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

December 12, 2016

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Refer to NMFS No: WCR-2016-4505

Mr. Charles Mark, Forest Supervisor
Salmon-Challis National Forest
1206 South Challis Street
Salmon, Idaho 83467

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Authorization of Operation and Maintenance of Existing Water Diversions on the Middle Salmon River Watershed of the Salmon-Challis National Forest, HUCs 1706020301, 1706020302, 1706020303, 1706020304 and 1706020305, Lemhi County, Idaho

Dear Mr. Mark:

Thank you for your letter of April 1, 2015, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 *et seq.*) for authorization of operation and maintenance of water diversions on the Middle Salmon River Watershed of the Salmon-Challis National Forest (SCNF). The enclosed document contains a biological opinion (Opinion) prepared by NMFS pursuant to section 7(a)(2) of the ESA. In this Opinion, NMFS concludes that the actions, as proposed, are likely to jeopardize the continued existence of Snake River spring/summer Chinook salmon and are likely to result in destruction or adverse modification of Snake River spring/summer Chinook salmon designated critical habitat. NMFS also concludes that the actions, as proposed, are not likely to jeopardize the continued existence of Snake River Basin steelhead, or result in the destruction or adverse modification of designated critical habitat Snake River Basin steelhead. The Salmon-Challis National Forest did not request consultation on Snake River sockeye salmon and this Opinion does not cover Snake River sockeye salmon.

NMFS shared a draft of the Opinion with the SCNF on October 13, 2016, and provided additional information requested by the SCNF on October 24, 2016, and November 2, 2016. NMFS received comments from the SCNF on November 10, 2016. NMFS considered the SCNF comments when finalizing the Opinion. A record of how each SCNF comment was addressed is documented in the administrative record.

As required under the ESA for consultations concluding with jeopardy and adverse modification determinations, NMFS discussed with the SCNF the availability of a reasonable and prudent alternative that the SCNF can take to avoid violation of the SCNF's ESA section 7(a)(2) responsibilities (50 CFR 402.14(g)(5)). Reasonable and prudent alternatives refer to alternative actions identified during formal consultation that: (1) Can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction; (3) are economically and technologically feasible; and (4) the Regional Administrator believes would avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat (50 CFR 402.02). The Opinion includes a reasonable and prudent alternative which can be implemented to avoid jeopardy and adverse modification of critical habitat, while meeting each of the other requirements listed above. NMFS has also prepared an incidental take statement describing and exempting the extent of incidental take reasonably certain to occur under the reasonable and prudent alternative.

Although the SCNF did not make ESA determinations for Southern Resident killer whales (*Orcinus orca*) and their critical habitat, NMFS' analysis identified potential impacts on the whale's prey base. The attached document concludes the proposed action "may affect," but is "not likely to adversely affect" Southern Resident killer whales and their critical habitat.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes three Conservation Recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. 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 SCNF 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, we ask that you dearly identify the number of conservation recommendations accepted.

Please contact Jim Morrow, Fishery Biologist, Southern Snake Basin Office, 208-378-5695, jim.morrow@noaa.gov, if you have questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

Barry A. Thom
Regional Administrator

Enc.

cc: R. Holder – USFWS
T. Curet – IDFG
C. Colter – SBT
S. Brick – GCNW
R. Johnson – ICL
M. Kellner – ICL

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

Authorization of Operation and Maintenance of Existing Water Diversions on the Middle Salmon River Watershed of the Salmon-Challis National Forest, HUCs 1706020301, 1706020302, 1706020303, 1706020304 and 1706020305

Lemhi County, Idaho

NMFS Consultation Number: WCR-2016-4505

Action Agency: USDA Forest Service, Salmon-Challis National Forest

Affected Species and NMFS' Determinations:

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

Fishery Management Plan that Describes 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:

Barry A. Thom
Regional Administrator

Date: December 12, 2016

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BA	Biological Assessment
BLM	Bureau of Land Management
cfs	cubic feet per second
Chinook salmon	Snake River spring/summer Chinook Salmon
diversions	water diversions
DPS	Distinct Population Segment
DQA	Data Quality Act
EFH	Essential Fish Habitat
EFSR	East Fork Salmon river
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Units
HAPC	Habitat Areas of Particular Concern
HUC	Hydrologic Unit Codes
ICA	Idaho Conservation League
ICBTRT	Interior Columbia Basin Technical Recovery Team
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
ITS	Incidental Take Statement
LAA	Likely to Adversely Affect
m^2	square meters
MFSR	Middle Fork Salmon River
MPG	Major Population Group
MSA	Magnuson-Stevens Fishery Conservation and Management Act
msl	mean sea level
NFSR	North Fork Salmon River
NMFS	National Marine Fisheries Service
OMP	Operation and Maintenance Plans
Opinion	Biological Opinion
PBF	Physical and Biological Features
PFMC	Pacific Fishery Management Council
PIT	Passive Integrated Transponder
POD	Point of Diversion
Program	program
PSMFC	Pacific States Marine Fisheries Commission
RM	River Mile
RPA	Reasonable and Prudent Alternatives
RPM	Reasonable and Prudent Measures
SAR	Smolt to Adult Return Rates

SCNF	Salmon-Challis National Forest
sockeye salmon	Snake River sockeye salmon
SRKW	Southern Resident Killer Whales
SRLM	Salmon River Lower Mainstem
SRUM	Salmon River Upper Mainstem
steelhead	Snake River Basin steelhead
SUP	Special Use Permits
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
VSP	Viable Salmonid Population

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) portion and incidental take statement (ITS) portion of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 *et seq*.), and implementing regulations at 50 CFR 402.

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

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 through NMFS' Public Consultation Tracking System [https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts]. A complete record of this consultation is on file at the Snake Basin Area Office in Boise, Idaho.

1.2 Consultation History

Informal consultation on water diversions (diversions) on U.S. Forest Service (USFS) land in the Salmon-Challis National Forest (SCNF) began in June 2002, when the SCNF entered into an agreement to settle a lawsuit over diversions on SCNF-administered lands (Western Watershed Project v. Matejko 2002). As of April 27, 2016, six separate formal consultations have been completed. Four of these consultations determined that the proposed actions would not likely jeopardize the continued existence of Snake River spring/summer Chinook salmon (Chinook salmon) or Snake River Basin steelhead (steelhead) or adversely modify designated critical habitat (NMFS 2014a; NMFS 2015a; NMFS 2015b; NMFS 2015c). The other two consultations determined that the proposed actions would likely jeopardize the continued existence of Chinook salmon and steelhead and would likely adversely modify designated critical habitat for both species (NMFS 2012a; NMFS 2012b). These two "jeopardy" biological opinions included reasonable and prudent alternatives (RPAs) to minimize adverse effects. As of September 14, 2016, NMFS has not received monitoring reports describing implementation of the RPAs for either consultation and NMFS therefore assumes the RPAs have yet to be implemented. NMFS has also not received monitoring reports for the "non-jeopardy" consultation completed in 2014, and therefore assumes that protective measures stipulated in that consultation have yet to be implemented. Completed and ongoing water diversion related consultations on ESA listed anadromous fishes on the SCNF are in Table 1.

Table 1. Water diversion related consultations with the SCNF, geographic areas covered, and date completed or due.

Consultation Title	Geographic Area Covered	Date Completed or Due
Diversions located on the Salmon-Challis National Forest in the Lemhi River Watershed, HUC 17060204, Lemhi County, Idaho (multiple actions)	Lemhi River drainage	Completed February 27, 2012
Diversions located on National Forest Lands in the Upper Salmon River Watershed, HUCs 1706020117 and 1706020118, Custer County, Idaho	Mainstem Salmon River and tributary drainages between river miles 335 and 313.	Completed August 10, 2012
Water diversion activities in the Camas Creek drainage, HUCs 1706020601, 1706020602, and 1706020603, Lemhi County, Idaho (12 projects)	Camas Creek drainage (tributary of the Middle Fork Salmon River)	Completed March 31, 2014
Authorization of Operation and Maintenance of Existing Water Diversions in the Lower Canyon Watershed, HUCs 1706020108 and 1706020109, Custer County, Idaho	Mainstem Salmon River and tributary drainages between river miles 363 and 347.	Completed December 29, 2015
Authorization of Operation and Maintenance of Existing Water Diversions on the North Fork Salmon River Ranger District, HUC 1706020306, Lemhi County, Idaho	North Fork Salmon River drainage	Completed December 29, 2015
Authorization of Operation and Maintenance of Existing Water Diversions on the Middle Fork Salmon River Subbasin, HUCs 1706020506, 1706020601, and 1706020603, Custer and Lemhi Counties, Idaho	Middle Fork Salmon River drainage, except the Camas Creek and Big Creek drainages.	Completed December 29, 2015
Authorization of Operation and Maintenance of Existing Water Diversions on the Middle Salmon River Watershed of the Salmon-Challis National Forest, HUCs 1706020301, 1706020302, 1706020303, 1706020304 and 1706020305, Lemhi County, Idaho	Mainstem Salmon River and tributary drainages between river miles 304 and 237, except the Pahsimeroi River, Lemhi River, and North Fork Salmon River drainages.	Due October 31, 2016
Authorization of Operation and Maintenance of Existing Water Diversions on the Lower Salmon Watershed of the Salmon-Challis National Forest, HUCs 1706020307, 1706020308, 1706020313, 1706020701 and 1706020702, Lemhi and Idaho Counties, Idaho	Mainstem Salmon River and tributary drainages between river miles 237 and 135, except the Middle Fork Salmon River and Panther Creek drainages.	Due October 31, 2016
Authorization of Operation and Maintenance of Water Diversions in the Panther Creek Watershed, HUC 17060203, Lemhi County, Idaho.	Panther Creek drainage	Due October 31, 2016

This consultation covers diversions on USFS land in the Middle Salmon River watershed of the SCNF (Figure 1). The Middle Salmon River watershed is defined by the SCNF as all land in the five fifth field Hydrologic Unit Codes (HUC) along the mainstem Salmon River between the confluence of the Pahsimeroi River (River Mile [RM] 304) and the confluence of the North Fork Salmon River (RM 237). The Middle Salmon River watershed encompasses 451,132 acres, all of which is in the upper Salmon River drainage, the Upper Salmon Chinook salmon Major Population Group (MPG), and the Salmon River steelhead MPG. Water right priority dates indicate that water diversion on land currently administered by SCNF in the Middle Salmon watershed started in the late 1800s. In the past, operation and maintenance of some of the diversions have been authorized via special use permits (SUPs) and Ditch Bill easements, however, consultation on ESA listed anadromous salmonids has not been completed for any of those authorizations. Informal consultation on ongoing operation and maintenance of diversions on SCNF land started in June 2002, when the SCNF entered into the agreement described in the previous paragraph. Figure 1 shows the distribution of SCNF administered land and the approximate location of diversions in the Middle Salmon River watershed.

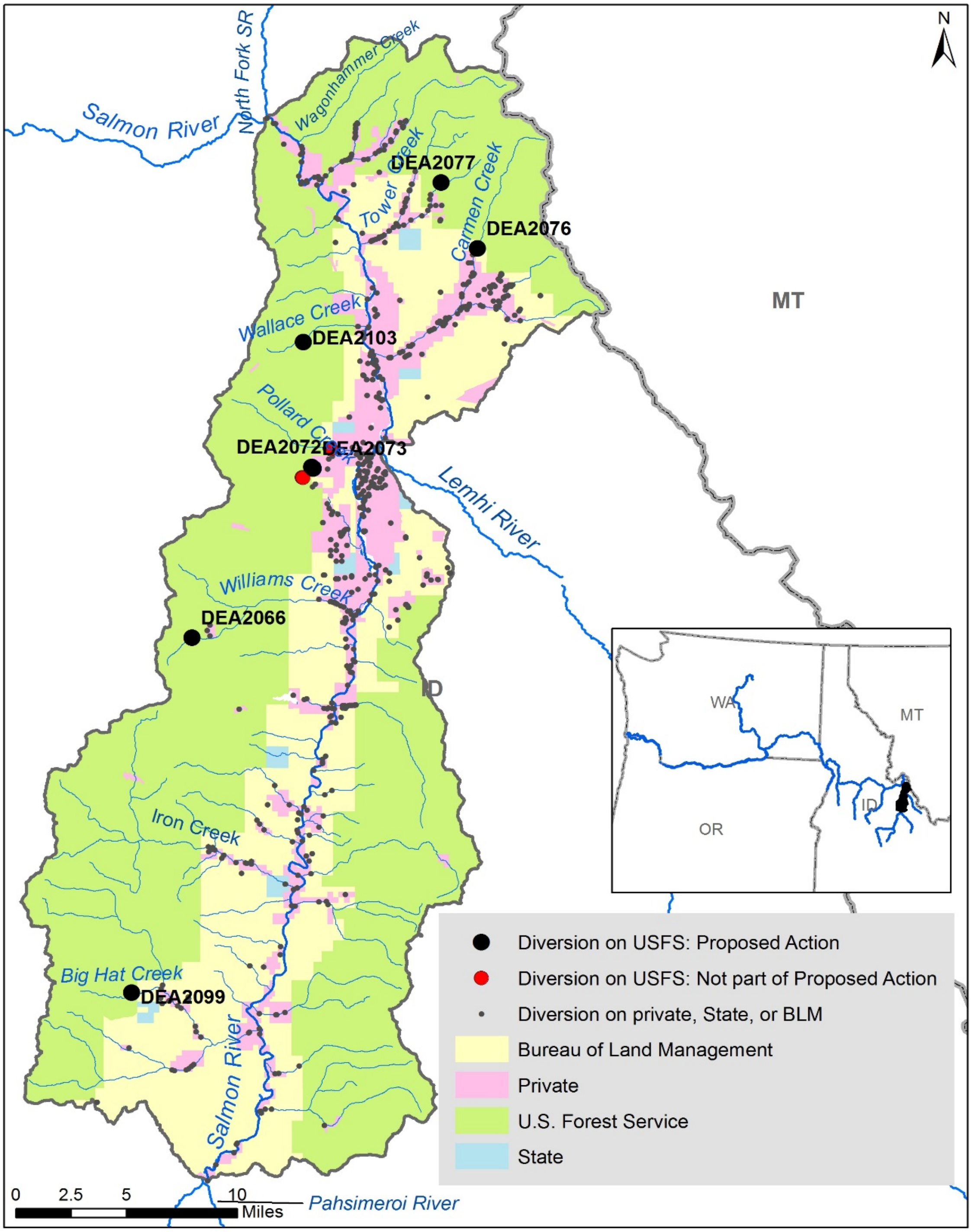


Figure 1. Middle Salmon River Watershed of the SCNF.

On December 27, 2007, NMFS received a biological assessment (BA) for ongoing operation and maintenance of diversions on SCNF land in the Middle Salmon watershed and a request to initiate ESA section 7 consultation on the Federal actions of permitting operation and maintenance of those diversions. On February 22, 2008, NMFS sent a letter to the SCNF indicating that the BA did not contain sufficient information to initiate formal consultation (NMFS 2008a). On December 13, 2013, the Idaho Conservation League (ICL) filed a notice of intent to sue both the SCNF and NMFS because several consultations on water diversion-related activities remained incomplete. Subsequent negotiations led to a schedule for completing consultation on outstanding water diversion-related activities and on May 15, 2014, the SCNF sent a letter to the ICL describing this schedule (USFS 2014). On February 25, 2015 the SCNF sent NMFS example terms and conditions for SUPs authorizing diversions; on April 1, 2015, the SCNF sent NMFS an updated proposed action to supplement the 2007 BA; and on October 22, 2015 the SCNF sent NMFS information supplementing the updated proposed action. These three documents are collectively referred to as the 2015 BA and these three documents together with the 2007 BA are collectively referred to as simply, the BA. The BA did not include all of the information needed to complete information and this Opinion therefore incorporates information obtained by NMFS from a variety of sources.

The 2007 BA described 20 diversions and requested ESA section 7 consultation on permitting operation and maintenance of 12 of those diversions. The 2015 BA listed the 20 diversions described in the 2007 BA but requested consultation on only seven. The 20 diversions described in the 2007 BA, consultation request status in 2007 and 2015, and the SCNF reasons for not requesting consultation are listed in Table 2.

The SCNF determined that none of the proposed actions would affect Snake River sockeye salmon (sockeye salmon) or designated critical habitat for sockeye salmon, and sockeye salmon were therefore not included in this Opinion. Of the seven diversions included in this Opinion, the SCNF determined that four "may affect" and are "likely to adversely affect" (LAA) Chinook salmon, steelhead, and their designated critical habitat; one LAA steelhead and critical habitat for Chinook salmon and steelhead but would have no effect on Chinook salmon; and two LAA Chinook salmon critical habitat but would have no effect on Chinook salmon, steelhead, or steelhead critical habitat. The "no effect" determinations were based on absence of species or critical habitat in the affected Salmon River tributaries. However, water diversion reduces flow in downstream reaches (Van Kirk and Naman 2008; Naik and Jay 2011; Axness and Clarkin 2013) and the analysis for this opinion revealed effects on Chinook salmon, steelhead and designated critical habitat in downstream reaches that were not considered in the BA. NMFS therefore analyzed effects of the seven diversions covered by this Opinion on Chinook salmon, steelhead, and designated critical habitat for the evolutionarily significant unit (ESU) and distinct population segment (DPS). The ESA-listed species and designated critical habitats addressed by this Opinion are listed in Table 3.

Table 2. Water diversions described in the 2007 and 2015 Biological Assessments, requests for consultation in 2007 and 2015, and reason for not requesting consultation.

HUC	Diversion Name	Source Stream	Consultation Requested in 2007	Consultation Requested in 2015	Reason Consultation was not Requested
Hat Creek 1706020301	DEA 2098-1	North Fork Cow Creek	Yes	No	Ditch Bill easement issued on January 24, 1995[a]
	DEA 2098-2				
	DEA 2099	Big Hat Creek	Yes	Yes	NA
Iron Creek 1706020302	DEA 2100	Peel Tree Creek, Tributary of Iron Creek	Yes	No	Ditch Bill easement issued on July 29, 1999[a]
Twelvemile Creek 1706020303	DEA 2067-1	Lake Creek	No	No	"No effect[b]"
	DEA 2067-2				
	DEA 2083	South Fork Sevenmile Creek	No	No	"No effect[b]"
Williams Creek 1706020304	DEA 2066	South Fork Williams Creek	Yes	Yes	NA
	DEA 2068-1	Jesse Creek	No	No	"No effect[b]"
	DEA 2068-2				
	DEA 2072	Pollard Creek	Yes	Yes	Not applicable
	DEA 2073	Chipps Creek, Tributary of Pollard	Yes	Yes	Not applicable
	DEA 2078-1	Chipps Creek, Tributary of Pollard	Yes	No	Ditch Bill easement issued, date unknown
	DEA 2078-2				
	DEA 2075	Gorley Creek	No	No	"No effect[b]"
	DEA 2079	Spring Creek	No	No	"No effect[b]"
Carmen Creek 1706020305	DEA 2069	Wallace Creek	Yes	No	Ditch Bill easement issued, date unknown, possibly not in use[a].
	DEA 2071	Wallace Creek	Yes	No	Ditch Bill easement issued, date unknown, possibly not in use[a].
	DEA 2103	Wallace Creek	Yes	Yes	Not applicable
	DEA 2070	Wallace Creek	No	No	Diversion not in use
	DEA 2076	Carmen Creek	Yes	Yes	Not applicable
	DEA 2077	East Fork Tower Creek	Yes	Yes	Not applicable
	DEA 2080	Maxwell Gulch	No	No	"No effect[b]"
	DEA 2084	Napoleon Gulch	No	No	"No effect[b]"

[a] The 2015 BA asserted that the USFS does not have discretion over Ditch Bill easements that have already been issued.
[b] The SCNF determined that operation and maintenance of these diversions would have no effect on ESA listed anadromous fishes or designated critical habitat and did not request consultation on these diversions.

Although the SCNF did not make ESA determinations for Southern Resident killer whales (SRKW) (*Orcinus orca*) and their critical habitat[1], NMFS' review of the action's effects on salmon and steelhead identified potential impacts on the prey availability for the whales. The Opinion also provides an analysis of effects, concluding with a determination of "may affect, not likely to adversely affect" for Southern Resident killer whales and their critical habitat (Section 2.12).

[1] The SRKW were listed as endangered on November 18, 2005 (70 FR 69903); critical habitat for SRKW was designated on November 29, 2006 (71 FR 69054).

Table 3. Federal Register notices for final rules that list threatened and endangered species, designate critical habitats, or apply protective regulations to listed species considered in this consultation.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (*Oncorhynchus tshawytscha*)			
Snake River spring/summer run	T 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543 10/25/99; 64 CFR 57399	6/28/05; 70 FR 37160
Steelhead (*O. mykiss*)			
Snake River Basin	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Killer Whale (*Orcinus Orca*)			
Southern Resident DPS	E 11/18/05 69903	11/29/06; 71 FR 69054	ESA section 9 applies

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). The SCNF requested ESA section 7 consultation on the issuance of SUPs authorizing operation and maintenance of seven diversions. The following permit terms and conditions will be included in the operation and maintenance plans (OMPs) for these seven diversions:

- The permit holder and the District Ranger shall agree to all maintenance routes.
- The permit holder shall reclaim all disturbances resulting from access in accordance with standards identified by the District Ranger.
- The permit holder shall be responsible for prevention and control of soil erosion and gullying on land covered by the easement and the land adjacent thereto, resulting from operations and maintenance of granted use.
- The permit holder shall remove all obstructions from the diversion structure.
- The permit holder shall revegetate or otherwise stabilize all ground where the soil has been exposed.
- The permit holder shall be responsible for control of and spread of noxious weeds, as identified by the USFS and the local County weed list.
- When required by applicable laws and regulations, the permit holder shall obtain necessary permits from the State and U.S. Army Corps of Engineers for all work in natural channels in advance of performing such work.
- The permit holder shall inspect the facility prior to use each year and make necessary repairs. Work that is considered other than routine maintenance and/or minor repairs shall be discussed in advance with the District Ranger. All repairs shall be acceptable to and completed by the date specified by the District Ranger.

- The permit holder shall contact the District Ranger and obtain approval before proceeding with work that is other than routine operation. Some of these situations include:

    - Removal and disposal of significant amounts of vegetation and silt, and deposition of the same, if on National Forest System land.

    - Burning, application of seed mixtures, chemical application, or other means of vegetation control measures.

    - Reconstruction or rerouting of a portion of the canal or pipeline (the latter would also entail a new easement or SUP).

- Protection of ESA-listed Fish Species and their Habitats – The permit holder shall perform the following mitigation measures to avoid or reduce adverse effects on ESA-listed fish species and their habitats:

    - Prior to withdrawal of water, ensure that all diversions are screened to NMFS standards and ensure that fish passage for all diversions is maintained at all flows.

    - Prior to withdrawal of water, install continuous recording flow measuring devices at all diversions.

    - Before upgrading any intake structures, provide detailed intake structure designs and site-specific information to NMFS for approval[2].

    - Obtain the necessary approvals from the SCNF for upgrade or installation activities and follow all practices required by the approvals[2].

    - Mitigate any ground disturbance due to maintenance of diversion structures with a high level of erosion control to prevent erosion and subsequent sediment deposition into streams.

    - Repair any leakage due to a malfunctioning diversion structure as soon as possible to prevent streambank washout or erosion and to avoid sediment deposition in streams.

    - Adjust the volume of water being removed from the stream based on level of use. Do not divert water if it is not being put to its beneficial use.

    - Investigate and implement options to minimize rates of diversion when water is not needed (e.g., shut off valves, holding tanks, etc.).

[2] The SCNF and NMFS will determine if proposed modification of water diversion structures would be covered by this Opinion, covered by other completed ESA section 7 consultations, or would require new consultation. NMFS anticipates that most modification of water diversion structures would be covered by this Opinion or other completed consultations.

- Monitor the status and condition of water systems and report to the SCNF annually. Information on specific data to be recorded and reported shall be provided by the SCNF along with reporting forms.

- Water diversion, transmission, and use will comply with the State water rights.

- All OMPs will be reviewed annually by the permit holder and may be amended by mutual agreement when signed and dated by the permit holder and the District Ranger.

1.3.1 Points of Diversion and Places of Use

The proposed actions are issuance of SUPs authorizing seven diversions on SCNF land in the Middle Salmon watershed. Descriptions of these diversions are in sections 1.3.1.1 through 1.3.1.7.

1.3.1.1 Big Hat Creek Diversion (DEA 2099)

The Big Hat Creek diversion serves two water rights, 75-4199 and 75-2137. Water right 75-4199 has a maximum diversion rate of 0.47 cubic feet per second (cfs) that was used to irrigate 12.3 acres; and water right 75-2137 has a maximum diversion rate of 0.76 cfs that was used to irrigate 26.7 acres. The point of diversion (POD) is on Big Hat Creek approximately 1.2 miles upstream from Hat Creek, and approximately 4.9 miles upstream from the mainstem Salmon River. The diversion was surveyed on September 19, 2002, at which time it did not have a headgate, measuring device, or screen, and was diverting 0.33 cfs of the 0.51 cfs flowing in Big Hat Creek. The BA states that both water rights have been leased to the water supply bank for conservation purposes since April, 2009. This water transaction, which is described in the 2012 Water Transaction Program Monitoring and Evaluation Report (IDWR 2012) improves flow in Big Hat and Hat Creeks by suspending use of the Big Hat Creek diversion. The Big Hat Creek Diversion structures are still in place and the SCNF may choose to remove them or to maintain them in place depending on long term plans for the diversion. The SCNF will ensure that diversion structures are either removed or are maintained in such a way as to not restrict upstream or downstream fish passage.

1.3.1.2 South Fork Williams Creek Diversion (DEA 2066)

The South Fork Williams Creek diversion serves one water right, 75-4128, with a maximum diversion rate of 3.2 cfs that is used to irrigate 149.8 acres (Figure 2). The POD is on South Fork Williams Creek approximately 3.5 miles upstream from Williams Creek and approximately 9.5 miles upstream from the mainstem Salmon River. The diversion was surveyed on September 3, 2002, at which time it did not have a headgate, measuring device, or screen and was diverting all of the flow in South Fork Williams Creek at the POD. At the time of the survey, South Fork Williams Creek was flowing 0.52 cfs upstream from the POD.

1.3.1.3 Pollard Creek Diversion (DEA 2072)

The Pollard Creek and Chipps Creek (Section 1.3.1.4) diversions are components of the City of Salmon municipal water system that also includes the Jesse Creek diversions (DEA 2068-1 and DEA 2068-2) (Figure 3). The SCNF determined that the Jesse Creek diversions have no effect on anadromous fishes or designated critical habitat and operation and maintenance of the Jesse Creek diversions is not covered by this Opinion. However, some discussion of the Jesse Creek diversions is required to describe operation of the Pollard and Chipps Creek diversions.

The City of Salmon water system includes 13 water rights with a combined maximum diversion rate of 14.33 cfs (Figure 3). When flow in Jesse Creek is sufficient, only the Jesse Creek diversions are used. When flows in Jesse Creek drop below levels needed for the water system, water is diverted from Pollard Creek and injected into Jesse Creek upstream from the Jesse Creek PODs. When the combined flow in both Pollard and Jesse Creeks drop below levels needed for the water system, flow is diverted from Chipps Creek, injected into Pollard Creek upstream from the Pollard Creek diversion and rediverted to Jesse Creek. Jesse Creek was historically a tributary of Pollard Creek, and was anadromous fish habitat, but there is currently no functional stream channel between Jesse Creek and Pollard Creek and no fish passage into or out of the Jesse Creek drainage.

Information in the BA indicates that the Pollard Creek and Chipps Creek diversions serve the same four water rights (75-19E, 75-26A, 75-10075, and 75-10076) with a combined maximum diversion rate of 6.29 cfs. However, NMFS was unable to find water rights 75-19E and 75-10076 in the Idaho Department of Water Resources (IDWR) database. A search of the IDWR database by POD location revealed six water rights on Pollard and Chipps Creeks with the same POD location descriptions as 75-26A and 75-10075, for a total of eight water rights (i.e., 75-4, 75-17B, 75-19C, 75-26A, 75-2167, 75-10075, 75-14700, 75-14701), with a combined maximum diversion rate of 10.08 cfs. The place of use for all of these water rights is the City of Salmon municipal water supply system.

A review of the history of Pollard Creek drainage water rights indicates that the City of Salmon acquired water rights 75-4, 75-17B, 75-19C, 75-26A, and 75-10075, which were previously served by a diversion on private land and used for irrigation. Acquisition of these irrigation water rights was necessary because the original water supply water right (75- 2167) had a junior priority date that rendered it essentially unusable during the irrigation season. Because water rights 75-4, 75-17B, 75-19C, 75-26A, and 75-10075 could be diverted on private land, there is not a clear causal connection between the proposed actions and effects of diverting water to serve these water rights. In contrast, water rights 75-2167, 75-14700, and 75-14701 were originally appropriated for the municipal water supply and therefore have no utility without the proposed actions. Therefore, this Opinion analyzes effects of diverting water to serve water rights 75-2167, 75-14700, and 75-14701. Combined maximum diversion rate of these three water rights is 2.0 cfs from April 1 through October 31 and 4.54 cfs from November 1 through March 31.

The Pollard Creek diversion POD is on Pollard Creek approximately 3.0 miles upstream from the Salmon River. The POD is on SCNF land and consists of a concrete headbox with a screw-type bypass gate. A submerged inlet port in the side of the headbox diverts water into a 12-inch pipe for conveyance to Jesse Creek where it is rediverted into the municipal water works. The diversion is equipped with a lockable headgate, a measuring device, but no fish screen. The diversion was surveyed on September 5, 2002, at which time it was diverting 0.79 cfs of the 1.77 cfs flowing in Pollard Creek.

1.3.1.4 Chipps Creek Diversion (DEA 2073)

The Chipps Creek diversion is on Chipps Creek approximately 0.25 miles upstream from Pollard Creek and 3.25 miles upstream from the Salmon River (Figure 3). Water rights served by the Chipps Creek diversion and analyzed in this Opinion are described above in Section 1.3.1.3. The Chipps Creek POD is on private land and consists of a concrete headbox with a screw-type bypass gate. A submerged inlet port in the side of the headbox diverts water into a 12-inch pipe that conveys it across the SCNF boundary to Pollard Creek, just upstream from the Pollard Creek diversion. The diversion is equipped with a lockable headgate, a measuring device, but no fish screen. The diversion was surveyed on September 5, 2002, at which time it was diverting 0.86 cfs of the 0.86 cfs flowing in Chipps Creek.

1.3.1.5 Wallace Creek Diversion (DEA 2103)

The Wallace Creek POD is on Wallace Creek approximately 3.4 miles upstream from the Salmon River (Figure 4). The diversion is a rock berm in Wallace Creek that diverts flow into a ditch with no headgate, measuring device, or screen. The ditch apparently conveys water to Deriar Creek which conveys the water to the place of use near the Salmon River. The Wallace Creek diversion serves two water rights, 75-87C and 75-2099. Water right 75-87C has a maximum diversion rate of 0.4 cfs which is used to irrigate 18.8 acres. Water right 75-2099 is a storage water right for 12 acre feet per year on Wallace Lake. During the irrigation season, the stored water is conveyed from Wallace Lake to the Wallace Creek diversion where it is diverted and used to irrigate 12 of the 18.8 acres irrigated via 75-87C. Conditions of approval for water right 75-2099 limit total diversion to 0.02 cfs per irrigated acre, indicating that water right 75-2099 does not increase allowable diversion rate at the Wallace Creek diversion, but instead facilitates diversion after Wallace Creek natural flow drops below levels needed to meet irrigation needs. Based on descriptions of water rights served by the Wallace Creek diversion, NMFS assumes that a maximum of 0.4 cfs would be diverted to irrigate 18.8 acres. Neither water right lists Deriar Creek as a source, suggesting that Deriar Creek is considered a conveyance ditch and not a source stream. The diversion survey data used in the BA were collected on November 6, 2002, after the irrigation season, and did not include flow measurements.

1.3.1.6 Carmen Creek Diversion (DEA 2076)

The Carmen Creek diversion is on Carmen Creek approximately 7.3 miles upstream from the Salmon River (Figure 5). The diversion consists of a wooden dam across Carmen Creek that diverts water through a short section of 1.7-foot diameter pipe and into an open ditch. The BA states that the Carmen Creek diversion serves four water rights: 75-63A, 75-2002, 75-4332, and 75-4341. A search of water rights by location identified four additional water rights that could be served by the Carmen Creek diversion (i.e., 75-77B, 75-2128, 75-10061AN, and 75-10923). These eight water rights have a combined maximum diversion rate of 13.94 cfs that is used for stockwater (0.9 cfs) and to irrigate 326 acres (13.04 cfs). However, of the eight water rights served by the Carmen Creek diversion, five can also be served by downstream PODs. The three water rights that can only be served by the Carmen Creek diversion (i.e., 75-63A, 75-2002, and 75-4332) have a combined maximum diversion rate of 3.28 cfs used for stockwater (0.9 cfs) and to irrigate 169.9 acres (2.38 cfs).

The BA did not describe the amount of water that would be diverted via the Carmen Creek diversion or the amount of land that would be irrigated with the water diverted via the Carmen Creek diversion. Flow in Carmen Creek and in the Carmen Creek diversion was measured on September 9, 2002; August 18, 2008; September 18, 2008; and August 9, 2013 (Table 4). Based on these flow measurements and descriptions of water rights that can only be served via the Carmen Creek diversion, NMFS assumes that approximately 3.28 cfs would be diverted to irrigate 169.9 acres and provide stockwater.

Table 4. Flow measured in the Carmen Creek diversion and in Carmen Creek upstream from the POD.

Date	Carmen Creek Flow (cfs) upstream from the POD	Amount Diverted (cfs)	Percentage of Flow Diverted
September 9, 2002	5.7	0	0
August 18, 2008	10.7	3.5	33
September 18, 2008	4.9	4.3	88
August 9, 2013	8.7	2.6	29

The BA also states that diversions will be screened to NMFS standards and that fish passage will be maintained at all flows. NMFS therefore assumes that the SCNF will ensure that the Carmen Creek diversion is screened to NMFS standards and meets NMFS criteria for upstream fish passage.

1.3.1.7 East Fork Tower Creek Diversion DEA 2077

The East Fork Tower Creek diversion POD is on East Fork Tower Creek approximately 2.7 miles upstream from Tower Creek and 4.6 miles upstream from the Salmon River (Figure 6). The diversion dam and headbox is a wooden structure that diverts water into a plastic and metal pipeline. The diversion is not equipped with a screen, measuring device, or headgate. The BA states that the diversion serves three water rights (i.e., 75-4144A, 75-4144B, and 75-4345B) but a search by POD location revealed two additional water rights (75-4139 and 75-4140) that are likely diverted via the East Fork Tower Creek diversion. Based on descriptions of these five water rights, NMFS assumes that 1.33 cfs would be diverted to irrigate 86.90 acres. The diversion was surveyed on September 9, 2002, at which time 0.27 cfs of the 0.53 cfs flowing in East Fork Tower Creek was being diverted by the East Fork Tower Creek diversion.

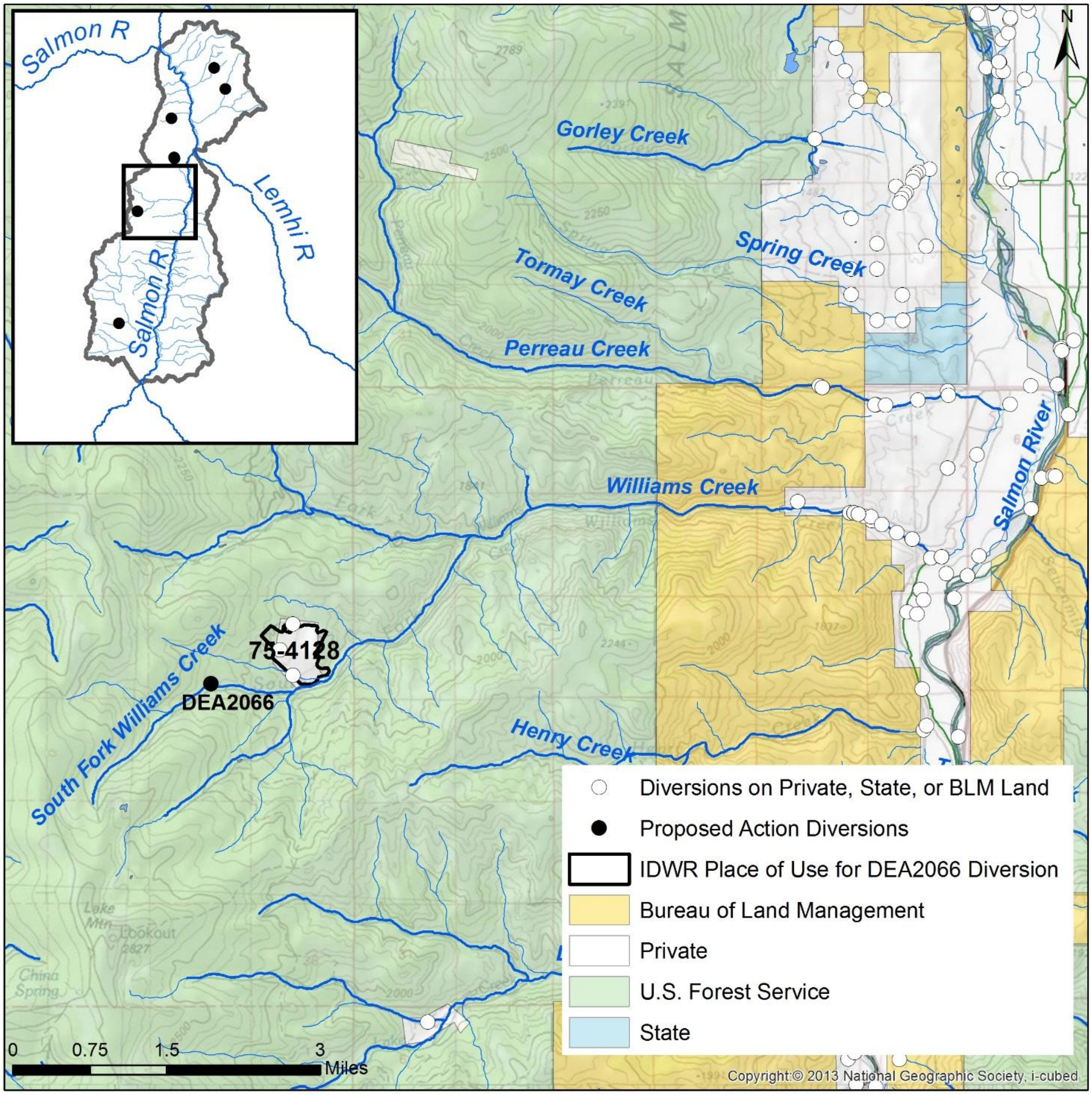


Figure 2. Point of diversion location and place of use boundary for water right 75-4128, served by the South Fork Williams Creek diversion (DEA 2066).

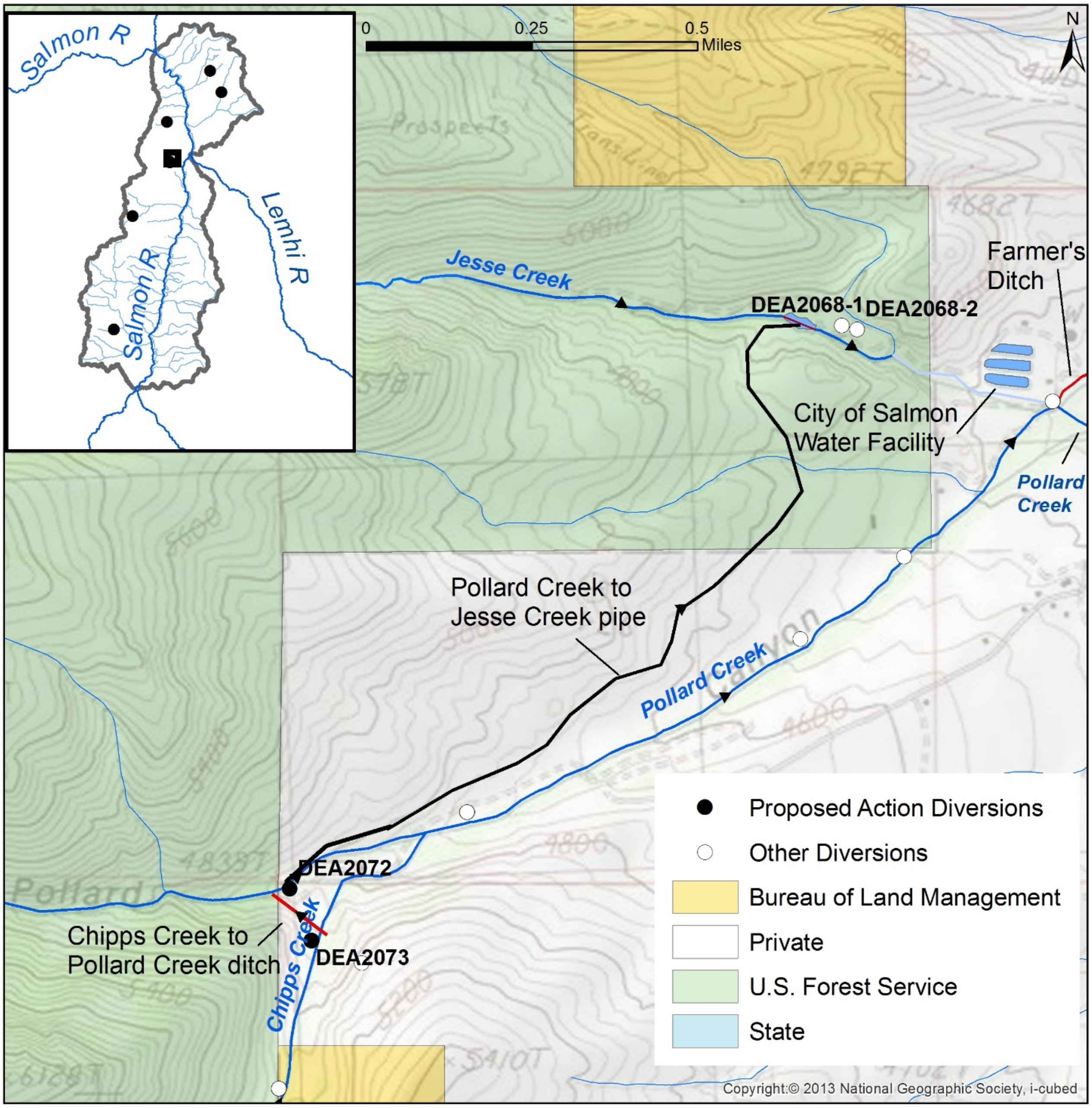
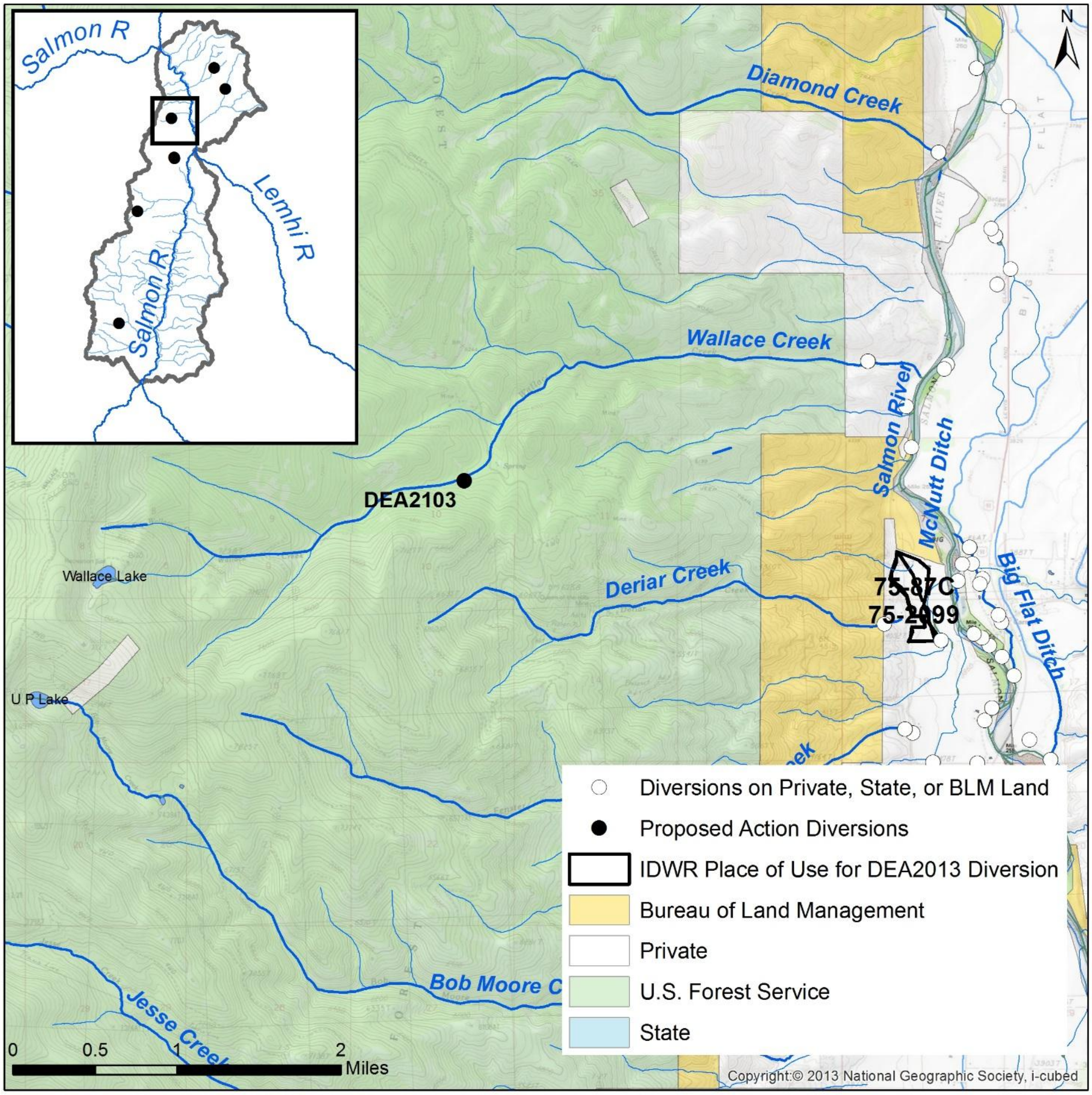
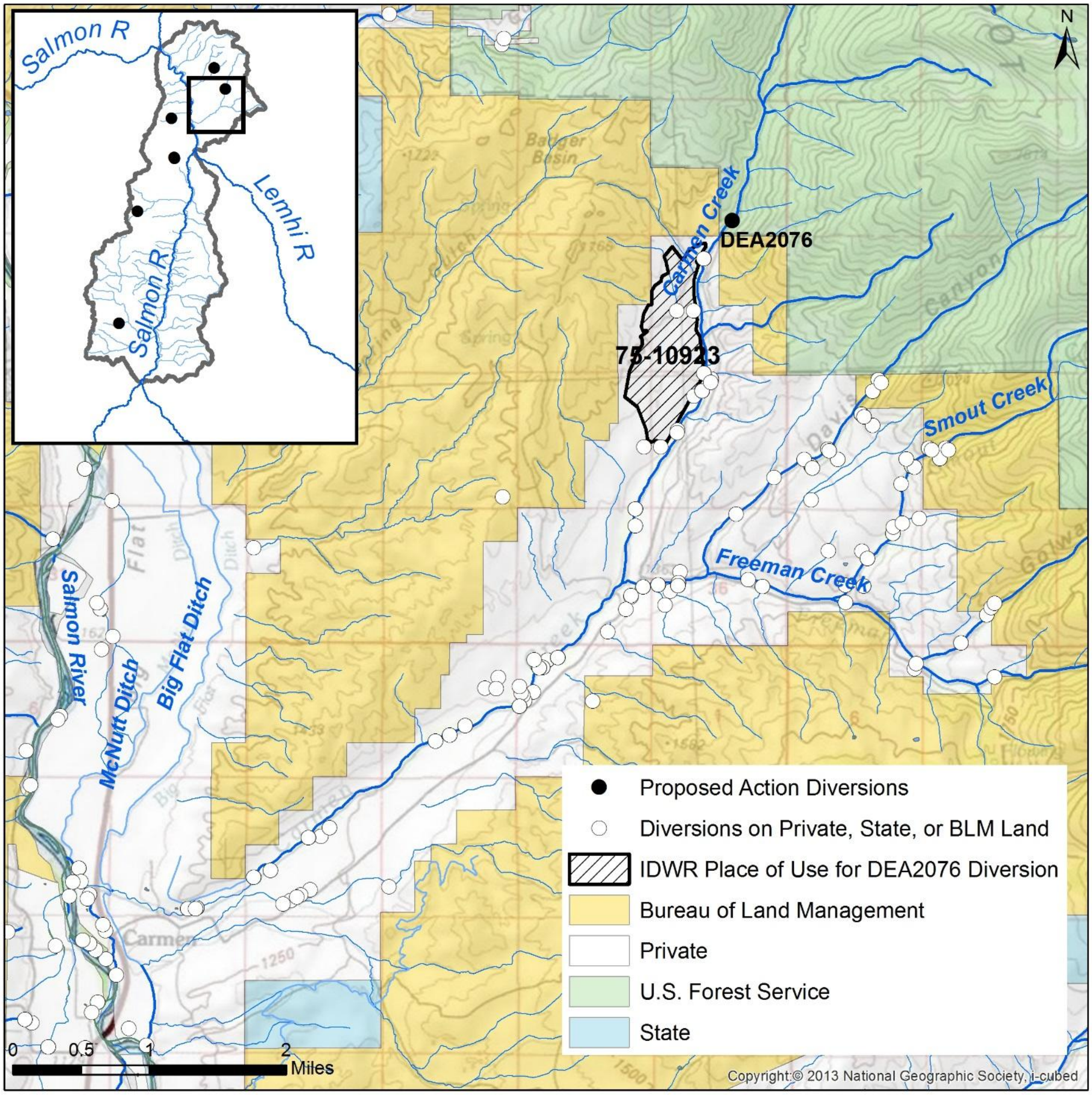


Figure 3. Location of points of diversion and approximate conveyance routes for the Chipps Creek (DEA 2073), Pollard Creek (DEA 2072), and Jesse Creek (DEA 2068-1 and DEA 2068-2) diversions.



Note: Water right 75-2099 also allows storage in Wallace Lake, approximately 2 miles upstream.

Figure 4. Point of diversion location and place of use boundary for water rights 75-87C and 75-2099, served by the Wallace Creek diversion (DEA 2103).



Note: Portions of the place of use are also irrigated with water diverted from the two PODs on Private land (i.e., the PODs in Sections 24 and 25).

Figure 5. Point of diversion location and place of use boundary for water rights served by the Carmen Creek diversion (DEA 2076) (i.e., the POD in section 13).

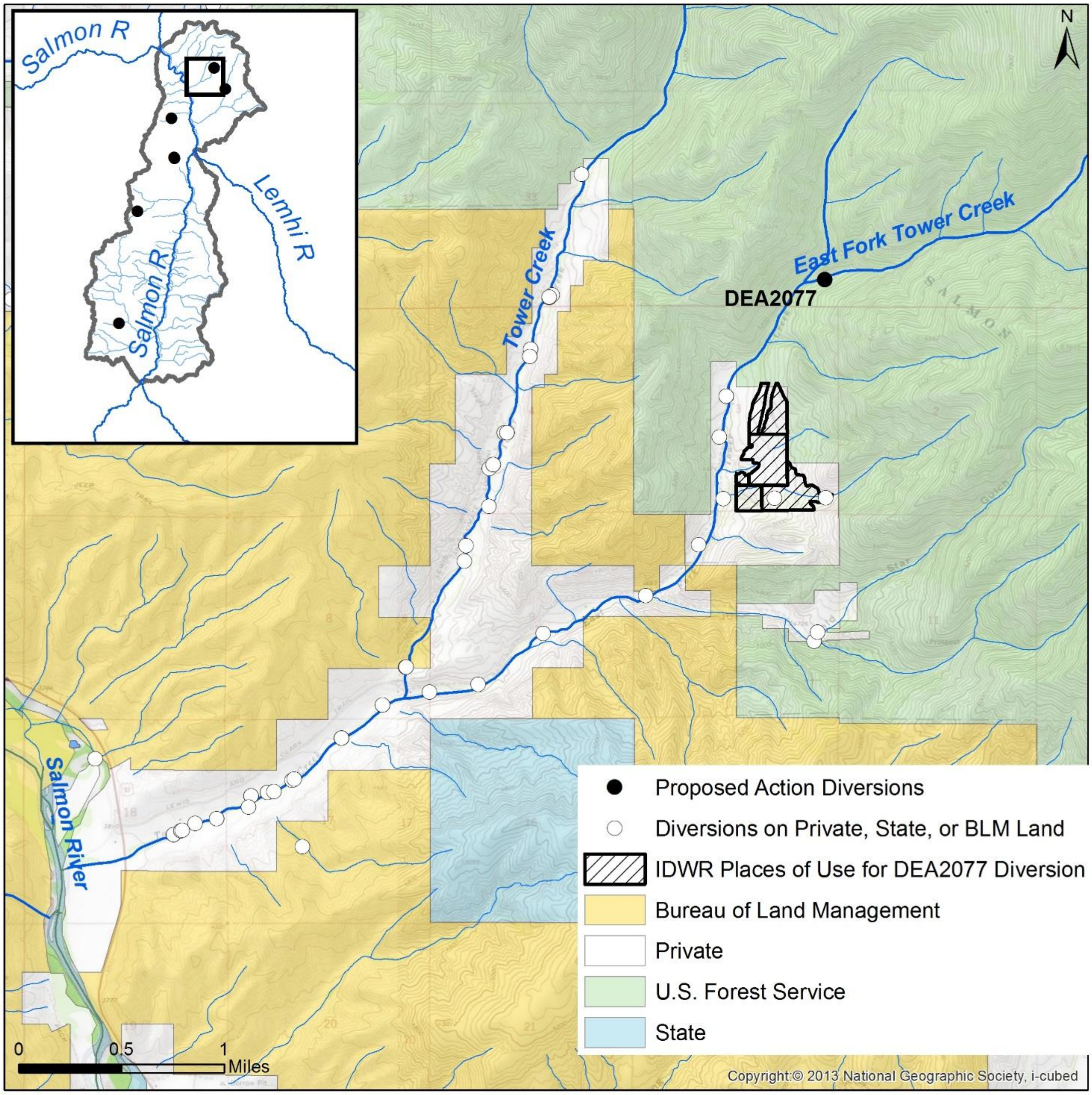


Figure 6. Point of diversion location and place of use boundary for water right 75-4139, 75-4140, 75-4144A, 75-4144B, and 75-4345B served by the East Fork Tower Creek diversion (DEA 2077).

1.3.1.8 Summary of Water Diversion Associated with the Proposed Actions

Because some water rights are served by more than one diversion and some have daily limits that are more stringent than the instantaneous maximum diversion rates, determining the amount of water that can be diverted, based on examination of water rights alone, is sometimes not possible. The BA did not include information needed to precisely determine the amount of water that would be diverted via some of the diversions that would be permitted due the proposed actions. We therefore reviewed the POD and point of use descriptions, the conditions of approval, and estimated flow in source streams for water rights associated with the proposed actions and used that information to estimate the actual amount of water that would likely be diverted. These expected actual water diversion rates are in Table 5.

Table 5. Expected actual water diversion rates that would occur due to the proposed actions.

Diversion	Water Rights	Maximum Diversion Rate (cfs)	Use Dependent on the Proposed Action	Comments	Expected Diversion Rate at the Permitted Diversion
Big Hat Creek (DEA 2099)	75-2137	0.76	Not Applicable	Donated for streamflow restoration. Previously used to irrigate 39 acres.	0 cfs
	75-4199	0.47			
South Fork Williams Creek (DEA 2066)	75-4128	3.2	Yes	A total of 3.2 cfs would be diverted due to the proposed action and used to irrigate 149.8 acres.	3.2 cfs
Pollard Creek (DEA 2072)	75-2167	2	Not Applicable	This is a junior water right in a drainage that was fully appropriated, during the irrigation season, prior to issuance. Because water was not available to fulfil this right, the water users acquired senior water rights to ensure a stable municipal water supply during the irrigation season. Because water is not available for a right that is this junior, existence of this water right does not likely result in an increase in water use over baseline conditions.	0 cfs
Chipps Creek (DEA 2073)	75-14700	0.24	Yes	Up to 2.54 cfs would be diverted from November 1 through March 31. Most or all diversion would likely be via the Jesse Creek diversion that was not included in this consultation.	Approx. 0 cfs
	75-14701	2.3	Yes		
Wallace Creek (DEA 2103)	75-87C	0.4	Yes	Up to 0.4 cfs would be diverted due to the proposed action and used to irrigate 18.8 acres	0.4 cfs
	75-2099	Storage	Yes		
Carmen Creek (DEA 2076)	75-63A	1.3	Yes	Up to 3.28 cfs would be diverted due to the proposed action and used for stockwater and to irrigate 169.9 acres. However, stockwater diversion is limited to 13,000 gallons per day (i.e., daily average of 0.02 cfs).	3.28 cfs maximum, 2.4 cfs average daily
	75-2002	1.08	Yes		
	75-4332	0.9	Yes		

Diversion	Water Rights	Maximum Diversion Rate (cfs)	Use Dependent on the Proposed Action	Comments	Expected Diversion Rate at the Permitted Diversion
East Fork Tower Creek (DEA 2077)	75-4139	0.16	Yes	Up to 1.33 cfs would be diverted due to the proposed action and used to irrigate 86.9 acres.	1.33 cfs
	75-4140	0.15	Yes		
	75-4144A	0.03	Yes		
	75-4144B	0.55	Yes		
	75-4345B	0.44	Yes		

1.3.2 Interrelated and Interdependent Actions

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). As a result of SUP issuance, the permittees will legally be able to divert water on and/or across USFS lands. Without issuance of the SUPs, operation and maintenance of the diversions on or across USFS lands would be unauthorized, and the effects associated with the ongoing use and maintenance of these diversions would not occur. Therefore, effects of these diversions only occur because of the SCNF's issuance of the SUPs. As a result, effects related to maintenance of water diversion and transmission facilities, and to the diversion and use of water, are interrelated/interdependent to the proposed actions. See ESA Section 7 Consultation Handbook, 4-26. Effects of interrelated and interdependent activities are analyzed in the analysis of effects section.

1.4 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 actions covered by this opinion would authorize operation and maintenance of seven diversions on streams in the Middle Salmon watershed. Operation of these seven diversions would result in diversion of 0.9 cfs for stockwater, approximately 7.31 cfs for irrigation, and approximately 4.54 cfs for municipal water supply. All of these uses will result in consumptive use of water, which will reduce flow in all reaches downstream from the diversions.

The action area includes all affect reaches of flow limited streams and reaches of non-flow limited streams in which diversions are greater than one percent of the lowest recorded flows (Tehan 2014). In accordance with this guidance, the action area includes: (1) South Fork Williams Creek from diversion (DEA 2066) to Williams Creek; (2) Williams Creek from South Fork Williams Creek to the Salmon River; (3) Chipps Creek from diversion (DEA 2073) to Pollard Creek; (4) Pollard Creek from diversion (DEA 2072) to the Salmon River; (5) Wallace Creek from Wallace Lake to the Salmon River; (6) Carmen Creek from diversion (DEA 2076) to the Salmon River; (7) East Fork Tower Creek from diversion (DEA 2077) to Tower Creek; (8) Tower Creek from East Fork Tower Creek to the Salmon River; and (9) the mainstem Salmon River from Williams Creek downstream to the confluence of the Middle Fork Salmon River.

The stream reaches described above are part of the action area due to streamflow related impacts. In addition to those stream reaches, the action area includes riparian and stream channel habitat that may be physically damaged due to diversion maintenance activities, or in the case of the Big Hat Creek diversion (DEA 2099), removal of diversion structures. Due to impacts on Chinook salmon in the upper Salmon River drainage and resultant impacts on SRKW's prey base, the action area for killer whales also includes the portion of the eastern Pacific Ocean in which SRKW feeding areas overlap with Chinook salmon from the Columbia River.

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, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an Opinion stating how the agency's actions would affect listed species and their critical habitat. If incidental take is expected, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1 Analytical Approach

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

The adverse modification analysis relies upon the regulatory definition of "destruction or adverse modification" of critical habitat that was published in 81 FR 7414 on February 11, 2016. The destruction or adverse modification of critical habitat means, "a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features.

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

- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action.

- Describe the environmental baseline in the action area.

- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.

- Describe any cumulative effects in the action area.

- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.

- Reach jeopardy and adverse modification conclusions.

- If necessary, define a RPA to the proposed action.

All of the populations analyzed in this opinion are necessary for the recovery of the affected species (NWFSC 2015). For this reason, any alterations within the area that each of these populations occupy that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features may lead to a conclusion that the actions will destroy or adversely modify designated critical habitat.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02.

This opinion also examines 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 current function of the essential physical and biological features (PBF) that help to form that conservation value. The designations of critical habitat for Chinook salmon (58 FR 68543) and steelhead (70 FR 52630) use the phrases "essential features" and "primary constituent elements," respectively to identify features essential to the conservation of the species. New critical habitat regulations (81 FR 7214) replace these with PBF, the current terminology used to define critical habitat under the ESA. In this opinion, we use the term PBF to mean primary constituent elements or essential feature, as appropriate for the specific critical habitat.

2.2.1 Status of the Species

This section describes the present condition of the Snake River spring/summer Chinook salmon, ESU and the Snake River Basin steelhead 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 McElhaney *et al.*'s (2000) description of a viable salmonid population (VSP) that defines "viable" as less than a five percent risk of extinction within 100 years and "highly viable" as less than a one percent risk of extinction within 100 years. A third category, "maintained," represents a less than 25% 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 (ICBTRT 2007). The risk level of the ESU/DPS is built up from the aggregate risk levels of the individual populations and MPGs that make up the ESU/DPS.

Attributes associated with a VSP are: (1) Abundance (number of adult spawners in natural production areas); (2) productivity (adult progeny per parent); (3) spatial structure; and (4) diversity. A VSP needs sufficient levels of these four population attributes in order to: safeguard the genetic diversity of the listed ESU or DPS; enhance its capacity to adapt to various environmental conditions; and allow it to become self-sustaining in the natural environment (ICBTRT 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.

2.2.1.1 Snake River Spring/Summer Chinook Salmon

The Snake River spring/summer Chinook salmon ESU was listed as threatened on April 22, 1992 (57 FR 14653). This ESU occupies the Snake River basin, which drains portions of southeastern Washington, northeastern Oregon, and north/central Idaho. Several factors led to NMFS' conclusion that Snake River spring/summer Chinook were threatened: (1) Abundance of naturally produced Snake River spring and summer Chinook runs had dropped to a small fraction of historical levels; (2) short-term projections were for a continued downward trend in abundance; (3) hydroelectric development on the Snake and Columbia Rivers continued to disrupt Chinook runs through altered flow regimes and impacts on estuarine habitats; and (4) habitat degradation existed throughout the region, along with risks associated with the use of outside hatchery stocks in particular areas (Good *et al.* 2005). On May 26, 2016, in the agency's most recent 5-year review for Pacific salmon and steelhead, NMFS concluded that the species should remain listed as threatened (81 FR 33468).

Snake River spring/summer Chinook salmon are characterized by their return times. Runs classified as spring Chinook salmon are counted at Bonneville Dam beginning in early March and ending the first week of June; summer runs are those Chinook salmon adults that pass Bonneville Dam from June through August. Returning adults will hold in deep mainstem and tributary pools until late summer, when they move up into tributary areas and spawn. In general, spring-run type Chinook salmon tend to spawn in higher-elevation reaches in mid- through late August; and summer-run Chinook salmon tend to spawn at lower elevations in late August and September (although the spawning areas of the two runs may overlap).

Spring/summer Chinook spawn generally follow a "stream-type" life history characterized by rearing for a full year in the spawning habitat and migrating in early to mid-spring as age-1 smolts (Healey 1991), however portions of some populations migrate during their first summer as age-0 smolts (Copeland and Venditti 2009). Eggs are deposited in late summer and early fall, incubate over the following winter, and hatch in late winter and early spring of the following year. Juveniles rear through the summer, and most overwinter and migrate to sea in the spring of their second year of life. Depending on the tributary and the specific habitat conditions, juveniles may migrate extensively from natal reaches into alternative summer-rearing or overwintering areas, or may migrate to the ocean as age-0 smolts. Snake River spring/summer Chinook salmon return from the ocean to spawn primarily as 4- and 5-year-old fish, after 2 to 3 years in the ocean. A small fraction of the fish return as 3-year old "jacks," heavily predominated by males (Good *et al.* 2005).

The Snake River ESU includes all naturally spawning populations of spring/summer Chinook in the mainstem Snake River (below Hells Canyon Dam) and in the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins (57 FR 23458), as well as the progeny of 15 artificial propagation programs (70 FR 37160). The hatchery programs include the South Fork Salmon River (McCall Hatchery), Johnson Creek, Lemhi River, Pahsimeroi River, East Fork Salmon River (EFSR), West Fork Yankee Fork Salmon River, Upper Salmon River (Sawtooth Hatchery), Tucannon River (conventional and captive broodstock programs), Lostine River, Catherine Creek, Lookingglass Creek, Upper Grande Ronde River, Imnaha River, and Big Sheep Creek programs. The historical Snake River ESU likely also included populations in the Clearwater River drainage and extended above the Hells Canyon Dam complex.

Within the Snake River ESU, the Interior Columbia Basin Technical Recovery Team (ICBTRT) identified 28 extant and four extirpated or functionally extirpated populations of spring/summer-run Chinook salmon, listed in Table 3 (ICTRT 2003; McClure *et al.* 2005). The ICBTRT aggregated these populations into five MPGs: Lower Snake River, Grande Ronde/Imnaha Rivers, South Fork Salmon River, Middle Fork Salmon River, and Upper Salmon River. For each population, Table 3 shows the current risk ratings that the ICBTRT assigned to the four parameters of a VSP (spatial structure, diversity, abundance, and productivity). All extant populations must achieve at least "maintained status" (i.e., moderate risk of extinction) for the ESU to recover (NMFS 2015d).

Spatial structure risk is low to moderate for most populations in this ESU (NWFSC 2015) and is generally not preventing the recovery of the species. Spring/summer Chinook salmon spawners are distributed throughout the ESU albeit at very low numbers. Diversity risk, on the other hand, is somewhat higher, driving the moderate and high combined spatial structure/diversity risks shown in Table 6 for some populations. Several populations have a high proportion of hatchery-origin spawners—particularly in the Grande Ronde, Lower Snake, and South Fork Salmon MPGs—and diversity risk will need to be lowered in multiple populations in order for the ESU to recover (ICTBRT 2007, ICBTRT 2010, NWFSC 2015). The ratio of hatchery fish to naturally produced fish in the ESU has been steadily increasing since listing (ODFG and WDFW 2015), indicating an overall increase in diversity risk.

Historically, the Snake River drainage is thought to have produced more than 1.5 million adult spring/summer Chinook salmon in some years (Matthews and Waples 1991), yet by the mid-1990s counts of wild fish passing Lower Granite Dam (LGD) dropped to less than 10,000 (IDFG 2007). Wild returns have since increased somewhat but remain a fraction of historic estimates. Between 2005 and 2015, the number of wild adult fish passing LGD annually ranged from 8,808 to 30,338 (IDFG 2016). Natural origin abundance has increased over the last 5 years for most populations in this ESU, but the increases have not been large enough to change population viability ratings for abundance and productivity; all but one population (Chamberlain Creek) remain at high risk of extinction over the next 100 years (NWFSC 2015). Many populations in Table 6 will need to see increases in abundance and productivity in order for the ESU to recover.

Table 6. Summary of VSP parameter risks and overall current status for each population in the Snake River spring/summer Chinook salmon ESU (NWFSC 2015).

MPG	Population	VSP Parameter Risk		Overall Viability Rating
		Abundance/ Productivity	Spatial Structure/ Diversity	
South Fork Salmon River (Idaho)	Little Salmon River	*Insufficient data*	Low	High Risk
	South Fork Salmon River mainstem	High	Moderate	High Risk
	Secesh River	High	Low	High Risk
	East Fork South Fork Salmon River	High	Low	High Risk
Middle Fork Salmon River (Idaho)	Chamberlain Creek	Moderate	Low	Maintained
	Middle Fk. Salmon River below Indian Ck.	*Insufficient data*	Moderate	High Risk
	Big Creek	High	Moderate	High Risk
	Camas Creek	High	Moderate	High Risk
	Loon Creek	High	Moderate	High Risk
	Middle Fk. Salmon River above Indian Ck.	High	Moderate	High Risk
	Sulphur Creek	High	Moderate	High Risk
	Bear Valley Creek	High	Low	High Risk
	Marsh Creek	High	Low	High Risk
Upper Salmon River (Idaho)	North Fork Salmon River	*Insufficient data*	Low	High Risk
	Lemhi River	High	High	High Risk
	Salmon River Lower Mainstem	High	Low	High Risk
	Pahsimeroi River	High	High	High Risk
	East Fork Salmon River	High	High	High Risk
	Yankee Fork Salmon River	High	High	High Risk
	Valley Creek	High	Moderate	High Risk
	Salmon River Upper Mainstem	High	Low	High Risk
	Panther Creek			***Functionally Extirpated***
Lower Snake (Washington)	Tucannon River	High	Moderate	High Risk
	Asotin Creek			***Functionally Extirpated***
Grande Ronde and Imnaha Rivers (Oregon/ Washington)	Wenaha River	High	Moderate	High Risk
	Lostine/Wallowa River	High	Moderate	High Risk
	Minam River	High	Moderate	High Risk
	Catherine Creek	High	Moderate	High Risk
	Upper Grande Ronde River	High	High	High Risk
	Big Sheep Creek			***Functionally Extirpated***
	Imnaha River	High	Moderate	High Risk
	Lookingglass Creek			Functionally Extirpated

Lemhi River Chinook Salmon. The Lemhi River Chinook salmon population is classified as very large, requiring a minimum population size of 250 or 2,000 returning spawners, respectively, to achieve "maintained" or "viable" status. Spawning and rearing habitat for the Lemhi River Chinook salmon population includes the entire Lemhi River drainage and the mainstem Salmon River and all tributaries between the Lemhi River and the North Fork Salmon River, but does not include the North Fork Salmon River drainage. This population must achieve at least “maintained” status for the ESU to recover. Due to historic size and location of this population in the lower part of the upper Salmon River MPG, the desired status is “viable” (NMFS 2014b).

Lemhi River Chinook salmon historically spawned throughout the mainstem Lemhi River (Gebhards 1959; NMFS 2014b), in at least eight Lemhi River tributaries, in Carmen Creek (NMFS 2014b), and possibly in the mainstem Salmon River. Currently, spawning only occurs in the mainstem Lemhi River upstream from the confluence of Hayden Creek and in the Hayden Creek drainage, leaving four of the five spawning areas unoccupied. Due to lack of spawning in four of the five spawning areas, the Lemhi River Chinook salmon population is moderate risk for spatial structure (NMFS 2014b). Although habitat restoration activities have reestablished flow in the lower reaches of some Lemhi River tributaries, the restored flows are insufficient for upstream passage of adult Chinook salmon. Spatial structure of the Lemhi River Chinook salmon population will not likely improve substantially in the foreseeable future.

Chinook salmon have not been stocked in the Lemhi River since 2002 and risk of hatchery introgression is low. However, diversity is threatened by elimination of spawning in areas that historically supported summer run Chinook salmon and by selective pressures on outmigrating juveniles. Currently, the major adult life history strategy is spring-run migration timing, but historically a summer-run component also existed. Summer-run fish primarily spawned in the lower mainstem Lemhi River, downstream from Hayden Creek. Spawning in this reach has been eliminated due to habitat degradation caused by irrigation diversions, resulting in a high-risk rating for diversity (NMFS 2014b). This diversity risk is further increased by selective pressures on juveniles. The Lemhi River Chinook salmon population produces age-1 smolts that migrate to the ocean in late winter and spring, and age-0 smolts that migrate in late spring and summer (Arthaud *et al.* 2010). Juveniles migrating in late spring and summer experience higher mortality due to increased impacts of water withdrawals and worsening conditions in the Snake and Columbia Rivers. This higher mortality of late migrating fishes reduces the expression of the age-0 smolt life history strategy (NMFS 2014b), increasing the already high diversity risk for this population. Habitat restoration activities are not currently targeting flow in habitat historically used by summer-run Chinook salmon and mortality of age-0 smolts continues to be high. Diversity of the Lemhi River Chinook salmon population will not likely improve substantially in the foreseeable future.

The Lemhi River Chinook salmon population has increased in abundance since listing, during the latest ten years, and during the latest 5 years (IDFG unpublished redd counts). The current population size (10-year geomean) is approximately 237 spawners. In spite of these increases, the current population size is only 6.5% of the historic (i.e., 1957 through 1966) size and 11.8% of the size needed to achieve “viable” status. However, it is 95% of the size needed to achieve “maintained” status. Abundance of Lemhi River Chinook salmon relative to the minimum needed for “viable” status is among the lowest in the ESU.

Salmonid populations usually exhibit density dependence, wherein population productivity decreases with higher population density (Lobon-Cervia 2007). The nature of the productivity versus density relationships is useful for determining potential for population growth. The Lemhi River Chinook salmon juvenile production versus density relationship described by Walters *et al.* (2013) indicates that smolt to adult return rates (SAR) of 4.7% and 29.9%, respectively, would be needed to achieve minimum population sizes for “maintained” and “viable” status. Information presented in NMFS (2014c) indicates that a long-term SAR as high as 4.7% is unlikely and a SAR of 29.9% would be practically impossible. Although increases in the Lemhi River Chinook salmon population size are encouraging, the juvenile production versus density relationship described by Walters *et al.* (2013), coupled with the out-of-basin survival described by NMFS (2014c), indicates that the population will likely remain at high risk of extinction for the foreseeable future.

As described above, Snake River spring/summer Chinook salmon juveniles often migrate extensively from natal reaches into alternative summer-rearing or overwintering areas. Data from the Lemhi River juvenile sampling program and the lower Lemhi River Passive Integrated Transponder (PIT) tag scanning array indicates that this life history tactic occurs in the Lemhi River Chinook salmon population. Between 2011 and 2015, proportion of the Lemhi River Chinook salmon year class migrating into the Salmon River during spring or summer of their first year averaged 7.3% (range 0.3% to 22%) and was density dependent, with the highest proportions of the year class moving during years with highest population densities (Unpublished IDFG data). Age of the fish and timing of movement indicates that these fish were seeking rearing habitat. However, as described in Section 2.3.1.1, high summer water temperatures and lack of cold water refugia may render this reach of the Salmon River unsuitable for rearing Chinook salmon. Lack of suitable rearing habitat downstream from the Lemhi River drainage probably limits size of the Lemhi River Chinook salmon population. The high proportion of Lemhi River Chinook salmon seeking rearing habitat in a currently unsuitable reach of the Salmon River during high population density years, may at least partially explain why the Lemhi River Chinook salmon population is capable of producing fewer smolts than other Chinook salmon populations studied by Walters *et al.* (2013).

In summary, Lemhi River spring/summer Chinook salmon spawning is constrained to a small portion of the historically available habitat, the population is at high risk due to low abundance, and the population is limited by lack of suitable juvenile rearing habitat. Although the population has grown in recent years, it remains below levels needed to achieve moderate risk of extinction. Juvenile production to spawner relationships indicate that risk due to low abundance will remain high for the foreseeable future. Improvement in quality and quantity of juvenile rearing habitat will be needed for the population to achieve “maintained” status. The RPA described in NMFS (2012a) would partially address issues with Lemhi River Chinook salmon spawning and rearing habitat. NMFS has not received monitoring reports stipulated by NMFS (2012a) and assumes that the RPA has yet to be implemented. This population must achieve at least “maintained” status for the ESU to recover and due to historic size and location of this population in the lower part of the upper Salmon River MPG, the desired status is “viable” (NMFS 2014b). However, as detailed above, the Lemhi River spring/summer Chinook salmon population will remain at high risk of extinction for the foreseeable future.

Salmon River Lower Mainstem Chinook Salmon. The Salmon River Lower Mainstem (SRLM) Chinook salmon population is classified as very large, requiring a minimum population size of

250 or 2,000 returning spawners, respectively, to achieve “maintained” or “viable” status. Spawning and rearing habitat for the SRLM Chinook salmon population includes the mainstem Salmon River from Redfish Lake Creek (RM 382) downstream to the Lemhi River (RM 259) and all of the smaller drainages tributary to this reach. The population area does not include the larger tributary drainages (i.e., Redfish Lake Creek, Valley Creek, Yankee Fork Salmon River, East Fork Salmon River, Pahsimeroi River, and the Lemhi River). This population must achieve at least “maintained” status for the ESU to recover and the current target for this population is “maintained” (NMFS 2011).

The SRLM Chinook salmon historically spawned throughout the mainstem Salmon River from Redfish Lake Creek to the Lemhi River (IDFG 1967), and probably spawned in at least nine Salmon River tributary streams (NMFS 2014b). Currently, spawning normally only occurs in the mainstem Salmon River upstream from the EFSR (RM 343) but spawning occurs sporadically downstream to the Pahsimeroi River (RM 314) and Idaho Department of Fish and Game (IDFG) continues to survey downstream to the Lemhi River. Due to lack of spawning downstream from the EFSR, the SRLM Chinook salmon population is at moderate risk of extinction due to lack of spatial structure (NMFS 2014b). The long term trend for the SRLM Chinook salmon population has been less spawning in the lower reaches and there is no indication of that trend changing. The SRLM Chinook salmon population will likely remain at moderate, or higher, risk of extinction, due to low and declining spatial structure, for the foreseeable future.

The diversity risk for the SRLM Chinook salmon population is moderate due to possible loss of an age-0 smolt life history strategy. The higher temperatures in the lower reaches of the SRLM Chinook salmon spawning area during fall, winter, and spring, likely facilitates relatively fast growth of juveniles, enabling expression of an age-0 smolt life history strategy (NMFS 2014b). As described in the previous paragraph, the long term trend for the SRLM Chinook salmon population has been less spawning in the lower reaches. The SRLM Chinook salmon population will likely remain at moderate, or higher, risk of extinction, due to and declining diversity, for the foreseeable future.

The SRLM Chinook salmon population is unusual for the ESU in that current abundance is approximately 28% lower than it was at listing and the population trends for the latest 15 years, ten years, and five years are negative (IDFG unpublished redd counts). The current population size (10-year geomean) is approximately 149 spawners. This is 12.7% of the historic (i.e., 1957 through 1966) size, 59.6% of the size needed to achieve “maintained” status, and 7.4% of the size needed to achieve “viable” status. Abundance of SRLM Chinook salmon relative to the minimum needed for “viable” status is among the lowest in the ESU, indicating that risk due to low abundance is among the highest. At the current rate of decline, the SRLM Chinook salmon population will be functionally extirpated (i.e., 10-year geomean of fewer than 50 spawners) in 25 years.

Juvenile outmigrant data are not available for the SRLM Chinook salmon population and the SRLM Chinook salmon production versus density relationship was therefore not described by Walters *et al.* (2013). However, the relationships of population productivity, expressed as returning adults, and population density for the SRLM and Lemhi River Chinook salmon populations are similar (Figure 7), indicating that the SRLM and the Lemhi River Chinook salmon populations likely have similar limitations on population growth. Also, the location of the currently occupied spawning habitat just upstream from mainstem upper Salmon River reaches that are likely unsuitable for rearing, suggests that, like the Lemhi River population, the SRLM population is constrained by suitable rearing habitat downstream from the spawning areas.

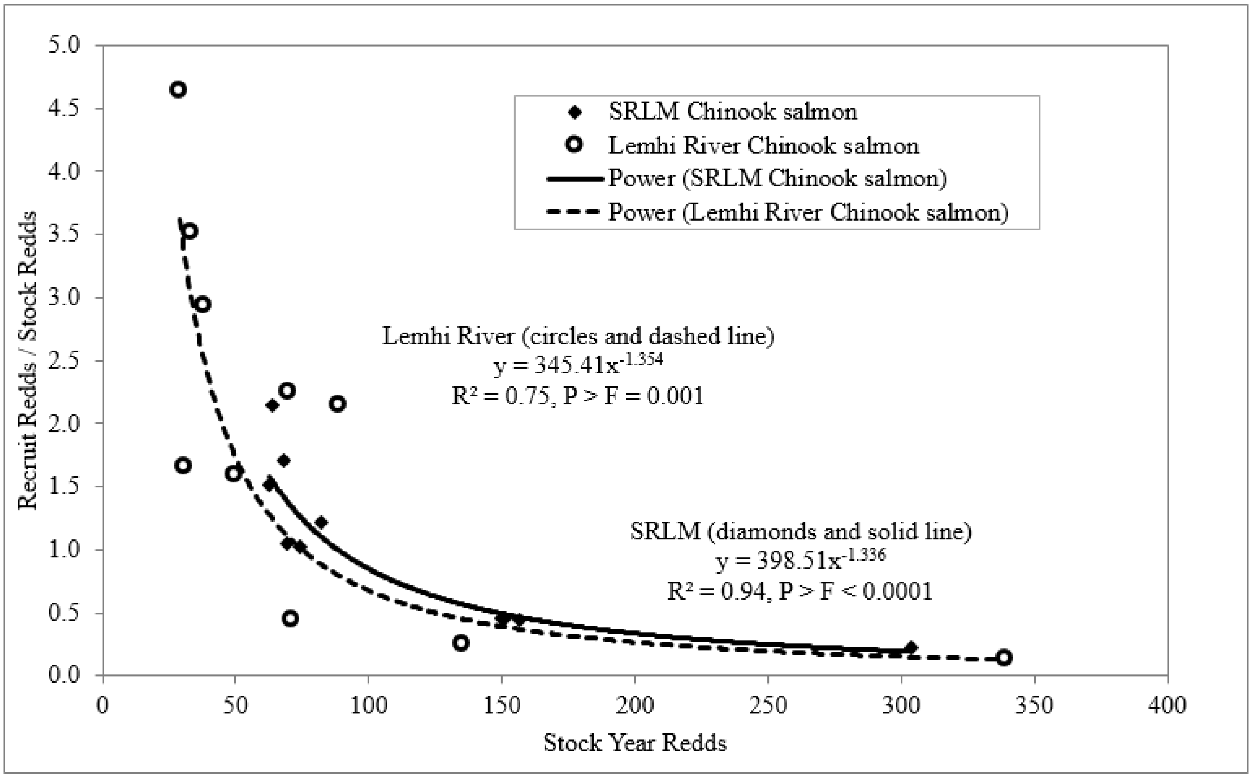


Figure 7. The SRLM and Lemhi River Chinook salmon recruit to stock ratio versus redds counted for the 2001 to 2010 brood years assuming equal proportions of 4- and 5-year-old returns.

In summary, SRLM Chinook salmon spawning is constrained to a small portion of the historically available habitat, the population is at high risk due to low abundance, and the population is apparently limited by lack of suitable juvenile rearing habitat. Unlike most populations in the ESU, the SRLM population is declining in both spawning distribution and abundance. Improvement in quality and quantity of juvenile rearing habitat will likely be needed to reverse the current trend of declining toward extinction. The RPA described in NMFS (2012b) would partially address issues with SRLM Chinook salmon spawning and rearing habitat. NMFS has not received monitoring reports stipulated by NMFS (2012b) and assumes that the RPA has yet to be implemented. This population must achieve maintained status for the recovery of the ESU. Based on the current trends, the SRLM Chinook salmon population will likely remain at high risk of extinction for the foreseeable future and may become functionally extinct by 2040.

North Fork Salmon River Chinook Salmon Population. The North Fork Salmon River (NFSR) Chinook salmon population is classified as a basic sized population, requiring a minimum population size of 250 or 500 returning spawners, respectively, to achieve "maintained" or "viable" status. Spawning and rearing habitat for the NFSR Chinook salmon population includes the entire NFSR drainage, the mainstem Salmon River, and all tributary drainages between the NFSR and Panther Creek (RM 210). This population must achieve at least "maintained" status for the ESU to recover and the current target for this population is "maintained" (NMFS 2014b).

Chinook are currently distributed throughout the historical range of the population, making the overall spatial structure risk low (NMFS 2014b). Chinook salmon were stocked only one time over 30 years ago and the population has apparently not lost any life history variants, making the overall diversity risk low (NMFS 2014b). However, the population is currently at high risk of extinction due to low abundance. Current population size is 41 adult spawners (10-year geomean), which is 17% of the historic (i.e., 1957 through 1966) population size, 16.4% of the size needed to achieve "maintained" status, and 8.2% of the size needed to achieve "viable" status. Population trends for the most recent 10- and 5-year periods are positive and, although redd count data are limited, the population appears to have increased since listing (IDFG unpublished redd count data). Although the population is increasing, the small size indicates that the population will remain at high risk of extinction due to low abundance, for the foreseeable future.

In summary, distribution throughout historic spawning habitat, low levels of historic stocking, and relatively consistent increases in abundance are good signs for the NFSR Chinook salmon population. This population must achieve at least "maintained" status for the ESU to recover. However, the low abundance indicates that the population will remain at high risk of extinction for the foreseeable future.

Panther Creek Chinook Salmon Population. The Panther Creek Chinook salmon population is classified as an intermediate sized population requiring a minimum population size of 250 or 750 returning spawners, respectively, to achieve "maintained" or "viable" status. Spawning and rearing habitat for the Panther Creek Chinook salmon population includes the Panther Creek drainage, the mainstem Salmon River, and all tributary drainages between Panther Creek and the Middle Fork Salmon River (MFSR). Mining activities from 1948 through 1967 rendered approximately 24.8 miles (40 kilometers) of lower Panther Creek (i.e., downstream from Blackbird Creek) uninhabitable by fish and most aquatic invertebrates (Mebane *et al.* 2015). By the mid-1960s, Chinook salmon were extirpated from the Panther Creek drainage and reintroduction efforts in the 1970s and 1980s failed, presumably due to poor water quality (Mebane 1994). Habitat restoration began in 1995, and by 2001 salmonids were again able to survive in lower Panther Creek (Mebane *et al.* 2015). The Panther Creek Chinook salmon population is currently listed as functionally extirpated with no target for recovery (NMFS 2014b). However, Chinook salmon have been spawning in Panther Creek, redds have been documented every year since 2006, current population size appears to be approximately 40 adult returns, and the number of Chinook salmon spawning in Panther Creek appears to be increasing. Although there are no recovery targets for this population, achieving "viable" status would contribute to recovery of the ESU. Although functionally extirpated, Chinook salmon have recolonized the Panther Creek drainage. Little is currently known about trends in abundance or distribution. The apparent low abundance indicates the population is likely at high risk of extinction but recent expansion into formally occupied habitat is promising.

2.2.1.2 Snake River Basin Steelhead

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

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

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

The ICBTRT identified 24 extant populations within this DPS, organized into five MPGs (ICTRT 2003). The ICBTRT also identified a number of potential historical populations associated with watersheds above the Hells Canyon Dam complex on the mainstem Snake River, a barrier to anadromous migration. The five MPGs with extant populations are the Clearwater

River, Salmon River, Grande Ronde River, Imnaha River, and Lower Snake River. In the Clearwater River, the historic North Fork population was blocked from accessing spawning and rearing habitat by Dworshak Dam. Current steelhead distribution extends throughout the DPS, such that spatial structure risk is generally low. For each population in the DPS, Table 7 shows the current risk ratings for the parameters of a VSP (spatial structure, diversity, abundance, and productivity). All populations in the DPS must achieve at least maintained status (i.e., moderate risk of extinction) for the DPS to recover (NMFS 2015d).

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

Table 7. Summary of VSP parameter risks and overall current status for each population in the Snake River Basin steelhead DPS (NWFSC 2015).

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

Note: Risk ratings with "?" are based on limited or provisional data series.

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

Diversity risk for populations in the DPS is either moderate or low. Large numbers of hatchery steelhead are released in the Snake River, and the relative proportion of hatchery adults in natural spawning areas near major hatchery release sites remains uncertain. Moderate diversity risks for some populations are thus driven by the high proportion of hatchery fish on natural spawning grounds and the uncertainty regarding these estimates (NWFSC 2015). During the most recent five years, approximately 76% of steelhead entering the Snake River were hatchery origin (ODFW and WDFW 2016), indicating a high potential for hatchery introgression. However, during the most recent ten years, proportion of hatchery origin steelhead has declined (ODFW and WDFW 2016), indicating a declining hatchery related diversity risk. Reductions in hatchery-related diversity risks would increase the likelihood of these populations reaching viable status.

Historical estimates of steelhead production for the entire Snake River basin are not available, but the basin is believed to have supported more than half the total steelhead production from the Columbia River basin (Mallet 1974, as cited in Good *et al.* 2005). Historical estimates of steelhead passing Lewiston Dam (removed in 1973) on the lower Clearwater River were 40,000 to 60,000 adults (Ecovista *et al.* 2003), and the Salmon River basin likely supported substantial production as well (Good *et al.* 2005). In contrast, at the time of listing in 1997, the 5-year mean abundance for natural-origin steelhead passing LGD, which includes all but one population in the DPS, was 11,462 adults (Ford 2011). Counts have increased since then, with between roughly 23,000 and 44,000 adult wild steelhead passing LGD in the most recent 5-year period (2011 through 2015) (NWFSC 2015).

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

Pahsimeroi River Steelhead. The Pahsimeroi River steelhead population is classified as an intermediate sized population requiring a minimum population size of 283 or 1,000 returning spawners, respectively, to achieve "maintained" or "viable" status. Spawning and rearing habitat for the Pahsimeroi River steelhead includes the Pahsimeroi River drainage and the mainstem Salmon River, and all tributaries between the Pahsimeroi and Lemhi Rivers. The Pahsimeroi River steelhead population must achieve at least "maintained" status for the DPS to recover and the draft recovery plan target for the population is "maintained" (NMFS 2014c).

The Pahsimeroi River steelhead population is moderate risk for spatial structure due to absence of steelhead in portions of the lower Pahsimeroi River drainage and, until recently, in the two minor spawning areas downstream from the Pahsimeroi River. Recent reestablishment of steelhead in the Iron Creek minor spawning area could reduce spatial structure risk. The population is also moderate risk for diversity due to reduced access to tributary habitat and portions of the mainstem Pahsimeroi River caused by dewatering from irrigation diversions, and due to presence of hatchery steelhead both in the Pahsimeroi River and the mainstem Salmon River.

Abundance risk of Salmon River steelhead populations are based on aggregate counts at LGD, which indicated that all of the A-run populations were moderate risk and all of the B-run populations were high risk (Ford 2011). The Pahsimeroi River steelhead population is characterized as primarily A-run and was therefore considered moderate risk for abundance (Ford 2011). Preliminary population estimates conducted by IDFG (Copeland *et al.* 2013; Copeland *et al.* 2014) indicate a 10-year geomean size of 649 returning spawners for the Pahsimeroi River steelhead population (see Appendix C), which supports the conclusions based on aggregate counts at LGD.

The available information indicates that the Pahsimeroi River steelhead population is currently "maintained," which is the target status for DPS recovery. However, abundance estimates are based on indirect measurements and population trend data are not currently available. Recent reestablishment of access to habitat in Pahsimeroi River tributary streams and Iron Creek could improve overall status of the population.

Lemhi River Steelhead. The Lemhi River steelhead population is classified as an intermediate sized population requiring a minimum population size of 283 or 1,000 returning spawners, respectively, to achieve "maintained" or "viable" status. Spawning and rearing habitat for the Lemhi River steelhead includes the Lemhi River drainage and the mainstem Salmon River, and all tributaries between the Lemhi River and the North Fork Salmon River. The Lemhi River steelhead population must achieve at least "maintained" status for the DPS to recover, but the draft recovery plan target for the population is "viable" (NMFS 2014c).

Because all major spawning areas are occupied, spatial structure risk is low for the Lemhi River steelhead population (NMFS 2014c). Until recently, both minor spawning areas were unoccupied, however, steelhead have apparently recolonized the Carmen Creek minor spawning area (IDFG unpublished PIT tag scanning array data) indicating that spatial structure risk might be declining. Diversity risk is moderate due to large numbers of hatchery fish stocked both in the Lemhi and Salmon Rivers, and due to reduced access to tributary spawning habitat due to irrigation diversions (NMFS 2014c). Increased access to tributary habitat, due to habitat restoration, may reduce diversity risk for the Lemhi River steelhead population.

Abundance risk of Salmon River steelhead populations is based on aggregate counts at LGD, which indicated that all of the A-run populations were moderate risk and all of the B-run populations were high risk (Ford 2011). The Lemhi River steelhead population is characterized as primarily A-run and was therefore considered moderate risk for abundance (Ford 2011). Preliminary population estimates conducted by IDFG (Copeland *et al.* 2013; Copeland *et al.* 2014) indicate a 10-year geomean size of 783 returning spawners for the Lemhi River steelhead population (see Appendix C), which supports the conclusions based on aggregate counts at LGD.

The available information indicates that the Lemhi River steelhead population is currently "maintained" status. Although "maintained" status is sufficient for recovery of the DPS, the desired status is "viable." However, abundance estimates are based on indirect measurements and population trend data are not currently available. Recent reestablishment of access to habitat in Lemhi River tributary streams and Carmen Creek could improve overall status of the population.

North Fork Salmon River Steelhead. The NFSR steelhead population is classified as a basic population requiring a minimum population size of 194 or 500 returning spawners, respectively, to achieve "maintained" or "viable" status. Spawning and rearing habitat for the NFSR steelhead population includes the NFSR drainage and the mainstem Salmon River and all tributaries between the NFSR and Panther Creek (NMFS 2011). The NFSR steelhead population must attain at least "maintained" status for the DPS to recover and the draft recovery plan target is "maintained" (NMFS 2014c).

Steelhead are currently present in all historic spawning areas, making spatial structure risk low (NMFS 2014c). Diversity risk is moderate due to past stocking in the North Fork Salmon River and ongoing stocking in the mainstem Salmon River (NMFS 2014c). Abundance risk of Salmon River steelhead populations are based on aggregate counts at LGD, which indicated that all of the A-run populations were moderate risk and all of the B-run populations were high risk (Ford 2011). The NFSR steelhead population is characterized as primarily A-run and was therefore considered moderate risk for abundance (Ford 2011). However, preliminary population estimates conducted by IDFG (Copeland *et al.* 2013; Copeland *et al.* 2014) indicate a 10-year geomean size of 139 returning spawners for the NFSR River steelhead population (see Appendix C), which indicates that the population may currently be high risk for abundance.

Although the status review classified the NFSR steelhead population as "maintained," the most recent abundance estimates indicates that the population may be at high risk due to low abundance. Presence of steelhead throughout all historically occupied habitat indicates that the population could achieve "maintained" status if abundance increased. As with all steelhead populations in the Salmon River drainage, population trend data are not available and actual current status is somewhat speculative.

Panther Creek Steelhead. The Panther Creek steelhead population is classified as a basic population requiring a minimum population size of 194 or 500 returning spawners, respectively, to achieve "maintained" or "viable" status (NMFS 2014c). Spawning and rearing habitat for the Panther Creek steelhead population includes the Panther Creek drainage, the mainstem Salmon River between Panther Creek and Chamberlin Creek, and all Salmon River tributaries between Panther and Chamberlin Creeks except the MFSR and Chamberlin Creek. The Panther Creek steelhead population must achieve "maintained" status for DPS recovery and the target for the population is "viable" (NMFS 2014c).

The Panther Creek steelhead population is high risk for spatial structure due to absence of steelhead in upper Panther Creek, possibly due to past mining activities (NMFS 2014c). Diversity risk of the Panther Creek population is moderate due to past stocking and reduced access to spawning habitat caused by past mining activities (NMFS 2014c). Abundance risk of Salmon River steelhead populations are based on aggregate counts at LGD, which indicated that all of the A-run populations were moderate risk and all of the B-run populations were high risk (Ford 2011). The Panther Creek steelhead population is characterized as primarily A-run and was therefore considered moderate risk for abundance (Ford 2011). Preliminary population estimates conducted by IDFG (Copeland *et al.* 2013; Copeland *et al.* 2014) indicate a 10-year geomean size of 243 returning spawners for the Panther Creek steelhead population (see Appendix C), which supports the conclusions based on aggregate counts at LGD.

Based on the information presented in Appendix C, the Panther steelhead population is currently "maintained" status for abundance. However, estimated abundance is only slightly higher than "high risk," abundance estimates are based on indirect measurements, and population trend data are not currently available. Reestablishment of access to habitat in upper Panther Creek would improve overall status of the population.

2.2.1.3 Summary Status of the Species

The proposed action would affect the SRLM, Lemhi River, NFSR, and Panther Creek Chinook salmon populations and the Pahsimeroi River, Lemhi River, NMFS, and Panther Creek steelhead populations. The VSP parameters most responsible for these ratings, the ratings necessary for recovery, and the target ratings are in Table 8.

Table 8. Existing viability rating, minimum rating needed for recovery and desired (i.e., target) rating described in the draft recovery plan (NMFS 2015d).

Population	Existing VSP Parameter Rating	VSP Rating Needed for Recovery	Target VSP Rating
SRLM Chinook salmon	Not viable	Maintained	Maintained
Lemhi River Chinook salmon	Not viable	Maintained	Viable
NFSR Chinook salmon	Not viable	Maintained	Maintained
Panther Creek Chinook salmon	Unknown	None	None
Pahsimeroi River steelhead	Maintained	Maintained	Maintained
Lemhi River steelhead	Maintained	Maintained	Viable
NFSR steelhead	Not viable	Maintained	Maintained
Panther Creek steelhead	Maintained	Maintained	Viable

<u>2.2.2 Rangewide Status of Critical Habitat</u>

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 9).

Table 9. Types of sites, essential PBFs, and the species life stage each PBF supports.

Site	Essential Physical and Biological Features (PBFs)	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 & 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 & Juvenile Rearing	Spawning gravel, water quality and quantity, cover/shelter, food, riparian vegetation, space	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, nearshore, and offshore marine areas have also been described for Snake River steelhead and Middle Columbia steelhead. These PBFs will not be affected by the proposed action and have therefore not been described in this Opinion.
[b] Forage includes aquatic invertebrate and fish species that support growth and maturation.
[c] Natural cover includes shade, large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
[d] Food applies to juvenile migration only.

Chinook salmon and steelhead designated critical habitat includes the mainstem Snake and Columbia Rivers used by rearing and migrating juveniles and by migrating adults and adults holding prior to spawning. Snake River spring/summer Chinook salmon and Snake River Basin steelhead designated critical habitats in the Snake and Columbia Rivers have been altered by a variety of factors including: (1) Operation of dams upstream from the migration corridor for water storage and flood control; (2) water diversion for irrigation within and upstream from the migration corridor; (3) construction of dams, reservoirs, and a navigation channel within the migration corridor; and (4) operation of dams and reservoirs for power generation, flood control, water storage, and navigation within the migration corridor. Use of water, primarily for irrigation, has greatly reduced water quantity available for rearing and migration (NMFS 2008c). Construction and operation of storage and flood control reservoirs has further reduced water quantity during spring when juvenile Chinook salmon migrate downstream through the Snake and Columbia River (NMFS 2008c; NMFS 2008d). The eight mainstem dams and their associated reservoirs along the migration route have greatly reduced water velocity and have increased habitat for native and introduced predators, such as pikeminnow, smallmouth bass, and channel catfish (Raymond 1979; NMFS 2008d). The eight mainstem dams also constitute physical barriers that can substantially decrease migration survival (Raymond 1979).

Impounding water for storage, flood control, and navigation may also increase summer water temperatures, which could adversely affect late migrating fishes, such as age-0 spring/summer Chinook salmon smolts. Improving migration PBFs, especially water velocity, within the Snake and Columbia Rivers will likely be required to recover the Snake River spring/summer Chinook salmon ESU and the Snake River Basin steelhead DPS (Haeseker *et al.* 2012).

Chinook salmon and steelhead designated critical habitat also includes adult holding, adult and juvenile migration, juvenile rearing, and spawning habitat in tributary streams. Table 10 describes the geographical extent of critical habitat within the Snake River drainage. Critical habitat for steelhead 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 to the stream channel, critical habitat for 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.

Quality of Chinook salmon and steelhead critical habitat varies greatly in the Snake River drainage. Within drainages that are mostly wilderness or roadless, such as the Imnaha River, Middle Fork Salmon River, South Fork Salmon River, and Chamberlin Creek drainages, spawning, rearing, and migration PBFs are likely functioning appropriately (NMFS 2015d). PBFs in more developed (i.e., more roads, power infrastructure, agriculture lands, residences, etc.) drainages, such as the Little Salmon River and upper Salmon River, generally function at lower levels and may be non-functional in the most developed portions of these drainages (NMFS 2015d). Human activities adversely affecting spawning, rearing, and migration PBFs in the Snake River drainage include mining, timber harvest, livestock grazing, irrigated agriculture, stream channelization and diking, draining and filling of wetlands, road construction and maintenance, and urbanization. Reduced summer streamflows, impaired water quality, and reduction of habitat complexity are common problems for critical habitat in non-wilderness areas.

Table 10. Geographical extent of designated critical habitat within the Snake River for ESA-listed salmon and steelhead.

ESU/DPS	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 DPS's geographical range that are excluded from critical habitat designation.

The proposed actions would affect Chinook salmon and steelhead designated critical habitat in the mainstem drainage. Section 2.2.2.1, below, has relevant information on status of critical habitat in the upper Salmon River drainage. Detailed information on status of critical habitat throughout the range of the Chinook salmon ESU and the steelhead DPS is in NMFS (2015b). The discussion below addressing critical habitat PBFs applies to both species unless noted otherwise.

2.2.2.1 Status of Critical Habitat in the Upper Salmon River Drainage

The upper Salmon River drainage includes the main Salmon River and all tributaries upstream from the MFSR (NMFS 2015d; USBWP 2015). Major tributaries within the drainage include Valley Creek, the Yankee Fork Salmon River, the EFSR, the Pahsimeroi River, the Lemhi River, the NFSR, and Panther Creek. The proposed actions would affect Chinook salmon and steelhead critical habitat in the mainstem upper Salmon River and certain tributary streams downstream from the Pahsimeroi River (RM 304). This section contains information on status of Chinook salmon and steelhead critical habitat in the upper Salmon River drainage that will be needed to analyze effects of the proposed actions on designated critical habitat in the Chinook salmon ESU and the steelhead DPS. Detailed information on status of critical habitat throughout the upper Salmon River drainage is in NMFS (2015b).

The upper Salmon River drainage is one of the more developed areas within the Snake River drainage and habitat degradation is common throughout much of the drainage. Spawning and rearing habitats throughout much of this area are impaired by factors such as timber harvest, tilling, grazing, off-highway vehicle use, roads, and diversions (NMFS 2011). Development of water resources, primarily for irrigated agriculture, has reduced flow, increased fine sediment in stream substrates, reduced amount and availability of invertebrate forage, decreased water velocity, increased summer water temperature, and impaired fish passage in the mainstem upper Salmon River and many tributary streams. However, some areas of the upper Salmon River drainage are relatively lightly developed and some of the smaller tributary drainages may have little, or no, development and critical habitat with highly functioning PBFs.

The mainstem upper Salmon River is classified as a flow-limited river for anadromous salmonids (Tehan 2014). Flow in spawning and rearing habitat is a limiting factor for nine of the 10 Chinook salmon populations, and all six of the steelhead populations, in the upper Salmon River drainage (NMFS 2014b; NMFS 2014c). There are approximately 147,000 acres of irrigated agriculture in the upper Salmon River drainage (Chamberlin 2006), which likely results in diversion of approximately 2,940 cfs (assuming 0.02 cfs per irrigated acre). Irrigation of 147,000 acres likely results in consumptive use of approximately 213,150 acre feet per year (assuming 1.45 acre feet per irrigated acre, as per the 1978 Lemhi Decree). Average flow during the irrigation season (May to September) in the mainstem Salmon River at the downstream end of the drainage (i.e., Salmon River near Shoup, Idaho) is approximately 4,372 cfs. Assuming that consumptive use represents the minimum possible impact and amount of water diverted represents the maximum, total flow reduction in the mainstem upper Salmon River is between 14% and 40% of average flow during the irrigation season. This drainage-wide flow reduction directly affects the water quantity PBF and likely indirectly impairs all other PBFs in Table 9, including water temperature, which is a limiting factor for six of the 10 Chinook salmon populations and for five of the six steelhead populations in the upper Salmon River drainage (NMFS 2014b; NMFS 2014c). The Salmon River at Salmon, Idaho gage record indicates a long term base flow decline with a reduction of approximately 30% since 1980 (see Appendix E), indicating a continued degradation of water quality and water quantity PBFs in the mainstem upper Salmon River.

Summer water temperatures in the mainstem upper Salmon River are generally lowest in the headwaters and increase downstream, with the warmest reaches between the Pahsimeroi River and the MFSR (IRZ 2002). Summer water temperatures in these reaches are regularly high enough to stress rearing and adult holding salmonids and approach lethal levels during hot years (see Appendix C and Section 2.3.1.1). Water temperature in upper Salmon River tributary streams is generally colder than the mainstem (Curet *et al.*2009) and these streams likely provide substantial cold water refugia in reaches upstream from Slate Creek (RM 358) (NMFS 2015a) and downstream from the NFSR (RM 237) (Section 2.3.1.1). Many of the tributaries between Slate Creek and the NFSR are dewatered due to irrigation diversions, greatly reducing amount of available cold water refugia (see Section 2.3.1.1). In the 47 miles between Iron Creek (RM 285.9) and Wagonhammer Creek (RM 238.9), all streams that could provide cold water refugia are completely dewatered by irrigation diversions during summer. High summer water temperature and reduction in cold water refugia has degraded the PBF for water quality in the 121 miles between Slate Creek and the NFSR, and has likely rendered it completely nonfunctional in 47 miles between Iron Creek and Wagonhammer Creek (see Section 2.3.1.1).

Because steelhead migrate upstream and spawn in spring when the water is cool, degradation of water quality PBFs in the mainstem Salmon River may affect steelhead critical habitat less than Chinook salmon critical habitat. Also, because steelhead can access seasonally connected Salmon River tributaries that are not available to Chinook salmon (Unpublished PIT tag scanning array data), steelhead are less likely than Chinook salmon to be confined to the mainstem upper Salmon River. The degraded to non-functional water quality PBF between Slate Creek and the NFSR is especially important for the lower elevation Chinook salmon populations, such as the Pahsimeroi River, Lemhi River, and SRLM populations, and may be a key factor in elimination of Chinook salmon spawning downstream from the Pahsimeroi River (RM 304).

The mainstem upper Salmon River is currently substantially flow depleted and is apparently becoming more flow depleted. Summer water temperatures in the lower reaches of the upper Salmon River may be too high to support rearing salmonids without cold water refugia and cold water refugia is likely limited downstream from Slate Creek due to dewatering of tributary streams. The RPA described in NMFS (2012b) would partially address impaired function of tributary streams related PBFs at RM 317 and 313 (between Slate Creek and NFSR). NMFS has not received monitoring reports stipulated by NMFS (2012b) and assumes that the RPA has yet to be implemented.

Pahsimeroi River Fourth Field HUC. The Pahsimeroi River subbasin is one of the most heavily developed areas in the upper Salmon River drainage. Approximately 29,500 acres, or 20%, of the irrigated agriculture in the upper Salmon River drainage is in the Pahsimeroi River subbasin. The amount of water allocated in the Pahsimeroi River subbasin is approximately five times the base flow in the mainstem Pahsimeroi River (see Appendix D). This intensive water use has severely impacted migration, rearing, and spawning PBFs. Most Pahsimeroi River tributaries and a portion of the mainstem are regularly dried during the irrigation season, rendering PBFs nonfunctional over much of the subbasin. The lower Pahsimeroi River has year round flow due to groundwater recharge but flows are severely depleted during the growing season, directly impairing the PBF for water quality and quantity, and indirectly impairing all of the other spawning and rearing related PBFs. Because steelhead are often able to access seasonally connected tributaries whereas Chinook salmon are often excluded from stream reaches that dry in summer, steelhead critical habitat in the Pahsimeroi River subbasin is likely functioning at somewhat higher levels than Chinook salmon critical habitat. In addition to critical habitat within the Pahsimeroi River subbasin, intensive agriculture development in the Pahsimeroi River subbasin has essentially rendered the Pahsimeroi River non-functional as cold water refugia and has contributed to degradation of flow quantity related PBFs in the mainstem upper Salmon River.

Lemhi River Fourth Field HUC. Like the Pahsimeroi River subbasin, the Lemhi River subbasin is among the most heavily developed in the upper Salmon River drainage. Approximately 61,000 acres (41%) of the irrigated agriculture in the upper Salmon River drainage are in the Lemhi River drainage. The amount of water allocated in the Lemhi River subbasin is approximately nine times the base flow in the mainstem Lemhi River (see Appendix D). This intensive water use has severely impacted migration, rearing, and spawning PBFs. All of the tributaries to the mainstem Lemhi River except Big Springs Creek and Hayden Creek were, until recently, dewatered by irrigation diversions, essentially rendering all PBFs non-functional in tributary streams. In addition to dewatering, many tributaries are also blocked by diversions, ditches, or culverts, making migration difficult or impossible even when streams are not dewatered, and thus rendering migration PBFs non-functional. Restoration projects have restored some flow in Little Springs Creek and in the lower reaches of Bohannon, Big Timber, Canyon, and Kenney Creeks. Although flows are not sufficient for upstream migration of adult Chinook salmon, Chinook salmon and steelhead juveniles have been documented rearing in those streams (Biggs 2013), and adult steelhead may be able to migrate upstream during spring when flows are greatest. For the above reasons, with the exception of Hayden and Big Springs Creeks, Chinook salmon critical habitat in the Lemhi River subbasin is non-functional or functioning at very low levels. Because steelhead can access some seasonally disconnected tributaries, steelhead critical habitat is probably somewhat functional in several Lemhi River tributaries.

In addition to impacts on tributary streams, development of water resources in the Lemhi River drainage has altered the hydrograph of the mainstem Lemhi River. The alteration of the Lemhi River is so severe that, prior to 2001, the lowest reach of the mainstem Lemhi River was regularly dried during the irrigation season. Since 2001, agreements with water users have maintained minimum flows of 25 cfs to 35 cfs in the lower Lemhi River but flow alteration throughout the mainstem Lemhi River remains severe and flow is the primary limiting factor for Chinook salmon production in the Lemhi River drainage (Arthaud *et al.* 2010). Designated critical habitat within the Lemhi River drainage has also been adversely affected by roads, channelization, bank stabilization, and grazing (Ecovista 2004), resulting in reduced shade, increased sediment, and decreased bank stability. A variety of habitat restoration projects implemented since the mid-1990s have substantially improved riparian and stream channel habitat in Big Springs Creek and the mainstem Lemhi River upstream from Hayden Creek. Although riparian habitat has improved somewhat, summer water temperatures in the lower mainstem Lemhi River are high enough to stress rearing salmonids (Waterbury 2003) and most tributaries that could provide cold water refugia are dry (see previous paragraph). Whether due to impaired flow, high water temperatures, or a combination of habitat perturbations, productivity of anadromous salmonids rearing in the mainstem Lemhi River is low (Arthaud *et al.* 2010; Walters *et al.* 2013), indicating that spawning and/or rearing PBFs in the mainstem Lemhi River are degraded. In addition to critical habitat within the Lemhi River subbasin, intensive agriculture development in the Lemhi River subbasin has essentially rendered the Lemhi River non-functional as cold water refugia and has contributed to degradation of flow quantity and quality related PBFs in the mainstem upper Salmon River.

Designated critical habitat in the Lemhi River drainage is impacted by presence of diversion structures. All diversions that are currently accessible to anadromous fishes on Hayden Creek, Big Springs Creek, the mainstem Lemhi River, and the mainstem Salmon River are equipped with fish screens and bypass systems but many diversions on other tributary streams, some of which may be accessible by steelhead, are unscreened. Depending on location of the redds from which they originate, juvenile Lemhi River Chinook salmon and steelhead migrating downstream encounter 41 to 71 diversions in the mainstem alone (Walters *et al.* 2012). Although the mainstem diversions are screened, entrainment still results in adverse impacts (Walters *et al.* 2012). Presence of numerous screened and unscreened diversions degrade migration PBFs in the Lemhi River drainage.

Except for Hayden and Big Springs Creeks, overall spawning, rearing, and migration PBFs for Chinook salmon critical habitat in tributary streams in the Lemhi River drainage is essentially non-functional. Spawning, rearing, and migration PBFs for steelhead critical are likely somewhat functional in some seasonally connected tributary streams but migration PBFs are impaired by unscreened diversions. Spawning, rearing, and migration PBFs are somewhat functional for Chinook salmon and steelhead critical habitat in the mainstem Lemhi River but low productivity/capacity indicates that PBFs are not functioning at high levels. The RPA described in NMFS (2012a) would partially address impaired spawning, rearing, and migration PBFs in the mainstem and tributaries within the Lemhi River drainage. NMFS has not received monitoring reports stipulated by NMFS (2012a) and assumes that the RPA has yet to be implemented.

The present condition of PBFs within designated critical habitat and the human activities that affect PBF trends within the action area are further described in the environmental baseline section (Section 2.3).

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. Several studies have revealed that climate change has the potential to affect ecosystems in nearly all tributaries throughout the Snake River (Battin *et al.*

2007; ISAB 2007). While the intensity of effects will vary by region (ISAB 2007), climate change is generally expected to alter aquatic habitat (water yield, peak flows, and stream temperature). As climate change alters the structure and distribution of rainfall, snowpack, and glaciations, each factor will in turn alter riverine hydrographs. Given the increasing certainty that climate change is occurring and is accelerating (Battin *et al.* 2007), NMFS anticipates salmonid habitats will be affected. Climate and hydrology models project significant reductions in both total snow pack and low-elevation snow pack in the Pacific Northwest over the next 50 years (Mote and Salathé 2009) changes that will shrink the extent of the snowmelt-dominated habitat available to salmon. Such changes may restrict our ability to conserve diverse salmon life histories.

In the Pacific Northwest, most models project warmer air temperatures, increases in winter precipitation, and decreases in summer precipitation. Average temperatures in the Pacific Northwest are predicted to increase by 0.1 to 0.6ºC (0.2ºF to 1.0ºF) per decade (Mote and Salathé 2009). Warmer air temperatures will lead to more precipitation falling as rain rather than snow. As the snow pack diminishes, seasonal hydrology will shift to more frequent and severe early large storms, changing stream flow timing which may limit salmon survival (Mantua *et al.* 2009). Also, as length of growing seasons increase, consumptive use of water will likely increase on currently irrigated land, reducing flow in anadromous salmonid spawning, rearing, and migration habitat.

Higher water temperatures and lower spawning and rearing flows are all likely to increase salmon mortality. The Independent Scientific Advisory Board (ISAB 2007) found that higher ambient air temperatures will likely cause water temperatures to rise. Salmon and steelhead require cold water for spawning and incubation. As climate change progresses and stream temperatures warm, thermal refugia will be essential to persistence of many salmonid populations. Thermal refugia are important for providing salmon and steelhead with patches of suitable habitat while allowing them to undertake migrations through or to make foraging forays into areas with greater than optimal temperatures. To avoid waters above summer maximum temperatures, juvenile rearing may be increasingly found only in the confluence of colder tributaries or other areas of cold water refugia (Mantua *et al.* 2009).

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

2.3 Environmental Baseline

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

2.3.1 Environmental Baseline in the Mainstem Salmon River

The Middle Salmon River watershed, as defined by the SCNF, includes the mainstem Salmon River from the confluence of the Pahsimeroi River (RM 304) downstream to the confluence of the NFSR (RM 237) and all tributary drainages except the Pahsimeroi River, Lemhi River, and NFSR drainages. This reach of the Salmon River was historic spawning habitat for Chinook salmon but Chinook salmon spawning was last documented in 1988. This reach is rearing and migration habitat for the Salmon River Upper Mainstem (SRUM), Valley Creek, Yankee Fork Salmon River, EFSR, Pahsimeroi River, SRLM, and the Lemhi River Chinook salmon populations; and rearing and migration habitat for the SRUM, EFSR, Pahsimeroi River, and Lemhi River steelhead populations.

Fish habitat in the Middle Salmon watershed has been affected by mining, construction and maintenance of roads, livestock grazing, conversion of uplands and wetlands into agriculture land, construction and maintenance of diversions, and extensive water use for irrigated agriculture. These activities have adversely affected riparian and instream habitat in the mainstem and most tributaries, with resultant increases in water temperature and sediment; reduced access to riparian wetlands, side channels, and tributary stream habitat; and reduced cold water refugia (NMFS 2011). Although impacts on riparian and instream habitat are largely caused by activities within the Middle Salmon watershed, impacts on flow are caused by water use both within and upstream from the watershed, with most use occurring upstream from the watershed (Chamberlin 2006).

Water has been appropriated to irrigate approximately 147,000 acres in the Salmon River drainage upstream from the lower bound of the Middle Salmon watershed (i.e., RM 237). Irrigation of this amount of land results in consumptive use of about 213,150 acre-feet per year (assuming 1.45 acre feet per acre per year), or about 14% of the annual flow of the Salmon River at Shoup, Idaho (i.e., U.S. Geological Survey [USGS] gage 13307000 at RM 208). Actual amount of water diverted during the irrigation season might be as much as 2,940 cfs (assuming diversion of 0.02 cfs per acre, Idaho Code § 42-202), or about 40% of the average flow (measured at the Shoup gage) during the irrigation season (May to September). Approximately 60%, or 75,000 acres, of the irrigated agriculture in the upper Salmon River drainage is upstream from the mouth of the Lemhi River (RM 259), which likely results in diversion of approximately 1,500 cfs. Current summer base flow in the upper Salmon River at RM 259 (i.e., USGS 13302500) is approximately 1,200 cfs. The ratio of amount of water appropriated and remaining flow suggests that current base flow is less than half of historical levels. Habitat restoration actions since Chinook salmon listing in 1992 have resulted in approximately 2,300 acres of irrigated agriculture taken out of production in the Salmon River drainage upstream from the Middle Salmon watershed. Also, agreements to leave flow in the lower Lemhi River may have slightly improved summer flow downstream from the Lemhi River. However, since 1980, an average of 93 acres of new irrigation has been added annually, suggesting that, even with habitat restoration, flow baseline conditions in the mainstem Salmon River portion of the Middle Salmon watershed have deteriorated since 1980 and are likely continuing to deteriorate. Also, since 1980 mean August flow in the Salmon River at Salmon, Idaho has declined by 355 cfs, or approximately 30% (see Appendix E). This decline could be due to additional irrigation, increase in irrigation efficiency which reduces summer flow (Venn *et al.* 2004), to climate change, or to a combination of all of these factors.

Some of the diversions upstream from the project area, which affect flow in the action area, are on USFS land and require SUPs or Ditch Bill easements to operate. As of April 27, 2016, four separate ESA section 7 consultations have been completed on these diversions. Two of these determined that the proposed actions would not jeopardize the continued existence of Chinook salmon, steelhead, or adversely modify designated critical habitat (NMFS 2014d; NMFS 2015a). In the other two consultations, NMFS determined that the proposed actions would likely jeopardize the continued existence of Chinook salmon and steelhead and would likely adversely modify designated critical habitat for both species (NMFS 2012a; NMFS 2012b). The two "jeopardy" consultations resulted in RPAs that would minimize adverse impacts by either limiting diversion operation to times when instream flow was sufficient for fish or by offsetting impacts through flow improvement actions. NMFS has not received monitoring reports stipulated by NMFS (2012a) and NMFS (2012b) and assumes that the RPAs have yet to be implemented.

2.3.1.1 Water Temperature and Cold Water Refugia in the Mainstem Upper Salmon River

The U.S. Environmental Protection Agency's (EPA) temperature criteria 7DADM[3] for salmon/trout "core" rearing, salmon/trout non-core rearing, and salmon/trout migration are 60.8°F (16°C), 64.4°F (18°C), and 68°F (20°C), respectively (EPA 2003). The Idaho water quality temperature criteria for cold water biota is 71.6°F (22°C) MDMT[4] and 66.2°F (19°C) MDAT[5] (http://www.deq.idaho.gov/water-quality/surface-water/temperature.aspx). Water temperature fluctuations and their relationship to dissolved oxygen can affect all aspects of salmon and steelhead life histories in freshwater including: incubation and egg survival in stream gravel; emergence, feeding, and growth of fry and juvenile fish; outmigration of juvenile fish; adult migration, holding, resting, pre-spawning and spawning activities (Spence *et al.* 1996). In addition, dissolved oxygen decreases as water temperature increases, potentially adding stress to fish. Long-term sublethal temperature effects, as well as short-term acute effects of warm water temperatures, can be detrimental to the overall health of salmonids (Bjornn and Reiser 1991). Heat stress increases the susceptibility of juvenile fish to disease (ODEQ 1995). Documented effects of specific temperatures include: Water temperatures of 70°F (21°C) or greater can cause death of cold-water species such as salmon and steelhead within hours or days

[3] 7-day average daily maximum.
[4] Maximum daily maximum temperature.
[5] Maximum daily average temperature.

(ODEQ 1995); density of rearing steelhead is strongly negatively related to water temperature at temperatures greater than 68°F (20°C) (Ebersole *et al.* 2001); negative effects on rearing Chinook salmon growth and survival likely begin at approximately 66.2°F (19°C) (Richter and Kolmes 2005); rearing coho salmon start seeking cold water refugia when ambient temperatures reach 66.2°F (19°C) (Sutton and Soto 2012); migrating adult steelhead are impaired by water temperatures greater than 66.2°F (19°C) (Keefer *et al.* 2009); and migrating adult sockeye salmon are impaired by water temperatures greater than 69.8°F (21°C) (Keefer *et al.*2008).

Based on the water temperature criteria and salmonid water temperature tolerance described in the previous paragraph and the temperature data described below, the mainstem Salmon River is likely not functioning appropriately for summer water temperature. Temperature logger data collected by the USFS are available for the mainstem Salmon River within the Middle Salmon watershed for August of 2000, 2007, 2009, and 2010. The maximum 7 DADM temperature for these years were 21.8º (71.2ºF) in 2000, 19.3ºC (66.7ºF) in 2007, 18.9ºC (66.0ºF) in 2009, and 19.7º C (67.4ºF) in 2010 (Appendix B). During August, 2001, an aerial survey using Forward Looking Infrared technology recorded afternoon water temperatures greater than 22.5ºC (72.5ºF) throughout the mainstem Salmon River portion of the Middle Salmon watershed HUC (IRZ 2002) and discrete measurements at the Salmon River at Salmon gage have recorded temperatures as high as 24.4º C (75.9ºF). During summer 2002, daily maximum temperatures in the Salmon River below the Lemhi River exceeded 20º C (68ºF) from late June through mid-August, peaking near 25º C (77ºF) in early July (Waterbury 2003). Although limited, the data that are available indicate that water temperature in the mainstem Salmon River within the Middle Salmon watershed likely exceeds all EPA and State of Idaho standards for salmonids. The available data also indicate that water temperatures in the Salmon River mainstem are sufficiently high to stress rearing juvenile Chinook salmon and steelhead, to impair upstream migrating and spawning adult Chinook salmon, and to impair upstream migrating sockeye salmon. Summer temperatures observed in the mainstem upper Salmon River are also sufficiently high to impair adult steelhead; however, adult steelhead are typically present in this reach only in winter and spring when temperatures are lower. High summer water temperature is considered a limiting factor for anadromous salmonids in the upper Salmon River (Ecovista 2004). Factors affecting water temperature in the upper Salmon River include: reduction in flow, irrigation return flow, and reduction in shade (Ecovista 2004).

Cold water refugia is an important component of salmonid habitat throughout the Pacific Northwest (EPA 2003), and spatial extent of cold water refugia is a critical aspect of a thermal regime that should be protected and restored (EPA 2003). Although limited surveys of potential cold water refugia have been conducted upstream from the EFSR (RM 343), cold water refugia data in the mainstem Salmon River downstream from the EFSR are completely lacking. In the absence of cold water refugia survey data, we examined water appropriation, estimated flow, temperature, and intrinsic potential habitat data for Salmon River tributary streams to gain insights into historic and current availability of cold water refugia.

Of the 54 named tributaries to the mainstem Salmon River portion of the Middle Salmon watershed, 17 have intrinsic potential habitat for steelhead or Chinook salmon. Of those 17 tributaries, 13 have water appropriations that exceed estimated unimpaired base flow (Appendix D). Prior to water appropriation, there was an average of 3.8 river miles (range 0.8 to

7.9 miles) between tributary streams with intrinsic potential habitat and perennial flow. This suggests that fish holding, rearing, or migrating in the mainstem Salmon River portion of the Middle Salmon watershed would have always been within 3.95 miles of an accessible patch of cold water refugia. Currently, there is an average of 13.5 miles (range 0.8 to 47.3 miles) between tributaries that have intrinsic potential and likely continue to have perennial flow. Within the mainstem Salmon River portion of the Middle Salmon watershed, holding and rearing fish could be as far as 23.6 miles from the nearest cold water refugia and migrating fish may have to traverse a 47.3-mile reach in which accessible cold water refugia has been greatly curtailed. Cold water refugia conditions within the action area downstream from the Middle Salmon River watershed are likely much less impaired. The NFSR (RM 237.2) likely provides substantial cold water refugia immediately downstream from the Middle Salmon River watershed and only three of the 36 named tributaries between the NFSR and the MFSR (RM 198.7) have water allocations that exceed estimated base flow.

Condition of tributary streams immediately upstream from the action area also affects distance to cold water refugia for fish rearing or holding in the action area. Of the three closest upstream tributaries with anadromous salmonid intrinsic potential habitat, two, Morgan Creek at RM 313.4 and Challis Creek at RM 317.3, have water allocations greatly exceeding estimated base flow and are completely dried during the irrigation season[6]. Impairment of cold water refugia associated with these tributaries exacerbates conditions for anadromous salmonids migrating through, rearing in, or holding in, the action area and is probably especially detrimental for pre-spawning adult Chinook salmon attempting to hold in the action area. A portion of the flow impairment in Challis and Morgan Creeks is due to operation of diversions on SCNF land which were consulted on in 2012, resulting in an RPA that NMFS assumes has yet to be implemented (NMFS 2012b).

Flow improvement projects have been implemented on three Salmon River tributaries within the Middle Salmon watershed: Iron Creek, Lemhi River, and Carmen Creek. The Lemhi River project prevents the Lemhi River from being completely dewatered but water temperatures in the lower Lemhi River are not appreciably colder than in the mainstem Salmon River (Waterbury 2003). Therefore, the project probably does not contribute appreciable cold water refugia. The Carmen Creek project increases flow in a portion of lower Carmen Creek but does not improve flows in the lowest reach and therefore likely does not result in increase in cold water refugia. In contrast, the Iron Creek project provides substantial cold water refugia in lower Iron Creek (RM 285.9) which is heavily utilized by juvenile Chinook salmon and steelhead rearing in the mainstem Salmon River (Curet *et al.* 2009). Implementation of the Iron Creek project reduced average distance between streams with intrinsic potential habitat and perennial flow from 16.7 miles to 13.5 miles. The Iron Creek project also results in perennial flow in a tributary stream with Chinook salmon intrinsic potential. In the 97.5 river miles between Bayhorse Creek (RM 334.7) and the NFSR, Iron Creek, the Pahsimeroi River, the Lemhi River and Wagonhammer Creek are the only tributaries with intrinsic potential habitat for Chinook salmon and perennial flow at their mouths; and Iron Creek is likely the only tributary with intrinsic potential for Chinook salmon and accessible cold water refugia in the stream channel.
The mainstem Salmon River within the Middle Salmon River watershed regularly reaches temperatures sufficient to stress rearing and migrating Chinook salmon and steelhead, holding

[6] A lease agreement currently maintains a flow of 2 cfs in the lowest reach of Morgan Creek.

adult Chinook salmon, and spawning Chinook salmon. During warm years, the mainstem Salmon River approaches lethal temperatures for salmonids. In the 106 river miles between the EFSR and the NFSR, accessible cold water refugia has likely been reduced by approximately 77%, resulting in long distances between tributary streams with accessible cold water refugia. Although dewatered tributaries could, theoretically, provide cold water refugia in the mainstem Salmon River (Ebersole *et al.* 2014), surveys have not been conducted to determine if any such cold water refugia actually exists.

2.3.2 Environmental Baseline in Affected Tributary Drainages

There are 54 named tributaries to the mainstem Salmon River within the Middle Salmon River watershed, 31 of which have water allocations that exceed estimated August flow. However, most of the tributaries are very small with 38 having estimated mean August flow less than 1.0 cfs. Thirteen of the 17 streams with Chinook salmon or steelhead intrinsic potential habitat have water allocations that exceed estimated base flow, suggesting that habitat functions normally provided by tributary streams (i.e., water temperature moderation, cold water refugia, source of invertebrate foods, etc.) would be substantially impaired and perhaps eliminated. Water use impairing tributary streams in the Middle Salmon River watershed includes irrigation of 1,135.7 acres with 22.31 cfs of water diverted via diversions on SCNF land that have not been addressed in ESA section 7 consultation and are not included in this consultation (see Table 2)[7]. Tributary stream function may also be impaired by physical barriers. Although the BA did not include information on passage barriers in the Middle Salmon River watershed, the number of road crossings and location of Salmon River irrigation ditches suggests that physical barriers may limit access to tributary habitat.

The action area includes portions of six Salmon River tributary drainages, three within the Pahsimeroi River steelhead and the SRLM Chinook salmon populations (i.e., Hat Creek, Williams Creek, and Pollard Creek; and three within the Lemhi River Chinook salmon and steelhead populations (i.e., Carmen Creek; Wallace Creek, and Tower Creek). The BA included matrices of pathways and indicators for the fifth field HUCs but did not include information specific to the tributary drainages within the action area. NMFS obtained information on baseline conditions for the five Salmon River tributary drainages affected by the proposed actions from a variety of sources including: IDWR water rights search http://www.idwr.idaho.gov/apps/ExtSearch/WRAJSearch/WRADJSearch.aspx; IDWR Water Transactions program annual reports; USGS StreamStats http://water.usgs.gov/osw/streamstats/; Idaho Power Corporation gage data https://www.idahopower.com/OurEnvironment/WaterInformation/Streamflow/stationList/basinstationList.cfm?selectS=3; Pacific States Marine Fisheries Commission (PSMFC) StreamNet http://www.streamnet.org/; PSMFC PIT tag data base http://www.ptagis.org/home; USGS

[7] Water use due to diversions on private land, and due to diversions on public land that have not been through ESA section 7 consultation, are considered part of the baseline conditions, both in the past and continuing into the future. Water use due to diversions that have been through ESA section 7 consultation are part of the baseline conditions. The description of water use in affected tributary drainages excludes water use that would occur due to operation of diversions that would be permitted due to the proposed actions. However, prior to completion of this consultation, effects of operation of water diversions that would be permitted due to the proposed actions were part of the baseline conditions.

topographic maps; USFS maps; Google Earth Pro imagery; NMFS geographic information system data for intrinsic potential habitat; and personal communications with natural resource agency biologists. This information is summarized below.

2.3.2.1 Hat Creek

Hat Creek flows into the mainstem Salmon River at RM 294 at an elevation of 4,495 feet mean sea level (msl). Mainstem Hat Creek is 10.91 miles long and has two main tributaries: Little Hat Creek which is 9.62 miles long and flows into Hat Creek approximately 2.5 miles upstream from the mouth; and Big Hat Creek which is 5.87 miles long and flows into Hat Creek approximately 3.7 miles upstream from Little Hat Creek. The Hat Creek drainage contains 7,605 square meters (m^2) (1.88 acres) and 23,947 m^2 (5.9 acres), respectively, of Chinook salmon and steelhead intrinsic potential habitat. The drainage has a mean elevation of 6,800 msl and an area of 48,986 acres. Land ownership is 95% Federal (62% USFS and 34% Bureau of Land Management [BLM]), 3.6% private, and 1.0% state of Idaho. Although private land is a small percentage of the drainage, approximately 3.9 miles (36%) of Hat Creek and 1.9 miles (20%) of Little Hat Creek are on private land. There are apparently no paved roads or improved dirt roads in the drainage but secondary roads run adjacent to approximately 2.9 miles of Hat Creek, 1.7 miles of Little Hat Creek, and 1.0-mile of a small tributary of Hat Creek. There are 5.08 cfs of water rights in the Hat Creek drainage (including water rights associated with the proposed action but excluding stockwater rights) that are used to irrigate 152.6 acres. There are no streamflow gage data for Hat Creek. Estimated median, unimpaired mean monthly flows at the mouth of Hat Creek range from 33.9 cfs for June to 6.36 cfs for September (www.streamstats.usgs.gov). Estimated median, mean monthly flows under current conditions are 29.4 cfs in June and 5.85 cfs in September (Appendix D).

The IDFG lists the lower 2.17 miles of Hat Creek as occupied Chinook salmon and steelhead habitat. StreamNet (www.streamnet.org) identifies a falls on Hat Creek 2.15 miles upstream from the mouth that may be a passage barrier, but information on the falls is lacking. The IDFG lists a total of 29.69 stream miles upstream from the falls as year round habitat for cutthroat trout and/or bull trout. The ratio of allocated water to estimated baseflow suggests that Hat Creek is likely not functioning appropriately for flow. The BA did not include information on condition of riparian or instream habitat but the amount of streams on private land and secondary roads adjacent to streams indicates that some aspects of riparian and instream habitat may not be functioning appropriately. The limited temperature data available suggest that summer water temperature in lower Hat Creek is somewhat cooler than the mainstem Salmon River (Appendix B). Therefore, the lower 2.15 miles of Hat Creek may be important cold water refugia for rearing Chinook salmon and steelhead.

2.3.2.2 Williams Creek

Williams Creek appears to have historically flowed into the mainstem Salmon River at RM 267 at an elevation of 4,069 feet msl. Williams Creek starts at the confluence of South Fork Williams Creek and North Fork Williams Creek approximately 6 miles upstream from the

Salmon River. Aerial photography suggests that Williams Creek currently flows into an irrigation ditch that flows north along the Salmon River, emptying into the Salmon River near the mouth of Perreau Creek at RM 265 at an elevation of 4,022 feet. The Williams Creek drainage contains 0 m^2 and 48,068 m^2 (11.9 acres) respectively, of Chinook salmon and steelhead intrinsic potential habitat. The drainage has a mean elevation of 6,800 msl and an area of 17,440 acres. Land ownership is 94% Federal (83.5% USFS and 10.5% BLM) and 5.9% private. Although private land is a small percentage of the drainage, approximately 2.3 miles (38%) of Williams Creek is on private land. Improved unpaved roads run the entire length of mainstem Williams Creek and along most of North Fork Williams Creek, and an unimproved road runs along most of South Fork Williams Creek. There are 15.2 cfs of water rights in the Williams Creek drainage (including water rights associated with the proposed action but excluding stockwater rights) that are used to irrigate 748.9 acres. There are no streamflow gage data for Williams Creek. Estimated unimpaired median, mean monthly flows at the mouth of Williams Creek range from 42.8 cfs for June to 6.81cfs for September (www.streamnet.org). Estimated median of mean monthly flows under current conditions are 7.9 cfs, 8.0 cfs, 0 cfs, 0 cfs, and 0 cfs, respectively for May, June, July, August, and September (Appendix D).

Williams Creek is apparently captured by a Salmon River irrigation ditch and no longer has a discernable channel downstream from the ditch. This irrigation ditch likely serves as the Williams Creek channel outside of the irrigation season. Adult steelhead have been documented in lower Williams Creek (C. Fealko, personal communication, NMFS, Fishery Biologist, February 9, 2016). The best available information indicates they migrated there via the Salmon River irrigation ditch. Although anadromous fishes are apparently able to enter Williams Creek, passage barriers at road crossings likely confine them to the lower reaches. Due to heavy appropriation of Williams Creek water and capture of Williams Creek by the Salmon River irrigation ditch, migration into or out of Williams Creek is unlikely during the irrigation season. The IDFG does not list Williams Creek as currently occupied by anadromous fishes, but all of mainstem Williams, North Fork Williams, and South Fork Williams Creeks is listed as occupied bull trout and cutthroat trout habitat, suggesting that the Williams Creek drainage contains some high quality salmonid habitat.

The limited water temperature data suggest that summer water temperature in Williams Creek may be as much as 8ºC (14.4ºF) colder than the mainstem Salmon River (Appendix B). Presence of bull trout throughout much of the Williams Creek drainage is another indication that summer water temperatures are relatively low. Tributary stream confluences can constitute cold water refugia even when there is no surface flow in the tributary (Ebersole *et al.* 2014). Therefore, although Williams Creek is likely dried by irrigation diversions during summer, the Williams Creek/Salmon River confluence may still be cold water refugia.

2.3.2.3 Pollard Creek

Depending on the database, this creek is Jesse Creek, Pollard Creek, or Pollard Canyon Creek. The USFS map shows Jesse Creek as an historic tributary of Pollard Creek with Pollard Creek flowing into the mainstem Salmon River at RM 259.5 at an elevation of 3,940 feet msl. Amount of intrinsic potential habitat in the Pollard Creek drainage is not currently known. The drainage has a mean elevation of 7,050 msl and an area of 12,550 acres. Land ownership is 92% Federal (91% USFS and 0.8% BLM) and 7.9% private. Pollard Creek flows through the town of Salmon, Idaho and from the mouth upstream to the historic confluence with Jesse Creek, the stream channel is a series of developed channels and culverts, with the lowest 400 feet flowing through a culvert under a parking lot adjacent to Highway 93 and Courthouse Drive. In contrast to the lower reaches, the drainage appears to be relatively undeveloped upstream from the confluence of Jesse Creek. There are approximately 38.1 cfs of water rights in the Pollard/Jesse Creek drainage (including the proposed actions but excluding domestic rights), 18.5 cfs of which are used to irrigate 563 acres with 18.3 cfs allocated to the City Salmon for municipal use. There are no streamflow gage data for Pollard Creek. Estimated median, mean monthly flows at the mouth of Pollard Creek range from 27.3 cfs for June to 2.26 cfs for September (www.streamstats.usgs.gov).

The IDFG does not list Pollard Creek as currently occupied by anadromous fishes but all of mainstem Pollard Creek and Chipps Creek (tributary of Pollard Creek) is occupied cutthroat trout habitat and Jesse Creek is occupied bull trout habitat. The ratio of allocated water to estimated flow suggests that Pollard Creek is completely dewatered for most of the year. Limited fish passage may be possible when flow is available (Lukens 2005), although the developed stream channel and numerous culverts in the lower 1.5 miles suggests that fish passage might be limited even when flow is available. The BA did not include information on condition of riparian or instream habitat. Distribution of development suggests that habitat in the lower 1.5 miles is likely degraded but the remainder of the drainage may be in good condition. Temperature data are not available for Pollard Creek but elevation of the drainage suggests that summer water temperature would be relatively cold where the stream is not dewatered. Pollard Creek may have historically been cold water refugia for anadromous salmonids rearing in the mainstem Salmon River but the stream channel is currently dewatered during summer and does not constitute cold water refugia. Tributary stream confluences can be cold water refugia even when there is no surface flow in the tributary (Ebersole *et al.* 2014), however, the impermeable nature of the lower Williams Creek streambed (i.e., the culvert) suggests that cold water refugia is likely no longer available at the Pollard Creek/Salmon River confluence.

2.3.2.4 Wallace Creek

Wallace Creek flows into the Salmon River at RM 252 at an elevation of approximately 3,840 feet msl. The drainage contains 220 m^2 (0.05 acres) of steelhead intrinsic potential habitat and no Chinook salmon intrinsic potential habitat. The drainage has a mean elevation of 6,970 feet msl and an area of 4,896 acres. Land ownership is 98.9% USFS and 1.1% private. There are 7.0 cfs of water rights in the Wallace Creek drainage (including water rights associated with the proposed action but excluding domestic and stockwater rights) that are used for mining (2.0 cfs), hydropower production (0.6 cfs) and irrigation of 290 acres (4.4 cfs). There are no streamflow gage data for Wallace Creek. Estimated unimpaired median of mean monthly flows at the mouth of Wallace Creek range from 9.81 cfs for June to 0.56 cfs for September (www.streamstats.usgs.gov). Estimated median of mean monthly flows under current conditions are 3.0 cfs, 4.0 cfs, 0 cfs, 0 cfs, and 0 cfs, respectively for May, June, July, August, and September (Appendix D). Although 98.9% of the Wallace Creek drainage is USFS, the lower half mile is on private land and aerial imagery indicates that habitat in this reach is extremely degraded. The limited water temperature data suggest the summer water temperature in Wallace Creek is approximately 4.5º C (8.2º F) colder than the mainstem Salmon River.

The IDFG does list the lower 0.06 miles of Wallace Creek as Chinook salmon rearing habitat and the entire Wallace Creek channel as cutthroat trout habitat. The ratio of allocated water to estimated flow suggests that Wallace Creek is completely dewatered for most of the irrigation season. The BA did not include information on condition of riparian or instream habitat but aerial photography suggests that habitat in the lower 0.5 miles of Wallace Creek is likely degraded. Temperature data suggest that Wallace Creek was likely important cold water refugia for anadromous salmonids rearing in the mainstem Salmon River. With current levels of water use, it is doubtful if any cold water refugia is available in the Wallace Creek stream channel. However, tributary stream confluences can constitute cold water refugia even when there is no surface flow in the tributary (Ebersole *et al.* 2014) and the Wallace Creek/Salmon River confluence may therefore still constitute cold water refugia.

2.3.2.5 Carmen Creek

Carmen Creek flows into the Salmon River at RM 254 at an elevation of approximately 3,840 feet msl. The drainage contains 20,293 m^2 (5.0 acres) and 106,194 m^2 (26.2 acres) respectively, of Chinook salmon and steelhead intrinsic potential habitat. The drainage has a mean elevation of 6,750 feet msl and an area of 30,784 acres. Land ownership is 80.4% Federal (50% USFS and 30% BLM), 19.4% private, and 0.3% State of Idaho. There are 128 cfs of water rights in the Carmen Creek drainage (including water rights associated with the proposed action but excluding domestic and stockwater rights) that are used to irrigate 3,498 acres. A streamflow gage was operated near the mouth of Carmen Creek from June 14, 2005, through September 30, 2013. Mean monthly flow during this period ranged from 101.8 cfs in June to 1.0 cfs in September and appear to be heavily influenced by irrigation from late April through early November. During most years, the stream was practically dry from late July through early October. The limited water temperature data suggest that summer water temperature in Carmen Creek is approximately 5.6ºF (3.1ºC) colder than the mainstem Salmon River.

The IDFG lists the lower 3.94 miles of Carmen Creek as Chinook salmon rearing habitat. The IDFG does not currently list Carmen Creek as occupied steelhead habitat. However, recent work by the IDFG screen shop has improved fish passage conditions in mainstem Carmen Creek and a PIT scanning array installed near the mouth of Carmen Creek in 2013 has documented adult steelhead migrating upstream from late March through early May. Improved passage conditions and presence of adult steelhead in early spring suggests that Carmen Creek is currently occupied steelhead spawning and rearing habitat. Presence of adult steelhead in early spring (i.e., prior to dewatering) and presence of Chinook salmon intrinsic potential suggests that Carmen Creek could support Chinook salmon spawning if summer flows were improved.

During most years, dewatering due to irrigation diversions precludes anadromous fish movement through lower Carmen Creek from late July through mid-October. Carmen Creek likely historically provided substantial cold water refugia for rearing and migrating anadromous salmonids; but, due to dewatering by irrigation diversions, there is likely little or no cold water refugia remaining in the Carmen Creek stream channel. However, tributary stream confluences can constitute cold water refugia even when there is no surface flow in the tributary (Ebersole *et al.* 2014) and the Carmen Creek/Salmon River confluence may therefore still constitute cold water refugia. The BA did not contain information on condition of riparian and instream habitat but given the degree of dewatering, riparian and instream habitat in lower Carmen Creek is likely degraded. Recent issuance of water rights for irrigation suggests that flow baseline conditions in the Carmen Creek drainage will continue to decline.

2.3.2.6 Tower Creek

Tower Creek flows into the Salmon River at RM 248 at an elevation of approximately 3,770 feet msl. The drainage contains 28,781 m^2 (7.1 acres) of steelhead intrinsic potential habitat and no Chinook salmon intrinsic potential habitat. The drainage has a mean elevation of 6,020 feet msl and an area of 13,721 acres. Land ownership is 84.7% Federal (67% USFS and 18% BLM), 12.5% private, and 2.8% State of Idaho. Unpaved improved roads run along most of the lower 4.5 miles of Tower Creek and the lower 2.5 miles of East Fork Tower Creek and an unimproved road runs along much of Gold Star Gulch (tributary of East Fork Tower Creek). Although only 12.5% of the drainage is private land, private land is concentrated along Tower and East Fork Tower Creeks and encompasses almost all of the potential anadromous fish habitat. There are 11.2 cfs of water rights in the Tower Creek drainage (including water rights associated with the proposed action but excluding domestic and stockwater rights) that are used to irrigate 468.5 acres. There are no streamflow gage data for Tower Creek. Estimated unimpaired median, mean monthly flows at the mouth of Tower Creek range from 6.7 cfs for May to 1.08 cfs for September (www.streamstats.usgs.gov). Estimated median of mean monthly flows under current conditions are zero for May through September. The limited water temperature data suggest that summer water temperature in Tower Creek is approximately 3.8ºC (6.8ºF) colder than the mainstem Salmon River.

The IDFG lists the lower 0.21 miles of Tower Creek as Chinook salmon rearing habitat. The IDFG does not list Tower Creek as currently occupied steelhead habitat but steelhead may use Tower Creek when flow is available. The ratio of allocated water to estimated baseflow suggests that Tower Creek is likely not functioning appropriately for flow and is likely dewatered from mid-July through the end of the irrigation season. The BA did not include information on condition of riparian or instream habitat but the amount of streams on private land and amount and location of roads indicates that some aspects of riparian and instream habitat may not be functioning appropriately. The limited temperature data suggest that summer water temperature in lower Tower Creek is substantially cooler than the mainstem Salmon River. Dewatering due to water use likely precludes cold water refugia in the Tower Creek stream channel. However, tributary stream confluences can constitute cold water refugia even when there is no surface flow in the tributary (Ebersole *et al.*2014) and the Tower Creek/Salmon River confluence may therefore still constitute cold water refugia.

2.3.3 Effects of Climate Change on the Environmental Baseline

As discussed in the Section 2.2, climate change is expected to alter baseline hydrology by increasing rainfall and reducing snowpack, leading to higher fall and winter flows and lower late spring and summer flows. Analyses by the University of Washington Climate Impacts Group (Hamlet *et al.* 2010) indicate that in the upper Salmon River basin, snowpack (expressed as the “snow water equivalent,” the total water content of the snowpack) could be reduced by approximately 25% or more by the 2040s and 50% or more by the 2080s. The same analysis predicts that Salmon River peak flows could occur 1 to 2 months earlier in the future and that late spring and summer flows could be reduced up to 10% to 20%. Decreased flows and increased air temperatures are likely to result in increased summer stream temperatures in the Salmon River basin of 1º to 4ºC (maximum weekly mean temperature) by the 2030 to 2069 period and 2º to 6ºC by the 2070 to 2099 period (Beechie *et al.* 2013). As also mentioned in Section 2.2, climate change effects will not be spatially homogenous. Areas with elevations high enough to maintain temperatures well below freezing for most of the winter and early spring would be less affected. Low-lying areas that historically have received scant precipitation and contribute little to total streamflow are likely to be more affected. These long-term effects may therefore limit the amount of habitat that salmon and steelhead tend to occupy and how long they occupy it, thereby increasing fish density and decreasing productivity. These long-term effects will also likely increase the importance of cold water refugia for rearing and migrating salmonids.

The mainstem Salmon River portion of the Middle Salmon watershed is limited by water temperatures (Idaho Department of Environmental Quality [IDEQ] 2003) that exceed IDEQ criteria for cold water biota (Herron *et al.* 2002). Water temperatures in this reach exceed EPA and State of Idaho temperature standards for salmonids and approach lethal temperatures during warm years. Climate change may result in: (1) An overall depletion of cold water mainstem areas for spawning, rearing, and migration; (2) variation in quality and quantity of tributary rearing habitat; (3) alterations to migration patterns; (4) accelerated embryo development; (5) premature emergence of fry; and (6) increased competition with other fish species (ISAB 2007). The effects of climate change would increase importance of cold water refugia for salmon and steelhead rearing in, or migrating through, the upper Salmon River, and would likely reduce the number of cold water refugia sites and overall cold water refugia area. This would exacerbate conditions in the action area where mainstem water temperatures already approach lethal levels and there may be 48 river miles between accessible patches of cold water refugia.

Prior to 1974, Chinook salmon regularly spawned in the mainstem Salmon River portion of the Middle Salmon River watershed but no spawning has been documented since 1988. Lack of spawning is possibly due to excessive water temperature and/or lack of cold water refugia in July and August when Snake River spring/summer Chinook salmon hold prior to spawning. Increased water temperature and/or reduced cold water refugia since the 1970s may have occurred due to increased water use, conversion to more efficient irrigation systems that can reduce late season flow (Venn *et al.* 2004), or climate change that has already occurred. Regardless, reestablishing Chinook salmon spawning in the Middle Salmon watershed will likely require reestablishment of connectivity between relatively cold tributary streams and the mainstem Salmon River.

2.4 Effects of the Action

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

Snake River spring/summer Chinook salmon, and Snake River Basin steelhead, occur in the action area. The entire action area is designated critical habitat for Snake River Chinook salmon and portions of the action area are designated critical habitat for Snake River Basin steelhead. Although the SCNF determined that some of the proposed actions would have no effect on Chinook salmon, steelhead, or steelhead critical habitat, effects of operation and maintenance of all diversion covered in this Opinion extend into steelhead designated critical habitat and Chinook salmon and steelhead occupied habitat. Therefore, this document addresses effects of the proposed actions on Chinook salmon, steelhead, and designated critical habitat for both species.

2.4.1 Effects on Snake River Spring/Summer Chinook Salmon and Snake River Basin Steelhead

Effects of the proposed action would occur in Chinook salmon and steelhead occupied habitat. All of the diversions that would be permitted by the proposed action are on tributaries with considerable habitat perturbations in the lower reaches. These perturbations limit upstream fish passage, thereby limiting occurrence of anadromous fishes at the PODs. However, steelhead often move upstream during spring, when passage conditions are typically best, and therefore may be present at some of the PODs. Although steelhead may be present at some of the PODs, most of the effects on anadromous fishes occur because effects of operating the diversions extend downstream into currently occupied habitat.

Operation and maintenance of surface diversions on SCNF land in the Middle Salmon watershed could result in a variety of flow related and non-flow related adverse effects. Possible non-flow related impacts include physical damage to riparian and stream channel habitat from maintenance activities, erosion due to failed water transmission facilities, blockage of upstream migration by diversion structures, and entrainment of downstream migrating fishes in diversion structures. Flow related impacts include reduction of riparian vegetation, impairment of upstream and downstream migration, increase in fine sediments, reduced productivity of rearing habitat, slowed downstream migration, increased summer water temperatures, and reduced availability of cold water refugia. The proposed actions would permit activities that have been ongoing since the late 1800s and early 1900s and are currently ongoing either without permits or under expired permits. The SCNF did not describe the duration of the permits, therefore this analysis assumes an ongoing action into the foreseeable future.

Sections 2.4.1.1 and 2.4.1.2 contain general descriptions of non-flow and flow, respectively, related effects of the proposed action, including methods used to quantify effects of the proposed action on Chinook salmon and steelhead. The following seven sections (i.e., Sections 2.4.1.3 through 2.4.1.9) are tributary drainage and river reach specific sections wherein effects of the proposed action are broken down by mechanism, described in detail, and quantified when feasible. The effects described in detail in the tributary and river reach sections are combined and summarized in Section 2.4.1.10. Effects described as minor in the general description sections are not described further in the tributary and river reach specific sections but are addressed in the Integration and synthesis (Section 2.6).

2.4.1.1 Non-flow Related Effects of Operation and Maintenance of Water Diversions

Operation and maintenance of surface diversions could result in physical damage to occupied Chinook salmon and steelhead spawning and rearing habitat. The following bullets describe damage that could occur:

- Maintenance of the diversion structures and access routes would involve hand tools and may involve power tools and heavy equipment. This maintenance could damage riparian vegetation, streambanks, and stream channels; which would reduce shade, increase water temperature, reduce instream habitat for rearing salmonids, reduce habitat for holding adult salmonids, and increase sediment delivery and deposition.

- Operation of water transmission ditches and pipes along the contours of hills above streams can increase the chance of mass wasting into streams. Ditches and pipes sometimes fail and, if not immediately addressed, the failure can cause mass wasting into the stream.

Primary impacts on Chinook salmon and steelhead, resulting from habitat damage described in these bullets, would be due to reduced riparian habitat function and increased sediment deposition. This could result in: (1) Wider, shallower streams; (2) reduced access to escape cover; (3) reduced production of invertebrate foods; and (4) increased water temperatures; all of which could reduce growth and increase mortality of rearing juvenile Chinook salmon and steelhead. The SUP and easement terms and conditions require: (1) Regular maintenance of diversion structures to reduce chance of resource damage due to ditch or pipe failure; (2) revegetation and stabilization of all ground disturbed by maintenance activities; (3) USFS approval prior to use of heavy equipment; (4) USFS approval prior to removing significant amounts of vegetation or silt; (5) control of noxious weeds; and (6) annual inspections to ensure compliance with all SUP terms and conditions. These terms and conditions will reduce the chance that adverse impacts described above would occur, and will reduce the magnitude of the impacts should any occur. Because both risk and magnitude of adverse impacts due to maintenance of diversions should be effectively minimized, NMFS anticipates low levels of impacts on aquatic resources due to maintenance of diversions associated with the proposed actions.

Diversion dams and weirs, and sometimes other diversion structures, can block upstream movement of adult and juvenile salmonids. Unimpaired upstream passage is important for adult anadromous salmonids to reach spawning habitat and for juvenile salmonids to access important features of rearing habitat including cold water refugia. Some diversion structures are complete barriers to upstream migration, blocking all migration. Other diversion structures may be partial barriers, blocking some of the fish some of the time, some of the fish all of the time, or all of the fish some of the time. However, the SCNF states that diversion structures will be passible by fish at all flows. NMFS therefore assumes that operation and maintenance of diversions permitted by the proposed actions will not impair upstream fish passage at the POD.

The proposed actions will likely result in entrainment of juvenile salmonids. The proportion of migrating juvenile salmonids entrained in surface diversions is variable (Simpson and Ostrand 2012) but is likely to be approximately equal to (Simpson and Ostrand 2012), or slightly less (Walters *et al.* 2012) than the proportion of flow diverted. Fishes entrained in unscreened diversions are lost to the population (Simpson and Ostrand 2012), but screens can reduce mortality of entrained juvenile salmonids by more than 97% (Simpson and Ostrand 2012; Walters *et al.* 2012). NMFS assumed that the proportion of fish entrained in surface diversions would be equal to the proportion of water diverted. However, because the diversions would be screened, NMFS assumed that 97% of entrained fishes would survive (i.e., three percent entrainment mortality rate).

2.4.1.2 General Flow-related Impacts of Operation and Maintenance of Water Diversions

The SCNF proposes permitting operation and maintenance of seven diversions in the Middle Salmon watershed. Water rights associated with the proposed actions and estimates of base flow in source streams at the PODs are described in Table 11.

The proposed actions on SCNF lands in the Middle Salmon watershed will reduce flow in streams in which Chinook salmon and steelhead spawn, incubate, rear, migrate downstream as juveniles, migrate upstream as adults, and hold prior to spawning. Snake River spring/summer Chinook salmon and Snake River Basin steelhead spend the entire juvenile rearing phase of their life cycles in stream habitats and must procure all food needed to survive and grow in the stream habitat. Food availability for stream dwelling salmonids is generally positively related to streamflow across the entire range of base flows (Harvey *et al.* 2006; Hayes *et al.* 2007; Davidson *et al.* 2010) and this relationship can extend into spring (i.e., higher) flows (Davidson *et al.* 2010). In addition to base flows, high flow can also be important for stream dwelling salmonids as juvenile salmon grow measurably faster when flows inundate floodplains and promote higher production of invertebrates (Jager 2014). Reducing streamflow, and the resultant reduction in food availability, reduces individual growth (Harvey *et al.* 2006) and population productivity (Nislow *et al.* 2004) of stream dwelling salmonids. In addition to food, juvenile stream dwelling anadromous salmonids must have access to instream object cover and in-water escape cover to rear successfully (Hardy *et al.* 2006); and reducing flow generally reduces access to escape cover (Hardy *et al.* 2006a). Reduction in streamflow caused by surface diversions can also result in long-term increases in fine sediments in stream substrates (Baker *et al.* 2011) and increased summer water temperature (Rothwell and Moulton 2001; Tate *et al.* 2005; Miller *et al.* 2007). Cold water refugia are important for rearing juvenile Chinook salmon and steelhead (Sauter *et al.* 2001; Richter and Kolmes 2005) and for pre-spawning adult Chinook salmon (Berman and Quinn 1991; Torgersen *et al.* 1999) and reducing cold water inflow from tributary streams would, therefore, adversely affect Chinook salmon, steelhead, and designated critical habitat for both species.

Studies have shown that year class strength of salmonid populations is positively related to streamflow (Ricker 1975; Mathews and Olson 1980; Mitro *et al.* 2003; Elliott *et al.*1997; Nislow *et al.* 2004; Arthaud *et al.* 2010; Beecher *et al.* 2010). 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 outmigrating juveniles, which in turn affected number of returning adults, resulting in a relationship of rearing streamflow and whole life cycle productivity. Because of size, the adult life stages of anadromous salmonids are often perceived to be the most limiting with respect to streamflow. However, the available literature indicates that flow during the rearing life stages is often a limiting factor (Mathews and Olson 1980; Mitro *et al.* 2003; Elliott *et al.* 1997; Nislow *et al.* 2004; Arthaud *et al.* 2010; Beecher *et al.* 2010) and can be the primary limiting factor (Mathews and Olson 1980; Elliott *et al.* 1997; Arthaud *et al.* 2010; Beecher *et al.* 2010). Therefore, except where flows for adult passage were specifically identified as a concern, we analyzed flow related effects of the proposed actions based on "rearing" streamflow.

If a tributary stream has habitat, measured as intrinsic potential (Cooney and Holzer 2006), for a particular species, we considered it to be rearing habitat for that species. In tributaries considered to be rearing habitat, and in mainstem MFSR non-plume habitat, we analyzed effects based on relationships of fish populations and flow. The Middle Salmon watershed includes rearing habitat for the SRLM and Lemhi River Chinook salmon populations. We used the relationship of Lemhi River Chinook salmon whole life cycle productivity and rearing streamflow, and SRLM Chinook salmon whole life cycle productivity and rearing streamflow to quantify flow related impacts of the proposed actions in the Lemhi River and SRLM population areas, respectively (Appendix A). For both populations, we assumed that population level impacts would be proportional to amount of intrinsic potential habitat affected, or for the mainstem Salmon River, the estimated percentage of the year class rearing in the affected habitat. Impacts on Chinook salmon productivity caused by reducing flow in rearing habitat during the juvenile rearing life stages, are described in Sections 2.4.1.3 through 2.4.1.9.

Table 11. Water rights that are served by diversions, maximum allowable diversion rates, acres irrigated, and estimated 80%, 50%, and 20% exceedance mean August flow for Middle Salmon watershed diversion source streams.

Diversion	Water Right Number	Maximum Diversion Rate (cfs)	Acres Irrigated	Estimated Mean August Flow (cfs)		
				80% Exceedance[1]	50% Exceedance[1]	20% Exceedance[1]
Big Hat Creek (DEA 2099)	75-2137	0.76	26.7	0.53	0.76	1.01
	75-4199	0.47	12.3			
	Total	**1.23**	**39**			
South Fork Williams Creek (DEA 2066)	75-4128	3.2	149.8	0.54	0.78	1.04
	Total	**3.2**	**149.8**			
Pollard Creek (DEA 2072)	75-2167	2.0	NA	Pollard Creek 1.97	Pollard Creek 2.86	Pollard Creek 3.80
	75-14700	0.24	NA			
	75-14701	2.3	NA			
Chipps Creek (DEA 2073)	**Total**	**4.54**	**NA**	Chipps Creek 0.96	Chipps Creek 1.39	Chipps Creek 1.84
Wallace Creek (DEA 2103)	75-87C	0.4	18.8	0.62	0.90	1.20
	75-2099	Storage	12			
	Total	**0.4**	**18.8**			
Carmen Creek (DEA 2076)	75-63A	1.3	106	5.42	7.82	10.41
	75-2002	1.08	63.9			
	75-4332	0.9[2]	NA			
	Total	**3.28**	**169.9**			
East Fork Tower Creek (DEA 2077)	75-4139	0.16	10	0.50	0.73	0.97
	75-4140	0.15	26			
	75-4144A	0.03	2			
	75-4144B	0.55	28			
	75-4345B	0.44	20.9			
	Total	**1.33**	**86.9**			

Note: Flow estimates are based on discrete flow measurements in source streams and flow data from the Salmon River at Salmon and Napias Creek near Leesburg gages.

[1] Percentage exceedance is the percent of the time that the stipulated flow would be exceeded. It is used to describe frequency of occurrence. For example, flows would be expected to be greater than an 80% exceedance flow in 4 of 5 years and less in 1 of 5 years.

[2] Limited to 13,000 gallons per day, or 0.02 cfs diverted continuously for 24 hours.

The Middle Salmon watershed includes spawning and rearing habitat for the Pahsimeroi River and Lemhi River steelhead populations. Both of these populations are unusual among steelhead populations in that population trend data are available that can be compared to streamflow during the rearing life stages. We used the relationship of Lemhi River *O. mykiss* whole life cycle productivity and rearing streamflow, and Pahsimeroi River steelhead whole life cycle productivity and rearing streamflow to quantify flow-related impacts of the proposed actions in the Lemhi River and Pahsimeroi River population areas, respectively (Appendix A). For both populations, we assumed that population level impacts would be proportional to the amount of intrinsic potential habitat affected.

All of the diversions are in tributary drainages of the mainstem Salmon River. These drainages are relatively steep, flowing from high elevation to low elevation relatively quickly, and are therefore potentially cooler than the mainstem. Cold water refugia is an important component of salmonid habitat throughout the Pacific Northwest (EPA 2003), and spatial extent of cold water refugia is a critical aspect of a thermal regime that should be protected and restored (EPA 2003). The size of a cold water refugia patch is largely determined by the volume of cold water entering the stream and the turbulence of the stream where the cold water enters (Bilby 1984). Sutton and Soto (2012) found that for very small tributaries (i.e., 1.0 to 3.0 cfs), juvenile salmonids tended to use cold water refugia within the tributaries much more than the tributary plumes. However, Torgersen *et al.* (2012) documented both juvenile and adult salmonids using very small cold water refugia within relatively large streams, suggesting that plumes of small streams could be important. Also, tributary streams can provide cold water refugia in receiving streams even when no surface flow is present in the tributary (Ebersole *et al.* 2014), suggesting that plumes of even very small tributaries may constitute important cold water refugia. Cold water refugia habitat, both within tributary streams and below tributaries in the mainstem, is important for Chinook salmon and steelhead rearing in the Salmon River (Curet *et al.* 2009).

Summer water temperature in small Rocky Mountain streams is inversely related to flow (Tate *et al.* 2005) and can be increased by diversions that reduce flow (Rothwell and Moulton 2001). However, because diversions associated with the proposed actions are some distance upstream from the tributary mouths, quantifying impact of the diversions on water temperature in the potential cold water refugia habitat would be impossible with available information. Also, the available tributary water temperature data indicate that tributary water temperatures are sufficiently cold to support cold water refugia habitat and these data were presumably collected with diversions associated with the proposed actions operating. Therefore, we assume that impacts of the proposed actions on cold water refugia will likely be primarily due to impacts on volume of tributary flow rather than on temperature of water in the affected tributaries.

Small tributary streams are an important source of invertebrate foods for rearing salmonids (Wipfli and Gregovich 2002; Wipfli *et al.* 2007; Wipfli and Baxter 2010) and areas below tributary streams may be important for foraging. However, Flinders *et al.* (2013) determined that salmonid preference for plume habitat was dependent on temperature differential between plume and non-plume mainstem habitat, suggesting that the primary function was as cold water refugia. We therefore assumed that the primary function of habitat in tributaries that are typically considered too small to be rearing habitat, and of tributary plume habitat in the mainstem, was as cold water refugia.

In tributary streams that do not contain intrinsic potential habitat and in tributary streams plumes in the mainstem Salmon River, we assumed the primary impacts of reducing flow would be related to cold water refugia. Information needed to precisely quantify impacts of reducing flow on cold water refugia is not available and we therefore relied on a number of assumptions that were based on the information that is available and our best professional judgment. Because reducing flow in tributary streams will generally raise summer water temperature and reduce available habitat, we assumed that reduction in cold water refugia in a tributary stream was directly proportional to reduction in flow. Cold water refugia in tributary plume habitat is related to "surplus" water (i.e., proportion of the water budget that is not consumptively used) (Ebersole *et al.* 2014). Therefore, in tributary stream plumes in the mainstem Salmon River, we assumed that reduction in cold water refugia was directly proportional to reduction in "surplus" water.

Quantifying the number of fish that would be present in cold water refugia is problematic. In the absence of stream-specific data, we based estimates of fish use of cold water refugia on the only available study of fish use of cold water refugia in the upper Salmon River drainage (i.e., Curet *et al.* 2009). Curet *et al.* (2009) conducted snorkel surveys in one Salmon River tributary and in the plumes of ten other Salmon River tributaries. The one Salmon River tributary that was surveyed, Iron Creek, flows into the Salmon River at river mile 286. We assumed that fish use of cold water refugia in Iron Creek would be roughly representative of fish use in tributaries affected by the proposed actions if those tributaries were unimpacted by irrigation. However, Iron Creek is only 0.8 miles upstream, and 3.1 miles downstream, from streams that likely provide cold water refugia (i.e., contain intrinsic potential habitat and estimated base flow exceeds water allocations). In contrast, tributaries affected by the proposed actions are at least 12 miles from tributaries that likely contain cold water refugia. Assuming that fish use of Iron Creek as cold water refugia is representative of tributaries that are a substantial distance from the nearest alternative cold water refugia likely greatly underestimates potential fish use and consequently, underestimates impacts of the proposed actions on rearing Chinook salmon and steelhead. Also, although Iron Creek is somewhat restored, Iron Creek flow is not representative of an undiverted stream. Assuming that fish use of Iron Creek is representative of a stream unimpacted by irrigation likely further underestimates impacts of the proposed action. However, the fish use data from Iron Creek represents the only, and therefore the best, data available on rearing Chinook salmon and steelhead use of cold water refugia in Salmon River tributary streams; however, in relying on it we have taken into account the likelihood it underestimates effects in some contexts.

The 10 tributary plumes studied in Curet *et al.* (2009) are between RMs 334 and 377, or 30 to 73 miles upstream from the upper boundary of the Middle Salmon watershed. These 10 tributaries are all within 0.1 and 5.5 miles of tributaries that likely contain cold water refugia compared to 12 to 22.2 miles for tributaries affected by the proposed actions. Also, the reaches of the mainstem Salmon River studied are likely somewhat colder than reaches in the action area. Therefore, assuming that fish use of tributary plumes recorded by the study is representative of potential fish use of plumes affected by the proposed actions likely greatly underestimates actual potential use of streams affected by the proposed actions. Underestimating potential fish use of tributary plumes affected by the proposed actions results in underestimation of effects of the proposed actions on rearing Chinook salmon and steelhead. However, data presented in Curet *et al.* (2009) are the only and therefore the best, information available for fish use of cold water refugia in Salmon River tributary plume habitat.

To estimate potential number of fish using cold water refugia within a tributary stream, we assumed that Chinook salmon and steelhead use of habitat in Iron Creek as reported in Curet *et al.* (2009), and when expressed as fish use per drainage area, was roughly representative of potential fish use in tributary streams affected by the proposed actions. Because only one stream was surveyed, comparisons of fish use and drainage area or other factors that may influence fish use, were not possible. To estimate potential number of fish using cold water refugia in tributary plumes, we compared fish use presented in the study to drainage area and Salmon River mile. Approximately half the variability of Chinook salmon use of tributary plume habitat was explained with a multivariate regression of drainage area and Salmon River mile. We therefore estimated potential Chinook salmon use of tributary plume habitat by extrapolating this regression to the tributaries affected by the proposed actions. Steelhead use of tributary plume habitat was not related to drainage area or Salmon River mile. We therefore assumed that potential steelhead use of tributary plume habitat was equal to the average use reported in Curet *et al.* (2009). Estimated numbers of juvenile Chinook salmon and steelhead potentially using tributary stream and tributary plume habitat impacted by the proposed actions are in Table 12.

Table 12. Potential number of juvenile Chinook salmon and steelhead utilizing cold water refugia tributaries affected by the proposed actions and number of Chinook salmon potentially utilizing cold water refugia in the plumes of those tributaries in the mainstem.

Tributary	River Mile	Drainage Area	Potential number of Chinook Salmon utilizing Cold Water Refugia in Tributary Plumes	Potential Number Utilizing Cold Water Refugia Within Tributaries	
				Chinook Salmon	Steelhead
Hat Creek	293.8	76.5	158	81	16
Williams Creek	267.1	27.3	217	29	6
Pollard Creek	259.4	19.61	233	21	4
Carmen Creek	253.4	48.1	242	51	10
Wallace Creek	252.3	7.65	248	8	2
Tower Creek	249.2	21.6	253	23	4

Reducing flow in tributary streams also has the potential to adversely affect pre-spawning adult Chinook salmon. All of the affected tributary streams likely historically provided, or contributed to, cold water refugia for adult Chinook salmon holding prior to spawning. Currently, there is likely very little available cold water refugia in the 47.9 river miles between Warm Springs Creek (RM 285.1) and the NFSR (RM 237.2). The apparent complete lack of spawning downstream from RM 304 suggests that this reach may no longer be used as adult Chinook salmon holding habitat; however, the fact that approximately 18% of adult Lemhi River Chinook salmon hold somewhere in the mainstem Salmon River through mid-July suggests that some holding habitat might still be at least partially functional. Regardless, the proposed actions would reduce cold water inputs potentially used by holding pre-spawning Chinook salmon and adult Chinook salmon are apparently present in the mainstem Salmon River that could benefit from cold water inputs. The effect of the proposed actions on pre-spawning adult Chinook salmon is likely important and should be recognized. Although information needed to quantify this effect is not available, we expect that effect on Lemhi River Chinook salmon is moderate and effect on SRLM Chinook salmon is possibly substantial, and perhaps the reason the SRLM Chinook salmon population has declined while adjacent populations have gradually increased.

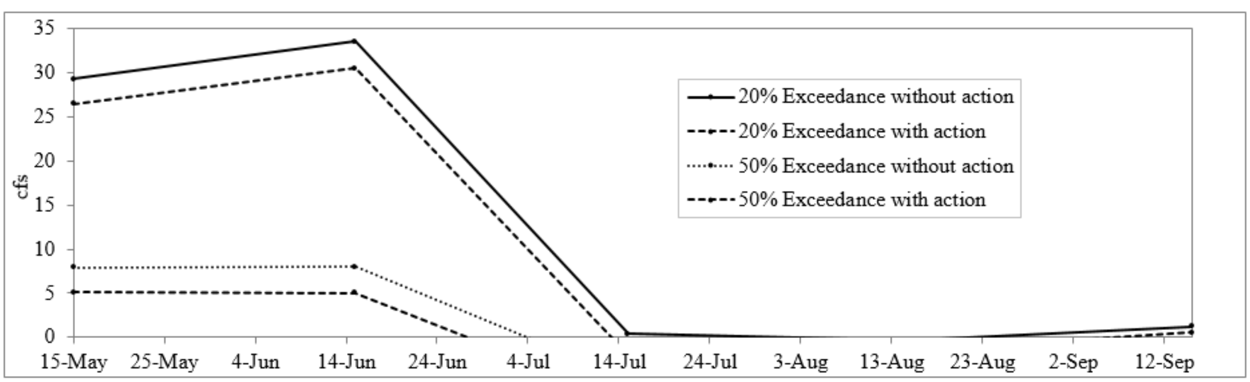
2.4.1.3 Impacts of the Big Hat Creek Diversion (DEA 2099) on Chinook Salmon and Steelhead

Water rights served by the Big Hat Creek Diversion are currently in the water bank as part of the IDWR Water Transactions program. This has restored surface flow in lower Big Hat Creek and has improved flow conditions in the Hat Creek drainage. Because the Big Hat Creek diversion will not be operated, fish will not be entrained in the diversion, there will be no effects on cold water refugia, and there will be no effects on flow downstream from the diversion. As described in 2.4.1, maintenance of diversion structures and/or modification or removal of diversion structures to ensure fish passage, may have minor effects on Chinook salmon and steelhead.

2.4.1.4 Impacts of Operation and Maintenance of the South Fork Williams Creek Diversion (DEA 2066) on Chinook Salmon and Steelhead

The South Fork Williams Creek Diversion is the only diversion in the Williams Creek drainage that would be permitted through the proposed actions. The POD serves one water right, 75-4128, with a maximum diversion rate of 3.2 cfs that is used to irrigate 149.8 acres. The proposed action would possibly result in complete dewatering of South Fork Williams Creek at the POD for most of the irrigation season (i.e., typically late April through late September).

We used flow and diversion information from the upper Lemhi River drainage and Challis Creek (i.e., tributary of the upper Salmon River) to estimate flow impacts on Williams Creek. Based on this information, irrigation of 149.8 acres would reduce flow in Williams Creek by 2.8, 3.0, 2.4, 1.2, and 0.7 cfs for May, June, July, August, and September, respectively (Appendix F). Diversions that are not associated with the proposed action (baseline diversions) likely completely dry Williams Creek for the entire irrigation season during 80% exceedance years (Appendix B), suggesting that the proposed action might not appreciably impact surface flow in Williams Creek during very dry years because the creek would be completely dewatered due to diversions on private land. During 50% exceedance years, Williams Creek would likely be completely dewatered during most base flow periods; and during 20% exceedance years, Williams Creek might be dry for about 24 days in August. Operation of the South Fork Williams Creek Diversion would increase the amount of time that Williams Creek is dry by 6 days during 50% exceedance years, and 17 days during 20% exceedance years[8] (Figure 8).



Note: During 80% exceedance years, flow at the mouth of Williams Creek would likely be zero for the entire irrigation season.

Figure 8. Estimated flow at the mouth of Williams Creek with and without the proposed action of permitting operation and maintenance of the South Fork Williams Creek diversions.

[8]During the irrigation season, surface flow in Williams Creek would be intercepted by an irrigation ditch from a Salmon River diversion and would therefore likely not reach the mainstem Salmon River.

Migration and Entrainment Related Effects of the Action in South Fork Williams Creek. Because Williams Creek is currently captured by an irrigation diversion on the Salmon River, successful migration into Williams Creek is unlikely during the irrigation season. Outside of the irrigation season, steelhead sometimes migrate into Williams Creek via the Salmon River diversion ditch; however, due to passage barriers on Williams Creek, steelhead are apparently not able to migrate upstream past the Williams Lake Road, approximately 0.5 miles from the historic confluence with the Salmon River (Chad Fealko, NMFS, Fisheries Biologist, pers. comm.). Because migration barriers not associated with the proposed actions preclude anadromous fishes from migrating upstream as far as the South Fork Williams Creek POD, operation of the diversion is not likely to result in entrainment of anadromous fishes or blockage of migration at the POD. Operation of the South Fork Williams Creek Diversion would reduce flow in Williams Creek. However, because the passage barriers in lower Williams Creek are apparently not flow dependent (i.e., are barriers at all flows), flow reduction due to the proposed action would not likely further exacerbate passage conditions in Williams Creek. The IDFG has an active program installing fish screens and restoring fish passage throughout the Salmon River drainage. Although Williams Creek is not currently a high priority for restoration, IDFG may eventually remove the physical barriers to fish passage. If physical barriers to passage downstream of the POD are removed, then operation of the South Fork Williams Creek Diversion would reduce amount of time that adult steelhead could move upstream to spawn and that juvenile steelhead could successfully migrate downstream. In a system like Williams Creek, where flow conditions are degraded sufficiently to render fish passage marginal, reducing amount of time that adult steelhead can migrate upstream could preclude steelhead spawning in some years.

Cold Water Refugia Effects of the South Fork Williams Creek Diversion. The intrinsic potential models indicate that lower Williams Creek is potentially high quality steelhead habitat. Although the intrinsic potential models indicate no potential Chinook salmon habitat in the Williams Creek drainage, juvenile Chinook salmon are often found in streams without Chinook salmon intrinsic potential and Williams Creek is adjacent to occupied Chinook salmon rearing habitat, suggesting that juvenile Chinook salmon would likely use lower Williams Creek as rearing habitat if access were available. Williams Creek currently flows into a Salmon River diversion ditch, rendering migration into or out of Williams Creek practicably impossible during the irrigation season. Although migration into and out of Williams Creek apparently occurs outside of the irrigation season, rearing Chinook salmon and steelhead only need cold water refugia during summer (i.e., in the irrigation season) when migration into Williams Creek is impossible due to factors unrelated to the proposed action. Operation of the South Fork Williams Creek Diversion would therefore not likely affect access to cold water refugia in the Williams Creek stream channel. However, if the physical barriers to fish passage are downstream from the POD are removed, then operation of the South Fork Williams Creek Diversion would reduce amount of time that fish could access cold water refugia in Williams Creek. During some years, this could preclude use of cold water refugia in Williams Creek.

NMFS assumes that the Williams Creek plume could potentially constitute cold water refugia for Chinook salmon and steelhead rearing in the mainstem Salmon River and possible for prespawn adult Chinook salmon. The limited available water temperature data suggest that August water temperatures in Williams Creek are substantially colder than in the Middle Salmon watershed portion of the mainstem upper Salmon River (Appendix B). Tributary streams can provide cold water refugia in receiving streams even when no surface flow is present in the tributary (Ebersole *et al.* 2014). Therefore, the Williams Creek/Salmon River confluence may constitute cold water refugia for rearing juvenile Chinook salmon and steelhead even when surface flow is absent. Ebersole *et al.* (2014) determined that water surpluses (i.e., precipitation + snow melt – evapotranspiration) during the spring and summer months were the best predictors for presence of cold water refugia at tributary confluences. In the absence of precipitation and snowmelt data for the Williams Creek drainage, we assumed that estimated unimpaired stream flow at the mouth of Williams Creek was a reasonable approximation of mean water surplus without irrigation, and estimated unimpaired flow minus consumptive use due to irrigation is a reasonable approximation of water surplus with irrigation. Under these assumptions, irrigation resulting from the proposed action would reduce water surplus in Williams Creek by 13.1% during May through July. Assuming that amount of cold water refugia is proportional to water surplus, the proposed action would reduce cold water refugia in the Salmon River at the confluence of Williams Creek by 13.1%.

Based on the only survey of fish use of tributary plume habitat in the mainstem Salmon River, NMFS estimates that approximately 217 juvenile Chinook salmon and 16 juvenile steelhead could potentially utilize cold water refugia in the Williams Creek plume (Table 12). Assuming that reducing cold water refugia by 13.1% would displace 13.1% of fish utilizing that refugia, operation of the Williams Creek Diversion might displace 28 Chinook salmon and two steelhead. Because summer water temperatures in this reach of the Salmon River approach lethal levels for salmonids, and other cold water refugia might be as much as 18 miles away, it is reasonable to assume that all displaced salmonids will die. Estimated average annual number of SRLM Chinook salmon and Pahsimeroi River steelhead outmigrants is 9,278 and 41,076, respectively. Based on the estimated impacts of the proposed actions on rearing juvenile Chinook salmon and steelhead, and on the estimated numbers of Chinook salmon and steelhead outmigrants, cold water refugia related effects of operating the Williams Creek Diversion would reduce productivity of the SRLM Chinook salmon and Pahsimeroi River steelhead populations by 0.30% (i.e., 28/9,278) and 0.005% (i.e., 2/41,076) respectively. These adverse impacts will occur for as long as the Williams Creek Diversion operates.

***Flow Effects of the South Fork Williams Creek Diversion*.** Intrinsic potential modeling indicates that Williams Creek contains high quality steelhead habitat; however, passage barriers likely limit steelhead to reaches downstream from Williams Lake Road. Williams Creek does not contain intrinsic potential habitat for Chinook salmon and passage into Williams Creek is blocked during the irrigation season, when Chinook salmon would likely migrate upstream. Chinook salmon are therefore not likely to be present in Williams Creek.

Estimated median monthly flow in lower Williams Creek is 7.9 cfs in May, 8.0 cfs in June, and 0 cfs for the rest of the irrigation season (Appendix D). These flows were estimated under the current baseline wherein water appropriated for use is more than 500% of the estimated unimpaired baseflow. Based on these estimated flows and the estimated impacts of the proposed action described above, operating the South Fork Williams Creek Diversion, during a 50% exceedance year, would reduce flow in lower Williams Creek by an estimated 35.4% and 37.4%

in May and June, respectively. Because of the heavy appropriation, lower Williams Creek would probably be completely dewatered during July and August of a 50% exceedance year, regardless of whether or not the South Fork Williams Creek diversion was operating. We therefore assume that operation of the South Fork Williams Creek diversion would reduce surface flow by 35.4% and 37.4% in May and June, respectively, and would have essentially no impact, on surface flow, in July and August. According to the productivity versus flow relationships described in Appendix A, this flow reduction corresponds to a 28.5% reduction in Pahsimeroi River steelhead population productivity. Although all reaches downstream from the POD would be affected, due to migration barriers, steelhead can only occupy habitat downstream from the Williams Lake Road. There is 3.43 acres (13,900 m^2) of steelhead intrinsic potential habitat downstream from the Williams Creek Road that could be inhabited by steelhead, or 0.36% of habitat in the Pahsimeroi River steelhead population area. Therefore, the effect of the proposed action on steelhead rearing in Williams Creek would reduce productivity of the Pahsimeroi River steelhead population by approximately 0.10% (28.5% reduction * 0.36% of the population exposed = 0.10%). However, if physical barriers to upstream migration are removed, the proportion of the steelhead population affected would increase with consequent increase in population level effects of operating the South Fork Williams Creek diversion.

Because water that is diverted but not consumptively used would eventually return to the mainstem Salmon River, we assumed that effects of operating the South Fork Williams Creek Diversion on flow in the mainstem Salmon River would be due to consumptive use alone. Operation of the South Fork Williams Creek diversion would result in irrigation of 149.8 acres and consumptive use of approximately 217.2 acre feet per year, or 0.91 cfs spread evenly over a 120-day irrigation season. Effects of reducing flow in the mainstem Salmon River are not limited to cold water refugia and are therefore best quantified using fish population productivity versus flow relationships described in Appendix A. Flow related effects of the actions in the mainstem Salmon River are described in Section 2.4.1.9.

2.4.1.5 Impacts of Operation and Maintenance of the Pollard Creek Diversion (DEA 2072) and the Chipps Creek diversion (DEA 2073) on Chinook Salmon and Steelhead

The Chipps and Pollard Creek diversions are used to divert water from the same fifth field HUC to serve the same water rights at the same point of use (i.e., City of Salmon Water Supply). Because of these similarities, effects of operation and maintenance of the Chipps and Pollard Creek diversions are related, similar, and in some cases, indistinguishable for each other. We therefore describe effects of operation and maintenance of the Chipps and Pollard Creek diversions in the same section.

Three water rights are relevant to the proposed action of permitting operation of the Chipps Creek and Pollard Creek Diversions. Water right 75-2167 has a maximum diversion rate of 2.0 cfs and a year round season of use. Water rights 75-14700, and 75-14701 have a combined maximum diversion rate 2.54 cfs and November 1 through March 31 season of use. With the exception of rights used for stockwater, these three water rights are the only ones in the Pollard Creek drainage that allow water diversion outside of the irrigation season, and are therefore, the most senior water rights from November 1 through March 31. Because water right 75-2167 is junior to approximately 7.4 cfs of other water rights during the irrigation season, the proposed action likely does not result in diversion of water from April 1 through October 31. Therefore, the proposed actions would not likely result in additional diversion or use from April 1 through October 31.

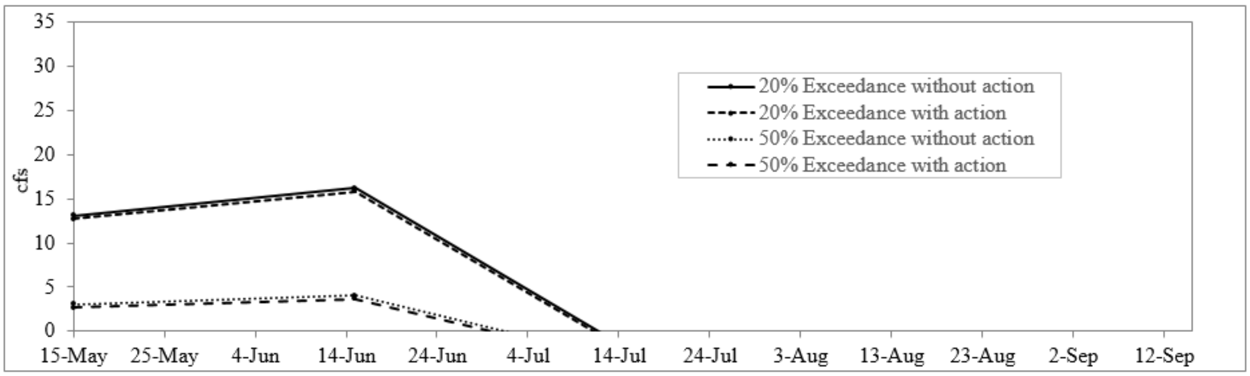
Operation of the Chipps and Pollard Creek diversions could, theoretically, result in additional water diversion and use from November 1 through March 31. However, water to serve 75-2167, 75-14700, and 75-14701 is also diverted via the Jesse Creek diversion which is not covered in this Opinion. The Chipps and Pollard Creek diversions would only be used when flow in Jesse Creek is insufficient to meet needs of the municipal water system. The lowest estimated mean monthly 80% exceedance flow in Jesse Creek is 0.97 cfs and occurs in February. The Chipps and Pollard Creek diversions would, therefore, rarely be used when demand for water was less than 0.97 cfs. Based on the size of the city of Salmon, Idaho and per capita domestic water use in the United States, municipal demand for water during the non-irrigation season would be approximately 0.48 cfs. The Chipps and Pollard Creek diversions would therefore likely not be used during the non-irrigation season and would probably not result in additional water diversion and use from November 1 through March 31.

Because operation of the Pollard and Chipps Creek diversions are not likely to result in additional water diversion and use during the irrigation season and because the diversions will not likely be operated outside of the irrigation season, permitting operation of the Pollard and Chipps Creek diversions will not likely result in flow-related effects on Chinook salmon or steelhead. Baseline conditions in lower Pollard Creek likely preclude movement of anadromous fishes into the Pollard Creek drainage. Because anadromous fishes are likely not currently present in the Pollard Creek drainage, they are not likely to be entrained in the Chipps or Pollard Creek diversions. Likewise, because anadromous fishes are likely not currently present in the Pollard Creek drainage, they are not likely to be blocked by the Pollard or Chipps Creek diversions. The proposed action of permitting operation and maintenance of the Pollard and Chipps Creek diversions is not likely to result in flow or non-flow related effects on Chinook salmon or steelhead.

2.4.1.6 Impacts of Operation and Maintenance of the Wallace Creek Diversion (DEA 2103) on Chinook Salmon and Steelhead

The Wallace Creek Diversion is located approximately 3.4 miles upstream from the confluence of Wallace Creek and the mainstem upper Salmon River. The Wallace Creek Diversion is the only diversion in the Wallace Creek drainage that would be permitted by the proposed action. The Wallace Creek Diversion serves two water rights with a maximum diversion rate of 0.4 cfs that is used to irrigate 18.8 acres. Estimated median, mean monthly flow at the POD is 1.36, 4.42, 4.96, 1.84, 0.88, and 0.77 cfs, respectively for April, May, June, July, August, and September. Therefore, the proposed action of permitting diversion of 0.4 cfs would likely result in reducing base flow by approximately 45% at the POD.

We used flow and diversion information from the upper Lemhi River drainage and Challis Creek (i.e., tributary of the upper Salmon River) to estimate flow impacts on Wallace Creek. Based on this information, irrigation of 18.8 acres would reduce flow in Wallace Creek by 0.35, 0.38, 0.30, 0.15, and 0.08 cfs for May, June, July, August, and September, respectively. During 50% exceedance years, Wallace Creek would likely be completely dewatered from mid-July through the end of the irrigation season without the proposed action, and would be dewatered approximately 0.5 days earlier with the proposed action (Figure 9). During 20% exceedance years, Wallace Creek would be completely dewatered from early July through the end of the irrigation season without the proposed action, and would be dewatered approximately one day earlier with the proposed action (Figure 9).



Note: During 80% exceedance years, flow at the mouth of Wallace Creek would likely be zero for the entire irrigation season.

Figure 9. Estimated flow at the mouth of Wallace Creek with and without the proposed action of permitting operation and maintenance of the Wallace Creek Diversion.

Migration and Entrainment Related Effects of the Action in Wallace Creek. There are no natural barriers between the Wallace Creek Diversion and occupied Chinook salmon and steelhead habitat, and Chinook salmon and steelhead could therefore, theoretically, migrate upstream as far as the Wallace Creek Diversion prior to and after the irrigation season. However, the diversion is approximately three miles upstream from steelhead intrinsic potential habitat and IDFG-recognized Chinook salmon rearing habitat. Because the diversion is a substantial distance upstream from currently or potentially "suitable" Chinook salmon or steelhead habitat, few (possibly no) Chinook salmon and steelhead are likely to be present at the Wallace Creek diversion and few (possibly none) would be entrained in the diversion. Likewise, because few (possibly no) Chinook salmon or steelhead would be migrating upstream past the diversion, few (possibly none) would be blocked by the diversion structures or reduced flow in the stream channel below the diversion.

The SCNF did not describe flows needed for fish migration into Wallace Creek. Because some flow is presumably needed for Chinook salmon and steelhead to migrate into Wallace Creek, and Wallace Creek is probably dewatered by irrigation diversions at some point during the late spring or early summer, it is reasonable to assume that fish migration into Wallace Creek is blocked due to inadequate flow at some point during late spring or early summer. Operation of the Wallace Creek Diversion would reduce flow in lower Wallace Creek, causing migration to be blocked earlier. Based on the description of flow with and without the proposed action (Section 2.4.6.1), we presume the proposed action will block migration into Wallace Creek for less than one additional day compared to baseline conditions without the proposed action. However, in a system like Wallace Creek, where flow conditions are degraded sufficiently to render fish passage marginal, reducing amount of time that steelhead could move upstream, by even a small amount, could preclude steelhead use in some years. Although habitat in lower Wallace Creek is likely severely degraded, there may be high quality habitat in upstream reaches and precluding steelhead use of Wallace Creek could, therefore, have additional adverse effects. Because Wallace Creek does not contain intrinsic potential habitat for Chinook salmon, NMFS assumes that migration related effects on Chinook salmon would be extremely small.

Cold Water Refugia Effects of the Wallace Creek Diversion. Intrinsic potential models indicate that Wallace Creek contains steelhead habitat, and the SCNF did not describe migration barriers in Wallace Creek, so we assume steelhead would be present at the diversion. Although Wallace Creek is likely dewatered for most of the irrigation season, steelhead might be able to move upstream in the spring of normal years and possibly into early summer of wet years. Although habitat in the lowest reaches is likely degraded, quality steelhead habitat might be present in upstream reaches. In the absence of evidence to the contrary, we assume that Wallace Creek is occupied steelhead habitat and we also assume that impacts on steelhead rearing in Wallace Creek would not be limited to cold water refugia-related effects. Because effects on steelhead rearing in Wallace would likely not be limited to cold water refugia-related effects, and because cold water refugia-related effects are included in analyses based on relationship of population productivity and flow, we used relationships of population productivity and flow to quantify impacts of the proposed action on steelhead in Wallace Creek.

The limited available water temperature data suggest that August water temperatures in Wallace Creek are substantially colder than in the Middle Salmon portion of the mainstem upper Salmon River. Although the intrinsic potential models indicate no potential Chinook salmon habitat in the Wallace Creek drainage, juvenile Chinook salmon are often found in streams without Chinook salmon intrinsic potential and Wallace Creek is adjacent to occupied Chinook salmon rearing habitat, suggesting that juvenile Chinook salmon would likely use lower Wallace Creek as rearing habitat if access were available. However, Wallace Creek is likely dewatered from late June or early July through the end of the irrigation season rendering migration into or out of Wallace Creek during summer, when cold water refugia is needed, practicably impossible. We therefore conclude that access to cold water refugia in Wallace Creek has likely been eliminated by water diversion and use. Operation of the Wallace Creek diversion contributes to the dewatering of lower Wallace Creek that results in elimination of accessible cold water refugia. Approximately 6.1% of water use in the Wallace Creek drainage is due to operation of the Wallace Creek diversion. We therefore assume that 6.1% of the impact on Chinook salmon cold water refugia in Wallace Creek is due to the proposed action. Eight Chinook salmon could potentially utilize cold water refugia in the Wallace Creek stream channel. Assuming that 6.1% of the elimination of accessible cold water refugia in Wallace Creek is due to operation of the Wallace Creek Diversion, then the proposed action results in displacing fewer than one rearing Chinook salmon annually.

Tributary streams can provide cold water refugia in receiving streams even when no surface flow is present in the tributary (Ebersole *et al.* 2014). Therefore, the Wallace Creek/Salmon River confluence may constitute cold water refugia for rearing juvenile Chinook salmon and steelhead even when surface flow is absent. Ebersole *et al.* (2014) determined that water surpluses (i.e., precipitation + snow melt – evapotranspiration) during the spring and summer months were the best predictors for presence of cold water refugia at tributary confluences. In the absence of precipitation and snowmelt data for the Wallace Creek drainage, we assumed that estimated unimpaired stream flow at the mouth of Wallace Creek was a reasonable approximation of mean water surplus without irrigation, and estimated unimpaired flow minus consumptive use due to irrigation is a reasonable approximation of water surplus with irrigation. Under these assumptions, irrigation resulting from the proposed action would reduce water surplus in Wallace Creek by 4.7% during May through July. Assuming that amount of cold water refugia is proportional to water surplus, the proposed action would reduce cold water refugia in the Salmon River at the confluence of Wallace Creek by 4.7%.

Based on the only survey of fish use of tributary plume habitat in the mainstem Salmon River, NMFS estimates that approximately 248 juvenile Chinook salmon and 16 juvenile steelhead could potentially utilize cold water refugia in the Wallace Creek plume each summer (Table 12). Assuming that reducing cold water refugia by 4.7% would displace 4.7% of fish utilizing that refugia, operation of the Wallace Creek Diversion might displace approximately 12 Chinook salmon and one steelhead. Because summer water temperatures in this reach of the Salmon River approach lethal levels for salmonids, and other cold water refugia might be as much as 15 miles away, it is reasonable to assume that all displaced salmonids will die. Estimated average annual number of Lemhi River Chinook salmon and Lemhi River steelhead outmigrants is 9,636 and 49,447, respectively (Appendix G). Based on the estimated of impacts of the proposed actions on rearing juvenile Chinook salmon and steelhead, and on the estimated numbers of Chinook salmon and steelhead outmigrants, effects of operation of the Wallace Creek diversion on cold water refugia in the mainstem Salmon River would reduce productivity of the Lemhi River Chinook salmon and Lemhi River steelhead populations by 0.12% (i.e., 12/9,636) and 0.002% (i.e., 1/49,447) respectively. This adverse impact will occur for as long as the Wallace Creek Diversion operates.

Flow Effects of the Wallace Creek Diversion. Estimated median monthly flow in lower Wallace Creek is 3.0 cfs in May, 4.0 cfs in June, and 0 cfs for the rest of the irrigation season (Appendix D). These flows were estimated under the current baseline wherein water appropriated for use is more than 600% of the estimated unimpaired baseflow. Based on these estimated flows and the estimated impacts of the proposed action described above, operating the Wallace Creek Diversion, during a 50% exceedance year would reduce flow in lower Wallace Creek by an estimated 11.7% and 9.4% in May and June, respectively. Because of the heavy appropriation, lower Wallace Creek would probably be completely dewatered during July and August of a 50% exceedance year, regardless of whether or not the Wallace Creek diversion was operating. We therefore assume that operation of the Wallace Creek diversion would reduce surface flow by 11.7% and 9.4% in May and June, respectively, and would have essentially no impact, on surface flow, in July and August. Based on the relationship of rearing streamflow and productivity of *O. mykiss* rearing in the upper Lemhi River (Appendix G), the impact of the proposed action would reduce productivity of *O. mykiss* rearing in Wallace Creek by 3.6%. Intrinsic potential modeling indicates that Wallace Creek contains 0.11 acres (440 m^2) of steelhead intrinsic potential habitat, or 0.01% of the habitat in the Lemhi River steelhead population area. Assuming that impact on the population is proportional to impact on intrinsic potential habitat, effect of the proposed action on steelhead rearing in Wallace Creek would reduce productivity of the Lemhi River steelhead population by approximately 0.0036% (3.6% reduction * 0.01% of the population exposed = 0.0036%). Although IDFG considers lower Wallace Creek to be Chinook salmon rearing habitat, the intrinsic potential modeling did not indicate Chinook salmon intrinsic potential habitat in Wallace Creek. Therefore, we assume that impacts on Chinook salmon rearing in Wallace Creek would be primarily related to cold water refugia, which were described in the previous section.

Because water that is diverted but not consumptively used would eventually return to the mainstem Salmon River, we assumed that effects of operating the Wallace Creek diversion on flow in the mainstem Salmon River would be due to consumptive use alone. Operation of the Wallace Creek diversion would result in irrigation of 18.8 acres and consumptive use of approximately 27.3 acre feet per year, or 0.11 cfs spread evenly over a 120-day irrigation season. Effects of reducing flow in the mainstem Salmon River are not limited to cold water refugia and are therefore best quantified using fish population productivity versus flow relationships described in Appendix A. Flow-related effects of the actions in the mainstem Salmon River are described in Section 2.4.1.9.

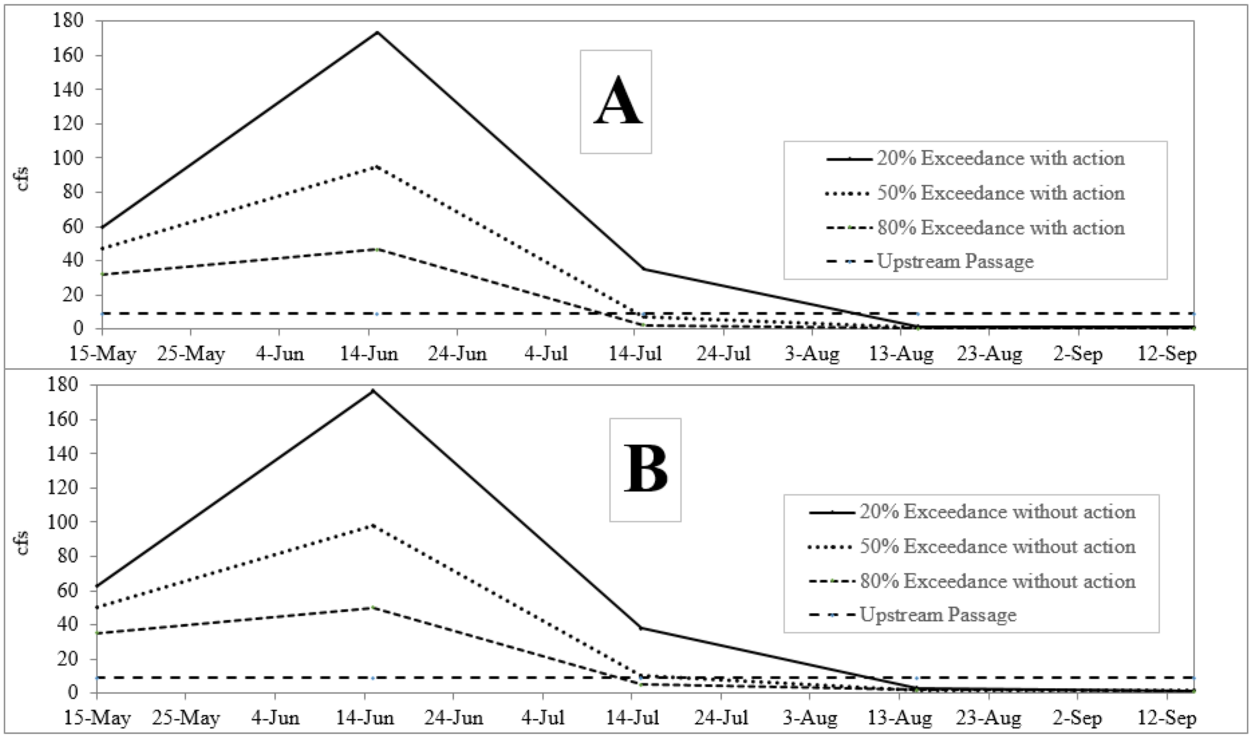
2.4.1.7 Impacts of Operation and Maintenance of the Carmen Creek Diversion (DEA 2076) on Chinook Salmon and Steelhead

The Carmen Creek diversion is on Carmen Creek approximately 7.3 miles upstream from the confluence of Carmen Creek and the mainstem upper Salmon River. Although a total of eight water rights can be served via water diverted from the Carmen Creek diversion, only three are dependent on the diversion (see Section 1.3.1). These three water rights (i.e., 75-63A, 75-2002, and 75-4332) have a combined maximum diversion rate of 3.28 cfs used for stockwater (0.9 cfs) and to irrigate 169.9 acres (2.38 cfs). However, the stockwater right (75-4332) is limited to 13,000 gallons per day, or 0.02 cfs if diverted continuously, so actual daily average combined maximum diversion would be 2.40 cfs. Estimated median, mean monthly unimpaired flow at the POD is 10.8, 33.0, 36.4, 13.8, 7.77, and 7.18 cfs, respectively for April, May, June, July, August, and September. Therefore, the proposed action of permitting diversion of 2.40 cfs would likely reduce base flow by approximately 32% at the POD during the irrigation season.

Estimated mean monthly 50% exceedance flow near the mouth of Carmen Creek, based on flow measurements taken from 2005 – 2013, are 36.9, 93.1, 16.2, 1.1, and 1.1 cfs for May June, July, August, and September, respectively (Appendix B). These flow measurements represent flow influenced by operation of diversions, including the Carmen Creek water diversion that has been operating without a current SUP. We used flow and diversion information from the upper Lemhi River drainage and Challis Creek (i.e., tributary of the upper Salmon River) to estimate flow impacts on Carmen Creek. Based on this information, irrigation of the 169.9 acres associated with the proposed action would reduce flow in Carmen Creek by 3.2, 3.4, 2.7, 1.4, and 0.77 cfs for May, June, July, August, and September, respectively (Appendix F). Because flow data not influenced by operation of the Carmen Creek diversion are not available, we assumed that flow near the mouth of Carmen Creek without the proposed action (i.e., without operation of the Carmen Creek diversion) would be equal to the estimated 50% exceedance flow based on gage data and the estimated impact of the Carmen Creek diversion. Under this assumption, the proposed action would reduce flow in Carmen Creek by 7.9%. 3.5%, 14.2%, 55.2%, and 41.2% respectively for May, June, July, August, and September.

Migration and Entrainment Related Effects of the Action in Carmen Creek. The Carmen Creek drainage contains intrinsic potential habitat for both Chinook salmon and steelhead. Based on studies in the upper Salmon River drainage, a flow of approximately 9 cfs would be needed to facilitate upstream passage of adult anadromous salmonids in lower Carmen Creek (Appendix H). Estimated dates that flows would drop below 9 cfs are: July 11 with the proposed action and July 12 without the proposed action in 80% exceedance years; July 14 with the proposed action and July 15 without the proposed action in 50% exceedance years; and August 8 with the proposed action and August 10 without the proposed action in 20% exceedance years (Figure 10). On average, the proposed action would reduce amount of time that flows exceed nine cfs by 1.5 days. Therefore, NMFS assumes the proposed action would reduce the time in which adult anadromous salmonids can migrate upstream in Carmen Creek by 1.5 days. It is unknown how many steelhead would be blocked by reducing passage by 1.5 days. However, in a system like Carmen Creek, where flow conditions are degraded sufficiently to render fish passage marginal, reducing amount of time that steelhead could move upstream by even a small amount could preclude steelhead spawning in Carmen Creek in some years. In addition, permitting operation and maintenance of the Carmen Creek diversion could impede ongoing and future efforts to restore fish migration in Carmen Creek.

Although the proposed action would reduce amount of time that steelhead could migrate into Carmen Creek, some migration would likely occur during most years. The SCNF did not describe passage barriers in Carmen Creek so we assume that upstream passage is possible when sufficient flow is available. Although the SCNF describes the current diversion structure as a complete barrier to upstream fish migration and a seasonal barrier to downstream passage, the proposed action states that upstream and downstream fish passage will be maintained at all flows. NMFS therefore assumes that the proposed action will not impair upstream passage of anadromous fishes at the POD and that they could be entrained in the Carmen Creek diversion.



Note: Estimated minimum flow needed for upstream passage of adult anadromous was 12.8 cfs. The proposed action would reduce the amount of time that flows exceeded the minimum for upstream passage by approximately 1.5 days.

Figure 10. Estimated 80%, 50%, and 20% mean monthly exceedance flow with (A) and without (B) the proposed action.

Operation of the Carmen Creek diversion would result in diversion of up to 3.28 cfs. However, because the stockwater right is limited to 13,000 gallons daily, the maximum average instantaneous diversion rate would be 2.40 cfs. This amount of diversion represents approximately 19% of the estimated median, mean annual flow at the POD. Assuming downstream migrating fishes are evenly distributed temporally across the year and spatially across the stream, operation of the Carmen Creek diversion would entrain approximately 19% of downstream migrating anadromous salmonids. However, because the diversion will be screened to NMFS standards, only three percent of entrained fishes will be killed. There 3.28 acres (13,293 m^2) of steelhead habitat upstream from the diversion, which represents 0.32% of habitat in the Lemhi River steelhead population area. Therefore, operation of the Carmen Creek diversion might entrain and kill approximately 0.0018% of the Lemhi River steelhead population (19% entrained * 3% entrainment mortality * 0.32% of the population exposed = 0.0018%). There is no Chinook salmon intrinsic potential habitat upstream from the Carmen Creek diversion, so operation of the diversion would likely result in entrainment of few to none juvenile Chinook salmon.

Cold Water Refugia Effects of the Carmen Creek Diversions. The BA did not include fish sampling data for Carmen Creek but IDFG lists the lower 3.94 miles of Carmen Creek as occupied Chinook salmon habitat, Carmen Creek has intrinsic potential habitat for both Chinook salmon and steelhead, and PIT tag scanning array data indicates that adult steelhead migrate into Carmen Creek during spring and early summer. NMFS therefore assumed that Carmen Creek is occupied habitat for Chinook salmon and steelhead and that effects on Chinook salmon and steelhead in Carmen Creek would not be limited to cold water refugia. Because effects on Chinook salmon and steelhead in Carmen Creek are not limited to cold water refugia, and because cold water refugia-related effects are included in analyses based on relationships of population productivity and flow, we used relationships of population productivity and flow to quantify impacts of the proposed action on Chinook salmon and steelhead in Carmen Creek. These flow-related effects are described in the next section.

In contrast to the Carmen Creek stream channel, we assumed the primary effects on Chinook salmon and steelhead in the Carmen Creek plume would be due to impacts on cold water refugia. Water temperature data indicate that Carmen Creek is substantially colder than the mainstem Salmon River. Although water use dries lower Carmen Creek during late summer when cold water refugia is needed, tributary streams can provide cold water refugia in receiving streams even when no surface flow is present in the tributary (Ebersole *et al.* 2014). Therefore, the Carmen Creek/Salmon River confluence may constitute cold water refugia for rearing juvenile Chinook salmon and steelhead even when surface flow is absent. Ebersole *et al.* (2014) determined that water surpluses (i.e., precipitation + snowmelt – evapotranspiration) during the spring and summer months were the best predictors for presence of cold water refugia at tributary confluences. In the absence of precipitation and snowmelt data for the Carmen Creek drainage, we assumed that estimated unimpaired stream flow at the mouth of Carmen Creek was a reasonable approximation of mean water surplus without irrigation, and estimated unimpaired flow minus consumptive use due to irrigation is a reasonable approximation of water surplus with irrigation. Under these assumptions, irrigation resulting from the proposed action would reduce water surplus in Carmen Creek by 2.5% during March-July. Assuming that amount of cold water refugia is proportional to water surplus, the proposed action would reduce cold water refugia in the Salmon River at the confluence of Carmen Creek by 2.5%.

Based on the only survey of fish use of tributary plume habitat in the mainstem Salmon River, NMFS estimates that approximately 242 juvenile Chinook salmon and 16 juvenile steelhead could potentially utilize cold water refugia in the Carmen Creek plume (Table 12). Assuming that reducing cold water refugia by 2.5% would displace 2.5% of fish utilizing that refugia, operation of the Carmen Creek diversion might displace approximately six Chinook salmon and fewer than one steelhead. Because summer water temperatures in this reach of the Salmon River approach lethal levels for salmonids, and other cold water refugia might be as much as 16 miles away, it is reasonable to assume that all displaced salmonids will die. Estimated average annual number of Lemhi River Chinook salmon and Lemhi River steelhead outmigrants is 9,636 and 49,447, respectively. Based on the estimated impacts of the proposed actions on rearing juvenile Chinook salmon and steelhead, and on the estimated numbers of Chinook salmon and steelhead outmigrants, effects of operation of the Carmen Creek diversion on cold water refugia in the mainstem Salmon River would reduce productivity of the Lemhi River Chinook salmon and Lemhi River steelhead populations by 0.06% (i.e., 6/9,636) and 0% (i.e., >1/49,447) respectively. This adverse impact will occur for as long as the Carmen Creek Diversion operates.

Flow Effects of the Carmen Creek Diversion. Estimated median mean monthly flow at the mouth of Carmen Creek is 36.9, 93.1, 16.2, and 1.1 cfs for May, June, July, and August, respectively. Estimated impact, on flow, of operating the Carmen Creek diversion is 3.2, 3.4, 2.7, and 1.4 cfs for May, June, July, and August, respectively. Based on these estimates, operating the Carmen Creek diversion would reduce flow in lower Carmen Creek by 7.9%, 3.5%, 14.2%, and 56.0% for May, June, July, and August, respectively. Based on relationships of rearing streamflow and productivity of Chinook salmon and *O. mykiss* rearing in the upper Lemhi River, the impact of the proposed action on flow in Carmen Creek would reduce productivity of Chinook salmon and *O. mykiss* rearing in Carmen Creek by 14.9% and 11.4%, respectively. The affected reach of Carmen Creek contains 4.97 acres (20,126 $m^{2)}$ of Chinook salmon intrinsic potential habitat, or 1.5% of the habitat in the Lemhi River Chinook salmon population area; and 20.87 acres (84,456 m^2) of steelhead intrinsic habitat, or 2.0% of habitat in the Lemhi River steelhead population area. Assuming that impact on the population is proportional to impact on intrinsic potential habitat, effect of the proposed action on Chinook salmon and steelhead rearing in Carmen Creek would reduce productivity of the Lemhi River Chinook salmon and steelhead populations by approximately 0.22% (14.9% reduction * 1.5% of the population exposed = 0.22%), and 0.23% (11.4% reduction * 2.0% of the population exposed = 0.23%).

Because water that is diverted but not consumptively used would eventually return to the mainstem Salmon River, we assumed that effects of operating the Carmen Creek Diversion on flow in the mainstem Salmon River would be due to consumptive use alone. Operation of the Carmen Creek Diversion would result in diversion of 3.28 cfs to irrigate 169.9 acres which would result in consumptive use of 246 acre feet per year, or 1.03 cfs spread evenly over a 120-day irrigation season. Flow-related effects of the actions in the mainstem Salmon River are described in Section 2.4.1.9.

2.4.1.8 Impacts of Operation and Maintenance of the East Fork Tower Creek Diversion (DEA 2077) on Chinook Salmon and Steelhead

The East Fork Tower Creek diversion POD is approximately 2.7 miles upstream from Tower Creek and 4.6 miles upstream from the Salmon River. The diversion serves five water rights (75-4144A, 75-4144B, 75-4345B, 75-4139 and 75-4140) with a combined maximum diversion rate of 1.33 cfs that is used to irrigate 86.9 acres. Estimated median, mean monthly unimpaired flow at the POD is 1.08, 3.59, 3.97, 1.44, 0.70 and 0.61 cfs for April, May, June, July, August, and September, respectively. Therefore, the proposed action of permitting 1.33 cfs of diversion could result in complete dewatering of East Fork Tower Creek at the POD for most of the summer.

We used flow and diversion information from the upper Lemhi River drainage and Challis Creek (i.e., tributary of the upper Salmon River) to estimate flow impacts on Tower Creek. Based on this information, irrigation of the 86.9 acres associated with the proposed action would reduce flow in Tower Creek by 1.33, 1.33, 1.33, 0.7, and 0.4 cfs for May, June, July, August, and September, respectively (Appendix F). There are no streamflow gage data available for Tower Creek. A comparison of estimated unimpaired flow and estimated impacts of water use suggests that lower Tower Creek would be dewatered for the entire irrigation season during years with median flows or less (Appendix D). Lower Tower Creek would likely have flow during parts of the irrigation season during wet years. During years with 20% exceedance flow, the proposed action would reduce flow in Tower Creek by 20% in May, 22% in June, and 100% in September; but might not reduce flow in July and August because all surface flow would be removed by diversions not associated with the proposed action.

Migration and Entrainment Related Effects of the Action in the Tower Creek Drainage. Tower Creek and East Fork Tower Creek contain intrinsic potential habitat for steelhead. Based on studies in the Lemhi River drainage, a flow of approximately 9 cfs would be needed for upstream passage of adult anadromous salmonids in lower Tower Creek (Appendix H). Based on estimated flows and estimated impacts of water use not associated with the proposed action, a flow of nine cfs or greater in lower Tower Creek would only occur for short periods in the spring prior to initiation of irrigation. We therefore conclude that, because diversions not associated with the proposed action likely preclude upstream migration during the irrigation season, operation of the East Fork Tower Creek diversion would have a small impact on migration of adult salmonids into Tower Creek. However, permitting operation of the East Fork Tower Creek diversion would render restoration of migration into Tower Creek more difficult and could possibly impede future restoration efforts.

Other than reduced flow, the BA did not describe anthropogenic passage barriers in Tower Creek or East Fork Tower Creek so we assume that upstream passage is possible when sufficient flow is available. The SCNF states that upstream and downstream fish passage will be maintained at all flows, so NMFS assumes that the proposed action will not impair upstream passage of anadromous fishes at the POD and that anadromous fishes will be present upstream from the POD. Operation of the East Fork Tower Creek diversion would result in diversion of up to 1.33 cfs. This amount of diversion represents approximately 53% of the estimated median, mean annual flow at the POD. Assuming downstream migrating fishes are evenly distributed temporally across the year and spatially across the stream, operation of the Carmen Creek diversion would entrain approximately 53% of downstream migrating anadromous salmonids. However, because the diversion would be screened to NMFS standards, only three percent of entrained fish will be killed. However, there is no Chinook salmon or steelhead intrinsic potential habitat upstream from the East Fork Tower Creek diversion, so operation of the diversion would likely result in entrainment of few, possibly no, juvenile Chinook salmon or steelhead.

Cold Water Refugia Effects of the East Fork Tower Creek Diversion. The BA did not include fish sampling data for Tower Creek but IDFG lists the lower 0.21 miles of Tower Creek as occupied Chinook salmon habitat. Because only a very short section of Tower Creek is occupied Chinook salmon habitat and there is no intrinsic potential habitat for Chinook salmon in the Tower Creek drainage, NMFS assumed that effects on Chinook salmon rearing in Tower Creek would primarily be related to cold water refugia. Although no data are available on steelhead presence in Tower Creek, steelhead intrinsic potential habitat is present throughout the affected reaches of Tower and East Fork Tower Creeks, steelhead may be able to access habitat in Tower Creek in early spring, prior to irrigation turn on; and quality habitat may be present upstream from the dewatered lower reaches. NMFS therefore assumed that effects on steelhead rearing in the Tower Creek drainage would not be limited to cold water refugia. Because effects on steelhead rearing in the Tower Creek drainage are not limited to cold water refugia, and because cold water refugia-related effects are included in analyses based on relationships of population productivity and flow, we used relationships of population productivity and flow to quantify impacts of the proposed action on steelhead in Tower Creek. These flow-related effects are described in the next section.

Tower Creek is substantially colder than the mainstem Salmon River. Although the intrinsic potential models indicate no potential Chinook salmon habitat in the Tower Creek drainage, juvenile Chinook salmon are often found in streams without Chinook salmon intrinsic potential and IDFG lists lower 0.21 miles of Tower Creek as occupied Chinook salmon habitat. We therefore conclude that Tower Creek would likely constitute cold water refugia if surface flow was available. However, Tower Creek is likely dewatered from late June or early July through the end of the irrigation season, rendering migration into or out of Tower Creek during summer, when cold water refugia is needed, practicably impossible. We therefore conclude that access to cold water refugia in Tower Creek has likely been completely eliminated by water diversion and use. Operation of the EF Tower Creek Diversion contributes to the dewatering of lower Tower Creek that results in elimination of accessible cold water refugia. Approximately 18.5% of water use in the Tower Creek drainage is due to operation of the East Fork Tower Creek diversion. We therefore assume that 18.5% of the impact on Chinook salmon cold water refugia in Tower Creek is due to the proposed action. Approximately 23 Chinook salmon could potentially utilize cold water refugia in the Tower Creek stream channel (Appendix A). Assuming that 18.5% of the elimination of accessible cold water refugia in Tower Creek is due to operation of the East Fork Tower Creek Diversion, then the proposed action would displace approximately four rearing Chinook salmon annually. Because summer water temperatures in this reach of the Salmon River approach lethal levels for salmonids and other cold water refugia might be as much as 12 miles away, it is reasonable to assume that all displaced salmonids will die. Estimated average annual number of Lemhi River Chinook salmon outmigrants is 9,636 (Appendix G). Based on the estimated of impacts of the proposed actions on rearing juvenile Chinook salmon, and on the estimated numbers of Chinook salmon outmigrants, effects of operation of the East Fork Tower Creek Diversion on cold water refugia in Tower Creek would reduce productivity of the Lemhi River Chinook salmon population by 0.04% (i.e., 4/9,636). This adverse impact will occur for as long as the East Fork Tower Creek Diversion operates.

Tributary streams can provide cold water refugia in receiving streams even when no surface flow is present in the tributary (Ebersole *et al.* 2014). Therefore, the Tower Creek/Salmon River confluence may constitute cold water refugia for rearing juvenile Chinook salmon and steelhead even when all surface flow has been diverted. Ebersole *et al.* (2014) determined that water surpluses (i.e., precipitation + snowmelt – evapotranspiration) during the spring and summer months were the best predictors for presence of cold water refugia at tributary confluences. In the absence of precipitation and snowmelt data for the Tower Creek drainage, we assumed that estimated unimpaired stream flow at the mouth of Tower Creek was a reasonable approximation of mean water surplus without irrigation, and estimated unimpaired flow minus consumptive use due to irrigation is a reasonable approximation of water surplus with irrigation. Under these assumptions, irrigation resulting from the proposed action would reduce water surplus in Tower Creek by 19.9% during March through July. Assuming that amount of cold water refugia is proportional to water surplus, the proposed action would reduce cold water refugia in the Salmon River at the confluence of Tower Creek by 19.9%.

Based on the only survey of fish use of tributary plume habitat in the mainstem Salmon River, approximately 253 juvenile Chinook salmon and 16 juvenile steelhead could potentially utilize cold water refugia in the Tower Creek plume (Appendix A). Assuming that reducing cold water refugia by 19.9% would displace 19.9% of fish utilizing that refugia, operation of the East Fork Tower Creek Diversion might displace approximately 50 Chinook salmon and three steelhead. Because summer water temperatures in this reach of the Salmon River approach lethal levels for salmonids and other cold water refugia might be as much as 12 miles away, we assume that all displaced salmonids will die. Estimated average annual number of Lemhi River Chinook salmon and Lemhi River steelhead outmigrants is 9,636 and 49,447, respectively. Based on the estimated of impacts of the proposed actions on rearing juvenile Chinook salmon and steelhead, and on the estimated numbers of Chinook salmon and steelhead outmigrants, effects of operation of the East Fork Tower Creek diversion on cold water refugia in the mainstem Salmon River would reduce productivity of the Lemhi River Chinook salmon and Lemhi River steelhead populations by 0.52% (i.e., 50/9,636) and 0.006% (i.e., 3/49,447) respectively. This adverse impact will occur for as long as the East Fork Creek Diversion operates.

Flow Effects of the East Fork Tower Creek Diversion. A comparison of estimated flow and estimated impacts of water use suggests that Tower Creek would likely have little or no surface flow near the mouth for much of the irrigation season, with or without East Fork Tower Creek diversion operating. However, recent PIT tag scanning array data from Carmen Creek, suggests that seasonally dewatered Salmon River tributary streams might actually be steelhead spawning and rearing habitat. The BA did not include flow or fish habitat data for Tower Creek. In the absence of information, NMFS assumed that steelhead spawn in Tower Creek and that flow estimated by Streamstats near the mouth of Tower Creek approximated flow in reaches that are likely used by spawning and rearing steelhead. Based on those assumptions, and applying the impacts on flow described above, operating the East Fork Tower Creek diversion would reduce flow in Tower Creek by 19.9%, 25.3%, 60.4%, and 48.4% for May, June, July, and August, respectively. Based on relationships of rearing streamflow and productivity of *O. mykiss* rearing in the upper Lemhi River (Appendix G), the impact of the proposed action on flow in Tower Creek would reduce productivity of *O. mykiss* rearing in Tower Creek by 20.2%. There is 7.11 acres (28,781 m^2) of steelhead intrinsic potential habitat in the Tower Creek drainage, or 0.70% of the intrinsic potential habitat in the Lemhi River steelhead population area. Reducing productivity of habitat in the Tower Creek drainage by 20.2% would reduce productivity of the Lemhi River steelhead population by approximately 0.14% (0.70% of available habitat * 20.2% reduction in productivity = 0.14%).

Because water that is diverted but not consumptively used would eventually return to the mainstem Salmon River, we assumed that effects of operating the East Fork Tower Creek Diversion on flow in the mainstem Salmon River would be due to consumptive use alone. Operation of the East Fork Tower Creek Diversion would result in diversion of 1.33 cfs to irrigate 86.9 acres which would result in consumptive use of 126 acre feet per year, or 0.53 cfs spread evenly over a 120-day irrigation season. Flow-related effects of the actions in the mainstem Salmon River are described in Section 2.4.1.9.

2.4.1.9 Flow-Related Impacts of the Proposed Actions on Chinook salmon and Steelhead in the Mainstem Salmon River

The proposed actions would reduce flow in the mainstem upper Salmon River. The affected portion of the mainstem upper Salmon River is juvenile rearing, juvenile and adult migration, and adult holding habitat for Chinook salmon and steelhead and spawning habitat for steelhead.

Because water diverted and not consumptively used eventually returns to streams, we presumed the effect on flow in the mainstem Salmon River would be entirely due to consumptive use of water (i.e., water removed from the water budget) and would be exactly equal to the amount of water consumptively used. Water diverted via diversions that would be permitted by the proposed actions would be used for municipal purposes and irrigation. Both of these uses results in consumptive use of a portion of the water diverted. However, as described in Section 2.4.1.5, permitting of municipal diversions, covered in this Opinion, would likely not result in an additional water diversion and use over baseline conditions. We therefore presume that all consumptive use resulting from the proposed actions would be due to irrigation. The proposed actions would result in irrigation of 425.4 acres. Assuming a net consumptive use of 1.45 acre feet per acre per year (Lemhi Decree 1978), the proposed actions would result in consumptive use of approximately 616.8 acre feet per year, or 2.59 cfs spread evenly over a 120-day growing season. The reach specific flow reductions would be: 0.91 cfs between Williams Creek and Carmen Creek; 1.95 cfs between Carmen Creek and Wallace Creek; 2.06 cfs between Wallace Creek and Tower Creek; and 2.59 cfs downstream from Tower Creek (Table 13).

Pahsimeroi River and Lemhi River Steelhead Populations. All of the affected reaches of the mainstem upper Salmon River contain intrinsic potential habitat for steelhead. We estimated impacts of reducing flow on steelhead rearing in the mainstem Salmon River based on amount of intrinsic potential habitat affected and relationships of flow and steelhead population productivity. These estimates are in Table 13.

Table 13. Reach specific effects of the proposed actions on steelhead rearing in the mainstem Salmon River.

Salmon River Reach	Affected Population	Impact (cfs)	Annual Reduction in Productivity in Affected Reach	Habitat in Affected Reach (Percent of Population)	Annual Reduction in Population Productivity
Williams Creek – Carmen Creek	Pahsimeroi River steelhead	0.91	0.065%	4.3	0.0028%
	Lemhi River steelhead		0.024%	1.8	0.00043%
Carmen Creek – Wallace Creek	Lemhi River steelhead	1.95	0.051%	0.57	0.00029%
Wallace Creek – Tower Creek	Lemhi River steelhead	2.06	0.054%	2.1	0.0012%
Tower Creek - MFSR	Lemhi River steelhead	2.59	0.068%	4.0	0.0027%
Total effect on Pahsimeroi River steelhead					**0.0028%**
Total effect on Lemhi River steelhead					**0.0046%**

Salmon River Lower Mainstem and Lemhi River Chinook Salmon Populations. There is no Chinook salmon intrinsic potential habitat in the mainstem Salmon River portion of the Middle Salmon watershed or in any of the downstream reaches that would be affected by the proposed actions. However, a review of River Chinook salmon life history in the upper Salmon River indicates that juvenile Lemhi River and SRLM Chinook salmon likely rear in the mainstem Salmon River portion of the action area. Portions of Snake River spring/summer Chinook salmon year classes begin moving downstream as fry and movement out of spawning reaches continues through summer, fall, winter and the following spring when the last of the year class migrates downstream as yearling smolts (Bjornn 1978; Copeland and Venditti 2009; Arthaud *et al.* 2010). Although some juveniles moving downstream as subyearlings proceed to the ocean as subyearling smolts (Tiffan *et al.* 2000; Copeland and Venditti 2009; Arthaud *et al.* 2010), many rear and overwinter between the spawning reaches and the mainstem dams on the Snake and Columbia Rivers (Arthaud *et al.* 2010). Recent PIT tag scanning array data suggest that an average of 7.3% of PIT tagged Lemhi River Chinook salmon move out of the Lemhi River and into the Salmon River as subyearlings during summer (Appendix A). We presume that these fish complete rearing in the mainstem Salmon River. SRLM Chinook salmon are not PIT tagged as juveniles and there are therefore no PIT tag scanning array data for juvenile SRLM Chinook salmon. In the absence of any information on movement of juvenile SRLM Chinook salmon, we assume they exhibit similar behaviors as adjacent populations described in multiple studies (Bjornn 1978; Copeland and Venditti 2009; Arthaud *et al.* 2010) and that percentage of juveniles likely rearing in the mainstem Salmon River portion of the action area is the same as for the adjacent Lemhi River population. We therefore assume that an average of 7.3% of the Lemhi River and the SRLM Chinook salmon populations rear in the mainstem Salmon River portion of the action area (Appendix A). Assuming that: 7.3% of the Lemhi River and SRLM populations would be affected; an average flow reduction of 0.91 cfs in the mainstem Salmon River portion of the SRLM Chinook salmon population area; and an average flow reduction of 1.88 cfs for mainstem Salmon River portion of the Lemhi River Chinook salmon population area; the effect of the proposed actions on Chinook salmon rearing in the mainstem Salmon River would reduce productivity of the SRLM and Lemhi River Chinook salmon populations by 0.0011% and 0.0048%, respectively.

The PIT tag scanning array data indicate that proportion of the year class migrating out of the Lemhi River as subyearlings during summer is positively related to population density within the Lemhi River drainage (see Section 2.2.1.1). This relationship suggests that rearing habitat outside of the Lemhi River drainage will become more important as the population recovers and more juveniles disperse downstream. We assume the same is true for habitat downstream from the currently used spawning reaches within the SRLM population area.

Chinook Salmon and Steelhead Populations Downstream from the Project Area. The mainstem Salmon River portion of the action area includes portions of the NFSR and Panther Creek Chinook salmon and steelhead populations. Effects on the NFSR and Panther Creek Chinook salmon and steelhead populations would be limited to flow-related effects on habitat in the mainstem Salmon River. Because most actively migrating juvenile Chinook salmon and steelhead move through the action area prior to the irrigation season and/or during peak flows, we did not specifically analyze effects of the actions on juvenile Chinook salmon or steelhead migration survival. Because adult steelhead migrate upstream and spawn prior to the irrigation season, we did not analyze effects on adult steelhead migration or spawning.

As described above, the proposed action would reduce flow in the Salmon River downstream from Tower Creek by 2.59 cfs during the irrigation season. This reduction translates to approximately 0.16% of average August flow measured at the Shoup, Idaho gage. Information needed to describe fish population productivity versus flow relationships is not available for the NFSR and Panther Creek Chinook salmon and steelhead populations. Based on relationships for the SRLM and Lemhi River Chinook salmon populations and the Pahsimeroi River and Lemhi River steelhead populations, a flow reduction of 2.59 cfs corresponds to 0.046% and 0.087% reduction in productivity of Chinook salmon and steelhead, respectively, rearing in the mainstem Salmon River between the NFSR and the MFSR.

Juvenile outmigrant data are not available for the NFSR or Panther Creek Chinook salmon populations and there is no Chinook salmon intrinsic potential habitat in this reach of the mainstem Salmon River. Assuming that proportion of these populations rearing in the Salmon River is similar to the Lemhi River population (i.e., 7.3%), then the proposed actions would reduce productivity of the NFSR and Panther Creek Chinook salmon populations by approximately 0.0032%. Based on an average population size of approximately 65 adult returns (NMFS 2015b) and a SAR of 1.1%, average smolt population would be approximately 5,910. Reducing the NFSR Chinook salmon population productivity by 0.0032% translates to approximately 0.19 smolts per year. The Panther Creek Chinook salmon population was functionally extirpated in the early 1960s (Mebane *et al.* 2015), but habitat has been restored sufficiently for recolonization and the population currently numbers approximately 40 adults. Assuming 40 adult returns and a SAR of 1.1%, average smolt population would be approximately 3,636 and reducing population productivity by 0.0032% would result in 0.12 fewer smolts from this population.

The mainstem Salmon River portion of the NFSR steelhead population contains 17.37 acres (70,311 m^2) of intrinsic potential habitat, or 7.2% of habitat in the NFSR steelhead population area. Assuming that impact on the NFSR steelhead population is proportional to amount of intrinsic potential habitat affected, then the proposed actions would reduce productivity of the NFSR steelhead population by 0.0063% (i.e., 7.2% of the population affected * 0.087% reduction in productivity). Assuming a population size of 139 adults (Appendix C) and a SAR of 1.58% (Tuomikoski *et al.* 2013), average smolt population would be approximately 8,797 and reducing population productivity by 0.0063% would result in 0.55 fewer smolts.

The mainstem Salmon River portion of the Panther Creek steelhead population does not contain steelhead intrinsic potential habitat and information that could be used to estimate Panther Creek steelhead use of the mainstem Salmon River are not available. NMFS therefore assumes that impact of the proposed actions on the Panther Creek steelhead population would be too small to describe with available information.

2.4.1.10 Summary of Effects on Chinook Salmon and Steelhead

Conservation measures included in the proposed action should result in unimpaired upstream fish passage and should reduce adverse effects due to maintenance activities to negligible levels. Reduction in flow downstream from diversions and reduction in cold water refugia in affected tributaries and in the mainstem Salmon River at the confluences of affected tributaries due to water diversion, will result in adverse effects on Chinook salmon and steelhead. Entrainment in the Carmen Creek diversion will result in adverse effects on steelhead. These adverse effects will reduce productivity of the SRLM Chinook salmon, Lemhi River Chinook salmon, Pahsimeroi River steelhead, and Lemhi River steelhead populations (Tables 14 and 15). Impacts on the NFSR and Panther Creek Chinook salmon and steelhead populations would be approximately two orders of magnitude less than the effects on the other four populations. Overall, the impacts translate to approximately 1.3 Chinook salmon adult returns and 3.7 steelhead adult returns per year (Tables 14 and 15). Although these reductions in population productivity are relatively small, they will occur for as long as subject diversions operate, and therefore, are likely consequential to long-term population abundance.

The proposed action will also adversely affect spatial structure/diversity of the Lemhi and Pahsimeroi River steelhead populations and the Lemhi River and SRLM Chinook salmon populations (Tables 14 and 15). Adverse effects on spatial structure of the Lemhi and Pahsimeroi River steelhead populations and the Lemhi River Chinook salmon population are due to reduced access to, and productivity of, spawning and rearing habitat in Salmon River tributary streams. Adverse effects on SRLM Chinook salmon spatial structure are due to reduced suitability of prespawn adult holding and spawning habitat in the Salmon River. Adverse effects on SRLM and Lemhi River Chinook salmon diversity are due to reduced suitability of rearing for juveniles that disperse downstream during summer. Information is not available to quantify these impacts but the adverse impacts would occur for as long as the subject diversions operate.

Table 14. Summary of impacts of the proposed actions on the SRLM and Lemhi River Chinook salmon populations.

Description of Adverse Effect	SRLM Chinook Salmon		Lemhi River Chinook Salmon	
	Abundance/ Productivity[1]	Spatial Structure/ Diversity[2]	Abundance/ Productivity[1]	Spatial Structure/ Diversity[2]
Reduced adult holding habitat	Unknown	Reduction	Unknown	None
Entrainment in diversions	None	None	None	None
Reduced cold water refugia in tributary streams	None	None	0.05% reduction in productivity	Reduction
Reduced flow in tributary streams	None	None	0.22% reduction in productivity	Reduction
Reduced flow in the mainstem Salmon River	0.0011% reduction in productivity	Reduction	0.0048% reduction in productivity	Reduction
Reduction in cold water refugia in the mainstem Salmon River	0.30% reduction in productivity	Reduction	0.71% reduction in productivity	Reduction
Total impact, expressed as percent of the total population	0.30% reduction in productivity	Reduction	0.98% reduction in productivity	Reduction
Total impact, expressed as individual fish[3]	28 smolts and 0.31 adult returns, annually		95 smolts and 1.3 adult returns, annually	

[1] Abundance/productivity risk is high for both populations.
[2] Spatial structure/diversity risk is low for the SRLM population and high for the Lemhi River Chinook salmon population.
[3] Adults were calculated assuming a SAR of 1.1%, calculated from Arthaud *et al.* (2010).

Table 15. Summary of impacts of the proposed actions on the Pahsimeroi River and Lemhi River steelhead populations.

Description of Adverse Effect	Pahsimeroi River Steelhead		Lemhi River Steelhead	
	Abundance/ Productivity[1]	Spatial Structure/ Diversity[2]	Abundance/ Productivity[1]	Spatial Structure/ Diversity[2]
Reduced access to tributary streams due to reduced flow	Unknown	Reduction	Unknown	Reduction
Entrainment in diversions	None	None	0.0018% reduction in productivity	Reduction
Reduction of cold water refugia in tributary streams	None	None	None	None
Reduced flow in tributary streams	0.10% reduction in productivity	Reduction	0.3736% reduction in productivity	Reduction
Reduced flow in the mainstem Salmon River	0.0028% reduction in productivity	Reduction	0.0046% reduction in productivity	Reduction
Reduction in cold water refugia in the mainstem Salmon River	0.005% reduction in productivity	Reduction	0.010% reduction in productivity	Reduction
Total impact, expressed as percent of the total population	0.11% reduction in productivity	Reduction	0.39% reduction in productivity	Reduction
Total impact, expressed as number of juvenile outmigrants[3]	45 smolts and 0.71 adult returns, annually		188 smolts and 3.7 adult returns, annually	

[1] Abundance/productivity risk is moderate for both populations.
[2] Spatial structure/diversity risk is moderate for both populations.
[3] Adults were calculated assuming SAR of 1.58% from Tuomikoski *et al.* (2013).

2.4.2 Effects on Snake River Spring/Summer Chinook Salmon and Snake River Basin Steelhead Designated Critical Habitat

The entire action area is designated critical habitat for Chinook salmon. All affected reaches of the mainstem Salmon River and Carmen Creek, and portions of Williams Creek and Tower Creek are steelhead designated critical habitat. All of the steelhead populations analyzed in this Opinion are necessary for recovery of the Snake River Basin steelhead DPS and the Lemhi River Chinook salmon, SRLM Chinook salmon, and NFSR Chinook salmon populations are necessary for recovery of the Snake River spring/summer Chinook salmon ESU (NMFS 2015d). The ICBTRT has identified these populations as necessary for recovery. Actions that alter the physical or biological features essential to their conservation, or that preclude or significantly delay development of such features, may lead to a conclusion that the actions will destroy or adversely modify designated critical habitat.

2.4.2.1 Non-Flow Effects of the Proposed Actions on Riparian and Stream Channel Habitat

Operation and maintenance of surface diversions associated with the proposed actions could result in physical damage to Chinook salmon and steelhead designated critical habitat in Carmen Creek, and to Chinook salmon critical habitat in Big Hat, South Fork Williams, Wallace, and East Fork Tower Creeks. The following three bullets describe effects that could occur:

- Maintenance of the diversions with hand tools and heavy equipment could damage riparian vegetation and streambanks. Damage to riparian vegetation and streambanks could reduce shade and increase water temperature, increase sediment delivery and deposition, and reduce quality and quantity of instream habitat suitable for rearing salmonids.

- Maintenance of "push up" diversion dams could involve instream work, which could destabilize streambeds. Destabilizing streambeds will increase sediment delivery and deposition, reducing the quality and quantity of habitat suitable for rearing salmonids. If left unchecked, destabilized streambeds could result in severe long-term damage to riparian vegetation and streambanks.

- Water transmission facilities sometimes fail and, if not immediately addressed, the failure can cause mass wasting into the stream. Operation of the water transmission facilities upslope from the stream channels could result in mass wasting into streams, which would reduce quality and quantity of habitat suitable for rearing salmonids.

Primary impacts on Chinook salmon and steelhead designated critical habitat, resulting from habitat damage described in these bullets, would be due to reduced riparian habitat function and increased sediment delivery. Reduced riparian habitat function and increased sediment delivery could result in: (1) Wider, shallower stream channels; (2) reduced production of invertebrate foods; and (3) increased water temperatures. These impacts would affect rearing PBFs for Chinook salmon and steelhead designated critical habitat in the affected tributaries. Impaired function of habitat in affected tributaries would reduce invertebrate food production and increase summer temperatures, and could reduce quality of rearing, migration, and adult holding habitat in the affected tributaries and downstream in the mainstem upper Salmon River (Spence *et al.*1996).

The conservation measures included in the proposed action require: (1) Regular maintenance of diversion structures to reduce the chance of resource damage due to ditch or pipe failure; (2) revegetation and stabilization of all ground disturbed by maintenance activities; (3) USFS approval prior to use of heavy equipment; (4) USFS approval prior to removing significant amounts of vegetation or silt; (5) control of noxious weeds; and (6) annual inspections by USFS to ensure compliance with all SUP and easement terms. These measures are expected to reduce the chance that adverse impacts described above will occur, and will reduce the magnitude of the impacts should any occur. Because both risk and magnitude of adverse impacts due to maintenance of diversions should be effectively minimized, NMFS anticipates minimal degradation of PBFs due to maintenance of the diversions associated with the proposed actions.

2.4.2.2 Cold Water Refugia-related Effects of the Proposed Actions on Designated Critical Habitat

The proposed actions would affect water quality, specifically cold water refugia, in the affected tributaries and in their plumes in the mainstem upper Salmon River. Summer water temperatures in the mainstem Salmon River portion of the action area are regularly high enough to stress Chinook salmon and steelhead and approach lethal levels during warm years. Effects of the actions would occur within a 47.3-mile reach in which cold water refugia has been severely impacted, and possibly virtually eliminated, a condition greatly exacerbated by water diversion and use within the action area. Effects that are specifically associated with cold water refugia would occur in Williams, Wallace, Carmen, and Tower Creeks, and in the plumes of these tributaries within the mainstem upper Salmon River.

Cold water refugia related effects of the proposed actions would negatively affect PBFs for Chinook salmon rearing juveniles. Cold water refugia is important for rearing anadromous salmonids, facilitating rearing in habitat that may otherwise be unsuitable (Nielsen and Lisle 1994; Belchik 1997). Habitat downstream from spawning reaches constitutes important rearing habitat for Salmon River Chinook salmon populations and the portion of the mainstem Salmon River within the project area was likely valuable rearing habitat for SRLM and Lemhi River Chinook salmon. Under current conditions, conservation value of this habitat is extremely limited for rearing juveniles, largely due to curtailment of cold water refugia. By further curtailment of cold water refugia, the proposed actions would further reduce conservation value of rearing habitat in the project area. By increasing flow impairment of tributary streams, the proposed actions would also impair future restoration of cold water refugia for rearing Chinook salmon in the project area.

Cold water refugia related effects of the proposed actions would also negatively affect PBFs for pre-spawning adult Chinook salmon. Cold water refugia is an important habitat component for pre-spawning Chinook salmon (Torgersen *et al.* 1995; Torgersen *et al.* 1999; Sutton *et al.* 2007). Curtailment of cold water refugia in the project area likely increases stress for pre-spawning

Lemhi River and SRLM Chinook salmon and was possibly a major factor in elimination of Chinook salmon spawning in the lowest reaches of the SRLM population area (i.e., IDFG index reach NS-24). The proposed actions would further curtail cold water refugia, thereby further impairing PBFs for pre-spawning adult Chinook salmon. Further impairment of tributary flow, due to the proposed actions, would impair future restoration of PBFs for pre-spawning adult Chinook salmon.

The cold water refugia related effects on Chinook salmon rearing habitat would reduce productivity of Chinook salmon designated critical habitat in the SRLM Chinook salmon and Lemhi River Chinook salmon population areas by 0.30% and 0.76%, respectively. Information is not available to quantify cold water refugia related impacts on adult Chinook salmon holding habitat, but lack of suitable cold water holding habitat is likely a factor precluding Chinook salmon spawning in this reach of the mainstem Salmon River and the proposed actions would contribute to the degradation of this habitat feature.

Steelhead designated critical habitat within the action area is confined to the mainstem Salmon River and portions of Williams, Carmen, and Tower Creeks. Williams, Carmen, and Tower Creeks are potential spawning and rearing habitat for steelhead and as described in Section 2.4.1.2, effects in spawning and rearing habitat are not limited to those effects related to cold water refugia. Because steelhead designated critical habitat in tributary streams is potential spawning and rearing habitat, effects on steelhead designated critical habitat that are specifically associated with cold water refugia would be limited to the plumes of Williams, Wallace, Carmen, and Tower Creeks in the mainstem Salmon River.

Cold water refugia related effects of the proposed actions on PBFs for rearing steelhead would be similar to those for rearing Chinook salmon. However, because steelhead can access designated critical habitat in some seasonally connected tributaries, rearing habitat in the mainstem Salmon River is likely not as critical on a population scale. Unlike Chinook salmon, because adult steelhead migrate upstream and spawn prior to low summer flows and high water temperatures, cold water refugia related effects of the proposed actions would not substantially impair PBFs for pre-spawning adult steelhead. The cold water refugia related effects of the proposed actions would reduce productivity of designated critical habitat in the Pahsimeroi River steelhead and Lemhi River steelhead population areas by 0.005% and 0.010%, respectively. Effects that are not specifically related to cold water refugia are described in the next section.

2.4.2.3 Flow Effects of the Actions on Designated Critical Habitat

The proposed actions would reduce flow by up to 3.0 cfs, 0.38 cfs, 3.4 cfs, and 1.3 cfs in Williams, Wallace, Carmen, and Tower Creeks, respectively; and by 0.91 cfs to 2.59 cfs in the mainstem upper Salmon River. The primary effect of this reduction in flow would be on water quantity for spawning, rearing, and migration; but because flow influences access to cover, food production, substrate quality, etc.; the secondary effects would affect all PBFs listed in Table 9. Because essentially all PBFs would be affected, overall effects on designated critical habitat can be quantified using the relationship of population productivity versus flow and population density described in Appendix A.

Most of the effects of the proposed actions on Chinook salmon designated critical habitat are related to cold water. Effects on Chinook salmon designated critical habitat that are not specifically related to cold water refugia are confined to Carmen Creek and the mainstem Salmon River. An impact of 3.4 cfs represents a substantial portion of the remaining base flow in Carmen Creek but there is not much Chinook salmon intrinsic potential habitat in Carmen Creek, making effects relatively small at the population level. Mean August flow in the mainstem Salmon River is 1,188 cfs, so reductions of 0.91 cfs to 2.59 cfs represent a relatively small impact. However, mean August flow in the mainstem Salmon River at Salmon has declined by approximately 355 cfs, or approximately 30%, since 1980 (see Section 2.3.1), so even small additional impacts could be meaningful. Based on estimated impacts on flow described above and the population productivity versus flow relationships in Appendix A, flow-related impacts that are not specifically related to cold water refugia would reduce productivity of designated critical habitat in the SRLM Chinook salmon, Lemhi River Chinook salmon, NFSR Chinook salmon, and Panther Creek Chinook salmon population areas by 0.0011%, 0.2248%, 0.0032%, and 0.0032%, respectively.

As described in the previous section, because steelhead designated critical habitat is potential spawning and rearing habitat, most of the flow-related effects on steelhead designated critical habitat are not specifically related to cold water refugia. Based on estimated impacts on flow described above and the population productivity versus flow relationships in Appendix A, flow-related impacts that are not specifically related to cold water refugia would reduce productivity of designated critical habitat in the Pahsimeroi River steelhead and Lemhi River steelhead population areas by 0.1028% and 0.3648%, respectively. Although these flow-related effects are small, flow baseline conditions are extremely degraded and likely continuing to diminish (see Section 2.3.1) so these effects could be meaningful. The proposed actions would also reduce productivity of designated critical habitat in the NFSR steelhead population area by 0.0063% and in the Panther Creek population area by an amount that is too small to calculate with available information. These effects may actually be too small to be meaningful.

Estimates of impacts of the proposed actions on productivity of designated critical habitat are based on estimates of average current use of affected habitat. During years of relatively high Chinook salmon abundance, higher proportions of the SRLM Chinook salmon and Lemhi River Chinook salmon populations likely rear in the action area. Therefore, estimated impacts based on average current use of designated critical habitat within the action area will underestimate impacts during years of relatively high abundance.

2.4.2.4 Summary of Effects of the Proposed Actions on Chinook Salmon and Steelhead Designated Critical Habitat

Conservation measures included in the proposed action are expected to reduce adverse effects of water diversion maintenance activities to negligible levels. However, flow in spawning and rearing habitat is a limiting factor for all Chinook salmon and steelhead populations in the action area and the proposed actions would result in reduced flow in Chinook salmon and steelhead designated critical habitat. These reductions in flow would occur in tributary streams that are severely impacted by water use not associated with the proposed actions and in reaches of the mainstem upper Salmon River that are warm, have little cold water refugia, have base flows reduced by approximately one half, and have continually diminishing baseline conditions. Adverse effects on Chinook salmon and steelhead designated critical habitat would continue for as long as diversions permitted due to the proposed actions operate.

Reduction in flow due to the proposed actions will reduce usefulness and potential usefulness of Chinook salmon designated critical habitat in Williams, Wallace, Carmen, and Tower Creeks and the mainstem Salmon River; and will reduce conservation value of steelhead designated critical habitat in Williams Creek, Carmen Creek, Tower Creek, and the mainstem Salmon River. Designated critical habitat would be affected in portions of the SRLM Chinook salmon, Pahsimeroi River steelhead, Lemhi River Chinook salmon and steelhead, NFSR Chinook salmon and steelhead, and the Panther Creek Chinook salmon and steelhead population areas. However, effects within the NFSR and Panther Creek Chinook salmon and steelhead population areas would be confined to flow related effects in the mainstem Salmon River. Reduced conservation value due to the proposed actions would reduce productivity of the SRLM Chinook salmon, Pahsimeroi River steelhead, Lemhi River Chinook salmon, and Lemhi River steelhead populations by 0.30%, 0.11%, 0.98%, and 0.37%, respectively. Because effects within the NFSR and Panther Creek Chinook salmon and steelhead population areas would be confined to the mainstem Salmon River, population scale reductions in productivity of designated critical habitat for those populations would be approximately two orders of magnitude less than for the other four affected population areas.

2.5 Cumulative Effects

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

Ongoing activities on private land will continue to adversely impact ESA-listed anadromous salmonids and their habitat. For example, water diversion and use on private land in and upstream from the action area will likely continue and will: (1) Entrain fishes in screened and unscreened diversions; (2) reduce flow in the mainstem Salmon River and tributary streams with the resultant variety of adverse impacts on fish and habitat; (3) reduce access to tributary stream habitat; and (4) reduce cold water refugia in the mainstem Salmon River and tributary streams. Water use on private land will likely increase as growing seasons lengthen due to climate change. Livestock grazing will continue on private land along the mainstem Salmon River and the lower reaches of tributary streams which will cause relatively widespread damage to riparian and instream habitat. Private, city, and county roads will continue to be maintained adjacent to and across streams in the action area, which will impair fish passage, adversely impact floodplains, and will contribute fine sediments to streams. Although most of land in the Middle Salmon River watershed is Federal, most of the land adjacent to the mainstem Salmon River and affected tributaries is non-Federal. Therefore, additional development that could adversely impact aquatic resources is possible.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5), taking into account the status of species and critical habitat (Section 2.2), to formulate the agency's Opinion as to whether the proposed action is likely to: (1) Result in appreciable reductions in the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated critical habitat for the conservation of the species.

The PIT tag scanning array data indicate that subyearling Chinook salmon move into the mainstem Salmon River portion of the Middle Salmon River watershed during summer, presumably seeking rearing habitat. The PIT tag scanning array data also indicate that rearing juvenile steelhead move into the mainstem Salmon River and Carmen Creek portions of the action area to rear and that adult steelhead migrate into Carmen Creek during spring, indicating that Carmen Creek is currently occupied steelhead spawning/rearing habitat. The mainstem Salmon River portion of the action area is also migration habitat for all upstream populations of Chinook salmon and steelhead, possibly rearing habitat for upstream populations, and was Chinook salmon spawning habitat until 1988. Migrating Chinook salmon and steelhead, rearing juvenile Chinook salmon and steelhead, spawning steelhead, and holding adult Chinook salmon are in the action area and would be affected by the proposed actions.

The proposed actions included provisions to protect riparian and instream habitat from adverse effects of maintenance activities, so maintenance of diversion structures, transmission structures, access routes, and other aspects of diversion maintenance should not result in effects to ESA-listed anadromous salmonids of any magnitude and should not adversely affect designated critical habitat. Anadromous salmonids could possibly be in the vicinity of the Wallace Creek, Carmen Creek, and Tower Creek diversions while they are operating but diversions will be screened to NMFS standards, which should reduce mortality of entrained fishes by approximately 97%. The proposed actions would result in reduction in flow in rearing habitat, migration habitat, cold water refugia habitat, spawning habitat, potential spawning habitat, and adult holding habitat. This reduction in flow would reduce number of, and distance between, patches of cold water refugia habitat in the mainstem Salmon River, reduce access to rearing and cold water refugia habitat in tributary streams, reduce access to spawning habitat in tributary streams, and reduce productivity of rearing habitat in tributary streams and the mainstem Salmon River. These reductions in population productivity and equilibrium population size would occur for as long as the diversions remain in operation.

Although habitat restoration has reestablished cold water refugia in Iron Creek (upstream of the action area), and has slowed degradation of flow baseline conditions in the mainstem Salmon River, baseline conditions are degraded throughout the Middle Salmon River watershed and is continuing to deteriorate. Twelve of 15 tributaries that are large enough to contain anadromous fish habitat are likely dewatered during baseflow periods and some are likely dewatered for the entire irrigation season. Summer water temperature in the mainstem Salmon River is regularly high enough to stress cold water fishes and approaches lethal levels during warm years. All cold water refugia in the 47.9 mile reach, from Warm Springs Creek to the NFSR, has been degraded by water use, possibly to the point that no functional cold water refugia remains in this reach. Summer base flow in the mainstem Salmon River declined by approximately 30% since 1980, probably due to a combination of increased irrigation, improvements in irrigation technology, and climate change. Historic Chinook salmon spawning habitat in the mainstem Salmon River portion of the Middle Salmon River watershed is apparently unusable, possibly due to degradation or elimination of suitable adult holding habitat, which is at least partially due to reduced flow in the mainstem Salmon River and reduced cold water inputs from tributary streams. Much of the anadromous fish habitat in the Middle Salmon river watershed is on private land and, therefore, has little protection from current land use activities and future development. Baseline conditions in Middle Salmon River watershed are currently unsuitable for spawning or rearing Chinook salmon, although some juvenile Chinook likely continue to attempt to rear in the watershed. Because steelhead spawn in spring and can sometimes utilize seasonally connected tributaries, portions of the Middle Salmon watershed continue to support spawning and rearing steelhead.

Climate change will adversely affect suitability of Chinook salmon and steelhead habitat for the foreseeable future. Reduced snowpack and increased consumptive use on irrigated lands will likely exacerbate problems with summer water temperature, availability of cold water refugia, and access of tributary habitats. Of the affected populations, SRLM Chinook salmon will likely be most affected by climate change because their spawning and rearing is currently confined to the mainstem Salmon River. Lemhi River Chinook salmon will also likely be severely affected because spawning and rearing is limited to the mainstem Lemhi and Salmon Rivers and one tributary drainage. Because steelhead have more access to tributary stream habitat, adverse effects of climate change will be less than for Chinook salmon. For all affected populations, habitat restoration that increases access to, and utility of, habitat in Salmon River tributary drainages will tend to ameliorate adverse effects of climate change.

The Lemhi River Chinook salmon population is 12% of the size needed to meet draft recovery objectives, making it the second weakest extant population in the Upper Salmon MPG. The population is currently at high risk of extinction due to low abundance and productivity and extensive studies of juvenile production indicates that the population will remain at high risk for the foreseeable future. Habitat degradation due to water diversion and use is a primary limiting factor for the Lemhi River Chinook salmon population. A previous opinion NMFS (2012a) determined that effects of permitting diversions on the Lemhi River Chinook salmon population would likely jeopardize continued existence of Chinook salmon and may destroy or adversely modify Chinook salmon designated critical habitat. To date, NMFS has not received the monitoring reports required by NMFS (2012a) and thereby assumes that its RPA has yet to be implemented. The proposed actions would reduce productivity of the Lemhi River Chinook salmon population by 0.98% which would reduce long term population size by about one adult return. This reduction in population productivity and size would be in addition to reductions due to degraded flow baseline conditions within the action area as well as degraded conditions in the portion of the Lemhi River Chinook salmon population area that is outside of the action area. In addition to these impacts, which are based on effects on the juvenile rearing life stage, the proposed actions would also adversely impact pre-spawning adult Chinook salmon by reducing the number of and distance between areas of holding habitat/thermal refugia, likely increasing prespawn mortality. Adverse impacts of the proposed actions on the Lemhi River Chinook salmon population will occur for as long as diversions operate.

The SRLM Chinook salmon population is 8.1% of the size needed to meet draft recovery objectives, making it the weakest extant population in the Upper Salmon MPG. This population is currently at high risk of extinction due to low abundance and productivity and similarities to the Lemhi River Chinook salmon population suggests that the population will remain at high risk for the foreseeable future. Habitat degradation due to water diversion and use is a primary limiting factor for the SRLM Chinook salmon population. A previous opinion, NMFS (2012b) determined that effects of permitting diversions on the SRLM Chinook salmon population would likely jeopardize continued existence of Chinook salmon and adversely affect Chinook salmon designated critical habitat. To date, NMFS has not received the monitoring reports required by NMFS (2012b) and thereby assumes that its RPA has yet to be implemented. The proposed actions would reduce productivity of the SRLM Chinook salmon population by 0.41% which would reduce long term population size by about 0.31 adult returns. This reduction in population productivity and size would be in addition to reductions due to degraded flow baseline conditions within the action area as well as degraded conditions in the portion of the SRLM Chinook salmon population area that is outside of the action area. In addition to these reductions, which are based on effects on the juvenile rearing life stage, the proposed actions would also adversely impact pre-spawning adult Chinook salmon by reducing the number of and distance between areas of holding habitat/thermal refugia, likely increasing pre-spawn mortality and precluding spawning in the historically used lower reaches of the population area. Adverse impacts of the proposed actions on the SRLM Chinook salmon population will occur for as long as diversions operate.

The actions, as proposed, will increase probability of extinction for the SRLM and Lemhi River Chinook salmon populations because: (1) The Lemhi River and the SRLM Chinook salmon populations are at high risk of extinction due to low population productivity and abundance; (2) the populations will likely remain at high risk of extinction for the foreseeable future; (3) the proposed actions will reduce population productivity and abundance; (4) the reductions in population productivity and abundance are in addition to reductions caused by water diversion and use not covered in this consultation, as well as other baseline activities that adversely affect the species and are expected to continue; (5) the proposed actions would adversely affect pre-spawning adults; (6) climate change will likely tend to reduce base flow, increase summer water temperature, and reduce cold water refugia; and (7) status of RPAs from previous consultations is unknown. Increasing probability of extinction for either the Lemhi River Chinook salmon population or the SRLM Chinook salmon population increases probability of extinction for the Upper Salmon River Chinook salmon MPG. Increasing probability of extinction for the Upper Salmon River Chinook salmon MPG increases probability of extinction for the Snake River spring/summer Chinook salmon ESU. In reaching this conclusion, NMFS considered both the survival and the recovery of Snake River spring/summer Chinook salmon.

Chinook salmon designated critical habitat is largely degraded throughout the SRLM and Lemhi River Chinook salmon population areas. Much of this degradation is due to reduced flows and migration barriers caused by water diversion and use. Increased irrigation, improved irrigation technology, and climate change will likely result in continued flow related degradation of

Chinook salmon designated critical habitat. Unknown status of RPAs from previous consultations suggests that diversions on USFS lands may be continuing to diminish value of Chinook salmon designated critical habitat.

Although Chinook salmon spawning historically occurred in the action area, degraded habitat has confined all current spawning to the mainstem Salmon River upstream from the Pahsimeroi River, the mainstem Lemhi River upstream from the Hayden Creek drainage, and the Hayden Creek drainage (all upstream of the action area). Degraded habitat has likewise confined Chinook salmon rearing to the mainstem Lemhi and Salmon Rivers, Hayden Creek, Big Springs Creek, and the lower reaches of a few tributaries that have been partially reconnected through habitat restoration. Even with improvements that have been made, current amount of accessible spawning/rearing habitat is insufficient to meet recovery objectives for abundance and productivity, or even to achieve less than high risk of extinction, for either the SRLM or the Lemhi River Chinook salmon population. Available information also indicates that neither the SRLM nor the Lemhi River Chinook salmon population can achieve recovery, or even achieve less than high risk of extinction, through improvement in migration conditions alone. Clearly, current amount and quality of accessible designated critical habitat is insufficient, and further degradation due to increased irrigation, improved irrigation technology, and climate change is likely. The proposed actions will further reduce access to Chinook salmon rearing habitat and potential spawning habitat, will adversely impact Chinook salmon adult holding habitat/cold water refugia, will increase distance between cold water refugia for rearing juveniles, and will reduce productivity of and possibly access to currently accessible spawning and rearing habitat. The proposed actions would likely appreciably diminish value of designated critical habitat within the Snake River spring/summer Chinook salmon ESU because: (1) Condition of Chinook salmon designated critical habitat is degraded throughout the SRLM and Lemhi River Chinook salmon population areas; (2) flow and cold water refugia baseline conditions are likely continuing to decline; (3) status of implementation of RPAs for previous water diversion related consultations is unknown; (4) the proposed actions would further degrade flow and cold water refugia related habitat factors; and (5) both the SRLM and Lemhi River Chinook salmon populations much achieve at least “maintained” status in order for the Snake River spring/summer Chinook salmon population to recover. Also, because proportion of the SRLM and Lemhi River Chinook salmon populations rearing in the action area is greatest during years of relatively high population abundance, poor habitat condition in the action area likely has a population dampening effect that is not accurately described by the analysis, which is based on mean population size.

Effects of the proposed actions on the NFSR steelhead and Panther Creek steelhead populations will be confined to flow-related effects on rearing in the mainstem Salmon River. Tributary habitat would not be affected and cold water refugia habitat in the mainstem would not likely be affected. Because tributary habitat and cold water refugia would not likely be affected and the mainstem Salmon River contains a relatively small portion of rearing habitat for these populations, adverse effects of the proposed actions on the NFSR steelhead and Panther Creek steelhead populations would be extremely small. Magnitude of effects suggests that the proposed actions would not likely appreciably reduce population productivity or population size of the NFSR and Panther Creek steelhead populations and would not likely appreciably reduce conservation value of Snake River Basin steelhead designated critical habitat.

The proposed actions will reduce population productivity of the Pahsimeroi River and Lemhi River steelhead populations, which will tend to reduce population size and increase risk of extinction for both populations. These adverse effects will occur for as long as diversions operate. However, both populations presumably achieved their current sizes with the diversions operating, and recent studies suggest that both populations are sufficiently large to achieve moderate risk of extinction. Climate change will adversely affect steelhead but habitat restoration in the form of full or partial tributary reconnection will likely have positive effects. Because steelhead can access seasonally connected tributary streams, even partial tributary reconnection may have substantial positive effects. The current draft recovery goal for the Pahsimeroi River and Lemhi River steelhead populations is moderate risk of extinction (i.e., "maintained" status). Assuming that population size estimates are accurate and the draft recovery objectives are appropriate, size of the Pahsimeroi River and Lemhi River steelhead populations, and quality and quantity of designated critical habitat within the Pahsimeroi River and Lemhi River population areas are likely currently sufficient to meet recovery objectives.

Because the Pahsimeroi River and Lemhi River steelhead population areas are heavily influenced by activities on private land, there may be some degradation in habitat conditions. However, tributary stream habitat restoration projects are ongoing in both population areas and recent PIT tag scanning array data from Carmen Creek suggests that, unlike adult Chinook salmon, adult steelhead have been migrating into, and juvenile steelhead have been found rearing in, seasonally reconnected tributaries. Therefore, the quality of, and access to, steelhead spawning/rearing habitat will likely increase somewhat for both populations. Given current size of the Pahsimeroi River and Lemhi River steelhead populations, anticipated future baseline conditions, and magnitude of the proposed action's adverse effects, it is unlikely that the proposed actions will cause either population to worsen their status from moderate to high risk of extinction. The Snake River Basin steelhead DPS can achieve recovery objectives with the Pahsimeroi River and Lemhi River steelhead populations at moderate risk of extinction, both populations are likely currently at moderate risk of extinction, and the proposed actions are not likely to result in a change status for either population.

2.7 Conclusion

After reviewing and analyzing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed actions, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' Opinion that the proposed actions are likely to jeopardize the continued existence of Snake River spring/summer Chinook salmon and are likely to destroy or adversely modify Snake River spring/summer Chinook salmon designated critical habitat. It is NMFS' Opinion that the proposed actions are not likely to jeopardize the continued existence of Snake River Basin steelhead and are not likely to destroy or adversely modify Snake River Basin steelhead designated critical habitat.

2.8. Reasonable and Prudent Alternative

"Reasonable and prudent alternatives" refer to alternative actions identified during formal consultation that can be implemented in a manner consistent with the intended purpose of the action, that can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction, that are economically and technologically feasible, and that would avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat (50 CFR 402.02).

NMFS determined that the proposed actions would jeopardize the continued existence of Snake River spring/summer Chinook salmon and would also destroy or adversely modify their designated critical habitat. Therefore, NMFS must discuss with the USFS, the availability of RPAs that the SCNF can take to avoid violation of USFS' ESA section 7(a)(2) responsibilities (50 CFR 402.14(g)(5)). This section presents USFS with an RPA which can be implemented to avoid jeopardy and adverse modification of critical habitat, while meeting each of the other requirements identified above. The USFS shall fully implement the RPA within 3 years of the issuance date of this Opinion.

2.8.1 Maintenance of Diversions

Maintenance of diversions permitted by the proposed actions will be as originally proposed in Section 1.3.

2.8.2 Addressing Impacts on Chinook Salmon

In order to offset adverse impacts of operating permitted diversions, the SCNF will implement a program (Program) to improve cold water refugia and/or flow baseline conditions in the Middle Salmon watershed. The Program can be implemented in conjunction with, or as an addition to, existing or future programs operated by other Federal agencies or by state agencies. The Program will: (1) Improve base flow (i.e., flow during August and September) at the mouth of mainstem Salmon River tributary streams in the Middle Salmon watershed by a total of 3.5 cfs; or (2) acquire, through purchase, rental, or donation, a total of 7.33 cfs of irrigation water rights currently diverted from any reach of any tributary stream in the Middle Salmon watershed, allow the water to remain in the source stream, and ensure that the land is not irrigated; or (3) any combination of 1 and 2; and (4) appropriate expansion of the Program if the SCNF determines that water diversion and use that is relevant to operation of the Carmen Creek diversion is greater than described in Table 5. Streamflow restoration described in numbers 1 and 2, above, should be increased by approximately 0.48 cfs and 1.0 cfs, respectively, for each additional cfs of diversion that is determined to be relevant to operation of the Carmen Creek diversion.

Number 1 can be accomplished by moving a POD(s) from a tributary stream to the mainstem Salmon River and does not require land to be taken out of production. However, there should be a mechanism in place to ensure that target flows at the tributary mouth are met. The Iron Creek

Phase II project (IDWR 2012) is an example of a project wherein flow at the tributary mouth was restored by moving a POD from the source tributary to the mainstem Salmon River. Because moving PODs from tributary streams to the mainstem Salmon River may involve improvement of water transmission facilities, measures will be taken to ensure that projects do not result in an increase in consumptive use of water.

Number 2 will require taking currently irrigated land out of production. However, achieving target flows at the mouth of the tributary will not be necessary. Although this approach may not result in consistent flows at the tributary mouth, reducing amount of irrigation will improve overall flow baseline conditions, including an increase in “surplus” flow that should increase cold water refugia in tributary plumes. The Big Hat Creek project (IDWR 2012) is an example of a project wherein overall flow baseline conditions were improved by reducing amount of irrigation in the drainage.

Projects that fit requirements for both 1 and 2 can apply to both. For example, 2.38 cfs represents 68% of the target for number 1, and 32% of the target for number 2. Therefore, if 2.38 cfs of water rights were acquired by purchase, lease, or donation, and applied to an instream flow target at the mouth of a tributary stream, and all land irrigated with the 2.38 cfs (i.e., approximately 119 acres) were taken out of production, then the requirements of this RPA would be met.

2.8.3 Monitoring

2.8.3.1 Diversion Status, Maintenance, and Operation

The USFS will determine, and document, status and condition of water diversion and transmission structures, headgates, flow measuring devices, and access routes on at least an annual basis. Documentation can be accomplished via photographic evidence provided by the permittee, but the USFS must physically inspect diversions at least every 3 years.

The water user will record amount of water diverted at each diversion permitted by the proposed actions on IDWR form NTD1:12/00 (Appendix I).

The USFS or a cooperating agency will:

- Monitor water diversion structures to ensure that water rights acquired through purchase, lease, or donation are not used for irrigation.

- If the USFS chooses to improve base flow at one or more tributary mouths, then monitor flows near the mouths of restored tributaries to determine if target flows are being met.

- If monitoring indicates that target flows at the mouths of restored tributaries are not being met, conduct studies to determine the cause for not achieving target flows and formulate solutions to correct the discrepancies.

- Study the Carmen Creek diversion and associated water rights as needed to determine if any portion of the water needed to serve water rights 75-77B, 75-2128, 75-10061AN, 75-10923, or 75-4341 must be diverted via the Carmen Creek diversion.

2.8.3.2 Reporting

The SCNF will submit an annual monitoring report to:

National Marine Fisheries Service
Attention: WCR-2016-4505
800 East Park Boulevard
Plaza IV, Suite 220
Boise, Idaho 83712-7743

2.8.4 Implementation of the Reasonable and Prudent Alternatives

The USFS must fully implement the RPA within 3 years of finalization of this Opinion.

2.8.5 Reasonable and Prudent Alternative Analysis of Effects on Snake River Spring/Summer Chinook Salmon and their Designated Critical Habitat

The RPA would permit operation and maintenance of diversions in the Middle Salmon watershed. Diversion configuration, diversion maintenance, access routes for diversions, etc., are the same as described in Section 1.3, and effects that are not related to flow and/or cold water refugia are the same as described in Section 2.4.1.1. The RPA includes provisions to address flow and cold water refugia related adverse effects resulting from operation of the South Fork Williams Creek, Wallace Creek, Carmen Creek, and East Fork Tower Creek diversions; however, some adverse effects would still occur.

2.8.5.1 Flow and Cold Water Refugia Related Effects of the RPA

Flow and cold water refugia related effects of the proposed actions on Snake River spring/summer Chinook salmon, and their designated critical habitat are described in Sections 2.4.1 and 2.4.2. At current population sizes, the proposed actions would result in an ongoing annual take of approximately 123 juvenile Chinook salmon, 101 due to cold water refugia related effects and 22 due to other flow related effect. The RPA requires the USFS to either restore 3.5 cfs of flow in the lower reaches of Middle Salmon watershed tributaries or reduce water use in Middle Salmon River tributaries by 7.33 cfs, or a combination of restoring tributary flow and reducing tributary water use.

Because tributary flow can be restored by moving PODs from tributaries to the Salmon River, adverse effects on flow in the mainstem Salmon River would be essentially the same as described in Sections 2.4.1 and 2.4.2. Likewise, because flow would not necessarily be restored in tributaries with Chinook salmon intrinsic potential habitat, flow effects in tributary streams that are not related to cold water refugia could be essentially the same as described in Sections 2.4.1 and 2.4.2. However, restoring 3.5 cfs of flow to the lowest reaches of Middle Salmon watershed tributary streams would likely restore cold water refugia in tributary streams and would also likely increase cold water refugia in tributary plume habitat in the mainstem Salmon River. Assuming that cold water refugia in restored tributary streams is directly related to amount of restored flow, and assuming that Iron Creek is representative of restored cold water refugia in the Middle Salmon watershed (i.e., 7.08 cfs restored and habitat for 61 rearing Chinook salmon and 12 rearing steelhead), adding 3.5 cfs to the lower reaches of Middle Salmon watershed tributaries would provide cold water refugia for 30 rearing Chinook salmon and six rearing steelhead in tributary streams. Likewise, leaving 3.5 cfs in the lower reaches of Middle Salmon watershed tributaries would result in a slight net increase in baseflow at tributary mouths. Because cold water refugia is typically an issue during baseflow periods, providing an overall increase in tributary baseflow at tributary mouths should completely offset impacts on cold water refugia in tributary plume habitat, which should provide cold water refugia for approximately 96 rearing Chinook salmon and seven rearing steelhead in tributary plume habitat. Therefore, leaving 3.5 cfs in the lower reaches of Middle Salmon watershed tributaries would provide cold water refugia habitat for 126 rearing Chinook salmon and 13 rearing steelhead.

Acquiring 7.33 cfs of irrigation water rights on Middle Salmon watershed tributary streams and leaving the water that would otherwise be diverted in stream, would essentially offset the impacts on flow described in Section 2.4.1. Although water rights would not necessarily be acquired in tributary streams affected by the proposed actions, they would be on streams within the Middle Salmon River watershed and we therefore assume that magnitude of the positive effects of leaving water in the streams would be approximately equal to the magnitude of the adverse effects due to the proposed actions.

Acquiring 7.33 cfs of water rights for flow restoration would essentially offset adverse impacts on Chinook salmon. Assuming that providing cold water refugia translates to survival of rearing juveniles that would have otherwise died, then restoring 3.5 cfs of flow to the lower reaches of Middle Salmon watershed tributaries would essentially offset all adverse impacts on Chinook salmon. Effects of future climate change would not likely reduce effectiveness of the RPA in minimizing effects of the proposed actions. Full implementation of the Program may require up to three years, during which time net adverse impacts on Chinook salmon could occur. Based on stock size and rearing conditions for the 2011 through 2015 year classes, and considering effects of climate change described in Section 2.6, both the SRLM and Lemhi River Chinook salmon populations should remain functionally extant through at least 2018 (see Appendix A). Assuming that positive effects would be equally distributed among the populations in the project area, after full implementation of the Program, the proposed action as modified by the RPA would: (1) Not likely reduce population productivity or abundance of SRLM and Lemhi River Chinook salmon; and (2) would likely reduce abundance of the NFSR and Panther Chinook salmon by less than one outmigrating smolt per year.

2.8.5.2 Effects of the Reasonable and Prudent Alternatives on Snake River Spring/summer Chinook Salmon and Designated Critical Habitat, Conclusions

After reviewing the best available scientific and commercial information regarding the biological requirements and the status of Snake River Basin steelhead and Snake River spring/summer Chinook salmon considered in this Opinion, the environmental baseline for the action area, the draft recovery plan, the effects of the RPA, and the cumulative effects, NMFS concludes that the RPA is not likely to jeopardize the continued existence of Snake River spring/summer Chinook salmon and Snake River Basin steelhead and is not likely to modify designated critical habitat for either species. Specific considerations supporting these conclusions are summarized below.

- The RPA would either: (1) Increase cold water refugia; or (2) reduce tributary water use.
- Increase in cold water refugia would be sufficient to completely offset adverse effects on rearing Chinook salmon that would result due to operation of diversions that would be permitted due to the RPA.
- Reduction of water use in tributary streams would be sufficient to essentially offset all adverse effects on Chinook salmon and steelhead that would result due to operation and maintenance of diversions that would be permitted due to the RPA.

Because this Opinion has found both jeopardy and adverse modification of critical habitat for Chinook salmon, the SCNF is required to notify NMFS of its final decision on the implementation of the RPA.

2.8.5.3 Effects of the Reasonable and Prudent Alternatives on Snake River Basin Steelhead and Designated Critical Habitat

The analysis described in this Opinion determined that the action, as proposed and in consideration of the recovery plan (NMFS 2016), would not likely jeopardize the continued existence of Snake River Basin steelhead and would not likely adversely modify steelhead designated critical habitat. The RPA would minimize effects on steelhead in much the same way as it would minimize effects on Chinook salmon, albeit probably not to the same extent. Because the action, as proposed, would not likely jeopardize the continued existence of Snake River Basin steelhead and would not likely adversely modify steelhead designated critical habitat, and the RPA would reduce those effects, the proposed action, as modified by the RPA, would not likely jeopardize the continued existence of Snake River Basin steelhead and would not likely adversely modify steelhead designated critical habitat.

2.9 Incidental Take Statement

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

2.9.1 Amount or Extent of Take

In the Opinion, NMFS determined that incidental take would occur as follows:

NMFS anticipates that the proposed action, as modified by the RPA will injure, kill, and harm Chinook salmon and steelhead within the Middle Salmon watershed because Chinook salmon and steelhead occur in the watershed and the proposed action, as modified by the RPA will result in the following impacts: (1) Streamflow will be reduced in affected reaches of South Fork Williams, Williams, Wallace, Carmen, East Fork Tower, and Tower Creeks. This reduction in streamflow will reduce amount of cold water refugia; reduce food availability; reduce access to functional and escape cover; and as a result will reduce growth and survival of some individual Chinook salmon and steelhead; (2) juvenile steelhead will enter screened diversions permitted by the proposed actions and approximately three percent of fish entering the diversions will be killed; and (3) flow in the mainstem Salmon River may be reduced, which would reduce survival rates of juvenile Chinook salmon and steelhead rearing in the Salmon River.

The take exempted by this ITS is the loss of Snake River spring/summer Chinook salmon and Snake River Basin steelhead from these circumstances. The proposed action as modified by the RPA would result in ongoing take of spring/summer Chinook salmon and steelhead in the Williams, Wallace, Carmen, and Tower Creek drainages, and in the mainstem Salmon River. However, changes in mortality cannot be monitored sufficiently to ensure that amount and extent of take is not exceeded. This is because information on number of Chinook salmon and steelhead in the Middle Salmon watershed is not available, population density of Chinook salmon and steelhead varies greatly from year to year, and because fish harmed due to increased environmental stress caused by the RPA 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 Middle Salmon watershed could be adequately quantified, monitoring total take due to the RPA would still not be feasible because some mortality due to effects of the RPA in the Middle Salmon watershed is likely to occur during the downstream migration or in the estuary. This is because fish growth is related to streamflow (Harvey *et al.* 2006; Davidson *et al.* 2010), so reducing streamflow in rearing habitat likely reduces size of downstream migrating smolts. Smaller smolts have higher mortality outside of the natal tributaries (Zabel and 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. Amount of water diverted and tributary flow are acceptable surrogates for take because they are determiners of cold water refugia in the Middle Salmon watershed; they are determiners of juvenile Chinook salmon growth and survival in occupied rearing habitat; they are determiners of fish entrainment in diversions; and they can be monitored in near real time to define the extent of take or to determine if take has been exceeded. Because flow measurements would occur weekly under the RPA, reinitiation triggers could be met on a weekly basis.

As a quantifiable habitat indicator, amount of water diverted and tributary flow can be measured accurately and, as established above in Section 2.8.5, reduction of streamflow due to water diversion and use is the principal cause of take due to the RPA. Because reduction of streamflow is the principal mechanism for take from the RPA, and the amount of take cannot be quantified with available information, NMFS uses the causal link established between the activity and a change in habitat conditions affecting the species to describe the extent of take. In this case, the extent of take will be described as the amount of water diverted and amount of streamflow restored. The extent of take exempted by this ITS would be exceeded if: (1) Water diverted via the Big Hat Creek, South Fork Williams Creek, Wallace Creek, or East Fork Tower Creek diversions exceeds the expected diversion rates listed in Table 5; or (2) water diverted via the Carmen Creek diversion is greater than the expected diversion rates listed in Table 5 without a corresponding expansion of the Program; or (3) the Program does not meet targets for acquisition of water rights or improvement of flow at tributary mouths.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

"Reasonable and Prudent Measures" described below are non-discretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

During the course of consultation, NMFS determined that the proposed action would both jeopardize a listed species considered in this consultation and destroy or adversely modify its critical habitat. As required in such circumstances, NMFS developed an RPA that meets each of the RPA criteria, including the requirement that the RPA avoids jeopardy of the species and adverse modification of critical habitat. In achieving these results, the RPA changes the proposed action in a way that reduces, minimizes, or avoids habitat modification that would have resulted in take of Snake River spring/summer Chinook salmon and Snake River Basin steelhead. Since implementing the RPA adequately minimizes take in and of itself, NMFS has not identified further measures for minimizing the anticipated extent of take beyond full implementation of the RPA.

The USFS shall minimize incidental take caused by authorizing operation and maintenance of diversions on and across SCNF land in the Middle Salmon watershed by:

1. Implement the Program to improve tributary flow and cold water refugia related baseline conditions in the Middle Salmon watershed.

2. Ensure that all diversions permitted by the RPA meet NMFS criteria for screening and fish passage.

2.9.4. Terms and Conditions

The terms and conditions described below are non-discretionary, and the SCNF or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The SCNF or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the actions and their impacts on the species 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. To be exempt from the prohibitions of section 9 of the ESA, the USFS and its cooperators, including applicants, must fully comply with the elements of the RPA described above. The specific measures to implement the RPAs are in the RPAs.

1. To implement RPMs #1 and 2, the SCNF shall ensure that measures in Sections 2.8.1 through 2.8.3 are implemented.

NOTICE: If a steelhead or salmon becomes sick, injured, or killed as a result of project-related activities but in a manner not addressed by this Opinion, and if the fish would not benefit from rescue, the finder should leave the fish alone, make note of any circumstances likely causing the death or injury, location and number of fish involved, and take photographs, if possible. If the fish in question appears capable of recovering if rescued, photograph the fish (if possible), transport the fish to a suitable location, and record the information described above. Adult fish should generally not be disturbed unless circumstances arise where an adult fish is obviously injured or killed by proposed activities, or some unnatural cause. The finder must contact NMFS Law Enforcement at (206) 526-6133 as soon as possible. The finder may be asked to carry out instructions provided by Law Enforcement to collect specimens or take other measures to ensure that evidence intrinsic to the specimen is preserved. NMFS also suggests that the finder coordinate with local biologists to recover any tags or other relevant research information. If the specimen is not needed by local biologists for tag recovery or by NMFS for analysis, the specimen should be returned to the water in which it was found, or otherwise discarded.

2.10 Conservation Recommendations

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

1. **Implement flow restoration in Carmen Creek –** As much as practicable, implement measures described in Section 2.8.2, to improve flow baseline conditions, in the Carmen Creek drainage.

2. **Implement RA-1 in PACFISH (USFS and BLM 1995) –** The USFS should work to improve baseline conditions for Chinook salmon and steelhead and their habitat in the Upper Salmon River watershed. This includes identifying and cooperating with Federal, Tribal, State and local governments to secure instream flows needed to maintain riparian resources, channel conditions, and aquatic habitat. The USFS should also work with the parties identified in RA-1 to find ways to keep conserved water instream throughout the Upper Salmon River watershed.

2.11 "Not Likely to Adversely Affect" Determination

On November 18, 2005, NMFS listed the SRKW DPS as endangered under the ESA (70 FR 69903). The SRKW DPS is composed of a single population that ranges as far south as central California and as far north as Southeast Alaska. Although the entire DPS has the potential to occur along the outer coast at any time during the year, occurrence along the outer coast is more likely from late autumn to early spring. The SRKW have been repeatedly observed feeding off the Columbia River plume in March and April during peak spring Chinook salmon runs (Krahn *et al.* 2004; Zamon *et al.* 2007; Hanson *et al.* 2008; and Hanson *et al.* 2010). For this reason, the eastern Pacific Ocean, where SRKW overlap with Chinook salmon from the Columbia Basin is also included in the action area due to potential impacts on the whale's prey base.

The final listing rule identified several potential factors that may have resulted in the decline or may be limiting recovery of SRKW including: quantity and quality of prey, toxic chemicals which accumulate in top predators, and disturbance from sound and vessel traffic. The rule further identified oil spills as a potential risk factor for the small population of SRKW. The final recovery plan includes more information on these potential threats to SRKW (73 FR 4176).

NMFS designated critical habitat for the SRKW DPS on November 29, 2006 (71 FR 69054). Designated critical habitat for SRKW includes approximately 2,560 square miles of Puget Sound, excluding areas with water less than 20 feet deep relative to extreme high water; there is no designated critical habitat within the action area.

The SRKWs spend considerable time in the Georgia Basin from late spring to early autumn, with concentrated activity in the inland waters of Washington State around the San Juan Islands, and typically move south into Puget Sound in early autumn (NMFS 2008b). While these are seasonal patterns, SRKW have the potential to occur throughout their range (from Central California north to the Queen Charlotte Islands) at any time during the year.

The SRKW consume a variety of fish and one species of squid, but salmon, Chinook salmon in particular, are their primary prey (NMFS 2008b). Ongoing and past diet studies of SRKW sampled inland waters of Washington State and British Columbia during the spring, summer, and fall months (i.e., Ford and Ellis 2006; Hanson *et al.* 2010). Chum salmon was consumed in greater proportion during the fall (Hilborn *et al.* 2012). Less is known about the diet of SRKW off the Pacific Coast; however, chemical analyses support the importance of salmon in the year-round diet of SRKW (Krahn *et al.* 2002; Krahn *et al.* 2004). The predominance of Chinook salmon in the SRKW's diet when in inland waters, even when other species are more abundant, combined with information indicating that the killer whales consume salmon year round, makes it reasonable to expect that SRKW consume Chinook salmon when available in coastal waters. Their switch to chum salmon in the fall makes it reasonable to expect that SRKW consume other species when Chinook salmon is not available.

The proposed action will not have any direct effects on SRKW; however, it may indirectly affect the quantity of prey available to them. As described in the above Opinion and ITS, the action may result in the annual average of 1.6 returning adult Chinook salmon each year. The ocean range of Snake River spring/summer Chinook salmon (Weitkamp 2010) overlaps with the known range and designated critical habitat of SRKW. The periodic loss of approximately 1.6 Chinook salmon from each brood years could reduce the SRKW's available prey base when the affected broods would otherwise have been present in the Pacific Ocean. This small number of projected salmon losses will result in an insignificant reduction in prey resources for SRKW that may intercept these species within their range. Therefore, NMFS finds that the effects of the proposed action on the quantity of prey available to the whales in the long term across their vast range is expected to be very small. For these reasons, the proposed action will have an insignificant effect on SRKW. Therefore, NMFS concurs that the proposed action may affect, but is not likely to adversely affect SRKW.

2.12 Reinitiation of Consultation

This concludes formal consultation for the Authorization of Operation and Maintenance of Existing Water Diversions on the Middle Salmon Watershed. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) The amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

Specific circumstances that would require reinitiation of consultation include, but are not limited to the following:

1. The Hat Creek diversion is used for irrigation.

2. Improvements in baseline conditions due to the Program are less than expected.

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions, or proposed actions that may adversely affect EFH. The MSA (Section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quantity or quality of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that may be taken by the action agency to conserve EFH. This analysis is based, in part, on the EFH assessment provided by the SCNF and descriptions of EFH for Pacific coast salmon (PFMC 1999) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The Pacific Fishery Management Council (PFMC) designated EFH for Chinook salmon, coho salmon, and Puget Sound pink salmon (PFMC 1999). The proposed action and action area for this consultation are described in the Introduction to this document. The entire action area is designated as EFH for Chinook salmon. All freshwater life stages of Chinook salmon would be affected.

The PFMC has identified five habitat areas of particular concern (HAPC), which warrant additional focus for conservation efforts due to their high ecological importance. Three of the five HAPC are applicable to freshwater and include: (1) Complex channels and floodplain habitats; (2) thermal refugia; and (3) spawning habitat. Proper function of complex channels and floodplain habitat could be affected in Williams, Carmen, Wallace, and Tower Creeks; spawning habitat could be affected in Carmen Creek and the mainstem Salmon River; and thermal refugia could be affected in Williams, Carmen, Wallace, and Tower Creeks and in the mainstem Salmon River near the mouths of these tributaries.

3.2 Adverse Effects on Essential Fish Habitat

Based on information provided in the BA and the analysis of effects presented in the ESA portion of this document, NMFS concludes that the proposed actions will have the following effects on EFH designated for Chinook salmon:

1. The proposed actions will result in ground-disturbing activities, which may adversely affect riparian and instream habitat in the Williams, Pollard, Carmen, Wallace, and Tower Creek drainages.

2. The proposed actions will reduce streamflow in portions of Williams, Carmen, Wallace, and Tower Creeks and the mainstem Salmon River; which will increase summer water temperature; reduce amount of habitat available for adult Chinook salmon; reduce food for juvenile Chinook salmon; reduce access to escape cover for juvenile Chinook salmon; reduce movement of sediment in the affected tributaries; and reduce cold water refugia habitat for juvenile rearing and adult holding Chinook salmon.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS expects that full implementation of these three EFH Conservation Recommendations would protect Chinook salmon EFH by avoiding or minimizing the adverse effects described in Section 3.2 above.

1. Measures should be implemented as described in Sections 2.8.1 and 2.8.2 to avoid and/or minimize effects of the proposed action by ensuring that water diversion structures are maintained in such a way as to protect riparian and instream habitat and the Program is implemented to reduce impacts of irrigation and/or improve flow in Salmon River tributary streams.

2. Monitoring and reporting measures should be implemented as described in Section 2.8.3 to ensure that impacts on Chinook salmon are not more than anticipated.

3. The SCNF should identify and cooperate with Federal, Tribal, state, and local governments to secure instream flows needed to maintain riparian resources, channel conditions, quality of aquatic habitat, and to aid downstream migration.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the SCNF must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation from NMFS. 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 measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NMFS 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 SCNF 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 user of this Opinion is the SCNF. Other interested users include the USFS permittees for the actions in question. A copy of this Opinion was provided to the SCNF. This Opinion will be posted on NMFS West Coast Region website (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan.

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

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this Opinion/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

Fish Population Data, Flow Data, Regression Equations Used to Quantify Flow Related Impacts, and Fish Use Data Used to Quantify Cold Water Refugia Related Impacts.

I. Chinook Salmon Population Productivity versus Flow during Juvenile Rearing

Table A-1. Lemhi River Chinook salmon redd counts, recruit to stock ratio, and normalized mean monthly flow during rearing (i.e., the year following the brood year), projected recruit to stock ratios and redd counts are in italics.

Brood year	Brood Year Redds (Stock)	Recruit Year Redds (Recruits)	Recruit to Stock Ratio	Ln Recruit to Stock Ratio	Ln Stock	Normalized Mean Monthly Flow, Lemhi River at McFarland Campground			
						May	June	July	August
1996	29	93	3.21	1.17	3.37	123	191	147	145
1997	50	339	6.78	1.91	3.91	189	219	296	179
1998	41	135	3.29	1.19	3.71	126	113	73	74
1999	48	71	1.48	0.39	3.87	78	40	69	85
2000	93	31	0.33	-1.10	4.53	82	42	58	94
2001	339	50	0.15	-1.91	5.83	65	40	67	83
2002	135	38	0.28	-1.27	4.91	70	45	52	77
2003	71	29	0.41	-0.90	4.26	63	40	51	77
2004	31	33	1.06	0.06	3.43	90	49	86	73
2005	50	70	1.40	0.34	3.91	58	48	63	91
2006	38	89	2.34	0.85	3.64	47	41	44	77
2007	29	134	4.62	1.53	3.37	115	54	55	81
2008	33	135	4.09	1.41	3.50	126	265	121	87
2009	70	97	1.39	0.33	4.25	98	197	137	106
2010	89	217	2.44	0.89	4.49	205	237	299	235
2011	134	164	1.22	0.20	4.90	104	48	37	81
2012	135	*49.8*	*0.37*			62	31	45	55
2013	97	*60.3*	*0.62*			92	44	41	71
2014	217	*59.6*	*0.27*			94	77	59	82

Note: Recruit to stock ratios were calculated assuming all adult returns were 4-year-olds. Redd counts are multiple pass ground counts in the mainstem Lemhi River.

Table A-2. Results of multivariate regression of the natural log recruit to stock ratio against natural log density (i.e., brood year redds) and normalized mean monthly flow during rearing (i.e., the year following the brood year) for Lemhi River Chinook salmon spawning in the mainstem Lemhi River.

Month	Slope		Intercept	Probability of Greater F Value			R^2
	Flow	Ln Density		Flow Leverage	Density Leverage	Model	
May	0.01231	-1.096	3.569	0.001	< 0.0001	< 0.0001	0.83
June	0.00549	-1.058	4.100	0.011	0.0005	0.0001	0.75
July	0.00553	-1.175	5.583	0.011	0.0001	0.0001	0.76
August	0.00936	-1.240	4.462	0.018	0.0001	0.0002	0.74

Table A-3. Redd counts for Salmon River Lower Mainstem (SRLM) Chinook salmon spawning between Warm Springs Creek (River Mile [RM] 364.6) and the East Fork Salmon River (RM 343.0), recruit to stock ratio, and normalized mean monthly flow during rearing (i.e., the year following the brood year).

Brood year	Brood Year Redds (Stock)	Recruit Year Redds (Recruits)	Recruit to Stock Ratio	Ln Recruit to Stock Ratio	Ln Stock	Normalized Mean Monthly Flow, Salmon River at Salmon			
						May	June	July	August
1992	9	15	1.67	0.51	2.20	121	105	101	137
1993	13	17	1.31	0.27	2.56	48	28	22	38
1994	5	10.5	2.10	0.74	1.61	76	136	203	130
1995	0	.	.	.	.	124	169	146	118
1996	7	28.5	4.07	1.40	1.95	186	201	151	164
1997	23	48	2.09	0.74	3.14	104	96	155	123
1998	11	53	4.82	1.57	2.40	106	147	117	118
1999	10	30	3.00	1.10	2.30	91	60	45	59
2000	31	18.5	0.60	-0.52	3.43	53	26	31	39
2001	26	11.5	0.44	-0.82	3.26	63	73	53	54
2002	70	13	0.19	-1.68	4.25	82	93	52	62
2003	36	11	0.31	-1.19	3.58	56	47	56	68
2004	24	7	0.29	-1.23	3.18	76	60	57	55
2005	13	13.5	1.04	0.04	2.56	175	102	78	75
2006	10	24.5	2.45	0.90	2.30	100	45	38	54
2007	16	28	1.75	0.56	2.77	111	94	97	88
2008	6	16	2.67	0.98	1.79	113	139	104	102
2009	8	26	3.25	1.18	2.08	50	132	114	101
2010	19	28	1.47	0.39	2.94	97	146	218	140

Note: Recruit to stock ratios were calculated assuming equal proportion of 4- and 5-year-old adult returns. Redd counts are single pass helicopter counts for index reach NS-20.

Table A-4. Results of multivariate regression of the natural log recruit to stock ratio against natural log density (i.e., brood year redds) and normalized mean monthly flow during rearing (i.e., the year following the brood year) for SRLM Chinook salmon spawning between RM 343.6 and RM 343.0.

Month	Slope		Intercept	Probability of Greater F Value			R^2
	Flow	Ln Density		Flow Leverage	Density Leverage	Model	
May	0.00285	-1.117	3.003	0.46	< 0.0001	< 0.0001	0.71
June	0.00326	-1.064	2.816	0.31	0.0002	< 0.0001	0.72
July	0.00244	-1.091	2.982	0.034	< 0.0001	< 0.0001	0.72
August	0.00511	-1.035	2.595	0.19	0.0002	< 0.0001	0.74

Table A-5. Redd counts for all SRLM Chinook salmon, recruit to stock ratio, and normalized mean monthly flow during rearing (i.e., the year following the brood year).

Brood year	Brood Year Redds (Stock)	Recruit Year Redds (Recruits)	Recruit to Stock Ratio	Ln Recruit to Stock Ratio	Ln Stock	Normalized Mean Monthly Flow, Salmon River at Salmon			
						May	June	July	August
1992	26	35.5	1.37	0.31	3.26	121	105	101	137
1993	48	39.5	0.82	-0.19	3.87	48	28	22	38
1994	9	27	3.00	1.10	2.20	76	136	203	130
1995	6	51.5	8.58	2.15	1.79	124	169	146	118
1996	23	100	4.35	1.47	3.14	186	201	151	164
1997	48	176.5	3.68	1.30	3.87	104	96	155	123
1998	31	174.5	5.63	1.73	3.43	106	147	117	118
1999	23	115.5	5.02	1.61	3.14	91	60	45	59
2000	80	84	1.05	0.05	4.38	53	26	31	39
2001	120	52.5	0.44	-0.83	4.79	63	73	53	54
2002	233	50.5	0.22	-1.53	5.45	82	93	52	62
2003	116	53	0.46	-0.78	4.75	56	47	56	68
2004	115	52.5	0.46	-0.78	4.74	76	60	57	55
2005	53	55.5	1.05	0.05	3.97	175	102	78	75
2006	52	89	1.71	0.54	3.95	100	45	38	54
2007	49	105	2.14	0.76	3.89	111	94	97	88
2008	57	58	1.02	0.02	4.04	113	139	104	102
2009	48	72.5	1.51	0.41	3.87	50	132	114	101
2010	63	77	1.22	0.20	4.14	97	146	218	140
2011	115	*51.8*	*0.68*			141	94	90	92
2012	95	*70.7*	*0.72*			82	46	46	55
2013	21	*70.3*	*3.21*			131	82	73	96
2014	124	*72.3*	*0.63*			85	55	45	70

Note: Recruit to stock ratios were calculated assuming equal proportion of 4- and 5-year-old adult returns. Redd counts are single pass helicopter counts for index reach NS-20.

Table A-6. Results of multivariate regression of the natural log recruit to stock ratio against natural log density (i.e., brood year redds) and normalized mean monthly flow during rearing (i.e., the year following the brood year) for all SRLM Chinook salmon.

Month	Slope		Intercept	Probability of Greater F Value			R^2
	Flow	Ln Density		Flow Leverage	Density Leverage	Model	
May	0.003584	-0.913583	3.5481289	0.30	< 0.0001	< 0.0001	0.76
June	0.0016984	-0.920566	3.7509037	0.57	< 0.0001	< 0.0001	0.75
July	0.0009928	-0.936204	3.8843953	0.38	< 0.0001	< 0.0001	0.75
August	0.003898	0.903465	3.6024944	0.49	< 0.0001	< 0.0001	0.75

II. Steelhead Population Productivity versus Flow during Juvenile Rearing

Table A-7. *Oncorhynchus mykiss* redds counted in the mainstem Lemhi River and Big Springs Creek, tributary to the Lemhi River, recruit to stock ratio, and normalized mean monthly flow during rearing (i.e., the brood year and the following year).

Brood year	Brood Year Redds (Stock)	Recruit Year Redds (Recruits)	Recruit to Stock Ratio	Ln Recruit to Stock Ratio	Ln Stock	Normalized Mean Monthly Flow, Lemhi River at McFarland Campground			
						May	June	July	August
1997	97	283	2.92	1.07	4.57	156	205	222	162
1998	235	556	2.37	0.86	5.46	158	166	185	127
1999	139	287	2.06	0.73	4.93	102	77	71	79
2000	306	234	0.76	-0.27	5.72	80	41	64	90
2001	283	121	0.43	-0.85	5.65	73	41	62	89
2002	556	215	0.39	-0.95	6.32	67	43	59	80
2003	287	233	0.81	-0.21	5.66	66	42	51	77
2004	234	199	0.85	-0.16	5.46	76	44	68	75
2005	121	164	1.36	0.30	4.80	74	49	74	82
2006	215	207	0.96	-0.04	5.37	52	44	53	84
2007	233	172	0.74	-0.30	5.45	81	47	49	79
2008	199	368	1.85	0.61	5.29	121	160	88	84
2009	164	330	2.01	0.70	5.10	112	231	129	96
2010	207	558	2.70	0.99	5.33	151	217	218	171
2011	172	200	1.16	0.15	5.15	154	143	168	158

Note: Recruit to stock ratios were calculated assuming all adult returns were 4-year-olds. Although Idaho Department of Fish and Game does not classify these redds as being constructed by anadromous *O. mykiss*, there are no fish passage barriers in the Lemhi River or Big Springs Creeks, juvenile *O. mykiss* tagged in the Lemhi River and Big Springs Creeks have been documented migrating downstream to the ocean, and returning adult steelhead have been documented migrating into Big Springs Creek. NMFS therefore considers the Lemhi River/Big Springs Creek *O. mykiss* redd counts to be an index of Lemhi steelhead abundance.

Table A-8. Results of multivariate regression of the natural log recruit to stock ratio against natural log density (i.e., brood year redds) and normalized mean monthly flow during rearing for *Oncorhynchus mykiss* spawning in the mainstem Lemhi River and Big Springs Creek index reaches.

Month	Slope		Intercept	Probability of Greater F Value			R^2
	Flow	Ln Density		Flow Leverage	Density Leverage	Model	
May	0.00895	-0.7793	3.437	0.0049	0.0056	0.0001	0.78
June	0.00502	-0.7273	3.549	0.0011	0.0044	< 0.0001	0.83
July	0.00508	-0.8006	3.931	0.0087	0.0062	0.0002	0.76
August	0.00634	-0.9507	4.615	0.086	0.0048	0.0014	0.66

Note: Flow during rearing was an average of flow during the brood year and the following year.

Table A-9. Wild steelhead counted at the Pahsimeroi River hatchery weir, recruit to stock ratio, and normalized mean monthly flow during rearing (i.e., the brood year and the following year).

Brood year	Brood Year Weir Count (Stock)	Recruit Year Weir Count (Recruits)	Recruit to Stock Ratio	Ln Recruit to Stock Ratio	Ln Stock	Normalized Mean Monthly Flow, Pahsimeroi River at Ellis			
						May	June	July	August
1993	24	25	1.04	0.04	3.18	85	63	83	97
1994	35	48	1.37	0.32	3.56	86	109	126	99
1995	17	38	2.24	0.80	2.83	101	135	150	105
1996	17	58	3.41	1.23	2.83	118	121	124	119
1997	25	133	5.32	1.67	3.22	124	131	163	143
1998	48	378	7.88	2.06	3.87	132	158	158	129
1999	38	180	4.74	1.56	3.64	123	124	92	96
2000	58	67	1.16	0.14	4.06	92	64	71	83
2001	133	42	0.32	-1.15	4.89	80	66	74	85
2002	378	68	0.18	-1.72	5.93	84	63	70	79
2003	180	22	0.12	-2.10	5.19	84	63	71	81
2004	67	.	.	.	4.20	83	72	77	83
2005	42	18	0.43	-0.85	3.74	85	78	78	81
2006	68	157	2.31	0.84	4.22	84	72	72	83
2007	22	242	11.00	2.40	3.09	83	82	74	80
2008	.	290	.	.	.	94	139	104	91
2009	18	223	12.39	2.52	2.89	110	155	127	106

Note: Recruit to stock ratios were calculated assuming all adult returns were 4-year-olds.

Table A-10. Results of multivariate regression of the natural log recruit to stock ratio against natural log density (i.e., brood year natural steelhead count) and normalized mean monthly flow during rearing for Pahsimeroi River natural origin steelhead.

Month	Slope		Intercept	Probability of Greater F Value			R^2
	Flow	Ln Density		Flow Leverage	Density Leverage	Model	
May	0.03035	-0.9587	1.194	0.050	0.0044	0.0006	0.71
June	0.01761	-0.8158	1.885	0.045	0.020	0.0005	0.72
July	0.00823	-1.047	3.667	0.37	0.0093	0.0028	0.62
August	0.01714`	-1.030	2.767	0.28	0.0079	0.0023	0.64

Note: Flow during rearing was an average of flow during the brood year and the following year.

III. Estimated Potential Use of Tributary Streams and Tributary Plumes by Juvenile Chinook Salmon and Steelhead

Curet *et al.*(2009) surveyed plumes of ten tributary streams between Salmon River miles 334.7 and 376.8 (Table A-9). A bivariate regression of numbers of Chinook salmon observed in tributary plumes against drainage area and Salmon River mile (Salmon RM) was significant for Salmon RM and suggestive for Drainage Area. The regression equation is: (-2.01*Salmon RM

Mile) – (0.102*Drainage Area) + 755.6. The probability of greater F is 0.035 for Salmon RM, 0.127 for Drainage Area, and 0.072 for the whole model, and R^2 is 0.53. Number of Chinook salmon potentially using plumes of tributary stream affected by the proposed action estimated with this equation, are in Table A-10. We could not identify a relationship between numbers of steelhead and Salmon RM and/or drainage area. Curet *et al.*(2009) observed an average of 16.1 juvenile steelhead in tributary plumes in the mainstem Salmon River.

Table A-11. Number of juvenile Chinook salmon and steelhead observed in plumes of Salmon River tributary streams, from Curet *et al.*(2009).

Tributary	River Mile	Drainage Area	Number of Fish Observed			
			Wild Steelhead	Hatchery Steelhead	All Steelhead	Chinook Salmon
4 Aces	376.8	2.2	4	4	8	16
Rough Creek	370.5	9.17	7	77	84	14
Yankee Fork Salmon River	368.3	190	12	3	15	12
Slate Creek	358.8	31.9	1	1	2	7
Holman Creek	355.5	6.09	21	0	21	11
Thompson Creek	354.8	30.2	4	1	5	48
Squaw Creek	350.6	78.2	4	4	8	0
Kinnikinic Creek	346.8	17.4	3	0	3	96
East Fork Salmon River	343	551	1	2	3	11
Bayhorse	334.7	23.9	12	0	12	100

Curet *et al.*(2009) observed 61 juvenile Chinook salmon and 12 juvenile steelhead in Iron Creek, which has a drainage area of 57.9 $miles^2$. This was the only survey of cold water refugia within a tributary stream. Potential number of juvenile Chinook salmon and steelhead utilizing cold water refugia in tributary streams affected by the proposed actions, based on the one survey of Iron Creek and assuming numbers are related to drainage area, are in Table A-10

Table A-12. Potential number of juvenile Chinook salmon and steelhead utilizing cold water refugia tributaries affected by the proposed actions and number of Chinook salmon potentially utilizing cold water refugia in the plumes of those tributaries in the mainstem Salmon River.

Tributary	River Mile	Drainage Area	Potential number of Chinook Salmon utilizing Cold Water Refugia in Tributary Plumes	Potential Number Utilizing Cold Water Refugia Within Tributaries	
				Chinook Salmon	Steelhead
Hat Creek	293.8	76.5	158	81	16
Williams Creek	267.1	27.3	217	29	6
Pollard Creek	259.4	19.61	233	21	4
Carmen Creek	253.4	48.1	242	51	10
Wallace Creek	252.3	7.65	248	8	2
Tower Creek	249.2	21.6	253	23	4

IV. Dates of Adult Passive Integrated Transponder (PIT) Chinook Salmon Migrating Across the Lower Lemhi River PIT Tag Scanning Array

Table A-13. Detection dates for adult PIT tagged adult Chinook salmon at the Lower Lemhi River PIT tag scanning array located 0.8 miles upstream from the mouth of the Lemhi River.

Year	First Obs	Last Obs	Number of Migrants Detected						Adults Migrating into the Lemhi River After July 14	
			May	Jun	Jul	Aug	Sep	Total	Number	Percentage
2010	1-Jun	26-Aug	0	9	11	2	0	22	3	14.0
2011	22-Jun	16-Sep	0	3	32	1	7	43	29	67.0
2012	12-Jun	7-Sep	0	23	3	1	1	28	2	7.1
2013	21-May	28-Aug	1	92	17	5	0	114	7	6.1
2014	3-Jun	11-Sep	0	110	24	1	2	137	8	5.8
2015	14-May	5-Sep	28	83	7	2	1	93	8	8.6

APPENDIX B

Water Temperature in the Mainstem Salmon River Portion of the Middle Salmon River Watershed and in Hat, Williams, Wallace, Carmen, and Tower Creeks

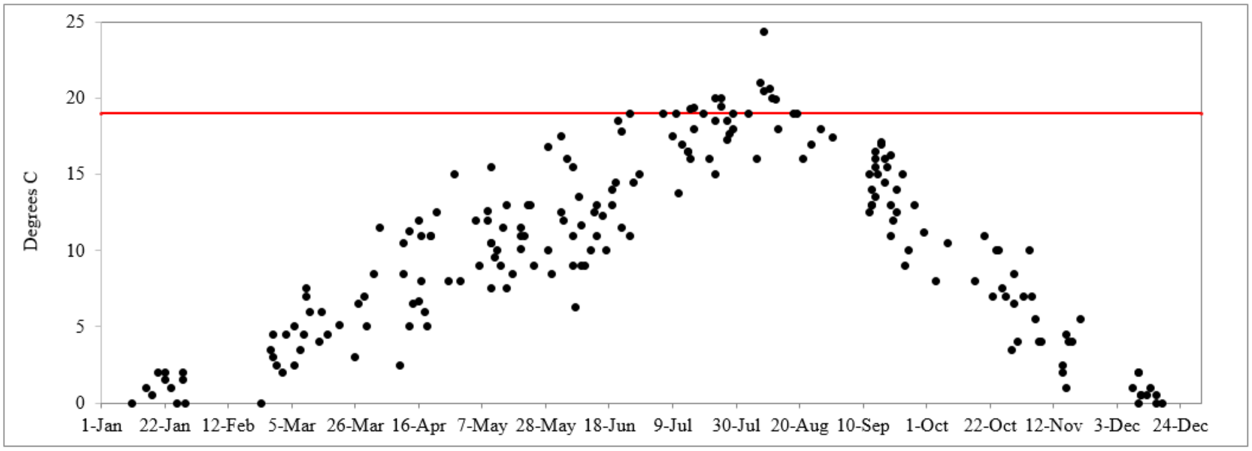

Figure B-1. **Discrete temperatures measurements taken at various times of day at the Salmon River at Salmon gage (river mile [RM] 258) from 1970 through 2008.**

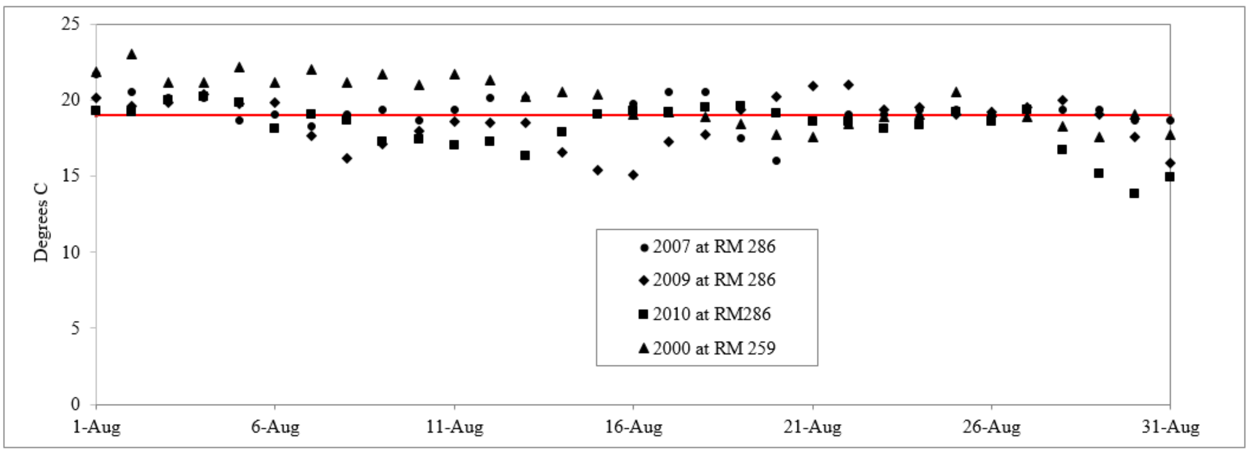

Figure B-2. **Maximum daily water temperature in the mainstem Salmon River at RM 259 in 2000 and RM 286 in 2007, 2009, and 2010.**

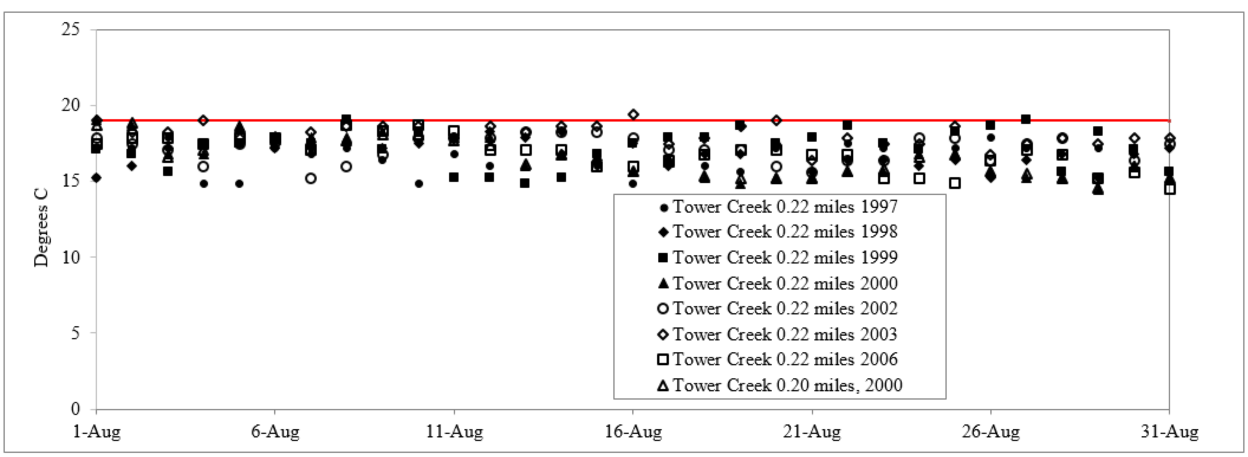

Figure B-3. **Maximum daily water temperature in Tower Creek 0.22 miles upstream from the mouth in 1997 through 2003 and 2006, and 0.20 miles upstream from the mouth in 2000.**

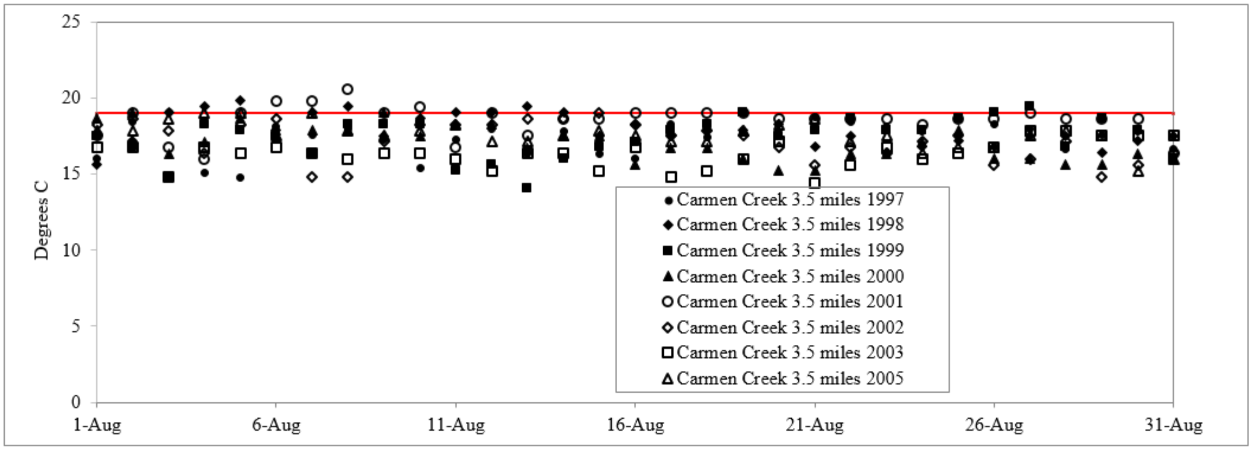

Figure B-4. Maximum daily water temperature in Carmen Creek 3.5 miles upstream from the mouth in 1997 through 2003 and 2005.

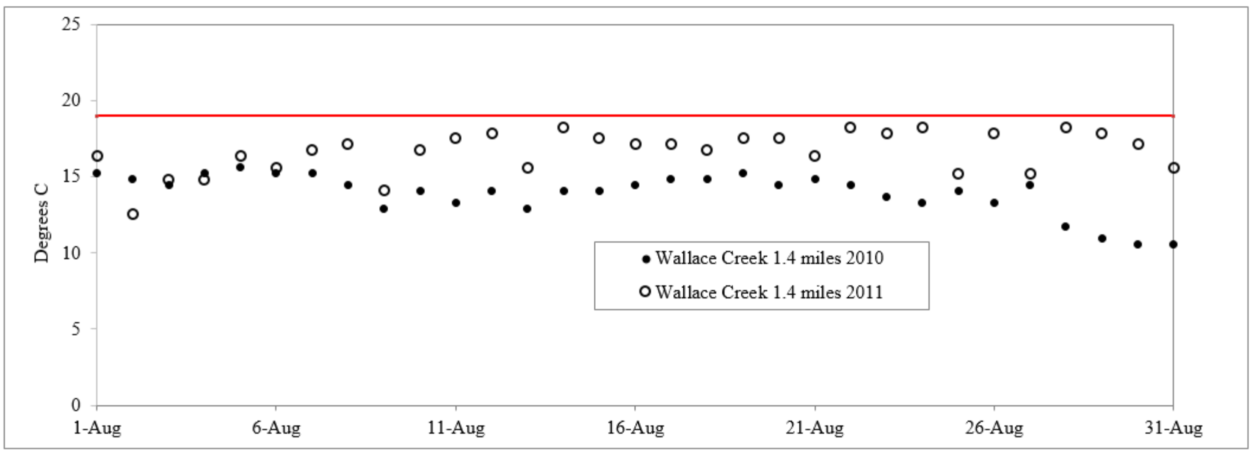

Figure B-5. Maximum daily water temperature in Wallace Creek 1.4 miles upstream from the mouth in 2010 and 2011.

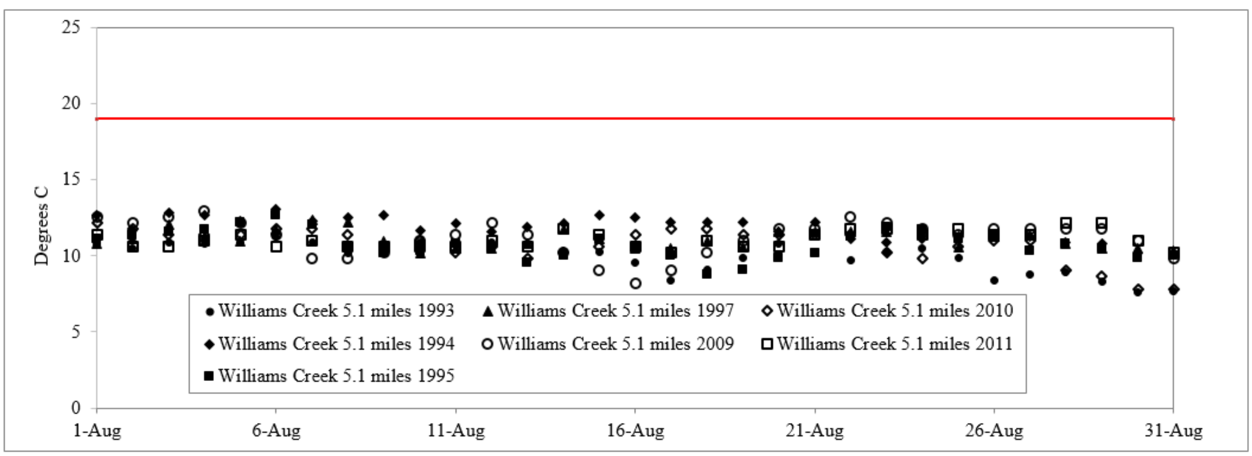

Figure B-6. Maximum daily water temperature in Williams Creek 5.1 miles upstream

from the mouth in 1993, 1994, 1995, 1997, 2009, 2010 and 2011.

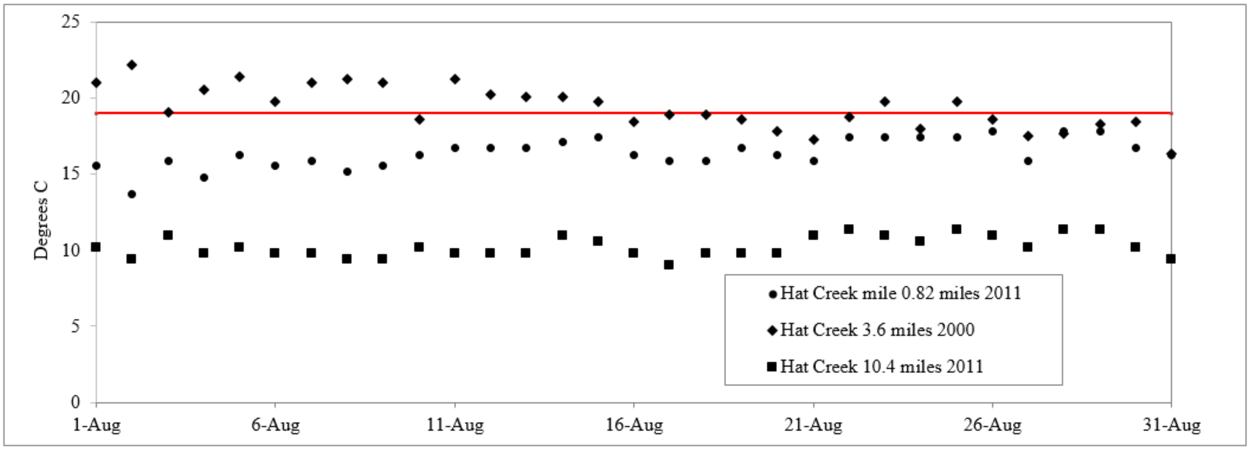

Figure B-7. Maximum daily water temperature in Hat Creek 0.82 miles upstream from the mouth in 2011, 3.6 miles upstream from the mouth in 2000, and 10.4 miles upstream from the mouth in 2011.

Table B-1. August water temperature in mainstem Salmon River within the Middle Salmon River watershed.

Date	Salmon River at RM 286												Salmon River at RM 259			
	2007				2009				2011				2000			
	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day
1	17.9	19.7	21.7	19.3	16.9	18.6	20.2	18.6	16.9	18.2	19.3	18.2	17.9	20.0	21.9	21.8
2	18.3	19.4	20.6	19.2	17.8	18.8	19.7	18.6	16.7	18.0	19.2	18.2	18.7	20.8	23.0	21.7
3	17.5	18.9	20.2	19.2	17.5	18.6	19.8	18.6	17.0	18.4	20.0	18.3	18.6	19.8	21.2	21.5
4	17.5	18.9	20.2	19.2	17.3	18.8	20.4	18.5	17.7	19.0	20.3	18.4	18.9	19.8	21.2	21.5
5	16.4	17.6	18.7	19.1	18.2	18.8	19.7	18.5	17.9	18.6	19.9	18.4	17.9	20.0	22.2	21.6
6	14.9	16.9	19.0	19.2	18.0	18.7	19.8	18.5	16.4	17.2	18.2	18.5	17.5	19.6	21.2	21.5
7	15.6	17.0	18.3	19.2	15.6	16.8	17.7	18.5	16.3	17.7	19.1	18.6	17.6	19.9	22.0	21.3
8	14.5	16.7	19.0	19.3	13.9	15.0	16.2	18.6	16.9	17.8	18.7	18.7	17.3	19.5	21.2	21.1
9	15.6	17.4	19.4	19.2	14.5	15.8	17.1	18.7	16.0	16.7	17.3	18.8	17.8	19.8	21.7	21.0
10	15.6	17.2	18.7	19.1	15.3	16.6	18.0	18.7	15.0	16.2	17.5	18.9	18.3	19.7	21.0	20.6
11	15.6	17.6	19.4	19.1	16.4	17.6	18.6	18.7	15.8	16.3	17.0	19.1	17.8	19.7	21.7	20.4
12	15.6	17.8	20.2	19.0	16.9	17.8	18.6	18.6	14.5	16.0	17.3	19.2	16.8	19.2	21.4	20.0
13	16.0	18.0	20.2	19.0	16.0	17.2	18.5	18.6	15.5	16.0	16.3	19.3	16.5	18.6	20.2	19.5
1	16.4	17.3	17.9	18.9	15.3	16.0	16.6	18.6	14.7	16.1	17.9	19.5	16.2	18.3	20.5	19.2
15	15.2	17.1	19.0	18.9	13.4	14.5	15.4	18.5	15.8	17.4	19.1	19.6	16.0	18.2	20.4	18.8
16	16.0	18.0	19.8	18.9	13.1	14.2	15.1	18.6	16.8	18.0	19.3	19.6	16.3	17.7	19.1	18.5
17	17.1	18.7	20.6	18.7	13.4	15.3	17.3	18.8	16.6	17.9	19.3	19.7	15.1	17.1	19.2	18.5
18	17.1	18.9	20.6	18.5	15.1	16.4	17.7	18.8	16.9	18.2	19.6	19.7	15.4	17.1	18.9	18.4
19	15.2	16.6	17.5	18.4	15.7	17.5	19.4	18.9	17.1	18.2	19.6	19.6	14.9	16.9	18.4	18.7
20	14.1	14.9	16.0	18.4	17.0	18.6	20.2	18.9	16.0	17.7	19.2	19.6	15.4	16.7	17.8	18.8
21	14.1	16.1	18.7	18.5	17.8	19.3	20.9	18.9	16.4	17.4	18.6	19.6	13.7	15.8	17.6	19.0
22	14.5	16.7	19.0	18.6	18.0	19.5	21.0	18.8	16.0	17.1	18.6	19.6	14.0	16.2	18.4	19.0
23	14.9	16.7	19.0	18.6	17.5	18.6	19.4	18.7	14.5	16.2	18.2	19.5	15.1	17.0	18.9	18.9
24	14.5	16.9	19.4	18.7	16.1	17.8	19.5	18.7	14.6	16.4	18.4	19.5	16.8	17.8	19.1	19.0
25	15.2	17.3	19.4	18.7	16.6	17.8	19.1	18.7	15.2	17.1	19.2	19.6	15.9	18.1	20.5	18.8
26	15.6	17.3	19.0		16.0	17.6	19.2		15.8	17.3	18.6		16.0	17.8	19.2	
27	15.6	17.4	19.4		16.3	17.9	19.5		16.3	17.7	19.4		15.4	17.2	18.9	
28	15.2	17.2	19.4		17.0	18.5	20.0		14.1	15.3	16.7		14.9	16.7	18.3	
29	15.6	17.4	19.4		17.4	18.2	19.1		13.1	13.8	15.2		13.7	15.8	17.6	
30	15.6	17.2	18.7		15.5	16.7	17.6		12.5	13.0	13.9		14.9	16.9	19.1	
31	16.4	17.4	18.7		14.0	15.0	15.8		12.4	13.6	15.0		14.4	16.3	17.8	

Table B-2. August water temperature in Tower Creek.

Date	Tower Creek 0.22 Miles Upstream from Mouth															
	1997				1998				1999				2000			
	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day
1	11.8	13.4	15.2	16.3	12.6	13.7	15.2	16.8	12.6	14.8	17.1	17.1	13.7	16.0	19.1	17.9
2	12.2	14.2	17.2	16.5	13.3	14.4	16.0	17.1	12.9	14.8	16.8	17.4	14.1	16.4	18.7	17.7
3	12.2	14.6	17.9	16.4	12.6	14.6	17.2	17.3	13.3	14.5	15.6	17.5	13.3	15.0	16.8	17.7
4	13.3	14.1	14.8	16.0	12.9	15.0	17.5	17.4	13.7	15.1	17.5	17.8	14.4	15.4	16.8	17.9
5	13.7	14.0	14.8	16.3	12.6	15.0	17.5	17.4	12.9	15.0	17.5	17.5	13.7	15.8	18.7	18.1
6	12.2	14.5	17.2	16.4	12.9	15.0	17.2	17.5	13.7	15.4	17.9	17.2	12.6	15.0	17.5	17.9
7	12.9	14.8	16.8	16.1	13.7	15.3	17.2	17.6	13.3	15.0	17.5	16.7	12.6	15.0	17.9	17.7
8	12.9	14.5	17.2	16.1	13.3	15.1	17.5	17.8	12.6	15.2	19.1	16.4	12.2	14.9	17.9	17.6
9	11.4	13.6	16.4	15.9	12.9	14.7	17.2	17.6	12.9	15.1	17.1	16.1	12.9	15.4	18.3	17.4
10	11.4	13.2	14.8	15.7	12.9	15.0	17.5	17.7	12.6	15.2	18.3	16.2	13.7	15.6	18.3	17.0
11	11.4	13.6	16.8	15.9	12.9	15.1	17.9	17.5	14.1	14.6	15.2	16.1	14.1	15.7	17.9	16.7
12	11.8	13.5	16.0	15.8	13.7	15.6	18.3	17.3	12.9	14.2	15.2	16.5	12.2	14.7	17.9	16.3
13	11.8	13.3	14.8	15.8	13.3	15.5	17.9	17.1	12.6	13.5	14.8	17.0	11.8	14.0	16.0	15.9
1	12.2	14.1	16.8	16.1	14.1	15.9	18.3	17.0	11.4	13.4	15.2	17.3	11.8	14.3	16.8	15.8
15	12.2	13.8	16.0	16.3	12.9	14.8	16.4	16.7	11.8	13.8	16.8	17.7	11.8	14.2	16.4	15.6
16	12.2	13.2	14.8	16.5	12.9	14.8	17.5	16.7	11.4	14.0	17.5	18.0	12.2	14.0	15.6	15.4
17	11.8	13.7	16.4	16.8	12.6	14.2	16.0	16.5	11.8	14.5	17.9	18.0	11.4	13.7	16.4	15.4
18	12.9	14.2	16.0	16.9	12.6	14.4	16.8	16.5	12.2	14.8	17.9	17.9	11.8	13.5	15.2	15.5
19	11.4	13.5	15.6	17.1	12.2	14.3	16.8	16.4	14.4	16.1	18.7	17.9	11.0	13.2	14.8	15.7
20	11.4	14.0	17.2	17.4	12.6	14.9	17.5	16.2	13.3	15.3	17.5	17.9	12.2	13.5	15.2	15.8
21	12.2	14.5	17.9	17.4	12.9	14.3	15.6	16.1	13.3	15.3	17.9	18.2	10.2	12.8	15.2	15.8
22	11.8	14.3	17.5	17.1	11.8	13.9	16.4	16.2	13.3	15.5	18.7	17.8	10.6	13.0	15.6	15.8
23	11.8	14.3	17.2	17.0	11.8	13.6	16.4	16.1	12.6	15.0	17.5	17.8	11.0	13.4	15.6	15.7
24	13.3	14.7	17.2	17.0	11.4	13.4	16.0	16.1	13.3	15.0	17.1	17.7	13.7	14.9	16.8	15.7
25	11.4	14.0	17.2	16.8	11.4	13.6	16.4	16.3	12.6	15.0	18.3	17.5	12.2	14.3	16.8	15.5
26	12.2	14.6	17.9		11.4	13.3	15.2		12.9	15.6	18.7		11.4	13.6	15.6	
27	12.2	14.5	17.2		11.4	13.6	16.4		13.3	15.8	19.1		11.4	13.4	15.2	
28	11.8	13.9	15.6		11.0	13.5	16.8		14.4	15.2	15.6		11.4	13.3	15.2	
29	11.8	13.9	17.2		11.4	13.3	15.2		13.3	15.4	18.3		10.2	12.5	14.4	
30	11.4	13.7	16.8		11.8	14.0	16.8		12.6	14.9	17.1		11.8	13.7	16.0	
31	11.4	13.5	15.6		11.4	14.0	17.2		11.8	13.1	15.6					

Table B-3. August water temperature in Tower Creek.

Date	Tower Creek 0.22 Miles Upstream from Mouth												TC 0.20 Miles Upstream from Mouth			
	2002				2003				2006				2000			
	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day
1	11.4	14.4	17.9	17.0	13.3	16.3	19.1	18.3	13.3	15.4	17.5	17.7	13.8	16.2	18.7	17.9
2	12.6	14.7	17.5	16.7	14.4	16.6	18.3	18.3	12.6	15.0	17.9	17.8	14.6	16.7	18.9	17.8
3	12.2	14.6	17.1	16.6	15.6	16.9	18.3	18.3	12.2	15.0	17.9	17.9	13.5	15.2	16.6	17.7
4	13.3	14.7	16.0	16.8	14.8	16.8	19.1	18.4	12.9	15.1	17.5	18.0	14.7	15.7	17.1	17.9
5	13.7	15.3	17.5	17.0	14.1	16.2	17.9	18.2	12.9	15.3	17.9	18.1	13.9	16.0	18.6	18.0
6	13.7	15.5	17.9	17.1	14.4	15.9	17.5	18.3	12.6	15.3	17.9	18.0	12.7	15.2	17.9	17.8
7	13.3	14.2	15.2	17.1	13.3	15.7	18.3	18.4	12.9	15.2	17.1	17.9	12.7	15.2	17.7	17.6
8	12.2	13.7	16.0	17.6	13.7	16.1	18.7	18.5	12.9	15.5	18.7	17.9	12.4	15.0	17.7	17.4
9	10.6	13.3	16.8	17.9	13.3	15.9	18.7	18.5	14.5	16.3	18.3	17.5	13.0	15.5	18.1	17.2
10	11.4	14.3	17.9	18.1	13.3	15.9	18.7	18.6	13.3	16.0	18.7	17.2	13.9	15.8	18.1	16.9
11	12.6	14.9	17.9	17.9	13.3	15.7	17.9	18.4	14.1	16.0	18.3	16.9	14.3	16.0	17.7	16.7
12	12.2	14.7	17.9	17.8	14.4	16.5	18.7	18.4	13.3	15.2	17.1	16.6	12.6	14.9	17.4	16.3
13	12.2	14.7	18.3	17.7	14.1	16.4	18.3	18.4	12.2	14.5	17.1	16.6	12.1	14.2	16.2	16.0
1	11.8	14.9	18.3	17.4	14.4	16.6	18.7	18.6	11.4	14.2	17.1	16.6	12.1	14.5	16.8	15.9
15	12.2	15.1	18.3	17.0	15.2	17.1	18.7	18.2	12.9	14.4	16.0	16.6	12.1	14.4	16.5	15.6
16	12.6	14.8	17.9	16.7	16.4	17.6	19.4	18.1	12.9	14.4	16.0	16.7	12.4	14.2	15.7	15.5
17	10.6	13.6	17.1	16.5	14.8	16.1	17.5	17.8	12.6	14.2	16.4	16.6	11.5	13.9	16.3	15.5
18	11.4	14.0	17.1	16.6	13.3	15.7	17.9	17.8	11.4	13.9	16.8	16.4	12.1	13.8	15.4	15.6
19	11.0	13.8	17.1	16.8	13.7	16.1	18.7	18.0	11.0	13.9	17.1	16.2	11.5	13.4	15.2	15.8
20	13.3	14.5	16.0	16.7	15.2	17.1	19.1	17.7	11.8	14.5	17.1	16.1	12.4	13.7	15.2	15.9
21	12.6	13.9	15.6	16.9	13.3	15.3	16.4	17.5	11.8	14.5	16.8	16.1	10.7	13.0	15.2	15.9
22	10.6	13.2	16.4	17.2	15.2	16.4	17.9	17.7	12.6	14.7	16.8	16.1	10.7	13.2	15.7	15.9
23	11.0	13.5	16.4	17.0	14.1	15.8	17.5	17.6	11.4	13.6	15.2	15.8	11.3	13.7	15.8	15.7
24	12.6	14.3	17.9	17.0	13.3	15.5	17.5	17.7	11.4	13.5	15.2	15.9	13.8	15.0	16.6	15.8
25	11.8	14.2	17.9	17.0	13.7	16.0	18.7	18.3	12.9	13.8	14.9	15.8	12.2	14.5	16.8	15.6
26	12.2	14.0	16.4		13.3	15.3	16.8		12.2	14.0	16.4		11.6	13.8	15.7	
27	12.6	14.2	17.5		14.8	16.1	17.5		11.8	14.2	17.1		11.6	13.7	15.5	
28	12.6	14.3	17.9		14.1	15.7	17.9		11.8	14.3	16.8		11.8	13.5	15.2	
29	12.2	13.6	15.2		12.9	15.1	17.5		12.2	13.9	15.2		10.5	12.7	14.6	
30	11.8	13.5	16.4		12.9	15.2	17.9		11.8	13.2	15.6		12.1	14.0	16.0	
31	12.6	14.3	17.5		12.2	14.8	17.9		9.4	11.7	14.5		11.2	13.4	15.2	

Table B-4. August water temperature in Carmen Creek.

Date	Carmen Creek 9.8 Miles Upstream from Mouth															
	1997				1998				1999				2000			
	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day
1	8.8	9.9	10.9	12.0	9.5	10.4	11.4	12.5	9.5	10.8	11.8	12.2	11.8	12.8	14.1	13.5
2	8.9	10.4	12.2	12.2	10.2	10.9	11.7	12.7	10.0	11.0	11.7	12.2	11.8	12.9	13.7	13.3
3	9.4	11.0	12.6	12.1	9.5	11.0	12.3	12.9	10.3	10.9	11.4	12.4	11.4	12.0	12.9	13.3
4	10.8	11.3	12.0	11.8	10.0	11.5	12.9	12.9	10.6	11.7	12.9	12.6	11.8	12.5	14.1	13.4
5	10.5	10.8	11.2	11.7	10.2	11.7	13.1	12.9	10.3	11.5	12.5	12.4	11.4	12.4	13.7	13.3
6	9.7	10.9	12.3	11.7	10.8	11.9	12.8	12.9	10.8	11.8	12.8	12.3	10.2	11.8	12.9	13.2
7	10.2	11.4	12.5	11.5	11.1	12.2	13.4	13.0	10.6	11.3	12.0	12.0	10.2	11.7	12.9	13.1
8	10.0	11.2	12.5	11.4	10.5	11.8	12.9	13.0	9.8	11.1	12.5	11.8	10.2	11.5	12.9	13.0
9	8.6	10.2	11.7	11.3	10.2	11.5	12.5	13.0	10.0	11.3	12.5	11.6	11.0	12.1	13.7	12.9
10	8.6	9.8	10.6	11.1	10.2	11.5	12.8	13.1	10.3	11.6	12.8	11.3	11.8	12.5	13.3	12.5
11	8.6	9.7	10.8	11.3	10.2	11.7	12.9	12.9	11.1	11.5	12.0	11.2	11.8	12.6	13.7	12.3
12	9.1	10.1	11.7	11.4	10.6	12.0	13.3	12.8	10.3	11.0	11.7	11.2	10.2	11.6	12.9	12.0
13	9.2	10.0	10.6	11.4	10.8	12.2	13.4	12.6	9.5	10.0	10.6	11.5	9.8	11.1	12.2	11.8
1	9.5	10.5	11.9	11.6	11.1	12.3	13.4	12.4	8.4	9.6	10.6	11.8	9.8	10.9	12.2	11.6
15	9.8	10.8	11.5	11.7	10.8	11.8	12.6	12.2	9.1	9.9	10.9	12.2	9.8	10.9	12.2	11.3
16	9.4	10.0	10.9	11.8	10.6	11.6	12.9	12.1	8.3	9.7	10.8	12.5	9.8	10.7	11.4	11.2
17	8.6	9.9	11.7	12.0	10.0	11.0	12.0	11.8	9.1	10.4	11.8	12.8	9.4	10.5	11.8	11.2
18	9.7	10.6	11.5	12.1	9.7	10.8	11.9	11.7	9.5	11.0	12.3	12.9	9.8	10.7	11.8	11.3
19	9.1	10.3	11.5	12.1	9.1	10.5	11.7	11.6	11.2	12.2	13.5	13.0	9.4	10.4	11.4	11.4
20	9.5	10.7	12.0	12.3	10.0	11.3	12.5	11.5	10.9	12.0	12.9	13.0	9.4	10.0	10.6	11.5
21	10.2	11.3	12.6	12.3	10.5	11.2	11.9	11.3	11.1	12.0	12.9	13.0	8.2	9.3	10.2	11.6
22	9.7	10.9	12.3	12.1	9.5	10.7	11.7	11.2	10.8	11.8	13.1	13.0	8.2	9.6	11.0	11.7
23	10.0	11.1	12.3	11.9	9.2	10.3	11.2	11.1	10.4	11.7	12.8	13.0	9.0	10.2	11.4	11.7
24	11.1	11.6	12.6	11.8	8.5	9.8	10.9	11.2	11.2	12.1	12.9	13.0	11.0	11.5	12.5	11.7
25	8.9	10.2	11.5	11.7	8.5	9.8	11.1	11.4	10.4	11.7	12.9	12.8	10.2	11.2	12.9	11.4
26	9.7	10.9	12.3		8.9	10.0	10.9		10.6	11.9	13.1		9.8	10.8	11.8	
27	10.2	11.1	12.2		8.9	10.1	11.2		11.1	12.2	13.4		9.4	10.4	11.4	
28	9.4	10.5	11.2		8.9	10.2	11.4		12.2	12.4	12.8		9.0	9.9	11.0	
29	9.1	10.2	11.4		9.1	10.3	11.2		11.1	12.1	13.4		8.2	9.4	10.6	
30	8.9	10.0	11.5		9.7	10.8	11.9		10.9	11.9	12.5		9.0	9.9	11.4	
31	9.4	10.3	11.4		9.5	10.8	12.0		9.1	10.0	11.4		9.0	9.9	11.0	

Table B-5. August water temperature in Carmen Creek.

Date	Carmen Creek 9.8 Miles Upstream from Mouth															
	2001				2002				2003				2006			
	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day
1	7.8	9.4	11.0	12.4	8.6	10.3	11.8	12.0	10.6	12.3	14.5	14.1	10.6	11.9	14.1	14.2
2	9.0	10.8	12.5	12.9	9.8	11.0	12.2	11.8	11.4	12.4	13.3	14.0	9.8	11.4	14.1	14.4
3	10.2	11.3	12.2	13.0	9.4	10.8	12.2	11.5	12.2	12.8	13.3	14.1	9.4	11.2	14.1	14.6
4	11.0	11.5	12.2	13.2	10.2	11.0	11.4	11.4	11.4	12.6	15.2	14.2	10.2	11.5	14.1	14.7
5	9.4	11.1	12.5	13.2	9.8	11.1	12.5	11.4	11.0	12.3	14.1	13.9	10.2	11.9	14.9	14.9
6	10.2	11.7	13.3	13.2	10.6	11.6	12.5	11.3	11.4	12.3	14.1	13.9	10.2	12.0	14.9	14.8
7	11.0	12.2	13.3	13.2	10.2	10.8	11.4	11.2	10.6	12.2	14.5	13.8	11.0	12.0	12.9	14.7
8	11.4	12.7	14.1	13.2	9.0	9.5	10.2	11.3	11.0	12.1	13.3	13.8	11.0	12.5	15.6	14.8
9	11.4	12.5	13.3	13.0	7.4	8.8	10.2	11.5	10.6	12.0	14.1	14.0	11.8	12.8	15.6	14.4
10	10.6	12.0	13.3	12.9	8.2	9.8	11.4	11.8	10.6	12.1	14.1	14.2	11.0	12.6	15.2	14.1
11	11.0	11.5	12.2	12.9	9.4	10.5	11.8	11.7	11.0	12.1	13.3	14.2	11.4	12.5	15.2	13.8
12	10.2	11.6	12.9	13.1	9.0	10.2	11.4	11.6	11.4	12.4	13.7	14.3	10.6	11.6	14.1	13.6
13	11.4	12.3	12.9	13.1	9.0	10.2	11.8	11.5	11.4	12.5	13.7	14.5	9.4	10.8	14.1	13.6
1	11.0	12.2	13.3	13.0	9.0	10.5	12.2	11.4	11.4	12.7	14.1	14.7	9.0	10.8	13.7	13.7
15	11.0	12.0	12.9	12.9	9.4	10.7	12.2	11.2	12.5	13.3	14.9	14.5	10.2	11.0	12.6	13.7
16	10.2	11.7	12.9	12.8	9.4	10.6	11.8	10.9	13.3	13.9	16.0	14.3	10.2	11.3	14.1	13.7
17	10.6	12.0	13.3	12.8	8.2	9.6	11.0	10.7	11.8	12.6	14.1	14.1	9.8	10.8	12.9	13.4
18	11.0	12.3	13.3	12.7	8.6	9.8	11.0	10.7	10.6	11.8	13.7	14.2	8.6	10.4	13.7	13.3
19	10.6	11.8	12.9	12.5	8.2	9.6	11.0	10.8	11.0	12.2	14.9	14.4	8.6	10.5	14.1	13.5
20	9.8	11.2	12.2	12.5	9.4	10.2	11.0	10.8	11.8	12.9	15.6	14.0	9.4	10.9	14.5	13.5
21	9.8	11.2	12.5	12.6	9.0	9.7	10.2	10.8	11.0	11.9	12.5	13.6	9.8	11.0	13.7	13.5
22	9.8	11.3	12.5	12.7	7.8	9.0	10.2	10.9	12.2	12.6	13.3	13.9	10.2	11.3	12.6	13.6
23	10.2	11.4	12.5	12.7	8.2	9.3	10.2	10.9	11.4	12.4	14.9	14.0	9.8	10.9	12.6	13.6
24	10.2	11.3	12.5	12.7	9.0	10.1	11.4	10.9	10.6	11.9	14.5	13.8	9.4	10.4	12.2	13.3
25	9.8	11.2	12.5	12.6	9.0	10.1	11.4	10.9	11.0	12.0	14.9	13.6	10.2	11.1	14.5	13.3
26	9.8	11.2	12.5		9.0	10.0	11.0		10.6	11.6	12.2		9.4	10.9	14.5	
27	10.6	11.7	12.9		9.4	10.0	11.0		11.8	12.3	13.3		9.8	11.0	14.5	
28	10.6	11.8	12.9		9.0	10.1	11.4		11.0	12.1	14.5		9.8	11.2	14.5	
29	10.2	11.4	12.5		9.0	9.7	10.2		9.8	11.2	13.7		10.2	11.2	12.2	
30	10.2	11.3	12.5		8.6	9.5	10.2		9.8	11.0	13.7		9.0	10.1	11.0	
31	10.6	11.5	12.2		9.4	10.2	11.4		9.4	10.7	13.3		7.4	8.6	12.2	

Table B-6. August water temperature in Carmen Creek.

Date	Carmen Creek 9.8 Miles Upstream from Mouth															
	2007				2008				2009				2010			
	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day
1	11.4	13.0	16.4	14.7	9.0	11.2	14.9	14.7	9.4	10.9	13.3	12.5	7.8	9.8	13.3	12.9
2	11.8	13.2	14.9	14.5	9.8	11.4	15.2	14.7	9.4	10.7	12.2	12.1	7.8	9.4	12.6	12.5
3	12.6	13.5	16.0	14.3	9.0	10.9	14.9	14.6	10.2	11.4	13.3	11.9	7.4	9.6	12.9	12.4
4	11.8	13.1	15.2	14.0	9.0	11.0	14.9	14.7	10.2	11.7	13.7	11.7	8.2	10.2	13.3	12.2
5	11.4	12.0	12.6	13.9	9.0	11.3	15.2	14.7	10.6	11.5	12.9	11.5	8.2	9.9	12.2	11.8
6	10.2	11.7	14.9	14.2	9.8	11.9	16.0	14.7	10.6	11.0	11.8	11.3	8.2	9.9	12.9	11.8
7	10.6	11.7	12.9	14.1	11.0	11.4	11.8	14.6	8.2	9.5	10.6	11.3	8.2	10.0	12.9	11.4
8	10.2	11.7	14.9	14.0	10.6	11.5	15.2	15.0	8.2	9.1	10.2	11.4	7.8	9.3	11.0	11.3
9	10.6	11.8	13.7	13.8	10.2	11.3	14.5	15.1	8.6	9.6	11.0	11.2	8.2	9.2	11.4	11.5
10	11.0	12.1	14.1	13.6	9.0	10.8	15.6	15.2	8.2	9.9	11.4	10.9	7.8	9.0	11.4	11.8
11	10.2	11.7	14.1	13.7	8.6	10.6	14.9	15.1	9.0	10.4	12.6	10.7	7.8	9.1	11.0	12.0
12	10.6	12.2	15.2	13.8	8.6	10.7	15.2	15.2	9.8	10.7	11.8	10.4	7.0	8.9	11.8	12.3
13	10.6	11.9	14.1	13.4	9.4	11.0	14.9	14.7	9.4	10.6	11.8	10.4	7.4	8.5	10.6	12.5
1	10.6	11.3	11.8	13.0	9.4	10.9	14.9	14.4	9.0	10.1	11.0	10.5	6.6	8.6	12.2	12.8
15	10.2	11.5	13.3	13.2	9.4	11.2	15.6	14.1	7.4	8.3	9.0	10.7	6.6	8.9	12.6	12.9
16	11.0	11.9	12.9	13.1	9.4	11.2	15.2	13.6	7.0	7.7	9.0	11.3	7.4	9.6	12.9	12.7
17	11.8	12.8	14.5	13.0	9.8	11.4	15.2	13.3	6.2	7.9	9.8	11.7	7.8	9.9	13.3	12.5
18	11.8	12.8	14.9	12.7	9.8	11.5	15.2	12.9	7.8	9.0	10.6	12.1	7.8	10.0	12.9	12.3
19	10.6	11.3	12.2	12.4	10.6	11.4	11.8	12.5	8.6	10.0	11.8	12.2	8.2	10.0	12.9	12.2
20	10.2	10.5	11.4	12.4	9.8	11.0	12.9	12.7	9.0	10.5	12.2	12.3	7.4	9.4	12.6	11.8
21	10.2	10.9	13.3	12.5	9.8	11.0	12.9	12.4	9.8	11.1	12.6	12.4	7.4	9.7	12.9	11.8
22	9.4	10.6	12.9	12.3	7.8	9.5	12.2	12.3	10.6	11.7	13.3	12.4	8.6	9.7	11.4	11.3
23	9.4	10.7	12.2	12.2	7.8	9.4	12.6	12.3	11.0	11.3	11.8	12.2	7.4	8.8	11.8	11.0
24	9.0	10.3	12.2	12.1	8.2	10.0	12.9	12.2	9.8	10.8	12.6	12.3	6.2	8.4	11.8	10.6
25	9.0	10.5	12.6	12.2	9.8	10.9	12.6	11.8	9.4	10.4	11.4	12.2	7.0	9.1	12.2	10.0
26	9.8	10.9	12.6		9.4	10.5	12.9		9.4	10.7	12.6		7.4	8.8	10.2	
27	9.4	10.7	12.2		8.2	9.3	10.6		9.4	10.7	12.6		7.8	9.4	12.2	
28	9.4	10.5	11.8		7.8	9.4	12.2		10.2	11.2	12.6		7.0	8.1	9.4	
29	9.4	10.5	11.8		8.6	9.9	12.6		10.6	11.5	12.2		7.0	7.8	9.8	
30	9.4	10.7	11.8		9.4	10.3	11.4		10.6	11.3	12.6		6.2	6.9	8.6	
31	10.6	11.4	12.6		9.0	9.9	10.6		9.4	10.6	11.8		5.8	6.6	7.8	

Table B-7. August water temperature in Carmen Creek.

Date	CC 9.8 Miles Upstream from Mouth				Carmen Creek 7.7 Miles Upstream from Mouth								CC 3.5 Miles from Mouth			
	2011				1994				1995				1995			
	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day
1	7.8	8.6	9.8	10.0					7.4	9.1	10.8	11.6				
2	7.0	8.2	9.4	10.2					8.0	9.5	11.1	11.5				
3	7.0	8.4	10.2	10.4					8.6	10.1	11.4	11.3	11.6	13.0	15.8	16.9
4	7.0	8.2	9.4	10.4					8.9	10.3	11.7	11.2	11.6	13.1	15.9	16.9
5	7.4	8.5	10.2	10.6	12.2	13.2	14.2	13.3	9.2	10.7	12.2	11.1	12.5	14.7	17.2	16.9
6	6.6	8.3	10.2	10.7	11.3	12.5	13.6	13.1	9.4	10.8	12.3	10.9	12.0	14.7	17.7	16.7
7	7.0	8.7	11.0	10.7	11.1	12.2	13.4	12.9	9.7	10.8	11.7	10.5	12.0	13.9	17.5	16.4
8	7.0	8.6	11.0	10.7	10.6	12.1	13.3	12.8	8.2	9.2	9.9	10.3	12.3	14.0	17.2	16.3
9	7.0	8.7	11.0	10.7	10.9	11.9	12.7	12.8	6.8	8.6	10.2	10.5	12.0	14.3	16.7	16.2
10	7.0	8.5	10.2	10.5	10.6	11.8	13.4	13.0	8.0	9.3	10.5	10.5	11.4	13.2	15.8	16.1
11	7.0	8.4	10.6	10.6	10.2	11.5	12.7	12.9	8.0	9.4	10.8	10.5	10.2	12.1	16.2	16.1
12	6.6	8.2	10.6	10.7	11.1	11.9	12.3	12.9	8.0	9.3	10.8	10.3	10.8	12.5	15.6	16.2
13	6.6	8.4	10.6	10.7	10.3	11.4	12.2	13.0	7.8	9.1	10.0	10.1	11.8	13.6	15.6	16.4
1	7.4	9.0	11.0	10.7	10.2	11.7	13.3	13.1	7.2	8.6	10.0	10.1	11.4	13.8	16.7	16.6
15	7.4	9.0	10.6	10.7	10.9	12.1	13.3	13.0	7.6	9.3	10.9	10.2	10.9	12.7	16.7	16.5
16	6.6	8.2	10.2	10.8	10.9	12.2	13.6	12.9	9.1	10.0	10.8	10.3	11.2	12.8	16.1	16.3
17	6.6	8.2	10.6	11.0	10.8	11.9	12.9	12.6	9.1	9.7	10.5	10.6	10.9	13.5	15.9	16.2
18	7.0	8.6	11.0	11.1	10.3	11.6	12.7	12.3	6.6	7.9	8.9	10.8	10.3	13.3	16.6	16.1
19	6.6	8.3	10.6	11.0	10.3	11.4	12.7	12.1	6.3	7.9	9.4	11.2	10.8	12.8	17.2	16.0
20	7.0	8.6	10.6	11.2	10.5	11.8	13.1	12.0	7.1	8.5	10.0	11.5	11.7	13.4	16.7	15.9
21	7.4	9.0	11.0	11.3	10.6	11.6	12.5	11.8	8.3	9.6	10.9	11.7	12.2	14.0	16.2	15.8
22	7.8	9.3	11.4	11.4	10.9	11.9	12.5	11.8	9.6	10.7	11.9	11.7	11.8	13.5	15.6	15.7
23	7.8	9.3	11.8	11.5	10.3	10.9	11.6	11.7	10.5	11.6	12.5	11.5	10.2	12.0	15.4	15.8
24	7.8	9.3	11.4	11.5	8.6	9.9	11.3	11.6	10.5	11.3	11.9	11.2	9.8	11.6	14.9	16.1
25	8.6	9.5	10.6	11.3	8.9	10.0	11.3	11.6	9.7	10.8	11.6	11.0	10.9	13.5	16.1	16.4
26	8.2	9.7	11.8		9.2	10.6	11.9		9.6	10.7	11.7		10.3	13.5	16.6	
27	8.2	9.6	11.0		9.6	10.6	11.6		8.3	9.9	11.1		11.4	13.0	15.8	
28	9.4	10.5	12.2		10.2	11.1	12.3		8.6	9.9	11.1		12.3	13.6	15.4	
29	9.0	10.2	12.2		10.0	10.8	11.7		8.4	9.7	10.8		13.7	15.2	16.6	
30	8.2	9.6	11.4		9.2	10.4	11.4		8.0	9.2	10.2		13.3	15.2	17.2	
31	7.8	9.0	10.2		8.6	9.7	10.8		7.8	9.2	10.5		12.9	14.2	16.9	

Table B-8. August water temperature in Carmen Creek.

Date	Carmen Creek 3.5 Miles Upstream from Mouth															
	1997				1998				1999				2000			
	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day
1	11.7	13.8	16.0	17.0	12.2	13.7	15.6	18.3	11.4	14.5	17.5	17.0	12.9	15.5	18.7	18.0
2	11.8	14.7	18.4	17.3	12.9	14.8	17.2	18.8	12.2	14.1	16.8	17.1	13.3	15.8	19.0	17.8
3	12.2	15.2	19.1	17.1	12.2	15.3	19.1	18.9	12.2	13.7	14.8	17.3	12.5	14.2	16.4	17.8
4	13.1	14.1	15.1	16.6	12.6	15.7	19.4	18.8	12.6	14.8	18.3	17.8	13.7	15.0	17.1	18.0
5	13.2	13.8	14.8	16.9	12.6	15.7	19.8	18.8	11.8	14.6	17.9	17.4	12.9	15.4	18.7	18.2
6	12.2	14.8	18.1	17.4	12.9	15.4	17.9	18.7	12.6	14.8	17.5	17.1	12.2	14.6	17.9	18.1
7	12.9	15.1	17.6	17.1	13.3	15.7	19.1	18.9	12.2	14.2	16.4	16.6	12.2	14.6	17.9	18.0
8	12.8	15.0	18.0	17.2	12.9	15.6	19.4	18.9	11.8	14.7	18.3	16.5	11.8	14.4	17.9	17.9
9	11.2	14.1	17.3	16.9	12.2	14.6	17.5	18.6	11.8	14.7	18.3	16.3	12.5	15.1	19.0	17.8
10	11.7	13.5	15.4	16.7	12.2	15.1	18.7	18.7	11.8	14.9	18.3	16.2	13.3	15.1	17.5	17.4
11	11.8	14.2	17.3	17.2	12.6	15.4	19.1	18.6	12.9	13.8	15.2	16.1	13.3	15.5	18.3	17.2
12	12.2	14.5	18.0	17.2	13.3	15.8	19.1	18.4	12.2	13.7	15.6	16.5	12.2	14.8	18.3	17.0
13	12.3	14.1	16.4	17.2	12.9	15.7	19.4	18.2	11.4	12.8	14.1	17.0	11.8	14.1	16.8	16.7
1	12.8	14.7	17.8	17.4	13.7	16.0	19.1	18.1	10.6	13.2	16.0	17.5	11.4	14.1	17.5	16.5
15	12.9	14.4	16.4	17.6	12.9	15.0	17.5	17.7	11.0	13.8	16.8	17.8	11.4	14.0	17.5	16.2
16	12.3	13.8	16.0	17.9	12.9	15.0	18.3	17.7	10.6	13.7	17.1	18.1	11.4	13.4	15.6	16.0
17	12.0	14.6	18.3	18.2	11.8	14.2	17.5	17.5	11.4	14.4	17.9	18.2	10.6	13.4	16.8	16.1
18	12.8	14.8	17.5	18.1	11.8	14.5	17.9	17.4	11.4	14.8	18.3	18.2	11.4	13.5	16.8	16.2
19	12.0	14.6	17.8	18.1	11.4	14.3	17.9	17.3	13.3	15.9	19.1	18.2	11.0	13.2	16.0	16.3
20	12.0	14.7	18.3	18.2	12.2	14.9	18.3	17.1	12.2	14.9	17.5	18.2	11.4	13.2	15.2	16.3
21	12.8	15.3	18.8	18.1	12.6	14.3	16.8	17.0	12.6	15.1	17.9	18.5	10.2	12.5	15.2	16.4
22	12.2	14.9	18.4	17.8	11.4	14.0	17.5	17.1	12.6	15.3	18.7	18.3	10.2	13.0	16.4	16.5
23	12.3	14.9	18.1	17.7	11.4	13.5	16.4	16.9	11.8	15.1	17.9	18.3	10.6	13.5	16.4	16.4
24	13.8	15.0	17.8	17.7	10.6	13.3	16.8	17.0	12.6	15.0	17.9	18.3	12.5	14.6	17.1	16.4
25	11.5	14.3	17.6	17.5	10.6	13.5	17.2	17.1	11.8	15.1	18.7	18.1	11.8	14.4	17.9	16.2
26	12.2	14.8	18.3		11.0	13.5	16.8		12.6	15.6	19.1		11.4	13.6	16.0	
27	12.3	14.9	18.0		11.4	14.0	17.5		12.6	15.9	19.4		11.0	13.4	16.0	
28	11.7	14.2	16.7		11.0	13.8	17.5		14.1	15.1	16.8		10.6	13.2	15.6	
29	11.7	14.4	17.6		11.0	13.6	16.4		12.6	15.4	18.7		9.8	12.5	15.6	
30	11.4	14.2	17.8		11.8	14.1	17.2		12.2	15.1	17.9		11.0	13.5	16.4	
31	11.7	13.9	16.7		11.4	14.1	17.5		11.0	13.4	16.0		10.6	13.2	16.0	

Table B-9. August water temperature in Carmen Creek.

Date	Carmen Creek 3.5 Miles Upstream from Mouth															
	2001				2002				2003				2005			
	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day
1	10.6	13.7	17.5	18.3	10.6	14.1	18.3	17.6	11.4	13.8	16.8	16.4	12.9	15.0	17.9	18.4
2	11.8	15.0	19.0	18.7	11.8	14.6	18.7	17.1	11.8	13.8	16.8	16.3	13.3	15.4	17.9	18.4
3	12.2	14.4	16.8	18.7	11.0	14.3	17.9	16.9	12.9	13.5	14.9	16.2	12.9	15.3	18.7	18.4
4	12.9	14.7	16.0	19.1	12.5	14.0	16.4	16.9	12.2	14.0	16.8	16.4	12.6	15.2	19.0	18.3
5	11.8	14.9	19.0	19.2	12.2	14.7	18.3	17.2	11.4	13.5	16.4	16.3	12.9	15.6	19.0	18.2
6	12.2	15.5	19.8	19.2	12.2	14.9	18.7	17.2	12.2	14.0	16.8	16.2	12.9	15.0	17.5	17.9
7	12.5	15.7	19.8	18.9	12.5	13.3	14.9	17.2	11.8	13.8	16.4	16.1	12.9	15.5	19.0	17.8
8	13.7	16.6	20.6	18.7	11.0	12.7	14.9	17.7	11.8	13.6	16.0	16.1	13.7	15.1	17.9	17.6
9	12.9	15.8	19.0	18.4	9.4	12.9	17.1	18.3	11.4	13.6	16.4	16.0	13.3	15.2	17.5	17.6
10	12.5	15.6	19.4	18.4	10.6	14.0	18.3	18.5	11.8	13.8	16.4	16.1	12.9	15.2	17.9	17.6
11	12.2	14.1	16.8	18.4	11.4	14.4	18.3	18.4	11.8	13.6	16.0	15.8	12.9	15.1	18.3	17.5
12	11.8	14.9	19.0	18.7	11.0	14.1	18.3	18.3	12.2	13.6	15.2	15.7	12.2	14.2	17.1	17.4
13	13.3	15.2	17.5	18.7	11.0	14.4	18.7	18.2	11.8	13.7	16.4	15.8	12.6	14.1	17.1	17.5
1	12.2	14.7	18.7	18.9	11.0	14.6	18.7	18.0	11.8	14.0	16.4	15.9	11.4	14.0	17.5	17.6
15	12.2	15.0	18.7	18.9	11.8	15.0	19.0	17.5	12.5	14.0	15.2	15.7	11.8	14.3	17.9	17.8
16	11.8	14.9	19.0	18.9	11.4	14.4	18.3	17.2	12.9	14.2	16.8	15.7	12.2	14.5	17.5	17.7
17	11.8	15.0	19.0	18.8	9.8	13.4	17.5	16.9	12.2	13.2	14.9	15.7	12.6	14.4	17.1	17.7
18	12.2	15.3	19.0	18.7	10.6	13.9	17.9	16.9	11.4	13.2	15.2	15.9	12.2	14.2	17.1	17.6
19	12.2	15.1	19.0	18.7	10.2	13.7	17.5	16.8	11.8	13.6	16.0	16.1	11.4	14.1	17.9	17.5
20	11.4	14.5	18.7	18.6	12.2	14.0	16.8	16.5	12.2	14.2	17.1	16.2	11.4	14.3	18.3	17.4
21	11.8	14.7	18.7	18.7	11.4	13.0	15.6	16.4	11.4	13.2	14.5	16.3	11.8	14.7	18.7	17.2
22	11.8	14.8	18.7	18.7	9.4	12.7	16.8	16.7	12.9	14.0	15.6	16.8	13.3	14.9	17.1	17.1
23	11.8	15.0	18.7	18.7	9.8	13.0	16.4	16.4	12.2	13.8	16.8	17.0	12.2	14.5	17.5	17.2
24	11.8	14.7	18.3	18.7	11.4	13.8	17.1	16.3	11.8	13.6	16.0	17.1	11.4	13.5	16.4	16.9
25	11.4	14.7	18.7	18.4	10.6	13.7	17.5	16.2	12.2	13.8	16.4	17.4	10.2	13.1	16.8	16.8
26	11.4	14.9	18.7		11.0	13.0	15.6		11.8	14.1	16.8		10.6	13.4	16.8	
27	12.5	15.0	19.0		11.4	13.4	16.0		13.7	15.2	17.9		11.4	14.0	17.5	
28	12.2	15.0	18.7		11.0	13.5	17.1		12.9	14.8	17.9		11.8	14.3	17.9	
29	11.8	14.8	18.7		11.0	12.8	14.9		11.8	14.3	17.5		11.4	14.1	17.5	
30	11.4	14.7	18.7		10.2	13.0	15.6		12.2	14.2	17.5		11.8	13.1	15.2	
31	12.2	14.3	16.4		11.8	13.7	16.4		11.4	14.1	17.5		9.8	12.4	16.0	

Table B-10. August water temperature in Wallace Creek and Williams Creek.

Date	Wallace Creek 1.4 Miles Upstream from Mouth								Williams Creek 5.1 Miles Upstream from Mouth							
	2010				2011				1993				1994			
	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day
1	11.8	13.1	15.2	15.1	11.8	12.4	16.4	15.3	8.3	9.6	10.8	10.9	10.5	11.5	12.7	12.5
2	11.4	12.8	14.9	15.0	11.0	11.7	12.6	15.5	8.0	9.3	10.5	10.8	10.3	11.2	11.7	12.5
3	11.4	12.7	14.5	14.7	10.6	11.9	14.9	15.7	8.6	9.7	10.9	10.8	10.5	11.6	12.8	12.6
4	11.8	13.0	15.2	14.7	10.6	11.9	14.9	15.9	8.4	9.6	10.8	10.8	11.1	11.9	12.7	12.5
5	11.8	13.2	15.6	14.4	11.0	12.3	16.4	16.3	9.2	10.1	10.9	10.8	10.5	11.5	12.3	12.4
6	12.2	13.2	15.2	14.2	10.6	12.0	15.6	16.5	8.8	10.0	11.3	10.8	10.8	11.9	13.1	12.3
7	11.8	13.1	15.2	13.9	10.6	12.2	16.8	16.5	8.9	9.9	10.9	10.7	10.3	11.4	12.3	12.1
8	11.4	12.7	14.5	13.7	10.6	12.3	17.1	16.8	8.8	9.4	10.2	10.6	10.0	11.2	12.5	12.1
9	11.8	12.3	12.9	13.6	11.0	11.9	14.1	16.8	8.4	9.6	10.6	10.7	10.3	11.5	12.7	12.1
10	11.4	12.2	14.1	13.9	10.6	12.1	16.8	17.2	8.3	9.7	10.9	10.5	9.6	10.9	11.7	12.1
11	11.0	12.0	13.3	14.0	10.2	12.1	17.5	17.3	9.1	10.2	10.8	10.2	10.3	11.1	12.1	12.2
12	10.2	11.7	14.1	14.2	10.2	12.1	17.9	17.2	9.1	10.1	10.9	9.9	9.9	10.7	11.6	12.2
13	10.6	11.3	12.9	14.4	10.2	11.9	15.6	17.1	9.1	10.0	10.8	9.8	9.7	10.9	11.9	12.3
1	9.8	11.5	14.1	14.6	11.0	12.6	18.3	17.4	8.3	9.4	10.3	9.8	10.2	11.1	12.1	12.2
15	10.2	11.7	14.1	14.7	11.0	12.5	17.5	17.1	8.6	9.5	10.3	9.8	10.2	11.4	12.7	12.2
16	10.6	12.2	14.5	14.7	10.2	12.0	17.1	17.2	8.3	9.0	9.6	9.7	10.2	11.4	12.5	12.0
17	11.0	12.5	14.9	14.6	9.8	11.8	17.1	17.4	7.4	8.1	8.4	9.8	9.9	11.1	12.2	11.8
18	11.0	12.6	14.9	14.4	10.2	12.1	16.8	17.5	7.4	8.2	9.1	10.1	9.9	11.0	12.2	11.6
19	11.4	12.8	15.2	14.3	10.2	12.0	17.5	17.3	7.7	9.0	9.9	10.2	9.9	11.1	12.2	11.5
20	10.6	12.4	14.5	14.0	10.2	12.2	17.5	17.4	8.6	9.7	10.8	10.0	10.0	10.9	11.6	11.4
21	11.0	12.5	14.9	14.0	11.0	12.4	16.4	17.0	9.2	9.7	10.2	9.7	10.2	11.2	12.2	11.3
22	11.4	12.5	14.5	13.6	11.0	12.8	18.3	17.3	8.6	9.3	9.7	9.5	9.7	10.4	11.1	11.1
23	10.6	11.7	13.7	13.1	11.4	12.7	17.9	17.2	8.6	9.5	10.3	9.3	8.3	9.6	10.9	11.1
24	9.4	11.3	13.3	12.7	11.0	12.8	18.3	17.1	8.0	9.3	10.5	8.9	8.6	9.9	11.1	11.0
25	9.8	11.7	14.1	12.3	12.2	12.9	15.2	16.8	7.4	8.7	9.9	8.5	9.1	10.2	11.3	10.9
26	10.2	12.0	13.3		11.8	13.3	17.9		6.6	7.6	8.4		9.1	10.3	11.4	
27	11.4	12.3	14.5		11.8	13.1	15.2		6.6	7.8	8.8		9.4	10.4	11.3	
28	10.2	11.0	11.8		12.6	13.7	18.3		6.3	7.6	8.9		9.4	10.2	10.9	
29	9.8	10.3	11.0		12.6	13.7	17.9		6.4	7.5	8.3		8.6	9.8	10.8	
30	9.0	9.7	10.6		12.2	13.3	17.1		5.4	6.7	7.6		8.2	9.3	10.2	
31	8.6	9.4	10.6		11.4	12.6	15.6		5.7	6.8	7.7		8.2	9.2	10.2	

Table B-11. August water temperature in Williams Creek.

Date	Williams Creek 5.1 Miles Upstream from Mouth															
	1995				1997				2009				2010			
	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day
1	8.2	9.6	11.1	11.8	9.2	10.1	10.8	11.5	9.0	10.7	12.6	11.9	9.0	10.5	12.2	11.7
2	8.8	10.1	11.4	11.8	9.2	10.2	11.1	11.7	9.0	10.6	12.2	11.5	8.2	10.1	11.8	11.5
3	9.4	10.5	11.6	11.6	9.6	10.7	12.1	11.6	9.8	11.1	12.6	11.3	8.6	9.9	11.4	11.4
4	9.7	10.7	11.7	11.4	10.5	10.8	11.3	11.4	9.8	11.2	12.9	11.0	9.0	10.3	11.4	11.3
5	9.9	11.0	12.2	11.3	10.5	10.7	10.9	11.3	9.8	11.1	12.2	10.8	9.4	10.5	11.4	11.2
6	10.0	11.3	12.7	11.0	9.9	10.7	11.7	11.2	9.8	10.6	11.4	10.8	9.4	10.5	11.8	11.0
7	10.3	11.2	12.1	10.6	10.5	11.4	12.3	11.1	8.6	9.3	9.8	10.8	9.4	10.5	11.8	10.8
8	8.8	9.5	10.6	10.3	10.6	11.4	12.2	11.0	8.2	9.0	9.8	10.9	9.0	10.1	11.4	10.5
9	7.4	8.8	10.2	10.3	8.9	10.0	10.9	10.8	7.8	9.0	10.2	10.8	9.4	10.0	10.6	10.4
10	8.3	9.4	10.3	10.4	8.8	9.4	10.2	10.8	7.8	9.4	11.0	10.5	9.0	9.9	11.0	10.5
11	8.6	9.7	10.8	10.4	8.6	9.5	10.5	10.8	8.2	9.9	11.4	10.2	9.0	9.6	10.2	10.7
12	8.0	9.4	10.5	10.1	8.9	9.7	10.5	10.9	9.0	10.5	12.2	10.0	7.8	9.2	10.6	10.9
13	7.8	8.8	9.6	9.9	8.9	9.8	10.8	10.9	8.6	10.0	11.4	9.9	8.2	9.1	9.8	11.0
1	7.4	8.7	10.0	9.9	9.4	10.4	11.7	11.0	8.6	9.5	10.2	9.9	7.0	8.6	10.2	11.2
15	8.0	9.5	11.1	9.9	9.7	10.5	11.1	11.0	6.6	7.9	9.0	10.1	7.4	9.0	10.6	11.4
16	9.2	9.9	10.6	10.0	8.9	9.8	10.5	11.1	5.8	7.2	8.2	10.7	8.2	9.6	11.4	11.5
17	8.8	9.4	10.0	10.2	8.6	9.6	10.5	11.2	5.8	7.5	9.0	11.2	8.6	10.1	11.8	11.3
18	6.9	8.0	8.8	10.4	9.2	10.1	10.9	11.4	7.0	8.6	10.2	11.6	8.6	10.2	11.8	11.0
19	6.3	7.7	9.1	10.7	8.9	9.9	10.6	11.3	7.8	9.4	11.0	11.8	9.0	10.2	11.4	10.9
20	7.2	8.5	9.9	11.0	9.1	10.2	11.6	11.4	8.6	10.0	11.8	11.9	7.8	9.7	11.4	10.8
21	8.4	9.4	10.2	11.1	9.7	10.7	11.6	11.4	9.0	10.4	11.8	11.9	8.2	9.9	11.4	10.8
22	9.4	10.3	11.3	11.2	9.6	10.6	11.6	11.3	9.8	11.0	12.6	11.9	9.8	10.4	11.4	10.4
23	10.2	11.0	11.9	11.1	9.6	10.7	11.6	11.1	10.2	10.9	12.2	11.8	7.8	9.1	10.2	10.0
24	10.2	10.9	11.7	10.8	10.5	11.0	11.6	11.0	9.0	10.4	11.8	11.6	6.6	8.3	9.8	9.7
25	9.7	10.4	11.1	10.6	8.6	9.8	10.6	10.8	8.2	9.8	11.4	11.3	7.4	8.9	10.6	9.4
26	9.4	10.3	11.3		9.2	10.3	11.3		8.6	10.2	11.8		7.8	9.5	11.0	
27	8.3	9.5	10.3		9.4	10.5	11.4		8.6	10.0	11.8		9.0	10.0	11.0	
28	8.4	9.6	10.8		8.9	10.0	10.8		9.0	10.3	11.8		7.0	8.2	9.0	
29	8.4	9.6	10.5		8.9	9.9	10.5		9.8	10.8	11.8		7.4	8.0	8.6	
30	8.0	9.0	9.9		8.4	9.6	10.5		9.4	10.3	11.0		7.0	7.4	7.8	
31	7.8	9.0	10.0		8.8	9.6	10.3		8.2	9.2	9.8		6.6	7.2	7.8	

Table B-12. August water temperature in Williams Creek and Hat Creek.

Date	Williams Creek 5.1 Miles				Hat Creek 0.82 Miles				Hat Creek 3.6 Miles				Hat Creek 10.4 Miles			
	2011				2011				2000				2011			
	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day	Min	Ave	Max	7-Day
1	9.8	10.4	11.4	10.9	12.1	13.6	15.6	15.4	13.2	16.9	21.1	20.7	8.6	9.2	10.2	10.0
2	9.0	9.9	10.6	10.8	10.9	12.3	13.7	15.3	14.6	17.8	22.2	20.8	7.4	8.5	9.4	9.9
3	8.6	9.6	10.6	10.8	10.6	12.9	15.9	15.6	13.5	16.0	19.1	20.6	7.0	8.9	11.0	9.9
4	8.2	9.7	11.0	10.8	10.9	12.9	14.8	15.7	14.8	16.8	20.6	20.5	7.0	8.5	9.8	9.8
5	9.4	10.2	11.4	10.8	10.9	13.3	16.3	15.9	13.5	17.1	21.4	20.6	7.4	8.6	10.2	9.8
6	8.6	9.6	10.6	10.7	10.2	12.9	15.6	16.0	12.3	16.1	19.8	20.5	6.6	8.3	9.8	9.8
7	8.6	9.8	11.0	10.7	10.6	13.0	15.9	16.2	12.3	16.2	21.1	20.5	7.0	8.5	9.8	9.8
8	8.2	9.7	10.6	10.8	10.6	12.9	15.2	16.3	11.4	16.1	21.2	20.4	6.6	8.2	9.4	9.9
9	9.0	9.8	10.6	10.9	11.3	13.4	15.6	16.6	13.1	16.9	21.1	20.1	7.4	8.3	9.4	10.1
10	8.6	9.7	10.6	10.9	10.6	13.3	16.3	16.7	13.8	16.3	18.6	19.8	6.6	8.3	10.2	10.2
11	8.2	9.5	10.6	10.9	10.2	13.2	16.7	16.7	12.9	16.5	21.2	19.8	6.2	8.1	9.8	10.0
12	7.8	9.3	11.0	10.9	10.2	13.2	16.7	16.6	11.1	15.3	20.2	19.5	6.2	8.1	9.8	10.0
13	7.8	9.4	10.6	10.9	10.2	13.3	16.7	16.6	10.9	15.0	20.1	19.3	6.6	8.4	9.8	10.0
1	9.0	10.3	11.8	10.9	10.9	13.9	17.1	16.5	10.7	15.0	20.1	18.9	7.4	9.1	11.0	10.0
15	9.0	10.1	11.4	10.8	11.3	14.0	17.4	16.3	10.9	14.9	19.8	18.5	7.4	8.9	10.6	10.0
16	7.8	9.2	10.6	10.9	10.2	13.0	16.3	16.3	11.2	14.5	18.5	18.4	6.2	7.9	9.8	10.1
17	7.8	9.1	10.2	11.0	9.8	12.8	15.9	16.5	10.6	14.4	18.9	18.6	6.2	7.8	9.0	10.3
18	8.2	9.6	11.0	11.2	10.2	13.0	15.9	16.7	11.4	14.5	18.9	18.5	6.6	8.0	9.8	10.5
19	7.8	9.3	10.6	11.3	10.2	13.1	16.7	16.9	10.0	13.8	18.6	18.6	6.2	8.0	9.8	10.7
20	7.8	9.3	10.6	11.4	10.9	13.4	16.3	17.1	10.6	13.6	17.8	18.6	6.6	8.3	9.8	10.9
21	8.6	9.9	11.4	11.5	11.3	13.5	15.9	17.0	9.7	13.2	17.3	18.5	7.4	9.0	11.0	10.9
22	9.0	10.3	11.8	11.7	11.3	14.2	17.4	17.3	10.0	14.0	18.8	18.6	7.4	9.3	11.4	11.0
23	9.0	10.3	11.8	11.7	10.9	14.1	17.4	17.4	10.6	14.7	19.8	18.5	7.4	9.0	11.0	11.0
24	8.6	10.0	11.4	11.6	10.6	13.8	17.4	17.3	13.5	15.7	18.0	18.3	7.0	8.8	10.6	10.9
25	9.8	10.8	11.8	11.4	13.3	15.0	17.4	17.1	11.7	15.3	19.8	18.1	9.0	9.8	11.4	10.7
26	9.4	10.6	11.4		12.1	14.8	17.8		11.2	14.6	18.6		8.2	9.7	11.0	
27	9.4	10.5	11.4		11.7	14.1	15.9		10.7	13.9	17.5		8.2	9.4	10.2	
28	10.6	11.3	12.2		12.9	15.1	17.8		10.3	13.7	17.6		9.0	10.1	11.4	
29	9.8	11.0	12.2		12.5	14.9	17.8		9.5	13.6	18.3		8.2	9.7	11.4	
30	9.4	10.3	11.0		11.7	14.2	16.7		11.1	14.2	18.5		7.4	9.1	10.2	
31	8.6	9.6	10.2		10.9	13.3	16.3		10.1	13.1	16.4		7.0	8.3	9.4	

APPENDIX C

Estimated Number of Natural-origin Adult Steelhead Returning to Independent Population Areas in the Salmon River Major Population Group

Introduction

Information on numbers of steelhead returning to natal tributaries is lacking for most populations in the Salmon River drainage. Steelhead spawn in spring, when flows are high, making population estimation by counting redds impractical in most areas. Some hatchery weir count data are available but the vast majority of steelhead spawning reaches are not sampled by hatchery weirs. Currently, adult return trend data are available for the: (1) East Fork Salmon River (EFSR) population upstream from the EFSR weir; (2) Upper Salmon River population upstream from the Sawtooth Hatchery weir; (3) Pahsimeroi River population upstream from the Pahsimeroi Hatchery weir; (4) Lemhi River upstream from Hayden Creek; and (5) Big Springs Creek in the Lemhi River drainage. Counts are available in the upper Lemhi River and Big Springs Creek because flows are sufficiently low to count redds during spring.

Population abundance and population productivity estimates used to determine risk of extinction for Salmon River major population group (MPG) steelhead populations were derived from aggregate counts at Lower Granite Dam (LGD) (Ford 2011). Ford (2011) identified two approaches as showing promise for estimating population level spawner abundance: (1) Use of genetic baseline information to partition LGD counts; and (2) use of passive integrated transponder (PIT) tag detection data to partition LGD counts. In 2013, Idaho Department of Fish and Game (IDFG) published the first Snake River Basin steelhead run reconstruction (Copeland *et al.*2013). This report presented estimates of population level returns of adult Snake River Basin steelhead to LGD for the 2010 to 2011 spawning run (Copeland *et al.*2013). The following year IDFG published estimates for the 2011 to 2012 spawning run (Copeland *et al.*2014). These studies used a combination of genetic baseline information to derive population level estimates of adult steelhead reaching LGD. The reports also estimated escapement past the fisheries between LGD and natal tributaries (or hatchery weirs). However, it is important to note that techniques used are new and results are considered preliminary, and escapement estimates upstream from LGD do not consider natural mortality and straying.

This Appendix uses PIT tag data to estimate a generic conversion rate (i.e., proportion of migrating fish reaching a particular point) from LGD to natal tributaries. It applies the conversion rate to results from Copeland *et al.*(2013) and Copeland *et al.*(2014) to estimate escapement into population areas for the 2011 and 2012 spawning years, and compares size of the 2010 to 2011 and 2011 to 2012 runs to the 10-year geomeans to estimate population level 10-year geomeans.

Methods

We obtained PIT tag detection data for the LGD adult fishway detection array[1], the Lower Lemhi River detection array (LLR), and the Big Creek at Taylor Ranch detection array (TAY) from Columbia River Dart (www.cbr.washington.edu/dart). We chose LLR because all fish migrating into the Lemhi River drainage must pass the array (i.e., little or no spawning habitat downstream from the array), the array extends across the entire river except for approximately one meter near the banks, and large numbers of natural origin steelhead are PIT tagged in the

[1]This detection array is designated LGR in the PTAGIS database (www.ptagis.org).

Lemhi River drainage. We chose TAY because it is the only detection array in the Middle Fork Salmon River drainage. Big Creek is also the only tributary in the Middle Fork Salmon River drainage with consistent tagging of a large number of juvenile steelhead. We estimated transition rates for each year and each natal tributary (i.e., Lemhi River and Big Creek) by dividing number of adult steelhead detected in the natal tributary by the number detected at Lower Granite Reservoir (LGR). We calculated travel time from LGR to the natal tributary by subtracting travel time to LGR from travel time to the natal tributary interrogation array. We only used natural origin fish tagged as juveniles in the natal tributary drainage and detected migrating upstream in the LGR adult fishway in these calculations.

We took population level estimates of Salmon River MPG origin natural-origin adult steelhead returning to LGR from Copeland *et al.*(2013) and Copeland *et al.*(2014). We multiplied these estimates by the LGR to LLR conversion rate for Lemhi River steelhead to estimate number of steelhead returning to natal tributaries in 2011 and 2012. We did not use the LGR to TAY conversion rates for these calculations because they were substantially lower than the LGR to LLR rates, suggesting that detection probability in the TAY array is appreciably less than 100%.

We obtained total number of natural-origin steelhead counted at LGR from the Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife (2012). We calculated a 10-year geomean for migration years 2004 to 2005 through 2013 to 2014, and a 2-year geomean for 2010 to 2011 through 2011 to 2012. We divided the 2-year geomean by the 10-year geomean and used the quotient to calculate population level 10-year geomeans from data presented in Copeland *et al.*(2013) and Copeland *et al.*(2014). We also estimated recruit to stock ratio assuming equal probability of returning as a 4- or 5-year-old, regressed recruit to stock ratio against stock number, and calculated an equilibrium population size.

Results

Conversion rate was 0.741 from LGR to LLR (Table C-1) and 0.339 for LGR to TAY (Table 2). Average travel time was 204 days from LGR to LLR and 215 days from LGR to TAY. Minimum, average, and maximum travel times were very consistent over the 5 years examined (Tables C-1 and C-2).

Table C-1. Transition rate and travel time of adult PIT tagged steelhead detected Lower Granite Dam and the Lower Lemhi River PIT tag interrogation array (LLR).

Observation year	Number detected at LGR	Number detected at LLR	Transition rate	Travel time (days)		
				Minimum	Average	Maximum
2010	32	22	0.688	144	202	265
2011	20	12	0.600	153	205	274
2012	34	25	0.735	154	208	252
2013	22	19	0.864	161	203	258
2014	16	14	0.875	169	204	239
All years	**124**	**92**	**0.742**	**144**	**204**	**274**

Table C-2. Transition rate and travel time of adult PIT tagged steelhead detected at Lower Granite Dam and the Big Creek at Taylor Ranch PIT tag interrogation array (TAY).

Observation year	Number detected at LGR	Number detected at TAY	Transition rate	Travel time (days)		
				Minimum	Average	Maximum
2010	36	9	0.250	182	224	263
2011	16	10	0.625	197	221	239
2012	16	5	0.313	193	206	223
2013	12	5	0.417	160	199	224
2014	29	8	0.276	194	214	267
All years	**109**	**37**	**0.339**	**160**	**215**	**267**

Counts of natural-origin steelhead started at LGD in 1994. The 10-year geomean for the 2004 to 2005 through the 2013 to 2014 migration years was 27,311; and the 2-year geomean for the 2010 to 2011 through 2011 to 2012 migration years was 42,430, for a ratio of 1.554. A comparison of recruit to stock ratio (calculated assuming equal numbers of 4- and 5-year-old returns) and stock indicates density dependence with a theoretical equilibrium population size of 37,353 (Figure C-1).

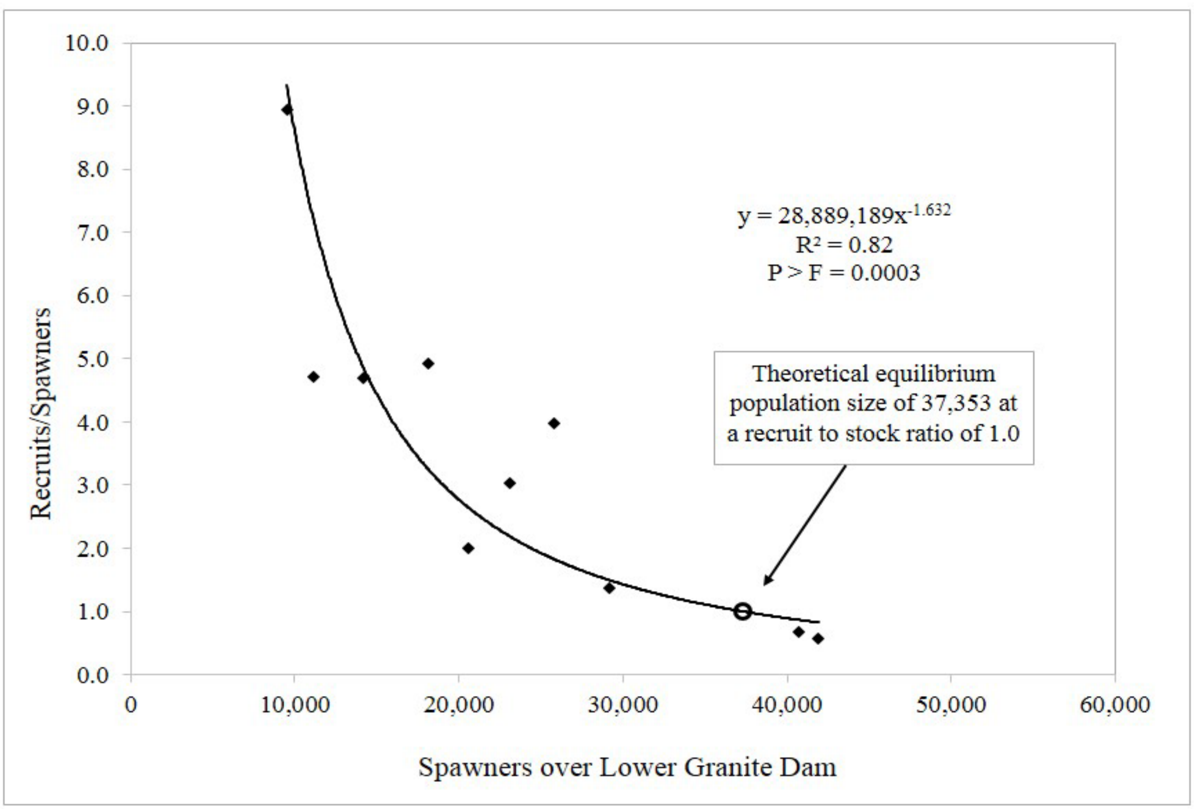

Figure C-1. Recruit to stock ratio versus stock year number of natural-origin steelhead over LGD. The circle denotes a theoretical equilibrium population (i.e., recruit to stock ratio of 1.0) of 37,353 spawners.

Population level run size estimates at LGD for the 2010 to 2011 and 2011 to 2012 migrations, estimated numbers entering natal tributaries in 2011 and 2012, estimated 10-year geomean population size, and percentage of minimum population size for "maintained" and "viable" status, for the Salmon River steelhead MPG, are in Table C-3. All populations, except the North Fork Salmon River population, likely exceed minimum population size for "maintained" status. The Little Salmon River population was the only one that exceeded the minimum size for "viable" status.

Table C-3. Estimated run size at Lower Granite Dam, estimated number reaching spawning tributaries, and estimated 10-year geomean population size based on comparison of year class strength.

Population	Run Size at Lower Granite Dam[a]		Estimated Number Reaching Spawning Habitat[b]		Estimated 10-year Geomean in Spawning Habitat[c]	Intrinsic Population Size	Percent of Minimum Population Size[d]		Run Type[e]
	2010-2011	2011-2012	2011	2012			Maintained	Viable	
Little Salmon River	976	1,203	724	893	517	Basic	267%	103%	A
S. F. Salmon River	1,463	688	1,086	510	479	Intermediate	169%	48%	B
Secesh River	626	294	464	218	205	Basic	106%	41%	B
Chamberlain Creek	847	410	628	304	281	Basic	145%	56%	A
Lower M. F. Salmon River	1,808	1,150	1,342	853	689	Intermediate	243%	69%	B
Upper M. F. Salmon River	1,926	1,225	1,429	909	734	Intermediate	259%	73%	B
Panther Creek	499	521	370	387	243	Basic	126%	49%	A
N. F. Salmon River	285	298	211	221	139	Basic	72%	28%	A
Lemhi River	1,605	1,674	1,191	1,242	783	Intermediate	277%	78%	A
Pahsimeroi River	1,330	1,388	987	1,030	649	Intermediate	229%	65%	A
E. F. Salmon River	1,416	1,477	1,051	1,096	691	Intermediate	244%	69%	A
Upper Salmon River	1,711	1,786	1,270	1,325	835	Intermediate	295%	83%	A
Overall	**14,492**	**12,114**	**10,753**	**8,989**	**6,245**		**212%**	**66%**	

[a] Estimates from Copeland *et al.*(2013) and Copeland *et al.*(2014).

[b] Run size estimates from Copeland *et al.*(2013) and Copeland *et al.*(2014) multiplied by the overall PIT tag detection rate for 2010 to 2014 for natural-origin Lemhi River steelhead (i.e., 0.742).

[c] Population level 2-year geomean (2011 through 2012) escapement divided by the ratio of the 2-year geomean (2010 to 2011 through 2011 to 2012) and 10-year geomean (2004 to 2004 through 2013 to 2014) of number of natural-origin steelhead over LGD (i.e., 1.554).

[d] The minimum size for a viable population (i.e., five percent chance of extinction over 100 years) is 500 and 1,000, respectively, for basic size and intermediate size populations. Population productivity at these sizes would have to be at least 1.27 and 1.14, respectively, for basic size and intermediate size, populations. Population size and productivity for a maintained population (i.e., 25% chance of extinction over 100 years) is 194 and 1.27, respectively, for a basic sized population and at 283 and 1.14, respectively, for an intermediate sized population. All populations could theoretically achieve maintained status at a population size of 119, but population productivity would have to be 2.3. For this analysis, we assumed the minimum size for a maintained population is the size corresponding to the population productivity corresponding to the minimum size for a viable population (i.e., 194 for basic size and 283 for intermediate size, populations).

[e] Primary run type, some populations have a mixture of types.

Discussion

The majority of Snake River Basin steelhead overwinter upstream from the Federal Columbia River Power System (FCRPS). Keefer *et al.*(2008) estimated 18.9% non-fishing mortality for adult steelhead overwintering upstream from the FCRPS. Copeland *et al.*(2013) and Copeland *et al.*(2014) estimated fishing mortality of natural-origin steelhead upstream from LGD of 2.8% and 2.9%, respectively. Adding the non-fishing mortality from Keefer *et al.*(2008), and the fishing mortality from Copeland *et al.*(2013) and Copeland *et al.*(2014), results in a LGD to population area survival rate of 78.2% to 78.3%.

The conversion rates included fishing mortality, natural mortality, straying losses, and missed detections in the tributary arrays. By only using fish detected at LGR and not correcting for detection efficiency of the tributary arrays we essentially assumed 100% detection efficiency in the tributary arrays. Assuming 100% detection efficiency in the tributary arrays would tend to overestimate migration mortality and underestimate number of fish making it to natal habitat. However, the overall estimated LGR to LLR survival rate of 75% is comparable to survival after accounting for non-fishing mortality described in Keefer *et al.*(2008) and fishing mortality described in Copeland *et al.*(2013) and Copeland *et al.*(2014), suggesting that detection efficiency of the LLR array may be sufficiently high to assume 100% without appreciably overestimating total losses. Even if the LGR to population area survival estimate is accurate, using one estimate for all populations and all years will result in imprecise estimates of spawner population size. More population-specific migration survival estimates are needed to accurately estimate population level numbers of potential spawners in population areas.

The geomean number of natural-origin fish at LGD for the 2010 to 2011 and 2011 to 2012 runs is 155% of the 10-year geomean. Correcting the 2-year geomean based on the long-term trend should improve the estimates. However, estimating 10-year geomeans based on 2 years of estimates adds another level of uncertainty to the population level estimates in Table C-3. More years of data should greatly improve estimates of 10-year geomean population sizes.

Ford (2011) listed A-run populations as “maintained” for abundance/productivity and B-run populations as “high risk.” If the estimates presented by Copeland *et al.*(2013) and Copeland *et al.*(2014) are reasonably accurate, all of the B-run populations in the Salmon River MPG may be sufficiently large to achieve “maintained” status for abundance, and the North Fork Salmon River population is likely “high risk” for abundance. The Little Salmon River population may be slightly above minimum population size for “viable” but this population has substantial hatchery influence, which might have influenced the estimated numbers of “natural-origin” fish.

Figure C-1 suggests that distinct population segment (DPS) scale productivity is approximately 1.0 at a population size of 37,353, or approximately 137% of the current population size (10-year geomean). The equilibrium population size is larger than the 10-year geomean because the number of natural-origin fish has been generally increasing during the past 10 years. If the increasing trend is due to variable climatic conditions, then the 10-year geomean is probably the best measure of abundance. If the increase is due to increase in rearing and/or migration habitat quality, then the equilibrium population size might be a better measure and population level numbers presented in Table C-3 might be underestimates.

The new information presented in Copeland *et al.*(2013) and Copeland *et al.*(2014) facilitate the first Snake River steelhead DPS-wide population level estimates of abundance. However, the results are preliminary and the time series is too short to estimate population level productivities. Regardless, more population level abundance estimates will be needed for high confidence in to estimate population level productivities. More studies like these should improve knowledge of steelhead population status throughout the DPS.

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APPENDIX D

Impairment of Salmon River Tributary Streams and Overall Impacts of Water Use on Flow in the Mainstem Salmon River Portion of the Middle Salmon River Watershed.

Table D-1. Tributary streams between Valley Creek (river mile [RM] 378.5) and the East Fork Salmon River (EFSR) (RM 343.0).

Tributary Name	River Mile	Acres Irrigated	Flow Allocated	Median August Flow (cfs)	% of August Flow Allocated	Intrinsic Potential Habitat (1,000 m^2)	
						Ch	St
Valley Creek	378.5	3,451	69.02	102.9	67	273	335
Nip and Tuck Creek	377.7	0.7	0.02	0.4	5	0	0
Four Aces Creek	376.8	-	-	1.4	0	0	0
Joes Gulch Creek	376.8	0.04	-	0.7	0	0	0
Elkhorn Creek	375.8	-	-	0.3	0	0	0
Little Casino Creek	374.6	-	-	4.1	0	0	16
Copper Creek	374.6	-	-	0.0	0	0	0
Big Casino Creek	374.3	17.0	1.50	5.7	26	0	27
Lynch Creek	373.8	-	-	0.2	0	0	0
Basin Creek	371.8	-	-	25.2	0	328	83
Rough Creek	370.5	-	-	4.7	0	0	2.6
Upper Harden Creek	370.5	-	-	1.8	0	0	7.5
Lower Harden Creek	370.1	-	-	1.7	0	0	7.6
American Creek	369.1	-	-	0.7	0	0	0
Blind Creek	386.8	-	-	1.4	0	0	0
Yankee Fork	368.3	16.0	18.21	113.0	16	196	290
Elk Creek	367.5	-	-	2.7	0	0	64
Muley Creek	366.3	-	-	1.7	0	0	1.6
Marshall Creek	365.7	-	-	0.4	0	0	0
Warm Springs Creek	364.6	12.5	1.67	87.7	2	167	98
Aspen Gulch	363.8	7.0	0.14	0.0	0	0	0
Peach Creek	362.8	49.8	1.79	6.1	29	0	29
Treon Creek	362.2	0.22	-	4.0	0	0	0
Gardner Creek	361.8	-	-	5.6	0	0	4.0
Cold Creek	360.8	-	-	0.2	0	0	0
Burnt Creek	360.4	-	-	0.4	0	0	0
Badger Creek	359.5	-	-	0.3	0	0	0
Beaver Creek	359.3	-	-	0.6	0	0	5.5
Slate Creek	358.0	36.5	3.10	19.5	16	124	73
Mill Creek	356.6	-	-	0.2	0	0	0
Holman Creek	355.5	-	-	0.8	0	0	8.5
Oster Gulch Creek	355.1	-	-	0.1	0	0	0
Thompson Creek	354.8	24.0	21.71	10.4	209	113	98
Spring Creek	354.1	-	-	0.2	0	0	0
French Creek	351.9	77.7	1.69	1.7	99	0	17
Squaw Creek	350.6	234.1	29.84	19.4	154	537	137
Sullivan Creek	350.0	26.2	2.20	1.9	116	0	9.6
Kinnikinic Creek	346.8	-	10.00	5.6	179	0	44
Spud Creek	344.2	21.4	1.50	1.4	107	0	13

Table D-2. Tributary streams between the EFSR (RM 343.0) and the Pahsimeroi River (RM 304.0).

Tributary Name	River Mile	Acres Irrigated	Flow Allocated	Median August Flow (cfs)	% of August Flow Allocated	Intrinsic Potential Habitat (1,000 m^2)	
						Ch	St
EF Salmon River	343.0	2,360	47.2	258	18	563	1,540
Birch Creek	342.5	-	-	0.8	0	0	5.5
Sink Creek	340.3	45.0	0.90	0.6	150	0	0
Lyon Creek	338.5	114.1	6.22	1.7	366	0	1.3
Rattlesnake Creek	337.8	-	-	1.2	0	0	0
Bradshaw Gulch Creek	337.5	-	-	0.7	0	0	14
Malm Gulch Creek	336.1	-	-	1.1	0	0	0
Bayhorse Creek	334.7	171.6	8.44	9.0	94	5.9	97
Germer Spring Creek	334.6	-	-	0.3	0	0	0
Wood Creek	333.3	-	-	0.2	0	0	0
Mud Springs Gulch	330.6	-	-	0.1	0	0	0
Bradbury Gulch	330.2	-	-	0.1	0	0	0
Birch Creek	329.5	21.0	0.50	0.8	63	0	5.5
Warm Spring Creek	324.4	-	1.88	10.7	18	0	0
Camp Creek	322.0	-	-	0.4	0	0	0
Leaton Gulch Creek	321.0	-	-	0.4	0	0	0
Garden Creek	320.9	722.6	27.18	6.2	438	16	85
Pennal Creek	319.0	-	-	0.6	0	0	1.2
Challis Creek	317.3	3,527.7	158.81	27.1	586	81	441
Stephens Gulch Creek	317.0	-	-	0.1	0	0	0
Dry Gulch Creek	315.8	-	-	0.1	0	0	0
Fuller Gulch Creek	315.5	-	-	0.0	0	0	0
Morgan Creek	313.4	770.0	53.91	15.6	346	68	206
Gerry Gulch Creek	312.7	-	-	0.2	0	0	0
Spring Gulch Creek	312.0	-	-	0.2	0	0	0
Shep Creek	309.1	-	-	0.2	0	0	0
Shotgun Creek	307.9	-	-	0.1	0	0	0
Ellis Creek	305.1	21.2	0.42	0.7	60	0	30

Table D-3. Tributary streams between the Pahsimeroi River (RM 304.0) and the Lemhi River (RM 261.3).

Tributary Name	River Mile	Acres Irrigated	Flow Allocated	Median August Flow (cfs)	% of August Flow Allocated	Intrinsic Potential Habitat (1,000 m^2)	
						Ch	St
Pahsimeri River	304.0	29,494	590	122	484	1,053	2,648
Deer Gulch Creek	303.3	-	-	0.05	0	0	0
Dry Gulch Creek	301.7	-	-	0.06	0	0	0
Cow Creek	299.0	177.7	4.75	7.69	62	0	12.3
Allison Creek	296.2	310.8	7.42	1.01	735	0	0
Hat Creek	293.8	152.6	5.08	6.75	75	7.6	24
Shep Creek	292.6	-	-	0.15	0	0	0
McKim Creek	292.3	258.7	5.14	4.17	123	0	4.3
Ezra Creek	291.2	84.0	1.49	0.16	931	0	0
Ringle Creek	288.9	10.0	0.20	0.21	95	0	0
Poison Creek	286.7	341.0	6.82	2.96	230	0	10.1
Cabin Creek	286.4	0.8	0.02	0.24	8	0	0
Iron Creek	285.9	375.5	17.51	9.34	187	24	89.4
Warm Springs Creek	285.1	82.0	1.06	2.78	38	0	9.4
Rye Grass Creek	283.7	26.2	1.00	0.01	7,692	0	0
Deer Creek	282.0	54.7	2.33	0.47	496	0	2.9
Lime Creek	281.6	3.0	0.06	0.07	92	0	0
Waddington Creek	280.5	76.8	2.12	0.20	1,060	0	0
Rattlesnake Creek	280.0	155.3	3.13	0.89	352	0	0.91
Second Creek	278.9	130.0	2.60	0.34	765	0	0
Briney Creek	277.1	6.2	0.12	0.20	60	0	0
Dummy Creek	276.4	-	-	0.08	0	0	0
Camp Creek	276.1	-	-	0.12	0	0	0
Birch Creek	275.4	-	-	0.18	0	0	0
Twelvemile Creek	273.6	234.6	7.13	3.71	192	0	15.1
Lake Creek	273.4	119.1	3.30	2.30	143	0	0
Tenmile Creek	270.6	12.4	0.47	0.30	157	0	0
Henry Creek	270.0	15.0	0.30	0.30	100	0	0.79
Sevenmile Creek	267.2	341.6	4.69	0.09	5,385	0	0
Hyde Creek	265.4	101.6	2.46	0.04	5,591	0	0
Williams Creek	267.1	748.9	15.15	2.62	578	0	40.9
Perreau Creek	264.5	579.2	12.19	1.55	786	0	0
Spring Creek	264.5	689.4	2.80	0.10	2,917	0	0
Gorley Creek	264.5	595.0	37.28	0.17	21,929	0	0
Hot Spring Creek	264.5	138.2	2.51	0.03	8,655	0	0
Pollard Creek	259.4	563.2	18.5	1.41	1,312	0	0

Table D-4. Tributary streams between the Lemhi River (RM 261.3) and the North Fork Salmon River (NFSR) (RM 237.2).

Tributary Name	River Mile	Acres Irrigated	Flow Allocated	Median August Flow (cfs)	% of August Flow Allocated	Intrinsic Potential Habitat (1,000 m^2)	
						Ch	St
Lemhi River	261.3	67,004	1,200	134	895	1,324	3,690
Bob Moore Creek	255.0	411.0	7.12	0.2	3,560	0	0
Fenster Creek	253.7	90.0	1.00	0.1	1,000	0	0
Deriar Creek	253.7	-	-	0.1	0	0	0
Carmen Creek	253.4	3,498.0	124.06	6.1	2,034	20	106
Wallace Creek	252.3	309.0	4.40	0.7	629	0	0.22
Diamond Creek	250.9	-	-	0.2	0	0	0
Badger Creek Gulch	250.4	-	-	0.0	0	0	0
Bird Creek	249.1	-	-	0.2	0	0	0
Tower Creek	249.2	468.5	9.83	1.5	655	0	29
Comet Creek	245.9	-	-	0.2	0	0	0
Kriley Creek	244.4	12.0	0.16	0.03	533	0	0
Fourth of July Creek	242.2	1,573.6	31.71	2.2	1,441	0	18
Napoleon Gulch Creek	241.4	-	-	0.1	0	0	0
Bobcat Gulch Creek	240.8	-	-	0.1	0	0	0
Maxwell Gulch Creek	239.2	55.0	1.10	0.1	1,100	0	0
Wagonhammer Creek	238.9	-	-	0.5	0	0	6.7
Dry Gulch Creek	238.7	60.0	1.00	0.02	5,000	0	0
Burns Gulch Creek	238.3	-	-	0.04	0	0	0

Table D-5. Tributary streams between the NFSR (RM 237.2) and the Middle Fork Salmon River (RM 198.7).

Tributary Name	River Mile	Acres Irrigated	Flow Allocated (cfs)	Median August Flow (cfs)	% of August Flow Allocated	Intrinsic Potential Habitat (1,000 m^2)	
						Ch	St
NF Salmon River	237.2	1,304	37	39.8	93	169	622
Donnelley Gulch	235.8	-	-	0.1	0	0	0
Rose Gulch	234.7	-	-	0.01	0	0	0
Camel Gulch	234.1	-	-	0.05	0	0	0
Deadwater Gulch	233.5	-	-	0.1	0	0	0
Buster Gulch	233.0	-	-	0.04	0	0	0
Dump Creek	232.8	-	-	2.6	0	0.21	0.76
Fan Gulch	232.0	-	-	0.1	0	0	0
Moose Creek	231.5	-	-	0.9	0	0	0.28
Sage Creek	229.1	24.0	0.48	0.4	120	0	0.21
Little Sage Creek	228.6	-	-	0.03	0	0	0
Indian Creek	226.7	133.2	2.45	5.5	45	22	74
Squaw Creek	226.6	105.6	2.11	1.4	151	0	20
East Boulder Creek	226.4	0.5	0.02	1.4	1.4	0	0
Sawlog Gulch	225.1	5.0	1.00	0.2	2,000	0	0
Hale Gulch	224.0	-	-	0.04	0	0	0
Transfer Gulch	224.9	-	-	0.02	0	0	0
Little Spring Creek	220.7	-	-	0.02	0	0	0
Spring Creek	219.8	63.9	1.93	1.7	114	0	98
McKay Creek	219.2	-	-	0.01	0	0	0
China Gulch	218.6		-	0.03	0	0	0
Boulder Creek	218.3	-	0.16	1.3	12	0	0.83
Pine Creek	216.8	63.0	1.89	2.9	65	0	15
Little Sheepeater Creek	216.2	-	-	0.1	0	0	0
Cohen Gulch	215.2	-	-	0.01	0	0	0
Big Sheepeater Creek	214.3	-	-	0.3	0	0	0
Halfway Gulch	214.3	-	-	0.03	0	0	0
Dutch Oven Creek	212.7	-	-	0.1	0	0	0
Panther Creek	210.1	1,308.6	40.80	99.8	40	286	561
Cove Creek	208.7	-	-	0.2	0	0	0
Owl Creek	207.5	28.5	0.69	6.4	11	6.0	49
Skull Gulch Springs	206.2	0.9	0.03	0.004	750	0	0
Ebenezer Creek	203.2	-	-	0.1	0	0	0
Lake Creek	203.0	25.0	0.50	0.7	71	0	0
Colson Creek	202.1	50.0	0.99	0.7	141	0	15
Shell Creek	201.6	8.5	0.16	0.05	320	0	0
Long Tom Creek	199.5	-	-	0.2	0	0	0

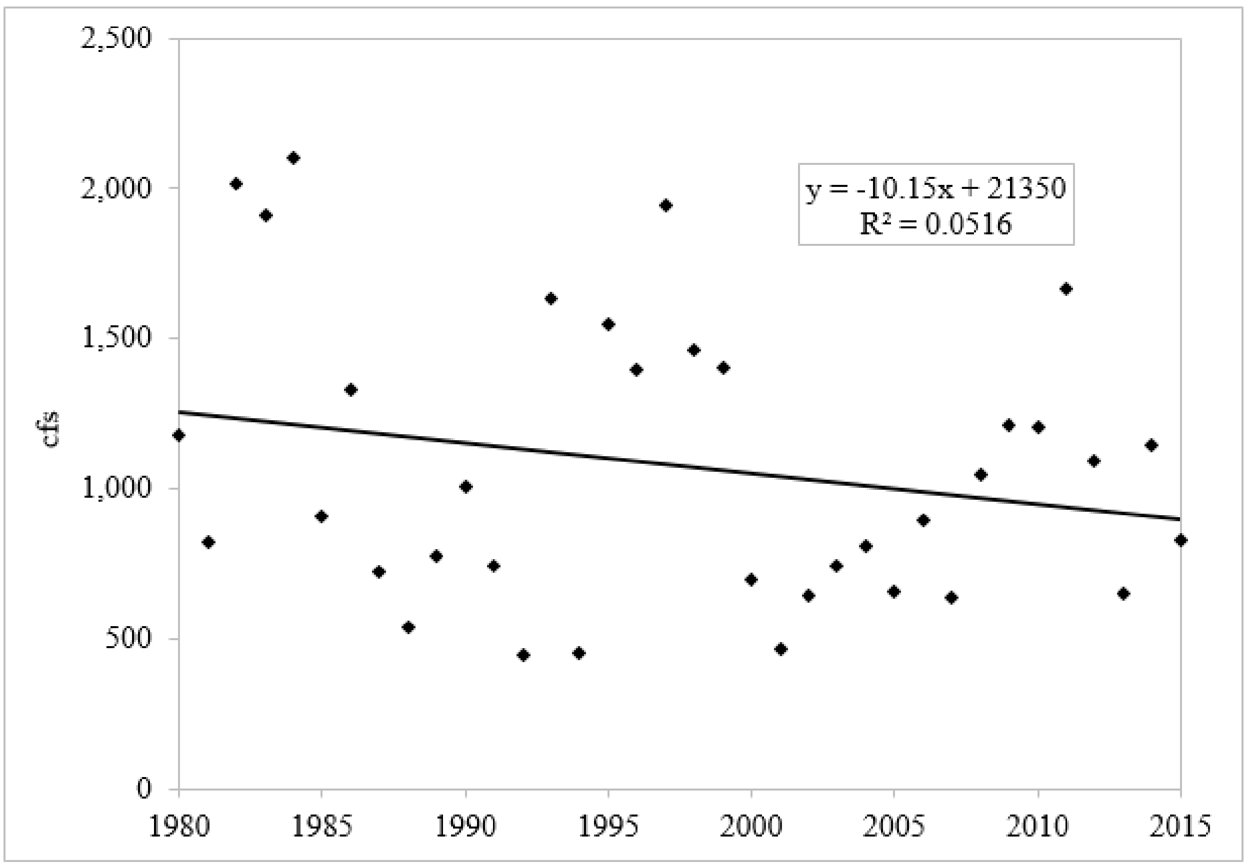
Table D-6. Estimated unimpaired mean monthly flow in tributary streams estimated with StreamStats (www.streamstats.usgs.gov) and estimated flows under current conditions (Baseline Flow) based on StreamStats and irrigation impacts presented in NMFS (2012a) and NMFS (2012b) and summarized in Appendix E.

Hat Creek						
Month	Unimpaired Flow (cfs)			Baseline Flow (cfs)		
	80%	50%	20%	80%	50%	20%
May	12.2	31.5	66	10.1	29.4	63.9
June	9.82	33.9	79.1	7.55	31.6	76.8
July	6.98	12.8	26.1	5.18	11.0	24.3
August	4.73	6.75	12.0	3.81	5.83	11.1
September	4.84	6.36	10.7	4.33	5.85	10.2
Williams Creek						
Month	Unimpaired Flow (cfs)			Baseline Flow (cfs)		
	80%	50%	80%	80%	50%	20%
May	40.5	19.1	7.38	0	7.9	29.3
June	45.5	20	6.49	0	8.0	33.5
July	9.82	4.72	2.77	0	0	0.35
August	4.52	2.64	1.89	0	0	0
September	3.91	2.41	1.88	0	0	1.21
Pollard Creek						
Month	Unimpaired Flow (cfs)			Baseline Flow (cfs)		
	80%	50%	20%	80%	50%	20%
May	8.93	23.0	49.4	0	12.5	38.9
June	10.5	27.3	59.1	0	16.0	47.8
July	2.91	4.75	9.71	0	0	0
August	1.94	2.69	4.5	0	0	0
September	1.76	2.26	3.58	0	0	0
Carmen Creek						
Month	Unimpaired Flow (cfs)			Baseline Flow (cfs)		
	80%	50%	20%	80%	50%	20%
May	97.5	112.2	124.9	35.4	50.0	62.7
June	116.6	164.8	243.4	50.1	98.2	176.8
July	57.6	62.8	90.5	4.98	10.2	37.9
August	28.9	29.2	30.1	1.79	2.09	3.04
September	16.2	16.5	16.8	1.22	1.46	1.76
Wallace Creek						
Month	Unimpaired Flow (cfs)			Baseline Flow (cfs)		
	80%	50%	20%	80%	50%	20%
May	3.16	8.44	18.5	13.1	3.0	0
June	3.61	9.81	22	16.2	4.0	0
July	0.67	1.18	2.64	0	0	0
August	0.48	0.65	1.28	0	0	0
September	0.44	0.56	1.04	0	0	0
May	15.4	6.68	2.15	8.27	0	0
June	15.4	5.26	1.08	7.77	0	0
July	4.79	2.2	1.52	0	0	0
August	2.11	1.46	1.08	0	0	0
September	2.07	1.48	1.22	0	0	0

Note: Baseline flows were estimated assuming that diversions permitted by the proposed actions would not be operated. Except Carmen Creek in which baseline flows were estimated from gage data and unimpaired flows were estimated by adding estimated impacts to flows estimated from gage data.

Table D-7. Amount of land irrigated in the upper Salmon River, amount of appropriation needed for the irrigation, consumptive use resulting from the irrigation, and mean August flow at the Salmon River at Salmon, Idaho and Salmon River near Shoup, Idaho gages.

Parameter	Salmon River at Salmon, Idaho Gage	Salmon River near Shoup, Idaho Gage
Irrigated agriculture upstream from gage	74,979 acres	161,824 acres
Maximum diversion rate assuming 0.02 cfs per acre	1,500 cfs	3,236 cfs
Annual consumptive use assuming 1.45 acre feet per acre/year	108,720 acre feet	234,645 acre feet
Instantaneous consumptive use assuming all use occurs during 150-day growing season	365 cfs	789 cfs
Mean August flow	1,016 cfs (1990-2015)	1,319 cfs (2003-2015)
Amount of August flow allocated	60%	71%



Note: The trend line indicates a decrease of 355 cfs since 1980, or approximately 30%.

Figure D-1. Average annual flow measured at the Salmon River at Salmon gage from 1980 through 2015.

APPENDIX E

Assorted Streamflow Gage Data for the Upper Salmon River Drainage

Table E-1. Mean monthly flow in Carmen Creek at the lower gage (station number 13305650), approximately 0.45 miles upstream from the mouth.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	.	.	.	.	.	.	1.5	0.4	0.4	0.5	5.9	11
2006	12	22	8.6	21	63	71	3.1	0.6	0.6	0.9	9.1	7.5
2007	5.3	7.8	18	14	54	30	0.9	0.7	0.7	2.0	9.6	15
2008	13	13	13	13	48	114	27	0.7	0.7	0.7	11	14
2009	10	10	13	21	79	148	19	2.4	1.0	1.8	12	13
2010	12	8.9	10	8.5	6.9	191	47	1.2	4.0	5.6	29	47
2011	18	16	13	11	43	210	98	3.3	1.0	2.5	14	11
2012	12	11	12	37	45	75	7.6	0.4	0.4	0.9	8.2	10
2013	11	9.2	9.4	10	25	26	2.8	0.2	0.5	.	.	.
80% Exceedance	**10**	**9.0**	**9.7**	**10**	**32**	**47**	**2.3**	**0.4**	**0.5**	**0.8**	**8.6**	**11**
50% Exceedance	**12**	**11**	**12**	**13**	**47**	**95**	**7.6**	**0.7**	**0.7**	**1.4**	**10**	**12**
20% Exceedance	**12**	**15**	**13**	**21**	**60**	**173**	**35**	**1.7**	**1.0**	**2.3**	**13**	**14**
Average	**12**	**12**	**12**	**17**	**46**	**108**	**23**	**1.1**	**1.0**	**1.9**	**12**	**16**

Note: Gage location is 45º 14’ 47" N 113º 53' 34" W and elevation is approximately 3,870 feet msl.

Table E-2. Mean monthly flow in Carmen Creek at the upper gage (station number 13305640). The gage is approximately 2 miles upstream from the Carmen Creek diversion (DEA 2076) and approximately 9.3 miles upstream from the Salmon River.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2005	.	.	.	.	.	.	20	8.5	4.7	4.7	4.7	4.2
2006	4.0	3.5	3.4	15	113	96	17	5.9	4.7	4.1	.	.
2007	.	.	.	.	.	42	8.8	4.9	4.2	4.5	.	.
2008	.	.	.	2.7	76	126	44	7.6	4.4	.	.	.
2009	.	2.3	2.4	11	83	116	26	10	5.0	.	.	.
2010	.	.	.	.	30	138	42	9.9	7.2	7.2	.	.
2011	.	3.6	3.1	5.2	69	183	109	18	8.0	.	.	.
2012	4.1	3.7	4.1	35	78	89	24	7.2	4.7	.	.	.
2013	.	.	.	6.8	71	64	17	5.4	4.7	.	.	.
80% Exceedance	**.**	**3.1**	**2.8**	**5.2**	**69**	**74**	**17**	**5.7**	**4.5**	**4.4**	**.**	**.**
50% Exceedance	**.**	**3.6**	**3.3**	**8.6**	**76**	**106**	**24**	**7.6**	**4.7**	**4.6**	**.**	**.**
20% Exceedance	**.**	**3.6**	**3.7**	**15**	**82**	**133**	**43**	**10**	**5.9**	**5.7**	**.**	**.**
Average	**4.0**	**3.3**	**3.3**	**13**	**74**	**107**	**34**	**8.6**	**5.3**	**5.2**	**4.7**	**4.2**

Note: The gage location is 45º20’42", 113º47'22" and elevation is approximately 5,780 feet msl.

Table E-3. Mean monthly flow in Iron Creek at the Iron Creek gage (station number 13302080).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2013										17	22	16
2014	13	12	13	25	91	51	16	12	9.3	10	13	11
2015	15	14	18	40	89	51	15	8.3	7.8	7.4		
Average	14	13	15	33	90	51	16	10	8.6	11	17	13

Note: The gage is approximately 0.06 miles upstream from the Salmon River. The gage location is 44º53’16" N 113º58'14" W and the elevation is approximately 4,380 feet msl.

Table E-4. Mean monthly flow in the North Fork Salmon River (NFSR) near the mouth (station number 13306000).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1929										32	36	38
1930	33	36	41	157	256	169	54	39	36	39	35	30
1931	32	31	34	60	220	126	37	22	25	29	31	30
1932	28	31	35	73	407	334	108	46	37	46	49	31
1933	35	31	38	84	242	604	115	50	38	46	49	48
1934	48	47	89	303	272	97	40	25	28	42	44	41
1935	39	35	40	84	255	272	78	29	26	34	42	30
1936	30	31	46	230	454	263	77	46	45	41	45	43
1937	30	31	37	46	235	175	66	32	27	31	36	43
1938	36	36	42	102	327	363	121	47	37	43	45	42
1939	40	38	57	161	418	226	90	40	40	45	.	.
2005	.	.	.	.	.	.	98	50	39	47	46	56
2006	38	37	40	164	702	391	92	53	43	54	52	38
2007	40	37	68	105	355	198	70	40	40	52	46	41
2008	40	40	39	79	574	.	.	.	.	.	.	.
Average	36	36	46	127	363	268	80	40	36	41	43	39

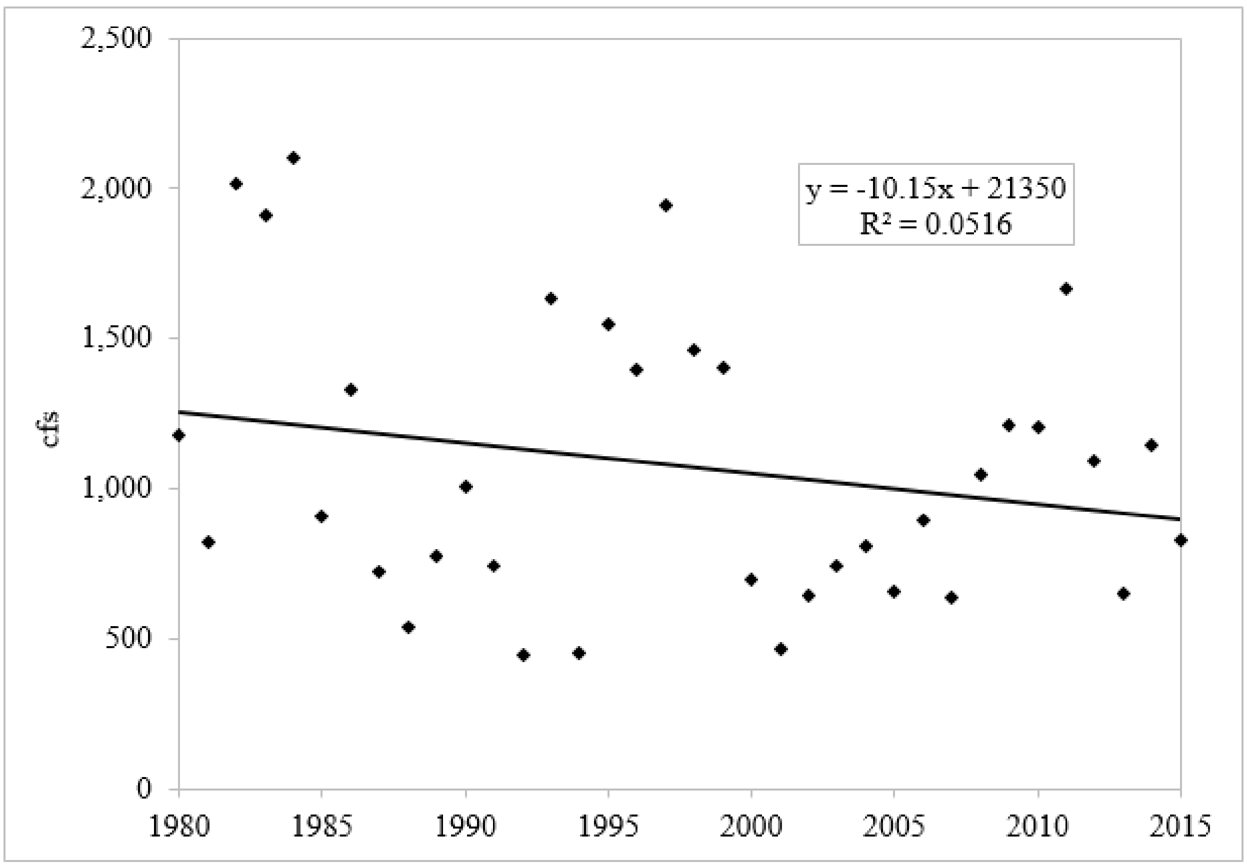
Note: The gage is approximately 1,100 feet upstream from the Salmon River. The gage location is 45º24’27" N 113º59'35" W and the elevation is approximately 3,620 feet msl.

Table E-5. Minimum daily flow and date that the minimum flow occurred in the NFSR near the mouth (station number 13306000).

Month	2005		2006		2007			
	cfs	Date	cfs	Date	cfs	Date	cfs	
January	.	.	30	17	25	14	35	14
February	.	.	30	8	30	3	31	18
March	.	.	32	21	30	3	31	28
April	.	.	57	3	72	4	33	2
May	.	.	284	11	227	31	136	2
June	180	30	162	29	100	29	.	.
July	64	27	49	30	54	24	.	.
August	33	31	44	24	32	31	.	.
September	29	6	39	8	32	6	.	.
October	40	1	36	31	43	14	.	.
November	33	25	25	30	30	30	.	.
December	50	31	30	20	30	1	.	.

Table E-6. Amount of land irrigated in the upper Salmon River, amount of appropriation needed for the irrigation, consumptive use resulting from the irrigation, and mean August flow at the Salmon River at Salmon, Idaho and Salmon River near Shoup, Idaho gages.

Parameter	Salmon River at Salmon, Idaho Gage	Salmon River near Shoup, Idaho Gage
Irrigated agriculture upstream from gage	74,979 acres	161,824 acres
Maximum diversion rate assuming 0.02 cfs per acre	1,500 cfs	3,236 cfs
Annual consumptive use assuming 1.45 acre feet per acre/year	108,720 acre feet	234,645 acre feet
Instantaneous consumptive use assuming all use occurs during 150-day growing season	365 cfs	789 cfs
Mean August flow	1,016 cfs (1990-2015)	1,319 cfs (2003-2015)
Amount of August flow allocated	60%	71%



Note: The trend line indicates a decrease of 355 cfs since 1980, or approximately 30%.

Figure E-1. Average annual flow measured at the Salmon River at Salmon gage from 1980 through 2015.

APPENDIX F

Impacts per Irrigated Acre in Challis Creek and Lemhi River Tributary Drainages and Estimated Impacts of Proposed Actions on Flow in Williams, Wallace, Carmen, and Tower Creeks, Based on Challis Creek and Lemhi River Drainage Data

Table F-1. Per irrigated acre impact of water use in Challis Creek and five Lemhi River tributaries.

Drainage	Average Impact (cfs) on Streamflow per Acre of Irrigated Land in the Source Drainage			
	May	June	July	August
Big Eightmile Creek	0.00429	0.01367	0.00687	0.00383
Big Timber Creek	0.01193	0.02091	0.00943	0.00373
Canyon Creek	0.03118	0.05141	0.03207	0.00883
Eighteenmile Creek	0.02517	0.03637	0.01719	0.00608
Texas Creek	0.01243	0.02562	0.00624	0.00112
Challis Creek	0.02662	0.03747	0.01981	0.02540
Average	**0.01861**	**0.03091**	**0.01527**	**0.00816**

Note: Estimates are based on information from water rights records, streamflow gage data, and data from U.S. Forest Service streamflow studies. Methods for developing estimates are described in NMFS (2012a) and NMFS (2012b).

Table F-2. Estimated impact of operating the South Fork Williams Creek Diversion (DEA 2073) on flow in South Fork Williams Creek downstream from the diversion and on Williams Creek downstream from South Fork Williams Creek.

Water Right	Maximum Diversion Rate	Acres Irrigated	Impact (cfs) on Flow in South Fork Williams Creek and Williams Creek			
			May	June	July	August
75-4128	3.2	149.8	2.80	3.00	2.37	1.22
Total	**3.2**	**149.8**	**2.80**	**3.00**	**2.37**	**1.22**

Table F-3. Estimated impact of operating the Carmen Creek Diversion (DEA 2076) on flow in Carmen Creek downstream from the diversion.

Water Right	Maximum Diversion Rate	Acres Irrigated	Impact (cfs) on Flow in Carmen Creek			
			May	June	July	August
75-63A	1.3	106	1.97	3.28	1.62	0.87
75-2002	1.08	63.9	1.19	1.97	0.98	0.52
75-4332	0.9	NA	.	.	.	.
Total	**2.4**	**169.9**	**2.4**	**2.4**	**2.4**	**1.39**

Table F-4. Estimated impact of operating the Wallace Creek Diversion (DEA 2103) on flow in Wallace Creek downstream from the diversion.

Water Right	Maximum Diversion Rate	Acres Irrigated	Impact (cfs) on Flow in Wallace Creek			
			May	June	July	August
75-87C	0.4	18.8	0.35	0.58	0.29	0.15
75-2099	Storage	12	.	.	.	.
Total	**0.4**	**18.8**	**0.35**	**0.40**	**2.29**	**0.15**

Table F-5. Estimated impact of operating the East Fork Tower Creek Diversion (DEA 2077) on flow in East Fork Tower Creek downstream from the diversion and on Tower Creek downstream from East Fork Tower Creek.

Water Right	Maximum Diversion Rate	Acres Irrigated	Impact (cfs) on Flow in East Fork Tower Creek and Tower Creek			
			May	June	July	August
75-4139	0.16	10	0.19	0.31	0.15	0.08
75-4140	0.15	26	0.48	0.80	0.40	0.21
75-4144A	0.03	2	0.04	0.06	0.03	0.02
75-4144B	0.55	28	0.52	0.87	0.43	0.23
75-4345B	0.44	20.9	0.39	0.65	0.32	0.17
Total	**1.33**	**86.9**	**1.33**	**1.33**	**1.33**	**0.71**

References

National Marine Fisheries Service (NMFS). 2012a. Endangered Species Act Section 7(a)(2) Biological Opinion And Magnuson- Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Diversions located on the Salmon-Challis National Forest in the Lemhi River Watershed, HUC 17060204, Lemhi County, Idaho. NMFS Consultation Number: 2005/00061

NMFS. 2012b. Endangered Species Act – Section 7 (a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Diversions Located on National Forest Lands in the Upper Salmon River Watershed, HUCs1706020117 and 1706020118, Custer County, Idaho. NMFS Consultation Number F/NWR/2004/01982

APPENDIX G

Estimates of Juvenile Outmigrants for SRLM Chinook salmon, Lemhi River Chinook Salmon, Pahsimeroi River Steelhead, and Lemhi River Steelhead.

Lemhi River and Salmon River Lower Mainstem Chinook Salmon Population Estimates

Salmon River Lower Mainstem Chinook Salmon Estimated Adult Returns

Lemhi River Chinook salmon index reach redd counts, Lemhi River Chinook salmon multiple pass redd counts, Salmon River Lower Mainstem (SRLM) index reach redd counts, and SRLM estimated multiple pass redd counts are in Table G-1. More than 99% of Chinook salmon spawning in the mainstem Lemhi River occurs within the index reaches; however, because index reach counts are single pass, the multiple pass counts identified an average of 30% more redds than the index reach counts. The SRLM index reaches include all historically used Chinook salmon spawning habitat in the mainstem Salmon River portion of the SRLM population area and all currently used spawning habitat in the population area. Multiple pass redd counts have not been conducted in the SRLM population area. National Marine Fisheries Service (NMFS) estimated SRLM multiple pass redd counts by multiplying the index reach counts by the ratio of average Lemhi River redds counted in the multiple pass and index reach counts (i.e., 81.8/66.0). NMFS assumed that multiplying the SRLM estimated multiple redd counts by two (i.e., two spawners per redd) provided the best available estimate of SRLM Chinook salmon adult returns. Under this assumption, the geomean population size for 2006 through 2015 is 149.2 (i.e., 74.6*2).

Table G-1. Lemhi River Chinook salmon index reach and multiple pass redd counts; SRLM Chinook salmon index reach redd counts, and SRLM multiple pass redd counts estimated by multiplying SRLM index reach counts by the ratio of Lemhi River multiple pass and index reach counts.

Brood Year	Lemhi River Redds, Index Reach Counts	Lemhi River Redds, Multiple Pass Redd Counts	SRLM Redds Index Counts	SRLM Index Counts * (81.8/66.0) (i.e., Estimated Multiple Pass Redd Counts)
1992	15	15	26	33.9
1993	23	37	48	62.6
1994	7	20	9	11.7
1995	5	9	6	7.8
1996	29	29	23	30.0
1997	50	50	48	62.6
1998	40	41	31	40.4
1999	35	48	23	30.0
2000	85	93	80	104.4
2001	316	339	120	156.5
2002	135	135	233	304.0
2003	47	71	116	151.3
2004	30	31	115	150.0
2005	37	50	53	69.1
2006	25	38	52	67.8
2007	19	29	49	63.9
2008	25	33	57	74.4
2009	61	70	48	62.6
2010	32	90	63	82.2
2011	41	121	115	150.0
2012	63	135	95	123.9
2013	60	97	21	27.4
2014	208	217	124	161.8
2015	116	164	30	39.1
Average 1992-2015	**62.7**	**81.8**	**66.0**	**86.2**
Geomean 1992-2015	**40.6**	**57.5**	**48.7**	**63.5**
Geomean 2006-2015	**49.4**	**81.5**	**57.2**	**74.6**

Lemhi River Chinook Salmon Estimated Adult Returns

Multiple pass redd counts started in the mainstem Lemhi River in 1992. Redd counts started in all available habitat in the Hayden Creek drainage in 2002. Counts in 2002 and 2003 appear to be single pass counts but counts in all subsequent years are multiple pass. NMFS assumed that number of redds counted in multiple pass redd counts was the approximate number of redds constructed in the surveyed stream reaches and assumed that each redd represented two adult returns. Redd counts in the mainstem Lemhi River and the Hayden Creek drainage included all currently used Chinook salmon spawning habitat in the Lemhi River Chinook salmon population area. Therefore, estimated number of Lemhi River Chinook salmon adult returns was the total number of redds counted in the mainstem Lemhi River and the Hayden Creek drainage times two. Redds counted in the mainstem Lemhi River and the Hayden Creek drainage are in Table

G-2. The estimated geomean population size for 2006 through 2015 is 236.8 (i.e., 118.4 *2). Since 2002, an average of 28% of redds counted in the Lemhi River population area have been in the Hayden Creek drainage.

Table G-2. Redds counted in the mainstem Lemhi River and in the Hayden Creek drainage (mainstem Hayden Creek and Bear Valley Creek) from 2002-2015.

Brood Year	Lemhi River Redds, Multiple Ground Counts	Hayden Creek Drainage Redds, Multiple Ground Counts 2005-2015	Total Redds Counted in the Lemhi River Chinook Salmon Population Area	Percentage of Redds Counted in the Hayden Creek Drainage
2002	135	44	179	25
2003	71	24	95	25
2004	31	10	41	24
2005	50	14	64	22
2006	38	13	51	25
2007	29	31	60	52
2008	33	9	42	21
2009	70	17	87	20
2010	89	37	126	29
2011	134	68	202	34
2012	135	26	161	16
2013	97	34	131	26
2014	217	71	288	25
2015	164	149	313	48
Average 2002-2015	**92.4**	**39.1**	**131.4**	**28.0**
Geomean 2002-2015	**75.9**	**28.3**	**106.5**	**26.6**
Geomean 2006-2015	**82.2**	**32.8**	**118.4**	**27.7**

Note: All except the 2002 through 2003 Hayden Creek drainage counts are multiple pass ground counts.

Estimated Number of Smolts Migrating from the Lemhi River and Salmon River Lower Mainstem Population Areas

Idaho Department of Fish and Game operates a juvenile screw trap in the mainstem Lemhi River at the location of the old Lemhi River fish sampling weir, just upstream from Hayden Creek. This trap samples juveniles migrating downstream from spawning reaches upstream. Since the early 1990s, approximately 99% of Chinook salmon spawning in the mainstem Lemhi River spawn upstream from this trap and, therefore, essentially all juvenile Chinook salmon spawned in the mainstem must migrate past the trap during their downstream migration. We estimated number of juvenile Chinook salmon migrating downstream past the trap using tag recapture methods. Approximately 85% of juveniles move downstream past the screw trap during the summer and fall as parr and overwinter between the screw trap and Lower Granite Dam (LGD). Copeland and Venditti (2009) found that Pahsimeroi River Chinook salmon that move downstream past the Pahsimeroi River screw trap as parr survive to LGD at approximately half the rate as Chinook salmon that move past the trap as yearling smolts during spring. The difference is presumably due to overwinter mortality. We therefore assumed that approximately half of parr moving past the trap would survive to become smolts. Under this assumption, estimated number of smolts moving out of the Lemhi River was the estimated number of parr moving past the trap, divided by two, plus the estimated number of smolts moving past the trap. Estimated number of smolts migrating downstream out of the mainstem Lemhi River is in the third column of Table G-3. Estimated geomean number of smolts migrating out of the mainstem upper Lemhi River for the most recent ten years for which data are available (i.e., 2004 through 2013 brood years) is 7,115 (Table G-3).

A juvenile screw trap has also been operated on lower Hayden Creek for a number of years. However, NMFS does not have ready access to data from this trap and the data was not included in the biological assessment (BA). In the absence of information, we assumed that smolt production, per redd counted, in Hayden Creek was the same as in the upper mainstem Lemhi River. Number of smolts migrating out of the Hayden Creek drainage, estimated under the assumption of equal smolts per redd as in the upper mainstem Lemhi River, are in the seventh column of Table G-3. Estimated geomean number of smolts migrating out of the Hayden Creek drainage for the most recent 10 years for which data are available (i.e., 2004 through 2013 brood years) is 2,521 (Table G-3). Essentially all Chinook salmon spawning in the Lemhi River population area occurs in the Hayden Creek drainage and in the mainstem Lemhi River upstream from Hayden Creek. We therefore assumed that the best estimate for number of smolts migrating out of the Lemhi River Chinook salmon population area was the estimated number migrating out of the upper mainstem Lemhi River (i.e., 10-year geomean = 7,115) plus the number migrating out of the Hayden Creek drainage (i.e., 10-year geomean = 2,521), or approximately 9,636 smolts.

There are no juvenile screw trap data available for the SRLM Chinook salmon population. In the absence of information, we assumed that smolt production, per redd counted, in the SRLM population area was the same as in the upper mainstem Lemhi River. Number of smolts migrating out of the SRLM population area, estimated under the assumption of equal smolts per redd as in the upper mainstem Lemhi River, are in the eighth column of Table G-3. Estimated geomean number of smolts migrating out of the SRLM Chinook salmon population area for the most recent ten years for which data are available (i.e., 2004 through 2013 brood years) is 9,278 (Table G-3).

Table G-3. Number of Chinook salmon smolts from the mainstem upper Lemhi River, estimated from screw trap data with tag recapture methods, and number of Chinook salmon smolts from the Hayden Creek drainage and the SRLM population area estimated assuming equal smolt production per redd as in the mainstem upper Lemhi River.

Brood Year	Lemhi River Redds, Multiple Ground Counts	Smolts from Mainstem Upper Lemhi River	Smolts per Lemhi River Redd	Hayden Creek Drainage Redds, Multiple Ground Counts	SRLM Redds, Estimated Multiple Ground Counts (Table F-1)	Smolts per Lemhi River Redd * Redds	
						Hayden Creek	SRLM
1996	29	4,130	142	NA	30.0	NA	4,272
1997	50	25,171	503	NA	62.6	NA	31,514
1998	41	7,146	174	NA	40.4	NA	7,042
1999	48	7,145	149	NA	30.0	NA	4,465
2000	93	6,821	73	NA	104.4	NA	7,657
2001	339	17,255	51	NA	156.5	NA	7,966
2002	135	10,930	81	44	304.0	3,562	24,613
2003	71	5,029	71	24	151.3	1,700	10,717
2004	31	5,615	181	10	150.0	1,811	27,170
2005	50	4,038	81	14	69.1	1,131	5,581
2006	38	2,274	60	13	67.8	778	4,056
2007	29	2,518	87	31	63.9	2,692	5,548
2008	33	4,161	126	9	74.4	1,135	9,380
2009	70	23,573	337	17	62.6	5,725	21,081
2010	89	14,375	162	37	82.2	5,976	13,277
2011	134	19,410	145	68	150.0	9,850	21,728
2012	135	8,200	61	26	123.9	1,579	7,526
2013	97	11,418	118	34	27.4	4,002	3,225
Average All Years	**84.0**	**9,956**	**144.5**	**27.3**	**97.3**	**3,328**	**12,045**
Geomean All Years	**65.8**	**7,800**	**118.6**	**22.9**	**79.2**	**2,566**	**9,514**
Geomean 2004-2013	**60.1**	**7,115**	**118.4**	**21.3**	**78.4**	**2,521**	**9,278**

Lemhi River and Pahsimeroi River Steelhead Population Estimates

The estimated 10-year geomean population size for the Pahsimeroi River and Lemhi River steelhead populations, respectively, is 649 adult returns and 783 adult returns (Appendix C). Although juvenile screw traps are operated within both population areas: the data are not readily obtainable by NMFS; the data were not included in the BA; an unknown but likely substantial numbers of steelhead spawn downstream from the screw traps; and the traps capture both resident and anadromous *O. mykiss* which are indistinguishable. For all of these reasons, the screw trap data are not useful for estimating numbers of juvenile smolts migrating downstream from the Pahsimeroi River and Lemhi River steelhead population areas. In the absence of fish sampling data useful for estimating number of steelhead smolts, we assumed number of smolts would be equal to estimated number of adult returns divided by the smolt to adult return rate of 1.58% reported by Tuomikoski *et al.*(2013). Under this assumption, the 10-year geomean number of smolts migrating from the Pahsimeroi River and Lemhi River steelhead populations, respectively, is 41,076 and 49,447.

References

Copeland, T. and D. A. Venditti. 2009. Contribution of three life history types to smolt production in a Chinook salmon (*Oncorhynchus tshawytscha*) population. Canadian Journal of Fisheries and Aquatic Sciences. 66:1658-1665.

Tuomikoski, J., J. McCann, B. Chockley, H. Schaller, S. Haeseker, J. Fryer, R. Lessard, C. Petrosky, E. Tinus, T. Dalton, and R. Ehlke. 2013. Comparative Survival Study of PIT tagged Spring/Summer/Fall Chinook, Summer Steelhead, and Sockeye. 2013 Annual Report, BPA Contract #19960200. 47 pp. Appendices.

APPENDIX H

Flows Needed to Meet Passage Depth Criteria in Dewatered Salmon River and Lemhi River Tributary Streams

Methods: We reviewed U.S. Geological Survey (USGS) and U.S. Bureau of Reclamation (BOR) flow studies conducted in the upper Salmon and Lemhi Rivers (Maret *et al.*2005; Maret *et al.*2006; Morris and Sutton 2007; Sutton and Morris 2005; Sutton and Morris 2006) to determine flows needed to meet Thompson's depth criteria (Thompson 1975) for steelhead in seasonally dewatered Lemhi River and Salmon River tributaries (Table H-1). We assumed that the seasonally dewatered portions of tributaries affected by the proposed actions would be similar to the dewatered reaches surveyed in the USGS and BOR flow studies. We also assumed that Thompson's criteria for steelhead would be sufficient for Chinook salmon that would likely spawn in Salmon River tributaries.

Table H-1. Flow needed to meet Thompson's depth criteria for steelhead in Lemhi and Salmon River tributaries that were periodically dewatered at the time of the surveys.

Tributary	Tributary of:	Drainage Area	Elevation of Mouth	Flow (cfs) to Achieve Passage Depth of 0.6 feet
Morgan Creek	Salmon River	107.0	4,770	11.2
Challis Creek	Salmon River	148.0	4,850	9.7
Beaver Creek	Salmon River	15.2	7,100	9.3
Bohannon Creek	Lemhi River	21.2	4,320	6.0
Big Eightmile Creek	Lemhi River	28.6	5,690	5.0
Canyon Creek	Lemhi River	59.2	5,930	13.0
Eighteenmile Creek	Lemhi River	218.3	5,970	6.0
Average				**9.0**

References

Maret, T.R., Hortness, J.E., and Ott, D.S. 2005. Instream flow characterization of upper Salmon River Basin streams, Central Idaho, 2004: U.S. Geological Survey Scientific Investigations Report 2005-5212, 124 pp.

Maret, T. R., J. E. Hortness, and D. S. Ott. 2006. Instream flow characterization of upper Salmon River Basin streams, central Idaho, 2005: U.S. Geological Survey Scientific Investigations Report 2006-5230, 110 pp.

Morris, C., and R. Sutton. 2007. Instream Flow Assessment Hawley Creek and Eighteenmile Creek, Idaho. U.S. Department of the Interior, Bureau of Reclamation, Snake River Area Office, Boise, Idaho. 161 pp.

Sutton, R., and C. Morris. 2005. Instream Flow Assessment Big Eightmile Creek, Bohannon Creek, and Hayden Creek, Idaho. U.S. Department of the Interior, Bureau of Reclamation Snake River Area Office, Boise, Idaho. 183 pp,

Sutton, R., and C. Morris. 2006. Instream Flow Assessment Upper Lemhi River and Canyon Creek, Idaho. U.S. Department of the Interior, Bureau of Reclamation, Snake River Area Office, Boise, Idaho. 167 pp.

Thompson, K. 1972. Determining stream flows for fish life. Presented at: Pacific Northwest River Basins Commission, Instream Flow Requirement Workshop, Vancouver, Washington. March 15-16, 1972. Pages 31-50, Appendix.

APPENDIX I

State of Idaho form NTD1:12/00, to be used to record amount of water diverted via diversions on Salmon-Challis National Forest land in the Lower Salmon River watershed.

NTD1:12/00

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
WATER MEASUREMENT ANNUAL REPORT
REPORTING YEAR____________

OPEN CHANNEL MEASUREMENT OR NON-TOTALIZING DEVICE

ATTENTION: Year-end data must be submitted to Idaho Department of Water Resources, 322 East Front Street, Boise, ID 83720, on or before **January 15** of the ensuing year.

A separate reporting form must be submitted for each diversion. Refer to page 5 for instructions.

Name: ____

Water Source: ____

Water Right No: ____

Legal Description: ***T***_______ ***R***_______ ***Sec.***_______ _______☐_______☐_______☐

Site Tag No: ____

Diversion Name: ____

SECTION I Water Right Holder/Operator Information

(If there are multiple water right holders on a common ditch or conveyance system, please designate the contact person below)

Current Water Right Owner Please check for address correction ☐

Name______________________________________ Phone________________________

Last, First, MI

Address____________________________________ Fax__________________________

City_______________________________________ Mobile_______________________

State & Zip_________________________________ e-mail_______________________

Operator or Contact Person *(if different from owner)*

Name______________________________________ Phone________________________

Last, First, MI

Address____________________________________ Fax__________________________

City_______________________________________ Mobile_______________________

State & Zip_________________________________ e-mail_______________________

Original Owner *(if sold within last year)*

Name______________________________________ Phone________________________

Last, First, MI

Address____________________________________

City, State & Zip____

SECTION II Water Measurement Log ***(measurements must be recorded at least once per week and in units of cubic feet per second.)***

DAY	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
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22						
23						
24						
25						
26						
27						
28						
29						
30		--------				
31		--------		--------		--------

SECTION II Water Measurement Log (Continued). ***(measurements must be recorded at least once per week and in units of cubic feet per second.)***

DAY	JULY	AUGUST	SEPT	OCTOBER	NOVEMBER	DECEMBER
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
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26						
27						
28						
29						
30						
31			--------		--------	

SECTION III Measuring Device Information

Type & Description of Measuring

Device(s):____

____

____

B. Period of Use: For seasonal or partial year diversion/use, show turn-on (start) and turn-off (end) dates:

Beginning diversion date______/______ Ending diversion date______/______
month day month day

C. Attach copies of all measuring device rating tables to this report (omit if previously supplied to the Department).

SECTION IV Modifications made to water system

Please describe in the space below any major modification made to the diversion works or measuring device which would affect the accuracy of the flow measurement during the reporting year. Attach drawings, sketches, notes or design information if needed.

____

____

____

SECTION V Certification

I hereby certify that the information reported is correct to the best of my knowledge and that I recognize that willful submittal of false or inaccurate data is a violation of law subject to the penalty provisions of Sections 42-311, 42-350 and 42-351, Idaho Code.

____ ______________________

Signature Title Date

IMPORTANT: Each reporting form shall be accompanied by a report processing fee in the amount of **twenty-five dollars ($25) per diversion** made payable to the Idaho Department of Water Resources. (Section 42-701(6), Idaho Code). Fee may be waived if no diversions are made during the reporting year.

For Department Use Only

Received by____________________ Date____________________ Time___________

Fee amount submitted_____________ Correct? yes_____no_____

Receipted by____________________ Receipt No._______________

Reviewed by____________________ Date_____________________

Data entry by___________________ Date_____________________

Max Div Rate (cfs)_______________ Date_______________ Total Vol (acre-feet)______________

Instructions for Completing Non-Totalizing Report Form

This report form is for all open channel measurements. The form may also be used for closed conduit measuring devices which do not totalize volume. Supplemental forms must be completed for open channel measurements which are based on rated sections or rated structures.

A label has been attached to page 1 of the report form which identifies the diversion name or facility, source of water, and water right owner or contact name. The water right owner name may be blank if there are multiple water right holders from the same diversion. The diversion or facility name describes either the name of the diversion (*i.e.; Bell Ditch*), or the name of the diversion facility (*i.e.; Idaho Trout Co. Hatchery at Billingsley Creek*). The label must remain attached to the form.

Section I: Please use this section to identify the current water right owner. If the current owner is a new owner within the last 12 months, please list the former or original owner in the space provided. If a person other than the water right owner is submitting the report and/or is the person who should be contacted regarding measurement of this diversion, please identify that person and his or her address and phone number in the space provided under 'Operator or Contact Person'.

Section II: This section may be used to show daily diversion rates. **Each diversion must be measured and recorded at least once per week** (once every seven days) or more frequently if conditions change or diversion adjustments are made. All flows must be recorded in cubic feet per second (CFS). **Weekly measurements and recordings must be made unless IDWR or the measurement district has authorized a different schedule.** Record the diversion flow rate on this form for each day a measurement is taken. Daily flows may be recorded if the user wishes or is already measuring on a daily basis. A flow rate of 0 (zero) cfs should be entered for any day where water is not diverted. Total annual flow and volume will be computed by IDWR or the district. **IDWR will assume constant flow rates between measurements.**

Section IIIA: Please use this section to describe the type of measuring device or devices being used. *Example: 'A six foot contracted Cippolletti weir installed in ditch approximately 100 feet below headgate.'* An additional description may be required for more complex measurements, or for multiple measuring devices from the same source. *Example: 'Three separate four foot suppressed rectangular weirs, and two separate five foot contracted rectangular weirs installed in outflow of fish hatchery raceways. Measurements at these five weirs are combined to account for total diversion from Spring Creek as reported in Section 2 of this report.*'

Section IIIB: For seasonal use (*i.e.;* irrigation), or diversions/use made during only part of the year, please show the beginning (turn-on) and ending (turn-off) diversion dates for annual period of use. Short periods of non-use within the season should be shown on the log sheet as 0 (zero) cfs daily flow rates.

Section IIIC: Attach copy of measuring device table if this is the first year of reporting or if you have not previously submitted a measuring device table to IDWR with a previous water measurement report. *(Submittal of tables in future years will be required only if existing measuring device has been changed or re-rated, or if a new measuring device has been installed.)*

Section IV: Use this space to submit additional explanation or any comments pertaining to your measurements.

Section V: Affix signature, title and date in space provided and submit $25 report processing fee with report.