United States Department of the Interior

U.S. Fish and Wildlife Service

Idaho Fish and Wildlife Office
1387 S. Vinnell Way, Room 368
Boise, Idaho 83709
Telephone (208) 378-5243
http://www.fws.gov/idaho

Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

JUL 2 7 2016

Subject: Coleman Hydroelectric Project, Lemhi County, Idaho—Biological Opinion—FERC No. 13629
In Reply Refer to: 01EIFW00-2016-F-0394

Dear Ms. Bose:

Enclosed are the U.S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) and concurrence with the Federal Energy Regulatory Commission's (Commission) determinations of effect on species listed under the Endangered Species Act (Act) of 1973, as amended, for the proposed Coleman Hydroelectric Project in Lemhi County, Idaho. In a letter dated February 12, 2016, and received by the Service on February 18, 2016, the Commission requested formal consultation on the determination under section 7 of the Act that the proposed project is likely to adversely affect bull trout (*Salvelinus confluentus*). The Commission also determined that the proposed project will have no effect on the yellow-billed cuckoo (*Coccyzus americanus*) or the Canada lynx (*Lynx canadensis*). The Service acknowledges these determinations.

The enclosed Opinion and concurrence are based primarily on our review of the proposed action, as described in your February 12, 2016, Final Environmental Assessment, the anticipated effects of the action on listed species, and other pertinent information, and were prepared in accordance with section 7 of the Act. Our Opinion concludes that the proposed project will not jeopardize the survival and recovery of bull trout, and will not result in the destruction or adverse modification of critical habitat. A complete record of this consultation is on file at this office.

<u>Clean Water Act Requirement Language:</u>

This Opinion is also intended to address section 7 consultation requirements for the issuance of any project-related permits required under section 404 of the Clean Water Act. Use of this letter associated Opinion to document that the Army Corps of Engineers (Corps) has fulfilled its responsibilities under section 7 of the Act is contingent upon the following conditions:

1. The action considered by the Corps in their 404 permitting process must be consistent with the proposed project as described in the Assessment such that no detectable difference in the effects of the action on listed species will occur.
2. Any terms applied to the 404 permit must also be consistent with conservation measures and terms and conditions as described in the Assessment and addressed in this letter and Biological Opinion.

Thank you for your continued interest in the conservation of threatened and endangered species. Please contact Dwayne Winslow at (208) 378-5249 if you have questions concerning this Opinion.

Sincerely,

for Dennis Mackey
State Supervisor

Enclosure

cc: NOAA, Boise (LaMontagne)
IDFG, Idaho Falls (Bassista, Vecellio)
IDFG, Salmon (Diluccia)
GeoSense, Idaho Falls (Josten)
BLM, Salmon (Littlejohn)
SCHNF, Salmon (Garcia)
Fred Coleman

BIOLOGICAL OPINION
FOR THE
Coleman Hydroelectric Project

01EIFW00-2016-F-0394

U.S. FISH AND WILDLIFE SERVICE
IDAHO FISH AND WILDLIFE OFFICE
BOISE, IDAHO

Supervisor Russell Holder for Dennis Mackey

Date JUL 27 2016

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1. BACKGROUND AND INFORMAL CONSULTATION

1.1 Introduction

The U.S. Fish and Wildlife Service (Service) has prepared this Biological Opinion (Opinion) of the effects of authorizing the proposed Coleman Hydroelectric Project on bull trout (*Salvelinus confluentus*). In a letter dated February 12, 2016, and received on February 18, 2016, the Federal Energy Regulatory Commission (Commission, or FERC) requested formal consultation with the Service under section 7 of the Endangered Species Act (Act) of 1973, as amended, for its proposal to authorize the proposed action. The Commission determined that the proposed action is likely to adversely affect bull trout, and may adversely modify bull trout critical habitat. As described in this Opinion, and based on the Final Environmental Assessment (FERC 2016) developed by the Commission; the license application prepared by Nicholas E. Josten, agent for the applicant Fred Coleman; and other information, the Service has concluded that the action, as proposed, is not likely to jeopardize the continued existence of bull trout, and will not adversely modify bull trout critical habitat.

The Commission has also determined the action will not affect the yellow-billed cuckoo (*Coccyzus americanus*) or the Canada lynx (*Lynx canadensis*). With this document, the Service is providing concurrence with those determinations.

1.2 Consultation History

The Service has maintained communication regarding the consultation with the Commission and Nicholas E. Josten, agent for the applicant, since August 12, 2015.

August 14, 2015	Received from the Commission's August 12, 2015, request for formal consultation on this project, accompanied by the Commission's Draft Environmental Assessment.
August 26, 2015	The Service files an acknowledgment of the Commission's formal consultation request. We requested a delay in beginning formal consultation due to loss of staff with key knowledge of the project, and to allow us to participate in a site visit to acquire knowledge needed to conduct the consultation. We received no formal written approval of our extension request, but the Commission approved our request for a teleconference call on September 22, 2016, to further discuss our request.
September 22, 2015	We participated in a conference call attended by the Commission, Idaho Department of Fish and Game (IDFG), the National Marine Fisheries Service (NMFS), and others to discuss the project. Due to the nature of our consultation request discussed during the call, and due to subsequent filings from the National Marine Fisheries Service (National Oceanic and Atmospheric

	Administration(NOAA)) and the IDFG regarding this project, including comments to the Draft Environmental Assessment, the Commission delayed pursuing consultation with the Service.
September 30, 2015	The Service visited the project site with the applicant's agent, IDFG personnel, and a local resident with knowledge of the project and the area.
October 16, 2015	The Service participated in teleconference call attended by the applicant's agent, the NMFS, the IDFG, and others, to hear and discuss NMFS/IDFG 10j/10a recommendations.
February 3, 2016	Receipt from the Commission of the availability of the Final Environmental Assessment for this project.
February 18, 2016	Receipt of the Commission's (2nd) request for formal consultation on this project, stating that the Final Environmental Assessment is also to serve as the Commission's Biological Assessment for the consultation.
April 14-15, 2016	Telephone and email correspondence with Jordan Whittaker, a local Leadore resident with broad knowledge of water use near Leadore, regarding fate of project water before reaching Big Springs Creek and the Lemhi River.
June 21, 2016	Telephone conversation with Jim Hastreiter, fisheries biology with the Commission, discussing the Service's need for an extension to the consultation period.
June 22, 2016	The Service filed our request for a 21-day extension to the consultation period, with our final Opinion to be delivered to the Commission on or before July 25, 2016.
June 29, 2016	Receipt of Commission approval of the Service's request to extend the consultation period for an additional 21 days.
July 18, 2016	Telephone conversation between the Service and the applicant's agent, Nicholas E. Josten of GeoSense. We reviewed the Terms and Conditions with Mr. Josten, who gave his verbal approval during the conversation.
July 21-22, 2016	Email exchange between the Service and the Commission, where we advised that with our final review process, delivery of our Biological Opinion would occur by COB on July 28, 2016, and that we had cleared this with the applicant's agent, Nicholas E. Josten of GeoSense. The Commission acknowledged in reply that there were no issues with the short delay.

2. BIOLOGICAL OPINION

2.1 Description of the Proposed Action

This section describes the proposed Federal action, including any measures that may avoid, minimize, or mitigate adverse effects to listed species or critical habitat, and the extent of the geographic area affected by the action (i.e., the action area). The Federal action being considered is issue of a license by the Commission for the construction and operation of the proposed Coleman Hydroelectric Project. The term "action" is defined in the implementing regulations for section 7 as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The term "action area" is defined in the regulations as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action."

2.1.1 Action Area

The action area (Figure 1) includes:

- From 100 feet upstream of the third diversion, the third irrigation diversion (or ditch) itself, the approximate 500 foot reach of Little Timber Creek from the third ditch to the designated location of the project diversion (or project site) on the second irrigation ditch (second ditch); and the first 1,320 feet (0.25 miles) of the reach of Little Timber Creek from the second diversion to the first diversion.
- The 26,700 foot penstock, from its origin at the project diversion to its termination at the project powerhouse.
    - During construction, a one-quarter mile buffer on either side of the penstock, and post-construction a 40-foot wide right-of-way.
- The flood-irrigated agricultural fields which will receive irrigation water exiting the powerhouse;
- The extent of current groundwater flow beneath the surface of the alluvial fan that extends northeast from the general line of the penstock to Big Springs Creek;
- Big Springs Creek;
- The Lemhi River from its confluence with Big Springs Creek downstream to its confluence with Big Eightmile Creek and Little Eightmile Creek.
- A new, 12.5 kilovolt (kV) transmission line from the powerhouse to an existing Idaho Power Company-owned 69 kV transmission line; and a 50 foot buffer on both sides of the new transmission line.

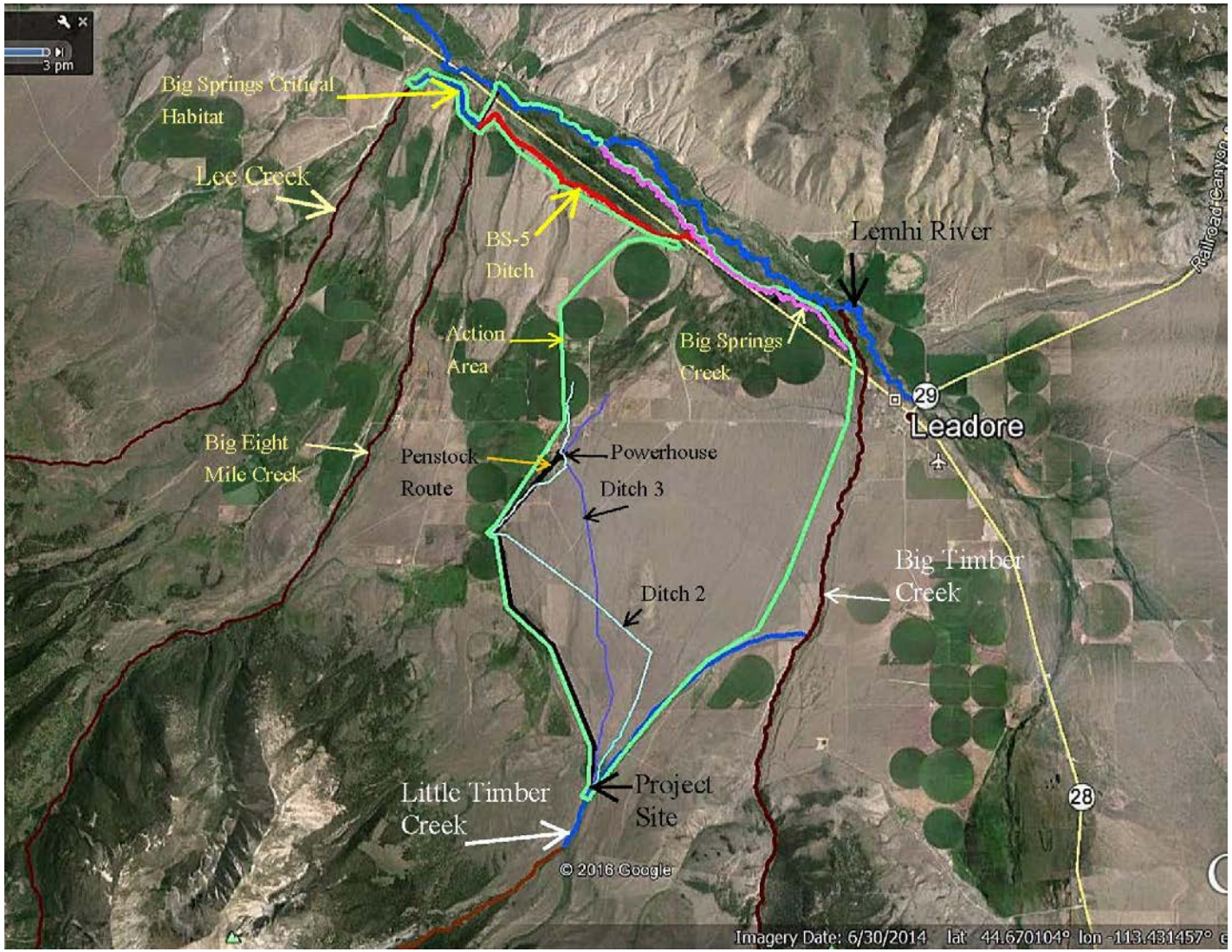


Figure 1. Action area in relation to some project components and geographical features.

2.1.2 Proposed Action

The proposed action is for the Commission to issue a license for the construction and operation of the proposed Coleman Hydroelectric Project. If licensed, the license period may be ordered for 30, 40, or 50 years; and, the license is expected to describe and order the following project components:

2.1.2.1 Project Facilities

The proposed project would consist of the following new facilities:

- An approximately 60-foot long, 15-foot wide, and 6-foot high concrete diversion and intake structure partially extending into Little Timber Creek;
- Trash rack with 2-inch spacing;
- Two 12-foot long rotating drum fish screens and fish bypass pipe to Little Timber Creek;
- A 26,700-foot long penstock made of 20 to 30-inch diameter plastic or steel buried pipe;
- A 20-foot wide, 24-foot long, 11-foot high powerhouse containing a 750 kilowatt (kW) Pelton turbine/generator;
- A 6.7-mile long, 12.5 kV transmission line, connecting to an existing Idaho Power Company 69 kV transmission; and,
- Other appurtenant facilities.

The project boundary will be on private land and will enclose the penstock with a permanent 40-foot wide right-of-way for maintenance.

2.1.2.2 Project Configuration and Operation

There are five active irrigation diversions (or ditches) on Little Timber Creek, numbered in order beginning with the first diversion (downstream-most diversion) about 2.7 miles upstream of the confluence of Little Timber/Big Timber creeks. The second diversion is located about 3,200 feet upstream of the first diversion; the third diversion is located about 500 feet upstream of the second; the fourth diversion is located about 125 feet upstream of the third; and the fifth diversion is about 3,500 feet upstream from the fourth.

Water diverted for project operation would use the combined water rights authorized at the existing second (3.9 cfs) and third (13.2 cfs) diversions, and would operate only during the irrigation season. Operation of the project will not alter the historical timing or amount of irrigation water use nor change the point of use. The amount and timing of water diverted from Little Timber Creek for power generation will be controlled by the local irrigation district, which currently controls the amount and timing of water diverted by the second and third diversion structures. Water currently withdrawn for irrigation at the second and third diversion structures will instead be withdrawn at the proposed project diversion and intake structure to be constructed at the location of the second diversion, which would be removed (Figure 2). The third diversion structure will not be altered and will continue to be available to convey irrigation water, as needed, when water is not being diverted into the project intake. The project diversion and intake structure will be designed to withdraw the maximum permissible diversion rate for the combined flow of the second and third diversions, which total 17.1 cfs. Any diverted flow above 17.1 cfs will be bypassed back into Little Timber Creek through the fish bypass pipe.

Water diverted from Little Timber Creek into the project intake would be conveyed through the 5-mile-long penstock to the powerhouse, bypassing 10.5 miles of diversions (the combined lengths of the second and third diversions upstream of the powerhouse), and released from the powerhouse into the downstream 1-mile long terminuses of the second and third diversions to deliver irrigation water to the fields. Water exiting the powerhouse would enter the non-project concrete splitter box (i.e., the splitter box is not part of the Commission's project area), fitted with a pump and headgate. The headgate would control flow into the existing third diversion ditch and the pump would be used to pump water into the second diversion ditch.

When flows into the project intake fall below 2 cfs, the applicant proposes to stop diverting water and cease power generation. If the powerhouse unexpectedly goes offline, water would automatically be routed through a turbine bypass, exit the powerhouse, and be conveyed to the second and third ditches to ensure irrigation water is not interrupted. If water cannot be diverted at the project intake for operation, irrigation water would be delivered to the fields through the existing irrigation facilities.

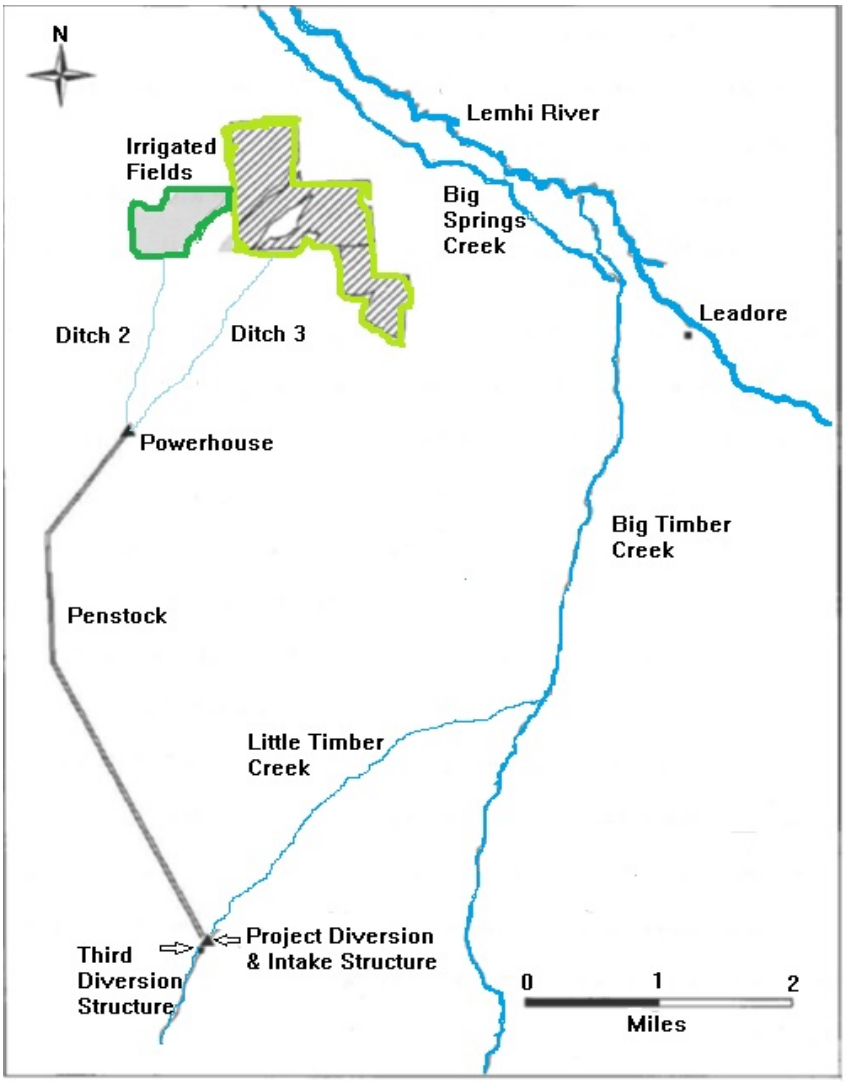


Figure 2. Main project facilities and configuration.

2.1.2.3 Proposed Environmental Measures

Coleman Hydro, LLC (applicant), and the Commission propose to incorporate the following environmental measures into the design, operation, and maintenance of the proposed project:

- Water will be diverted at the project intake for operation between April 1 to October 31 to be consistent with historic irrigation practices. The existing water rights authorize that irrigation diversions can occur from March 1 through November 15. In practice, however, historical diversions occurred from early April to late October.
- A gaging plan will be developed that includes:
    - Installing two flow gages, one within the intake to ensure project diversions are consistent with timing and amount of historical irrigation diversions; and one immediately upstream of the intake to ensure the project does not operate when flows at the intake are less than 2 cfs;
    - Compiling a historical data set of average monthly flows diverted for irrigation at the second and third diversions for the most recent 20-year period to use as a compliance baseline; and,
    - Filing an annual water diversion report on the amount of water diverted for project operation to ensure that historical diversion practices are maintained to protect the fisheries resources in Big Springs Creek and the Lemhi River below Big Springs Creek
- A water quality monitoring plan will be developed for monitoring water temperature and dissolved oxygen immediately upstream and downstream of the project intake for the first season of operation;
- An erosion control plan will be developed to include site-specific measures to minimize construction related impacts to aquatic resources. In addition, existing roads will be used for access to construction sites to reduce soil disturbance.
- In-water construction work will be limited to July 1 through the third week of August to ensure that related impacts to water quality such as sedimentation are minimized;
- A fish passage design plan will be developed for the project diversion and intake structure, fish screen, and fish bypass to ensure designs meet NMFS criteria to protect fish resources;
- A hydraulic evaluation plan will be developed for the project diversion and intake structure, fish screen, and fish bypass to ensure the facilities operate within the allowable hydraulic operating and fish passage criteria of NMFS before starting project operation;
- An operations and maintenance plan will be developed with detailed guidelines for operating and maintaining the project intake, fish screen, and bypass to ensure the protection of the fishery resources;
- A project transmission line design plan will be developed in consultation with the fish and wildlife agencies to ensure that the transmission line is designed in accordance with Avian Power Line Interaction Committee (APLIC) guidelines to protect birds from electrocution;
- The revegetation plan will be designed to minimize noxious and invasive weed colonization. In addition, it will provide for use of mixed shrub, forb, and grass seed mix to reseed disturbed areas within key greater sage-grouse habitat, drill seeding for all reseeding, and long-term monitoring of disturbed areas and control of invasive plant species;

- Project transmission lines will be routed parallel to an existing line and thus will avoid key greater sage-grouse lekking and nesting areas. Transmission lines will be constructed to current raptor protection standards.
- Construction of the transmission line, lower pipeline, and powerhouse will be timed to occur only from October 1 through February15 to avoid disturbing sage-grouse staging behavior that occurs between February 15 and March 15. The applicant will consult with Idaho DFG prior to any ground-disturbing activities.

In addition to environmental measures proposed by the applicant and the Commission, NMFS prescribed a number of fishway measures under Section 18 of the Federal Power Act. These prescriptions are mandatory conditions for fish passage that the Commission must include as requirements in the license. There is overlap between some of NMFS Section 18 prescriptions and some environmental protection measures proposed by the applicant and the Commission.

1. The applicant in consultation with NMFS, must design the intake structure, screen, and bypass facilities that support instream fish passage around the diversion to provide safe, timely, and effective upstream and downstream fish passage;
2. The applicant in consultation with NMFS, must develop an operating plan within 1 year of license issuance and approved by NMFS before construction of the fish screen and bypass facility;
3. The applicant must file final design drawings of the diversion facility for NMFS approval before filing with the Commission within 1 year of license issuance for approval;
4. The diversion must be constructed and operational within 2 years of license issuance;
5. The applicant must maintain safe, timely, and effective upstream and downstream passage at the two diversion structures [second and third diversions] consolidated for this project within 60 days of beginning project operation;
6. The applicant must complete work below the bankfull elevation and other in-water work from July 1 through the third week of August, unless approved by NMFS;
7. The applicant must conduct and complete a hydraulic evaluation of the diversion (e.g. intake, screen, and bypass) and power facilities to ensure they operate within allowable hydraulic operating and passage criteria within 2 years of license issuance and before beginning project operation;
8. The applicant must maintain and repair the screen facility, or replace it at NMFS request, if screen operation is compromised and no longer functions to prevent fish injury and mortality;
9. The applicant must identify for NMFS and the Commission a responsible party for maintenance and repair of the facility;
10. The applicant must install, maintain, and operate automated monitoring equipment to ensure the screen and bypass facility are operating as designed whenever the project is operating;
11. The screen must be checked weekly or greater than weekly if debris is noted and cleaned daily until the debris problem subsides;
12. If the screen is removed for any reason, water should not be diverted at the project intake; and,
13. The applicant must provide an annual report by December 31 to the Commission and NMFS identifying days when the screen facility was not functioning properly and describe any fish injury or mortality.

2.2 Analytical Framework for the Jeopardy and Adverse Modification Determinations

2.2.1 Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this Opinion relies on four components:

1. The *Status of the Species*, which evaluates the bull trout's rangewide condition, the factors responsible for that condition, and its survival and recovery needs.
2. The *Environmental Baseline*, which evaluates the condition of the bull trout in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the bull trout.
3. The *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the bull trout.
4. *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the bull trout.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the bull trout's current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the bull trout in the wild.

As discussed below under the *Status of the Species*, six recovery units have been designated for the bull trout for purposes of recovery planning and application of the jeopardy standard. Per Service national policy (USFWS 2006, entire), it is important to recognize that the establishment of recovery units does not create a new listed entity. Jeopardy analyses must always consider the impacts of a proposed action on the survival and recovery of the species that is listed. While a proposed Federal action may have significant adverse consequences to one or more recovery units, this would only result in a jeopardy determination if these adverse consequences reduce appreciably the likelihood of both the survival and recovery of the listed entity; in this case, the coterminous U.S. population of the bull trout.

The joint Service and National Marine Fisheries Service (NMFS) *Endangered Species Consultation Handbook* (USFWS and NMFS 1998, p. 4-38), which represents national policy of both agencies, further clarifies the use of recovery units in the jeopardy analysis:

> When an action appreciably impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, include in the biological opinion a description of how the action affects not only the recovery unit's capability, but the relationship of the recovery unit to both the survival and recovery of the listed species as a whole.

The jeopardy analysis in this Opinion conforms to the above analytical framework.

2.2.2 Adverse Modification Determination

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 a listed 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 (50 CFR 402.02).

In accordance with policy and regulation, the adverse modification analysis in this Opinion relies on four components:

1. The *Status of Critical Habitat*, which evaluates the rangewide condition of designated critical habitat for the bull trout in terms of the physical and biological features (PBFs) essential to bull trout conservation, the factors responsible for that condition, and the intended recovery function of the critical habitat overall.
2. The *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area.
3. The *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PBFs and how that will influence the recovery role of affected critical habitat units.
4. *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the PBFs and how that will influence the recovery role of affected critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed Federal action on bull trout critical habitat are evaluated in the context of the rangewide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat rangewide would remain functional (or would retain the current ability for the PBFs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the bull trout.

The analysis in this Opinion places an emphasis on using the intended rangewide recovery function of bull trout critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

2.3 Status of the Species and Critical Habitat

This section presents information about the regulatory, biological and ecological status of the bull trout and its critical habitat that provides context for evaluating the significance of probable effects caused by the proposed action.

2.3.1 Bull Trout

2.3.1.1 Listing Status

The coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon, the Jarbidge River in Nevada, north to various coastal rivers of Washington to the Puget Sound, east throughout major rivers within the Columbia River Basin to the St. Mary-Belly River, and east of the Continental Divide in northwestern Montana (Cavender 1978, pp. 165-166; Bond 1992, p. 4; Brewin and Brewin 1997, pp. 209-216; Leary and Allendorf 1997, pp. 715-720). The Service completed a 5-year Review in 2008 and concluded that the bull trout should remain listed as threatened (USFWS 2008, p. 53).

The bull trout was initially listed as three separate Distinct Population Segments (DPSs) (63 FR 31647, 64 FR 17110). The final listing rule consolidated the five bull trout DPSs into one listed taxon. Recognition of the uniqueness and value of individual DPSs for the survival and recovery of the species was retained in the DPS designations as interim recovery units. Interim recovery units were the units to which the jeopardy standard was applied under Section 7 of the Act until an approved recovery plan was developed. The Recovery Plan for the Coterminous United States Population of Bull Trout (*Salvelinus confluentus*) (Recovery Plan, USFWS 2015a) was finalized and became effective in September of 2015. The most recent information and findings utilizing mitochondrial and microsatellite DNA analyses; biogeographical considerations, including geological establishment of major watersheds; isolation of portions of watersheds above major waterfalls; co-occurrence with other fish species, and occurrence in different ecological zones were evaluated, and led to the designation of the final six recovery units displayed in Figure 3 (USFWS 2015a, p. 36).

The project area is located in the Upper Snake Recovery Unit. As discussed above under the *Analytical Framework for the Jeopardy and Adverse Modification Determinations*, the Service's jeopardy analysis for the proposed project will involve consideration of how the project is likely to affect the Upper Snake Recovery Unit for the bull trout based on its uniqueness and significance as described in the Recovery Plan. However, in accordance with Service national policy, the jeopardy determination is made at the scale of the listed species; in this case, the coterminous U.S. population of the bull trout.

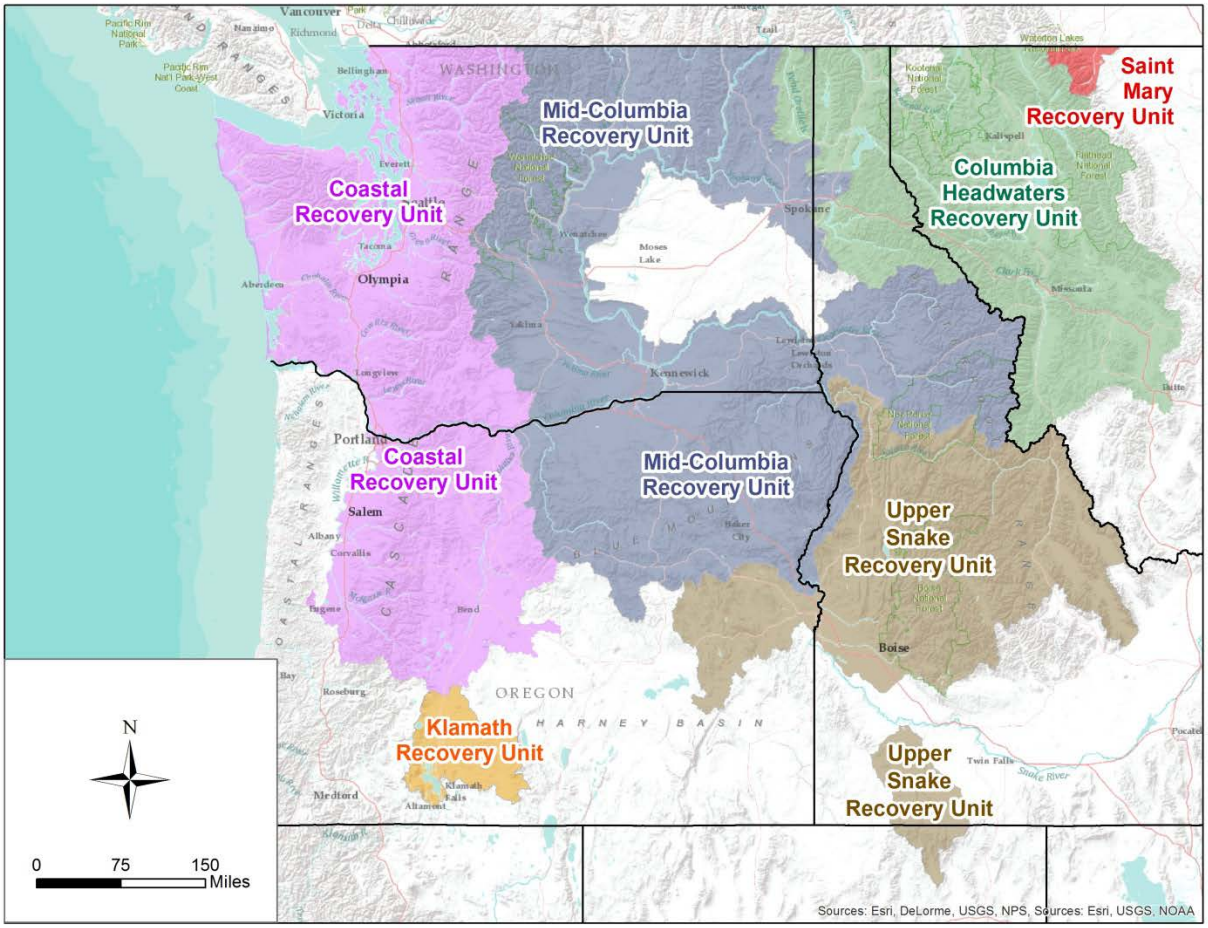


Figure 3. Locations of the six bull trout recovery units in the coterminous U.S.

2.3.1.1.1 Reasons for Listing

Though wide ranging in parts of Oregon, Washington, Idaho, and Montana, bull trout in the interior Columbia River basin presently occur in only about 45 percent of the historical range (Quigley and Arbelbide 1997, p. 1177; Rieman et al. 1997, p. 1119). Declining trends due to the combined effects of habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment into diversion channels and dams, and introduced nonnative species (e.g., brook trout, *Salvelinus fontinalis*) have resulted in declines in range-wide bull trout distribution and abundance (Bond 1992, p. 4; Schill 1992, p. 40; Thomas 1992, pp. 9-12; Ziller 1992, p. 28; Rieman and McIntyre 1993, pp. 1-18; Newton and Pribyl 1994, pp. 2, 4, 8-9; Idaho Department of Fish and Game in litt. 1995, pp. 1-3). Several local extirpations have been reported, beginning in the 1950s (Rode 1990, p. 1; Ratliff and Howell 1992, pp. 12-14; Donald and Alger 1993, p. 245; Goetz 1994, p. 1; Newton and Pribyl 1994, p. 2; Berg and Priest 1995, pp. 1-45; Light et al. 1996, pp. 20-38; Buchanan and Gregory 1997, p. 120).

Land and water management activities such as dams and other diversion structures, forest management practices, livestock grazing, agriculture, road construction and maintenance,

mining, and urban and rural development continue to degrade bull trout habitat and depress bull trout populations (USFWS 2002, p. 13).

2.3.1.2 Species Description

Bull trout (*Salvelinus confluentus*), a member of the family Salmonidae, are char native to the Pacific Northwest and western Canada. The bull trout and the closely related Dolly Varden (*Salvelinus malma*) were not officially recognized as separate species until 1980 (Robins et al. 1980, p. 19).

2.3.1.3 Life History

Water is the primary life history requirement for bull trout. Bull trout exhibit resident and migratory life history strategies throughout much of the current range (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the streams where they spawn and rear. Migratory bull trout spawn and rear in streams for 1 to 4 years before migrating to either a lake (adfluvial), river (fluvial), or, in certain coastal areas, to saltwater (anadromous) where they reach maturity (Fraley and Shepard 1989, p. 1; Goetz 1989, pp. 15-16). Resident and migratory forms often occur together and it is suspected that individual bull trout may give rise to offspring exhibiting both resident and migratory behavior (Rieman and McIntyre 1993, p. 2).

Bull trout have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993, p. 4). Watson and Hillman (1997, p. 248) concluded that watersheds must have specific physical characteristics to provide habitat requirements for bull trout to successfully spawn and rear. It was also concluded that these characteristics are not necessarily ubiquitous throughout these watersheds, thus resulting in patchy distributions even in pristine habitats.

Bull trout are found primarily in colder streams, although individual fish are migratory in larger, warmer river systems throughout the range (Fraley and Shepard 1989, pp. 135-137; Rieman and McIntyre 1993, p. 2 and 1995, p. 288; Buchanan and Gregory 1997, pp. 121-122; Rieman et al. 1997, p. 1114). Water temperature above 15°C (59°F) is believed to limit bull trout distribution, which may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989, p. 133; Rieman and McIntyre 1995, pp. 255-296). Spawning areas are often associated with cold water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, p. 6; Rieman and McIntyre 1993, p. 7; Rieman et al. 1997, p. 1117). Goetz (1989, pp. 22, 24) suggested optimum water temperatures for rearing of less than 10°C (50°F) and optimum water temperatures for egg incubation of 2 to 4°C (35 to 39°F).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Goetz 1989, pp. 22-25; Pratt 1992, p. 6; Thomas 1992, pp. 4-5; Rich 1996, pp. 35-38; Sexauer and James 1997, pp. 367-369; Watson and Hillman 1997, pp. 247-249). Jakober (1995, p. 42) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Bull trout prefer relatively stable channel and water flow conditions (Rieman and McIntyre 1993, p. 6). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997, pp. 368-369).

The size and age of bull trout at maturity depend upon life history strategy. Growth of resident fish is generally slower than migratory fish; resident fish tend to be smaller at maturity and less

fecund (Goetz 1989, p. 15). Bull trout normally reach sexual maturity in 4 to 7 years and live as long as 12 years. Bull trout are iteroparous (they spawn more than once in a lifetime), and both repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982, p. 95; Fraley and Shepard 1989, p. 135; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Migratory bull trout frequently begin spawning migrations as early as April, and have been known to move upstream as far as 250 kilometers (km) (155 miles (mi)) to spawning grounds (Fraley and Shepard 1989, p. 135). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p.1) with eggs hatching later in colder water. After hatching, juveniles remain in the substrate. Time from egg deposition to emergence from the substrate may exceed 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992, p. 1).

The iteroparous reproductive system of bull trout has important repercussions for the management of this species. Bull trout require two-way passage up and downstream, not only for repeat spawning, but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous (fishes that spawn once and then die, and therefore require only one-way passage upstream) salmonids. Therefore, even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route.

Bull trout are opportunistic feeders with food habits primarily a function of size and life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro zooplankton and small fish (Boag 1987, p. 58; Goetz 1989, pp. 33-34; Donald and Alger 1993, pp. 239-243). Adult migratory bull trout are primarily piscivores, known to feed on various fish species (Fraley and Shepard 1989, p. 135; Donald and Alger 1993, p. 242).

2.3.1.3.1 Population Dynamics

The Recovery Plan (USFWS 2015a, p. 71) defines core areas as core habitat (*i.e.*, habitat that could supply all elements for the long-term security of bull trout) and a core population (a group of one or more local bull trout populations that exist within core habitat) of bull trout. The combination of core habitat and a core population constitutes the basic unit on which to gauge recovery within a recovery unit. Core areas require both habitat and bull trout to function, and the number (replication) and characteristics of local populations inhabiting a core area provide a relative indication of the core area's likelihood to persist. A core area represents the closest approximation of a biologically functioning unit for bull trout, and is presumed to reflect the metapopulation structure of bull trout (USFWS 2015a, p. 71). In theory, bull trout metapopulations (or core areas) can be composed of two or more local populations, but Rieman and Allendorf (2001, p. 763) suggest that for a bull trout metapopulation to function effectively, a minimum of 10 local populations are required. Bull trout core areas with fewer than 5 local populations are at increased risk of local extirpation, core areas with between 5 and 10 local populations are at intermediate risk, and core areas with more than 10 interconnected local populations are at diminished risk (USFWS 2002, pp. 50-51).

The presence of a sufficient number of adult spawners is necessary to ensure persistence of bull trout populations. In order to avoid inbreeding depression, it is estimated that a minimum of 100

spawners are required. Inbreeding can result in increased homozygosity of deleterious recessive alleles which can in turn reduce individual fitness and population viability (Whitesel et al. 2004, p. 36). For persistence in the longer term, adult spawning fish are required in sufficient numbers to reduce the deleterious effects of genetic drift and maintain genetic variation. For bull trout, Rieman and Allendorf (2001, p. 762) estimate that approximately 1,000 spawning adults within any bull trout population are necessary for maintaining genetic variation indefinitely. Many local bull trout populations individually do not support 1,000 spawners, but this threshold may be met by the presence of smaller interconnected local populations within a core area.

For bull trout populations to remain viable (and recover), natural productivity should be sufficient for the populations to replace themselves from generation to generation. A population that consistently fails to replace itself is at an increased risk of extinction. Since estimates of population size are rarely available, the productivity or population growth rate is usually estimated from temporal trends in indices of abundance at a particular life stage. For example, redd counts are often used as an indicator of a spawning adult population. The direction and magnitude of a trend in an index can be used as a surrogate for growth rate.

Survival of bull trout populations is also dependent upon connectivity among local populations. Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution even in pristine habitats (Rieman and McIntyre 1993, p. 7). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991, p. 22). Burkey (1989, p. 76) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth of local populations may be low and probability of extinction high. Migrations also facilitate gene flow among local populations because individuals from different local populations interbreed when some stray and return to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished in this manner.

In summary, based on the works of Rieman and McIntyre (1993, pp. 9-15) and Rieman and Allendorf (2001, pp 756-763), the draft bull trout Recovery Plan identified four elements to consider when assessing long-term viability (extinction risk) of bull trout populations: (1) number of local populations, (2) adult abundance (defined as the number of spawning fish present in a core area in a given year), (3) productivity, or the reproductive rate of the population, and (4) connectivity (as represented by the migratory life history form).

2.3.1.4 Status and Distribution

Bull trout historically occurred in major river drainages in the Pacific Northwest from the southern limits in the McCloud River in northern California (now extirpated), Klamath River basin of south central Oregon, and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, p. 165-169; Bond 1992, p. 2-3). To the west, the bull trout's current range includes Puget Sound, coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992, p. 2-3). East of the Continental Divide bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978, p. 165-169; Brewin and Brewin 1997, pp. 209-216). Bull trout are wide spread throughout the Columbia River basin, including its headwaters in Montana and Canada.

As noted above, the six Recovery Units of the coterminous United States population of the bull trout are considered essential to the survival and recovery of this species. Central to the survival and recovery of the bull trout is the maintenance of core areas. Core areas can be further described as complex or simple (USFWS 2015a, p. 35). Complex core areas are core areas that contain multiple local bull trout populations; typically they are situated in a larger patch of habitat, sometimes occupied by bull trout of both the migratory life history form and the resident form, which includes a diverse pattern of connected spawning and rearing and foraging, migration, and overwintering (FMO) habitats. Simple core areas are those that contain one bull trout local population. Simple core areas are almost always small in scope, with a population size that is necessarily restricted by the size of the habitat. Typically, simple core areas are ecologically if not physically isolated from other core areas by natural, not anthropogenic factors (e.g., natural barriers, thermal gradients, or large spatial separation from other core areas) that have been operable for thousands of years. Number and area of simple core areas are less in all Recovery Units compared to number and area of complex core areas. The Upper Snake Recovery Unit contains two simple core areas, the North Fork Payette River and the Lake Creek core areas, neither of which occur within the Lemhi River basin. The remainder of the Upper Snake Recovery Unit consists of complex core areas (Figure 4).

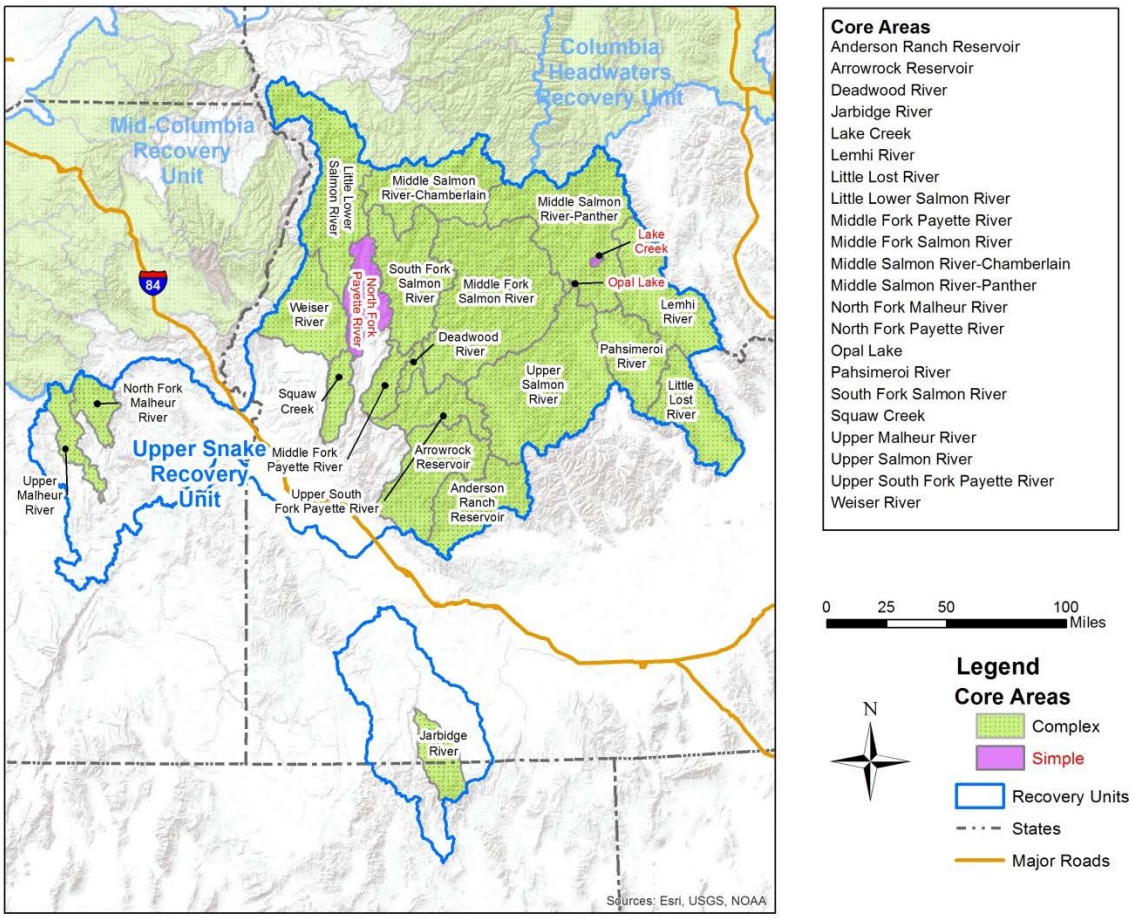


Figure 4. Map of the Upper Snake Recovery Unit.

2.3.1.6 Conservation Needs

Within core areas and local bull trout populations, survival and recovery of the species is considered contingent on conserving or restoring the following bull trout habitat components, as outlined in the Recovery Plan (USFWS 2015a, p.25-33):

- Appropriate spawning habitat;
- Cold water of excellent quality (high dissolved- oxygen, and minimum contaminants and sediment);
- Low gradient stream segments with stable channel structure; and presence of complex cover;
- For migrant populations, maintaining or restoring the presence of appropriate FMO habitat, and maintaining or restoring connectivity between these three migratory habitat components to maintain or improve metapopulation structure, genetic exchange, and recolonization of extirpated populations;
- Reduce, minimize, or prevent the establishment of invasive species that may compete for juvenile and adult bull trout prey; and,
- Conduct management planning to account for increased threats from climate change to bull trout and bull trout habitat, and proactively protect those habitats that are expected to best maintain coldwater conditions suitable for the species in the face of warming air and water temperatures.

2.3.2 Bull Trout Critical Habitat

2.3.2.1 Legal Status

The Service first designated critical habitat for bull trout on October 6, 2004 (USFWS 2004), including 1,748 miles and 61,235 acres of bull trout habitat in the Columbia and Klamath River basins only. This designation was subsumed within the range-wide designation of critical habitat on September 26, 2005 (USFWS 2005), including 3,828 miles and 143,218 acres of bull trout habitat. The 2005 designation was challenged in the U.S. District Court for the District of Oregon, in part because of concern over large exclusions of habitat that were made from the final rule compared to that which had been proposed. The Court directed the agency to complete a proposed revision by December 31, 2009, with a final designation to be delivered to the Federal Register by September 30, 2010. Final critical habitat was designated for bull trout and was published on October 18, 2010 (USFWS 2010a), including 19,729 miles and 488,252 acres of bull trout habitat.

We identified 32 critical habitat units (CHUs) and 78 critical habitat subunits (CHSU) in our 2010 bull trout critical habitat listing rule (USFWS 2010a), reflecting single core areas or groups of core areas that are in close proximity geographically and that are included in the six recovery units in Figure 3. These CHUs are specific to critical habitat designation and interagency consultation procedures under section 7 of the Act. The CHUs are generally a level of organization at the major river basin scale that are intermediate in size and scope between recovery units and core areas in the hierarchical structure, and represent groupings of habitats that facilitate implementation of the rule, generally as aggregations of core areas within major river basins.

In designating bull trout critical habitat, we considered the conservation relationship between critical habitat and recovery planning (USFWS 2015a, p. 22). Recovery plans formulate the recovery strategy for a species; however, unlike critical habitat, they are not regulatory documents, and there are no specific protections, prohibitions, or requirements afforded a species based solely on a recovery plan. While we expect that the 2010 critical habitat designation will contribute to the overall recovery strategy for bull trout described in the recovery plan, designated critical habitat, by itself, does not achieve recovery plan goals.

Compared to the 2005 designation, the final rule increases the amount of designated bull trout critical habitat by approximately 76 percent for miles of stream/shoreline and by approximately 71 percent for acres of lakes and reservoirs.

This rule also identifies and designates as critical habitat approximately 1,323.7 km (822.5 miles) of streams/shorelines and 6,758.8 ha (16,701.3 acres) of lakes/reservoirs of unoccupied habitat to address bull trout conservation needs in specific geographic areas in several areas not occupied at the time of listing. No unoccupied habitat was included in the 2005 designation. These unoccupied areas were determined by the Service to be essential for restoring functioning migratory bull trout populations based on currently available scientific information. These unoccupied areas often include lower mainstem river environments that can provide seasonally important migration habitat for bull trout. This type of habitat is essential in areas where bull trout habitat and population loss over time necessitates reestablishing bull trout in currently unoccupied habitat areas to achieve recovery.

2.3.2.2 Conservation Role and Description of Critical Habitat

The conservation role of bull trout critical habitat is to support viable core area populations (75 FR 63943). The core areas reflect the metapopulation structure of bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. CHUs generally encompass one or more core areas and may include FMO areas, outside of core areas, that are important to the survival and recovery of bull trout.

As previously noted, 32 CHUs within the geographical area occupied by the species at the time of listing are designated under the final rule. Twenty-nine of the CHUs contain all of the physical or biological features identified in this final rule and support multiple life-history requirements. Three of the mainstem river units in the Columbia and Snake River basins contain most of the physical or biological features necessary to support the bull trout's particular use of that habitat, other than those physical and biological features which relate to breeding habitat.

The primary function of individual CHUs is to maintain and support core areas, which (1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics (Rieman and McIntyre 1993, p. 19); (2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); (3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); and (4) are distributed throughout the historic range of the species to preserve both genetic and phenotypic adaptations (MBTSG 1998, pp. 13-16; Rieman and Allendorf 2001, p. 763; Rieman and McIntyre 1993, p. 23).

In determining which areas to propose as critical habitat, the Service considered the physical and biological features that are essential to the conservation of bull trout and that may require special management considerations or protection. These features are the PBFs in the appropriate quantity and spatial arrangement for conservation of the species. PBFs are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of the young, dispersal, genetic exchange, or sheltering. The PBFs of designated critical habitat are:

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.
2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including, but not limited to, permanent, partial, intermittent, or seasonal barriers.
3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.
5. Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.
6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.
7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departures from a natural hydrograph.
8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
9. Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

2.3.2.3 Current Rangewide Condition of Bull Trout Critical Habitat

The condition of bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (67 FR 71240). This condition reflects the condition of bull trout habitat.

The primary land and water management activities impacting the physical and biological features essential to the conservation of bull trout include timber harvest and road building, agriculture and agricultural diversions, livestock grazing, dams, mining, urbanization and residential development, and nonnative species presence or introduction (75 FR 2282).

There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PBFs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows:

1. Fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Dunham and Rieman 1999, p. 652; Rieman and McIntyre 1993, p. 7).
2. Degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989, p. 141; MBTSG 1998, pp. ii - v, 20-45).
3. The introduction and spread of nonnative fish species, particularly brook trout and lake trout, as a result of fish stocking and degraded habitat conditions, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary et al. 1993, p. 857; Rieman et al. 2006, pp. 73-76).
4. In the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine near-shore foraging and migration habitat due to urban and residential development.
5. Degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

The bull trout critical habitat final rule also aimed to identify and protect those habitats that provide resiliency for bull trout use in the face of climate change. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features described in PBFs 1, 2, 3, 5, 7, 8, and 9. Protecting bull trout strongholds and cold water refugia from disturbance and ensuring connectivity among populations were important considerations in addressing this potential impact. Additionally, climate change may exacerbate habitat degradation impacts both physically (e.g., decreased base flows, increased water temperatures) and biologically (e.g., increased competition with nonnative fishes).

2.4 Environmental Baseline of the Action Area

This section assesses the effects of past and ongoing human and natural factors that have led to the current status of the species, its habitat and ecosystem in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have already undergone section 7 consultations, and the impacts of state and private actions which are contemporaneous with this consultation.

2.4.1 Bull Trout

2.4.1.1 Status of the Bull Trout in the Action Area

The project is located in the Salmon River Basin of the Upper Snake Recovery Unit. The Upper Snake Recovery Unit occurs within central Idaho, northern Nevada, and eastern Oregon (Figure 4) (USFWS 2015b, p. E3). Major basins include: the Salmon River, Malheur River, Jarbidge River, Little Lost River, Boise River, Payette River, and the Weiser River drainages. Most core areas in the Salmon River basin contain large populations with many occupied stream segments. Core areas in the Recovery Unit are found in 7 geographic regions: Boise River, Jarbidge River, Little Lost River, Malheur River, Payette River, Salmon River and Weiser River. The only core areas currently supporting adfluvial populations of bull trout are located in the Upper Salmon River, Deadwood River, Anderson Ranch, Arrowrock, Opal Lake, and Lake Creek core areas. All remaining core areas contain resident populations and most have fluvial populations.

The Salmon River basin contains 10 of the 22 core areas in the Upper Snake Recovery Unit and contains the majority of the occupied habitat (USFWS 2015b, p. E2). Connectivity *between* core areas in the Salmon River basin is intact; therefore it is possible for fish in the mainstem Salmon to migrate to almost any Salmon River core area or even the Snake River. Connectivity *within* Salmon River basin core areas is mostly intact except for the Pahsimeroi River core area and portions of the Lemhi River core area. The IDFG reported trend data from 7 of the 10 Salmon River basin core areas, including the Lemhi River Core; bull trout populations in the Lemhi River were indicated to be stable or increasing (IDFG 2005, 2008, 2014—see USFWS 2015b, p. E-5).

The Lemhi River contains FMO habitat (USFWS 2010b, p. 767 CH justification), including that portion of the river within the action area, and has fluvial bull trout (USFWS 2015b, p. E-93). Connectivity between the Lemhi River and many of its tributaries is reduced because of migration barriers resulting from irrigation diversions and other factors, but Hayden Creek has year-round connectivity to the Lemhi River and also contains a fluvial population. Current threats to the Lemhi River and Lemhi River core areas include connectivity impairment and habitat degradation, but there are no primary threats (USFWS 2015b, p. E93).

The Big Timber Creek drainage has its headwaters in the Lemhi Mountains south of the project site. Little Timber Creek is a tributary to Big Timber Creek which in turn is a tributary to the Lemhi River. About 0.7 miles upstream of the project site Little Timber Creek diverges into the North Fork Little Timber Creek and Middle Fork Little Timber Creek. Approximately 0.8 miles upstream of the divergence, both forks of Little Timber Creek enter the Salmon National Forest.

Big Timber Creek; Little Timber Creek from its confluence with Big Timber Creek upstream to the confluence of the North Fork Little Timber Creek and Middle Fork Little Timber Creek; and the North Fork Little Timber Creek; also provide FMO habitat (USFWS 2010b, p. 767-768).

The IDFG and the Salmon-Challis National Forest (SCNF) conducted electroshock fish surveys in the Big Timber Creek/Little Timber Creek drainages and in Big Springs Creek between 1997 and 2015 (Table 1). All bull trout recorded in the Little Timber Creek drainage during these surveys were recovered high in the watershed on the Salmon National Forest; no bull trout were recovered in the mainstem of Little Timber Creek, which includes the action area. Three bull trout were recorded in Big Springs Creek.

In the upper Salmon River basin bull trout begin entering the tributaries on the descending limb of the hydrograph (Schoby 2006, p. 24), i.e., as peak flows in the tributaries begin to diminish. The applicant estimated streamflow in Little Timber Creek using several methods (there are no recent stream gage data for Little Timber Creek), all of which indicate that the descending curve of the hydrograph in Little Timber Creek begins sometime in June and may extend into July (Josten 2011 in litt., p. 11). Schoby (2006, p. 24) found that bull trout in the upper Salmon River basin began spawning in late August, with spawning generally completed by mid-September. Applying the incubation period and time to emergence of fry from the substrate (possibly greater than 200 days, Section 2.3.1.3) to spawning activities observed in the upper Salmon River Basin (Schoby 2006, p. 24) suggests that bull trout fry could begin emerging from spawning gravels in the upper reaches of Little Timber Creek (upstream of the action area) between mid-March to early April.

Table 1. IDFG and SCNF fish survey results for bull trout in Big Timber Creek, Little Timber Creek, and Big Springs Creek.

Survey Report	Survey Year	Stream	Number of Bull Trout	Bull Trout Density
IDFG March 2004*	1997	Big Timber Creek	No data given	0.3/100 m^2
IDFG March 2004**	August 29 through October 2, 2003	Big Timber Creek	242	0.17 to 18.45/m^2 mean = 5.80/100 m^2
IDFG March 2004**	August 15 & 28, 2003	Little Timber Creek	0	0
	August 13 & 15, 2003	Middle Fork Little Timber Creek	126	mean = 12.75/100m^2
	August 14 & 20, 2003	North Fork Little Timber Creek	11	mean = 6.92/100m^2
SCNF Electrofishing Form 2009	October 2009	Middle Fork Little Timber Creek	0	
SCNF Electrofishing Form 2009	October 2009	North Fork Little Timber Creek	1	
SCNF Electrofishing Form 2009	July 2013	North Fork Little Timber Creek	0	
SCNF Electrofishing Form 2009	August 2013	Middle Fork Little Timber Creek	0	
IDFG Database	June 29, 2011	Big Springs Creek	3	
SCNF Electrofishing Form 2015	August 2015	North Fork Little Timber Creek	0	

* (Murphy and Horsmon 2004, p. 9)

** (Murphy and Horsmon 2004, p. 43)

2.4.1.2 Factors Affecting the Bull Trout in the Action Area

Restoration Projects

Irrigated agriculture is a predominate land-use in the Lemhi River basin. Water from more than 250 diversions in the Lemhi River Basin irrigate nearly 90,000 acres of cropland from May through September (Walters et al. 2012, p. 1180; Idaho DEQ 2012, p. 4). Historic diversions resulted in de-watering a number of tributaries, thus disconnecting bull trout populations high in the drainages from FMO habitat in the Lemhi River during irrigation season. Diversions also contribute to lower flows in the Lemhi River and in connected tributaries, which can lead to water temperatures higher than those tolerated by bull trout, and to sediment accumulation.

Since 2000 at least eight restoration projects, through water-right transfers; abandonment of inefficient ditches; changing points of diversions on tributaries and on the Lemhi River to make withdrawals further downstream in the river; and stream channel restoration, have resulted in gains in flow in the Lemhi River in the action area (Littlejohn 2012, p. 50; LaMontagne 2012, in litt.), and have reconnected Hawley Creek, Canyon Creek, Eighteenmile Creek, Big Timber Creek, and Big Eightmile Creek with the Lemhi River (LaMontagne 2012, in litt.). A 1.36 cfs gain in flow to the Lemhi River has been documented using Water Master records and other sources (Littlejohn 2012, p. 50). Between 5.6 and 7.6 cfs additional gains to the Lemhi River have been estimated to result from the above projects by combining "stated benefits from project funding applications, or personal judgment from persons offering visual accounts of typical summer flows" (LaMontagne 2012, in litt.), but have not been checked against gage records or flow measurements to verify actual amounts—in addition, gains from some projects will vary by water year. Another irrigation ditch will be closed in 2016 which may add an additional estimated 9.3 cfs to the Lemhi River in the action area (LaMontagne, 2012 in litt., p. 2; LaMontagne 2016a, pers. comm.).

Fish Passage

Both Big Timber Creek and Little Timber Creek have a number of irrigation diversions which affect connectivity with the Lemhi River. Due to irrigation withdrawals, Little Timber Creek is dewatered below the first diversion in most years beginning in July and extending through the end of the irrigation season in October (Josten 2011, in litt., p. 12-13). IDFG radio-tracking studies of bull trout movements in the Upper Salmon River Basin, including the Lemhi River Subbasin, indicated that bull trout move out of the Lemhi River and into the upper watershed perennial tributaries as spring peak flows in the tributaries begin to subside; they then spawn in the perennial tributaries when water temperatures drop in the autumn (Schoby 2006, p. 24). The applicant estimated streamflow in Little Timber Creek using several methods (there are no recent stream gage data for Little Timber Creek), all of which indicate that the descending curve of the hydrograph in Little Timber Creek begins sometime in June and may extend into July (Josten 2011 in litt., p. 11). June and July are also the period of peak irrigation demand in Little Timber Creek (FERC 2016, p. 25), and the timing of the drop in peak flows combined with increased irrigation demand results in dewatering of the creek below the first diversion beginning in July and through September of most years (Josten 2011 in litt., p. 13). Adult fluvial bull trout may be able to pass the diversions on Little Timber Creek into the upper watershed in the spring before or during high water, but not once irrigation diversion of water begins (Diluccia 2016, pers. comm.); dewatering of Little Timber Creek below the first diversion prevents movement of bull trout from the Lemhi River into the Little Timber Creek drainage during the descending hydrograph, the period when bull trout would most likely attempt to migrate to Little Timber Creek headwaters. We cannot rule out that individual adult fluvial bull trout may travel up the Little Timber Creek drainage before or during high water, but this would be expected to be a rare occurrence. Bull trout populations in the Middle and North forks of Little Timber Creek are thus likely resident populations, with little or no reproductive connection with Lemhi River populations.

Prior to 2010, irrigation withdrawals also dewatered lower Big Timber Creek in most years, largely blocking fish passage from the Lemhi River into Big Timber Creek. A fish passage restoration project to benefit anadromous fish in the Lemhi River basin was completed in 2010 (NOAA 2013), restoring connectivity between the Lemhi River and Big Timber Creek for

migrating and spawning steelhead (*Oncorhynchus mykiss*) and spring/summer Chinook salmon (*Oncorhynchus tshawytscha*). The restoration project also potentially linked bull trout populations in the Big Timber Creek drainage (includes the Little Timber Creek drainage) with bull trout in the Lemhi River. Since 2010 juvenile Chinook salmon and steelhead have been seen in the lower 1.5 miles of Big Timber Creek.

With fish passage restored between the Lemhi River and the Big Timber Creek drainage, it is possible that bull trout from the Lemhi River may move upstream into the Little Timber Creek drainage to the Middle Fork Little Timber Creek and North Fork Little Timber Creek, or vice versa, during periods of the year when lower Little Timber Creek is fully watered, but IDFG staff have no evidence of whether this occurs. No fish surveys for bull trout have been conducted in the Little Timber Creek drainage since connectivity between the Big Timber Creek drainage and the Lemhi River was restored.

Fish entrainment

While not identified as a threat to bull trout for the Lemhi River core area in the Recovery Plan, there is potential for entrainment of bull trout into irrigation diversions in the action area. Many diversions are unscreened, including all diversions on Little Timber Creek.

Water Quality

Water temperature in the Lemhi River peaks in July and August, with mean daily temperatures reaching 15.3 ^{o}C (USGS data, Gage # 13305000), exceeding the state salmonid spawning standard of 13 ^{o}C from mid-June to mid-September (IDEQ 2012, p. 12). Bull trout would be unlikely to use the river in summer due to the elevated summer water temperatures, but the Lemhi River otherwise provides FMO habitat. The applicant recorded water temperature at the project site on Little Timber Creek from mid-April through late-September of 2012. Maximum daily temperatures peaked at 18.7 ^{o}C on August 12 (Josten 2012, in litt.), with the mean temperature for that day at about 13.6 ^{o}C. The maximum mean daily temperature of about 14 ^{o}C occurred 13 days earlier on July 30. These mean daily temperatures for the mainstem Little Timber Creek recorded by the applicant are higher compared with the baseline August mean temperature range of 10-12 ^{o}C for this reach on the NorWeST Stream Temp Interactive Mapper website maintained by the Forest Service's Rocky Mountain Research Station (RMRS): Air, Water, & Aquatic Environments Program, in Boise, Idaho (RMRS 2016).

Water Quantity

Much of the water diverted from the Lemhi River for irrigation returns to the river by ground water movement through unconsolidated alluvial sediments (Donato 1998); the upper mainstem Lemhi River has flowed throughout the irrigation season even in recent driest years when all tributaries to the upper mainstem were dried by irrigation diversions (LaMontagne 2012, in litt., LaMontagne 2016b, pers. comm.).

Big Springs Creek as shown in Figure 1, for reasons to be discussed under Section 2.4.2.1, is not designated bull trout critical habitat. Big Springs Creek, a tributary to the Lemhi River, parallels the latter below Leadore for the entire length of Big Springs Creek (about 5 miles, Figure 1). Bull trout have been found in Big Springs Creek (IDFG 2011, in litt.; Uthe 2016 pers. com.), although it is not considered good bull trout habitat due to elevated water temperatures and

sedimentation. Big Springs Creek contributes water to the Lemhi River, and changes to Big Springs Creek flow could affect bull trout and bull trout critical habitat in the Lemhi River.

Groundwater contours in the action area run parallel to Big Springs Creek. Thus, the direction of groundwater flow in the action area is to the northeast through the unconsolidated materials in the alluvial fan that extends from the base of the Lemhi Mountains and west of Big Timber Creek/Little Timber Creek to just west of Big Springs Creek, and is intercepted by and incorporated into the streamflow of Big Springs Creek before flowing into the mainstem Lemhi River. It is possible that groundwater flow from the alluvial fan also reaches the Lemhi River. Google Earth Pro elevation readings suggest that in many places the Big Springs Creek channel is from 1 to 4 feet higher than the Lemhi River channel, which may allow for movement of groundwater beneath Big Springs Creek to emerge in the Lemhi River. However, it is not known if Google Earth Pro elevation readings are consistently accurate to within one foot.

As stated in Section 2.1.2.2, there are five irrigation diversions or ditches on Little Timber Creek located between approximately RM 3.3 and RM 4.1, numbered in order beginning with the downstream-most as the first diversion. Thirteen water rights at these five diversions together authorize the withdrawal of up to 46.7 cfs of streamflow. Average monthly withdrawals peak in June at 36 cfs. The water rights authorize irrigation diversions from March 15 through November 15 but in practice historical diversions occur from early April to late October. Peak crop demands for irrigation water occur in June and July (FERC 2016, p. 25).

Little Timber Creek can be dewatered whenever natural flow drops below the 46.7 cfs of total authorized withdrawals. Diversion records indicate that on average, only diversions two and three typically divert all their allocated water rights, and the remaining diversions divert less than their allocation (Josten 2011 in litt., p. 12). Even under conditions where typically less than the full allocation for all water rights is withdrawn, Little Timber Creek is dewatered below the first diversion in most years beginning in July and extending through September (Josten 2011 in litt., p. 12-13).

Both the second and third diversion ditches (ditch 2 and ditch 3) convey water to fields and pastures located between 4.5 and 6 miles due north of the proposed project diversion on Little Timber Creek. The owner of ditch 2 regularly deposits bentonite into the ditch throughout the irrigation season to act as a temporary sealant (Johnson 2011, in litt., p. 8), thus reducing (though not eliminating) loss of water due to seepage. Ditch 3 is unlined, and loses water through seepage along its entire length. Under current conditions, seepage from both ditches is assumed to flow northeast through the alluvial fan (Johnson 2011, in litt., p. 4-5), and contribute as groundwater input to Big Springs Creek (and possibly the Lemhi River) for about two-thirds of its length beginning at its source near the confluence of Big Timber Creek and the Lemhi River. Johnson (2011 in litt., p. 13-14) estimated the potential seepage from the two ditches as approximately 1,055 acre feet per year. Johnson (2011 in litt., p. 13-14) also determined that, due to time lags, subsurface flow toward the Lemhi River of ditch 2 and 3 seepage is essentially time-constant, despite the fact that seepage itself is seasonal; in other words, seepage from the two ditches during the irrigation season moves as subsurface flow across the alluvial fan toward Big Springs Creek and the Lemhi River at a more or less constant rate of 1.46 cfs throughout the year. Johnson conducted his analysis assuming that ditch 2 was unlined, and acknowledged that his results were an overestimate of the actual amount of seepage. We have used Johnson's seepage estimates in our analyses, but carry forward his acknowledgment that they are likely overestimates.

Future Hydrologic and Stream Temperature Conditions

If issued, the license period for this project may extend for 30, 40, or 50 years. Changes in hydrology and temperature resulting from changing climate have the potential to negatively impact aquatic ecosystems in Idaho, with salmonid fishes being especially sensitive. Changing climate conditions over the next 30-50 years, combined with project impacts, have the potential to affect bull trout in the action area.

Climate change will also likely interact with other stressors, such as habitat loss and fragmentation (Rieman et al. 2007, pp. 1558–1560; Porter and Nelitz 2009, p. 3); invasions of nonnative fish (Rahel et al. 2008, pp. 552–553); diseases and parasites (McCullough et al. 2009, p. 104); predators and competitors (McMahon et al. 2007, pp. 1313–1323; Rahel et al. 2008, pp. 552–553); and flow alteration (McCullough et al. 2009, pp. 106–108), rendering some current spawning, rearing, and migratory habitats marginal or wholly unsuitable.

Dalton et al., eds. (2013a, entire) summarize over fifteen years of research and data on climate change in the Pacific Northwest. Taking into account uncertainties and variance in the data, Dalton et al. eds. chapter authors conclude the following trends and projections can be made for the Columbia River Basin, which includes the action area (Dalton et al. 2013b, Figure 1.1 on p. xix), at this time:

- Mean annual temperatures are predicted to rise between 1.1 and 4.7 degrees C by between 2041-2070 across the Columbia River Basin. All models predict at least a 0.5 degree C increase in every season, with more warming predicted for summer than other seasons (Mote et al. 2013, p. 35).
- The number of days of extremes of heat will increase, and extremes of cold will decrease (Mote et al. 2013, p. 37).
- At least 20 more days in the frost-free period are predicted in the Northwest, lengthening the growing season; concomitantly, an increase in irrigation demand of 2.2 percent is projected across the Columbia River Basin by 2030 (Raymondi et al. 2013, p. 47).
- There will be up to a 30 percent decrease in summer precipitation, and an increase in winter precipitation (Mote et al. 2013, p. 33); snow-dominated watersheds (includes the mountains of central and southeast Idaho and the western Wyoming mountains) will shift to mixed rain and snow dominated areas, with snowmelt both decreasing and occurring earlier; and, by 2050, peak runoff may occur 3 to 4 weeks earlier than the current average (Mote et al. 2013, p. 36; Raymondi et al. 2013, p. 41-44).

In addition, analyses conducted by the Bureau of Reclamation (USBR) indicate that:

- Over the Columbia River Basin, average annual precipitation, averaged over all models, is projected to increase minimally by 1 to 2 percent out to 2059 (USBR et al. 2011, p. vi, Part IV).

The Climate Shield model developed by the Forest Service's Rocky Mountain Research Station, Aquatic Sciences Lab in Boise, Idaho, uses geospatial data to predict the probability of stream occupancy by bull trout in two future climate scenarios (2040s and 2080s) using four indicator variables (Isaak 2016 pers. comm.):

- Size or linear distance of a cold-water habitat patch (a 30 km patch at a preferred water temperature will persist at that temperature longer than a 5 km patch)
- Average temperature of a habitat patch (colder patches of a 10 km habitat patch will hold bull trout longer than a warmer 10 km patch—the latter will pass thermal thresholds more quickly)
- Gradient of a given habitat patch (steep patches provide less favorable habitat than less steep patches)
- Prevalence of brook trout

Brook trout occur in the Lemhi River, but IDFG fish surveys have not recorded them in the Big Timber Creek/Little Timber Creek drainages; under existing conditions irrigation diversions in Little Timber Creek would prevent brook trout migration into reaches occupied by bull trout.

In a baseline scenario with brook trout absent, the Climate Shield model shows a 0.75 to 0.9 probability that the North Fork and Middle Fork of Little Timber Creek should be occupied by bull trout, and the species is indeed present in both streams (Table 1). Projecting forward to the 2040s, the probability of bull trout occupying the North and Middle Forks of Little Timber Creek drops to between 0.25 and 0.5.

A recent study by Isaak et al. (2016, entire) examined stream-warming rates and associated climate change velocities using large water-temperature databases spanning 1968 to 2011. The data were evaluated for sensitivity to historical air-temperature variability and interpolated to provide high-resolution thermal habitat information over 220,000 kilometers of streams in the U.S. Pacific Northwest, encompassing the coastal streams of Washington and Oregon and the Columbia River Basin (p. 4374-4376). To then characterize thermal environments associated with regional endemic and non-native cold-water species, the authors matched NorWeST temperature data from stream reaches associated with species occurrences (p. 4378). The authors found that three native cold-water species, including bull trout, occupy a subset of environments typified by very cold water and particularly low rates of climate change velocities (p. 4376) that are found in the upper extent of this regional stream network, i.e., in higher elevation headwater streams. The climate change velocity concept, developed by Loarie et al. (2009, entire), is a climatic landscape metric or measure that yields a rate in kilometers per year representing a rate at which a species must move across a landscape to track or maintain the climate conditions it needs in order to persist through time (Hamann et al. 2015, p. 997). Climate change velocities in these coldest streams were relatively insensitive to increases in warming over the historical warming rate due to steep stream channel and temperature gradients. Ninety percent of the occurrences of the three coldwater species were at locations where climate change velocities were less than a kilometer per decade. The data indicates that these species, including bull trout, may have to move only relatively short stream distances of between approximately 1 and 10 kilometers over the span of a century to track their thermal habitats (p. 4376). The results suggest that declines in cold-water species along warm-edge boundaries are proceeding slower than was previously thought and imply that such taxa have greater probability for long-term persistence (p. 4376), although climate warming is likely to further isolate populations in headwater streams (p. 4377). Isaak et al. (2016) also found that non-endemic brook trout occupy the same subset of very cold water environments and low rates of climate change velocities as do bull trout (p. 4376, 4377), and noted that brook trout may displace bull trout from cold streams where the two species overlap.

Isaak (2016, pers. comm.) suggested a modification to the Climate Shield projections of probability of stream occupancy by bull trout based on the results from Isaak et al. (2016), proposing that, where brook trout are absent, the Climate Shield occupancy projection for the 2040s represents an extreme scenario, and the Climate Shield projection for the 2080s (not discussed in this Opinion) would be a very worse-case scenario.

Walters et al. (2013, entire) evaluated the effects of diversions and climate change on juvenile Chinook salmon in the Lemhi River basin. They used two climate models, ECHO-G, and CGCM3.1, to project air temperatures and precipitation in two time horizons (2040 and 2080) under the A1B emissions scenario, downscaled to the Lemhi River Basin (Walters et al. 2013; p. 2, Appendix S1). The A1B scenario assumes future energy use, and hence carbon emissions, will result from a balance between fossil and non-fossil energy sources (IPCC 2000, p. 8). ECHO-G and CGCM3.1 project temperature changes under A1B similar to the average projections of a set of 10 climate models used for the Columbia River Basin (U.S. Bureau of Reclamation et al. 2010, entire). However, ECHO-G, and CGCM3.1 model drier and wetter conditions, respectively, compared to the average precipitation projections for the Columbia River Basin, thus capturing a range of projected precipitation conditions for the Lemhi River Basin. In all climate change scenarios, air temperature in the Lemhi Basin increased by 1-2 ^{o}C for 2040 and 2-3 ^{o}C for 2080 (Walters et al. 2013, p. 1181).

Table 2 displays a subset of the results of Walters et al. (2013, Table S1.1, Appendix S1) modeling of future flows in the Lemhi River, where existing diversions of water (current conditions) in the Lemhi River Basin continue (i.e., water users continue to divert and use water similar to current use). Existing, or current diversions, in Table 2 are the 1992-2009 median monthly flows from data from the USGS gage # 13305310 on the Lemhi River near Salmon, Idaho (Walters et al. 2013, p. 1, Appendix S1). Projected flows for June from both models in both time horizons are less compared to current conditions: between 13 and 11 percent less in 2040 and 2080, respectively, from the wet model; and between 14 and 37 percent less in 2040 and 2080, respectively, from the dry model.

These results for the Lemhi River Basin are consistent with projected inflows to U.S. Bureau of Reclamation (USBR) reservoirs on the Snake River, Idaho, upstream of Brownlee Reservoir (USBR 2011). USBR utilized the same dataset and analyses available for the Pacific Northwest as did Walters et al. (2013, p.2, Appendix S1) that have been prepared and are updated by the University of Washington Climate Impacts Group, but applied a set of climate models different from Walters et al. (USBR et al. 2010, p. 41). Under a set of wetter climate change models (compared to historical conditions), projected inflow to USBR reservoirs (a function of precipitation and runoff) was higher in the non-irrigation season for two time periods: a 2020s scenario (2010-2039) and a 2040s scenario (2030-2059). Summer inflows, however, dropped below historical (1916-2006) by June for two of six models and by July or August for the remaining four other models in the 2020s scenario; and in the 2040s scenario inflows dropped below historical in June for three models and below historical by July for three models (USBR 2011, p. xviii-xx; p. 135). Results from modeling across the Columbia River Basin are consistent in that the projected precipitation increases under climate change usually will *not* lead to increased streamflow in mid to late summer or early autumn due to concomitant projected changes of increased rainfall in winter, less snow, and earlier runoff; rather, mid to late summer or early autumn flows are likely to be less than historical.

Table 2. Flow in the Lemhi River under three climate scenarios, displayed as median monthly discharge at USGS gage # 13305310, assuming existing water diversions continue (from Walters et al. 2013, Table S1.1)

Scenario	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Current Diversion Rates	220.01*	228.13	256.03	214.01	199.17	454.15	92.17	26.13	30.02	210.83	274.04	241.91
ECHO-G dry 2040	216.13	303.00	256.03	210.12	157.15	391.64	71.69	21.19	24.37	170.22	240.85	230.25
CGCM3.1 wet 2040	307.59	355.62	334.78	300.88	221.42	394.82	87.23	28.25	28.60	274.75	326.66	321.01
ECHO-G dry 2080	258.86	365.86	265.57	222.13	144.44	286.40	59.33	17.30	21.54	180.46	256.38	266.27
CGCM3.1 wet 2080	383.16	444.96	424.13	360.56	230.96	405.06	89.35	26.13	30.37	316.07	376.45	421.30

* Flows converted from cubic meters per second in Walters et al. (2013) to cfs.

Available flow estimates and average flow diversions for Little Timber Creek and Walters et al. (2013 entire) climate change analysis for the Lemhi River Basin allow a qualitative assessment of the impact of future climate conditions on future Little Timber Creek flows and diversions and on bull trout in the action area. For conditions on Little Timber Creek affecting the action area, we obtained the priority and flow amount of each individual water right for Little Timber Creek using the Idaho Department of Water Resources Irrigation Rights Mapper: except for a 2.75 cfs water right for ditch 4 and a 1.2 cfs water right on ditch 1, the senior-most water rights on Little Timber Creek are held by the users of ditches two and three (Table 3). We utilized the mean monthly flow estimated for Little Timber Creek by the U.S. Forest Service (USFS) in 1988 (Josten 2011 in litt., p. 11), and also the USGS StreamStats (USGS 2016) monthly estimates of Little Timber Creek flow (as the monthly 50 percent exceedance, or median, flows) immediately downstream of the confluence of the North and Middle Forks of Little Timber Creek, in order to be able to subtract out the senior water rights for ditches four, three, and two, and the senior right for ditch one that, under existing conditions, likely always passes ditch two. These are the diversion flows that have to be accounted for in determining potential future climate change effects on the amount of water that will be available at the project site.

Table 3. Water right flows (cfs) and seniority in Little Timber Creek (Idaho Department of Water Resources Irrigation Rights Mapper). Green flow values are senior rights in the second and third diversions; beige flow values are other senior rights that must be considered to determine the amount of water available at the project site. All other flow amounts are water rights junior to green and beige flow values.

Priority Year	Water Right #	Month/day priority	Final Priority	Allocated cfs	Ditch 5	Ditch 4	Ditch 3	Ditch 2	Ditch 1
1879	74-40	7/1	1	4.2			4.2		
	74-33	7/1	1	1.2					1.2
1892	74-38	6/1	2	3.84			3.84		
1898	74-36A	7/1	3	0.44				0.44	
	74-50B	11/6	4	2.75		2.75			
	74-36B	7/1	3	3.4				3.4	
1903	74-41	10/1	5	5.18			5.18		
1908	74-50A	11/6	6	2.75		2.75			
1909	74-49	8/21	7	2.9		2.9			
	74-48	10/9	9	2.4		2.4			
	74-47	9/27	8	5.7					5.7
1910	74-55	8/19	10	6.2	6.2				
1925	74-2210	8/21	11	5.7		5.7			
TOTALS				46.66	6.2	16.5	13.22	3.84	6.9

Josten (2011 in litt., p. 12) provided average monthly flows actually diverted from Little Timber Creek. The average amounts diverted for the fourth and first diversions have historically been less than the total flows allocated for those diversions. The percent of the total allocation actually diverted for a given month was used to calculate the fraction of the senior water rights that might have been diverted in the fourth and first diversions for that month. For example, total allocation for ditch 4 is 16.5 cfs. An average of 58 percent, or 9.5 cfs (Josten 2011 in litt., p. 12), has been diverted from ditch 4 each May. We assumed that 58 percent of the 2.75 cfs senior water right in ditch 4, or 1.6 cfs, would have been diverted in May, and this flow was added to the total of senior water rights to be subtracted from Little Timber Creek total flow in May. Monthly calculations were similarly made for the senior water right for ditch 1. Absent actual average diversion amounts for each individual water right for each month, these calculations for the senior water rights in ditches 1 and 4 are the most reasonable approximations.

To extrapolate climate change projections for the Lemhi River to Little Timber Creek, from Table 2 we calculated the percent differences in monthly flow between current conditions in the Lemhi River and both the ECHO-G (dry) and CGCM3.1 (wet) climate change scenarios for the river under both time horizons. The USFS 1998 flow estimates and the StreamStats flow estimates were then each multiplied by the four sets of percent differences in flow derived from the Lemhi River climate change projections to yield possible projected flows in Little Timber Creek under the ECHO-G (dry) and CGCM3.1 (wet) scenarios for 2040 and 2080. We then subtracted out mean historical diversions of senior water rights for ditches 1-4 (junior water rights were not included in our calculations). Our results shown in Figure 5 apply with or

without the project being licensed and implemented (note the difference between the Y-axis flows for USFS 1988 [left figures] and StreamStats [right figures]).

Josten's (2011 in litt., p. 12-13) analysis suggests that USFS 1988 flows are overestimates (i.e., the 1988 data indicated Little Timber Creek is dewatered for one month each year, which is not the case) and that StreamStats underestimates flows (i.e., StreamStats data indicate Little Timber Creek is dewatered for three months every year, also not the case), with actual flows falling between these two estimates. For this reason, we display our extrapolated results of future conditions for both sets of flow estimates. For comparison purposes, in Figure 5a we have also recreated Josten's Figure 4 (2011 in litt., p. 12-13) as two separate line graphs, showing mean historical diversions for *all* water rights subtracted from USFS 1988 mean monthly undiverted flows and StreamStats median monthly undiverted flows. Figure 5b-5f use only the senior water rights for ditches 1-4 as described in previous paragraphs.

We acknowledge that the correspondence between current and projected flows for the Lemhi River is unlikely to be one to one with those for Little Timber Creek. Yet, because a portion of the real (historical) and projected precipitation (as well as air temperatures) used to model flows in the Lemhi River Basin also falls in the Little Timber Creek watershed, we believe the correspondence is close enough to allow qualitative conclusions.

In Figure 5b flows at the project site—under existing conditions but without considering junior water rights—are depicted by the difference between mean historical diversions of senior water rights and undiverted flows estimated from the two sources. Figure 5c shows projected changes for undiverted flows in Little Timber Creek for dry and wet conditions for 2040, extrapolating from the percent change between current median monthly Lemhi River flows and projected monthly river flows in 2040. Future peak Little Timber Creek flows may be less during mid to late irrigation season (July through September) compared to existing conditions under both wet and dry scenarios in 2040: Figure 5d shows that under dry and wet conditions flows at the project site, less mean historical diversions of senior water rights, may range from very low flows to dewatering of the stream at the project site for up to three months.

Figures 5e and 5f are similar to 5b and 5c, but projected out to 2080. While projected flows actually increase in the spring under wet conditions compared to 2040, due to earlier runoff flows at the project site July through September change very little compared to 2040. Note: in Figure 5c-5f, the senior water right of 1.2 cfs for ditch 1 (which is senior to all but one of the water rights for ditches 2 and 3) might have to pass the project site, in which case Little Timber Creek technically would not be de-watered between the first and second diversions. This could not be displayed, however, due to limitations in Microsoft Excel in which the figures were created.

Analysis of the available information suggests the possibility of Little Timber Creek frequently experiencing very low flows or dewatering at the project site during three irrigation-season months under future climate conditions, assuming that future senior water right diversions are similar to historical diversions of senior water rights. Stated another way, the available information raises the possibility that the de-watered section of Little Timber Creek could extend upstream of the first diversion under future climate scenarios and with historical diversions of senior water rights.

It is unlikely that conditions in the Little Timber Creek/Big Timber Creek watershed will reach the projections in Figure 5. Before that might occur, we expect that water users and other

stakeholders in the Lemhi Valley, including the Water Master for the Lemhi River Basin (District 6), would meet to consider and develop a range of alternatives to address ongoing, or the potential for, increasing water shortages. We cannot predict what those alternatives might be. In order to analyze effects of climate change projections on bull trout in Little Timber Creek and the Lemhi River, we are assuming that as flows in Little Timber Creek decrease over time, the amount of water diverted into the five diversions on Little Timber Creek will decrease proportionately for all water rights in all diversions. In the action area, this will result in:

- A reduction over time of the amount of seepage from ditches 2 and 3 toward Big Springs Creek and the Lemhi River. In other words, the subsurface flow of 1.46 cfs across the alluvial fan (Water Quantity, in Section 2.4.1.2) will be reduced over time, resulting in less water ultimately reaching the Lemhi River that originates as seepage from ditches 2 and 3.
- Less water in Little Timber Creek between the second and first diversions, and less water between ditch 5 and the project site.

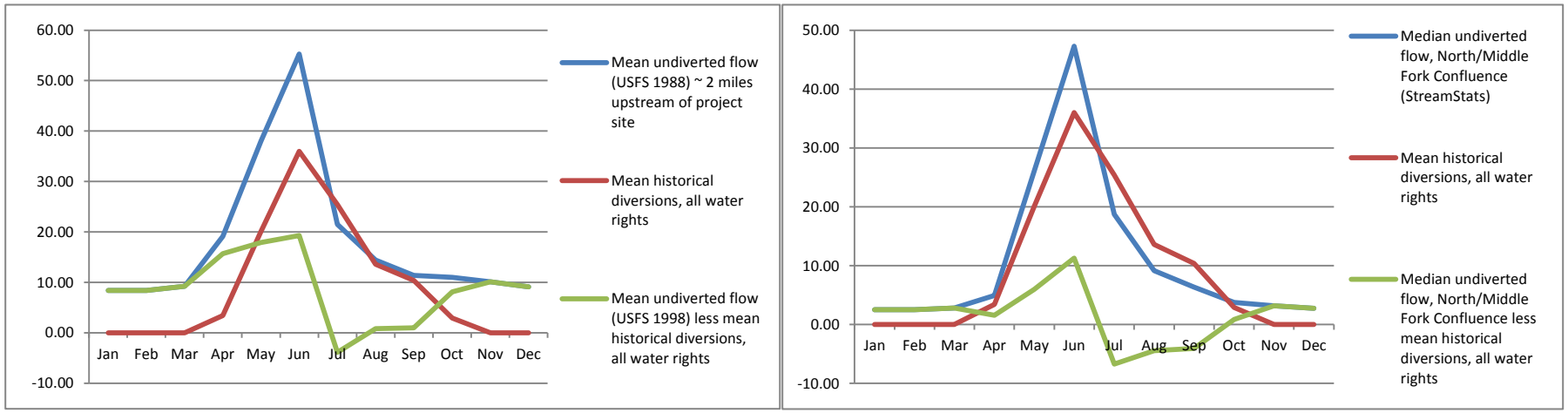


Figure 5a. Undiverted Little Timber Creek flows (USFS 1988 and StreamStats) upstream of diversion 5, less mean historical diversions for *all water rights*.

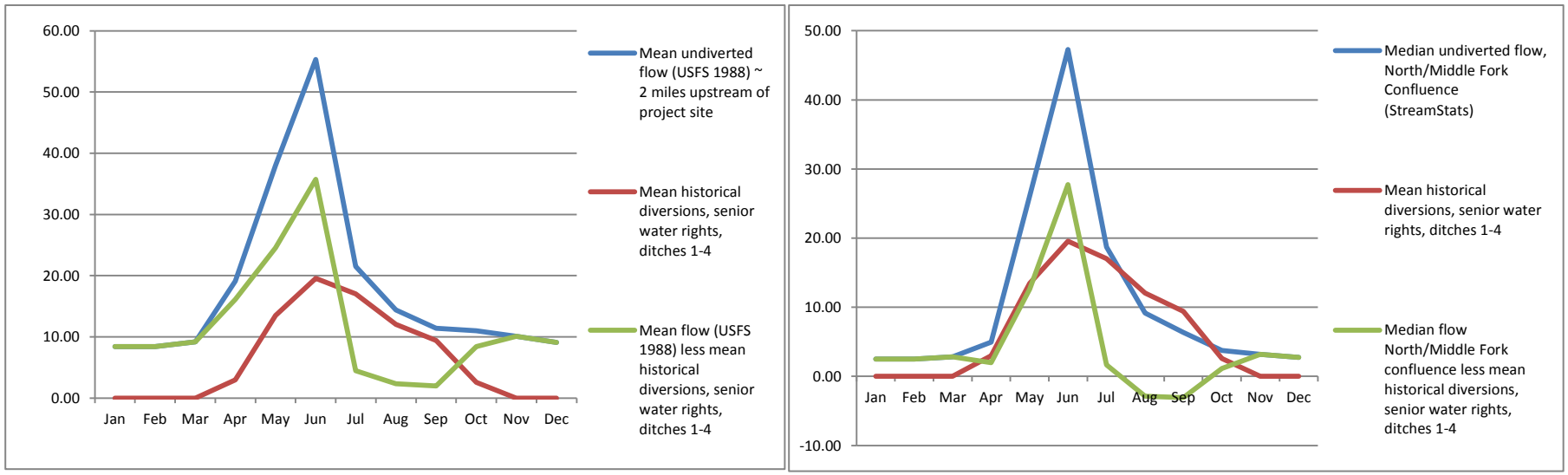


Figure 5b. Undiverted Little Timber Creek flows (USFS 1988 and StreamStats) upstream of diversion 5, less mean historical diversions *senior water rights*, ditches 1-4.

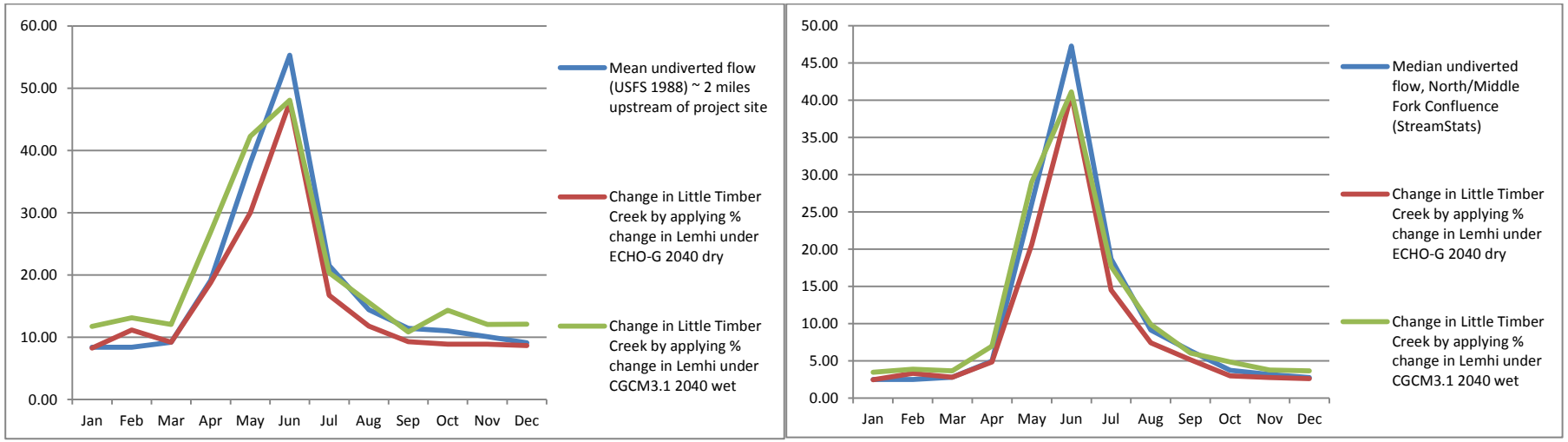


Figure 5c. Undiverted Little Timber Creek flows (USFS 1988 and StreamStats) upstream of diversion 5 compared to projected wet and dry conditions in 2040.

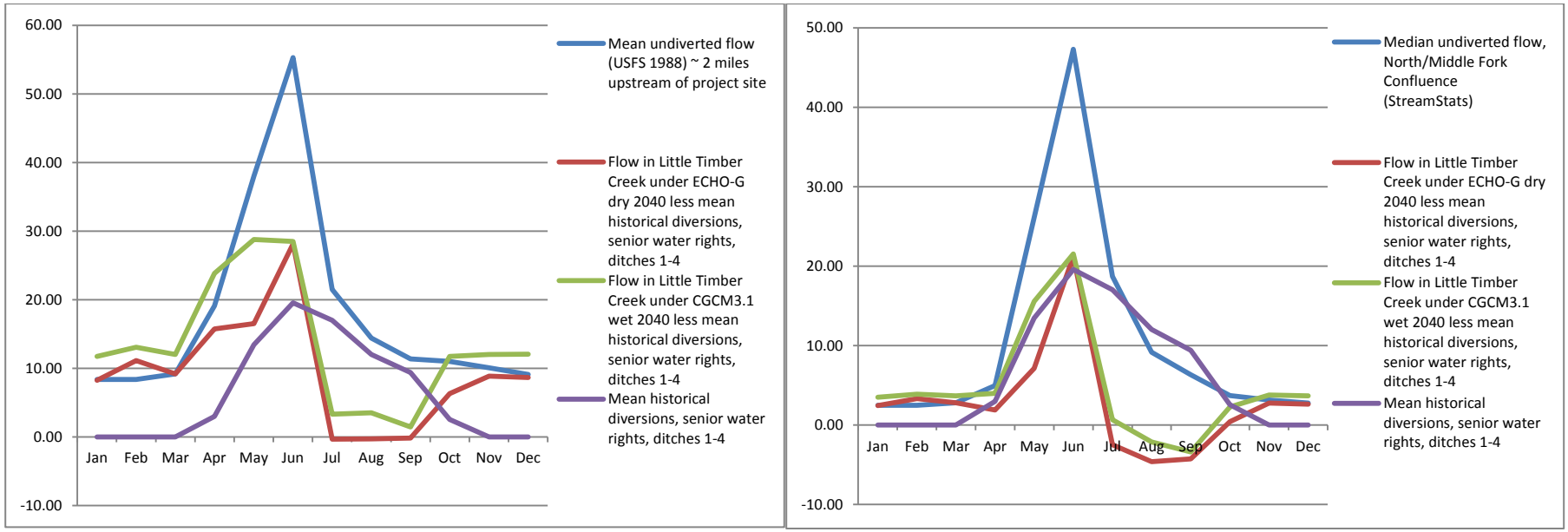


Figure 5d. Undiverted Little Timber Creek flows (USFS 1988 and StreamStats) upstream of diversion 5; mean historical senior water rights; Little Timber Creek flows less historical senior water rights under projected wet and dry conditions in 2040.

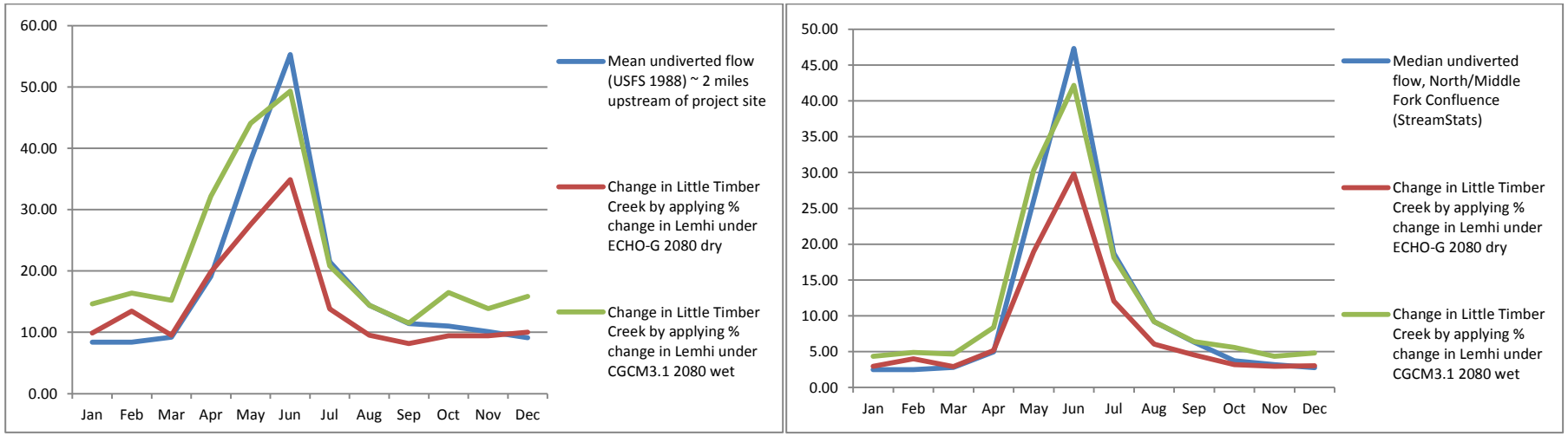


Figure 5e. Undiverted Little Timber Creek flows (USFS 1988 and StreamStats) upstream of diversion 5 compared to projected wet and dry conditions in 2080.

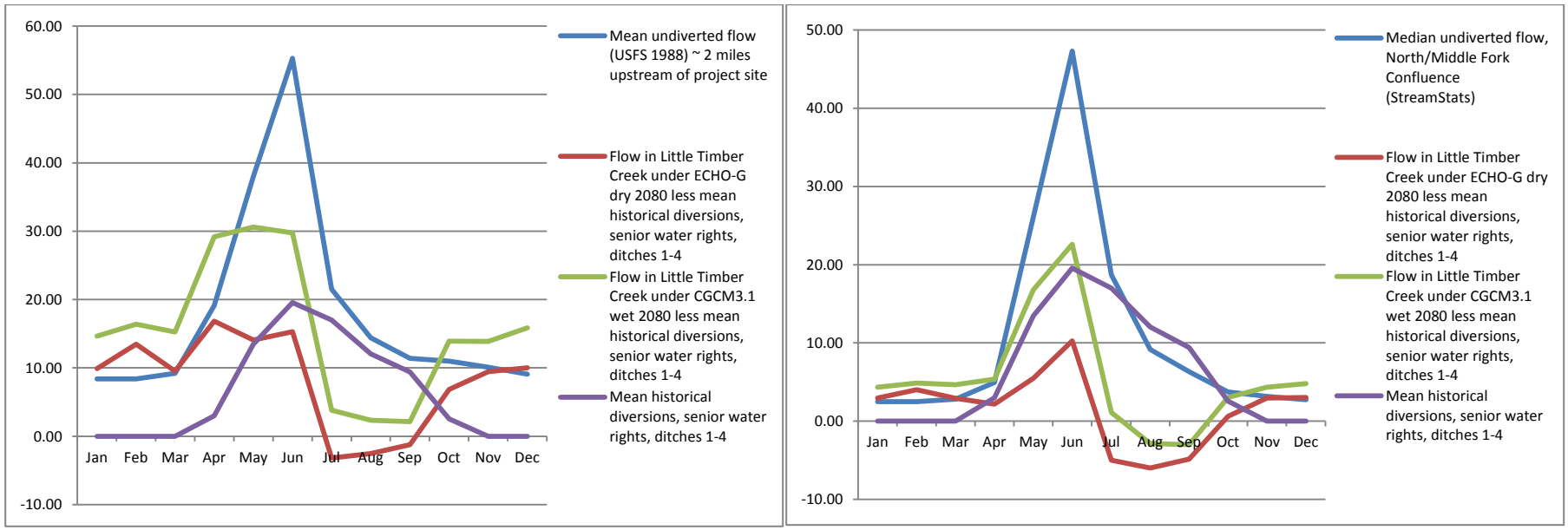


Figure 5f. Undiverted Little Timber Creek flows (USFS 1988 and StreamStats) upstream of diversion 5; mean historical senior water rights; Little Timber Creek flows less historical senior water rights under projected wet and dry conditions in 2080.

2.4.2 Bull Trout Critical Habitat

2.4.2.1 Status of Bull Trout Critical Habitat in the Action Area

The Lemhi River CHSU is contained within the Salmon River CHU, and is essential to bull trout conservation because it has many individuals, a large amount of habitat (234.3 stream miles of critical habitat), and few threats. The Lemhi River CHSU has fluvial life history forms that are important to the long-term recovery of the species (USFWS 2010b, p.767).

Within and adjacent to the project area, Little Timber Creek, Big Timber Creek, Big Springs Creek, and the Lemhi River are listed as designated bull trout critical habitat (USFWS 2010b, p. 767-768). The Lemhi River; Big Timber Creek; Little Timber Creek from its confluence with Big Timber Creek upstream to the confluence of the North Fork Little Timber Creek and Middle Fork Little Timber Creek; and the North Fork Little Timber Creek; all provide FMO habitat (USFWS 2010b, p. 767-768). While bull trout may access Little Timber Creek via Big Timber Creek, the latter is not affected by the proposed project.

Big Springs Creek critical habitat is described as containing FMO habitat from its confluence with Big Eightmile Creek to Lee Creek (USFWS 2010b, p. 767). However, Big Springs Creek proper (pink stream in Figure 1) does not naturally connect with these two streams. USFWS (2010b, p. 767) and Littlejohn (2012, p. 51); as well as Google Earth and other sources, indicate that the Big Springs Creek critical habitat described on page 767 of USFWS (2010b) is a 1.3 mile section of irrigation ditch connecting Lee Creek and Big Eightmile Creek just west of State Highway 28, about 1.5 air miles west of the confluence of Big Springs Creek and the Lemhi River (blue segment at far left of the action area in Figure 1). The irrigation ditch (red stream in Figure 1) is known as BS-5 (or LBSC-05, or Lateral BS-05: Littlejohn 2012, p. 51). BS-5 originates from a head gate on Big Springs Creek, roughly where excess overland flow from Little Timber Creek ditch 3 reaches State Highway 28, and carries flow from Big Springs Creek and excess overland flow from ditch 3 west for about three miles before reaching Big Eightmile Creek. The current function of BS-5 is to convey water to two areas: a 91.2 acre irrigated pasture adjoining BS-5 near the BS-5 headgate on Big Springs Creek, and 69.6 acres of irrigated pastures about 3.4 miles downstream of the BS-5 headgate (Josten 2015, in litt.). BS-5 now functionally terminates at this latter pasture (Littlejohn 2016a, pers. comm.). The section of BS-5 irrigating this pasture was part of what was designated as Big Springs Creek bull trout critical habitat.

The 1.3 mile section of BS-5 was designated bull trout critical habitat in 2010 to provide connectivity between Lee Creek and Big Eightmile Creek via Big Springs Creek proper (which was not designated as bull trout critical habitat), and the Lemhi River. A restoration project connecting Lee Creek and Big Eightmile Creek with the Lemhi River was completed in 2013 (Lee Creek and Big Eightmile Creek Reconnect Project: Littlejohn 2012; USFWS 2012, in litt.; Littlejohn 2016b, pers. comm.). As part of the project, the section of BS-5 designated as critical habitat that connected with Lee Creek was filled in. The connection of BS-5 with Big Eightmile Creek was also removed. Active flow in BS-5 now passes through a pipe beneath Big Eightmile Creek to enter what remains of the critical habitat section of BS-5, and flow stops in this section at the point where the water is directed onto a private pasture (Littlejohn 2016a, pers. comm.).

Other than the Lemhi River, neither Lee Creek nor Big Eightmile Creek are now connected with any other stream or flow in or near the project area that is designated bull trout critical habitat.

Flow in BS-5 is in large part drawn from Big Springs Creek. A reduction in Big Springs Creek flow resulting from reduced seepage from ditches 2 and 3 could technically affect flow in the remaining active portion of BS-5 that is designated bull trout critical habitat, but in practical terms of what will affect bull trout critical habitat that bull trout can access and use, a reduction in Big Springs Creek flow has potential to affect only bull trout critical habitat in the Lemhi River. For the reasons presented in this section, critical habitat designated as Big Springs Creek will not be discussed further in this Opinion.

2.4.2.2 Factors Affecting Bull Trout Critical Habitat in the Action Area

Most of the factors presented as affecting bull trout in the Lemhi River in the action area (Section 2.4.1.2) will also affect bull trout critical habitat in the action area portion of the Lemhi River. These factors include diversions continuing to lead to reduced summer flows, a changed hydrograph, increased water temperatures, and sediment accumulation, as well as beneficial effects of restoration projects re-connecting tributaries with Lemhi River and returning more water to the river within the action area. Brook trout, a non-endemic invasive species, occur in the Lemhi River.

An assessment of baseline bull trout critical habitat PBFs for Little Timber Creek within the action area are given in Table 4.

Table 4. Condition of bull trout critical habitat physical and biological features (PBF) in the action area on Little Timber Creek. Condition descriptions are derived from IDFG (2012, in litt.), and from USFWS observations from the September 2015 site visit.

PBF Description	PBF Condition in Little Timber Creek in the Action Area
1) Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia	Hyporheic flows are likely reduced due to presence of low flows during the irrigation season. Narrow riparian area may be a function of reduced hyporheic flows.
2) Migratory habitats with minimal physical , biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial intermittent, or seasonal barriers.	Migratory and FMO habitat in Big Timber Creek and the Lemhi River are disconnected from Little Timber Creek due to de-watering of lower Little Timber Creek during irritation season in most years, and due to all 5 irrigation diversions on Little Timber Creek acting as barriers to fish passage.
3) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.	Terrestrial food base present and likely sufficient due to presence of riparian shrubs and trees. Aquatic food base likely reduced due to flows reduced by irrigation withdrawals.
4) Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths gradients, velocities, and structure.	Sinuosity is reduced (1.15); large wood is marginal to adequate, averaging one piece every 11 feet; pools are reduced, with 86% of reaches consisting of riffles and glides (IDFG in litt. 2012) as provided by Josten (in litt. 2012). Reduced sinuosity & pools may be due to reduced flows, perhaps to past livestock impacts.
5) Water temperatures ranging from 2 to 15 ^{o}C (36 to 59 ^{o}F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shade, such as that provided by riparian habitat; and local groundwater influence.	Temperatures slightly elevated above the PBF range, likely due to low water levels. Maximum temperature in 2012 (between April 14-October 25) near the project site reached 18.7^{o}C in early August. Maximum temperature was 15°C or lower before end of May and after early September. Maximum temperature dropped to 13°C at the end of September, but average temperature dropped to 13°C by the end of August (IDFG in litt. 2012) as provided by Josten (in litt. 2012).
6) Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount (e.g., less than 12 percent) of fine substrates less than 0.85 mm (0.03 in.) in diameter and minimal embeddedness of these fines in larger substrates are characteristic of these conditions.	Fines are absent, with 54% fine-to-coarse gravels (IDFG in litt. 2012) as provided by Josten (in litt. 2012). Diversion dams may be functioning as effective sediment barriers, leading to fines absent in the action area portion of Little Timber Creek.
7) A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges, or if flows are controlled, they minimize departures from a natural hydrograph.	Natural hydrograph largely absent due to irrigation withdrawals.
8) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.	Water quantity is reduced due to irrigation. Water quality parameter of temperature is slightly reduced due to low flows. No known contaminant issues.
9) Few or no nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass; inbreeding (e.g., brook trout); or competitive (e.g., brown trout) species present.	No brook trout or other predatory fish species are present (IDFG in litt. 2012) as provided by Josten (in litt. 2012). Movement of brook trout into Little Timber Creek from the Lemhi River may be prevented by the diversions on Little Timber Creek.

As suggested by information in Table 4, irrigation diversions can be linked to impacts on all nine critical habitat PBFs in the Little Timber Creek portion of the action area, although some outcomes of diversions, such as the absence of fines and brook trout, may be beneficial. The primary impacts to critical habitat PBFs result from either reduced flows or dewatering.

Reduced flows can reduce hyporheic connectivity, sinuosity and pool formation, result in change or loss of the natural hydrograph, reduce aquatic invertebrate habitat, lead to narrowing of riparian zones, and lead to increases in water temperature. Dewatering during the irrigation season would act as a barrier to upstream movement of bull trout from the Lemhi River and Big Springs Creek, even if fish passage at the diversions was possible.

Available information suggests that current livestock use of the Little Timber Creek corridor is controlled. The Biological Assessment for BLM Actions in the Canyon to Big Timber Watershed Assessment Area indicates there are minimal impacts to Little Timber Creek that can be contributed to livestock use (BLM 2011, p. 122-136). Observations of Service biologists during a September 2015 site visit to the project area also indicate controlled livestock use, with abundant presence of native herbaceous and shrub vegetation adjacent to the riparian areas and narrow but generally closed riparian areas with shrub and tree growth. BLM observations (BLM 2011, p. 122-136) suggest that Little Timber Creek and other streams in the Big Timber Creek watershed are recovering from heavier, historical livestock use.

Future Hydrologic and Stream Temperature Conditions

Effects to bull trout in the action area from ongoing and future changes in climate as presented in Section 2.4.1.2 can be expected to affect bull trout critical habitat in the Lemhi River and Little Timber Creek, as well. Projected increasing air temperatures and reduced surface flows will lead to further reduction in hyporheic flows which may impact riparian areas; and in increased water temperatures remaining elevated for longer periods during the growing season.

To extrapolate climate change projections from information in Table 2 to flows in the Lemhi River in the action area at the Big Springs Creek confluence, we multiplied mean monthly flow estimates derived by the Commission (FERC 2016, p. 27) for the Lemhi River immediately downstream of the Big Springs Creek confluence by the percent differences in median monthly flow between current conditions in the Lemhi River at USGS gage # 13305310 and both the ECHO-G (dry) and CGCM3.1 (wet) climate change scenarios. Projected Lemhi River winter flows will increase early in the year under both wet and dry climate scenarios in 2040 and 2080 (Figure 6). Runoff and peak flows, however, will occur earlier, leading to flows less than or equal to current flows during the irrigation season. Broad differences in projected winter flows between wet and dry scenarios are much reduced during the irrigation season in 2040. By 2080, however, if current irrigation diversions are maintained minimum summer river flows in a dry scenario may begin to decrease substantially compared to minimum flows under current and wet scenarios. Thus, conditions for PBFs 2, 7, and 8 (which together with PBF 3 contribute to FMO habitat condition) in the Lemhi River in the action area may improve in winter under climate change in terms of flow, but conditions may remain static or downgrade in summer under climate change and current irrigation diversions.

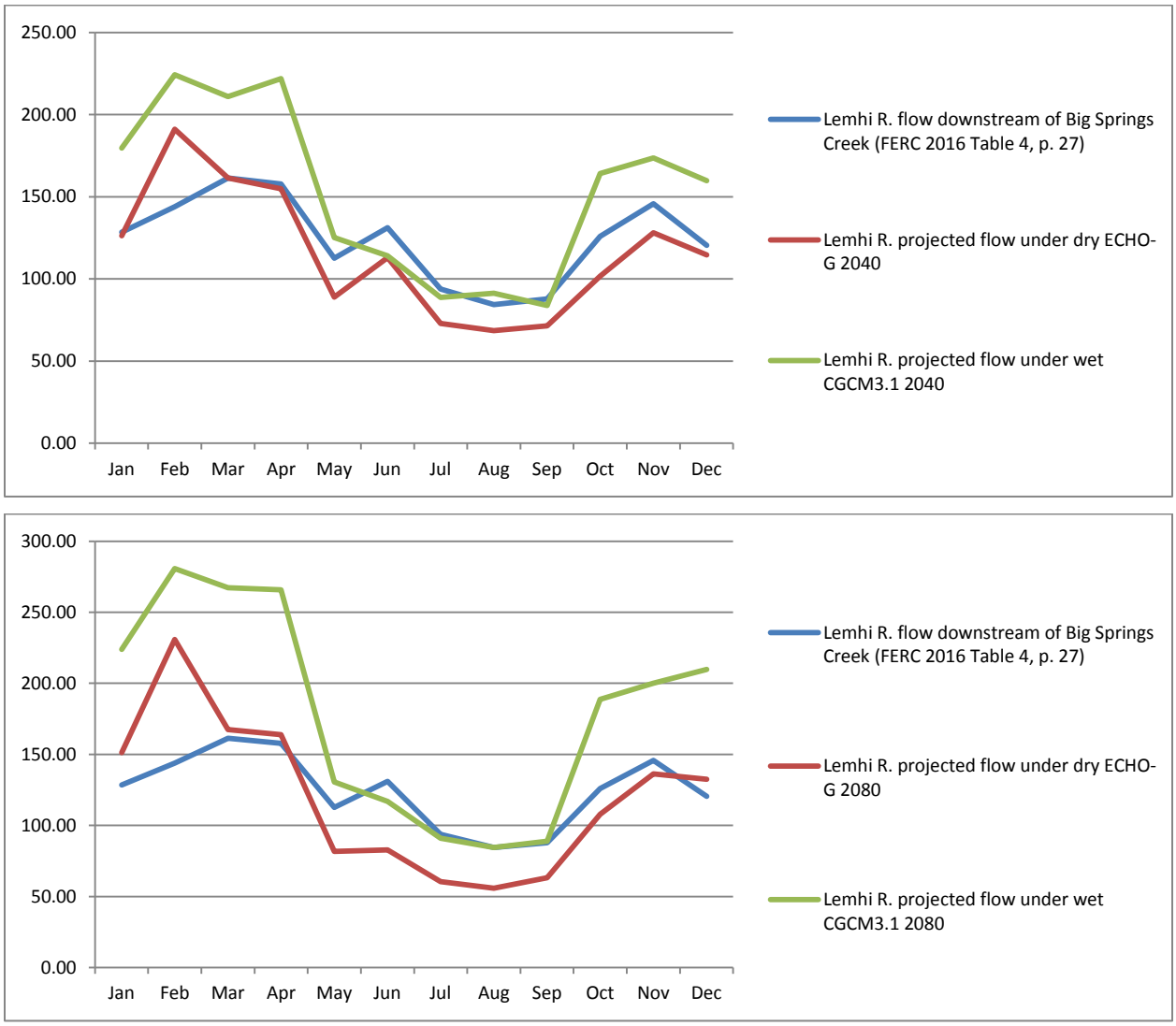


Figure 6. Current Lemhi River flow at Big Springs Creek confluence compared to projected flows, wet and dry conditions, in 2040 and 2080.

Winter flows in bull trout critical habitat in the currently wetted portion of the action area in Little Timber Creek are likely to be maintained or may increase slightly under both dry and wet scenarios (Figure 5). However, the frequency of dewatering of Little Timber Creek downstream of the action area during part of the irrigation season (which currently occurs in most years) is likely to increase under all future scenarios, and may extend upstream to include the action area; Little Timber Creek may be dewatered in the vicinity of the project site in at least some years. Reduced summer stream flow may eventually shrink the riparian area, which could reduce the terrestrial invertebrate forage base. Reduced summer flow is also likely to reduce hyporheic flows in the action area. Increased summer air temperatures occurring for longer duration compared to current conditions are likely to increase water temperature in Little Timber Creek in the action area, as well. Connectivity between resident bull trout populations in the North and Middle Forks of Little Timber Creek and the Lemhi River in winter will be maintained.

Consistent with Isaak et al. (2016, p. 4377), however, projected reductions in stream flow, narrowing riparian area, and increased water temperatures are likely to preclude bull trout using reaches in the vicinity and upstream of the project site during summer, further isolating the Little Timber Creek high elevation resident populations.

2.5 Effects of the Proposed Action

Effects of the action considers the direct and indirect effects of an action on the listed species and/or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species. Direct effects are defined as those that result from the proposed action and directly or immediately impact the species or its habitat. Indirect effects are those that are caused by, or will result from, the proposed action and are later in time, but still reasonably certain to occur. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation.

Note: In their final EA the Commission did not recommend adoption of, and did not analyze the effects of, the NMFS Section 18 Prescription #5 that requires the applicant provide for effective upstream and downstream fish passage at both the second and third diversions, because such fish passage at the third diversion is not required for project operation and would not be within the project boundary over which the Commission has authority. However, consultation under section 7 of the Act for hydroelectric power licensing under the Federal Power Act differs from the NEPA environmental analysis of license issue in that section 7 consultation is conducted to analyze the impacts on species and/or designated critical habitat that may result from issuing the license. Since the Federal Power Act provides that all Section 18 Prescriptions must be included as part of the license conditions, the Service must assume that upstream and downstream fish passage will be provided and so we are analyzing the effects of providing fish passage at the third diversion to bull trout.

Impacts to bull trout may result from the following aspects of the proposed action:

- Excavation and construction involved in the placement of the project diversion structure at the second diversion;
- Operation of the project diversion;
- Installation and operation of the project trash rack, fish bypass pipe, and fish screen;
- Construction, which might include excavation, to install a means of providing effective upstream and downstream fish passage at the third diversion (NMFS Section 18 Prescription # 5);
- Operation of the upstream and downstream fish passage at the third diversion; and,
- Operation of the penstock and the splitter box.

2.5.1 Direct and Indirect Effects of the Proposed Action

2.5.1.1 Little Timber Creek

Direct Effects

Direct effects from the proposed action to bull trout from excavation and construction involved with the project diversion structure, trash rack, fish bypass pipe, fish screen, and construction of fish passage at the third diversion, may result from increased turbidity and sediment deposition in that portion of the action area from the third diversion to the second diversion and downstream of the second diversion for approximately 1,320 feet (0.25 miles). Taking into account stream velocity and substrate type in Little Timber Creek, one quarter mile is a reasonable distance within which sediment mobilized during construction would be expected to re-deposit on the stream bottom.

Effects to bull trout in the action area on Little Timber Creek area from sediment mobilization and deposition are expected to be minimal and short term (lasting only during the construction period over two years). The action area is not considered spawning or rearing habitat, and so reproduction will not be affected by construction. During the construction period (July 1-August 31), Little Timber Creek is de-watered downstream of the first diversion, precluding movement of bull trout from the Lemhi River or Big Timber Creek into Little Timber Creek; at that time of year resident bull trout in Little Timber Creek are expected to remain in cold water habitat in the North and Middle Forks of Little Timber Creek. Hence, the probability of bull trout occurring in the Little Timber Creek portion of the action is considered very low. Their presence in this portion of the action area during construction however, cannot be ruled out.

Sediment is an important stressor to salmonids, and direct effects to bull trout from sedimentation resulting from the action could occur by a couple of routes. Bull trout are highly susceptible to sediment inputs and require the lowest turbidity and suspended sediment levels of all salmonids for spawning, incubation, and juvenile rearing. The Service knows of no positive effects to salmonids from increased sediment; while the potential negative impacts of increased suspended sediment on bull trout and other salmonids have been well documented (e.g., Bakke 2002; Newcombe and MacDonald 1991, pp. 72-73; Newcombe and Jensen 1996, pp. 700-715, Bash et al. 2001, p. 24).

Fish may avoid high concentrations of suspended sediments altogether (Hicks et al. 1991, p. 483-485). Increased sediment could lead to the direct effects of interference with feeding or physiological effects to the gills. Even small elevations in suspended sediment may reduce feeding efficiency of salmonids (Sigler et al. 1984 p. 142) by reducing visibility. Increasing suspended sediment in rivers and streams during low-flow periods, when background levels of sediment in the stream system are generally very low or absent, has greater potential to affect fish. Bash et al. (2001, p. 6-11) reported that background mucus levels of fish gills are lower during this time period, and increased sediment could lead to gill trauma.

If bull trout are in the Little Timber Creek action area during construction, their choices to avoid increased suspended sediment would be to move upstream or downstream of the turbid areas. The extent of movement upstream would be limited to the third diversion, which is a fish barrier; and the extent of movement downstream may be limited to those reaches that are continually watered.

Development and implementation of the site-specific erosion control plan (Section 2.1.2.3) is expected to reduce construction related impacts that might result in sediment mobilization and deposition in the Little Timber Creek portion of the action area.

Bull trout could also be affected through impacts to water quality through chemical contamination when equipment is working in or adjacent to Little Timber Creek. Equipment working near water raises the concern for the potential of an accidental spill of fuel, lubricants, hydraulic fluid, as well as other contaminants associated with construction, such as cement, into the riparian zone or directly into the water where it could adversely affect habitat, injure or kill aquatic food organisms, and/or poison bull trout.

The presence of large machinery will also result in increased noise levels, vibration, and other disturbances associated with increased human presence at the project site. If bull trout are present during these activities, they could be startled and move away from the general vicinity of the disturbance. The disturbance is relatively short-term, expected to last about two months per construction period over two years. Disturbance effects are expected to result in only minor disturbances to fish overall, with potential avoidance behaviors initially. Bull trout are typically most active at night (Homel and Budy 2008, p. 876), so daytime activities could result in bull trout moving from cover to avoid perceived threats associated with human and equipment presence. We expect that avoidance or alarm responses will be minimal, resulting in movement to other available cover in the immediate area or downstream. These effects are not considered a significant disruption to normal feeding, holding or sheltering behavior.

The Proposed Environmental Measures (Section 2.1.2.3) include provision for maintenance of the diversion intake, fish screens, fish bypass, and trash rack, which would reasonably include cleaning of debris and repairs. Direct effects from maintenance activities would most likely stem from movement and noise from personnel working in the water or on the bank at the diversion site. Bull trout in the vicinity of the diversion intake would be expected to respond similarly as they would to construction noise and vibration by initiating avoidance behaviors. Disturbance effects resulting from maintenance would be short term, and are expected to result in only minor disturbances to fish overall. Effects of sediment mobilization from personnel disturbing bottom sediments would be expected to be short term and minimal, and not rise to the level of impacting individual bull trout.

Indirect Effects

Some riparian vegetation, possibly including trees, will be removed in order to construct the project diversion, and possibly for construction of fish passage at the third diversion. Indirect effects to bull trout from riparian vegetation removal may include removal of shading area leading to an increase in water temperature, and a reduction in the terrestrial invertebrate forage base. These indirect effects would be small compared to the overall amount of riparian vegetation, but would be long term (greater than one year) for the time needed for woody shrubs and trees to regrow.

Once completed, operation of the project diversion will result in an increase in flow in the 500 foot reach between the 3rd and 2nd diversions by the amount of water normally diverted into ditch 3. For example, flows in June and July may increase from an average of 9.1 and 6.5 cfs, respectively, to an average of 22.3 and 18.5 cfs (see Josten 2011 in litt., p. 12). Over time, increased hyporheic flows resulting from increased flows in the reach may eventually support an expanded riparian area between the two diversions, which would be an indirect beneficial effect.

In addition, with the construction of upstream and downstream fish passage at the third diversion, bull trout would gain access to an additional 500 feet of FMO habitat with increased flow during the irrigation season, also an indirect beneficial effect.

None of the diversions on Little Timber Creek are screened, and so currently there is potential for entrainment of bull trout, if present, into all of the diversions. Installation of the fish screen at the project intake will prevent entrainment of bull trout into the project. Since project implementation is expected, under most circumstances, to result in water normally diverted into ditch 3 to be diverted into the project intake at the ditch 2 location, the project will effectively eliminate the potential for fish entrainment into both ditches 2 and 3, an indirect beneficial effect to bull trout. If the powerhouse at the downstream end of the penstock goes offline, water from both ditches will still enter the project intake via the fish screen, but will be routed through a turbine bypass in the powerhouse and from there will be conveyed to the second and third ditches (Section 2.1.2.2). In this situation entrainment is also prevented at the second and third diversions. Only if the project intake becomes inoperative will water be conveyed to the fields through the existing irrigation facilities, which could result in entrainment of bull trout into ditch 3.

There could be some potential for impingement of bull trout on the fish screen or trash rack at the project intake. However, since the maximum flow (17.1 cfs) expected to enter the project is known, the hydraulic evaluation plan required to be developed for the project diversion and intake structure, fish screen, and fish bypass pipe (Section 2.1.2.2) will ensure that trash rack and fish screen apertures will be designed and the system operated to eliminate the possibility of impingement of bull trout on these structures.

2.5.1.2 Lemhi River

Indirect Effects

As described in Section 2.4.1.2 under Water Quantity, seepage from ditches 2 and 3 is estimated as equivalent to approximately 1,055 acre feet of water per year. As subsurface flow, this volume of water is assumed to contribute to flows in Big Springs Creek and the Lemhi River at a more or less constant rate of 1.46 cfs throughout the year (Johnson 2011 in litt., p. 13-14).

If Little Timber Creek water is diverted directly into the project without traveling through the ditches, seepage from the ditches will be eliminated. Concerns were raised by the resource agencies that if routing all historically diverted water from the second and third diversions through the penstock eliminates seepage, the water thus saved would be subject to additional consumptive use by crops—either through increased evapotranspiration from existing crops, or through planting additional crops or higher water-consumptive crops. If this were to occur, then less water would end up in Big Springs Creek and ultimately in the Lemhi River, with potential to affect bull trout and bull trout critical habitat in the Lemhi River.

If crops are fully watered, plants will be transpiring at their maximum rate and application of additional water will not contribute to evapotranspiration. Owners of both diversions irrigate for alfalfa and grass pasture, some of the highest water-consumptive crops. Any additional water is unlikely to facilitate conversion to higher water-consumptive crops. Johnson (2011, in litt., p. 10-12) estimated the adequacy of the irrigation supply to crops for the second and third diversions using irrigation demands for alfalfa and grass pasture, the average monthly diversion

rate and monthly seepage estimates (1995-2009), and, precipitation, measured diversions, and atmospheric conditions (1997-2008) for the Lemhi Valley.

Fields irrigated by the third diversion were found to have never been water-short during the 1997-2008 period. Based on historical conditions and water use, additional water applied to these fields would not result in increased evapotranspiration (Johnson 2011, in litt., Appendix C). Since the ditch 3 crops are already fully-watered (implying the soil is largely saturated), saved seepage for ditch 3 is expected to travel overland across the fields and enter Big Springs Creek.

The analysis for the second diversion showed that in dry years water reaching the fields would have been inadequate to meet crop demands in at least one month during July, August, or September. Based on the analysis the field irrigated by the second diversion was estimated on average to be short 54 acre feet of water per dry year (Johnson 2011, in litt., p. 11). Thus, if 1,055 acre feet of saved seepage reach the fields irrigated by ditches 2 and 3, the ditch 2 field could consume an additional 54 acre feet via evapotranspiration during dry years, with the remainder of ditch 2 water traveling overland to Big Springs Creek.

When the project goes online, operation of the penstock and the splitter box at the exit of the powerhouse will have indirect effects on flow in Big Springs Creek and the Lemhi River. Seepage from ditches 2 and 3 that currently reaches Big Springs Creek and the Lemhi River as groundwater flowing at a more or less constant rate of up to 1.46 cfs year around will eventually cease (due to the slow rate of movement through the ground, some subsurface flow to Big Springs Creek and the Lemhi River originating as ditch 2 and 3 water might continue for up to a year after the project goes online). This would be an indirect effect to bull trout overwintering in the Lemhi River. A permanent decrease in winter flow of up to 1.46 cfs would be about 1.2 percent of the lowest average monthly winter flow (120.4 cfs for December) for the Lemhi River as calculated by the Commission (FERC 2016, p. 27). A small decrease in winter flow would not affect bull trout reproduction, since the mainstem of the Lemhi River is not bull trout spawning or rearing habitat. Other life history requirements that could be affected by a small decrease in flow, such as water temperature (low in winter), oxygen (lower oxygen consumption in winter due to low water temperature and lower metabolism), food (less required due to lower metabolism), are also reduced in winter. For these reasons, we consider that the indirect effect of a decrease in winter flow of up to 1.46 cfs would not rise to the level of take, and so would be insignificant to bull trout.

While project operation would eliminate the seepage input to the Lemhi River of 1.46 cfs (as subsurface flow) year around, a gain in input to the Lemhi River is expected during the 7-month irrigation season (April through October). If the entire volume of saved seepage, 1,055 acre feet, encounters fully watered crops watered by ditches 2 and 3, this amount as overland flow may reach the Lemhi River via Big Springs Creek. Averaged over the 7-month irrigation season (April through October), this is equivalent to a constant input to the Lemhi River of approximately 2.5 cfs, or about 1.04 cfs greater than the existing rate of 1.46 cfs of subsurface flow. In a dry year, fields watered by ditch 2 could consume up to 54 acre feet of the saved seepage, resulting in about 1,001 acre feet reaching the Lemhi River over the 7-month irrigation season. This volume would be equivalent to approximately 2.37 cfs, or about 0.9 cfs greater than the existing rate of 1.46 cfs. An increase of input to the Lemhi River of between 0.9 and 1.04 cfs during the irrigation season when diversions normally lead to minimum river flows would be a small but beneficial effect to bull trout. As indicated in Section 2.4.1.2 (Water Quantity), Johnson's (2011 in litt., entire) estimates of saved seepage assume that both ditches 2 and 3 are

unlined. Since the water-right holder using ditch 2 periodically lines the ditch with bentonite throughout the irrigation season, the actual saved seepage is likely to be less than 1,055 acre feet. Hence, the saved seepage reaching the Lemhi River is likely to be less than 0.9 or 1.04 cfs, though we do not have sufficient data from which to estimate for the difference.

In a river-and-irrigation system where water rights and success of river-flow restoration projects are allocated or measured to the tenths or hundredths of a cfs (Section 2.4.1.2 and Table 3, water rights; LaMontagne 2012 in litt.), the possible gain of up to 0.9 to 1.04 cfs of irrigation season flow (as compared to a 1.46 cfs decrease in winter flow) in the Lemhi River in the action area attributed to saved seepage from ditches 2 and 3 that may result from project implementation is considered significant. For example, an irrigation season gain of 0.9 cfs resulting from saved seepage is between 4.9 and 5.5 percent of the total potential flow increase (between 16.26 and 18.26 cfs) realized by summing the gains in the Lemhi River portion of the action area, the smallest of which was 1.36 cfs (Littlejohn 2012), from restoration projects described in Section 2.4.1.2. Restoration of connectivity between the Lemhi River and Big Timber Creek leads to the possibility that bull trout may be present in the action area of the Lemhi River in the early irrigation season prior to migrating upstream to Big Timber Creek in June. For these reasons, a flow increase of up to 0.9-1.04 cfs in the action area of the Lemhi River during irrigation season is considered a beneficial effect.

Temperature of water flowing exposed to the sun through ditches 2 and 3 would normally increase during transit, as well as while flowing over or being applied to the fields before reaching Big Springs Creek and the Lemhi River, thus contributing to elevated river water temperatures in the Lemhi River during the irrigation season. Since the penstock will be buried, temperature of water entering the penstock from Little Timber Creek is expected to be more or less maintained until it exits the powerhouse. Some thermal gain may occur as the water is returned to ditches 2 and 3 and after it is applied to the fields, but may be less compared to thermal gains acquired from traveling the entire distance from Little Timber Creek to the Lemhi River exposed to insolation. A decrease in irrigation return water temperature conveyed to the Lemhi River would be a beneficial effect to bull trout in the river and Big Springs Creek, and to critical habitat in the river.

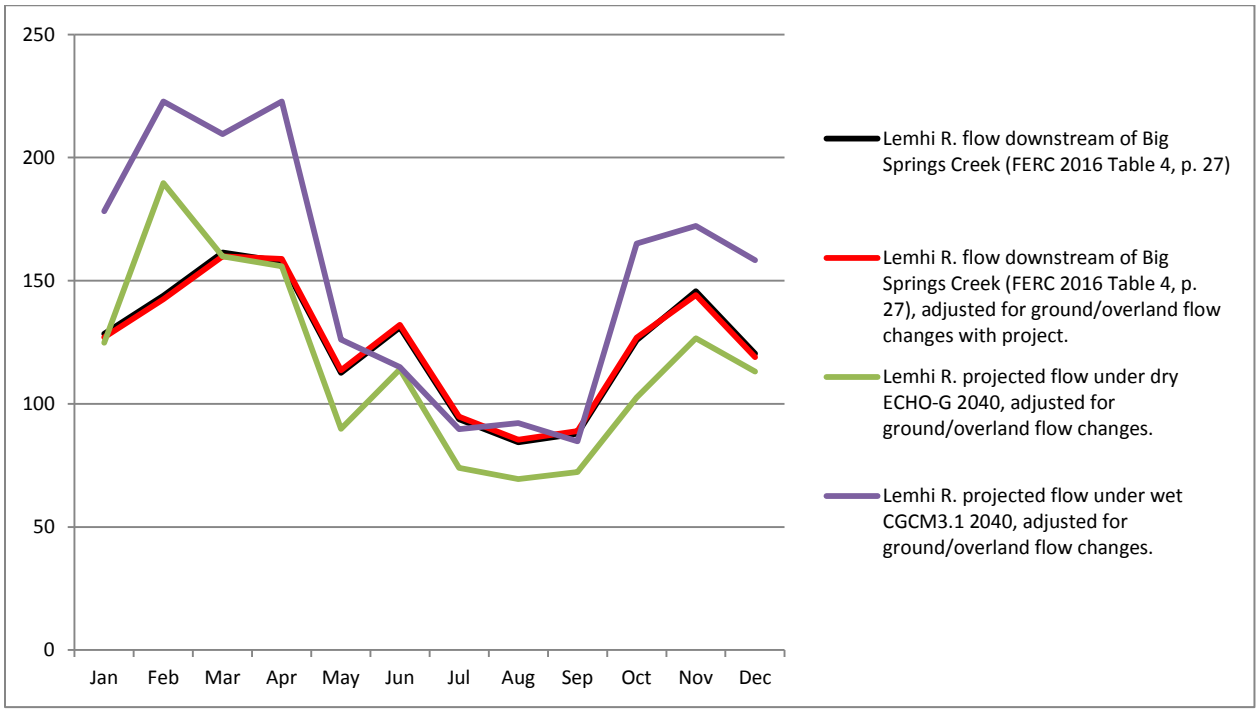
2.5.1.3 Indirect Effects to Bull Trout under Future Hydrologic and Stream Temperature Conditions

To assess the extent of how a gain of 0.9 to 1.04 cfs might contribute to functioning condition of bull trout critical habitat in the action area portion of the Lemhi River under future hydrologic conditions, we assumed that the gain would be maintained over time. To simplify, we rounded both estimates to 1.0 cfs. The 1.46 cfs rate of groundwater input to the Lemhi River (via Big Springs Creek) was subtracted from, and the 1.0 cfs of increased summer input was added to, the Commission's estimate of current Lemhi River flows in the action area (FERC 2016, p. 27). Percent changes in Lemhi River flows as modeled for future climate scenarios were applied to river flows in the action area to depict the contribution of the additional 1.0 cfs to summer flows under future conditions, as shown in Figure 7. Changes in future flows and timing of flows that can be attributed to diverting saved seepage to the Lemhi River during the irrigation season are likely to be overshadowed by fairly dramatic changes in flow resulting from climate change in both wet and dry scenarios in 2040 and 2080. Figure 7 suggests the possibility of benefit from the 1.0 cfs gain during periods of the lowest flows of between 50 and 100 cfs. The degree of benefit may depend on wetted channel shape at these low flows, with sloping river bottom and

banks receiving more benefit compared to a more box-shaped channel at low flows. If future diversions into ditches 2 and 3 decrease as Figure 5 suggests will be necessary, then gain to the Lemhi River from saved seepage will also be reduced.

Under climate change, increased precipitation in winter generally more than makes up for the 1.46 cfs reduction in winter flows attributed to the project in the four precipitation/time horizon scenarios (Figure 7). This is due in part because even the dry scenario includes some increase in winter precipitation. The exceptions are March, November, and December in the 2040 dry scenario, and November in the 2080 dry scenario.

If, as assumed under Section 2.4.1.2, under future climate conditions water diverted from Little Timber Creek is decreased proportionately for all water rights in all diversions, flow increases in the 500 foot reach between the third and second diversions that will result from completing the project will be diminished. Under future climate conditions flows will still be greater in this reach compared to conditions without the project, however, and will still be a beneficial indirect effect to bull trout; and, construction of upstream and downstream fish passage at the third diversion will still provide bull trout access to an additional 500 feet of FMO habitat with increased flow during the irrigation season. As flows decrease in this reach, their ability to support an expanded riparian area via increased hyporheic flows will also diminish.



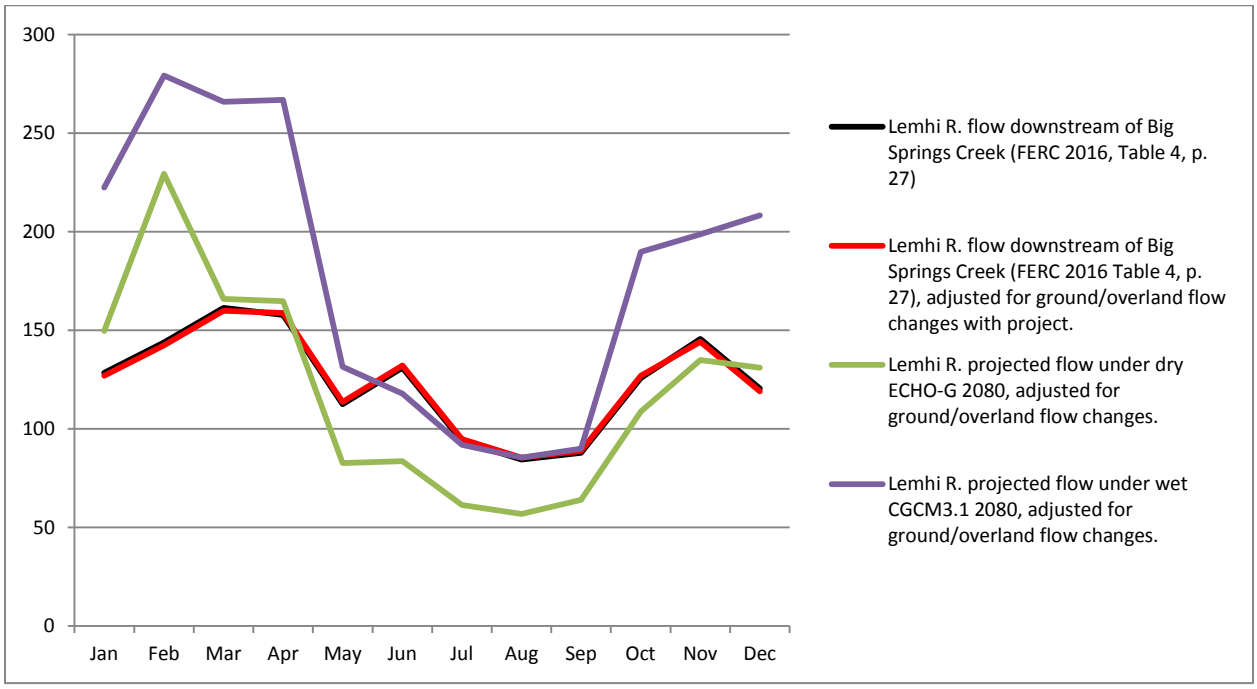


Figure 7. Current Lemhi River flow downstream of Big Springs Creek, compared to flow adjusted for 1.0 additional cfs, and compared to this adjusted flow under wet and dry conditions in 2040 and 2080.

If diversion of Little Timber Creek water is assumed to decrease over time, the amount of "saved seepage" reaching the fields and subsequently the Lemhi River will also decrease, diminishing the beneficial effect to bull trout in the Lemhi River. The penstock is expected to maintain the temperature of Little Timber Creek water diverted into the penstock until the water exits the powerhouse, but Little Timber Creek water temperatures are expected to increase under future climate conditions. With higher projected air temperatures, greater thermal gain would be expected as water travels across the fields after leaving the powerhouse. Hence, while temperature of water reaching the Lemhi River from the project is still expected to be lower compared to future conditions without the project, the beneficial effect to bull trout will be less compared to current conditions.

2.5.1.2 Effects of Interrelated or Interdependent Actions

The splitter box is not considered part of the proposed hydroelectric project (FERC 2016, p. A-3), and so will not be included in the license issued for the project. Operation of the splitter box to re-allocate the combined water from the second and third diversions back into their respective ditches upon exiting the powerhouse is an activity that is interrelated with the project, however, since but for the project combining water from the two diversions the splitter box would not be needed. Since effects of operation of both the splitter box and the penstock combined result in the indirect effects of delivery of saved seepage to the fields and thence ultimately to the Lemhi River, effects of the interrelated activity involving the splitter box have already been analyzed in Section 2.5.1.2, Lemhi River, Indirect Effects, and Section 2.5.1.3, Indirect Effects to Bull Trout under Future Hydrologic and Stream Temperature Conditions, and so will not be addressed separately in this section.

2.5.2 Bull Trout Critical Habitat

2.5.2.1 Direct and Indirect Effects of the Proposed Action

As stated in Section 2.3.2.2, PBFs are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of the young, dispersal, genetic exchange, or sheltering. Table 5 below summarizes the anticipated effects of the proposed action to the PBFs.

Table 5. Summary of anticipated effects of the proposed action to the PBFs under current and future climate conditions.

PBF Description	Anticipated Effects	Anticipated Effects Under Climate Change	Determination of Effect
1) Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia	Little Timber Creek: Water quality adversely affected during construction of project diversion & fish passage at 3rd diversion. Hyporheic flows may increase due to increased flow between ditch 2 and 3, a beneficial effect. Lemhi River: Up to a 1.46 cfs decrease in input to winter flow and up to a 0.9 to 1.04 cfs increase in summer input flow from saved seepage, combined with probable lower temperatures of project water reaching the river--both adverse and beneficial.	Little Timber Creek: Increase of hyporheic flows between ditch 2 and 3 will likely be less as climate change progresses, but still a beneficial effect. Lemhi River: Decrease in input to winter flow resulting from saved seepage remains the same, but may be negated by increased winter precipitation. Gains in summer input from saved seepage will diminish somewhat, but still a beneficial effect.	Little Timber Creek: Short-term adverse effect to water quality; long-term beneficial affect to hyporheic flows. Lemhi River: Both adverse & beneficial effects, long-term.
2) Migratory habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial intermittent, or seasonal barriers.	No change in connectivity between Little Timber Creek and the Lemhi River	None.	No effect.
3) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrtes, and forage fish.	Little Timber Creek: A short-term reduction in food base due to construction & removal of some riparian vegetation. Expected long-term increase in food base due to eventual expansion of riparian vegetation due to increased hyporheic flows. Lemhi River: No change.	Little Timber Creek: Expansion of riparian area due to increased hyporheic flows may be truncated as flow in Little Timber Creek decreases. Hence, less increase in terrestrial food base. Lemhi River: No change.	Little Timber Creek: Short-term adverse effect, long-term beneficial effect. Lemhi River: No effect.

PBF Description	Anticipated Effects	Anticipated Effects Under Climate Change	Determination of Effect
4) Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths gradients, velocities, and structure.	No change in either Little Timber Creek or the Lemhi River	No change to either Little Timber Creek or the Lemhi River.	No effect.
5) Water temperatures ranging from 2 to 15 ^{o}C (36 to 59 ^{o}F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shade, such as that provided by riparian habitat; and local groundwater influence.	Little Timber Creek: Probable reduction in water temperature over the long-term between the 2nd and 3rd diversions due to deeper, faster flow. Lemhi River: Possibility of some reduction in temperature of water from ditches 2 and 3 reaching the river, but effect on river water temperature may not be measureable	Little Timber Creek: Water temperatures expected to increase under climate change. Deeper, faster flow will slow the rate of increase in this reach, but still a beneficial effect. Lemhi River: Degree of reduction in temperature of water reaching the Lemhi River as a result of saved seepage traveling through the penstock will be less under climate change, but still a beneficial effect, although the change may not be measurable.	Little Timber Creek: Long-term beneficial effect. Lemhi River: Probable no effect.
6) Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount (e.g., less than 12 percent) of fine substrates less than 0.85 mm (0.03 in.) in diameter and minimal embeddedness of these fines in larger substrates are characteristic of these conditions.	Little Timber Creek: Short-term increase in fines due to construction activities. Increased flow between ditches 2 & 3 expected to flush any mobilized fines downstream. Lemhi River: possible increase in fines if saved seepage is directed over cattle-occupied fields before reaching Big Springs Creek.	Little Timber Creek: No climate change effects anticipated. Lemhi River: No climate change effects anticipated.	Little Timber Creek: Short-term adverse effect; long-term no effect. Lemhi River: possible adverse effect.
7) A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges, or if flows are controlled, they minimize departures from a natural hydrograph.	Little Timber Creek: Little Timber Creek does not have a natural hydrograph. No change in existing conditions due to project. Lemhi River: The Lemhi River does not have a natural hydrograph. No change in existing conditions due to project.	Little Timber Creek: No change in existing conditions due to project plus climate change. Lemhi River: No change in existing conditions due to project plus climate change.	No effect.

PBF Description	Anticipated Effects	Anticipated Effects Under Climate Change	Determination of Effect
8) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.	Little Timber Creek: Water quality adversely affected during construction of project diversion & fish passage at 3rd diversion. Hyporheic flows may increase due to increased flow between ditch 2 and 3, a beneficial effect. Lemhi River: Up to a 1.46 cfs decrease in winter flow, and up to a 0.9 to 1.04 cfs increase in summer flow, combined with probable lower temperatures of project water reaching the river--both adverse and beneficial.	Little Timber Creek: Water temperatures expected to increase under climate change, reducing water quality. Increase of hyporheic flows between ditch 2 and 3 will likely be less as climate change progresses, but still a beneficial effect. Lemhi River: Summer water temperatures expected to increase under climate change, reducing water quality. Decrease in input to winter flow resulting from saved seepage remains the same. Projected winter precipitation increases may offset decreased input to winter flow in some precipitation/time horizon scenarios. Summer gains from saved seepage will diminish, but still a beneficial effect.	Little Timber Creek: Short-term adverse effect to water quality; long-term beneficial affect to hyporheic flows. Lemhi River: Both adverse & beneficial effects, long-term.
9) Few or no nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass; inbreeding (e.g., brook trout); or competitive (e.g., brown trout) species present.	No change expected, due to no connectivity between the Lemhi River and Little Timber Creek during peak migration period. Brook trout expected to persist in the Lemhi River, unaffected by the project.	No change expected with the project plus climate change, due to no connectivity between the Lemhi River and Little Timber Creek during peak migration period. Brook trout expected to persist in the Lemhi River, unaffected by the project, but may become more restricted to cold-water refugia in the river as water temperatures warm under climate change.	No effect.

2.5.2.2 Effects of Interrelated or Interdependent Actions

Effect of the interrelated action of the splitter box operation will have no effect on critical habitat in Little Timber Creek. Operation of the splitter box resulting in irrigation water of between 0.9 and 1.04 cfs increasing Lemhi River summer flow may affect PBFs 1, 3, 5, and 8. The additional flow may maintain or increase hyporheic flows (PBF 1), benefiting water quality and possibly maintaining existing riparian vegetation supplying terrestrial invertebrates to the river food base (PBF 3). Increased summer flow may also help maintain current water temperatures in the Lemhi River (PBF 5), and contribute to maintaining sufficient water quality and quantity to support bull trout survival in the Lemhi River (PBF 8).

2.6 Cumulative Effects to Bull Trout and Critical Habitat

The implementing regulations for section 7 define cumulative effects to include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Opinion. 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 Act. While effects of climate change on bull trout and critical habitat are not cumulative effects under section 7, human response to climate change may include actions involving cumulative effects to the species.

Figures 6 and 7 indicate, even with projected increases in precipitation, the possibility of future lower irrigation season flows compared to current and historical conditions in the Lemhi River even without irrigation. In addition, higher summer air temperatures over a longer growing season may increase crop evapotranspiration, leading to an increased water demand in the vicinity of the action area while irrigation season flows may be decreasing. Irrigators utilizing water from tributaries feeding the Lemhi River upstream of the action area can all be expected to face the same climate change issues as those on Little Timber Creek. Use of Little Timber Creek for irrigation is reasonably certain to continue for the foreseeable future (foreseeable future is defined here as the license period, which typically may be 30, 40, or 50 years). Water rights in Little Timber Creek already seem to be over-allocated during the irrigation season in many or most years compared to Little Timber Creek average flow (Figure 5), and projections of decreasing flows suggest the degree of over-allocation during the irrigation season could increase. Options to ameliorate the situation for irrigators that would not involve a Federal action might include but not be limited to:

- Switch to less water-consumptive crops
- Switch all irrigation to sprinkler instead of flood irrigation

Switching to less water-consumptive crops and/or converting all irrigation to sprinkler instead of flood irrigation in response to decreasing flows in Little Timber Creek might allow irrigators to keep pace with decreasing water availability, but this might also gradually reduce the amount of excess water we have been describing as “saved seepage” that leaves the fields and reaches the Lemhi River. Thus, overall, we expect the amount of Little Timber Creek water reaching the Lemhi River to decrease during the irrigation season (already the period of lowest flows) as a result of climate change and irrigator response to climate change, exacerbated by an anticipated higher irrigation water demand resulting from higher air temperatures and a longer growing season. This would reduce summer flow and increase water temperatures in the Lemhi River, reducing its value as FMO habitat. Critical habitat PBFs 1 (hyporheic flow, reduced), 3 (riparian terrestrial macroinvertebrate forage base, reduced concurrent with 1), 5 (increased water temperature), 7 (natural hydrograph further depressed), and 8 (reduced water quality) would also be affected by irrigator response to climate change.

The option most likely to maintain irrigation at current levels and to return the same amount of Little Timber Creek water to the Lemhi River would be to construct a dam on Little Timber Creek to store the water when it’s most available. However, this is also the most likely scenario to involve a Federal action requiring section 7 consultation.

2.7 Conclusion

2.7.1 Bull Trout

The Service has reviewed the current status of bull trout; the environmental baseline in the action area, including future hydrologic conditions; effects of the Commission's proposed action; and cumulative effects, and it is our conclusion that the proposed action is not likely to jeopardize the species continued existence. While adverse effects to individuals may occur, population level effects in Little Timber Creek, the Lemhi River Core area, and the Upper Snake River Recovery unit are not expected. Implementation of the action will not appreciably reduce the reproduction, numbers, or distribution of bull trout across its coterminous range, and may have some beneficial effects in some parts of the action area.

2.7.2 Bull Trout Critical Habitat

The Service has reviewed the current status of bull trout critical habitat; the environmental baseline in the action area, including future hydrologic conditions; effects of the Commission's proposed action; and cumulative effects, and it is our conclusion that the proposed action is not likely to destroy or adversely modify designated critical habitat for bull trout. Adverse effects to some PBFs are expected into the future, but in Little Timber Creek, the Lemhi River in the action area, and at the Lemhi River CHSU and the Salmon River CHU scales, functionality of critical habitat will not be impacted by the proposed action. Critical habitat rangewide will remain functional to serve its intended recovery role for bull trout.

2.8 Incidental Take Statement

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species, respectively, without specific 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 in the definition of take in the Act means an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The Commission has a continuing duty to regulate the activity covered by this incidental take statement. If the Commission fails to assume and implement the terms and conditions the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental

take, the Commission must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

2.8.1 Form and Amount or Extent of Take Anticipated

The components of the Commission's action and the interrelated action may result in adverse effects to bull trout due to increases in sedimentation, potential for chemical contamination, noise, riparian shade removal, reduction in Lemhi River winter flow, and possible additional consumptive use of up to 54 acre feet of saved seepage water from Little Timber Creek that would otherwise reach the Lemhi River (Table 6).

Table 6. Effects pathway matrix, adverse and beneficial effects attributable to the project in the action area.

Project Component	Adverse Effects		Beneficial Effects	
	Effect Pathway	**Effect to bull trout**	**Effect Pathway**	**Effect to bull trout**
Excavation & construction: Little Timber Creek	Sediment mobilization	Harm & harassment from lowered visibility (interference with feeding) or physiological effects to gills	Creation of upstream-downstream fish passage at 3rd diversion	Establishes connectivity between resident populations & habitat downstream to first diversion
	Chemical contamination from construction spills	Harm & harassment due to toxic debilitating effects to bull trout		
	Noise	Harassment leading to bull trout avoidance of work site		
	Riparian shade removal	Harm due to increased water temperature & reduced source of terrestrial invertebrate forage		
Operation of trash rack, fish bypass pipe, and fish screen, diversion, penstock, splitter box: Little Timber Creek, Lemhi River	Possible increase of consumptive use of saved seepage water of up to 54 acre feet/yr	May reduce gain in Lemhi River summer flow from 1.04 cfs to 0.9 cfs	Gain in Lemhi River summer flow of 0.9 to 1.04 cfs	Increase in Lemhi River FMO habitat, slight reduction in Lemhi River water temperature
			Effectively screens both ditch 3 & 2	Eliminates potential for fish mortality due to entrainment into ditches 3 and 2

			Gain in summer flow between ditch 3 & 2	Increased in-water habitat, extended riparian area, increased value of Little Timber Creek FMO habitat
			Temperature reduction of water reaching Lemhi River from Little Timber Creek	Increases value of Lemhi River for FMO habitat
Post-construction maintenance (cleaning & repair) of project diversion facilities	Noise, presence of humans	Harassment leading to avoidance of the site, short term		
	Probable bottom sediment mobilization by personnel working in the water	Some harassment from lowered visibility (interference with feeding)		

Although bull trout have not been recorded in the action area in Little Timber Creek, their presence in Big Timber Creek, as a resident population high in the Little Timber Creek watershed, and the recent reconnection of Big Timber Creek with the Lemhi River establish the potential for bull trout presence anywhere in Little Timber Creek, including the action area. For these reasons we must assume that bull trout could be present in the action area on Little Timber Creek and in the Lemhi River during the construction period and during the post construction license period. The in-water construction period will extend from July 1 through the third week in August (NMFS Section 18 Prescription #6), and the diversion facility must be constructed and operational within 2 years of license issue (NMFS Section 18 Prescription #4). Although we have no way of estimating how many bull trout could be in the action area during construction, we expect the numbers would be very low, based on Schoby (2006, p. 24), who found that most bull trout will have migrated out of the mainstem rivers and into spawning areas high in the tributary watersheds as peak flows in the tributaries begin to subside (June in Little Timber Creek), and then spawn beginning in late August through mid-September. This behavior would keep most bull trout out of the action area during the construction period. Because of the difficulty in anticipating how many bull trout may be taken, we are using habitat as a surrogate measure to characterize the amount or extent of take.

The Service is authorizing incidental take of all bull trout in the action area on Little Timber Creek that may, during the construction period, be present in the habitat contained in a total linear stream distance of approximately 1944.5 feet, or from 100 feet upstream of the third diversion to 0.25 miles downstream of the second diversion (as measured using Google Earth Path Measure) between July 1 and through the third week in August during the 2 year construction period following license issue. If the July 1 through the third week in August work window is exceeded in a given year, or if work proceeds during this work window for more than 2 years after the license is issued (e.g., the work window is utilized for 3 consecutive years after

the license is issued), the incidental take limit of this Opinion will have been exceeded, and reinitiation of formal consultation may be necessary.

We anticipate that all bull trout present within this portion of the action area may be subject to take from:

- Direct exposure to increased levels of suspended sediment which may result in direct harm (gill irritation, physiological stress, and reduced feeding efficiency), and may also result in harassment should bull trout move out of areas of poor water quality. Moving out of the areas (harassment) may cause loss of territories, increase competition and stress, and reduce feeding efficiency. Incidental take of bull trout associated with sediment effects is only anticipated to occur during in-water construction.
- Direct exposure to noise associated with in-water and stream-side construction, which may lead to bull trout vacating an area with noise, resulting in harassment similar to that associated with vacating areas with suspended sediment.
- Direct exposure to any chemical contamination resulting from machinery leaks or construction spills of contaminants such as but not limited to fuel, oil, grease, and hydraulic fluid, which may lead to harm in the form of physiological effects to bull trout, including eye and gill irritation and loss of feeding efficiency.
- Exposure to indirect effects of riparian vegetation removal, which may result in harm in the form of shade loss and reduction in terrestrial invertebrate forage base.

We are also authorizing incidental take for all bull trout that may be in the habitat contained in a total linear stream distance of 100 feet, or from 50 feet upstream and 50 feet downstream of the fish screens and trash rack at the project site, when post-construction riparian and in-water maintenance activities involving minor repairs and removal of debris from the fish screens and trash rack are conducted. This incidental take is authorized for the license period. These activities could result in incidental take largely in the form of short-term harassment if bull trout move away from noise and in-water disturbance, for as long as the maintenance activity lasts. If these in-water or riparian post-construction maintenance activities result in mobilizing or suspending sediment in Little Timber Creek for more than half a day (more than 5 hours), then the incidental take limit of this Opinion will have been exceeded, and reinitiation of formal consultation may be necessary.

2.8.2 Effect of the Take

In the accompanying Opinion, the Service determined that this level of anticipated take is not likely to jeopardize the continued existence of the bull trout across its range. Individual bull trout may be taken, but populations are not expected to be meaningfully changed.

2.8.3 Reasonable and Prudent Measures

The Service concludes that the following reasonable and prudent measures (RPM) are necessary and appropriate to minimize the take of bull trout caused by the proposed action.

1. Minimize the potential for incidental take resulting from project-related sediment effects.
2. Minimize the potential for incidental take resulting from project related contaminant or chemical release or spill.

3. Minimize or restore riparian vegetation (a source of terrestrial invertebrate forage base) removed during construction at the diversion site to the extent possible.

2.8.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Commission and the applicant must comply with the following terms and conditions, which implement the reasonable and prudent measure described above. These terms and conditions are non-discretionary.

To implement RPM 1:

1a. Develop a site-specific erosion control plan as specified in Section 2.1.2.3, to include measures to minimize or prevent movement of soil into Little Timber Creek.

1b. Conduct turbidity monitoring in Little Timber Creek to ensure that turbidity at and downstream of the construction site (both for the project diversion [ditch 2] and installation of fish passage upstream at the third diversion) shall not exceed 50 NTUs above background turbidity instantaneously, or 25 NTUs above background over ten consecutive days (IDAPA Idaho Code 58.01.02.250.02.e). If construction results in exceeding either of these criteria, construction shall be ceased until levels drop below 25 NTUs. Background turbidity should be measured in Little Timber Creek upstream and out of the construction area. Downstream measurements can be taken at the nearest reasonable stream access between 175 and 250 feet downstream. Turbidity testing shall be conducted every 2 hours.

To implement RPM 2:

2. Develop and implement a Spill Prevention Plan with Best Management Practices and Spill Prevention Measures through consultation with the Idaho Department of Environmental Quality, in order to control and cleanup any contaminants spilled into Little Timber Creek or within the adjacent riparian area. Contaminants might include but should not be limited to fuel, oil, or grease (including leaks from heavy equipment working within the riparian area or reaching over the surface of Little Timber Creek), or cement or other construction-related materials that would be toxic to aquatic or riparian organisms.

To implement RPM 3:

3. Section 2.1.2.3 provides for a revegetation plan primarily applicable to the penstock burial route and transmission line construction, but not specific to the riparian areas disturbed by construction. Develop a similar revegetation plan for riparian areas that will be disturbed during construction activities. The riparian plant species list should be derived from the species' lists under Vegetation Resources on page 19 of the Application for License (Josten 2011 in litt.), and should include at least one tree species; at least two shrub species; and sedge and rush species, if the latter occurred onsite pre-construction. The plan should also provide for long term monitoring, with the monitoring period to be determined in cooperation with the Service, NMFS, and IDFG, and control for invasive plant species in the re-vegetated riparian areas.

2.8.5 Reporting and Monitoring Requirement

In order to monitor the impacts of incidental take, the Commission or the applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [(50 CFR 402.14 (i)(3)].

1. Report to the Service any instances of exceedance of turbidity criteria within 48 hours. Upon project completion provide the Service a copy of turbidity monitoring results.
2. During construction, report to the Service any instance of contaminant spills in Little Timber Creek or within the riparian area within or adjacent to the construction area within 24 hours, to include the means by which the spill was stopped, controlled, and was or will be cleaned up.
3. Provide the Service, NMFS, and IDFG with annual revegetation monitoring reports, to include measures of success, and also the effectiveness of invasive plant species control.

2.9 Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery programs, or to develop new information on listed species.

We ask that the Commission provide the Service with:

- Copies of the annual water diversion reports (specified as part of the gaging plan in Section 2.1.2.3, second bullet, p. 7 of this Opinion) which will detail the amount of water diverted for project operation to ensure that historical diversion practices are maintained to protect the fisheries resources in Big Springs Creek and the Lemhi River below Big Springs Creek; and,
- A copy of the water quality monitoring report for water temperature and dissolved oxygen for the first season of operation, as described in the third bullet under Proposed Environmental Measures on page 7 of this Opinion.

If data in the annual water diversion reports or in the water quality monitoring report for the first season of operation indicate significant deviation from historical diversion practices, or from environmental baseline water temperature and dissolved oxygen data reported in this Opinion, we ask that the Commission confer with the Service, NMFS, and IDFG to determine what additional environmental measures may be needed.

2.10 Reinitiation Notice

This concludes formal consultation on the Coleman Hydroelectric Project. 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 maintained (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 that may affect listed species or 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 to the listed species or critical habitat that was not considered in this Opinion.
4. A new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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for their determination that the proposed Lee Creek and Big Eightmile Creek Reconnect Project in Lemhi County, Idaho, will not likely to adversely affect bull trout. Includes summary of project description.

3.3 Personal Communications

Diluccia, J. 2016. Telephone conversation, in which Jeff Diluccia, fisheries staff biologist with IDFG in Salmon, ID, confirmed to D. Winslow (USFWS) his April 18, 2016 email, stating that the 1st Little Timber Creek diversion may be passable by adult but not juvenile salmonids during operation (while water is being diverted). Jeff also added that others of the remaining 4 Little Timber Creek diversions upstream of the 1st diversion are not passable by adults during operation. April, 2016.

Isaak, D. 2016. Notes from conversation with D. Winslow (USFWS) on May 16: Provided four indicator variables used by Climate Shield to predict stream occupancy probability by bull trout; suggested modification to Climate Shield projections of occupancy probability by bull trout—where brook trout are absent, projection for 2040s is an extreme scenario; projections for 2080s is a very worse-case scenario.

LaMontagne, A. 2016a. From notes from conversation with Idaho Department of Fish and Game fisheries biologist, Jeff Diluccia: [Irrigation ditch] L-63 . . . will be eliminated in 2016. In an email to D. Winslow (USFWS), May 12, 2016, referencing questions regarding LaMontagne (2012, in litt., entire).

LaMontagne. 2016b. Notes from telephone conversation with D. Winslow (USFWS) on May 9, where LaMontagne suggested that groundwater seepage from ditches 2 & 3 probably reach Big Springs Creek; based on professional judgment that subsurface input from the east side of the Lemhi River is insufficient to equal Lemhi flows during periods when all source tributaries upstream of Leadore are dewatered by irrigation diversions.

Littlejohn, L. 2016a. Phone conversation with D. Winslow (USFWS) on April 28. Littlejohn described that after the Lee Creek/Big Eightmile Creek reconnect project was completed, flow in irrigation ditch BS-5 stops at the water right points of delivery for water right numbers 74-1651 and 74-2025B, located between Lee Creek and Big Eightmile Creek.

Littlejohn, L. 2016b. Email exchange with D. Winslow (USFWS) on May 3, stating that completion of the last portion of the Lee Creek and Big Eightmile Creek [reconnect] occurred in 2013.

Uthe, P. 2016. Email from Idaho Department of Fish and Game fisheries biologist Patrick Uthe, stating in part that bull trout have been found in Big Springs Creek; transmitting excerpt from IDFG database of records from Lemhi River (see IDFG 2011 in litt.) between Big Eightmile Creek and Leadore, showing bull trout observed in Big Springs Creek. April19, 2016.