UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
Portland, Oregon 97232-1274

Refer to NMFS No: WCRO-2023-00905

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October 25, 2023

Ms. Linda Jackson
Forest Supervisor
Payette National Forest
500 North Mission Street, Building 2
McCall, Idaho 83638

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Big Creek Water Diversions Project, Upper Big Creek Watershed (HUC # 1706020605) and Lower Big Creek Watershed (HUC# 1706020609), Valley County, Idaho.

Dear Ms. Jackson:

Thank you for your May 16, 2023 email and accompanying materials requesting formal consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.) for the Big Creek Water Diversions Project. 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 this 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 (*Oncorhynchus tshawytscha*) or Snake River Basin steelhead (*O. mykiss*). NMFS also determined the action will not destroy or adversely modify designated critical habitat for these two species. 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 terms and conditions, including reporting requirements that the Payette National Forest (PNF) and any permittee who performs any portion of the action, must comply with in order to 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 five Conservation Recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. These Conservation Recommendations are similar, but not identical to 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 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 of the Interior Columbia Basin Office 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,

Nancy L Munn

Nancy L. Munn, Ph.D.
Acting Assistant Regional Administrator
Interior Columbia Basin Office

Enclosure

cc: C. Nalder – PNF
K. Hendricks – USFWS
A. Gonzalez – USFWS
M. Lopez – 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

Big Creek Water Diversions Project

NMFS Consultation Number: WCRO-2023-00905

Action Agency: USFS, 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 (*Oncorhynchus tshawytscha)*	Threatened	Yes	No	Yes	No
Snake River Basin steelhead (*O. mykiss*)	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: Nancy L Munn

Nancy L. Munn, Ph.D.
Assistant Regional Administrator
Interior Columbia Basin Office

Date: October 25, 2023

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

ACRONYMS

7DADM	Seven Day Average of the Daily Maximum
BA	Biological Assessment
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
DPS	Distinct Population Segment
DQA	Data Quality Act
eDNA	Environmental Deoxyribonucleic Acid
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FA	Functioning Appropriately
FAR	Functioning At Risk
FCRONRW	Frank Church River of No Return Wilderness
FR	Federal Register
FWS	U.S. Fish and Wildlife Service
HAPC	Habitat Area of Particular Concern
HUC	Hydrologic Unit Code
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
IP	Intrinsic Potential
ITS	Incidental Take Statement
LMFSR	Lower Middle Fork Salmon River
LRMP	Land and Resource Management Plan
LWD	Large Woody Debris
MFSR	Middle Fork Salmon River
MPG	Major Population Group
MSA	Magnuson–Stevens Fishery Conservation and Management Act
NFS	National Forest System
NMFS	National Marine Fisheries Service
NPT	Nez Perce Tribe
OMP	Operation and Maintenance Plan
Opinion	Biological Opinion
PBF	Physical or Biological Feature
PCE	Primary Constituent Element
PFMC	Pacific Fishery Management Council
PIT	Passive Integrated Transponder
PNF	Payette National Forest
POD	Point of Diversion
PVC	Polyvinyl Chloride

RCA	Riparian Conservation Area
RPA	Reasonable and Prudent Alternative
RPM	Reasonable and Prudent Measure
SRB	Snake River Basin
SRS	Snake River Spring/Summer
SUP	Special Use Permit
TWRS	Taylor Wilderness Research Station
U.S.C.	U.S. Code
USFS	U.S. Forest Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VSP	Viable Salmonid Population
WCI	Watershed Condition Indicator

1. Introduction

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

1.1. Background

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

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

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 at https://repository.library.noaa.gov/welcome. A complete record of this consultation is on file at the NMFS Boise office.

1.2. Consultation History

The most recent consultation (NMFS Tracking Number 2012-9526) for the majority of special use permits (SUPs) for water diversions included in this proposed action was issued on July 25, 2013, and expired for many of the SUPs on December 31, 2022 (NMFS 2013). The most recent consultation (NMFS Tracking Number 2008-06620) for the permitted diversions on No Name Creek was completed on December 3, 2008 and expired on December 31, 2017 (NMFS 2008).

The Payette National Forest (PNF) provided a draft biological assessment (BA) to NMFS on February 21, 2023. The BA contained an analysis of the effects of the proposed action on Snake River spring/summer (SRS) Chinook salmon (*Oncorhynchus tshawytscha*), Snake River Basin (SRB) steelhead (*O. mykiss*), and their designated critical habitats. The BA also contained an analysis of the proposed action's effects on Pacific Coast salmon EFH. NMFS provided comments to the PNF on March 31, 2023. A revised BA was provided to NMFS on April 21, 2023, and NMFS provided comments on May 4, 2023. The BA was discussed during a Level 1 Team meeting on May 9, 2023 and NMFS indicated that once edits were addressed, the PNF could submit a request to initiate formal consultation. NMFS received the PNF's request to initiate formal consultation on May 16, 2023. On June 13, 2023, NMFS informed the PNF that the information in the BA was sufficient to initiate formal consultation under the ESA and MSA. Thus, May 16, 2023 functions as the initiation date for formal consultation.

In preparing this opinion, NMFS relied upon information from the BA (Zurstadt & Nalder 2023) and its supporting documentation, published scientific literature, and other documents (e.g., government reports). This information provided the basis for our determinations as to whether the PNF can ensure that their 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.

NMFS provided a copy of the proposed action and terms and conditions section of the draft opinion to the PNF and Nez Perce Tribe (NPT) on September 28, 2023 and September 29, 2023, respectively. NMFS received comments from the PNF on October 3, 2023. The PNF requested NMFS clarify one term and condition and agreed to an additional clarification in the proposed action section. NMFS did not receive any comments from the NPT.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

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 (see 50 CFR 402.02). Under the MSA, "Federal action" means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal agency (see 50 CFR 600.910).

The PNF proposes to authorize continued use of National Forest System (NFS) land for existing water systems under 10 SUPs and one Ditch Bill easement. The general location of these facilities is illustrated in Figure 1. The principle authority for the PNF to issue SUPs and Ditch Bill Easements is described at 36 C.F.R., Part 251, Subpart B. The SUPs in this consultation have 20-year terms and they are typically reissued for another 20-year term prior to expiration. Minor changes to the SUP can be made by updating the operation and maintenance plan (OMP) that accompanies each SUP. More substantial changes require an amendment to the SUP. The easement extends in perpetuity, for as long as the land and water conveyance system facilities are used, operated, and maintained in accordance with the terms of the easement. The terms and conditions for operation and maintenance in the easement or in the OMP accompanying the easement may be modified as necessary.

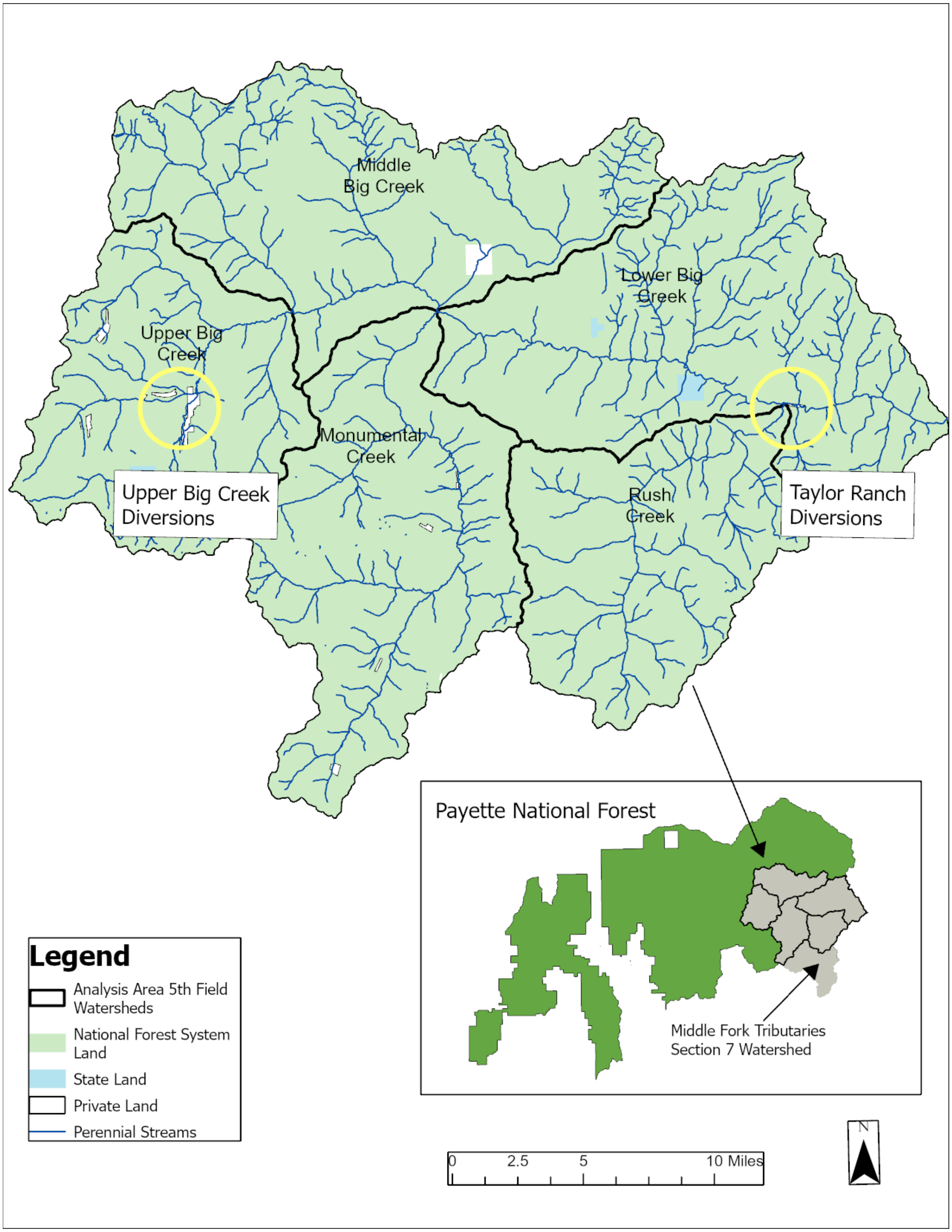

Figure 1. General special use permit diversion locations in the Big Creek watershed.

Specific maintenance activities are described in the OMP and will sometimes vary among the individual diversions because not all structures are of the same construction and function or have the same conditions for resource protection. In general, however, maintenance includes maintaining the point of diversion (POD), removal of debris, replacing improvements within the footprint of the authorized system, replacing broken pipe, fixing leaks in the collection box, keeping the area clean of limbs, fallen trees, and trimming back brush and trees. Routine maintenance does not include any expansion of the existing facilities or otherwise changing the "footprint" of the existing diversion. Any conditions for environmental protections such as fish screens, flow control and measuring, and minimum instream flows, are included in the OMP. An OMP can be updated as needed during the term of the SUP.

In the lower portion of the watershed, water is diverted from Pioneer and Cliff Creeks (Figure 2). In the upper portion of the watershed, water is diverted from No Name, Government, Logan, and Lick Creeks (Figure 3). Table 1 includes a summary of each SUP, including the permit holder name, the current or proposed expiration date, water right number, priority date, quantity, beneficial use, acres irrigated, and period of use.

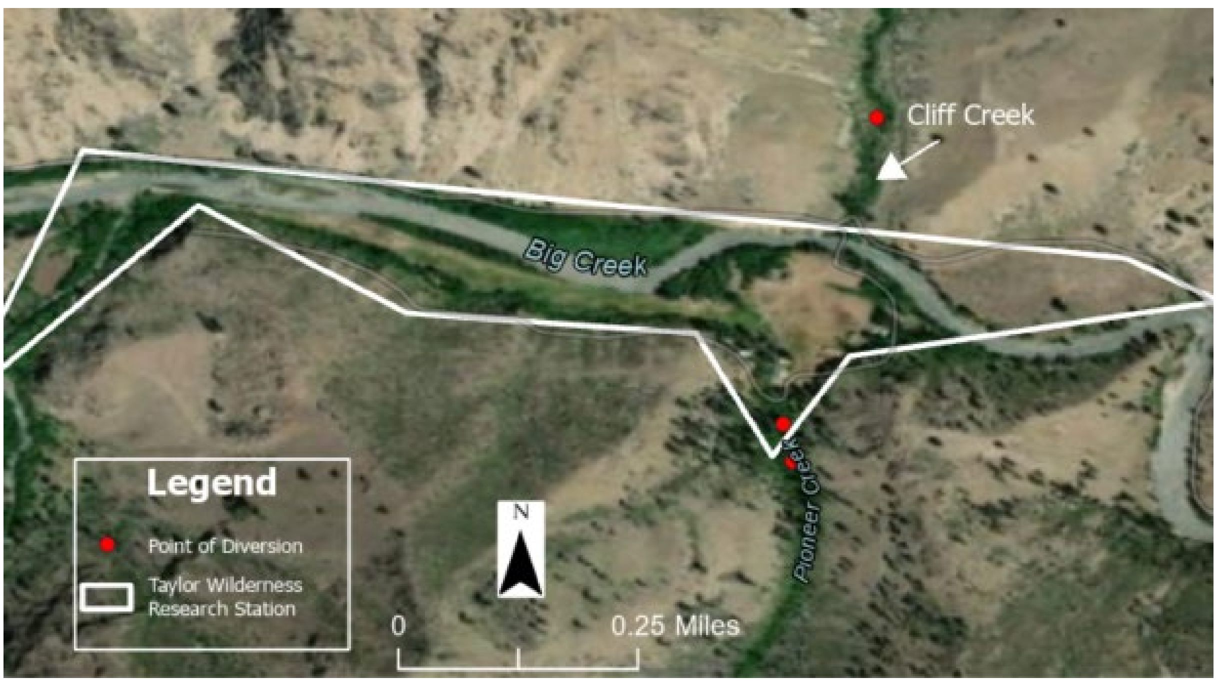

Figure 2. Special use permit diversion locations in Lower Big Creek watershed.

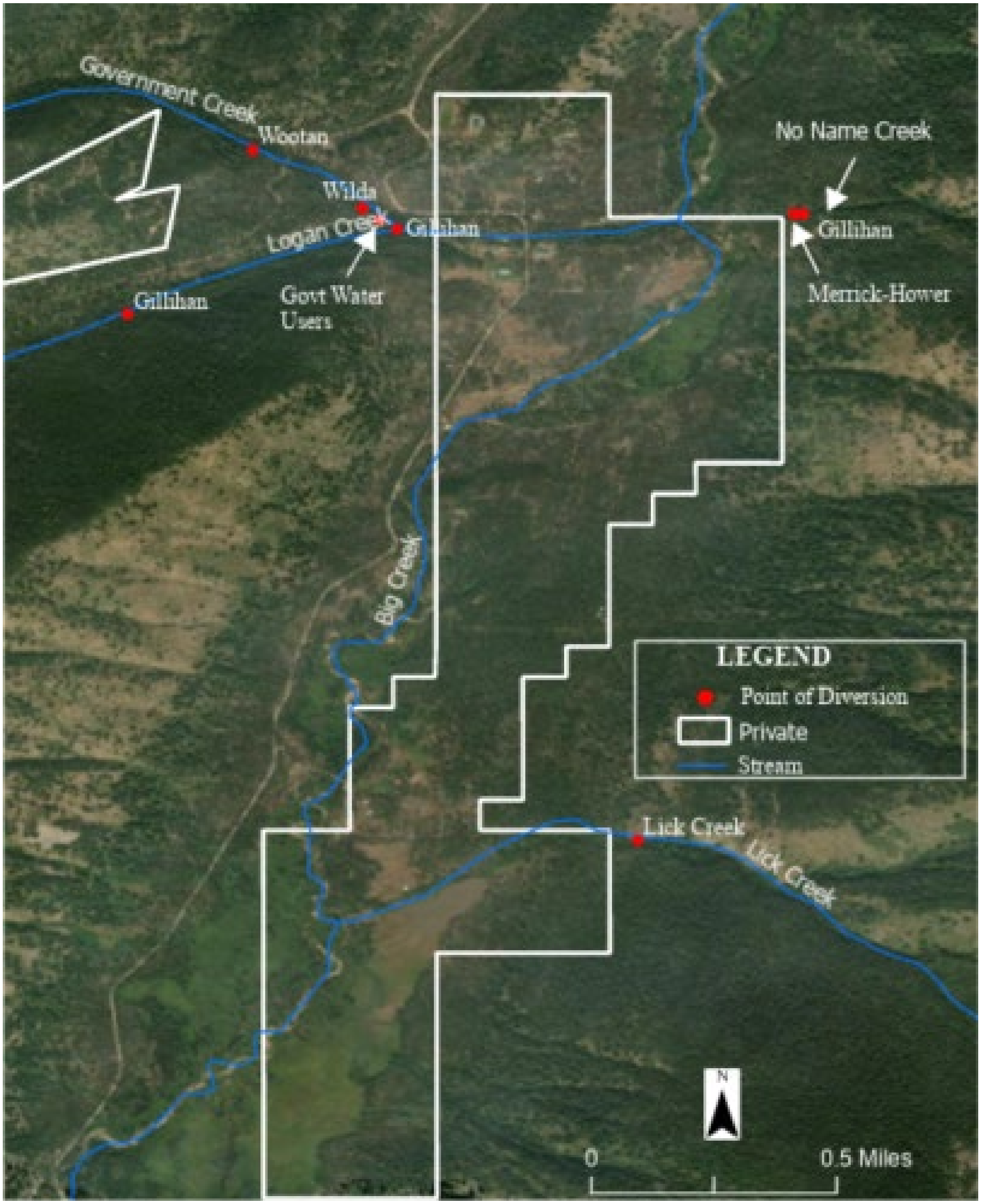

Figure 3. Special use permit diversion locations in the Upper Big Creek watershed (locations are not exact).

Table 1. Summary of water rights associated with special use permits and Ditch Bill easements included in the Big Creek Water Diversions Project.

Special Use Permit[1] (expiration date)	Name on Water Right	Water Right	Priority Date	Quantity (cubic feet per second)	Water Uses[2]	Use Period	Acres Irrigated
PIONEER & CLIFF CREEK DIVERSIONS							
NA[3] (in perpetuity)	University of Idaho Regents	77-2219	03/06/1948	0.64	Irrigation	4/1-10/31	32
				0.11	Domestic	1/1-12/31	
Total Diversion from Pioneer & Cliff Creeks				*0.64*			
LICK CREEK DIVERSIONS							
KRL268 (12/31/2040)	Vaughn, Darren & Jennifer	77-14344	01/10/1920	0.02	Irrigation	5/1-10/31	1
		77-14343	01/10/1920	0.02	Irrigation	5/1-10/31	1
				0.03	*Sub-Total*		
		77-14342	11/22/2010	0.04	Domestic	1/1-12/31	-
N/A[4]	Vita, Greg & Diana	77-14304	01/10/1920	0.02	Domestic	1/1-12/31	-
				0.1	Irrigation	5/1-10/31	5
				0.1	*Sub-Total*		
KRL158 (12/31/2033)	Fodor, Scott	77-7056	08/31/1976	0.04	Domestic	1/1-12/31	-
		77-7133	04/08/1981	0.6	Power	1/1-12/31	-
KRL223 Lick Creek Water Users Association (12/31/2033)	Smith, Paul Dean	77-10082	09/30/1965	0.05	Power	5/1-10/31	-
		77-2145A	04/23/1962	0.02	Domestic	1/1-12/31	-
				0.03	Irrigation	4/15-10/15	1.5
	Fregien, Wayne & Judy	77-2145B	04/23/1962	0.03	Irrigation	4/15-10/15	1.5
	Fodor, Scott	77-2145C	04/23/1962	0.02	Domestic	1/1-12/31	-
				0.06	Irrigation	4/15-10/15	3.0
				0.06	*Sub-Total*		
Total Diversion from Lick Creek				*1.0*			*13*
LOGAN CREEK DIVERSIONS							
KRL085 ([5])	Gillihan, Robert & Catherine	77-4007	05/07/1925	0.24	Irrigation	5/1-10/31	6.6
			01/10/1920	0.08	Domestic	1/1-12/31	-
-KRL236 Davies, Kennedy ([5])	Kennedy & Levier	77-2073A	01/05/1940	0.02	Irrigation	5/1-10/31	1
		77-4010	08/06/1965	0.03	Domestic	5/15-11/20	-
	Davies, James & Marsha	77-4033	06/01/1935	0.02	Irrigation	5/1-10/31	1
				0.04	Domestic	1/1-12/31	-
Total Diversion from Logan Creek				*0.43*			*8.6*

Special Use Permit[1] (expiration date)	Name on Water Right	Water Right	Priority Date	Quantity (cubic feet per second)	Water Uses[2]	Use Period	Acres Irrigated
GOVERNMENT CREEK DIVERSIONS							
KRL085 ([5])	Gillihan, Robert & Catherine	77-4008	10/05/1925	0.23	Irrigation	5/1-10/31	11.2
				0.02	Stockwater	1/1-12/31	-
				0.04	Domestic	1/1-12/31	-
KRL083 Government Creek Water Users ([5])	McRae, Robin	77-7031	08/01/1973	0.04	Domestic	1/1-12/31	-
	Tutt, Steven Alvin	77-7025	04/11/1972	0.1	Domestic	1/1-12/31	-
KRL238 (12/31/2035)	Wooten, Thomas	77-7236	10/16/1985	0.04	Domestic	1/1-12/31	-
KRL086 Wilda Association ([5])	Collord, James	77-10078	08/01/1935	0.18	Irrigation	5/1-10/31	9
				0.06	Domestic	1/1-12/31	-
Total Diversion from Government Creek				*0.71*			*20.2*
NO NAME CREEK							
KRL237 Merrick-Hower (12/31/2035)	Hower, Linn, & Jonne	77-7251	06/23/1987	0.02	Domestic	1/1-12/31	-
				0.06	Irrigation	4/15-10/15	2
	Merrick, Opal & Williams	77-2151	09/14/1962	0.04	Domestic	1/1-12/31	-
				0.02	Stockwater	1/1-12/31	-
	Hower, Linn, & Jonne	77-2150	09/14/1962	0.08	Domestic	1/1-12/31	-
				0.1	*Sub-Total*		
KRL205 (12/31/2032)	Gillihan, Robert & Catherine	77-7058	11/29/1976	0.44[6]	Power	1/1-12/31	-
				0.04	Domestic	1/1-12/31	-
				0.14	Irrigation	5/1-10/31	7
				0.48	*Sub-Total*		
Total Diversion from No Name Creek				*0.58*			*9*

[1]The name on the special use permit is also listed where it is different from the name on the water right. Also listed is the expiration date of the SUP.
[2]Sub-totals are listed when the Idaho Department of Water Resources includes an additional stipulation in the water right limiting the combined rate of diversion to something less than the summation of rates of diversion for each beneficial use.
[3]This is permitted through a Ditch Bill easement rather than a special use permit.
[4]Water associated with this water right is transmitted through the system that is permitted to Darren and Jennifer Vaughn (KRL268) (Caleb Zurstadt, personal communication, 2023).
[5]These SUPs expired 12/31/22 and are currently pending reissuance.
[6]The hydropower return flows into Big Creek.

While year-round diversions for some beneficial uses may occur, most of the residences are summer cabins that are unoccupied during the winter months, with the exception of the Taylor Wilderness Research Station (TWRS). The BA (pages 7–19) contains a detailed description of each water diversion facility, and is incorporated here by reference. Table 2 includes a brief summary of the water diversion facilities.

Table 2. Description of the water diversion facilities authorized under each special use permit included in the Big Creek Water Diversions Project.

Stream	SUP/Water System	Fish Screen[1]?	Flow Control?	Flow Measuring Device?	Description
Pioneer Creek	Taylor Wilderness Research Station Easement	Yes	Yes	Yes	There are two points of diversion (POD) on Pioneer Creek on National Forest System (NFS) lands. Water collected at the upstream-most diversion (POD 1) is carried across approximately 300 feet of NFS land prior to reaching private property. Water collected at POD 2 is transmitted across roughly 550 feet of NFS land. Water from both diversions is conveyed in pipes.
Cliff Creek	Taylor Wilderness Research Station Easement	No[2]	No[2]	No[2]	The POD on NFS land is not currently in use. The proposed action includes converting an open ditch to a piped system that will carry water from the POD across about one quarter mile of NFS land to private property. The POD will consist of a screened intake box. The intake box will be removable and held in place in Cliff Creek with cables fastened to rebar stakes driven into the streambed.
Lick Creek	KRL268 KRL158 KRL223	Yes	Yes	No	A single POD supplies several landowners with water from Lick Creek. A fish screen was installed in 2020 and a flow control device was installed in 2022. A flow measuring device has not been installed to date. From the diversion, water travels in an open ditch for about 180 feet to a cement dam. At the dam, water is conveyed in separate pipes to two storage tanks that are used to supply water via pipes to landowners. In addition, the ditch continues below the dam for about 160 feet, where water is collected in a box and then piped to private land 600 feet away. Any water remaining in the ditch infiltrates into the ground.
Logan Creek	KRL085 KRL236	Yes	Yes	No	A single POD supplies water to several landowners. A fish screen and flow control device were installed in 2017. A rock weir directs a portion of the stream flow over a vertical flat plate screen. A flow measuring device has not been installed to date. Flow is controlled by adjusting the rock weir and wood slats at the screen. In 2021 the open irrigation ditch was replaced by a 4-inch irrigation pipe. Water from this pipe is transferred 2,200 feet to an irrigation ditch where two collection boxes are situated. At this location, water is directed into pipes and/or irrigation ditches and transported across NFS land to private property.
Government Creek	KRL085	Yes	No	No	This POD currently includes a 10-inch polyvinyl chloride (PVC) pipe with an end-of-pipe screen that carries water to a headgate structure used to control water flow into a separate 10-inch PVC pipe. This pipe carries water for about 550 feet to private land where it flows into open ditches. The property owner is in the process of adding more pipe on private land to minimize open ditches and has installed caps on end-pipes to conserve water. The permittee is also designing a new intake system with a flow control device.
	KRL083	Yes	Self-limiting	Self-limiting	This POD consists of a 4-inch diameter pipe fitted with an end-of-pipe screen. The pipe can be lifted from the stream when not in use. The pipe directs water to a collection box

Stream	SUP/Water System	Fish Screen[1]?	Flow Control?	Flow Measuring Device?	Description
					where a 3-inch pipe carries water across 300 feet of NFS land to private property. The collection box has an overflow that directs water back to Government Creek.
Government Creek	KRL238	Yes	No	No	This POD consists of a 3-inch diameter pipe fitted with an end-of-pipe screen. Water is diverted to a collection box where another 3-inch pipe conveys water across roughly 1,300 feet of NFS land to private property. Overflow from the collection box is directed back into the creek.
	KRL086	Yes	Self-limiting	Self-limiting	This POD consists of a small, wooden headbox encompassing an intake pipe. The intake pipe is fitted with a screen that has a mesh size of less than 3/32-inch. The headbox is placed in the stream, and a rock weir is typically used to direct water toward the box where it flows into an opening in the box. Water is conveyed from the collection box across NFS land in buried piping for approximately 600 feet.
No Name Creek	KRL237	No[3]	No	No	The POD consists of a concrete water collection and headgate structure, where wood slats are used to dam the stream and direct flow into a 10-inch diameter pipe. The pipe conveys water for 200 feet across NFS lands to private property.
	KRL205	Yes[3]	No	No	This POD consists of a 12-inch by 12-inch by 16-inch headbox buried in the streambed with a horizontal screen with 3/32-inch mesh. Water is conveyed in a 2-inch diameter pipe for 500 feet across NFS land to private property.

[1]Fish screens comply with NMFS recommended screening criteria (NMFS 2011; NMFS 2022a).
[2]The original Cliff Creek POD has been unusable since 2000 and the current diversion is on private property. The University of Idaho intends to re-establish the original POD, with system upgrades, upon finalization and signature of the Ditch Bill easement.
[3]This location is believed to be non-fish bearing.

1.3.1. Mitigations

The mitigations listed below will be included in all future OMPs (or specific SUPs, as identified).

- Use of heavy equipment for maintenance of facilities will require review by a U.S. Forest Service (USFS) fisheries biologist.

- Any ground disturbance due to maintenance of permitted facilities will be mitigated with a high level of erosion control to prevent erosion and subsequent sediment deposition into streams. Examples of erosion control include slash, straw or wood mulch, and planting with a native seed mix.

- Any leakage due to malfunctioning diversion equipment will be repaired a soon as possible to prevent streambank washout or erosion and avoid sediment deposition in streams.

- Weirs constructed of river rock will be kept to the minimum size needed for the POD to function adequately and will not block fish passage.

- Where fish are present, PODs will include a NMFS and U.S. Fish and Wildlife Service (FWS) approved fish screen that is kept in good working condition and cleared of debris.

- Water systems that have the capacity to divert more water than the State water right will have a flow control and flow measuring device that are kept in good working condition.

- The final design for the Cliff Creek POD will be submitted to the Level 1 Team for approval prior to installation.

- The wood slats on the Gillihan POD (KRL205) on No Name Creek will be removed when water is not being diverted.

1.3.2. Monitoring

The PNF will perform the following monitoring.

- USFS will inspect permitted facilities a minimum of once every 5 years. Inspections will include rates of diversion where the system is not self-limiting to the water right and there are flow monitoring devices.

- Stream flow and rates of diversion will be recorded and reported to the Level 1 Team for Government, Lick, No Name, and Pioneer Creeks. Flows will be measured during the summer/fall baseflow period (September 1 – October 15) during a year, or years, in which flow in area streams are below average. The PNF will determine the best time to measure flows by monitoring real time gages in the South Fork Salmon River drainage, with the goal of measuring the lowest flows occurring during the irrigation season of a dry year. The flow measurements will be taken during 2023–2028 if suitable flows occur during that period, or after 2028 if flows are consistently unsuitable (i.e., higher than average) during 2023–2028.

The BA also includes a monitoring commitment to gain additional information on seasonal and interannual fish distribution and abundance in the lower 0.15 miles of No Name Creek and reporting those findings to the Level 1 Team by December 31, 2025. The PNF conducted electrofishing on July 27, 2023 to evaluate fish distribution between private land and the permitted water diversions on No Name Creek. A memorandum summarizing their findings was provided to the Services on August 15, 2023. This work performed in 2023 meets the commitment made in the BA; no additional fish distribution monitoring will be performed.

1.3.3. Project and Consultation Timeframe

The PNF requested consultation for the current SUPs and their re-issuance once they expire (every 20 years from reissuance) as long as none of the four conditions of reinitiating consultation are triggered. Similarly, consultation for the easement is in perpetuity, unless reinitiation of consultation is warranted. Prior to modifying, reissuing existing permits[1], or issuing a new permit, the PNF will document the rationale/analysis for why none of the four reinitiation clauses were triggered. The PNF will coordinate this documentation with NMFS and FWS to ensure consistency with this opinion. Therefore, the project timeline is in perpetuity for issuance of the easement and special use permits including the operation and maintenance of the facilities.

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

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

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat, upon which they depend. As required by Section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and Section 7(b)(3) requires that, at the conclusion of consultation, NMFS 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 reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1. Analytical Approach

This opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of"

[1] The first reissuance of currently expired permits (see Table 1) do not require this documentation.

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

The designations of critical habitat for SRS Chinook salmon and SRB steelhead use the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced these terms 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 ESA Section 7 implementing regulations define effects of the action using the term “consequences” (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision 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 critical 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 (RPA) to the proposed action.

2.2. Rangewide Status of the Species and Critical Habitat

In this opinion, we examine 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" for the jeopardy analysis. We also examine the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species. The Federal Register notices and notice dates for the species and critical habitat listings considered in this opinion are included in Table 3.

Table 3. Listing status, status of critical habitat designations and protective regulations, and relevant Federal Register decision notices for ESA-listed species considered in this opinion.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (*Oncorhynchus tshawytscha*)			
Snake River spring/summer-run	T 4/22/92; 57 FR 14653	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
Steelhead (*O. mykiss*)			
Snake River Basin	T 8/18/97; 62 FR 43937	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160

Note: Listing status 'T' means listed as threatened under the ESA; 'E' means listed as endangered.
[1]The listing status for Snake River spring/summer Chinook salmon was corrected on 6/3/92 (57 FR 23458).
[2]Critical habitat for Snake River spring/summer Chinook salmon was revised on 10/25/99 (64 FR 57399).

2.2.1. Status of the Species

In this section we describe the present condition of the SRS Chinook salmon evolutionarily significant unit (ESU) and the SRB steelhead distinct population segment (DPS). NMFS expresses the status of a salmonid 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 viable salmonid population (VSP) that defines "viable" as less than a 5 percent risk of extinction within 100 years and "highly viable" as less than a 1 percent risk of extinction within 100 years. A third category, "maintained," represents a less than 25 percent risk within 100 years (moderate risk of extinction). To be considered viable, an ESU or 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 built up from the aggregate risk levels of the individual populations and major population groups (MPGs) that make up the ESU/DPS.

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

In the following sections we summarize the status and available information on the species and designated critical habitats considered in this opinion based on the detailed information provided by the ESA Recovery Plan for Snake River Spring/Summer Chinook Salmon & Snake River Basin Steelhead (NMFS 2017); Biological Viability Assessment Update for Pacific Salmon and Steelhead Listed Under the Endangered Species Act: Pacific Northwest (Ford 2022); 2022 5-Year Review: Summary & Evaluation of Snake River Spring/Summer Chinook Salmon (NMFS 2022b); and 2022 5-Year Review: Summary & Evaluation of Snake River Basin Steelhead (NMFS 2022c). Additional information that has become available since these documents were published is also summarized in the following sections and contributes to the best scientific and commercial data available. These additional documents are incorporated by reference and are available on the NMFS West Coast Region website at https://www.westcoast.fisheries.noaa.gov.

2.2.1.1. Snake River Spring/Summer Chinook Salmon

A summary of the current status of the SRS Chinook salmon ESU can be found on NMFS' publicly available intranet site (https://www.fisheries.noaa.gov/s3/2023-02/feb-2023-status-snake-r-spring-summer-chinook.pdf) and is incorporated by reference here (NMFS 2023a). Overall, the SRS Chinook salmon ESU is at a moderate-to-high risk of extinction. While there have been improvements in abundance/productivity in several populations since the time of listing, the majority of populations experienced sharp declines in abundance in recent years. If productivity remains low, the ESU's viability will become more tenuous. If productivity improves, populations could increase again, similar to what was observed in the early 2000s. This ESU continues to face threats from disease; predation; harvest; habitat loss, alteration, and degradation; and climate change (NMFS 2022b). On August 18, 2022, in the agency's 5-year review for SRS Chinook salmon, NMFS concluded that the species should remain listed as threatened (NMFS 2022b).

Within this ESU, only the Big Creek population will be affected by the proposed action. This population is one of nine populations within the Middle Fork Salmon River (MFSR) MPG, which is not currently viable. In the latest viability report (Ford 2022), the most recent 5-year geometric mean (2015–2019) of natural-origin spawners decreased 63 percent relative to the previous 4-year geomean (2010–2014). To support recovery of the SRS Chinook salmon ESU, the Big Creek population is proposed to achieve a highly viable status (NMFS 2017). This requires the population achieve a minimum of very low abundance/productivity risk and low spatial structure/diversity risk (NMFS 2017). Currently, this population's integrated spatial structure/diversity risk rating is moderate and its integrated abundance/productivity risk rating is high. Overall, the Big Creek population is at a high risk of extinction within the next 100 years (NMFS 2022b).

2.2.1.2. Snake River Basin Steelhead

A summary of the current status of the SRB steelhead DPS can be found on NMFS' publicly available intranet site (https://www.fisheries.noaa.gov/s3/2023-02/feb-2023-status-snake-r-steelhead.pdf), and is incorporated by reference here (NMFS 2023b). Based on information available for the 2022 viability assessment of SRB steelhead (Ford 2022), none of the DPS' five MPGs are meeting their recovery plan objectives and the viability of many populations remains uncertain. The recent, sharp declines in abundance are of concern and are expected to negatively affect productivity in the coming years. Overall, available information suggests that SRB steelhead continue to be at a moderate risk of extinction within the next 100 years. This DPS continues to face threats from tributary and mainstem habitat loss, degradation, or modification; predation; harvest; hatcheries; and climate change (NMFS 2022c).

The proposed action may affect the Lower Middle Fork Salmon River (LMFSR) population, which is in the Salmon River MPG. Currently, the population has a low risk rating for the integrated spatial structure/diversity metric and a moderate risk rating for the integrated abundance/productivity metric. Overall, the population is considered to be maintained; however, it is targeted to achieve a highly viable status to support recovery of the DPS (NMFS 2017).

2.2.2. Status of Critical Habitat

In evaluating the condition of designated critical habitat, NMFS examines the condition and trends of PBFs, which are essential to the conservation of the ESA-listed species because they support one or more life stages of the species. Proper function of these PBFs is necessary to support successful adult and juvenile migration, adult holding, spawning, incubation, rearing, and the growth and development of juvenile fish. Modification of PBFs may affect freshwater spawning, rearing or migration in the action area. Generally speaking, sites required to support one or more life stages of the ESA-listed species (i.e., sites for spawning, rearing, migration, and foraging) contain PBFs essential to the conservation of the listed species (e.g., spawning gravels, water quality and quantity, side channels, or food) (Table 4).

Table 4. Types of sites, essential physical and biological features (PBFs) of critical habitat, and the species and life stage each PBF supports.

Site	Essential Physical and Biological Features	Species Life Stage
Snake River Basin steelhead[a]		
Freshwater spawning	Water quality, water quantity, and substrate	Spawning, incubation, and larval development
Freshwater rearing	Water quantity and floodplain connectivity to form and maintain physical habitat conditions	Juvenile growth and mobility
	Water quality and forage[b]	Juvenile development
	Natural cover[c]	Juvenile mobility and survival
Freshwater migration	Free of artificial obstructions, water quality and quantity, and natural cover[c]	Juvenile and adult mobility and survival
Snake River spring/summer Chinook salmon		
Spawning and juvenile rearing	Spawning gravel, water quality and quantity, cover/shelter, food, riparian vegetation, space, water temperature	Juvenile and adult
Migration	Substrate, water quality and quantity, water temperature, water velocity, cover/shelter, food[d], riparian vegetation, space, safe passage	Juvenile and adult

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

Table 5 includes a description of the geographical extent of critical habitat within the Snake River basin for SRS Chinook salmon and SRB steelhead. 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 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.

Table 5. Geographical extent of designated critical habitat within the Snake River basin for Snake River spring/summer Chinook salmon and Snake River Basin steelhead.

Evolutionarily Significant Unit / Distinct Population Segment	Designation	Geographical Extent of Critical Habitat
Snake River spring/summer Chinook salmon	58 FR 68543; December 28, 1993 64 FR 57399; October 25, 1999	All Snake River reaches upstream to Hells Canyon Dam; all river reaches presently or historically accessible to Snake River spring/summer Chinook salmon within the Salmon River basin; and all river reaches presently or historically accessible to Snake River spring/summer Chinook salmon within the Hells Canyon, Imnaha, Lower Grande Ronde, Upper Grande Ronde, Lower Snake-Asotin, Lower Snake-Tucannon, and Wallowa subbasins.
Snake River Basin steelhead	70 FR 52630; September 2, 2005	Specific stream reaches are designated within the Lower Snake, Salmon, and Clearwater River basins. Table 21 in the Federal Register details habitat areas within the distinct population segment's geographical range that are excluded from critical habitat designation.

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

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

Many stream reaches designated as critical habitat for these species are considered impaired for water quality, such as elevated water temperature (IDEQ 2022). Many areas that were historically suitable rearing and spawning habitat are now unsuitable due to high summer stream temperatures, such as some stream reaches in the Upper Grande Ronde. Removal of riparian vegetation, alteration of natural stream morphology, and withdrawal of water for agricultural or municipal use all contribute to elevated stream temperatures. Water quality in spawning and rearing areas in the Snake River has also been impaired by high levels of sedimentation and by heavy metal contamination from mine waste (IDEQ 2001; IDEQ & USEPA 2003).

The construction and operation of water storage and hydropower projects in the Columbia River basin, including the eight run-of-river dams on the mainstem lower Snake and lower Columbia Rivers, have altered biological and physical attributes of the mainstem migration corridor. Hydrosystem development modified natural flow regimes, resulting in warmer late summer and fall water temperature. Changes in fish communities led to increased rates of piscivorous predation on juvenile salmon and steelhead. Reservoirs and project tailraces have created opportunities for avian predators to successfully forage for smolts, and the dams themselves have created migration delays for both adult and juvenile salmonids. Physical features of dams, such as turbines, also kill out-migrating fish. In-river survival is inversely related to the number of hydropower projects encountered by emigrating juveniles. However, some of these conditions have improved. The Bureau of Reclamation and U.S. Army Corps of Engineers have implemented measures in previous Columbia River System hydropower consultations to improve conditions in the juvenile and adult migration corridor including 24-hour volitional spill, surface passage routes, upgrades to juvenile bypass systems, and predator management measures. These measures are ongoing and their benefits with respect to improved functioning of the migration corridor PBFs will continue into the future.

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

One factor affecting the rangewide status of Snake River salmon and steelhead, and aquatic habitat at large is climate change. As observed by Siegel and Crozier in 2019, long-term trends in warming have continued at global, national, and regional scales. The five warmest years in the 1880 to 2019 record have all occurred since 2015, while nine of the 10 warmest years have occurred since 2005 (Lindsey & Dahlman 2020). Events such as the 2014–2016 marine heatwave (Jacox et al. 2018) are likely exacerbated by anthropogenic warming, as noted in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al. 2018). The U.S. Global Change Research Program (USGCRP) reports average warming in the Pacific Northwest of about 1.3ºF from 1895 to 2011, and projects an increase in average annual temperature of 3.3ºF to 9.7ºF by 2070 to 2099 (compared to the period 1970 to 1999), depending largely on total global emissions of heat-trapping gases (predictions based on a variety of emission scenarios including B1, RCP4.5, A1B, A2, A1FI, and RCP8.5 scenarios). The increases are projected to be largest in summer (USGCRP 2018).

Climate change generally exacerbates threats and limiting factors, including those currently impairing salmon and steelhead survival and productivity. The growing frequency and magnitude of climate change related environmental downturns will increasingly imperil many ESA-listed stocks in the Columbia River basin and amplify their extinction risk (Crozier et al. 2019, 2020, 2021). This climate change context means that opportunities to rebuild these stocks will likely diminish over time. As such, management actions that increase resilience and adaptation to these changes should be prioritized and expedited. For example, the importance of improving the condition of and access and survival to and from the remaining functional, high-elevation spawning and nursery habitats is accentuated because these habitats are the most likely to retain remnant snowpacks under predicted climate change (Tonina et al. 2022).

Climate change is already evident. It will continue to affect air temperatures, precipitation, and wind patterns in the Pacific Northwest (ISAB 2007; Philip et al. 2021), resulting in increased droughts and wildfires, variation in river flow patterns, and increased stream temperatures

(Crozier & Siegel 2023). These conditions differ from those, under which native anadromous and resident fishes evolved and will likely increase risks posed by invasive species and altered food webs. Lower baseflows and long-term trends in low flow extremes have occurred throughout the West; affecting fish behavior, growth rates, and risk of mortality from stranding or overcrowding (Crozier & Siegel 2023). The frequency, magnitude, and duration of elevated water temperature events have increased with climate change and are exacerbated by the Columbia River hydrosystem (EPA 2021a, 2021b; Scott 2020). Thermal gradients (i.e., rapid change to elevated water temperatures) encountered while passing dams via fish ladders can slow, reduce, or altogether stop the upstream movements of migrating salmon and steelhead (Caudill et al. 2013). Additional thermal loading occurs when mainstem reservoirs act as a heat trap due to upstream inputs and solar irradiation over their increased water surface area (EPA 2021a, 2021b, 2021c). Consider the example of adult sockeye salmon in 2015, when high summer water temperatures contributed to extremely high losses of Columbia River and Snake River stocks during passage through the mainstem Columbia and Snake River (Crozier et al. 2020), and through tributaries such as the Salmon and Okanogan rivers, below their spawning areas. Some stocks are already experiencing lethal thermal barriers during a portion of their adult migration. The effects of longer or more severe thermal barriers in the future could be catastrophic. For example, Bowerman et al. (2021) concluded that climate change will likely increase the factors contributing to prespawn mortality of Chinook salmon across the entire Columbia River basin.

Columbia River basin salmon and steelhead spend a significant portion of their life-cycle in the ocean, and as such the ocean is a critically important habitat influencing their abundance and productivity. Climate change is also altering marine environments used by Columbia River basin salmon and steelhead. This includes increased frequency and magnitude of marine heatwaves, changes to the intensity and timing of coastal upwelling, increased frequency of hypoxia (low oxygen) events, and ocean acidification. These factors are already reducing, and are expected to continue reducing, ocean productivity for salmon and steelhead. This does not mean the ocean is getting worse every year, or that there will not be periods of good ocean conditions for salmon and steelhead. In fact, near-shore conditions off the Oregon and Washington coasts were considered good in 2021 (NOAA 2022). However, the magnitude, frequency, and duration of downturns in marine conditions are expected to increase over time due to climate change. Any long-term effects of the stressors that fish experience during freshwater stages that do not manifest until the marine environment will be amplified by the less-hospitable conditions there due to climate change. Together with increased variation in freshwater conditions, these downturns will further impair the abundance, productivity, spatial structure, and diversity of the region's native salmon and steelhead stocks (Isaak et al. 2018; ISAB 2007). As such, these climate dynamics will reduce fish survival through direct and indirect impacts at all life stages (NOAA 2022).

All habitats used by Pacific salmon and steelhead will be affected by climate dynamics. However, the impacts and certainty of the changes will likely vary by habitat type. Some changes affect salmon at all life stages in all habitats (e.g., increasing temperature), while others are habitat-specific (e.g., stream-flow variation in freshwater, sea-level rise in estuaries, upwelling in the ocean). How climate change will affect each individual salmon or steelhead stock also varies widely, depending on the extent and rate of change and the unique life-history characteristics of different natural populations (Crozier et al. 2008; Crozier & Siegel 2023). The continued persistence of salmon and steelhead in the Columbia basin relies on restoration actions that enhance climate resilience (Jorgensen et al. 2021) in freshwater spawning, rearing, and migratory habitats, including access to high elevation, high quality cold-water habitats, and the reconnection of floodplain habitats across the interior Columbia River basin.

2.3. Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The proposed action permits the operation and maintenance of water systems on NFS lands. The SUPs included in the proposed action are for water systems located in the Upper Big Creek watershed (5th-level hydrologic unit code [HUC] 1706020605), near Edwardsburg, Idaho. The Ditch Bill easement included in the proposed action is located in the Lower Big Creek watershed (fifth level HUC 1706020609). The action area includes the water conveyance facilities, places of water use, and stream reaches located downstream of the PODs. Specific streams include Lick, Government, Logan, No Name, Pioneer, Cliff, and Big Creeks from the Lick Creek confluence downstream to its confluence with the MFSR.

Impacts on flow immediately below the PODs will be equal to the amount of water being diverted. These impacts will decline with distance downstream from the diversion as water that is not consumptively used (e.g., most water used for domestic, stock water, hydropower purposes, as well as a proportion of the water used for irrigation) makes its way back to the stream. A portion of the water diverted will be lost due to evapotranspiration (i.e., "consumptively used") and will be permanently removed from the water budget. Water that is consumptively used due to the proposed action will permanently reduce streamflow in waterbodies downstream from the PODs. In determining the extent of the action area, NMFS considered how far downstream this permanent reduction in streamflow is discernible and is not lost in ambient or background conditions.

NMFS used estimates of evapotranspiration (Allen & Robison 2017) for McCall, Idaho, to determine the amount of water that could be permanently lost from the water budget due to irrigation (Appendix A). The average amount of diverted irrigation water that is lost to evapotranspiration is estimated to range from 0.05 cubic feet per second (cfs) (April) to 0.80 cfs (July). NMFS then compared these estimates to the unimpaired 50 percent exceedance flows in Big Creek at the mouth. During the irrigation season, the 50 percent exceedance flows at the mouth of Big Creek are estimated to range from about 252 cfs (October) to 2,730 cfs (June). The amount of water that is expected to be lost due to evapotranspiration associated with the proposed action amounts to anywhere from 0.01 to 0.17 percent of the estimated median monthly flows at the mouth of Big Creek. Such reductions in flow (either in cfs or in percent) at the mouth of Big Creek is no longer discernible and is lost in ambient or background conditions. Therefore, for this proposed project, the action area will encompass all of the stream reaches downstream of the PODs, extending to the mouth of Big Creek.

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 action area is used by the freshwater life history stages of threatened SRS Chinook salmon and SRB steelhead. All of the streams affected by the proposed action are considered designated critical habitat for SRS Chinook salmon. Cliff, Pioneer, Logan, and Big Creeks are designated critical habitat for SRB steelhead. The Big Creek Chinook salmon population and LMFSR steelhead population occupy the action area. NMFS recently completed 5-year reviews for SRS Chinook salmon (NMFS 2022b) and SRB steelhead (NMFS 2022c). Future opportunities to address small, localized areas of degraded habitat in the action area relevant to this consultation include reducing impacts from water diversions through administration of SUPs, and where possible, applying water acquired for habitat restoration projects to mainstem Salmon River instream flows.

The BA (pages 22–30) includes a thorough discussion of the environmental baseline, and is incorporated here by reference. Key aspects regarding the condition of designated critical habitats in the action area and presence of ESA-listed species in action area streams are described further in Sections 2.4.1. through 2.4.8.

2.4.1. General Habitat Conditions in the Action Area

The Big Creek drainage is approximately 595 square miles, and approximately 90 percent of the drainage lies within the Frank Church River of No Return Wilderness (FCRONRW). Approximately 1.1 square miles are privately owned in the Edwardsburg town site in the Upper Big Creek watershed. Because most of the drainage is located within the FCRONRW, the watersheds have not been degraded much beyond reference condition. However, localized portions of the drainage have been affected by legacy mining, residential development, and road development associated with these activities. However, the localized degradation in the upper watershed does not appear to be prohibiting streams from supporting aquatic life beneficial uses, including salmonid spawning. The Idaho Department of Environmental Quality monitored aquatic habitat and macroinvertebrate communities in Logan Creek near its mouth in 2008 and in Big Creek, just upstream of the Smith Creek confluence. At both locations, the macroinvertebrate community and habitat indices fully supported the aquatic life beneficial uses (IDEQ 2022).

The PNF evaluated the baseline conditions of Upper Big Creek and Lower Big Creek watersheds using the PNF Land and Resource Management Plan's (LRMP) Southwest Idaho Ecogroup

Matrix of Pathways and Watershed Condition Indicators (WCI). NMFS agrees with the PNF's conclusions that habitat conditions in the action area generally range between functioning at risk (FAR) and functioning appropriately (FA). Conclusions for all of the WCIs are included in Table 13 of the BA (page 33–44), which is incorporated here by reference. Those pathways/WCIs that may be affected by the proposed action include water quality (temperature), habitat access (physical barriers), habitat elements (substrate embeddedness, large woody debris [LWD], refugia, streambank condition), and flow/hydrology (change in peak/base flows). More detailed descriptions of the current conditions of these pathways and WCIs are below.

Temperature. From 1993 to 2022, maximum stream temperatures increased by 0.3 degrees Celsius (°C) per decade at a monitoring site in upper Big Creek. The monitoring site is located upstream of Edwardsburg in a location not influenced by land management activities. In addition, the area has not experienced wildfire activity in recent history. These temperature changes are likely attributable to climate change. Additional temperature data has been collected at eleven other sites in the drainage between 2010 and 2022. For the mainstem Big Creek, the seasonal maximum 7-day average of the daily maximum temperature (7DADM) between 2010 and 2022, across three sites, has ranged from 10.3 to 17.8°C. Tributaries that have been monitored exhibit seasonal maximum 7DADM values lower than those of the mainstem, ranging from 9.9 to 15.1°C. While stream temperatures may be considered to be FAR in some locations of the Big Creek mainstem, they are reflective of conditions with limited land management activities.

Habitat Access/Physical Barriers. The physical barrier WCI (which is equivalent to the safe passage PBF) is considered to be FA in the Big Creek drainage. In the past, some permittees have constructed rock weir diversions that may have impeded fish passage at lower flows; however, PNF personnel have conducted extensive outreach in the area and these fish passage barriers have been corrected.

Habitat Elements. The LWD, refugia, and streambank condition WCIs are considered to be reflective of the refugia and floodplain function PBFs, and all are considered to be FA in the Big Creek drainage. Action area streams are characterized of having sufficient LWD, pools, and off-channel habitat (where appropriate for the stream channel type). Recruitment of LWD to action area streams is likely increasing due to high mortality rates from insect and disease in Upper Big Creek, and fire killed trees in lower Big Creek and its tributaries (Fronk et al. 2019; Zurstadt & Nalder 2023). There has been very little anthropogenic channel modification that will have altered the amount or condition of off-channel habitat in the analysis area (Zurstadt & Nalder 2023). Off-channel habitat is constricted in a few localized areas that have been developed with residential cabins or road prisms in Upper Big Creek, but it is otherwise intact within the drainage (Zurstadt & Nalder 2023). Big Creek flows into the FCRONRW and joins the MFSR where the habitat is well connected and in near pristine condition.

Riparian Conservation Areas. The riparian conservation area (RCA) WCI is considered to be FAR. The RCAs are typically delineated as 300 linear feet on either side of perennial streams. Overall, RCAs are generally intact and functioning properly, although there are locations in the watershed where roads, private in-holdings and USFS administrative sites occur. There are approximately 28 miles of road within 150 feet of stream channels.

Flow/Hydrology. Big Creek and all the streams considered in this opinion exhibit hydrographs typical of snowmelt dominated systems, with flows generally rising in April and descending in July to summer baseflows. Timing varies among streams and among years, depending on snowmelt. The change in peak/base flows WCI is generally FA throughout the Big Creek drainage, although it is rated as FAR in the Upper Big Creek watershed due to potential alteration of streamflows from diversions. There are approximately 52 surface water rights in the Big Creek drainage (Appendix B), excluding water rights for minimum instream flows. The Idaho Water Resources Board holds six water rights for instream flows throughout the Big Creek drainage, two of which apply to Big Creek (one at the mouth and one at the confluence of Logan Creek), and one applies to Logan Creek. Although the purpose of the instream flow water right is to preserve fish and wildlife, scenic, and recreational values, and to protect and enhance water quality, it does not affect any water uses in the Big Creek drainage that are covered by existing water rights. The USFS acquired land and associated water rights in the upper Monumental Creek drainage and indicated the diversions are no longer active.

Diversion of water in the Big Creek drainage is controlled and managed by the individual water users with little oversight by the Idaho Department of Water Resources (IDWR). Because operation of all the diversions is controlled by individual water users with little oversight, the actual amount of water diverted could be more (or less) than the maximum diversion rate. Only the two PODs on Pioneer Creek have measuring devices; none of the other diversions that are part of this proposed action are equipped with measuring devices. It is highly likely that the other diversions in the drainage that are not included in the proposed action (Appendix B) do not have measuring devices. As such, water users may have only a rough idea of amount of water they are diverting.

Flow data for Big Creek and its tributaries are limited and includes some daily streamflow data at the U.S. Geological Survey (USGS) Big Creek gaging station (site number 1331000) as well as periodic flow measurements performed by the PNF. The gaging station was located upstream of Rush Creek, approximately 5 miles above the TWRS and operated from September 1944 to October 1958. Available flow information and information regarding anadromous fish use for each stream is summarized in the following section. The methods for estimating the unimpaired median monthly flows are summarized in Appendix C. It is worth noting that the water diversions that would be authorized by the proposed action are currently operating and are likely to continue to operate until the SUPs or easements are issued. Therefore, information about fish use and stream flows below diversions is reflective of water use in the action area.

2.4.2. Big Creek

While there are no direct diversions of water from the Big Creek mainstem, diversions on tributaries affect mainstem flows. The mean annual discharge[2] calculated for 1949 to 1957 at the Big Creek gaging station was about 525 cfs, with median monthly flows for September and October around 180 cfs. Estimated, unimpaired monthly flows for the Big Creek gage and two other locations in Big Creek are illustrated in Figure 4. Measured summer flows in upper Big Creek immediately downstream of Logan Creek ranged from 18.5–31.2 cfs in 2013, 2015, and

[2] Mean annual discharge was calculated for the calendar year (January 1 through December 31) and included only those years with complete datasets (i.e., 1949 through 1957). The statistic is based on average monthly discharges.

2022 (Table 6). As described in Appendix C, it is likely that the estimated monthly median flows are higher than the true monthly median because Big Creek flows during the period of record were above average. Furthermore, the methods for estimating flow don't account for climate change impacts, which are likely causing summer baseflows to decrease.

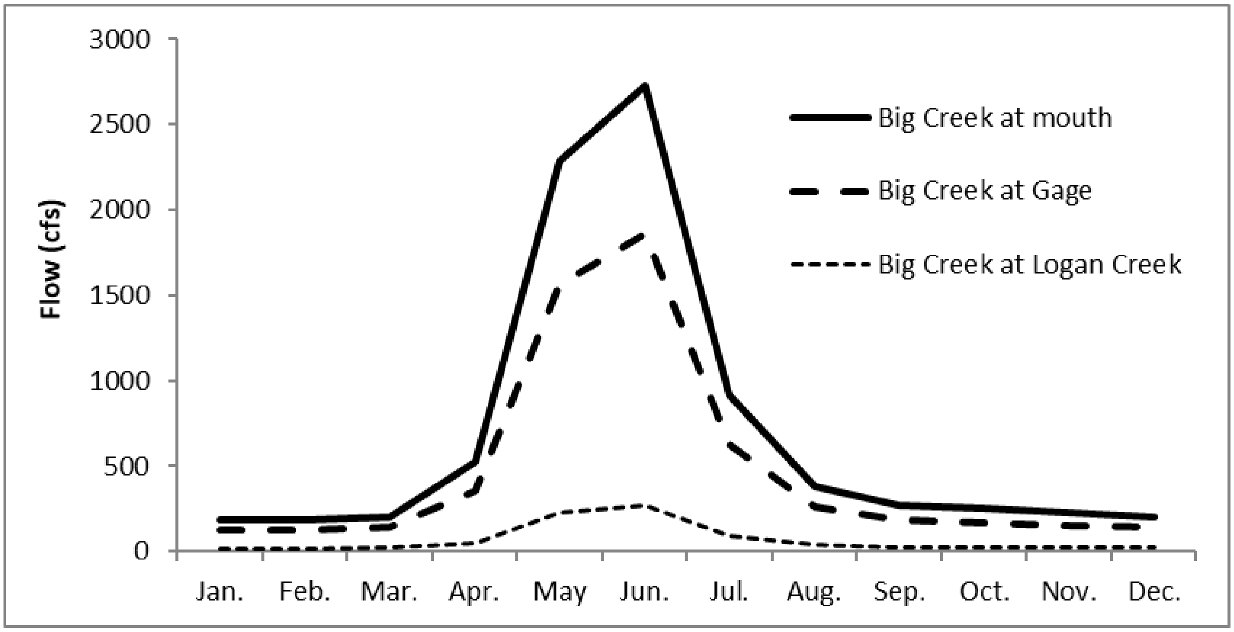

Figure 4. Calculated median monthly stream flows for the period of record (1949–1957) at the Big Creek gage and estimated unimpaired median monthly stream flows the mouth of Big Creek and at the Logan Creek confluence.

Table 6. Estimated monthly median flows of Big Creek at Logan Creek and measured stream flows (cubic feet per second) immediately downstream of Logan Creek.

Month	Estimated median flow (cfs)	Measured stream flow (cfs)[a]		
		2013	2015	2022
July	90.6	30.8		
August	38	20.3		31.2
September	26.8	20.3 [b]	18.5	
October	25	28.4		

[a]Expected measurement error is +/- 10 percent.
[b]Rainfall in mid-September increased flows.

The total maximum diversion rate authorized by active water rights in the Big Creek drainage is 8.5 cfs, over half of which is for irrigation purposes. As described in Section 2.3, assuming that only water lost due to evapotranspiration is permanently removed from the Big Creek water budget, then current water use in the drainage represents only a very small fraction (i.e., less than half a percent) of flows at the mouth of Big Creek. The overall impacts of historic and current water use in the Big Creek drainage is relatively light; although, localized impacts in the mainstem in the Upper Big Creek subwatershed are more pronounced.

Chinook salmon and steelhead utilize the mainstem Big Creek for spawning, incubation, rearing, and migration. The Idaho Department of Fish and Game (IDFG) started Chinook salmon index reach redd counts in the upper and lower sections of Big Creek in 1957. A total of 768 Chinook redds were counted in the mainstem of Big Creek in 1957 and counts were generally well above 300 the first 7 years of the survey. Since then, numbers have fluctuated substantially from a low of five redds in 1995 to a high of 265 in 2001. Figure 5 depicts the redd counts since 1995. Over time, there has been a slight decreasing trend in the 5-year geometric mean counts. The Big Creek reach between Jacobs Ladder Creek and Logan Creek has the highest density of redds relative to other reaches in the mainstem.

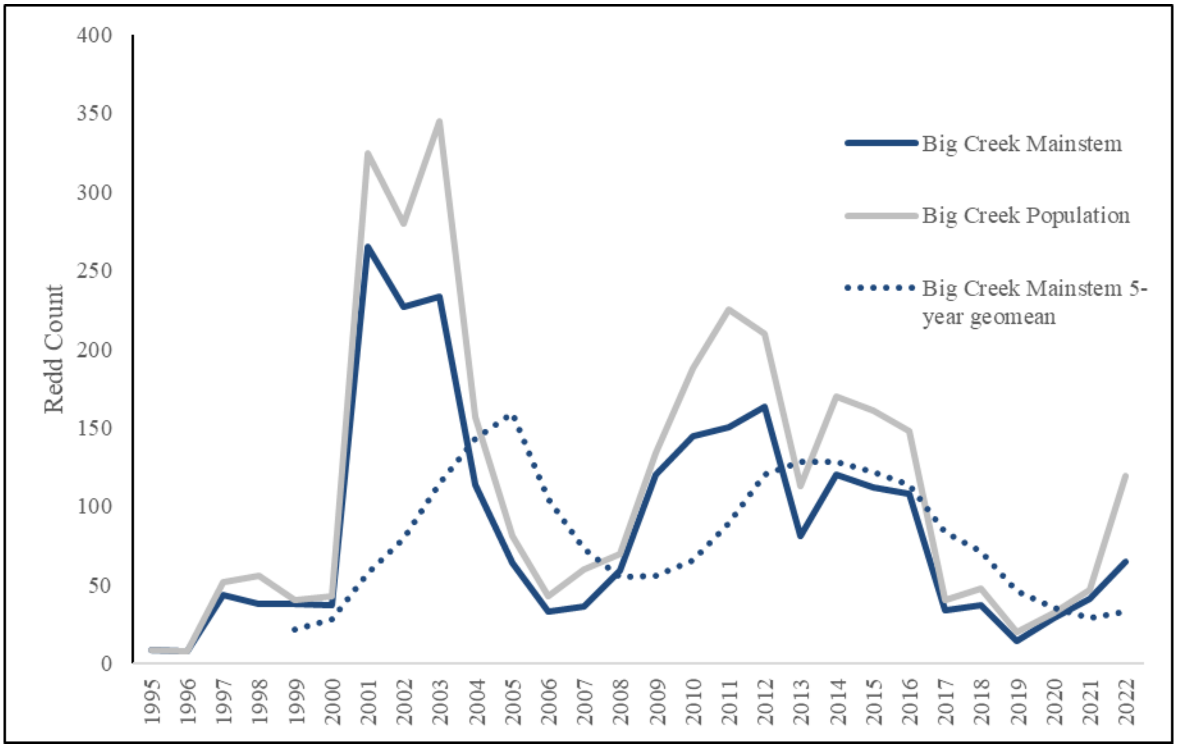

Figure 5. Chinook salmon redd counts in Big Creek (mainstem and overall population). The 5-year geomean for mainstem redd counts are the dashed blue line.

Steelhead redd surveys are not regularly performed, but spawning areas likely overlap with known Chinook salmon spawning areas. The IDFG has estimated the abundance of wild adult steelhead at the Big Creek passive integrated transponder (PIT) tag array since 2010 (Smith et al. 2022). The PIT tag array is located near the TWRS. Similar to Chinook salmon, abundances vary widely across years, and have declined substantially in recent years (Figure 6).

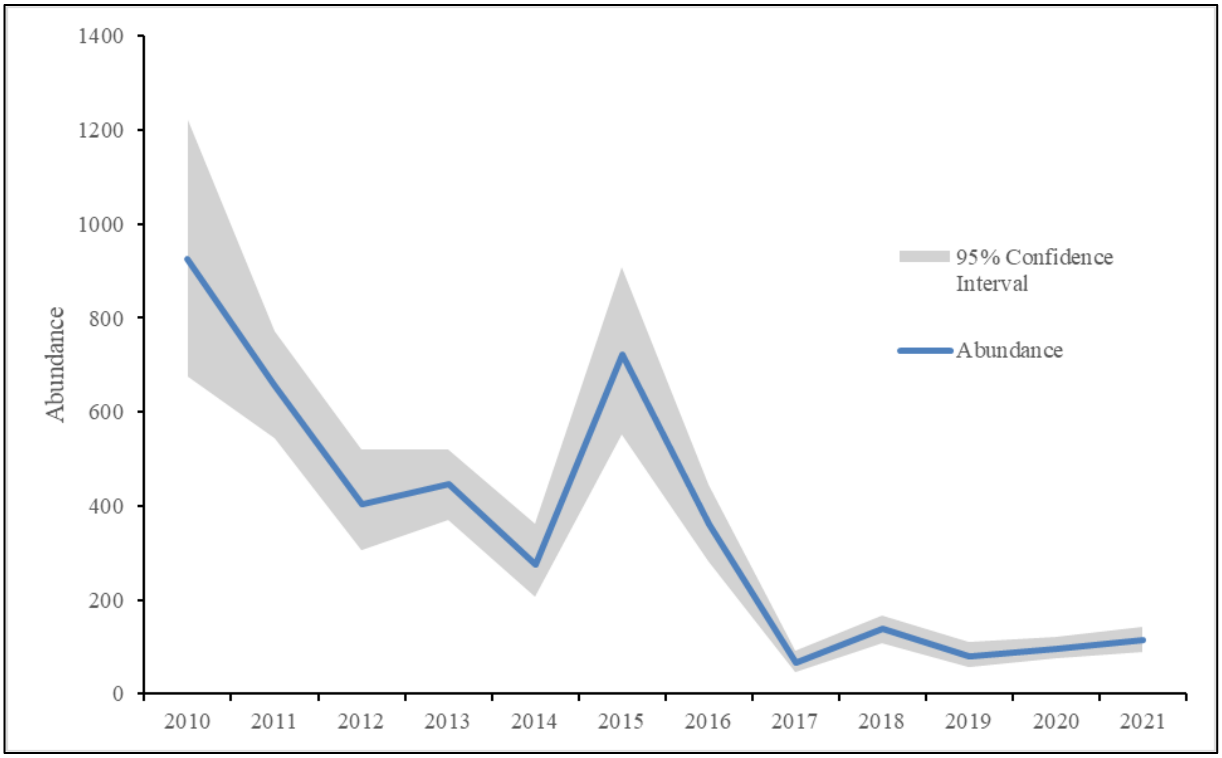

Figure 6. Wild adult steelhead abundance estimates for the Big Creek PIT tag array.

2.4.3. Lick Creek

Lick Creek is a first order tributary to Big Creek (Figure 3). The estimated, unimpaired, monthly 50 percent exceedance flows for Lick Creek range from 1 to 15.5 cfs (Appendix C). Streamflows measured upstream of the POD during the months of July through October ranged from 1.0 to 1.8 cfs (Table 7). Based on visual observations during numerous site visits and flow measurement in 2022 (Zurstadt 2022), the PNF believes instream flow requirements (i.e., to not divert more than 50 percent of Lick Creek) included in the current SUP have been met. As described previously, the POD is screened and has an operable flow control device. There is no flow measurement device.

Table 7. Estimated monthly median flows at the mouth of Lick Creek and measured stream flows (cubic feet per second) above the point of diversion.

Month	Estimated median flow (cfs)	Measured stream flow (cfs)[a]				
		2009	2010	2013	2015	2022
July	5.2	1.8		1.3		
August	2.2			1		1.3
September	1.5			1.2	1.2	
October	1.4		1.5	1.3		

[a]Expected measurement error is +/- 10 percent.

There are three additional water rights for Lick Creek with PODs on private land downstream of the proposed action POD, resulting in an additional potential withdrawal of approximately 1.6 cfs. Those water rights have been leased to the IDWR Water Supply Bank since 2019. If all water rights were fully exercised, even when limiting the uppermost water rights to the SUP instream flow requirements, the lower portion of Lick Creek would likely be dry during a portion of the irrigation season (July through October).

There are no known fish barriers between the POD and Big Creek. The lower reaches of Lick Creek, below the POD, are estimated to have gradients of less than six percent (Cooney & Holzier 2006). The average gradient of a 140-meter-long reach surveyed from a NFS trail to a point upstream of the POD was 18 percent. Considering this steep gradient, juvenile Chinook salmon are expected to only occupy the lower reaches of Lick Creek when adequate flows are present. Juvenile steelhead are expected to be able to occupy a greater proportion of Lick Creek and *O. mykiss* was detected in an environmental deoxyribonucleic acid (eDNA) sample collected at the POD. Given the size of the very small size of the stream, water depth, and habitat characteristics, the likelihood of adult Chinook salmon or steelhead utilizing Lick Creek is considered low.

Under baseline conditions, the usable habitat within the lower portions of Lick Creek is likely severely diminished when water users are exercising their full water rights.

2.4.4. Government Creek

Government Creek is a second order tributary stream to Logan Creek (Figure 3). The estimated, unimpaired monthly 50 percent exceedance flows for Government Creek range from 2 to 31 cfs (Appendix C). Streamflows measured upstream of the Wooten POD during the months of July through October ranged from 1.4 to 3.1 cfs (Table 8). As described in the proposed action section, all of the PODs on Government Creek are screened. A couple of the diversions are self-limiting and incapable of diverting more than their water right. Others are not self-limiting and do not have flow measuring devices. There are additional water rights (Appendix B) with PODs on Government Creek, with the potential to withdraw up to 0.46 cfs during the irrigation season. If all water rights were used to their fullest extent, Government Creek stream flows could be reduced by as much as 39 percent during the irrigation season relative to the estimated monthly unimpaired 50 percent exceedance flow.

Table 8. Estimated monthly median flows at the mouth of Government Creek and measured stream flows (cubic feet per second) above the Wooten point of diversion.

Month	Estimated median flow (cfs)	Measured stream flow (cfs) [a]				
		1987	2010	2013	2015	2022
July	10.5	1.4		3.1		
August	4.4			1.9		2.9
September	3.1			1.7[b]	1.7	
October	2.9		2.5	1.8		

[a]Expected measurement error is +/- 10 percent.
[b]Rainfall in mid-September increased flows.

Juvenile Chinook salmon have not been documented in Government Creek to date. There are no known barriers between the diversions on Government Creek and its confluence with Logan Creek, although there are numerous step pool complexes formed by large wood and boulders. Intrinsic potential (IP) for spawning and early rearing is modeled as super low to none (Cooney

& Holzier 2006) for Chinook salmon. For steelhead, IP for spawning and early rearing is similarly characterized as either super low to none or low. Given stream characteristics, there is low likelihood that adult Chinook salmon or steelhead utilize this creek for spawning or migration and holding. One eDNA sample detected *O. mykiss* in upper Government Creek, indicating the potential for juvenile steelhead to use this stream for rearing.

2.4.5. Logan Creek

Logan Creek is a third-order tributary to Big Creek (Figure 3). The estimated, unimpaired monthly 50 percent exceedance flows for Logan Creek at its mouth range from 6 to 93 cfs (Appendix C). Streamflows measured upstream of the Gillihan POD during the months of July through October ranged from 5.3 to 20.6 cfs (Table 9). The Gillihan POD is screened and has a flow control device installed. There are two other active water rights in the drainage (Appendix B) that can withdraw a total of 0.06 cfs from surface water. If all water rights were used to their fullest extent in this drainage, Logan Creek flows, upstream of the Government Creek confluence could be reduced by as much as 9 percent during the irrigation season. Downstream of the Government Creek confluence, flow in Logan Creek could be reduced by as much as 13 percent relative to estimated monthly median flows at the mouth of Logan Creek.

Table 9. Estimated monthly median flows in Logan Creek above the Government Creek confluence and measured stream flows (cubic feet per second) above the Gillihan point of diversion.

Month	Estimated median flow (cfs)[a]	Measured stream flow (cfs)[b]				
		1987	2010	2013	2015	2022
July	20.8	20.6		14.6		
August	8.7			10.3		9.9
September	6.2			7[c]	5.3	
October	5.7		7.4	11.1		

[a]These values are estimated upstream of the Government Creek confluence by subtracting the Government Creek estimated median monthly flows from those for Logan Creek at its mouth.
[b]Expected measurement error is +/- 10 percent.
[c]Rainfall in mid-September increased flows.

Within the action area, Logan Creek is characterized as having some high IP habitat for both Chinook salmon and steelhead. Spawning surveys have not been conducted in this stream; but stream characteristics suggest that adult Chinook salmon and adult steelhead occupancy and spawning is possible. Juvenile Chinook salmon have been documented in Logan Creek downstream of the Government Creek confluence. Juvenile steelhead have been documented at a variety of locations in Logan Creek.

2.4.6. No Name Creek

No Name Creek is a first order tributary to Big Creek (Figure 3). The estimated, unimpaired monthly 50 percent exceedance flows for No Name Creek range from 0.5 to 6.5 cfs (Appendix C). Streamflows in No Name Creek were measured in September of 2022, and were approximately 0.5 cfs near the PODs. Other than the water rights included as part of the proposed action, no other water rights exist in this small drainage. If all the water rights were fully exercised, the lower portion of the stream is expected to run dry at some point during the irrigation season. The permittee reported that in some years even when the hydropower diversion is not in operation, No Name Creek dries up near the confluence with Big Creek (Miri Gillihan, email, February 12, 2023, as cited in Zurstadt & Nalder 2023). Currently, one POD is not screened and neither POD has flow control or flow measuring devices.

No Name Creek is relatively steep, with an average gradient of 15 to 20 percent. Due to its small size, the stream was not included in the IP model. On July 27, 2023, the PNF electrofished approximately 120 meters of the stream between the POD and the private property boundary downstream (Zurstadt 2023b). No fish were captured or observed. The creek had an estimated average depth of less than 0.5 feet and an estimated wetted width of 2 to 3 feet. No water was being diverted at the time of the survey. One eDNA sample from 2017 documented *O. mykiss* in the lower reach of No Name Creek; Chinook salmon were not detected. The creek flows for about 250 feet on private property before reaching Big Creek. The stream is not expected to be used for adult spawning or holding. Lacking further information regarding fish use of habitat in lower No Name Creek, we have assumed that juvenile fish may be present on occasion. Anadromous fish are not expected to be present at the POD.

2.4.7. Pioneer Creek

Pioneer Creek is a second order tributary to Big Creek (Figure 2). The estimated, unimpaired monthly 50 percent exceedance flows for Pioneer Creek range from 2 to 34 cfs (Appendix C). Streamflows in Pioneer Creek were measured upstream of the uppermost POD during the months of July through October, and ranged from a low of 1.0 to 2.5 cfs (excluding suspect data in July 2013) (Table 10). All of the PODs on Pioneer Creek are screened and are equipped with a flow control device. Idaho water right 77-14145 allows an additional 0.22 cfs diversion from Pioneer Creek for year-round hydropower (non-consumptive use).

Pioneer Creek is modeled as having super low to no IP for Chinook salmon and steelhead spawning and early rearing. Considering this, it is very unlikely that adult anadromous salmonids occupy this stream. In addition, juvenile Chinook salmon have not been documented in Pioneer Creek. Juvenile *O. mykiss* have been detected in Pioneer Creek from its mouth to upstream of the PODs.

Table 10. Estimated monthly median flows in Pioneer Creek and measured stream flows (cubic feet per second) above the uppermost point of diversion.

Month	**Estimated median flow (cfs)**	**Measured stream flow (cfs)[a]**			
		2010	**2013**	**2015**	**2022**
July	11.6	80[b]			
August	4.8		2.5		
September	3.4	2.01	2	1	2.1
October	3.2		1.3		

[a]Expected measurement error is +/- 10 percent.
[b]This is an extraordinarily high value, and is suspect data.

2.4.8. Cliff Creek

Cliff Creek is a second order tributary to Big Creek (Figure 2). The estimated, unimpaired monthly 50 percent exceedance flows for Cliff Creek range from 3 to 41 cfs (Appendix C). Streamflows in Cliff Creek were measured in September 2010 as being 1.05 cfs (Kennedy et al. 2011). No other flow measurements are available. Currently, a portable pump is being used to deliver water from Cliff Creek (on private land) to the pasture. No additional water rights are currently authorized on Cliff Creek.

Cliff Creek is modeled as having super low to no IP for Chinook salmon and steelhead spawning and early rearing. Considering this, it is very unlikely that adult anadromous salmonids occupy this stream. Juvenile Chinook salmon have not been documented in Cliff Creek. Juvenile *O. mykiss* have been detected in Cliff Creek from its confluence with Big Creek to upstream of the PODs.

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 (see 50 CFR 402.02). 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 the factors set forth in 50 CFR 402.17(a) and (b).

2.5.1. Effects on Chinook Salmon and Steelhead Species

Authorizing the operation and maintenance of diversions on NFS land in the Big Creek watershed could result in a variety of adverse effects. Potential effects that are not related to flow reduction include physical damage to riparian and stream channel habitat from maintenance or construction activities, blockage of upstream migration by diversion structures, and entrainment or impingement of juvenile fish. Flow-related impacts include impairment of migration, increase in fine sediment, increase in stream temperatures, reduced availability of cold water refuges, and reduced productivity of rearing habitat.

The proposed action will permit activities that have been ongoing since as early as 1920. The last water right included in the proposed action to be authorized by IDWR, has been active for more than 35 years. Each SUP has a duration of 20 years; however, the PNF structured their proposed action to include SUP reissuance and operation and maintenance of authorized facilities in perpetuity. While year-round diversions for some beneficial uses may occur, most of the residences are summer cabins that are unoccupied during the winter months, with the exception of the TWRS. As a result, the most significant effects from the diversion occur July through October when the residences are occupied and many of the water rights including irrigation are in use.

2.5.1.1. Non-Flow Related Effects of Water Diversion Facilities

Operation and maintenance of water diversion facilities could result in physical damage to occupied Chinook salmon and steelhead spawning and rearing habitat. The physical damage, in turn, could negatively impact fish that occupy the stream. Similarly, installation of the new diversion structure in Cliff Creek can cause physical damage to habitat as well as disturb any fish that are present.

Maintenance of the water systems will generally include activities such as removing accumulated debris, replacing broken pipes, adjusting rock diversions, fixing leaks in ditches, and brushing and hazard tree removal around water diversion and conveyance facilities. General maintenance will be performed with hand tools only. General maintenance does not include any expansion of the existing facilities or otherwise changing the existing footprint of the water system. If the footprint of the existing facilities is proposed to be expanded, a permit amendment will be required and additional ESA consultation will be completed if any of the reinitiation triggers in Section 2.11 are met.

We expect facility maintenance could damage riparian vegetation, streambanks and stream channels, which could reduce shade, increase water temperature, reduce instream habitat for rearing fish, reduce habitat for holding adult salmonids, and increase sediment delivery and deposition. Alteration of vegetation within the RCA requires PNF approval under the annual OMPs. In the last 10 years, no requests have been made to remove vegetation. Some trimming of shrubs and tree limbs may be required to facilitate access. Overall, vegetation manipulation is expected to occur infrequently and only to a limited extent; therefore, there will not be a measurable impact on stream shading nor water temperature. Actions that result in soil disturbance require PNF approval under the annual OMPs. Such activities will require erosion control and other mitigations to minimize sediment delivery. There may be periodic spikes in turbidity as a result of ground disturbance or as a result of clearing debris from the PODs; however, these spikes are expected to be low in magnitude, infrequent, and last only minutes. Individual fish are not expected to be affected, lethally or sub-lethally, by these turbidity pulses.

The proposed action includes installation of a new diversion intake structure in Cliff Creek. Installation of the POD will involve wading into the stream to drive rebar stakes into the streambed (using a hammer, post-driver, or equivalent) and to attach a properly screened funnel box to them. No dewatering or fish removal will be required to accommodate this work. If present, fish will temporarily move to an alternative location during the short construction period, which we assume will be at most a few hours. Considering the short duration of displacement coupled with anticipated low juvenile densities and availability of nearby habitat of equivalent quality and forage, the behavioral change will have inconsequential effects on growth and survival. Little ground disturbance is expected to occur in the RCA, limiting the potential for erosion and sediment delivery. Inconsequential amounts of turbidity may occur during wading in the stream and driving the rebar into the substrate. Individual fish are not expected to be affected by these turbidity pulses.

Operation of the diversions can impede fish migration and can result in entrainment or impingement of juvenile fish. These are pathways of effect discussed further below.

Fish Passage Barriers. Fish passage barriers that limit the movement of adult and/or juvenile salmonids within a watershed can ultimately reduce successful spawning and rearing. Although fish often spawn in limited portions of a watershed, juveniles spread out and occupy any suitable areas that are accessible. Therefore, tributary streams that do not support spawning still play a very important role in the salmonid life cycle (Scrivener et al. 1994). Generally speaking, greater habitat availability results in greater carrying capacities of a watershed, which could in turn lead to greater population productivity. The proposed action can create passage barriers as a result of either the physical presence of the diversion structure or the removal of water from a stream reach. This section addresses the physical presence of diversion dams and weirs.

Many of the diversion structures included in the proposed action include small impoundments, rock weirs, and wooden boxes or pipes placed directly in the stream channel to divert water into the water conveyance structures (pipes and/or ditches). These diversion structures, especially the rock weirs and impoundments, have the potential to impede fish passage in at least some flows. In the past, some of the rock weirs have been constructed in such a way that fish passage could be impaired (Zurstadt 2016). Permittees have been instructed verbally or through formal letters to not construct channel-spanning weirs, and since around 2017 there has been good compliance (C. Zurstadt, personal observation, 2023a). The OMP for each SUP includes a requirement that rock weirs be kept to the minimum size needed and will not block fish passage. Minor manipulation of flows with rock weirs that only impact flow on the channel margins are not expected to impede upstream or downstream fish passage. Two diversions are channel-spanning by design and have the potential to impede fish passage. These are the Gillihan POD on No Name Creek and the TWRS POD 1 on Pioneer Creek.

While the Gillihan POD on No Name Creek creates an impassible vertical drop when the checkboards are in place; fish are not expected to be present at the POD. As such, fish passage is not impacted by the POD. The TWRS POD 1 on Pioneer Creek spans the stream channel and creates a vertical 0.8-foot drop (Kennedy et al. 2011). Kennedy et al. (2011) documented many natural and artificial "barriers" in Pioneer Creek downstream of POD 1, many of which were larger than the vertical drop at POD 1, and yet found trout downstream and upstream of POD 1. Given that fish are present above and below POD 1 and considering the height drop at POD 1 in the context of the natural stream geomorphology, it is unlikely that the POD is impeding upstream or downstream fish passage.

Entrainment or Impingement of Juvenile Salmonids. Entrainment occurs when a fish passes through a POD and becomes stuck in the water system. If the fish is unable to return to the stream either at the POD or at some point farther downstream in the water system, then that fish will die. Entrainment typically occurs when a POD in occupied habitat is not appropriately screened. If improperly designed, screened diversion structures could also harm or even kill ESA-listed fish through impingement. Impingement occurs when a fish is not able to avoid contact with a screen surface, trash rack, or debris accumulated at the intake. This happens when the stream velocity at the screen exceeds the swimming capability of the fish. Such contact may cause bruising, descaling, and other injuries. Direct mortality can also occur if impingement is prolonged, repeated, or occurs at high velocities. To minimize the potential for adverse effects to ESA-listed fish, NMFS developed design criteria and guidelines for fish screens and bypass facilities (NMFS 2022a).

There is low to no risk of entrainment because all but one (the Wilda POD) of the active PODs in fish-bearing streams have a fish screen that meets NMFS criteria and guidelines. The Wilda POD on Government Creek has a screen mesh size of less than 3/32 inch, which is still expected to protect against entrainment. Prior to installing the new structure, the TWRS will provide the Cliff Creek intake design to the PNF for review and approval with the Level 1 Team. The Level 1 Team will ensure the design adheres to the NMFS (2022a) screening criteria. The Gillihan diversion on No Name Creek is the one POD without a fish screen; however, fish are not expected to occur in the vicinity of the POD for reasons previously described (Section 2.4.6). Because all the PODs in stream reaches known to be fish bearing have appropriately sized screens, entrainment is not expected.

Screens that are designed, operated, and maintained in a manner that is consistent with the NMFS guidelines (NMFS 2022a) are expected to minimize the potential to impinge juvenile fish. As described above, all of the screens, with the exception of the Wilda POD, have NMFS approved designs. There is uncertainty regarding whether the Wilda intake meets all NMFS end-of-pipe recommendations for approach velocities and sweeping velocities. During numerous inspections of the screens from 2012 to 2022, fish impingement has not been observed (C. Zurstadt, Big Creek fish screen monitoring, 2012–2022). The screen is located within a collection box, which functions to limit the flow of water near the intake, and the flow of water is likely more influenced by the withdrawal of water through the intake than by stream hydraulics. For these reasons, we believe the risk of impingement at the Wilda POD is extremely low. Further, the OMP accompanying each SUP will contain a requirement for permittees to ensure the diversion structures are kept in good working condition and cleared of debris. For these reasons, there is minimal risk of impingement at all of the screens.

Summary. In summary, the non-flow related effects associated with the installation of the Cliff Creek intake structure along with ongoing operation and maintenance of the facilities will have minor, short-lived impacts on ESA-listed species. Fish may temporarily relocate to other habitats while fish screens are cleared of debris or instream weirs are adjusted. If streams experience elevated turbidity from maintenance activities, the turbidity pulses will be short-lived, low in magnitude, and infrequent. No fish are expected to be entrained in diversion facilities, and assuming proper operation and maintenance, there is a very low risk of impingement at all PODs.

2.5.1.2. Flow-Related Effects of Operation and Maintenance of Water Diversions

Permitting the operation of water systems on NFS lands in the Big Creek drainage will reduce flow in streams that Chinook salmon and steelhead use for incubation, rearing, migration, holding (pre-spawn), and/or spawning. As indicated previously, flow reductions could occur year-round; however, with the exception of the TWRS, the residences are primarily inhabited only during the spring, summer, and fall months.

Because of their size, the adult life stages are often perceived to be the most limiting with respect to streamflow, and inadequate streamflow can impair upstream migration of adults (Cragg-Hine 1985; Mitchell & Cunjak 2007), which could limit adult access to spawning grounds. Inadequate streamflow could also adversely affect holding and spawning adults. However, available literature indicates that flow during the rearing life stages is often a limiting factor (Arthaud et al.

2010; Beecher et al. 2010; Elliott et al. 1997; Mathews & Olson 1980; Mitro et al. 2003; Nislow et al. 2004) and can be the primary limiting factor (Arthaud et al. 2010; Beecher et al. 2010; Elliott et al. 1997; Mathews & Olson 1980). This is because in order to grow and survive, juvenile salmon need access to abundant food, have adequate space and cover, and have access to cold-water refuges during warmer periods.

Food availability for stream dwelling salmonids is generally positively related to streamflow across the entire range of base flows (Davidson et al. 2010; Harvey et al. 2006; Hayes et al. 2007) and this relationship can extend into spring (i.e., higher) flows (Davidson et al. 2010). Jager (2014) reported juvenile salmon grow measurably faster during years, in which floodplains are inundated, presumably due to increased production of invertebrates (Jager 2014), indicating that flood flows are also important for rearing salmon. Furthermore, reducing streamflow reduces overall habitat quantity, which in turn reduces the foraging opportunities and foraging efficiency of salmonids (Boulton 2003; Nislow et al. 2004; Stanley et al. 1994).

In addition to impacting available forage, foraging opportunities and foraging efficiency, stream flow reductions can alter other habitat features that salmonids rely upon for growth, survival, and successful reproduction. Juveniles must have access to instream object cover and in-water escape cover to rear successfully (Harvey et al. 2006); reducing flow can reduce the amount and types of habitat accessible to rearing salmonids. Reduction in streamflow caused by surface water diversions can also result in long-term increases in fine sediments in stream substrates (Baker et al. 2011), which reduces the quality and quantity of spawning and rearing habitat as well as forage potential.

Salmon and steelhead are poikilotherms, meaning their body temperature is variable and linked to the surrounding environment. Juvenile salmonids need cooler stream temperatures to grow, resist disease, efficiently forage, and successfully smolt. Coldwater refuges, such as those provided by tributaries, are vitally important for rearing juvenile Chinook salmon and steelhead (Richter & Kolmes 2005; Sauter et al. 2001) and for pre-spawning adult Chinook salmon (Berman & Quinn 1991; Torgersen et al. 2012). As mainstem temperatures increase, salmon and steelhead may behaviorally thermoregulate by moving into thermal plumes near the mouths of these tributaries or move into the tributaries themselves (Torgersen et al. 2012).

Streamflow and stream temperature are strongly linked environmental variables. Thermal regimes are influenced by energy exchange across the air-water interface and between the stream bed and banks, and through groundwater or hyporheic upwelling (Bois et al. 2023; Miralha et al. 2022; Noa-Yarasca et al. 2023). Reducing streamflow can result in increased stream temperatures during the summer (Arismendi et al. 2012; Meier et al. 2003; Miller et al. 2007; Rothwell & Moulton 2001; Tate et al. 2005). The degree, to which changes in streamflow can alter stream temperatures depends on a number of factors including, but not limited to stream size, stream shading, stream gradient, and hyporheic exchange. Modeling by Meier et al. (2003) found that for a steep (14.4 percent), 70 percent shaded mountain stream with 88 cfs, there was almost no temperature change due to 50 percent water diversion. Model results for a lower gradient (3.8 percent), lesser shaded (14 percent) stream with flows of 53 cfs indicated a 0.3°C temperature increase with 50 percent diversion.

Monitoring performed by the PNF suggests effects of diversions in the Big Creek drainage on stream temperature are small (Ferguson 2019). Absent paired studies on streams not impacted by diversions, it is difficult to differentiate effects associated with water withdrawal versus background variability, natural stream warming in the downstream direction, and measurement error. Differences in the 7-day moving average of maximum daily stream temperatures upstream and downstream of diversions on Government and Pioneer Creeks from 2015–2017 were typically between 0.2 and 0.4°C, respectively. The difference was more pronounced during the 2018 monitoring season (up to 0.65°C in Government Creek). Even with these increases in stream temperatures, overall conditions in the streams appear cold enough (Section 2.4.1) to fully support Chinook salmon and steelhead. Over time, it is possible that climate change will exacerbate the effect of these small diversions.

The PNF suggested that adverse effects would not be expected where flow reductions are less than 10 percent, however, NMFS disagrees with this assertion. Neither NMFS nor the PNF found studies examining the impact of flow reductions as low as some of those considered in the proposed action. Bradford and Heinonen (2008) reviewed a handful of studies that examined the effects of flow reduction on fish populations and macroinvertebrate communities in relatively small streams. The authors concluded that results of those few studies were relatively consistent in that there was little change to invertebrate or fish populations with the diversion of 50–75 percent of the summer low flows and more drastic changes were observed with diversion of greater than 75 percent of the flows. Notably, while there were no detectable changes in fish populations, two of these studies found that fish growth was negatively affected when flows were reduced 32 percent or more (Nuhfer & Baker 2004; Rimmer 1985). Harvey et al. (2014) evaluated the effects of diverting 24 percent of summer flows in a stream exhibiting similar characteristics to those considered in this proposed action. The authors found slightly higher biomass and abundance of rainbow trout above the diversion compared to below the diversion. It is worth noting that other factors such as habitat quality and forage availability were not examined as part of the Harvey et al. (2014) study.

A variety of studies have shown that year class strength (i.e., numbers of adults returning) of salmonid populations is positively related to streamflow (Arthaud et al. 2010; Beecher et al. 2010; Elliott et al. 1997; Mathews & Olson 1980; Mitro et al. 2003; Nislow et al 2004; Ricker 1975). Arthaud et al. (2010) found that the effects of streamflow on rearing juveniles can influence adult return rates. Year class strength of many salmonid populations is positively related to streamflow (Arthaud et al. 2010; Beecher et al. 2010; Elliott et al.1997; Mathews & Olson 1980; Mitro et al. 2003; Nislow et al. 2004; Ricker 1975). A review of 46 studies found that salmonid demography was usually positively, and was never negatively, related to summer flow (Kovach et al. 2016). Arthaud et al. (2010) determined that streamflow affected year class measured as out-migrating juveniles, which in turn affected the number of returning adults, resulting in a relationship of rearing streamflow and whole life cycle productivity. Because fish growth is related to streamflow (Davidson et al. 2010; Harvey et al. 2006) reducing streamflow in rearing habitat likely reduces the size of downstream migrating smolts. Smaller smolts have higher mortality outside of their natal tributaries (Zabel & Achord 2004), which results in lower smolt to adult return rates.

Therefore, in this opinion, we have quantified the effects of the proposed action on Chinook salmon and steelhead based on relationships of “rearing” streamflow in Big Creek and population productivity, which are presumably driven by food availability, access to suitable cover, and possibly by water temperature. The methods used to quantify the effects on Chinook salmon and steelhead are described in more detail below.

Step 1 - Quantifying Flow Reductions. This step entailed calculating the effect of the proposed action on flow in each stream reach for each month from May through October. The percent flow reductions were calculated by dividing the rate of diversion by the measured (typically July–October) or estimated 50 percent exceedance flows, whichever was lower. The methods used to derive the estimated 50 percent exceedance flows are included in Appendix C.

For our analysis, we assumed all active water rights would be used for the entire season of use and the maximum water right would be withdrawn. Although flow immediately below a POD will be reduced by the amount of water withdrawn, water that is non-consumptively used will eventually return to the drainage network. Water that is consumptively used (i.e., evapo-transpiration of a portion of the water used for irrigation purposes) is assumed to be lost from the Big Creek drainage permanently. Table 11 includes a summary of the stream reaches that are of interest to this opinion and the assumptions NMFS made regarding flows in the reach. Tables 12 through 15 include a summary of the potential flow reductions (expressed as a percent reduction) in each stream with PODs. To calculate the percent reductions conservatively, we used the lower of either the estimated monthly 50 percent exceedance flow or measured flow presented in Tables 6 through 10. Table 16 includes a summary of the potential flow reductions in Big Creek.

Table 11. Stream reaches that could be affected by the Big Creek Water Diversions Project and the assumptions National Marine Fisheries Service made regarding flow loss.

Stream Reach	Assumption Regarding Flow Effects
Lick Creek from Point of Diversion (POD) to mouth	All diverted flow is lost from Lick Creek.
Big Creek from Lick Creek to Logan Creek	All diverted flow in Lick Creek is lost from this segment of Big Creek.
Logan Creek from Gillihan POD to confluence of Government Creek	All diverted flow is lost from this segment of Logan Creek.
Government Creek from Wooten POD to mouth	All diverted flow is lost from Government Creek.
Logan Creek from Government Creek to mouth	All diverted flow from Logan and Government Creeks is lost.
Big Creek from Logan Creek to Smith Creek	Diverted flow from Lick, Logan, Government, and No Name Creeks is lost in this reach of Big Creek. The one exception is the hydropower diversion on No Name Creek, which is returned to Big Creek.
No Name Creek from POD to mouth	All diverted flow is lost from No Name Creek.
Big Creek from Smith Creek to Pioneer Creek	Only the consumptively used water associated with diversions on Lick, Logan, Government, and No Name Creeks is lost in this reach of Big Creek.
Pioneer Creek from POD1 to mouth	All diverted flow is lost from this reach of Pioneer Creek.
Cliff Creek from POD to mouth	All diverted flow is lost from Cliff Creek.
Big Creek immediately below Cliff Creek	All diverted flow from Cliff and Pioneer is lost from this reach as well as all consumptively used water upstream.

Stream Reach	Assumption Regarding Flow Effects
Big Creek at mouth	Only the consumptively used water associated with diversions in the drainage are lost at this point.

Table 12. Monthly percent reduction in estimated or measured flows in Lick Creek assuming utilization of the full water right, but no more than 50 percent of the flow. Shaded rows with bold font are based on measured flows.

Month	Mean Monthly Discharge[1] (cfs)	Water Right (SUP limit[2]) (cfs)	Flow Reduction (%)
January	1	0.74 (0.5)	50
February	1	0.74 (0.5)	50
March	1.2	0.74 (0.6)	50
April	3	0.87	29
May	13	1.06	8
June	15.5	1.06	7
July	**1.3**	**1.06 (0.65)**	**50**
August	**1**	**1.06 (0.5)**	**50**
September	**1.2**	**1.06 (0.6)**	**50**
October	**1.3**	**1.06 (0.65)**	**50**
November	1.3	0.74 (0.65)	50
December	1.2	0.74 (0.6)	50

Notes: cfs – cubic feet per second; SUP – special use permit.
[1]This is the lower of either (a) the estimated monthly 50 percent exceedance flows (Appendix C) or (b) the lowest measured flow.
[2]The SUP restricts the diversion to no more than 50 percent of upstream flows.

Table 13. Monthly percent reduction in estimated or measured flows in Logan and Government Creek. Shaded cells with bold font are based on measured flows.

Month	Mean Monthly Discharge[1] (cfs)			Logan Cr A		Government Cr		Logan Cr B	
	Logan Cr A[2]	Gov't Cr	Logan Cr B	Water Right (cfs)	Flow Reduction (%)	Water Right (cfs)	Flow Reduction (%)	Water Right (cfs)	Flow Reduction (%)
January	4.2	2.1	6.3	0.12	3	0.3	14	0.42	7
February	4.2	2.1	6.3	0.12	3	0.3	14	0.42	7
March	4.6	2.4	7	0.12	3	0.3	13	0.42	6
April	11.9	6.0	17.9	0.12	1	0.3	5	0.42	2
May	52.1	26.3	78.4	0.43	1	0.71	3	1.14	1
June	62.1	31.3	93.4	0.43	1	0.71	2	1.14	1
July	**14.6**	**1.4**	**17.7**	**0.43**	**3**	**0.71**	**51**	**1.14**	**6**
August	8.7	**1.9**	**12.2**	0.43	5	**0.71**	**37**	**1.14**	**9**
September	5.3	**1.7**	**8.7**	0.43	8	**0.71**	**42**	**1.14**	**13**
October	5.7	**1.8**	8.6	0.43	8	**0.71**	**39**	1.14	13
November	5.2	2.6	7.8	0.12	2	0.3	12	0.42	5
December	4.6	2.4	7	0.12	3	0.3	13	0.42	6

Notes: cfs – cubic feet per second; Cr – Creek; Logan Cr A = upstream of Government Creek; Logan Cr B = downstream of Government Creek.
[1]This is the lower of either (a) the estimated monthly 50 percent exceedance flows (Appendix C) or (b) the lowest measured flow.
[2]The estimated monthly 50 percent exceedance flow was calculated by subtracting Government Creek flow estimates from Logan Cr B flow estimates.

Table 14. Monthly percent reduction in estimated or measured flows in No Name Creek. Shaded rows with bold font are based on measured flows.

Month	Mean Monthly Discharge[1] (cfs)	Water Right (cfs)	Flow Reduction (%)
January	0.4	0.58	145
February	0.5	0.58	116
March	0.5	0.58	116
April	1.3	0.58	45
May	5.5	0.58	11
June	6.5	0.58	9
July	2.2	0.58	26
August	0.9	0.58	64
September	**0.5**	**0.58**	**116**
October	0.6	0.58	97
November	0.5	0.58	116
December	0.5	0.58	116

Notes: cfs – cubic feet per second.
[1]This is the lower of either (a) the estimated monthly 50 percent exceedance flows (Appendix C) or (b) the lowest measured flow.

Table 15. Monthly percent reduction in estimated or measured flows in Pioneer and Cliff Creeks. Shaded cells with bold font are based on measured flows.

Month	Mean Monthly Discharge[1] (cfs)		Pioneer Cr		Cliff Cr	
	Pioneer Cr	Cliff Cr	Water Right (cfs)	Flow Reduction (%)	Water Right (cfs)	Flow Reduction (%)
January	2.3	2.8	0.11	5	0	0
February	2.3	2.8	0.11	5	0	0
March	2.6	3.1	0.11	4	0	0
April	6.6	7.9	0.64	10	0.1	1
May	28.9	34.5	0.64	2	0.1	0.3
June	34.5	41.1	0.64	2	0.1	0.2
July	11.6	13.8	0.64	6	0.1	1
August	**2.5**	5.8	**0.64**	**26**	0.1	2
September	**1**	**1.05**	**0.64**	**64**	**0.1**	**10**
October	**1.3**	3.8	**0.64**	**49**	0.1	0
November	2.9	3.4	0.11	4	0	0
December	2.6	3.1	0.11	4	0	0

Notes: cfs – cubic feet per second.
[1]This is the lower of either (a) the estimated monthly 50 percent exceedance flows (Appendix C) or (b) the lowest measured flow.

Table 16. Monthly percent reduction in estimated or measured flows in Big Creek at various locations. Shaded cells with bold font are based on measured flows.

Month	*Big Creek Below Lick Creek*			*Big Creek Below Logan Creek*		
	Discharge (cfs)[1]	Flow Reduction (cfs) [2]	Flow Reduction (%)	Discharge (cfs)[1]	Flow Reduction[2] (cfs)	Flow Reduction (%)
January	9.8	0.5	5.1	18.2	1.06	5.8
February	9.8	0.5	5.1	18.2	1.06	5.8
March	11	0.6	5.4	20.4	1.16	5.7
April	28	0.87	3.1	51.8	1.43	2.8
May	122.7	1.06	0.9	226.8	2.48	1.1
June	146.3	1.06	0.7	270.5	2.48	0.9
July	**30.8** [3]	**0.65**	**2.1**	**30.8**	**2.07**	**6.7**
August	**20.3** [3]	**0.5**	**2.5**	**20.3**	**1.92**	**9.5**
September	14.5	0.6	4.1	**18.5**	**2.02**	**10.9**
October	13.5	0.6	4.4	25.0	2.02	8.1
November	12.2	0.65	5.3	22.5	1.21	5.4
December	11	0.6	5.4	20.4	1.16	5.7
	Big Creek below Smith Creek			*Big Creek below Pioneer Creek*		
January	20.5	0	0.0	176	0.11	0.06
February	20.5	0	0.0	176	0.11	0.06
March	23.0	0	0.0	197	0.11	0.06
April	58.4	0.01	0.02	500	0.65	0.13
May	256.0	0.23	0.09	2193	0.87	0.04
June	305.3	0.42	0.14	2615	1.06	0.04
July	102.3	0.49	0.48	877	1.13	0.13
August	42.8	0.4	0.94	368	1.04	0.28
September	30.2	0.2	0.67	259	0.84	0.33
October	28.2	0.04	0.15	242	0.68	0.28
November	25.4	0	0.0	218	0.11	0.05
December	23.0	0	0.0	197	0.11	0.06

Notes: cfs – cubic feet per second.
[1]This is the lower of either (a) the estimated monthly 50 percent exceedance flows (Appendix C) or the lowest measured flow.
[2]The flow reductions reflect assumptions outlined in Table 11.
[3]The estimated monthly 50 percent exceedance flow was greater than that measured farther downstream. We used the measured flows for Big Creek at Logan Creek rather than the estimated flows of Big Creek at Lick Creek.

Step 2a: Flow-Productivity Relationships. The relationship of "rearing" streamflow in Big Creek and population productivity is used to quantify the potential effects of the proposed action. This relationship is presumably driven by food availability, access to suitable cover, and possibly by water temperature. For this opinion, NMFS used the IDFG index reach redd count data

(1993–2022) for the Big Creek mainstem to estimate the productivity of the Big Creek Chinook salmon population. We assumed that the recruits for a given brood year were comprised of 75 percent 4-year old fish and 25 percent 5-year old fish based on adult age composition reported by the IDFG and NPT (Felts et al. 2020; Poole et al. 2022; Simmons et al. 2022; Tennant et al. 2020). Because there are no flow data for Big Creek that were collected at the same time as the redd count data, NMFS used flow data from the MFSR gage near Shoup (USGS 13310199) on the MFSR. The natural log of the population productivities was regressed against mean monthly flows for May through October (Figure 7). The relationships between streamflow and Big Creek Chinook salmon population productivity are relatively weak (r-squared values ranging from 0.03 to 0.25), but they are positive, which is typical for MFSR Chinook salmon populations (Jim Morrow, NMFS Fisheries Biologist, unpublished data). The preponderance of positive relationships of Chinook salmon population productivity and rearing streamflow suggests that actions that reduce flow during the growing season (i.e., summer and fall months) would reduce population productivity. This relationship represents the best available information for quantifying the effects of flow reduction on this population.

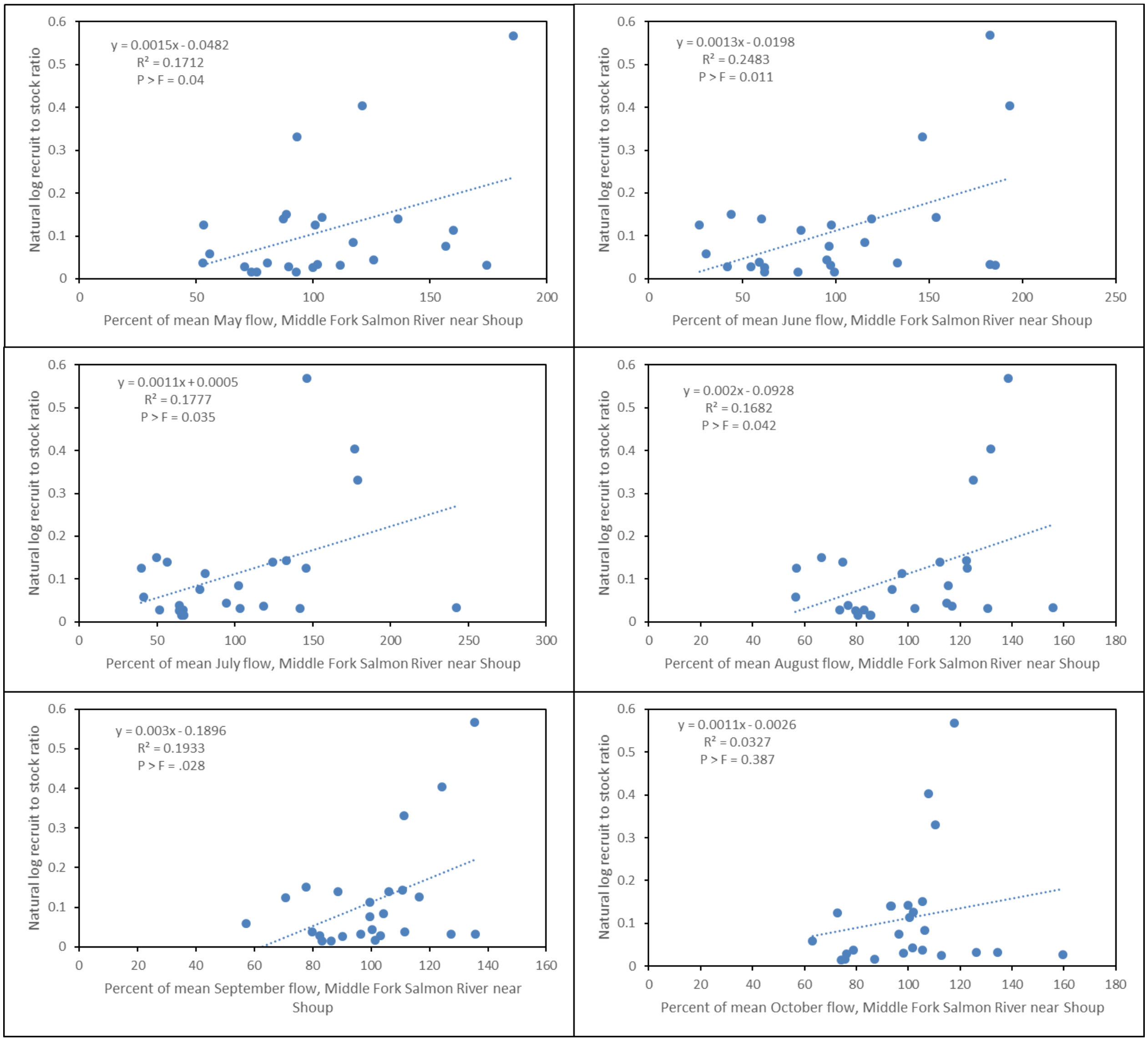

Figure 7. Natural log of recruit to stock ratios for the Big Creek spring/summer Chinook salmon population versus monthly mean flows for May through October (Brood years 1993–2017) measured near Shoup on the Middle Fork Salmon River.

Because steelhead spawn when flows are high, making redds difficult to count, population trend data are not available for any of the MFSR steelhead populations. The Lemhi River is one of the few systems for which population trend data are available for rainbow trout, *O. mykiss*. A comparison of these population trend data to rearing streamflow indicates that flow is important for population productivity (NMFS 2021). Because population data are not available for steelhead in Big Creek, we assumed that steelhead in the Big Creek drainage respond to changes in flow similarly to *O. mykiss* in the Lemhi River drainage because they are the same species. We used population productivity versus rearing flow relationships in the Lemhi River diversions biological opinion (NMFS 2021) to estimate the effect of the proposed action on steelhead rearing in the mainstem Big Creek and in affected tributary streams (Figure 8). Considering the

Lemhi River is a flow-limited system, it is likely that these relationships will over-estimate the effects of flow reductions in the Big Creek drainage.

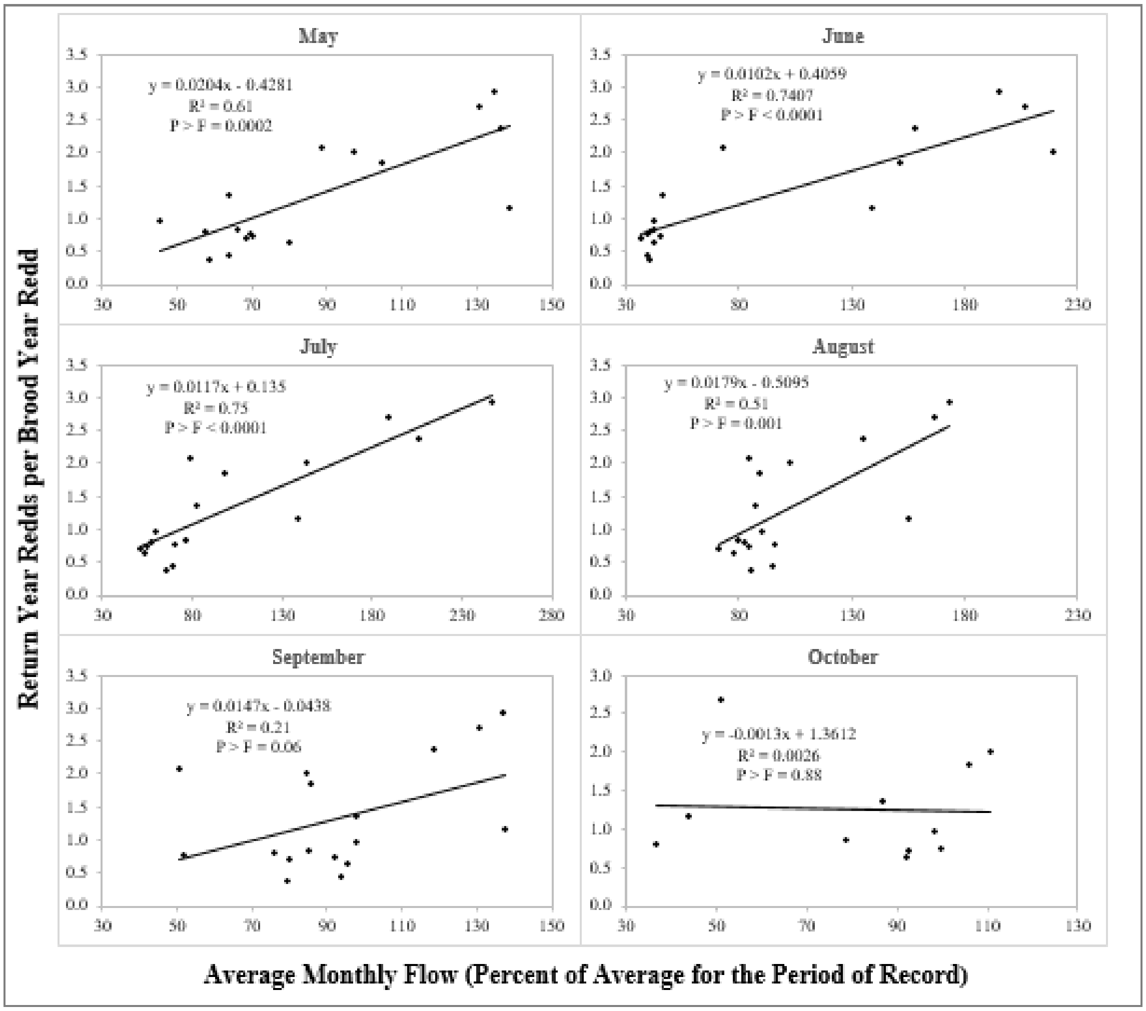

Figure 8. Lemhi River *Oncorhynchus mykiss* whole life cycle productivity versus flow measured at the McFarland Campground gage for brood years 1997–2013 (Source: Figure A.I.5, Appendix A, NMFS 2021).

Step 2b: Quantify Reach-Specific Reductions in Productivity. To quantify potential decreases in productivity as a result of reduced stream flow, NMFS calculated the difference in estimated productivity with and without the action using the regression equations for each month and each stream reach for Chinook salmon and steelhead. We then averaged the results to represent the species-specific effect for the rearing season (May–October) for each reach (Table 17).

Step 3: Quantify the Proportion of Weighted Intrinsic Potential Habitat in the Stream Reach. For this step, we determined the amount of each stream reach that may be occupied by Chinook salmon and steelhead, and expressed that as a percentage of the overall available weighted IP habitat for the population (Table 17). The methodology is described on page 59 of the 2013 biological opinion (NMFS 2013) and is incorporated herein by reference.

Step 4: Quantify Reductions in Productivity at the Population Scale. To quantify the population-level impact, we multiplied the percent reduction in productivity (Step 2b) by the percentage of IP habitat in the affected stream reaches (Step 3). We then summed the results for all of the stream reaches to obtain a population-level productivity reduction (Table 17).

Table 17. Reach specific percent reduction in Chinook salmon and steelhead productivity in stream reaches affected by the Big Creek Water Diversions Project, and percent reduction in productivity of the Big Creek Chinook salmon and the Lower Middle Fork Salmon River steelhead populations.

Stream Reach	**Reach-Specific Reduction in Productivity (%)**		**Proportion of Weighted Intrinsic Potential Habitat in the Stream Reach (%)**		**Reduction in Productivity at Population Scale (%)**	
	Chinook Salmon	***Steelhead***	***Chinook Salmon***	***Steelhead***	***Chinook Salmon***	***Steelhead***
Lick Creek from the mouth to POD	5.2	29.4	0.06	0.04	0.003	0.012
Government Creek from Wooten POD to mouth	4.9	23.6	0.07	0.02	0.003	0.005
Logan Creek from Gillihan POD to Government Creek	0.8	3.18	0.31	0.07	0.003	0.002
Logan Creek from Government Creek to mouth	1.3	5.33	0.23	0.05	0.003	0.003
Big Creek from Lick Creek to Logan Creek	0.44	1.8	2.36	0.51	0.010	0.009
Big Creek from Logan Creek to Smith Creek	1.33	6.05	1.99	0.95	0.026	0.057
Big Creek from Smith Creek to Pioneer Creek	0.16	0.89	44.15	7.60	0.071	0.068
Pioneer Creek from POD1 to mouth	4.8	17.75	0	0.01	0.000	0.002
Cliff Creek from POD to mouth	0.59	2.42	0	0.01	0.000	0.0002
Big Creek from Pioneer Creek to mouth	0.04	0.16	0.2	2.08	0.0001	0.003
Total					**0.12**	**0.16**

The proposed action has the potential to significantly reduce flows in tributary stream reaches immediately below the PODs. Operation of the No Name Creek waters systems can dry the lower 0.15 miles of the creek. The Lick Creek and Government Creek water systems can remove about 50 percent of the streamflow during some months. The water system on Logan Creek can decrease the upper reach of Logan Creek by up to 8 percent (Table 13). Combined, the water systems on Government and Logan Creeks can reduce flow in lower Logan Creek by up to 13 percent (Table 13). Operation of the TWRS water system could reduce flows in Pioneer and Cliff Creeks by approximately 2 to 64 and 0 to 10 percent (Table 15), respectively. All of the tributary reaches impacted by flow reductions comprise approximately 0.7 percent of the weighted IP habitat for the Big Creek Chinook salmon population and about 0.2 percent of the weighted IP habitat for the LMFSR steelhead population.

As expected, flow reductions in Big Creek are less pronounced than those of the tributary streams. Reduction of streamflow in Big Creek below Lick Creek as a result of operating the diversion facility on Lick Creek ranges from 0.9 to 4.4 percent (Table 16). Reduction of streamflow in Big Creek (below Logan Creek) as a result of operating the water systems in the Upper Big Creek drainage ranges from 1 to 11 percent (Table 16). These two affected reaches of Big Creek are within that portion of the mainstem that supports the highest densities of Chinook salmon redds. Similarly, reduction of streamflow in Big Creek (below Smith Creek) as a result of operating the permitted water diversion facilities in the Upper Big Creek subwatershed could range from 0 to 1 percent (Table 16). Below Pioneer Creek, flows in Big Creek may be reduced by up to 0.15 percent (Table 16).

Lick Creek has been observed to be dry at its mouth (Zurstadt & Nalder 2023) and it is possible that the proposed action has and will continue to contribute to the dewatering of the lower portion of this stream during the summer season. No Name Creek has reportedly been dry even when the diversions are not in operation (Zurstadt & Nalder 2023), so it is possible that this stream naturally dries or flows subsurface during some years. Operation of the water diversions likely increases the frequency of the stream drying in its lower reaches.

Maximum base flow reductions for Government, Lick, and Pioneer Creeks will likely reduce the depth and flow of fish habitat. The reduced depth and flow have the potential to inhibit fish movement especially through higher gradient reaches typical of these streams. The PNF has never observed impairment of fish passage or stranding of fish during site visits between 2012 and 2022 (Zurstadt & Nalder 2023), including those conducted in 2015, which had median precipitation well below the median and relatively low measured discharge (Zurstadt 2022). Therefore, we do not expect flow reductions associated with the proposed action to inhibit juvenile salmon or steelhead movement in any reaches because the flow reductions won't reduce depth or increase velocity in remaining wetted areas to impede passage in Logan, Government, Pioneer, Cliff, and Big Creeks. The proposed action may contribute to drying the lower reaches of Lick and No Name Creeks; which would impede fish use of these reaches.

Maximum reductions in flow of 11 percent in Big Creek (from Logan Creek to Smith Creek) and 13 percent of Logan Creek will reduce flow in 2.5 miles and 0.25 miles of potential Chinook spawning habitat, respectively. This flow reduction may cause a slight decrease in available spawning habitat in these reaches. This flow reduction is not expected to cause a migration barrier or hinderance to late summer/fall spawning adult Chinook salmon because adequate water depths and appropriate water velocities will be maintained. Similarly, these flow reductions will not be a factor for spring spawning steelhead, because spawning and incubation occurs early in the year when flows are higher and cabins are less likely to be occupied. Reductions in flow to Big Creek downstream of Smith Creek will be even smaller and are not expected to limit spawning or impede fish passage at any flow. Redds have been documented throughout the impacted reaches in Big Creek and upstream of them, demonstrating passage is maintained in all flow years with operation of the PODs.

Reduced streamflows are expected have adverse effects on the juvenile fish that rear in these reaches due to decreased habitat availability, decreased quantity and quality of forage, and increased competition in the areas that fish move to when displaced from these reaches. In addition, we anticipate that flow reductions associated with the proposed action are likely to lead to slightly warmer downstream temperatures than would otherwise occur absent water withdrawal. It is possible that under future climate scenarios reduced precipitation and streamflows will likely magnify the effects of diversions in Big Creek, but the magnitude and timing of these effects is uncertain. Monitoring of flows as described in the monitoring section will help evaluate long-term trends.

Finally, it is important to note that our analysis assumes water will be withdrawn in accordance with state water rights. However, a number of the diversion structures are capable of pulling more water than allowed under the water right and these structures do not have flow measuring devices installed. Those include the diversions on Lick, Logan, Government (Wooten and Gillihan), and No-Name Creeks. Conversely, it is also important to recognize that water will not be withdrawn at all times of the year, nor will the maximum allowable always be withdrawn. For example, actual water use in Pioneer Creek was no more than 50 percent of the allocated water right when measured (Zurstadt 2022), so the realized effect of operation and maintenance of the TWRS system is likely smaller than that considered in this opinion.

In summary, the proposed action will result in flow reductions in spawning, rearing, and migratory habitat. Flow reductions will alter habitat features that salmonids rely upon for growth, survival, and successful reproduction. The flow-productivity relationships are assumed to incorporate the effects of reduced flow on these habitat features. The calculated reductions in flow associated with the proposed action are predicted to reduce productivity of the Big Creek Chinook salmon and LMFSR steelhead populations by 0.12 and 0.16 percent, respectively.

2.5.2. Effects on Chinook salmon and Steelhead Designated Critical Habitat

The action area contains designated critical habitat for SRS Chinook salmon and SRB steelhead. Critical habitat within the action area has an associated combination of PBFs essential for supporting freshwater rearing, migration, and spawning for Chinook salmon and steelhead. Authorizing the operation and maintenance of diversions on NFS land in the upper and lower Big Creek watersheds has the potential to affect Chinook salmon water quantity, water quality, water temperature, cover/shelter, space, safe passage, riparian vegetation, and food PBFs; and steelhead water quantity, water quality, natural cover, free of artificial obstructions, and forage PBFs. Modification of these PBFs may affect freshwater spawning, rearing and/or migration in the action area. Proper function of these PBFs is necessary to support successful adult and juvenile migration, adult holding, spawning, incubation, rearing, and the growth and development of juvenile fish. In the following sections, we describe how the proposed action may affect these PBFs.

2.5.2.1. Water Quantity PBF

Authorizing operation of water diversions will reduce flow in SRS Chinook salmon and SRB steelhead designated critical habitats. The magnitude of these flow alterations is described in Section 2.5.1.2, and reach-specific flow reductions are summarized in Tables 12 through 16.

While the proposed action is expected to maintain annual floods and channel-forming processes and retain seasonal flow variability and timing, it will reduce baseflows. This, in turn, will reduce the potential productivity of designated critical habitat for Chinook salmon and steelhead.

The most significant flow reductions will occur in tributary stream reaches immediately below the PODs. As previously discussed, the proposed action contributes to the drying of the lower reach in Lick Creek and likely increases the frequency, with which the lower reach of No Name Creek dewaters. Dewatering a portion of a stream will clearly affect the ability of that habitat to function appropriately and support salmon and steelhead. In total, the affected reaches in tributaries to Big Creek comprise approximately 0.7 percent of the weighted IP for the Big Creek Chinook salmon population and about 0.2 percent of the weighted IP habitat for the LMFSR steelhead population. Reductions of streamflow in Big Creek (from Lick Creek to its mouth) will also occur, but will be less pronounced than those of the tributary streams. The mainstem of Big Creek, from Lick Creek to its mouth, comprises approximately 49 and 11 percent of the weighted IP habitat for the Big Creek Chinook salmon and LMFSR steelhead populations, respectively.

Overall, implementation of the proposed action will perpetuate streamflow reductions of varying magnitudes in Big Creek and its tributaries and this reduction will reduce the functioning condition of the water quantity PBF in localized areas.

2.5.2.2. Riparian Vegetation and Cover/Shelter/Space PBFs

As described in 2.5.1, alterations in streamflow and maintenance of diversion facilities can affect the availability of cover and shelter for salmonids, which include undercut streambanks (where appropriate for the channel type), overhanging vegetation, LWD, and deep pools. These features of habitat are supported by a flow regime characterized by annual floods and channel forming processes and a healthy riparian vegetation community that includes trees. Maintenance of the diversion facilities can also impact the functioning condition of RCAs. Riparian vegetation within the RCA provides shade for streams, forage (terrestrial invertebrates) for fish, stabilizes streambanks, filters sediment inputs from the surrounding landscape, and contributes LWD and organic material.

Reduction in streamflow is expected to have localized impacts on cover/shelter and space provided by pools or other inwater refuges in tributary streams. These impacts are expected to occur in the summer and fall months when the diversions are actively used. The stream reaches that may experience these reductions represent a small fraction of the overall habitat available to salmon and steelhead. Flow reductions in Big Creek are too small to measurably impact the available cover/shelter and space PBFs.

Maintenance of water systems will sometimes require trimming and/or removal of riparian vegetation in RCAs. Vegetation removal could reduce the recruitment potential of LWD. In the last 10 years, no requests have been made to remove vegetation. Vegetation manipulation is expected to occur infrequently and only to a limited extent. Furthermore, alteration of RCA vegetation requires PNF approval under the annual OMPs. In addition to having very little impact on riparian vegetation, the presence of intake structures and other components of the water systems along streambanks has had, and is expected to continue to have, minor localized impacts on streambank conditions. The PNF will continue to monitor stream channel conditions at the diversions. If the stream channel conditions are poor, then changes to the division activities will be required.

2.5.2.3. Safe Passage and Free of Artificial Obstruction PBFs

The presence of weirs and alterations in streamflow may affect the quality of salmonid migration habitat (Cragg-Hine 1985; Mitchell & Cunjak 2007; Thompson 1972;). As described in 2.5.1.1, none of the diversion facilities will impede upstream or downstream fish passage. As described in Section 2.5.1.2, maximum base flow reductions for Government, Lick, and Pioneer Creeks will likely reduce the depth and flow of fish habitat; however, these reductions are not expected to impede upstream or downstream juvenile fish passage. Potential drying of the lower portions of Lick and No Name Creeks will inhibit juvenile salmon and steelhead movement. Adult Chinook salmon or adult steelhead passage is also not anticipated to be impacted in Logan or Big Creeks because adequate water depths and appropriate water velocities will be maintained.

2.5.2.4. Water Quality/Temperature PBFs

Routine operation and maintenance of the diversion facilities has the potential to contribute sediment to streams and increase water temperatures. Periodic maintenance of the water diversion and transmission facilities (e.g., clearing debris from the intake, adjusting the weir, or using hand tools to maintain ditches or pipes) can cause a temporary spike in turbidity. Actions that result in soil disturbance require PNF approval under the annual OMPs. Such activities will require erosion control and other mitigations to minimize sediment delivery. Considering the limited amount of disturbance that will occur, and requirements to implement erosion control best management practices, any associated turbidity pulses are expected to be low in magnitude, short in duration (minutes), and infrequent.

As described in Section 2.5.1.2, some small temperature increases are likely to occur downstream of the PODs as a result of flow reductions. Even with these small increases in stream temperatures, stream temperatures are adequate to support all life stages of salmonids, as demonstrated by monitoring. Over time, it is possible that climate change will exacerbate the effect of these small diversions.

2.5.2.5. Forage/Food PBF

Small tributary streams are an important source of invertebrate foods for rearing salmonids (Wipfli & Baxter 2010; Wipfli & Gregovich 2002; Wipfli et al. 2007). As described in Section 2.5.1.2, streamflow reductions can decrease the amount of food available, foraging opportunities, and foraging efficiency. Caldwell et al. (2018) examined the impacts of flow reductions on invertebrate drift in the Upper Shasta River and their results suggested decreased streamflow can reduce the total biomass of invertebrate drift. The proposed action is expected to have the greatest impact on forage produced in No Name and Lick Creeks because of the potential to completely dewater the lower reaches of each creek. We presume that forage reductions could occur in the other streams as well and the effects of that reduction are reflected in the flow-productivity relationships.

Altered riparian vegetation can also decrease the availability of forage. As described in Section 2.5.2.2, the proposed action is not expected to cause much alteration of riparian vegetation. Therefore, the contribution of terrestrial invertebrates to the aquatic ecosystem from riparian vegetation will be maintained.

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 area is Federally managed; however, there are small pieces of land that are privately owned or owned by the State of Idaho. Activities on these lands include continued residential development, authorization of water rights for surface water withdrawals on private land, road maintenance, fuel wood cutting, and motorized and non-motorized recreation use. According to a Demographic Trend and Forecast Report (Clearwater Financial 2023), the population of Valley County, Idaho, has increased by 19 percent and is estimated to double in the next 20 to 30 years. Much of this growth is forecasted to occur near Donnelly and Cascade, Idaho, which is well outside the action area. The action area contains limited private property; however, much of the property is adjacent to streams. Valley County does not allow building in the floodplain and does not allow placement of fill in order to raise the surface elevation in order to build a residence. Considering the remoteness of the area and because it is typically accessed only during snow-free months, we do not anticipate substantial development to occur into the future. If development does occur, we expect those impacts to occur outside of the floodplain given the existing Valley County planning and zoning rules.

There are three additional water rights for Lick Creek downstream of the POD, resulting in an additional potential withdrawal of approximately 1.6 cfs. Those water rights have been leased to the IDWR Water Supply Bank since 2019. If all water rights were fully exercised, even when limiting the uppermost water rights to the SUP instream flow requirements, the lower portion of Lick Creek would likely be dry during a portion of the irrigation season (July through October). The TWRS diverts up to 0.22 cfs from Pioneer Creek to support hydropower. The hydropower returns water back to Pioneer Creek, but a section of stream channel experiences reduced flows.

All of these activities could adversely affect SRS Chinook salmon and SRB steelhead and their designated critical habitat; however, because private land is very limited within the action area, future impacts from development are likely to continue at rates similar to today, and are unlikely to be substantially more severe than they currently are. These impacts have been described in the environmental baseline (Section 2.4).

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 versus cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described earlier in the discussion of environmental baseline (Section 2.4).

2.7. Integration and Synthesis

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

2.7.1. Species

SRS Chinook salmon are at a moderate-to-high risk of extinction. While there have been improvements in abundance/productivity in several populations since the time of listing, the majority of populations, including those that could be impacted by the Project experienced sharp declines in abundance in recent years. In the latest viability report (Ford 2022), the most recent 5-year geometric mean (2015–2019) of natural-origin spawners decreased 63 percent relative to the previous 4-year geomean (2010–2014). In 2019, redd counts in the mainstem Big Creek reached levels similar to those observed at the time of listing. Redd counts have increased through 2022, but have not reached levels seen in the early 2000s. The low levels of redds observed in recent years are expected to negatively affect productivity in the coming year. The Big Creek population remains at a high risk of extinction. This population is targeted to achieve a highly viable status to support recovery of the ESU (NMFS 2017), but it remains far below the abundance and productivity levels needed to achieve a highly viable status (NMFS 2022b)

SRB steelhead continue to be at a moderate risk of extinction within the next 100 years (NMFS 2022c). Similar to Chinook salmon, SRB steelhead have experienced recent, sharp declines in abundance. In the latest viability report (Ford 2022), the most recent 5-year geometric mean (2015–2019) of natural-origin spawners for the population group encompassing Big Creek decreased by almost 60 percent relative to the previous 4-year geomean (2010–2014). This recent, sharp decline in abundance is concerning and expected to negatively affect productivity in the coming years. The LMFSR population is considered to be maintained, however, it is targeted to achieve a highly viable status to support recovery of the DPS (NMFS 2017).

The 5-year status reviews for Chinook salmon and steelhead identified future opportunities to enhance recovery of the species; one of those opportunities was to reduce impacts from water diversions through administration of the SUPs in the Big Creek watershed. Development of the proposed action for water diversion facility SUPs, completing consultation, and implementing any terms or conditions associated with this consultation will reduce impacts from water diversion.

The proposed action includes mitigation measures to protect riparian and instream habitat from adverse effects of maintenance-related activities and from installation of the new Cliff Creek

POD. Turbidity pulses that may occur as a result of any maintenance or installation activities are expected to be short in duration, low in magnitude, and infrequent. If SRS Chinook salmon and SRB steelhead are exposed to maintenance-related stressors (weir maintenance, turbidity pulses, etc.), the stressors are expected to be minor and will not cause any lethal or sublethal effects.

The physical presence of diversion structures in streams and/or the removal of water can create passage barriers to salmon and steelhead. None of the facilities included in the proposed action will create a barrier. Weirs are required to be kept to the minimum size necessary and are required to allow for both upstream and downstream passage. With the exception of the Lick Creek and No Name Creek diversions, flows will not be reduced to the degree that will impede juvenile (Government, Logan, Pioneer, and Cliff Creeks) or adult (Logan and Big Creeks) fish passage. The lower reaches of No Name and Lick Creeks may be dewatered as a result of the proposed action, which will preclude juvenile salmon and steelhead use.

All but one diversion in fish-bearing stream reaches comply with the NMFS (2022a) screening criteria. As such, risk of entrainment or impingement at these locations will be sufficiently avoided or minimized, assuming proper maintenance. The Wilda POD may not meet all of NMFS screening recommendations regarding approach velocities and sweeping velocities, therefore, there is some uncertainty regarding the impingement risk that exists at the Wilda POD. Because juvenile fish densities are expected to be low given the habitat characteristics and the intake is located within a wooden box that helps reduce surrounding water velocity, we believe the risk of entrainment or impingement at the Wilda POD is relatively low. The PNF has never observed an impinged fish on the screen.

The proposed action will result in flow reductions in spawning, rearing, and migratory habitat. Flow reductions can alter other habitat features that salmonids rely upon for growth, survival, and successful reproduction. Those features include stream temperature, access to adequate cover, suitable stream substrates that support spawning and rearing, and forage. Flow-productivity relationships are assumed to incorporate the effects of reduced flow on these other habitat attributes. The flow-productivity relationship for Chinook salmon is based upon redd data in Big Creek and flow data from the MFSR gage. NMFS assumed the steelhead flow-productivity relationships in the Lemhi River are representative of those for the LMFSR steelhead population. This assumption is conservative because flow impacts on productivity in a flow-limited system (i.e., the Lemhi River) are expected to be greater than those in a non-flow limited system like Big Creek (Jim Morrow, NMFS, unpublished data). The calculated reductions in flow associated with the proposed action are predicted to reduce productivity of the Big Creek Chinook salmon and LMFSR steelhead populations by 0.12 and 0.16 percent respectively.

Baseline flow conditions in the action area are already degraded by existing water diversions, including those that are part of the proposed action. The Big Creek Chinook salmon and LMFSR steelhead populations have varied over time, experiencing both increases and decreases in abundance. That variability, coupled with the fact that there is very little human influence in the Big Creek watershed, suggests that out-of-basin factors may have more importance for these populations. Ensuring diversions meet NMFS screening criteria, limiting water diversion to the allowable rates, ceasing water withdraw when water is not needed (e.g., through the winter or during extended periods of absence), and maintaining diversion structures and conveyance facilities should support recovery of the species.

The majority of habitat within the Big Creek drainage is in very good condition and due to being located within the FCRONRW, is at low risk of degradation due to future activities. In addition, it is likely that the effects of other state and private activities that have impacted the baseline will continue at similar levels into the future. Considering the existing condition of the environmental baseline and the potential cumulative effects, NMFS has determined that the small decrease in population productivity caused by the proposed action should not appreciably reduce the likelihood of the Big Creek Chinook salmon or LMFSR steelhead populations achieving their desired statuses. Similarly, adverse effects from the proposed action will not be substantial enough to appreciably reduce the likelihood of the MFSR Chinook salmon or the Salmon River steelhead MPGs from achieving their viability targets. Therefore, it is NMFS' opinion that the effects of the action will not cause reductions in reproduction, numbers, or distribution that would reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of SRS Chinook salmon and SRB steelhead.

2.7.2. Designated Critical Habitat

All of the streams affected by the proposed action are considered designated critical habitat for SRS Chinook salmon. Cliff, Pioneer, Logan, and Big Creeks are designated critical habitat for SRB steelhead. The majority of habitat within the Big Creek drainage is in very good condition, and there is low risk of future activities occurring within the drainage because much of it is within the FCRONRW. Stream temperatures are typically FA in tributary streams and are considered FAR in the Big Creek mainstem. However, considering human influences are relatively low in the watershed, we consider existing stream temperatures to be fairly reflective of natural conditions. There are a few other existing water diversion facilities in Big Creek that are not included in the proposed action. These amount to an additional 5.6 cfs water throughout the basin, of which 2.1 cfs is for the irrigation of 96 acres. Overall, the aquatic ecosystem of Big Creek and its tributaries appear to be capable of supporting ESA-listed salmonids. IDEQ (2022) determined streams in the upper Big Creek subwatershed are fully supporting their aquatic life uses.

The existing, baseline condition of all of the PBFs necessary to sustain Chinook salmon and steelhead within the action area would be maintained. The baseline condition of a few PBFs is slightly degraded from the low level of anthropogenic activities occurring in localized areas in the action area. Authorizing the continuation of these actions will perpetuate this slightly degraded baseline condition for the specific stream reaches of concern. The proposed action will reduce the quantity of water in select streams and rivers that are designated critical habitat for Chinook salmon and steelhead. This, in turn, will negatively affect the temperature, forage, and water quantity PBFs in discrete, localized, and small areas. Considering the baseline condition of the critical habitat, the potential for cumulative effects, and the fact that much of the drainage lies within the FCRONRW, the proposed action is not expected to appreciably diminish the conservation value of the these PBFs within the Big Creek drainage. Scaling up from the action area to the designation of critical habitat for each species, the proposed action is not expected to appreciably reduce the conservation value of the designated critical habitat for either SRS Chinook salmon or SRB steelhead.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of SRS Chinook salmon or SRB steelhead and is not likely to destroy or adversely modify their designated critical habitats.

2.9. Incidental Take Statement

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

2.9.1. Amount or Extent of Take

In the opinion, NMFS determined that the proposed action is reasonably certain to result in incidental take of ESA-listed species. NMFS is reasonably certain that incidental take will occur because: (1) the proposed action will reduce flows in the lower reaches of Lick, No Name, Government, Logan, and Cliff Creeks; (2) the proposed action will reduce flows in Big Creek from the Lick Creek confluence to the mouth of Big Creek; (3) juvenile Chinook salmon and steelhead likely use all of these reaches for rearing; (4) adult Chinook salmon and adult steelhead spawn throughout Big Creek and have the potential to spawn in Logan Creek; (5) the proposed action will perpetuate the consumptive use of water during the irrigation season; and (6) loss of water immediately below PODs and permanent loss of water in downstream reaches due to consumptive use of water will contribute to lower productivity of the Big Creek Chinook salmon and LMFSR steelhead populations. This reduced productivity is assumed to encompass the indirect effects of flow reduction on stream temperatures, space, forage quantity, and foraging efficiency.

The take exempted by this ITS is the loss of SRS Chinook salmon and SRB steelhead. We have quantified a reduction in productivity of less than 0.2 percent for both SRS Chinook salmon and SRB steelhead. Changes in productivity cannot be monitored sufficiently to ensure that the amount and extent of take is not exceeded. This is because: (1) steelhead population estimates are derived from data collected at Lower Granite Dam and lack the precision needed to monitor small production changes at the scale anticipated due to the proposed action; (2) information on number of Chinook salmon are limited to redd counts, which lack the precision to detect changes at the scale anticipated due to the proposed action; (3) population density of Chinook salmon and steelhead varies greatly from year to year; and (4) fish harmed due to increased environmental stress caused by the proposed actions would be difficult to distinguish from fish harmed due to environmental stress that normally occurs or that is caused by baseline actions. Even if take that occurred within the action area could be adequately quantified, monitoring total take due to the proposed actions would still not be feasible because some mortality due to effects of the proposed actions in action area is likely to occur during the downstream migration or in the estuary. Mortality from the proposed action is likely to occur during downstream migration or in the estuary because mortality is related to fish growth, which is related to streamflow (Davidson et al. 2010; Harvey et al. 2006). Reducing streamflow in rearing habitat likely reduces size of downstream migrating smolts. Smaller smolts have higher mortality outside of the natal tributaries (Zabel & Achord 2004), which results in lower smolt-to-adult return rates.

When take cannot be adequately quantified, NMFS describes the extent of take through the use of surrogate measures of take that would define the limits anticipated in this opinion. In this case, the extent of take will be described as the amount of water diverted and the amount of water remaining in the streams downstream of the PODs. As a quantifiable habitat indicator, flow can be measured accurately, flow is well correlated with upper Salmon River fish populations (Arthaud et al. 2010), and as established above in Section 2.5.1, reduction of streamflow is the principal cause of take due to the proposed actions. The extent of take exempted by this ITS will be exceeded if: (1) water diverted due to the proposed action exceeds the maximum diversion rate or seasonal volume allowed in the water rights listed in Table 1; or (2) the amount of land irrigated due to the proposed action exceeds the amount listed in Table 1. Although these surrogates could be considered coextensive with the proposed action, monitoring and reporting requirements included in this ITS will provide opportunities to check throughout the course of the proposed action whether the surrogates are exceeded. For this reason, the surrogates function as effective reinitiation triggers.

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 their critical habitat.

2.9.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02). NMFS believes that full application of the mitigation measures included as part of the proposed action, together with use of the RPMs described below, are necessary and appropriate to minimize the impact of incidental take of listed species due to implementation of the proposed action.

The PNF and the permittee shall:

1. Minimize take due to reducing flow in steelhead and Chinook salmon habitat.
2. Ensure completion of a monitoring and reporting program to confirm that the terms and conditions of this ITS are effective in avoiding and minimizing incidental take from permitted activities and ensure that incidental take is not exceeded.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The PNF or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement RPM 1 (minimizing take due to flow reductions):
    a. The PNF shall ensure that all water systems capable of withdrawing more water than authorized in the water right are equipped with a flow measuring device by December 31, 2025.
    b. The PNF shall include, as a condition of the SUP or easement, that the volume of water removed shall not exceed the authorized water right. The permittees shall ensure the amount of water diverted does not exceed the authorized water right.
    c. The PNF shall include, as a condition of the SUP or easement, that the volume of water removed from the stream be managed based on the level of use in order to maintain as much water in the stream as possible. For example, when the permittee is not putting the water to its beneficial use as identified in the water right, water shall be maintained in the stream as close to the point of diversion as possible (e.g., it is either prevented from being diverted or it is returned to the stream as overflow).
2. The following terms and conditions implement RPM 2 (monitoring and reporting):
    a. The PNF shall report the results of the proposed SUP inspection and streamflow monitoring efforts (which will include rates of diversion on systems that are not self-limiting) to NMFS by the end of each calendar year that monitoring is performed. The proposed monitoring is described in Section 1.3.2 of this opinion. This monitoring shall occur on Lick, Government, Logan, No Name, and Pioneer Creeks.

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 are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by the PNF and the permittees:

- While the impingement-related risk of juvenile Chinook salmon and steelhead is considered to be low at the Wilda POD, the PNF and permittee should carefully evaluate conditions at the intake (to see if they meet NMFS screening criteria as currently designed). If impingement risk can be further reduced, the PNF and permittee should redesign the intake in a manner that complies with NMFS (2022a) screening criteria.

- The PNF should continue to work with the KRL237 and KRL205 permittees in managing use of their diversions on No Name Creek such that perennial streamflow connection to Big Creek is maintained.

- The PNF should continue to investigate the currently unpermitted diversion on NFS land off North Fork Logan Creek. The diversion facilities should either be properly permitted or decommissioned.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Big Creek Water Diversions Project.

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the ITS is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (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 written concurrence; or (4) a new species is listed or critical habitat designated that may be affected by the identified action."

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. 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) of the MSA 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 Fishery Management Council (PFMC) and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The action area, as described in Section 2.3 of the above opinion, is also EFH for Chinook salmon (PFMC 2014). The PFMC designated the following five habitat types as habitat areas of particular concern (HAPCs) for salmon: complex channel and floodplain habitat, spawning habitat, thermal refugia, estuaries, and submerged aquatic vegetation (PFMC 2014). The proposed action may adversely affect spawning habitat as well as thermal refugia.

3.2. Adverse Effects on Essential Fish Habitat

The proposed action is described in Section 1.3 of this opinion. The proposed action may adversely affect EFH for Chinook salmon, as described in Section 2.5.2 of this opinion. Implementation of the proposed action will perpetuate water withdrawals in streams that are EFH for Chinook salmon. Reduced flows will reduce the quality of Chinook salmon habitat throughout the mainstem Big Creek, downstream of the Lick Creek confluence, as well as in Lick, No Name, Logan, Government, Pioneer, and Cliff Creeks. Adverse effects from reduced flows include reduced cold-water refuges at the mouths of these six tributaries, potential slight increase in stream temperatures downstream of the PODs, and reduced forage. Taken together, the impacted tributary habitat comprises approximately 0.7 percent of the weighted IP habitat for the Big Creek Chinook salmon population. The two reaches of Big Creek that will experience the greatest flow reductions account for approximately 4.5 percent of the weighted IP habitat for the Big Creek Chinook salmon population. The effects have been ongoing for at least 30 years and the proposed action will perpetuate these impacts into the future. Even with the impacts of the action, the habitat is capable of supporting population increases, as evidenced in the early 2000s.

3.3. Essential Fish Habitat Conservation Recommendations

NMFS determined that the following Conservation Recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

1. The PNF should ensure that all water systems capable of withdrawing more water than authorized in the water right are equipped with a flow measuring device by December 31, 2025.

2. The PNF should include, as a condition of the SUP or easement, that the volume of water removed not exceed the authorized water right. The permittees should ensure the amount of water diverted does not exceed the authorized water right.

3. The PNF should include, as a condition of the SUP or easement, that the volume of water removed from the stream be managed based on the level of use in order to maintain as much water in the stream as possible. For example, when the permittee is not putting the water to its beneficial use as identified in the water right, water should be maintained in the stream as close to the point of diversion as possible (e.g., it is either prevented from being diverted or it is returned to the stream as overflow).

4. The PNF should continue to work with the KRL237 and KRL205 permittees in managing use of their diversions on No Name Creek such that perennial streamflow connection to Big Creek is maintained.

5. The PNF should continue to investigate the currently unpermitted diversion on NFS land off North Fork Logan Creek. The diversion facilities should either be properly permitted or decommissioned.

Fully implementing these EFH Conservation Recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, for Pacific Coast salmon. More specifically, the spawning habitat and thermal refugia HAPCs in Big Creek would benefit.

3.4. Statutory Response Requirement

As required by Section 305(b)(4)(B) of the MSA, the PNF 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 10 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 the 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 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. Other interested users could include the permittees and NPT. Individual copies of this opinion were provided to the PNF. The document will be available within 2 weeks at the NOAA Library Institutional Repository at https://repository.library.noaa.gov/welcome. The format and naming adhere to conventional standards for style.

4.2. Integrity

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

4.3. Objectivity

Information Product Category: Natural Resource Plan.

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

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

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

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

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APPENDIX A

CALCULATION OF THE CONSUMPTIVE USE OF WATER RESULTING FROM THE PROPOSED ACTION

Water diverted from streams will be used consumptively and non-consumptively. Water that is used non-consumptively (e.g., domestic, stock water, and hydropower purposes) will return to the drainage network at some point downstream. Water used consumptively (i.e., evapotranspiration of a portion of the water used for irrigation) is assumed to be lost permanently from the Big Creek drainage network. Evapotranspiration is the combined process, by which water is lost from the land surface via evaporation or plant transpiration. Rates of evapotranspiration are strongly affected by weather, type of vegetation, and availability of water. Rates of evapotranspiration have been estimated at various locations in Idaho (Allen & Robison 2017). To evaluate how much water could be lost from the Big Creek drainage due to the proposed action, National Marine Fisheries Service used an average of actual evapotranspiration rates (ET_{act}) for two crops at the McCall, Idaho, station (Allen & Robison 2017). These rates are shown in Table A-1.

Table A-1. Monthly mean actual evapotranspiration rates (mm/day) at the McCall, Idaho, station. Actual evapotranspiration (ET_{act}) rates vary by month during the irrigation season. The National Marine Fisheries Service used the average of the actual evapotranspiration rates for two crops.

Crops	**ET_{act} (mm/day)**						
	April	**May**	**June**	**July**	**August**	**September**	**October**
Grass Pasture (low management)	0.84	2.51	4.44	4.88	4.23	2.25	0.57
Grass Hay	0.83	2.8	5.26	6.6	5.15	2.49	0.61
Average	0.84	2.66	4.85	5.74	4.69	2.37	0.59

The amount of water lost due to evapotranspiration during the irrigation season as a result of the proposed action was then calculated using the equation below. Results are presented in Table A-2. The average rate of water loss (in cubic feet per second [cfs]) due to evapotranspiration during the irrigation season on a per acre basis is 0.001 (April), 0.004 (May), 0.008 (June), 0.010 (July), 0.008 (August), 0.004 (September), and 0.001 (October).

$$ET_{act}\ (cfs) = ET_{act}\ mm/day * 0.0033\ ft/mm * 0.0000118\ day/sec * X\ acres * 43{,}560\ ft^2/acre$$

Based on information obtained from the water rights included in the proposed action, 40 acres could be irrigated in April and 83 acres could be irrigated during the remainder of the irrigation season.

Table A-2. Amount of water lost (cfs) due to evapotranspiration during the irrigation season.

	April	**May**	**June**	**July**	**August**	**September**	**October**
ET_{act} (cfs)	0.06	0.37	0.68	0.80	0.66	0.33	0.08

Appendix A. References

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APPENDIX B

SURFACE WATER RIGHTS IN THE BIG CREEK DRAINAGE AND STATUS OF ESA CONSULTATION

Table B-1. Recorded surface water rights in the Big Creek drainage. If the point of diversion is located on National Forest System land, then the status of ESA Section 7 consultation is listed, if known.

Watershed (5th field HUC)	Surface Water Source	IDWR Water Right Number	Maximum Diversion Rate (cfs)	Acres Irrigated	Is POD on Federal Land?	Status of Consultation and Survey Results[2]
Lower Big Creek	PIONEER CREEK	77-14145	0.22	0	No	POD was moved to private land.
	PIONEER CREEK	77-2219	0.64	32	Yes	Proposed Action
Monumental Creek	LITTLE LAKE CREEK	77-2006	0.14	0	Yes	There are no active diversions.
	SPRING	77-7201	0.25	0	Yes	There are no active diversions.
	TALC CREEK	77-10113	0.040	0	Yes	Unknown
	MULE CREEK	77-2084	0.50	0	Yes	All private land on Mule Creek is now National Forest and there are no active diversions.
	SPRING	77-2085	0.40	0	Yes	There are no active diversions.
	MULE CREEK	77-4050	0.05	0	Yes	All private land on Mule Creek is now National Forest and there are no active diversions.
	SPRING	77-4055	0.04	0	Yes	There are no active diversions.
	SPRINGS	77-7087	0.04	0	Yes	There are no active diversions.
	MONUMENTAL CREEK	77-7124	0.50	0	Yes	Unknown
	COON CREEK	77-7129	0.25	0	Yes	Unknown
Upper Big Creek	LICK CREEK	77-10105	0.020	0	No	N/A
	LICK CREEK	77-2048	0.20	10	No	N/A
	LICK CREEK	77-2095	1.40	73	No	N/A
	GOVERNMENT CREEK	77-10083	0.040	0	Yes	POD could not be located in 2020

Watershed (5th field HUC)	Surface Water Source	IDWR Water Right Number	Maximum Diversion Rate (cfs)	Acres Irrigated	Is POD on Federal Land?	Status of Consultation and Survey Results[2]
	SPRING	77-11650	0.020	0	Yes	Unknown
	McCORKLE CREEK	77-13920	1.000	0	Yes	NMFS Tracking # 200806620
	GOVERNMENT CREEK	77-2043A	0.020	1	Yes	No record of SUP or consultation. POD could not be located in 2020.
	GOVERNMENT CREEK	77-2043B	0.057	2.84	Yes	No record of SUP or consultation. POD could not be located in 2020.
	GOVERNMENT CREEK	77-2141	0.27	5	Yes	Same POD as 77-7025
	UNNAMED STREAM	77-2150	0.08	0	Yes	Proposed Action
Upper Big Creek	UNNAMED STREAM	77-2151	0.06	0	Yes	Proposed Action
	UNNAMED STREAM	77-2209	0.02	0	Yes	May have been included in Walker Mill Site Plan of Operations. POD could not be located in 2020.
	GOVERNMENT CREEK	77-4009	0.03	0	Yes	Statutory claim, not a water right. POD could not be located in 2020.
	LOGAN CREEK, GOVERNMENT CREEK	77-4205	0.04	0	Yes	PODs could not be located. It is possible that the POD is on private land.
	NO NAME CREEK	77-7058	0.48	7	Yes	Proposed Action
	MC CORKLE CREEK	77-7157	0.13	4	Yes	NMFS Tracking # 200806620
	UNNAMED STREAM	77-7230	0.02	0	Yes	Unknown
	GOVERNMENT CREEK	77-7233	0.03	0.40	Yes	Water right indicates this is combined with 77-2043. No other POD found on Government Creek in 2020.
	UNNAMED STREAM	77-7251	0.08	2	Yes	Proposed Action
	UNNAMED STREAM	77-7334	0.75	0	Yes	NMFS Tracking # 200806620
	GOVERNMENT CREEK	77-10078	0.240	9	Yes	Proposed Action
	LICK CREEK	77-10082	0.050	0	Yes	Proposed Action
	LICK CREEK	77-14304	0.100	5	Yes	Proposed Action
	LICK CREEK	77-14342	0.040	0	Yes	Proposed Action
	LICK CREEK	77-14343	0.020	1	Yes	Proposed Action

Watershed (5th field HUC)	Surface Water Source	IDWR Water Right Number	Maximum Diversion Rate (cfs)	Acres Irrigated	Is POD on Federal Land?	Status of Consultation and Survey Results[2]
	LICK CREEK	77-14344	0.020	1	Yes	Proposed Action
	LOGAN CREEK	77-2073A	0.02	1	Yes	Proposed Action
	LICK CREEK	77-2145A	0.04	1.5	Yes	Proposed Action
	LICK CREEK	77-2145B	0.03	1.5	Yes	Proposed Action
	LICK CREEK	77-2145C	0.06	3	Yes	Proposed Action
	LOGAN CREEK	77-4007	0.32	6.6	Yes	Proposed Action
	GOVERNMENT CREEK	77-4008	0.29	11.2	Yes	Proposed Action
	LOGAN CREEK	77-4010	0.03	0	Yes	Proposed Action
	LOGAN CREEK	77-4033	0.06	1	Yes	Proposed Action
	GOVERNMENT CREEK	77-7025	0.10	0	Yes	Proposed Action
Upper Big Creek	GOVERNMENT CREEK	77-7031	0.04	0	Yes	Proposed Action
	LICK CREEK	77-7056	0.04	0	Yes	Proposed Action
	LICK CREEK	77-7133	0.60	0	Yes	Proposed Action
	GOVERNMENT CREEK	77-7236	0.04	0	Yes	Proposed Action
	UNNAMED STREAM of NF Logan Creek	77-7300	0.60	0	Yes	Not considered active in IDWR database, but a POD is in operation. The Payette National Forest is investigating further.
		Total	**8.5**[3]	**179**		

[1]The POD location details from the water right were mapped on ArcGIS software to assess whether the POD was on private or public land.
[2]Staff from the PNF and Nez Perce Tribe attempted to locate PODs on National Forest System lands that were associated with water rights and that did not have ESA consultation during field visits in 2020. Even if PODs were not located, we still assumed that diversion of water may occur and included these water rights in the total diversion rate calculation.
[3]All private land in Mule Creek is now National Forest through a land acquisition that occurred after the adjudication. There are no known diversions, therefore, diversion rates for water rights 77-2006, 77-7201; 77-2084; 77-2085; 77-4050; 77-4055; and 77-7087 are not included in the total diversion rate. In addition, 77-7300 is not an active water right and is not included in the total diversion rate.

APPENDIX C

ESTIMATING 50 PERCENT STREAMFLOWS IN THE ACTION AREA

Big Creek and all of the streams affected by the proposed action exhibit hydrographs typical of snowmelt dominated systems, with the rising limb coming up in April and the descending limb dropping in July to a more or less stable summer base flow. The U.S. Geological Survey (USGS) operated a gaging station (1331000) on Big Creek from September 1944 to October 1958, however, flow data for complete calendar years were only available for 1949 through 1957. This gage is located just downstream of Cabin Creek, approximately 11 miles upstream of the mouth of Big Creek. The remaining streams affected by the proposed action (i.e., Lick, Logan, Government, Pioneer, and Cliff Creeks) are ungaged, so actual discharges are unknown. Because these streams are ungaged, the annual hydrograph was estimated as described below, and results are presented in Tables C-1 through C-3.

1. Calculated mean annual flow and monthly median flow at USGS gage 13310000 for years in the period of record that had flow data for the entire calendar year (1949 to 1957).

2. Calculated the ratio of monthly median flow to mean annual flow.

3. Estimated the mean annual flow (Q_{a_est}) for selected ungaged streams using the regression derived formula for Idaho watershed region 4 in Quillian and Harenberg (1982):

   $$Q_{a\_est} = (0.506*A^{0.951})*((E/1000)^{0.650})$$

   Where A is the drainage area and E is the mean drainage elevation in feet.

4. Estimated the median monthly flow at each location of interest by multiplying the ratios obtained in step 3 by the estimated mean annual flow obtained in step 4.

Flows during the period of record used for this analysis (1949–1957) are characterized as generally being above average based on flow data from the Johnson Creek gage (USGS Site 13313000). Annual flows in Johnson Creek during 8 of the 9 years ranged from 108 percent to 154 percent of the overall annual average flow. Only 1 year (1955) during this 9-year period of record had below average flows, with the annual flow for that year being 81 percent of the overall average annual flow in Johnson Creek. Considering this, it is likely that actual stream flows in the action area will generally be less than the estimated 50 percent exceedance flows.

Table C-1. Calculated mean annual flow and monthly median flows at USGS gaging station 13310000 for period of record with flow data for entire calendar year (1949 to 1957). The proportion of the monthly median flow to average annual flow will be used to estimate median monthly flows at ungaged locations in the basin.

Month	Median Flow (cfs)	% Of Annual Average Flow
January	125	24
February	125	24
March	140	27
April	356	68
May	1,560	296
June	1,860	353
July	623	119
August	261	50
September	184	35
October	172	33
November	155	29
December	140	27
Qa	***526.78***	

Table C-2. Estimated mean annual flow (Q_{a_est}) for ungaged streams in the action area. The estimated mean annual flows (cfs) were calculated using the regression equation for Idaho watershed region 4 (Quillian & Harenberg 1982).

	Big Creek at gage	Lick Creek	Big Creek below Lick Creek	Logan Creek	Government Creek	Big Creek below Logan Creek	No Name Creek	Big Creek above Smith Creek	Pioneer Creek	Cliff Creek	Big Creek below Cliff Creek	Big Creek at mouth
Drainage Area (mi^2)	451	2.4	25.9	16.1	5.1	49.6	0.98	56.7	6.1	7.2	566	595
Mean Elevation (ft)	6,990	7,710	7,530	7,550	7,560	7,470	7570	7,400	6,750	6,930	6,950	6,900
Q_{a_est} (cfs)	598.7	4.4	41.4	26.5	8.9	76.6	1.9	86.5	9.8	11.6	740.2	772.6

Table C-3. Estimated, monthly 50 percent exceedence flows (cfs) for ungaged streams in the action area.

Month	Lick Creek	Big Creek below Lick Creek	Logan Creek	Government Creek	Big Creek below Logan Creek	No Name Creek	Big Creek above Smith Creek	Pioneer Creek	Cliff Creek	Big Creek below Cliff Creek	Big Creek at mouth
January	1.0	9.8	6.3	2.1	18.2	0.4	20.5	2.3	2.8	175.7	183.3
February	1.0	9.8	6.3	2.1	18.2	0.4	20.5	2.3	2.8	175.7	183.3
March	1.2	11.0	7.0	2.4	20.4	0.5	23.0	2.6	3.1	196.7	205.3
April	3.0	28.0	17.9	6.0	51.8	1.3	58.4	6.6	7.9	500.3	522.1
May	13.0	122.7	78.4	26.3	226.8	5.5	256.0	28.9	34.5	2,192.1	2,288.0
June	15.5	146.3	93.4	31.3	270.5	6.5	305.3	34.5	41.1	2,613.7	2,728.0
July	5.2	49.0	31.3	10.5	90.6	2.2	102.3	11.6	13.8	875.4	913.7
August	2.2	20.5	13.1	4.4	38.0	0.9	42.8	4.8	5.8	366.8	382.8
September	1.5	14.5	9.2	3.1	26.8	0.6	30.2	3.4	4.1	258.6	269.9
October	1.4	13.5	8.6	2.9	25.0	0.6	28.2	3.2	3.8	241.7	252.3
November	1.3	12.2	7.8	2.6	22.5	0.5	25.4	2.9	3.4	217.8	227.3
December	1.2	11.0	7.0	2.4	20.4	0.5	23.0	2.6	3.1	196.7	205.3

Appendix C. References

IDWR (Idaho Department of Water Resources). 2023. IDWR Online Water Right Database. July 2023.

Quillian, E. W., and W. A. Harenberg. 1982. An evaluation of Idaho stream-gaging networks. USGS Open File Report 82–865. Boise, Idaho.