surfactants for use. The reported rainbow trout 96-hour LC₅₀ values for the most toxic surfactants are: Activator 90 (2.0 mg/L); Entry™ II (POEA) (0.65 mg/L); and R-11 (3.8 mg/L). The remaining surfactants have toxicities ranging from 17 to 130 mg/L.

Information on sublethal effects of glyphosate and glyphosate formulations is extremely limited and not available for many of the endpoints important to the overall health and fitness of salmonids. Xie et al. (2005) exposed juvenile rainbow trout to 0.11 mg a.e./L² glyphosate for 7 days and did not observe any significant increase in vitellogenin concentrations. The authors also exposed juvenile trout to mixtures of glyphosate (0.11 mg a.e./L) and either the surfactant R-11 (0.06 mg/L) or TPA (0.02 mg/L) for 7 days and observed some increases in vitellogenin concentrations. However, those increases were not statistically significant. No other studies evaluating sublethal effects to salmonids from acute exposures to technical grade glyphosate were found.

There have been some acute studies performed using Roundup® formulations. Morgan et al. (1991) reported that trout do not exhibit avoidance responses to glyphosate formulations (Vision with 15 percent surfactant and Vision with 10 percent surfactant) at concentrations less than the 96-hour LC₅₀. However, behavioral changes such as changes in coughing and ventilation rates, changes in swimming, loss of equilibrium, and changes in coloration were observed at concentrations as low as 50 percent of the LC₅₀ over exposures of up to 96 hours (some erratic swimming behavior was observed after just 24 hours). In this study, rainbow trout exposed to concentrations of up to 6.75 mg a.e./L of Vision (with 15 percent surfactant) did not exhibit abnormal behavior during the exposure period. Similarly, no abnormal behavior was observed in fish exposed to concentrations of up to 18.75 mg a.e./L of Vision (with 10 percent surfactant). Tierney et al. (2007) reported that rainbow trout may be able to sense glyphosate (Roundup® formulation) at about 0.076 mg a.e./L (as measured by olfactory-mediated behavioral and neurophysiological responses) during 30-minute exposure periods, but will not exhibit an avoidance response at this concentration. Rather, avoidance responses were exhibited at concentrations that were close to those causing acute lethality. The SERA (2011a) concluded that more toxic formulations (i.e., Roundup) had a surrogate lowest sublethal effect of 0.5 mg a.e./L for trout while the less toxic formulations (i.e., Rodeo, etc.) produced sublethal effects at concentrations ranging from 0.5 to 21 mg a.e./L.

One full life-cycle study assessing the chronic toxicity of technical grade glyphosate has been performed using the fathead minnow. In this study, no adverse effects to survival or reproduction occurred at exposures up to 25.7 mg a.e./L (the highest concentrations tested). Morgan and Kiceniuk (1992) conducted a long-term study (2 months) exposing rainbow trout to Vision at concentrations up to 0.046 mg a.e./L. No mortality or signs of toxicity were observed during the exposure period, and the authors did not find any evidence of pathology or changes in growth. The authors noted a decrease in the frequency of wigwag behavior in exposed trout at 0.0045 mg a.e./L; however, this effect was not observed at higher exposure concentrations

² SERA (2011a), reported the exposure concentration as 1.25 mg a.e./L; however, following review of the original publication (Xie et al. 2005), it appears as though 0.11 mg a.e./L glyphosate was measured, and the 1.25 mg a.e./L concentration was applicable to the chemical triclopyr.

(0.043 mg a.e./L). Because the change in wigwag behavior did not have a clear dose-response relationship, the authors were uncertain about its biological significance. No other chronic studies using salmonids were located.

Toxicity – Other Aquatic Organisms. The EPA (1993) classified glyphosate (technical grade) as slightly toxic to practically non-toxic to aquatic invertebrates. The 48-hour EC₅₀ values for aquatic invertebrates exposed to glyphosate or glyphosate IPA generally range from 50 to 650 mg a.e./L (SERA 2011a). For *Daphnia magna*, studies provided to EPA in support of the registration for glyphosate reported EC₅₀ values ranging from 128 to 647 mg a.e./L. Pereira et al. (2009) reported an extremely high acute EC₅₀ (more than 2,000 mg a.e./L). Even though this result is much higher than any previously reported EC₅₀ values, the test protocol used appeared to be relatively standard (SERA 2011a).

As expected, Rodeo has similar toxicities to the active ingredient and is much less toxic than formulations that contain surfactants. For aquatic invertebrates, the LC₅₀ values for Rodeo range from 86 mg a.e./L³ to more than 2,000 mg a.e./L. Simenstad et al. (1996) found no significant differences in the short term (28 days post treatment) or long term (119 days post treatment) between benthic communities of algae and invertebrates on untreated mudflats and mudflats treated with Rodeo® and the surfactant X-77 spreader.

Similar to fish, Roundup® and similar formulations of glyphosate are much more toxic to aquatic invertebrates than glyphosate, glyphosate IPA, and Rodeo. Toxicity values for most Roundup® formulations range from approximately 1.5 to 62 mg a.e./L. In a study of avoidance behavior, Folmar (1978) noted that mayflies avoided Roundup® at concentrations of 10 mg/L; however, no effect was noted at concentrations of 1 mg/L. Hildebrand et al. (1980) found that Roundup® treatments of an experimental pond at concentrations up to 196 lbs./acre did not significantly affect the survival of *Daphnia*.

Glyphosate is highly toxic to all types of terrestrial plants and is used to kill floating and emergent aquatic vegetation. Differences in species sensitivities to glyphosate acid are apparent for both algae (EC₅₀ values from about 2 to 600 mg a.e./L) and aquatic macrophytes (EC₅₀ values from 10 to near 200 mg a.e./L). The toxicity of Rodeo (no surfactant) to the algae *Ankistrodesmus* sp. was reported to be 29 mg a.e./L (Gardner et al. 1997). Perkins (1997) found Rodeo to be much more toxic to the aquatic macrophyte watermilfoil (14-day EC₅₀ of 0.84 mg a.e./L) and *Lemna gibba* (7.6 mg a.e./L).

³ Henry et al. (1994) reported an LC₅₀ value of 218 mg formulation/L for *Daphnia magna*. It appears as though SERA (2011a) erroneously reported this value as milligrams acid equivalent per liter (mg a.e./L). The formulation used contained 53.5 percent IPA salt of glyphosate. The ratio of glyphosate acid to the IPA salt in the formulation is 0.74. Thus, a toxicity value of 218 mg formulation/L equates to 86.3 mg a.e./L (218 * 0.535 * 0.74).

IMAZAMOX

Exposure. Imazamox has an average soil half-life of 81 days (SERA 2010). This estimated soil half-life is quite conservative based on SERA information indicating reports have shown that soil half-lives for imazamox range from 12 days to 30 days. All exposure assessments associated with terrestrial applications are based on the maximum application rate of 0.5 lb a.e./acre. The SERA (2010) identified a peak estimated rate of contamination of ambient water associated with the normal application of imazamox at 0.19 mg a.e./L at an application rate of 1 lb a.e./acre. The maximum application rate listed in the proposed action is 0.5 lbs a.e./acre; consequently, maximum peak exposure would be approximately 0.095 mg a.e./L. Simulations of imazamox runoff were conducted for clay, loam, and sand at annual rainfall rates, with the average penetration depth of imazamox estimated at about 40 inches with a range of about 12 to 60 inches (SERA 2010).

End-Use Products. Imazamox is available in acid and ammonium salt forms. The PNF propose to use Beyond and Raptor, which are formulated with 12.1 percent of the ammonium salt of imazamox. No other EUPs are proposed for use.

Toxicity – Fish. (This excerpt is taken directly from SERA 2010). Data on the toxicity of imazamox appears to be essentially nontoxic to fish in acute exposure assays. LC₅₀ values for fish were not determined in the standard acute toxicity studies on imazamox that are required for pesticide registration, and the reported acute no observed adverse effect concentration (NOAECs) range from 94.2 mg/L in sheepshead minnows to 122 mg/L in rainbow trout. All of the acute NOAECs are the highest concentrations tested in the acute toxicity studies. Thus, the differences in NOAECs do not imply differences in species sensitivities. Just as mammalian toxicity studies on imazamox fail to determine acutely toxic doses, aquatic toxicity studies fail to determine imazamox concentrations that are acutely toxic to fish—i.e., acute lowest observed adverse effect concentration.

Chronic toxicity studies in fish are not listed among the registrant-submitted studies on imazamox, and the EPA ecological risk assessments (EPA/OPP 2008a, 2008b) note that chronic risks to fish cannot be assessed because chronic toxicity data on fish are not available. This is an unusual situation, particularly for a pesticide that is labeled for aquatic applications. For some herbicides, the EPA/OPP will waive chronic toxicity studies in fish because of the low acute toxicity of the herbicide to fish. While the acute toxicity of imazamox appears to be very low, there is no explicit indication in the EPA ecological risk assessments (EPA/OPP 2008a and b) that chronic studies on fish were waived. The review of imazamox by the European Commission (2002) provides a very brief summary of two longer-term studies in rainbow trout—i.e., a 28-day NOEC of 122 mg/L and a 96-day NOEC of 11.8 mg/L. No further information, including reference citations, for these studies is provided. Registrants often submit studies to European regulatory groups that are not submitted to the EPA/OPP. Longer-term studies in fish, however, are typically required by the EPA/OPP, and it is not clear why these studies appear to have been submitted to the European Commission but not to the EPA/OPP.

For this opinion we applied the 115 mg a.e./L reported by SERA (2010) as the rainbow trout

96-hour LC₅₀. The lack of data regarding sublethal effects precludes us from applying a lowest sublethal effect threshold. We chose not to apply the 89.2 mg a.e./L sublethal threshold used by the SNF (2017) since it was derived from a study on bluegill and it is not known what sublethal endpoints were evaluated (SERA 2010).

Toxicity – Other Aquatic Organisms. (This excerpt is taken directly from SERA 2010). For imazamox, the toxicity data on aquatic invertebrates are similar to the data on fish. As summarized in Appendix 6 of the SERA 2010 document, there are two standard registrant-submitted acute toxicity studies on aquatic invertebrates, and as with fish, LC₅₀ values for imazamox were not determined. At the highest concentrations tested, imazamox caused no mortality and no signs of toxicity in either *Daphnia magna* with an NOAEC of 115 mg a.e./L or mysid shrimp with an NOAEC of 89.3 mg a.e./L.

Similar again to the fish data on imazamox, chronic toxicity studies in aquatic invertebrates are listed among the registrant-submitted studies on imazamox, and the EPA ecological risk assessments note that chronic risks to aquatic invertebrates cannot be assessed because chronic toxicity data are not available. There is no indication in the EPA risk assessments that the requirements for chronic toxicity testing in aquatic invertebrates were waived.

Finally, similar to the situation with the data on fish, the review by the European Commission notes a 21-day NOAEC for *Daphnia magna* of 137 mg/L. No other study details are provided, including whether the units are in a.i. or a.e., and the source for the information is not cited. It is likely that the 21-day NOAEC is from a standard reproduction study in *Daphnia* (SERA 2010).

While Clearcast is labeled for the control of aquatic macrophytes, it is not specifically labeled for the control of algae. As with imazapyr and imazapic, imazamox appears to be less toxic to algae than to aquatic macrophytes. This generalization, however, is somewhat tenuous in that extensive data are not available on the toxicity of imazamox to algae. The limited data on the toxicity of imazamox to algae is noted in the EPA ecological risk assessments on imazamox which indicate that the maximum application rate for imazamox is 112.5 parts per billion (ppb) for aquatic weed control (EPA/OPP 2008a). As detailed in Section 2.4.2 in SERA 2010, the current maximum target concentration for imazamox in aquatic weed control is 500 ppb. In any event, current data on the effect of imazamox on algae do not encompass the concentrations of 112.5 ppb or 500 ppb (SERA 2010).

IMAZAPIC

Exposure. Imazapic has an average soil half-life of 120 days, with degradation primarily occurring through soil microbial metabolism (Tu et al. 2001). Imazapic is moderately persistent in soils, and has not been found to move laterally with surface water (generally moving only 6 to 12 inches laterally but can leach to depths of 18 inches in sandy soils). Although the extent to which imazapic is degraded by sunlight is believed to be minimal when applied to terrestrial plants, it is rapidly degraded by sunlight in aqueous solutions (half-life of 1 to 2 days). Imazapic is water soluble and is not degraded hydrolytically in aqueous solution (Tu et al. 2001).

Simulations of imazapic runoff were conducted for both clay, loam, and sand at annual rainfall rates from 5 to 250 inches and the typical application rate of 0.1 lb a.e./acre (SERA 2004c). Based on the modeling, under arid conditions (i.e., annual rainfall of about 10 inches or less), no runoff is expected and degradation, not dispersion, accounts for the decrease of imazapic concentrations in soil. At higher rainfall rates, plausible offsite movement of imazapic may reach up to 3.5 percent of the applied amounts in clay soils. In very arid environments substantial contamination of water is unlikely. In areas with increasing levels of rainfall, exposures to aquatic organisms are more likely to occur. Thus, the anticipated WCRs (concentration of imazapic in ambient water per lb a.e./acre applied) associated with runoff encompass a very broad range, from 0 to 0.002 mg/L, depending on rainfall rates and soil type (SERA 2004c).

In their risk assessment, SERA (2004c) utilized a peak estimated rate of contamination of ambient water associated with the normal application of imazapic of 0.01 mg a.e./L at an application rate of 1 lb a.e./acre. Typical application rates for imazapic in the proposed action range from 0.1 to 0.16 lb a.e./acre, and the maximum label application rate is 0.19 lb a.e./acre. At the maximum application rate of 0.19 lb. a.e./acre, the peak concentrations of imazapic in ambient water, using the modeled WCR in SERA (2004c), would be 0.002 mg a.e./L. Considering the BMPs that will be implemented, it is likely that water concentrations of imazapic will be far less than that estimated here.

End-Use Products. Imazapic is available in acid and ammonium salt forms. The PNF proposes to use Plateau, which is formulated with 23.6 percent of the ammonium salt of imazapic. No other EUPs are proposed for use.

Toxicity – Fish. The ammonium salt form of imazapic is less toxic than the acid form. Fish appear to be relatively insensitive to imazapic exposures, with LC₅₀ values >100 mg/L for both acute toxicity and reproductive effects (SERA 2004c). In acute toxicity studies, all tested species (channel catfish, bluegill, sunfish, trout, and sheepshead minnow) evidenced 96-hour LC₅₀ values of >100 mg/L. The low toxicity of imazapic to fish is probably related to a very low rate of uptake of this compound by fish. In a 28-day flow-through assay, the bioconcentration of imazapic was measured at 0.11 L/kg (Barker et al. 1998) indicating that the concentration of imazapic in the water was greater than the concentration of the compound in fish. No studies are reported in the SERA assessment (2004c) for sublethal effects of imazapic to ESA-listed fish. Barker et al. (1998) observed no effects on reproductive parameters in a 32-day egg and fry study using fathead minnow.

Even though imazapic itself appears to be only moderately toxic to fish, based on the LC₅₀, Plateau contains roughly 76 percent inert ingredients that are not identified by the manufacturer. With many herbicides, the inert ingredients may be more toxic to fish and other aquatic organisms than the active ingredient. While toxicity tests are reported for imazapic, there is no apparent information regarding the toxicity to salmon and trout for the product formulation in Plateau, which includes imazapic and unspecified inert ingredients. Although none of the inert ingredients contained in Plateau are classified as toxic by the EPA (SERA 2004c), no studies are available lending insight into how the inerts may affect the toxicity of Plateau. Consequently the toxic effects of salmon or trout exposure to Plateau are unknown.

Toxicity – Other Aquatic Organisms. Similar to fish, there is relatively little information about the effects of imazapic on aquatic organisms in the natural environment. No adverse effects to *Daphnia* or mysid shrimp were observed at nominal concentrations of imazapic of up to 100 mg/L in 96-hour studies (SERA 2004c); however, the report did not specify if the analysis included any sublethal endpoints. Additionally, no adverse effects were noted in a life-cycle study that exposed *Daphnia* to concentrations up to 100 mg/L.

Effects of imazapic on aquatic plants is highly variable. *Lemna gibba*, a freshwater macrophyte, is the most sensitive aquatic plant reported in the literature, with an EC₅₀ value based on decreased frond counts of 0.0061 mg/L. Algae were less sensitive than macrophytes (reported LC₅₀ values >0.045 mg/L), and responses included both growth inhibition and growth stimulation (SERA 2004c).

IMAZAPYR

Exposure. In soil, imazapyr has reported soil half-lives ranging from 313 to 2,972 days, with an overall average of 2,150 days. Imazapyr is rapidly degraded by sunlight in aquatic solutions. In soils, however, there is little or no photodegradation of imazapyr, it is slowly degraded by microbial metabolism, and it can be relatively persistent. As of September 2003, imazapyr (tradename Habitat®) is registered for use in aquatic areas, including brackish and coastal waters, to control emerged, floating, and riparian/wetland species. Arsenal is also labeled for aquatic applications. The SERA (2011) identified a peak estimated rate of contamination of ambient water associated with the normal application of imazapyr as 0.26 mg a.e./L at an application rate of 1 lb a.e./acre.

End-Use Products. Imazapyr is available as an IPA salt. The PNF proposes to use five EUPs ((Arsenal, TVC Total Vegetation Control, and three variations of Chopper). The majority of these EUPs are formulated with about 28 percent of the IPA salt of imazapyr and 72 percent other ingredients. Chopper RTU is formulated with about 4 percent of the active ingredient and a much larger percent of other ingredients.

Toxicity – Fish. Based on LC₅₀ values of >100 mg a.e./L, imazapyr acid is classified as practically non-toxic to fish (SERA 2011d). Based on acute bioassays in both bluegills and trout, the IPA salt of imazapyr is also practically non-toxic to fish.

Toxicity data are also available on the Arsenal formulation of imazapyr. This formulation consists of the IPA salt of imazapyr (27.8 percent 40 a.i., 22.6 percent a.e.) and 72.2 percent inerts which include an unspecified solvent. The 96-hour LC₅₀ of 41 Arsenal Herbicide is about 41 mg a.e./L in bluegills and 21 mg a.e./L in trout (SERA 2011d). The SERA (SERA 2011d) document describes a study in trout, which notes the higher toxicity of the formulation relative to imazapyr and IPA salt of imazapyr. The substantially lower LC₅₀ values of Arsenal Herbicide, expressed in a.e., suggests that the inerts in the formulation contribute to its greater toxicity, as discussed further in the dose-response assessment (SERA 2011d). Given the results of the Arsenal formulation study, toxicity of imazapyr formulations appear more toxic than the active ingredient alone.

Effective aquatic applications of imazapyr will cause oxygen depletion in the water column secondary to rotting vegetation. The event will occur after the application of any effective aquatic herbicide and may kill fish as well as other aquatic organism. While hypoxia in fish due to oxygen depletion in water is identified as an endpoint of concern for fish and other aquatic organisms, potential hazards to fish associated with hypoxia should be minimal, if label directions are followed and only partial sections of standing bodies of water are treated at one time (SERA 2011d). Aquatic treatments are not proposed in the assessed action area and thus this effect will not occur.

Toxicity – Other Aquatic Organisms. The acute toxicity data on aquatic invertebrates are similar to the data on fish. Both imazapyr acid and IPA salt of imazapyr are classified as practically non-toxic to *Daphnia magna* as well as saltwater invertebrates—i.e., oysters and pink shrimp (SERA 2011d).

METSULFURON-METHYL

Exposure. The persistence of metsulfuron-methyl in soil is highly variable; reported soil half-lives range from a 14 to 180 days, with an overall average of 30 days. The rate of metsulfuron-methyl degradation depends on factors like temperature, rainfall, pH, organic matter, and soil depth. Metsulfuron-methyl in the soil is broken down to non-toxic and non-herbicidal products by soil microorganisms and chemical hydrolysis. Degradation will occur more rapidly under acidic conditions, and in soils with higher moisture content and higher temperature (Exttoxnet 1996).

The mobility of metsulfuron methyl ranges from moderate to highly mobile (NLM 2012). Off-site movement of metsulfuron-methyl is governed by the binding of metsulfuron-methyl to soil, the persistence in soil, as well as site-specific topographical, climatic, and hydrological conditions. The adsorption of metsulfuron-methyl to soil varies with the amount of organic matter present in the soil, soil texture, and pH. Adsorption to clay is low. In general, metsulfuron-methyl absorption to a variety of different soil types will increase as the pH decreases. Metsulfuron-methyl dissolves easily in water. There is a potential for metsulfuron-methyl to contaminate ground waters at very low concentrations. Metsulfuron-methyl readily leaches through silt loam and sand soils.

Fate and transport simulations reported in SERA (2004d) were conducted for clay, loam, and sand at annual rainfall rates ranging from 5 to 250 inches and the typical application rate of 0.03 lb a.e./acre. In all soil types under arid conditions (i.e., annual rainfall of about 10 inches or less), substantial contamination of surface water is unlikely. In areas with increasing levels of rainfall, peak WCRs of about 0.0001 to 0.002 mg a.e./L (per application of 1 lb a.e./acre) can be anticipated, under worst case conditions, at rainfall rates ranging from 15 to 250 inches per year. SERA (2004d) also estimated the WCR associated with an accidental direct spray to be 0.010 mg/L at an application rate of 1 lb a.e./acre. For this opinion, the higher WCR was multiplied by the maximum label application rate to estimate the EEC (i.e., 0.010 mg a.e./L x 0.15 lb a.e./acre = 0.002 mg a.e./L).

End-Use Products. There are several formulations of metsulfuron-methyl registered for use; however, the PNF propose to use the formulation Escort XP, Rometsol, and Amtide MSM 60 DF. Escort XP is the same formulation as Escort, but the shape has been changed to provide better mixability. Escort XP is manufactured by DuPont and is comprised of 60 percent metsulfuron methyl and 40 percent inert ingredients (SERA 2004d). The inert ingredients include sodium naphthalene sulfonate-formaldehyde condensate, a mixture of a sulfate of alkyl carboxylate and sulfonated alkyl naphthalene (sodium salt), polyvinyl pyrrolidone, trisodium phosphate, and sucrose. The remaining two EUPs are similar, with 60 percent active ingredients and 40 percent unspecified ingredients.

Both trisodium phosphate and sucrose are generally recognized as safe compounds and are approved as food additives. Although none of the remaining inerts in Escort XP are categorized by EPA as being of toxicological concern (List 1) or as being potentially toxic or as having a high priority for testing (List 2), there is insufficient information available to assess their potential toxicity to fish. Polyvinyl pyrrolidone is marketed as a disinfectant for fish aquaria and

treatment of certain fish infections; consequently, the product is not likely to be toxic to listed salmonids at environmental concentrations encountered under the proposed action.

The label for Escort XP recommends the use of a non-ionic surfactant, except in certain circumstances. There is limited information on the toxicity of surfactants (refer to the discussion included in Section 2.5.1.6 of the opinion and the “glyphosate” section of this appendix.

Toxicity – Fish. Based on available studies, metsulfuron-methyl appears to have a low toxicity to and does not bioaccumulate in fish. The reported rainbow trout 96-hour LC₅₀ values for metsulfuron-methyl range from more than 150 mg a.e./L to more than 1,000 mg a.e./L (SERA 2004d). The lowest concentration at which rainbow trout mortality was observed is 100 mg/L; however, in the same study, no mortality was observed in rainbow trout exposed to 1,000 mg/L (Hall 1984). Because of the lack of a dose-response relationship, Hall (1984) asserts that the mortality in the 100 mg/L exposure group was probably incidental rather than treatment related. This opinion uses a LC₅₀ of 150 mg a.e./L to evaluate the potential for use of metsulfuron-methyl to adversely affect ESA-listed fish.

Debilitating sublethal effects (i.e., erratic swimming, rapid breathing, and lying on the bottom of the test container) were observed by Muska and Hall (1982) after exposure to 150 mg/L for 24 hours. In tests with rainbow trout, no significant long-term effects (90-day exposure) were observed by Kreamer (1996) on hatch rate, last day of hatching, first day of swim-up, larval survival, and larval growth at concentrations up to 4.7 mg/L. However, concentrations greater than 8 mg/L resulted in small but significant decreases in hatching and survival of fry.

Toxicity – Other Aquatic Organisms. Toxicity studies on aquatic invertebrates are reported only for *Daphnia*. For acute exposures, the range of EC₅₀ values for immobility ranges from more than 150 mg/L to 720 mg/L. For chronic exposures, the NOEC of 17 mg/L for growth inhibition is used, although higher chronic NOECs, ranging from 100 to 150 mg/L, have been reported for survival, reproduction and immobility (SERA 2004d). The only effect reported by Hutton (1989) in a 21-day *Daphnia* study was a decrease in growth at concentrations as low as 5.1 mg/L, but decreased growth at concentrations less than 30 mg/L was not statistically significant. In aquatic invertebrates, decreased growth appears to be the most sensitive endpoint. Wei et al. (1999) report that neither metsulfuron-methyl nor its degradation products are acutely toxic to *Daphnia* at concentrations that approach the solubility of the compounds in water at pH 7.

The available data suggest that metsulfuron-methyl, like other herbicides, is much more toxic to aquatic plants than to aquatic animals. Macrophytes appear more sensitive to metsulfuron-methyl than algae (SERA 2004d). There are substantial differences in sensitivity to effects of metsulfuron-methyl among algal species, but all EC₅₀ values reported in SERA (2004d) are above 0.01 mg/L, and some values are substantially higher. Toxicity in algae increases with lower pH, most probably because of decreased ionization leading to more rapid uptake. At a concentration of 0.003 mg/L, metsulfuron-methyl was associated with a 6 percent to 16 percent inhibition (not statistically significant) in algal growth rates for three species but stimulation of growth was observed in *Selenastrum capricornutum* and the aquatic macrophyte, duckweed (SERA 2004d). Wei et al. (1998; 1999) assayed the toxicity of metsulfuron-methyl degradation products in *Chlorella pyrenoidosa* and found that the acute toxicity of the degradation products

was about two to three times less than that of metsulfuron-methyl itself in a 96-hour assay. One field study cited in SERA (2004c) on the effects of metsulfuron-methyl in algal species found that concentrations of metsulfuron-methyl as high as 1 mg/L are associated with only slight and transient effects on plankton communities in a forest lake.

PICLORAM

Exposure. Picloram is relatively persistent and can remain effective in the soil for up to 3 years after application. Picloram is resistant to biotic and abiotic degradation processes and has a field half-life of 20 to 300 days. Picloram is highly soluble in water and can readily leach through some soil types. Ismail and Kalithasan (1997) found that picloram moves rapidly out of the top 2 inches of soil with a half-life of about 4 to 10 days. Somewhat longer half-lives of 13 to 23 days have been reported by Krzyszowska et al. (1994), who also noted that picloram is degraded more rapidly under anaerobic than aerobic conditions and also degrades more rapidly at lower application rates.

The SERA (2011b) identified a peak estimated rate of contamination of ambient water associated with the normal application of picloram as 0.011 (0.001 to 0.18) mg a.e./L at an application rate of 1 lb a.e./acre. Typical application rates for picloram in the proposed action range from 0.25 to 1.0 lb a.e./acre, and the maximum application rate is 1 lb a.e./acre. The estimated peak WCR of picloram in ambient water normalized to an application rate of 1 lb a.e./acre is 0.18 mg a.e./L (SERA 2011b).

Multiplying the maximum application rate by the peak WCR results in an EEC of 0.18 mg a.e./L. Considering the BMPs that will be implemented (e.g., no application of picloram within 50 feet of water), it is likely that water concentrations of picloram will be far less than that modeled by SERA. The most likely scenario where picloram will enter the stream is where weeds are treated on floodplains with a high water table and highly permeable soils.

End-Use Products. The proposed action includes the use of Tordon 22K (also sold under the product name Outpost 22K), which contains the potassium salt of picloram (24.4 percent weight per volume). The remaining 75.6 percent of the formulations consist of inert ingredients. One inert is listed as a polymer of ethylene oxide, propylene oxide, and di-sec-butyl-phenol (CAS No. 69029-39-6).

Toxicity – Fish. The EPA (1995) classified picloram acid and picloram potassium salt as moderately toxic to freshwater fish with reported rainbow trout LC₅₀s of 5.5 mg a.e./L and 13 mg a.e./L, respectively. The SERA (2011b) reported a variety of 96-hour LC₅₀ values for rainbow trout, which ranged from 5.5 mg a.e./L to 41 mg a.e./L. These tests used either technical grade picloram, picloram acid, or the picloram potassium salt. The 96-hour LC₅₀ of 5.5 mg a.e./L was obtained by Batchelder (1974) in a test of the technical grade picloram. Earlier production of picloram contained impurities, which have been minimized in more recent production of picloram. As such, the 5.5 mg a.e./L might not be representative of current toxicity. Fairchild et al. (2009) reported a 96-hour LC₅₀ of 36 mg a.e./L for juvenile rainbow trout. The authors did not observe any mortality at a concentration of 12 mg a.e./L. Johnson and Finely (1980), as cited in SERA 2011b) found a 4.8 mg/L LC₅₀ for cutthroat trout exposed to technical grade material and 1.5 mg/L LC₅₀ for slightly larger cutthroat trout exposed to potassium salt. We applied the 4.8 mg/L value in this opinion.

Fish size or life stage can sometimes be an important factor in the toxicity of pesticides. Mayer and Ellersieck (1986) studied the toxicity of picloram on yolk sac rainbow trout fry, swim up fry,

and advanced fry. They found LC₅₀s of 8 mg a.e./L, 8 mg a.e./L, and 11 mg a.e./L (yolk sac fry, swim up fry, and advanced fry, respectively), which demonstrates little difference in sensitivity among the various stages tested.

Most of the potential sublethal effects for picloram have not been investigated in regard to toxicological endpoints that are important to the overall health and fitness of salmonids (e.g., growth, life history, mortality, reproduction, adaptability to environment, migration, disease, predation, or population viability). Of the very little research that has been conducted on the potential sublethal effects of picloram on aquatic life, the focus has primarily been on growth. Woodward (1979) found that picloram concentrations greater than 0.61 mg/L decreased growth of cutthroat trout, and a similar finding was reported by Mayes (1984). Exposure regimes where the maximum exposure concentration did not exceed 0.29 mg a.e./L had no adverse effects on the survival and growth of cutthroat trout fry (Woodward 1979). In a study of lake trout (*S. namaycush*), picloram concentrations of 0.04 mg a.e./L reduced the rate of yolk sac absorption, as well as fry survival, weight, and length (Woodward 1976). Mayes et al. (1987) reported that picloram concentrations of 0.9 mg a.e./L reduced the length and weight of rainbow trout larvae and concentrations of 2 mg a.e./L reduced survival of the larval fish. The authors reported the lowest NOEC as 0.55 mg a.e./L. Fairchild et al. (2009) reported a LOEC for growth of juvenile rainbow trout of 2.37 mg a.e./L, and a NOEC of 1.18 mg a.e./L. For juvenile bull trout, Fairchild et al. (2009) reported a LOEC for growth of 1.18 mg a.e./L and a NOEC of 0.6 mg a.e./L. Yearling coho salmon exposed to nominal concentrations of 5 mg a.e./L for 6 days suffered “extensive degenerative changes” in the liver and wrinkling of cells in the gills (Lorz et al. 1979). For this opinion we applied the adjusted value of 0.19 mg a.e./L documented in SERA (2011b).

Toxicity – Other Aquatic Organisms. Although picloram is toxic to salmonids, it is not as toxic to *Daphnia* or algae at the same concentrations. For *Daphnia*, the reported acute (48-hour) LC₅₀ values range from 48 mg a.e./L to 173 mg a.e./L (SERA 2011b). Chronic studies using reproductive or developmental parameters in *Daphnia* reported a NOEC of 11.8 mg a.e./L and a LOEC of 18.1 mg a.e./L (Gersich et al. 1984). Boeri et al. (2002) studied the effects of picloram acid on *Daphnia* reproductive endpoints and reported a NOEC of 6.79 mg a.e./L and a LOEC of 13.5 mg a.e./L. No toxicity studies involving the exposure of *Daphnia* to Tordon 22K are readily available.

The toxicity of picloram to aquatic plants varies substantially among different species. Based on the available toxicity bioassays, the most sensitive species is *Navicula pelliculosa*, a freshwater diatom, with an EC₅₀ (i.e., the concentration causing 50 percent inhibition of a process for growth) of 0.93 mg a.e./L and a NOEC of 0.23 mg a.e./L. The least sensitive aquatic plants appear to be from the genus *Chlorella* (another group of freshwater algae), with EC₅₀ values greater than 160 mg a.e./L (Baarschers et al. 1988). The macrophyte *Lemna gibba* (duckweed) has a reported 14-day EC₅₀ of 47.8 mg a.e./L and a 14-day NOEC of 12.2 mg a.e./L (Kirk et al. 1994). Other studies on the toxicity of picloram to macrophytes were not used in the 2011 risk assessment (SERA) because the test agent was not specified, the reporting units were not clear, or the test agent was a formulation of picloram not used by the Forest Service.

Effects on Non-Target Plants. While most grasses are resistant to picloram, it is highly toxic to many broad-leafed plants. Crop damage from irrigation water contaminated by picloram has been documented by the EPA (EPA 1995; USFS 2000b). Picloram is persistent in the environment, and may exist at levels toxic to plants for more than a year after application at normal rates. In normal applications, non-target plants may be exposed to chemical concentrations many times the levels that have been associated with toxic effects. Picloram's mobility allows it to pass from the soil to nearby, non-target plants. It can also move from target plants, through roots, down into the soil, and into nearby non-target plants. Given this capability, an applicator does not have to spray the buffer zone in order to affect the riparian vegetation. Spray drift may also kill plants some distance away from the area being treated. The proposed 50 foot no-spray buffer for picloram should reduce the unintended mortality of streamside trees, shrubs and other broadleaf plants.

SULFOMETURON-METHYL

Exposure. Sulfometuron-methyl can be moderately persistent in soils, with reported half-lives ranging from 10 to 170 days (SERA 2004e). Sulfometuron-methyl readily biodegrades in aerobic soil conditions, with reported half-lives of 12 to 25 days for various soil conditions (e.g., pH levels and moisture content). Sulfometuron-methyl does not bind strongly to soils and it is slightly soluble in water. Depending on soil conditions, sulfometuron-methyl can be mobile and may be transported to off-site soil by runoff or percolation. The potential for leaching depends on soil conditions such as organic matter content, moisture, and soil pH. Under acid conditions, sulfometuron-methyl hydrolyzes quickly and has less potential for movement.

At least one percent of the applied sulfometuron-methyl applied to an area could run off from the application site to adjoining areas after a moderate rain, based on studies of runoff from 3.3 inches of total rainfall (1.7 inches/hour for 2 hours) by Hubbard et al. (1989) and from 0.47 to 1.18 inches of rainfall by Wauchope et al. (1990). Losses could be much greater and might approach 50 percent in cases of extremely heavy rain and a steep soil slope (SERA 2004e).

Using the root zone model GLEAMS, SERA (2004e) estimated the peak WCRs of streams associated with the normal application (1 lb a.e./acre) of sulfometuron-methyl as ranging from 0.00006 to 0.02 mg a.e./L. Neary and Michael (1989) applied sulfometuron methyl in the form of dispersible granules at a rate of 0.36 lbs/acre to a study site in Florida. They monitored nearby surface water for chemical contamination for up to 203 days after treatment. The maximum concentration of sulfometuron methyl was reported as 0.07 mg/L. Normalizing this water concentration to an application rate of 1 lb/acre gives a WCR of 0.02 mg a.e./L. At the proposed maximum application rate of 0.378 lbs a.e./acre, the expected levels of sulfometuron methyl (under conditions similar to those in the Neary and Michael [1989] study) in surface water would be 0.008 mg a.e./L.

End-Use Products. The commercial formulations of sulfometuron-methyl that the PNF proposes to use are Oust XP (also sold under the name DPX-T5648) and Oust Extra. Oust XP is manufactured by Bayer and is comprised of 75 percent sulfometuron-methyl and 25 percent inert ingredients (SERA 2004e). The inert ingredients include sucrose, sodium salt of naphthalene-sulfonic acid formaldehyde condensate, polyvinyl pyrrolidone, sodium salt of sulfated alkyl carboxylated and sulfated alkyl naphthalene, and hydroxypropyl methylcellulose. None of these inert ingredients are classified by EPA as toxic. The toxicity of Oust XP appears to be similar to that of technical grade sulfometuron methyl; providing further support that the inerts are not very toxic. Oust Extra is a mixture of sulfometuron methyl (56%) and metsulfuon methyl (15%) and other ingredients (28%).

Toxicity – Fish. Sulfometuron-methyl does not appear to be highly toxic to fish; however, investigations of acute toxicity have been hampered by the limited water solubility of sulfometuron-methyl. Furthermore, the available studies have focused on lethal endpoints rather than sublethal ones. In the available studies, none of the fish died from acute exposure to sulfometuron-methyl, even at the highest concentration tests. As such, NOEC values (based on lethality) were placed at the highest concentrations tested: 7.3 mg a.e./L for fathead minnow (Muska and Driscoll 1982) and 148 mg a.e./L for rainbow trout (Brown 1994). Only one study

regarding chronic toxicity of sulfometuron-methyl to fish has been performed. Muska and Driscoll (1982) did not observe any effects on fathead minnow embryo hatch, larval survival, or larval growth over 30-day exposure periods where concentrations of sulfometuron ranged up to 1.17 mg a.e./L. We applied the 7.3 mg a.e./L value in this opinion.

Toxicity – Other Aquatic Organisms. Sulfometuron-methyl also appears to be relatively non-toxic to aquatic invertebrates, based on acute bioassays in daphnids, crayfish, and field-collected species of *Diaptomus*, *Eucyclops*, *Alonella*, and *Cypria*. The absolute LC₅₀ values reported in SERA (2004e) for daphnids, crayfish, and the aquatic invertebrates are above 601 mg a.e./L, some by more than a factor of 10. A couple of studies using daphnids as the test species did not test concentrations high enough to cause lethality (i.e., 48-hour LC₅₀ values of >12.5 mg/L and >150 mg/L). One daphnid reproduction study noted a reduction in the number of neonates at 24 mg/L, but not at 97 mg/L or at any of the lower concentrations tested (Baer 1990). This study did not have a clear dose-response effect.

Aquatic plants appear more sensitive than aquatic animals to the effects of sulfometuron-methyl, although there appear to be substantial differences in sensitivity among species of macrophytes and unicellular algae. The macrophytes, however, appear to be generally more sensitive. The 14-day NOEC (growth inhibition as measured by frond count) for duckweed exposed to technical grade sulfometuron-methyl was reported as 0.00021 mg a.e./L (Kannuck and Sloman 1995). For algae, the most sensitive algal species tested was *Selenastrum capricornutum*, with a 72-hour NOEC of 0.0025 mg/L and a 72-hour EC₅₀ of 0.0046 mg a.e./L, based on a reduction in cell density relative to controls (Hoberg 1990). The most tolerant algal species tested was *Navicula pelliculosa*, with a 120-hour NOEC of 0.37 mg/L (Thompson 1994). The EC₅₀ values for other freshwater algal species are generally greater than 10 µg/L, depending on the endpoint assayed (Landstein et al. 1993), but still fall in a range of concentrations that are likely to occur after a rainfall.

Effects on Non-Target Plants. The toxicity of sulfometuron-methyl to terrestrial plants was studied extensively and is well characterized. Assays using an application rate of 0.00892 lbs a.i./acre show high toxicity to seedlings of several broadleaf plants and grasses, either pre-emergence or post-emergence. Moreover, adverse effects were observed in most plants tested at application rates of 0.00089 lbs. a.i./acre (SERA 2004e). This application rate is a factor of about 100- to 300-fold less than the application rate that the USFS would typically use. Concern for the sensitivity of non-target plant species is further increased by field reports of substantial and prolonged damage to crops or ornamentals after the application of sulfometuron methyl in both an arid region, presumably due to the transport of soil contaminated with sulfometuron methyl by wind, and in a region with heavy rainfall, presumably due to the wash-off of sulfometuron methyl contaminated soil (SERA 2004e).

TRICLOPYR

Exposure. Triclopyr herbicides can contain one of two forms of triclopyr, either the triethylamine salt (TEA) or the butoxyethyl ester (BEE). The proposed action only proposed the use of the TEA, to minimize effects. In both soil and aquatic environments, the amine salt formulations of triclopyr rapidly convert to the triclopyr acid and other degradates. In various soil types, the half-life of TEA has been reported to range from 6 to 14 days. Triclopyr acid is further degraded by soil microorganisms to the metabolites trichloropyridinol (TCP) and trichloromethoxypyridine. In aerobic soils, triclopyr acid has a half-life of 8 to 18 days. The TCP is more persistent than triclopyr acid, with a soil half-life ranging from 40 to 95 days (Knuteson 1999).

In water, triclopyr TEA dissociates to the acid very rapidly (i.e., within one minute) (EPA 1998). The primary degradation mechanism for triclopyr acid in water is photolysis, with a half-life of 1-day. The TCP is more persistent in aquatic environments, having a half-life of 4 to 10 days (Petty et al. 2003). Triclopyr and TCP are not strongly adsorbed to soil particles and have the potential to be mobile, thus there is a chance that application of triclopyr near aquatic environments can result in surface water contamination.

The SERA (2011c) estimated peak WCRs (normalized to an application rate of 1 lb/acre) for three forms of triclopyr in stream water using a variety of methods. The WCRs were derived from various modeling efforts and from field studies pairing triclopyr application with surface water monitoring. Triclopyr BEE and ester formulations are not proposed for use, so WCRs are not reported here for those forms. For triclopyr acid, stream WCRs ranged from 0.00 to 0.24 mg a.e./L. The upper bound of the peak WCR (i.e., 0.24 mg a.e./L) was derived from EPA modeling efforts using PRZM/EXAMS (EPA 2009). For the metabolite TCP, modeled WCRs ranged from 0.00 to 0.03 mg TCP/L after application of triclopyr BEE and from 0.00 to 0.02 mg TCP/L after application of triclopyr TEA.

Maximum proposed application rates in the proposed action are 2.0 lbs/acre for triclopyr TEA. Multiplying the maximum application rate by the WCRs gives an EEC of: 0.48 mg a.e./L for triclopyr acid and 0.04 mg TCP/L after application of the TEA formulation. Typical application rates are likely to generate EEC's up to two times lower. Because triclopyr TEA near instantaneously dissolves to the acid, SERA (2011c) did not determine an EEC for that form of triclopyr.

End-Use Products. Triclopyr herbicides included in the proposed action contain only the use of the TEA form of triclopyr. The number of triclopyr EUPs that may be used by the USFS has increased over the years. In 1996, only two EUPs were available for use, Garlon 3A (TEA formulation) and Garlon 4 (BEE formulation). Since then, 17 additional EUPs (from eight different companies) have been approved at a national level for forests to consider using. For this assessment, the PNF indicated two EUPs would be used: Garlon 3A and Element 3A. Both of these are TEA formulations, with Element 3A being a generic version of Garlon 3A. The product labels recommend that a surfactant be added to the product prior to most applications. Some surfactants are more toxic than others. Toxicity of some surfactants proposed for use have been addressed in this opinion.

Toxicity – Fish. Both forms of triclopyr degrade into triclopyr acid and other degradates in the environment. Triclopyr acid is further degraded into TCP and other metabolites. The other metabolites (e.g., butoxyethanol and triethanolamine) are not being evaluated further because they are rapidly dissipated by microbial degradation. The TCP is of concern because it has been shown to be more toxic than the other forms of triclopyr to many groups of non-target organisms (SERA 2011c).

Lethal Effects. Data on the toxicity of triclopyr and its various forms has been collected since as early as 1973. Wan et al. (1987) completed the most extensive comparative study on the toxicity of the various forms and metabolites of triclopyr. This study summarizes a series of static bioassays on several species of salmonids that were conducted over a 4-month period in 1986 and a 2-month period in 1987. Wan et al. (1987) reported 96-hour LC₅₀ values for triclopyr acid, triclopyr ester, Garlon 3A, Garlon 4, and TCP, which are summarized in Table B-1. The authors found triclopyr ester was the most toxic chemical tested, followed in decreasing toxicity to salmonids by Garlon 4, TCP, triclopyr acid, and Garlon 3A.

The BEE form of triclopyr is exponentially more toxic to fish when compared to the TEA form. The salmonid LC₅₀ values for triclopyr BEE (technical grade and as formulated Garlon 4) ranged from 0.19 mg a.e./L to 1.9 mg a.e./L (SERA 2011c). The lowest LC₅₀ value was for coho salmon alevins (Mayes et al. 1986). The Wan et al. (1987) study is supported by more recent flow-through toxicity assays on Garlon 4 with reported acute LC₅₀ values for salmonids of 0.79 to 1.76 mg/L (Kreutzweiser et al. 1994) and 0.84 mg/L (Johansen and Geen 1990).

Wan et al. (1987) found that Garlon 3A, a formulation of triclopyr TEA, was about 170 times less toxic (significant at p<0.01) to salmonids than the Garlon 4 formulation. Triclopyr TEA LC₅₀ values for salmonids reportedly range from 75.4 mg a.e./L to 273.7 mg a.e./L (SERA 2011c). The EPA classified triclopyr TEA as practically non-toxic to freshwater fishes (EPA 1998).

Table B-1. Acute Toxicity of Triclopyr and Related Compounds to Various Species of Salmonids¹. Results are expressed as mg a.e./L, unless otherwise noted.

Fish Species	Triclopyr TEA (Garlon 3A)	Triclopyr BEE (Garlon 4)	Triclopyr BEE (technical grade)	Triclopyr Acid	TCP (mg TCP/L)
Coho salmon	167	1.0	1.0	9.6	1.8
Chum salmon	96.1	0.82	0.3	7.5	1.8
Sockeye salmon	112	0.67	0.4	7.5	2.5
Rainbow trout	151	1.3	1.1	7.5	1.5
Chinook salmon	99	1.3	1.1	9.7	2.1
Pink salmon	—	0.58	0.5	5.3	2.7

¹ Source: Wan et al. 1987. All bioassays conducted at 46.4 to 50°F, 10 fish/concentration. Static with aeration. LC₅₀ based on measured, rather than nominal concentrations. Photoperiod and lighting conditions not specified.

Based upon available information, the triclopyr acid appears to be approximately 11 times less toxic to salmonids than the triclopyr BEE. Based upon information in all available literature, the salmonid LC₅₀ values for triclopyr acid range from 5.3 mg a.e./L to 117 mg a.e./L (SERA 2011c). Six of the seven LC₅₀ values included in this range came from the Wan et al. (1987) study, and they appear to be outliers not only with respect to the higher LC₅₀ value from

Batchelder (1973), but also with respect to all 17 LC₅₀ values on triclopyr TEA. According to SERA, the results from Wan et al. (1987) cannot be attributed to experimental factors or methods, and the study cannot be dismissed as irrelevant. While one would expect the acid form to be more toxic than the salt form, the extreme difference (more than an order of magnitude) noted above is suspect (Patrick Durkin, personal communication). Because of this, neither SERA (2011c) nor EPA (2009) included the data in their assessments. Giving deference to toxicological experts, this opinion utilizes 117 mg a.e./L as the lethal concentration for triclopyr acid.

The TCP (an environmental metabolite of triclopyr acid), is substantially more toxic in fish than either triclopyr acid or triclopyr TEA, and is similar to the toxicity of triclopyr BEE. Salmonid TCP LC₅₀ values from two separate studies (Wan et al. 1987; Gorzinski et al. 1991) range from 1.5 mg TCP/L to 12.6 mg TCP/L. Six of the seven salmonid LC₅₀ values for TCP are from Wan et al. (1987), and all are approximately five times lower than the value obtained by Gorzinski et al. (1991). There is no clear explanation as to why these two experiments had such vastly different results. It may reflect experimental variability or other unknown factors rather than any differences in species sensitivity (SERA 2011c). This opinion uses the lowest value (i.e., 1.5 mg TCP/L) as the lethal concentration for TCP.

Sublethal Effects. A few acute and chronic studies examining sublethal effects have been performed on triclopyr BEE, triclopyr TEA, and the metabolite TCP. Similar to the lethality studies, results from the sublethal effects studies indicate that triclopyr BEE was the most toxic and triclopyr TEA was the least toxic.

An early life-stage study conducted with triclopyr BEE in rainbow trout yielded a NOEC of 0.017 mg a.e./L and a LOEC (based on larval length and weight) of 0.035 mg a.e./L (Weinberg et al. 1994). Johansen and Geen (1990) studied the sublethal effects of Garlon 4 on rainbow trout using flow-through systems. The authors noted fish were more docile (than the controls) at concentrations of 0.32 to 0.43 mg a.e./L, which are about a factor of 2 below the 96-hour LC₅₀ determined in this study. At levels ≤ 0.1 mg a.e./L, rainbow trout were hypersensitive to photoperiod changes over 4-day periods of exposure. This is reasonably consistent with the threshold for behavioral changes in rainbow trout for Garlon 4 of 0.26 mg a.e./L reported by Morgan et al. (1991).

For triclopyr TEA, a 28 day egg-to-fry study was performed using fathead minnows (Mayes et al. 1984; Mayes 1990). In these studies, fathead minnow eggs were exposed to concentrations of 26, 43, 65, 104, 162, and 253 mg a.i./L. The survival of fathead minnows (embryo-larval stages) was significantly reduced at 253 mg/L compared with control animals. At 162 mg/L, there was a slight decrease in body length. The authors reported a NOEC of 32.2 mg a.e./L and a LOEC (length) of 50.2 mg a.e./L. Morgan et al. (1991) examined behavior changes in rainbow trout after a 0.5-hour exposure to Garlon 3A. The authors reported a threshold for behavioral changes of 63.6 mg a.e./L and a threshold for avoidance response of 254 mg a.e./L.

Marino et al. (2003) conducted an egg-to-fry study, exposing rainbow trout to TCP. The authors exposed rainbow trout to 0.586, 0.106, 0.178, 0.278, 0.479, and 0.825 mg TCP/L in a flow-through system. Observations were made for 33 days post-hatch of the water control embryos.

The authors reported a NOEC for fry weight and growth of 0.178 mg TCP/L, and a LOEC of 0.278 mg TCP/L.

Although TCP is much more toxic than triclopyr TEA, field monitoring cited in SERA (2011c) indicates that TCP residues in soil and water occur at concentrations much lower than the application rate of the active ingredient. Given the high toxicity of TCP and the uncertainty of exposure risk to this metabolite, the potential for adverse effects to ESA-listed fish is uncertain. Garlon 4 is not proposed for use in this opinion.

Toxicity – Other Aquatic Organisms. Based on acute lethality, aquatic invertebrates appear to be about equally or somewhat less sensitive than fish to the various forms of triclopyr. Acute LC₅₀ values for triclopyr acid and triclopyr TEA range from about 100 to about 6,400 mg a.e./L. Gersich et al. (1982) conducted a chronic daphnid study and reported a NOEC of 25.95 mg a.e./L. Triclopyr BEE was substantially more toxic to aquatic invertebrates, with LC₅₀ values ranging from 0.19 to 20 mg a.e./L (SERA 2011c). Some of the studies reported NOEC (for lethality), and those ranged from 0.12 mg a.e./L to 1.2 mg a.e./L. Increases in invertebrate drift have been documented at triclopyr BEE concentrations of 0.6 to 0.95 mg/L (Kreutzweiser et al. 1995; Thompson et al. 1995), but no other effects such as changes in stream invertebrate abundance were noted. In a chronic study, Chen et al. (2008) reported concentration-related decreases in *Simocephalus vetulus* (a cladoceran) at triclopyr BEE concentration of 0.25 mg a.e./L and 0.5 mg a.e./L. Only two studies examining the toxicity of TCP on aquatic invertebrates were available. One study reported an acute LC₅₀ of 10.9 mg TCP/L (EPA 2009). The second study reported a NOEC of 0.058 mg TCP/L, based on a decrease in mean number of young/adult (Machado 2003).

Similar to aquatic organisms, algae are more sensitive to triclopyr BEE than to triclopyr TEA. For triclopyr BEE, the EC₅₀ values for growth inhibition in algae range from about 0.073 to 5.9 mg a.e./L. For triclopyr TEA and triclopyr acid, the EC₅₀ values for the same endpoint in algae range from about 0.49 to 80 mg a.e./L. The TCP toxicity falls between the other forms, with a reported EC₅₀ value of 1.8 mg TCP/L.

For aquatic macrophytes, triclopyr TEA is more toxic to dicots than to monocots, with EC₅₀ values ranging from 0.04 to 0.56 mg a.e./L and 6.06 to 15.8 mg a.e./L, respectively. In fact, triclopyr TEA appears to be more toxic to dicots than triclopyr BEE (EC₅₀ values ranging from 1.49 to 4.62 mg a.e./L). No studies were available regarding the toxicity of TCP.

NMFS Pesticide Registration Opinion. Chemical concentrations examined in the in the 2011 registration opinion (NMFS Tracking # 2004/02673) did not vary drastically from those summarized here. The triclopyr registration opinion used the following rainbow trout LC₅₀ values as assessment endpoints for triclopyr: 0.470 mg a.e./L for BEE, 79.2 mg a.e./L for TEA, and 177 mg a.e./L for triclopyr acid. Information presented in the 2011 opinion for EPA's registration of triclopyr does not suggest a different endpoint as being more appropriate than that which was used in this opinion.

The registration opinion concluded there was no overlap between the peak farm pond EECs for forestry uses (at 6 lb. a.e./acre) and the fish and invertebrate toxicity endpoints for triclopyr BEE.

Floodplain estimates for triclopyr BEE overlapped with all acute assessment endpoints at the application rate of 8 lb. a.e./acre. For triclopyr TEA, none of the peak concentrations and assessment endpoints overlapped.

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