Evan R. Lewis
Chief, Environmental and Cultural Resources Branch
U.S. Army Corps of Engineers, Seattle District
P.O. Box 3755
Seattle, Washington 98124-3755

Subject: Biological Opinion for the Albeni Falls Dam Fish Passage Project, Pend Oreille River, Bonner County, Idaho
In Reply Refer to: 01EIFW00-2018-F-0259

Dear Mr. Lewis:

Enclosed is the U.S. Fish and Wildlife Service’s Biological Opinion (Opinion) regarding the U.S. Army Corps of Engineers’ (Corps) proposed Albeni Falls Dam Fish Passage Project (Project) in Bonner County, Idaho, and its effects on the threatened bull trout (Salvelinus confluentus) and its critical habitat, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended.

The enclosed Opinion is based primarily on our review of the proposed action, as described in your October 25, 2017, Biological Assessment, and the anticipated effects of the action on listed species, and was prepared in accordance with section 7 of the Act. Our Opinion concludes that the Project is not likely to jeopardize the continued existence of bull trout, nor is the Project likely to adversely modify bull trout critical habitat. A complete record of this consultation is on file at this office.

Clean Water Act Requirement

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 and associated Opinion to document that the 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 Biological Assessment and addressed in this letter and Opinion.
Thank you for your continued interest in the conservation of threatened and endangered species. Please contact Jason Flory at (509) 893-8003 if you have questions concerning this Opinion.

Sincerely,

[Signature]

Stefanie K. Bluhovyd
For Gregory M. Hughes
State Supervisor

Enclosure

cc: IDFG, Coeur d’Alene (Siitari)
BIOLOGICAL OPINION
FOR THE
Albeni Falls Dam Fish Passage Project
01EIFW00-2018-F-0259

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

[Signature]
For Gregory M. Hughes
State Supervisor
Date 1/11/18
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BACKGROUND

Introduction

The U.S. Fish and Wildlife Service (Service) has prepared this Biological Opinion (Opinion) of the effects of the Albeni Falls Dam (AFD) Fish Passage Project (Project) on bull trout (Salvelinus confluentus) and its designated critical habitat. In an October 25, 2017, email (received on the same day), the U.S. Army Corps of Engineers (Corps) requested formal consultation with the Service under section 7 of the Endangered Species Act (Act) of 1973, as amended, for proposed implementation of the Project. The Corps determined that the Project is likely to adversely affect bull trout and “may affect, but is not likely to adversely affect” designated bull trout critical habitat. As described in this Opinion, and based on the Biological Assessment (Corps 2017, entire) developed by the Corps and other information, the Service has concluded that the action, as proposed, is not likely to jeopardize the continued existence of bull trout or result in the destruction or adverse modification of its designated critical habitat.

Consultation History

The Corps, Bonneville Power Association, and Bureau of Reclamation have completed several iterations of section 7 consultation for the operation and maintenance of the Federal Columbia River Power System (FCRPS), of which AFD is a component, with both the Service (USFWS: 1998 and 2000), and with the National Marine Fisheries Services (NMFS: 1995, 1998, 2000, 2004, 2008, as supplemented in 2010 and 2014, the last currently in effect). The above agencies submitted a BA to the Service requesting initiation of formal consultation on the coordinated water management functions of the fourteen Federal multiple-use projects in the FCRPS on December 7, 2016 and the Service acknowledged receipt of the BA and initiated consultation on December 20, 2016.

The Service’s 2000 Opinion is currently in effect regarding section 7 compliance for the operation and maintenance of AFD on bull trout. The 2000 Opinion contains the following reasonable and prudent measures (RPMs) and terms and conditions in its incidental take statement:

RPM 10.A.1.3 – The action agencies shall evaluate the feasibility of reestablishing bull trout passage at Albeni Falls Dam. If the information from these studies warrants consideration of modifications to the Albeni Falls facility, then the Service will work with the action agencies to implement these measures, as appropriate, or to reinitiate consultation, if necessary.

T&C 11.A.1.3 – The following terms and conditions are established to implement reasonable and prudent measure #3 [see previous paragraph] for the Upper Columbia River (Albeni Falls Operations):

a. By October 1, 2004, the action agencies shall conduct a feasibility study for reestablishment of two-way passage of adult and sub-adult bull trout at Albeni Falls
Dam. This study must include observations of movement and survival of radio-tagged bull trout from Lake Pend Oreille, and survival of adult and sub-adult bull trout passing through or over Albeni Falls Dam. The study must also analyze the feasibility of structural improvements such as fish ladders and measures to guide fish away from turbines.

b. Based on the results of the study, by October 1, 2005, the action agencies shall consult with the Service, as necessary, on the decision to reestablish fish passage at Albeni Falls Dam. If fish passage is determined to be necessary, the action agencies will seek appropriations for the construction of the facility by October 1, 2008.

The Corps has conducted a series of investigations and studies of bull trout in the Pend Oreille River and how they are affected by AFD.

**BIOLOGICAL OPINION**

**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 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.”

**Action Area**

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment.

The action area includes the mainstem Pend Oreille River from 300 feet (ft) downstream of AFD, upstream to Lake Pend Oreille approximately 30 miles (mi) upstream. The delineation of the action area downstream is based on the distance at which the effects of elevated noise and water quality changes will reach background conditions. The upstream limits of the action area are defined by the area upstream that will be accessible to fish after improved passage. For the purposes of this Opinion, we use the term “Project area” to refer to the areas around AFD that will be affected by construction of the facility.

Short-term water quality changes to the Project tailrace are expected during coffer dam construction and removal, as well as during rock removal prior to coffer dam construction. Potential water quality changes from concrete curing may also be expected. Due to minimal in-
water work and type of material disturbed, it is anticipated that water quality impacts to the river will be locally-confined. Depending on flows and degree of sediment disruption from construction activities, elevated turbidity and sedimentation could be present up to 100 ft downstream of the Project in the tailrace. Impacts from elevated noise (described below) are expected occur at a greater distance than water quality impacts; therefore, the downstream action area is defined by the distance of elevated in-water noise and overpressure.

Noise generated from construction equipment such as vehicles, power tools, cranes, etc., is not expected to be noticeable above background conditions at the Project. However, blasting of rock is expected to increase noise levels and overpressure above background with both the aquatic and terrestrial environment. It is expected all impacts from blasting will reach ambient levels within 300 ft based on channel condition and attenuation. The total area affected by elevated noise during blasting is approximately 10 acres.

**Proposed Action**

The proposed action is to construct an upstream “trap and haul” fish passage facility at AFD; downstream passage will occur through the spillway and powerhouse (Figure 1). The planned facility includes an entrance structure designed to discharge 300 cubic feet per second (cfs) with two vertical slot entrances, a gravity water supply system, a Half Ice Harbor ladder consisting of 19 pools, a pre-sort pool, a fish lock for lifting fish, a sorting area, and a truck loading area. The action includes the further design, construction, and operation of the facility, as well as best management practices to reduce impacts to bull trout. The operation is anticipated to be year-round, excluding the warmest month of August when temperatures exceed lethal thresholds for bull trout and during winter periods of river or facility ice-over. The facility is designed to operate between tailwater elevations from 2,030 feet to 2,048 ft. The gravity water supply can operate at forebay elevations as low as 2,047 ft and forebay-tailwater elevation differentials as low as 4 ft.

The entrance structure will be located on the left side of the powerhouse. This feature has two entrance locations. One is located the furthest upstream that a fish can swim to, and has strong year round flows from the turbines to attract fish to the entrance and is oriented perpendicular to powerhouse flows. The second is located just downstream on the island facing downstream. The ladder will extend about 200 ft along the north shore of Rock Island to the fish lock. A dedicated water supply system from the forebay will provide a gravity-supplied source of water to operate the facility. Once bull trout enter the trap and are captured, they will be sorted from non-target species for transport upstream via truck to a release location approximately 5 mi upstream of the dam. Non-target species will either be returned below AFD, be routed directly to the forebay upstream of the Dam, or euthanized by the resource managers.

Specific design details for the facility can be found on pages 8-22 of the Biological Assessment (Corps 2017). The layout of the proposed facility can be seen in Figure 2 below.
Figure 1. Albeni Falls Dam.
Construction

The construction of the facility is expected to take approximately 2 years. The activities include the installation of isolation devices, like a cofferdam or equivalent, delivery of materials and equipment by trucks or a barge, drilling and blasting of rock, placement of piles, and the curing of concrete for the assembly and attachment of the parts. The assembly of most of the structure will take place on land; however, construction of the entrance structure and parts of the auxiliary water intake may need to occur from a floating barge. The staging areas will be coordinated with AFD personnel. Limited laydown areas will be located on the right abutment within and adjacent to the Corps employee parking area. The construction trailer would be located at the AFD powerhouse parking area. Construction equipment includes a barge, boat, crane, drills, trucks, concrete trucks, graders, compactors, and excavators.

In general, access to the Project site will be from two areas: (1) barges working in the tailrace or forebay, and (2) the right abutment through the Corps access gate, parking area, and over the powerhouse intake deck. River access will be required to construct the fishway entrance as well as the auxiliary water supply (AWS) intake structure. Access to the remaining project elements will be from the right abutment off U.S. Highway 2 via the dam access road.

Construction Sequence

The construction schedule assumes a 2-year construction period centered on two low flow periods required for installation and removal of the cofferdam systems. Table 1, below, describes the duration and sequencing of construction for the AFD fish passage facility.
Table 1. Preliminary construction schedule for the AFD Fish Passage Facility.

<table>
<thead>
<tr>
<th>Feature Activity Description</th>
<th>Days by Project Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization to Site</td>
<td>25</td>
</tr>
<tr>
<td>Fishway Entrance</td>
<td>135</td>
</tr>
<tr>
<td>Underwater rock blasting/excavation for intake structure</td>
<td></td>
</tr>
<tr>
<td>Sink and anchor panelized pre-cast floor segments for entrance structure</td>
<td></td>
</tr>
<tr>
<td>Sink and anchor panelized pre-cast floor outboard wall segments</td>
<td></td>
</tr>
<tr>
<td>Dewater interior of entrance</td>
<td></td>
</tr>
<tr>
<td>Construct interior cast-in-place concrete walls</td>
<td></td>
</tr>
<tr>
<td>Install entrance gate structures</td>
<td></td>
</tr>
<tr>
<td>Install metal gratings and handrails</td>
<td></td>
</tr>
<tr>
<td>Fishway Ladder and AWS Channel</td>
<td>145</td>
</tr>
<tr>
<td>Rock blasting/excavation for fishway ladder</td>
<td></td>
</tr>
<tr>
<td>Place cast-in-place concrete slab for fishway and AWS</td>
<td></td>
</tr>
<tr>
<td>Construct cast-in-place interior divider wall</td>
<td></td>
</tr>
<tr>
<td>Construct cast-in-place pool/baffle walls</td>
<td></td>
</tr>
<tr>
<td>Construct exterior cast-in-place walls</td>
<td></td>
</tr>
<tr>
<td>Install metal gratings and handrails</td>
<td></td>
</tr>
<tr>
<td>Presort Holding and Fish Lock</td>
<td>105</td>
</tr>
<tr>
<td>Rock blasting/excavation for pre-sort holding pool</td>
<td></td>
</tr>
<tr>
<td>Place cast-in-place concrete slab for pre-sort pool</td>
<td></td>
</tr>
<tr>
<td>Construct cast-in-place concrete walls at pre-sort pool</td>
<td></td>
</tr>
<tr>
<td>Install vee-trap structure at pre-sort pool</td>
<td></td>
</tr>
<tr>
<td>Construct cast-in-place slab for fish lock</td>
<td></td>
</tr>
<tr>
<td>Install slide gates, floor diffusers, metal gratings and hand rails</td>
<td></td>
</tr>
<tr>
<td>Install fish lock brail lift</td>
<td></td>
</tr>
<tr>
<td>Sorting Area and Access Road</td>
<td>45</td>
</tr>
<tr>
<td>Excavation/Base Prep for sorting area</td>
<td></td>
</tr>
<tr>
<td>Place cast-in-place slab structure for sorting area</td>
<td></td>
</tr>
<tr>
<td>Construct elevated slab above head tank structure</td>
<td></td>
</tr>
<tr>
<td>Rock blasting/excavation for site access road</td>
<td></td>
</tr>
<tr>
<td>Install sorting facility equipment</td>
<td></td>
</tr>
<tr>
<td>Place/compact site access road base material</td>
<td></td>
</tr>
<tr>
<td>Place AC Pavement for site access road</td>
<td></td>
</tr>
<tr>
<td>Vertical Shaft and AWS Tunnel</td>
<td>85</td>
</tr>
<tr>
<td>Install temporary bulkhead structure</td>
<td></td>
</tr>
<tr>
<td>Drill and blast AWS horizontal tunnel</td>
<td></td>
</tr>
<tr>
<td>Drill and blast vertical shaft</td>
<td></td>
</tr>
<tr>
<td>Intake Structure and Fish Screen</td>
<td>295</td>
</tr>
<tr>
<td>Install cofferdam at intake structure and fish screen location</td>
<td></td>
</tr>
<tr>
<td>Dewater work area for intake structure and fish screen</td>
<td></td>
</tr>
<tr>
<td>Rock blasting/excavation for intake structure and fish screen</td>
<td></td>
</tr>
<tr>
<td>Drill pockets for installation of screen guides</td>
<td></td>
</tr>
<tr>
<td>Place cast-in-place slab for screen structure</td>
<td></td>
</tr>
<tr>
<td>Erect steel screen bay towers</td>
<td></td>
</tr>
<tr>
<td>Install dead plates and porosity plates</td>
<td></td>
</tr>
<tr>
<td>Install mechanical screen cleaner</td>
<td></td>
</tr>
<tr>
<td>Install metal grates and handrail at tower</td>
<td></td>
</tr>
<tr>
<td>Construct cast-in-place walls at end of screen structure</td>
<td></td>
</tr>
<tr>
<td>Construct cast-in-place decks at end of screen structure</td>
<td></td>
</tr>
<tr>
<td>Construct cast-in-place slab for AWS intake channel</td>
<td></td>
</tr>
<tr>
<td>Construct cast-in-place walls for AWS</td>
<td></td>
</tr>
<tr>
<td>Construct cast-in-place head wall for AWS</td>
<td></td>
</tr>
<tr>
<td>Removal of Temporary Systems</td>
<td>40</td>
</tr>
<tr>
<td>*Removal of intake structure/fish screen cofferdam</td>
<td></td>
</tr>
</tbody>
</table>
**Rock Drilling and Blasting**

Rock excavation is required for the AWS tunnel intake, the AWS tunnel, the vertical shaft, the entrance structure and the fish ladder. Bedrock in these areas primarily consists of jointed granodiorite with varying degrees of alteration and weathering. Controlled blasting methods will be used for excavation to minimize impacts to the dam. Blasting will be used for rock excavation for the partial ladder, entrance structure, and auxiliary water supply, and drilling will be required for the installation of the isolation devices (cofferdams or equivalent). Not all of this activity will occur underwater, but the entrance structure, and cofferdam will require underwater blasting and/or drilling. It is estimated that roughly 900 cubic yards of rock will need to be blasted to make room for the entrance structure. The majority of the blasting for the fish ladder will occur in the dry on the rock island. The last step of blasting for the fish ladder will occur at the location of the entrance structure, which will be in-water. The entrance structure will then be floated into place.

A blasting plan indicating types of explosives, methods, and mitigation measures will be developed as a pre-construction submittal to the Service. Blast designs will consider vibration control to protect structures and mitigation techniques to minimize overpressures and fish kill zones when blasting underwater. In general, holes will be drilled in the rock face and explosives will be inserted and detonated within these holes (confined blasting). In the absence of details regarding specific types and amounts of explosives, the Corps has assumed for the purposes of this consultation a “worst case” scenario for blasting zones, noise levels, and over-pressure. Charges for in-water blasting will be limited to no more than 30 pounds (lbs) per weight delay and charges for out of water blasting will be limited to no more than 65 lbs per weight delay. The in-water blasting will take up to 3 weeks, all of which will be within the in-water work window of July 1-August 31. Any change in the in-water work periods will be coordinated with the Service.

The rock excavated from each of these areas will be disposed of both on-site in the area between the left abutment of the powerhouse and the existing fill section and at an off-site location.

**Blasting Best Management Practices**

A blasting and drilling plan will be developed by the contractor to minimize mortality and injury to fish and other aquatic life. The Government Specifications for the contract will have certain requirements to minimize blasting impacts, including the best management practices (BMPs) listed below:

- Conducting blasting when bull trout are least likely to be present (July-early September);
- Limiting blasting to daylight hours;
- Limiting blasting to consolidated bedrock;
- Installation with an air bubble curtain to attenuate energy, if river conditions allow;
- Conducting test blasts to calibrate overpressures and/or vibration to actual environmental conditions, and to determine the appropriate blast design;
- Reducing overpressure by placing a blast mat over blast areas that are not in the water to attenuate explosive sound and vibration energy, contain rock, and contain the blast overpressure wave;
- Setting explosives in a borehole and placing material on top to reduce detonation velocities;
• Use appropriate stemming depth and material to confine the force of the explosion to the formation being fractured;
• Use time delay detonation initiators to reduce the overall detonation to a series of discrete explosions;
• Minimize the weight of explosives per charge delay to no more than 30 lbs for in-water blasting and 65 lbs for out of water blasting;
• Use decking (separation of charges with non-explosive material) and time delays within individual boreholes; and
• Avoid the use of submerged detonation cord which has an associated kill radius.

Dewatering

Cofferdams and/or dewatering systems will be required for both the AWS intake in the forebay, as well as the fishway entrance in the tailrace (see Figure 3). Construction of these systems will occur during the late-summer low flow period. Two approaches, which are described below, are being considered for the forebay cofferdam. Once in place, the cofferdam will provide protection for the full range of anticipated annual river flow conditions. Approximately 12,000 square feet would be isolated and dewatered between the intake structure and cofferdam.
Figure 3. Approximate locations of isolation devices (indicated in red).
Auxiliary Water Supply Dewatering

The cofferdam will extend around the perimeter of the new intake structure, allowing dewatering of the entire intake screen and AWS tunnel gate structure. With the area dewatered, rock excavation and construction of the new structures can proceed in the dry. The cofferdam structures would extend from an approximate invert elevation of 2,030 ft to an approximate top elevation of 2,065 ft, which would provide about 2.5 ft of freeboard under the maximum normal forebay elevation of 2,062.5 ft. The following two options are proposed:

Option 1 consists of a conventional cellular cofferdam founded on bedrock. With this option, the cofferdam would tie into the right abutment of the spillway and extend parallel to the spillway flow to tie into the existing rock point near the existing concrete abutment. The intake structure would be recessed behind the cofferdam. With this option, a larger quantity of rock removal would be required because the new facilities are located farther into the existing rock point. Access to the construction area would be from the top of the non-overflow section of the dam using a crane, or from a barge moored adjacent to the cofferdam structure.

Option 2 was developed to incorporate the cofferdam structure into the proposed screen structure. Drilled shafts approximately 36 inches in diameter would be installed along the face of the proposed new screen structure. This face would be located in-line with the right abutment of the spillway structure, minimizing rock excavation. Steel piers would be installed within the drilled shafts and extend to the proposed new intake deck elevation of 2,065 ft. The piers would be configured with two slots to accommodate the future fish screens and porosity control baffles for the intake structure. Temporary bulkhead and bracing would be installed in these slots to serve as the cofferdam during construction. The intake structure would then be constructed in the dry similar to Option 1. The biggest advantage to Option 2 is that a single structure would serve as both the cofferdam and final intake structure.

Leakage through the cofferdam would be collected with sump pumps and routed to a Baker-style settling tank, then discharged back to the river. With the area dewatered, rock excavation and construction of the new structures can proceed in the dry. The precise methods will be refined during higher levels of design and the construction contract will allow for the contractor to determine means and methods within a set of criteria and constraints determined by Corps.

Fishway Dewatering

Installation of a cofferdam and dewatering system for the fishway entrance will be challenging due to the steep rock abutment adjacent to the powerhouse. Installation of a conventional cofferdam is not feasible due to the depth of the water and lack of a suitable location to place the cofferdam. Two options for construction of the fishway entrance are proposed.

Option 1 involves floating the pre-cast structure into position, and then lowering it onto the pre-excavated rock foundation. Rock anchors will then be used to anchor the structure to prevent flotation. The size of the structure is the biggest challenge to this approach considering the top of the completed fishway is at elevation 2,055 ft and the slab invert elevation is 2,021 ft. To provide a reasonable working system, it may be necessary to break the structure into two vertical components, floating the lower section into position and constructing the upper section using conventional cast-in-place
methods. This approach would also require a location in the river downstream from the powerhouse where the structure could be constructed, then launched. With the fishway entrance installed, the structure would be tied to the existing rock and sealed to provide a watertight connection. The remainder of the fishway would then be constructed in the dry.

Option 2 involves constructing the fishway entrance in sections and erecting it off a barge. Similar to the pre-cast option, the existing rock abutment would be excavated and a tremie concrete slab placed to provide a level surface to install the fishway entrance slab. The entrance floor would then be placed on the tremie slab. The wall rebar would extend up out of the floor slab. Plywood forms would be placed on the walls to contain the concrete and pre-tied rebar cages would be lowered into the forms. The walls would then be poured to an elevation above the normal tailwater elevation that occurs during the dry months of the year. The rock excavation would extend into the rock cut required for the fishway structure construction. The entrance pool would be constructed up to the rock cut, and then sealed against the exposed rock walls. With the seal in place, bulkheads would be installed on the outside of the fishway entrances to allow dewatering of the entrance structure. The rock trench excavation would then continue up through the pre-sort holding pool and vertical shaft/headtank.

It is anticipated that a combination of pre-cast and cast-in-place construction techniques will be used to construct the entrance pool first, with the entrance pool constructed and tied to the exposed rock cut surface, and then the entire tailrace construction area can be dewatered for construction. The final design documents will provide some flexibility for contractors to select their methods of construction.

**Operation and Maintenance of Facility**

The project is designed to operate over a range of river flows and corresponding forebay/tailwater water surface elevations. With a gravity water supply the fishway will operate essentially in an automated manner, delivering water from the forebay through a screened intake to the pre-sort holding pool, fishway, and entrance structure. The system is designed to provide automatic adjustments to the fishway entrance gate position to maintain a 0.75-ft drop across the entrance, maintain an AWS flow of 300 cfs, and initiate cleaning cycles on the intake screen cleaning system. A series of pressure transducers will monitor water levels throughout the AFD fish passage facility and trigger these automated actions.

The operation of the fish passage facility will be conducted year-round for the first 3 years, with the exception of periods of freeze over conditions (likely in January) and during the month of August for facility maintenance when water temperatures are often above 20 °C (68 °F). The facility will operate during the months of July and September, regardless of elevated temperatures. However, there will be an alternate release site at Trestle Creek Recreation Area boat launch when temperatures are above 18 °C (64 °F) to provide more immediate access to cold water refuge. If, after 3 years, facility monitoring indicates that there are some periods of little to no bull trout occurrence, then with Service concurrence, the facility may close during those time periods in subsequent years.

The water level upstream and downstream of the dam will be maintained according to the current Corps’ AFD water control manual, a document that meets project authorization and regulations,
and requirements in the Service’s 2000 Opinion on the FCRPS (Service, 2000, entire). The 300 cfs needed for the fish passage facility will be subtracted from the total releases by the dam.

**Fish Holding, Handling, Transport, and Release**

The sorting operation is anticipated to occur during normal daytime working hours. Operations staff will crowd fish into the fish lock from the pre-sort holding pool, sort fish out of the lock, and then route fish to their intended destination. The frequency of cycling from pre-sort holding pool to fish lock to sorting area to transport truck/forebay/tailrace will depend on the time of year and number of fish trapped. It is not anticipated that sorting operations will require more than an 8-hour shift even during peak fish migration periods.

In general, the presence of bull trout or other fish in the trap will trigger the need to process captured fish. The fish will be transferred from the pre-sort holding pool to the sorting area via a fish lock. Bull trout will be processed 7 days per week during the month of May, when migration is at a peak, or at other times if monitoring shows peak periods occurring outside of May. During non-peak periods, bull trout will be processed Monday through Friday, although the monitoring devices (including cameras, and possibly PIT tag readers and/or fish counters), will be checked daily by dam operators. During late spring and summer months bull trout would be processed on weekend days if temperatures exceed a threshold temperature (likely 16-18 °C (61-64 °F)), to be determined in cooperation with the Service. During non-peak periods when temperatures are below upper thresholds, a bull trout that enters the fish facility on Friday evening or thereafter would not be processed until the following Monday morning, with up to 64 hours of holding time in the trap. There will be exclusion screens in the holding pools to provide fish opportunities to escape predation from larger fish during these longer holding periods.

Biologists handling fish at the trap will be trained to visually distinguish bull trout from brook trout, hybrids, and other salmonid species, as well as nonnative from native species of fish. Initial sorting of bull trout will separate trout species from other fish species, and secondary sorting will separate bull trout from other trout species. All non-target fish will then be separated into native versus nonnative. Fish other than bull trout that are native to the area, including cutthroat trout, mountain whitefish, and sucker species, will be released into the forebay. All nonnative fish will either be returned to the trailrace or euthanized.

Proposed routine monitoring and evaluation includes 2 years of post-construction monitoring to evaluate whether the facility is working as designed to provide safe (identify injury and mortality), timely and effective passage (mark and release either bull trout or surrogate species using PIT tags). Water-to-water transfer is the proposed method of transfer. Handling will occur to sort bull trout from other trout species and inspect for injuries, but all attempts will be made to do so at a sorting table with fish submersed in water.

Adult and sub-adult bull trout will be loaded on a truck for transport to the Bonner Park West boat launch release location approximately 5 mi upstream of the dam. The fish sorting platform allows direct loading via gravity into a transport pod located in the back of a 3/4-ton or 1-ton transport truck. Trucks will access the sorting facility from the north side of the Pend Oreille River, entering the AFD facility near the existing switchyard, crossing over the powerhouse intake deck, and approaching the sorting facility via a new access road that extends from the dam. Egress to the upstream release location will be following the same route in reverse. Aeration in the transport pods and chillers will be used when necessary. The Trestle Creek
Operation of Facility in Cold Weather Conditions

Conditions requiring shutdown of the facility will occur when water temperatures are 3 °C (37 °F) or below, and/or when average daily air temperature remains below freezing to the point where ice formation prevents safe operation of the structure or puts target species at risk (estimated at -6 °C (21 °F) and below). Operating within these parameters will safeguard the continued operation and mechanical integrity of the fishway, and prevent target species from becoming trapped in the fishway or the holding pool during ice-over conditions. As a general guideline, the time period when the facility may be shut down could extend from approximately December 15 – March 1; however, this will vary from year to year and will be dictated by the presence of fish and air and water temperatures. Typically, the extreme cold temperatures often occur in January. The Corps will operate the fishway inside this estimated timeframe if conditions allow.

Operation of Facility during Spring Runoff

The fishway will operate within tailwater elevations of 2,031.0 ft to 2,044.0 ft, which corresponds to river flows of approximately 5,100 cfs and 71,000 cfs, respectively. The fishway can operate up to a maximum tailwater elevation of 2,048.0 ft, but the water velocities in the fishway at that flow would not meet passage criteria, which correspond to a river flow of approximately 100,000 cfs. Flows exceed 71,000 cfs 4 percent of the time throughout the year, and are below 5,100 cfs less than 1 percent of the time throughout the year.

During high tailwater conditions, the objective is to continue successfully attracting and capturing upstream migrants in the fishway. When the tailwater elevations exceed 2,044.0 ft, the fishway entrances will still operate to maintain the 0.75 ft of differential across the entrance. The total AWS flow of 300 cfs would be routed through one entrance to maximize fish attraction to the fishway. Once the fish enter the fishway, they are expected to continue moving upstream in the fishway. The transport velocities will be lower than criteria, but fish movement upstream would still be expected. As the river tailwater conditions begin to decrease the transport velocities in the fishway would increase, providing more conducive flow conditions for upstream migrants. This would ensure that the fish can be trapped and transported before the river water temperatures begin to rise at the tail end of the spring run-off in July and bull trout depart the AFD tailrace for cooler water areas.

Operation of Facility during Warm Weather Conditions

Typically in August, river temperatures reach or exceed the lethal level for bull trout (20 °C (68 °F)). During these times, the facility will be shut down unless a bull trout is collected within the previous 2 weeks. The fishway operation will extend week by week until no bull trout have been collected within a two-week period, at which point the facility will be shut down. Operation of the facility would resume September 1, regardless of temperatures. If annual maintenance is needed, it would occur during the month of August during these closure periods.
Maintenance of the Facility

Routine maintenance will be performed to keep the facility in proper working condition. These actions will include, but are not limited to:

- Remove debris from the forebay trash racks, fishway entrance, water supply area, and fish return flumes, etc. - maintain these areas to be debris-free.
- Clean the pre-sort pool of sediment and other debris.
- Clean and sterilize all contact points in the sorting area and transport pods.
- Inspect fish ladder and collection system for flow changes that may indicate problems with diffuser gratings.
- Inspect and calibrate all staff gauges and water level indicators.
- Inspect and ensure that optimum passage conditions are maintained at fishway entrances, weirs, pre-sort pool entry, sorting area, and flume returns per the operations and maintenance plan.
- Inspections and repairs of entry gate mechanical and electric controls, the ladder, projections into the fishway that may injure fish, pre-sort pool equipment, fish lift and exit gate, diffusion gratings, staff gauges, diffusion valves, pumps, crowders, operating equipment at the sorting stations, and monitoring equipment for fish presence – video, PIT tags, as well as other potential problems.
- Prepare fish facility for ice-over conditions in the winter.

The Corps will prepare and submit to the Service a detailed operations and maintenance manual during higher levels of design.

Operations and Maintenance Conservation Measures and Best Management Practices

The following conservation measures and BMPs will be implemented during the operations of the fish trap and the handling of fish.

Personnel

- All fish trap operators will have training working with federally-listed fish species and identifying bull trout.
- Operators will be experienced in identifying bull trout from congeneric species.

Fish Holding and Processing

- Initial sorting would include the separation of trout species from other species, and secondary sorting would occur to sort bull trout from other trout species. Handling may occur to sort bull trout from other trout species and inspect for injuries, but all attempts would be made to do so at a sorting table with fish submersed in water.
- The holding pool will contain enough water to allow for 0.25 cubic feet per pound of fish for the maximum amount of fish in a day (5,000 fish averaging 1 lb each) for temps below 10 °C (50 °F). For temperatures above 10 °C (50 °F), the required volume per pound of fish will increase by 5 percent for each 0.5 degree C above 10 °C.
- A separator screen will be installed in the pre-sort holding pool, and possibly other holding areas, to limit predation of smaller fish by larger fish.
All holding pools will be equipped with water level sensors and alarms. Key water level alarms will be linked to pagers or a phone tree that goes to dam operators and/or biologists. Cameras will also be present in the pools that could be accessed remotely.

Adequate circulation and replenishment of water in holding units will be provided. Chillers will be utilized if water temperatures in the holding facility and transport pods rise above ambient river conditions and during periods above 16 °C (61 °F). However, water temperatures in the fish passage facility are not anticipated to be higher than the Pend Oreille River or Lake Pend Oreille because water entering the facility is all surface outflow from Lake Pend Oreille. If chilling is necessary, chilling would only occur in the transport pods and water will not be chilled more than 2 °C (36 °F) below ambient river temperature to avoid thermal shock upon release.

Transport and Release of Bull Trout

- Aeration shall be provided in all the transportation coolers.
- All bull trout shall be allowed to recover from the stress of transport fully before being released back into the water. Signs of recovery include maintaining neutral or negative buoyancy, upright and active swimming, and ease of breathing (no gasping).
- Transport pods will be sized appropriately for the maximum number of bull trout expected per day (20).
- Fish shall not be detained for more than the minimum time required to transport them to the release site.

Reporting

- Water temperatures will be recorded and checked daily in the fish holding areas.
- Number of bull trout, and approximate size and life stage will be documented to the extent practicable with minimal handling.

Analytical Framework for the Jeopardy and Adverse Modification Determinations

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 reasonably certain to occur 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, taken together with 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.

Recovery Units (RUs) for the bull trout were defined in the final *Recovery Plan for the Coterminous United States Population of [the] Bull Trout* (USFWS 2015a, entire). Pursuant to Service policy, when a proposed Federal action impairs or precludes the capacity of a RU 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, the biological opinion describes how the proposed action affects not only the capability of the RU, but the relationship of the RU to both the survival and recovery of the listed species as a whole.

The jeopardy analysis for the bull trout in this biological opinion considers the relationship of the action area and affected core areas (discussed below under the *Status of the Species* section) to the RU and the relationship of the RU to both the survival and recovery of the bull trout as a whole 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 jeopardy determination.

Within the above context, the Service also considers how the effects of the proposed Federal action and any cumulative effects impact bull trout local and core area populations in determining the aggregate effect to the RU(s). Generally, if the effects of a proposed Federal action, taken together with cumulative effects, are likely to impair the viability of a core area population(s), such an effect is likely to impair the survival and recovery function assigned to a RU(s) and may represent jeopardy to the species (USFWS 2005a, 70 FR 56258).

**Adverse Modification Determination**

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. A final rule revising the regulatory definition of “destruction or adverse modification of critical habitat” was published on February 11, 2016 (USFWS and NMFS 2016, 81 FR 7214). The final rule became effective on March 14, 2016. The revised definition states: “Destruction or adverse modification 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.”

The destruction or adverse modification analysis in this biological opinion relies on four components:

1. The *Status of Critical Habitat,* which describes the range-wide condition of designated critical habitat for the bull trout in terms of the key components of the critical habitat that provide for the conservation of the bull trout, the factors responsible for that condition,
and the intended value of the critical habitat overall for the conservation/recovery of the bull trout.

2. The Environmental Baseline, which analyzes the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat in the action area for the conservation/recovery of the listed species.

3. The Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the key components of critical habitat that provide for the conservation of the listed species, and how those impacts are likely to influence the value of the affected critical habitat units for the conservation/recovery of the listed species.

4. The Cumulative Effects, which evaluate the effects of future non-Federal activities that are reasonably certain to occur in the action area on the key components of critical habitat that provide for the conservation of the listed species and how those impacts are likely to influence the value of the affected critical habitat units for the conservation/recovery of the listed species.

For purposes of making the destruction or adverse modification determination, the effects of the proposed Federal action, together with any cumulative effects, are evaluated to determine if the value of the critical habitat rangewide for the conservation/recovery of the listed species would remain functional or would retain the current ability for the key components of the critical habitat that provide for the conservation of the listed species to be functionally re-established in areas of currently unsuitable but capable habitat.

Note: Past designations of critical habitat have used the terms "primary constituent elements" (PCEs), "physical or biological features" (PBFs) or "essential features" to characterize the key components of critical habitat that provide for the conservation of the listed species. The new critical habitat regulations (USFWS and NMFS 2016, 81 FR 7214) discontinue use of the terms "PCEs" or "essential features" and rely exclusively on use of the term PBFs for that purpose because that term is contained in the statute. Therefore, it is important to note that the terms PBFs, PCEs, and essential habit features are synonymous in meaning, and are used interchangeably in this document. This does not change the approach outlined above for conducting the ‘‘destruction or adverse modification’’ analysis, which is the same regardless of whether the original designation identified PCEs, PBFs or essential features.

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.

Bull Trout

Listing Status

The coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (USFWS 1999, 64 FR 58910-58933). The threatened bull trout occurs in the Klamath

The final listing rule for the United States coterminous population of the bull trout discusses the consolidation of five Distinct Population Segments (DPSs) into one listed taxon and the application of the jeopardy standard under section 7 of the Act relative to this species, and established five interim recovery units for each of these DPSs for the purposes of Consultation and Recovery (USFWS 1999, 64 FR 58930).

The 2010 final bull trout critical habitat rule (USFWS 2010a, 75 FR 63898-64070) identified six draft recovery units based on new information that confirmed they were needed to ensure a resilient, redundant, and representative distribution of bull trout populations throughout the range of the listed entity. The final bull trout recovery plan (RP) (USFWS 2015a, pp. 36-43) formalized these six recovery units: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake. The final recovery units replace the previous five interim recovery units and will be used in the application of the jeopardy standard for section 7 consultation procedures.

### Reasons for Listing and Emerging Threats

Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures; poor water quality; incidental angler harvest; entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels; and introduced nonnative species (USFWS 1999, 64 FR 58910). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats.

Since the time of coterminous listing the species (64 FR 58910) and designation of its critical habitat (USFWS 2004a, 69 FR 59996; USFWS 2005a, 70 FR 56212; USFWS 2010a, 75 FR 63898) a great deal of new information has been collected on the status of bull trout. The Service’s Science Team Report (Whitesel et al. 2004, entire), the bull trout core areas templates (USFWS 2005a, entire; 2009, entire), Conservation Status Assessment (USFWS 2005c, entire), and 5-year Reviews (USFWS 2008, entire; 2015h, entire) have provided additional information about threats and status. The final RP lists many other documents and meetings that compiled information about the status of bull trout (USFWS 2015a, p. 3). As did the prior 5-year review (2008), the 2015 5-year status review maintains the listing status as threatened based on the information compiled in the final bull trout RP (USFWS 2015a, entire) and the Recovery Unit Implementation Plans (RUIPs) (USFWS 2015b-g, entire).

When first listed, the status of bull trout and its threats were reported by the Service at subpopulation scales. In 2002 and 2004, the draft recovery plans (USFWS 2002a, entire; 2004a, entire; 2004b, entire) included detailed information on threats at the recovery unit scale (i.e., similar to subbasin or regional watersheds), thus incorporating the metapopulation concept with core areas and local populations. In the 5-year Reviews, the Service established threats...
categories (i.e., dams, forest management, grazing, agricultural practices, transportation networks, mining, development and urbanization, fisheries management, small populations, limited habitat, and wild fire) (USFWS 2008, pp. 39-42; USFWS 2015h, p. 3). In the final RP, threats and recovery actions are described for 109 core areas, forage/migration and overwintering areas, historical core areas, and research needs areas in each of the six recovery units (USFWS 2015a, p 10). Primary threats are described in three broad categories: Habitat, Demographic, and Nonnative Fish for all recovery areas within the coterminously listed range of the species.

The 2015 5-year status review references the final RP and the RUIPs and incorporates by reference the threats described therein (USFWS 2015h, pp. 2-3). Although significant recovery actions have been implemented since the time of listing, the 5-year review concluded that the listing status should remain as “threatened” (USFWS 2015h, p. 3).

**New or Emerging Threats**

The 2015 RP (USFWS 2015a, entire) describes new or emerging threats such as climate change and other threats. Climate change was not addressed as a known threat when bull trout was listed. The 2015 bull trout RP and RUIPs summarize the threat of climate change and acknowledge that some bull trout local populations and core areas may not persist into the future due to anthropogenic effects such as climate change. The RP further states that use of best available information will ensure future conservation efforts that offer the greatest long-term benefit to sustain bull trout and their required coldwater habitats (USFWS 2015a, pp. vii, 17-20).

Mote et al. (2014, pp. 487-513) summarized climate change effects in the Pacific Northwest to include rising air temperature, changes in the timing of streamflow related to changing snowmelt, increases in extreme precipitation events, lower summer stream flows, and other changes. A warming trend in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, reduce summer stream flows, and increase summer water temperatures (Poff et al. 2002, p. 34; Koopman et al. 2009, entire; Point Reyes Bird Observatory (PRBO) Conservation Science 2011, p. 13). Lower flows as a result of smaller snowpack could reduce habitat, which might adversely affect bull trout reproduction and survival. Warmer water temperatures could lead to physiological stress and could also benefit nonnative fishes that prey on or compete with bull trout. Increases in the number and size of forest fires could also result from climate change (Westerling et al. 2006, p. 940) and could adversely affect watershed function by resulting in faster runoff, lower base flows during the summer and fall, and increased sedimentation rates. Lower flows also may result in increased groundwater withdrawal for agricultural purposes and resultant reduced water availability in certain stream reaches occupied by bull trout (USFWS 2015c, p. B-10).

Although all salmonids are likely to be affected by climate change, bull trout are especially vulnerable given that spawning and rearing are constrained by their location in upper watersheds and the requirement for cold water temperatures (Rieman et al. 2007, p. 1552). Climate change is expected to reduce the extent of cold water habitat (Isaak et al. 2015, p. 2549, Figure 7), and increase competition with other fish species (lake trout, brown trout, brook trout, and northern pike) for resources in remaining suitable habitat. Several authors project that brook trout, a fish species that competes for resources with and predates on the bull trout, will continue increasing their range in several areas (an upward shift in elevation) due to the effects from climate change (e.g., warmer water temperatures) (Wenger et al. 2011, p. 998, Figure 2a, Isaak et al. 2014, p. 114).
Species Description

Bull trout, 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). 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 (Rode 1990, p. 1)), 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, pp. 165-169; Bond 1992, pp. 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 widespread throughout the Columbia River basin, including its headwaters in Montana and Canada.

Life History

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 (36 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 155 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) and, after hatching, fry remain in the substrate. Time from egg deposition to emergence 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).

**Population Dynamics**

*Population Structure*

As indicated above, bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Goetz 1989, p. 15). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989, p. 138; Goetz 1989, p. 24), or saltwater (anadromous form) to rear as subadults and to live as adults (Brenkman and Corbett 2005, entire; McPhail and Baxter 1996, p. i). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. Repeat- and alternate-year spawning has been reported, although repeat-spawning
frequency and post-spawning mortality are not well documented (Fraley and Shepard 1989, p. 135; Leathe and Graham 1982, p. 95; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout are naturally migratory, which allows them to capitalize on temporally abundant food resources and larger downstream habitats. Resident forms may develop where barriers (either natural or man-made) occur or where foraging, migrating, or overwintering habitats for migratory fish are minimized (Brenkman and Corbett 2005, pp. 1075-1076; Goetz et al. 2004, p. 105; Starcevich et al. 2012, p. 10; Barrows et al. 2016, p. 98). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002, pp. 96, 98-106) and Wenatchee River (Ringel et al. 2014, pp. 61-64). Parts of these river systems have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem rivers. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes.

Benefits of connected habitat to migratory bull trout include greater growth in the more productive waters of larger streams, lakes, and marine waters; greater fecundity resulting in increased reproductive potential; and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Frisse1 1999, pp. 861-863; MBTSG 1998, p. 13; Rieman and McIntyre 1993, pp. 2-3). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbances make local habitats temporarily unsuitable. Therefore, the range of the species is diminished, and the potential for a greater reproductive contribution from larger size fish with higher fecundity is lost (Rieman and McIntyre 1993, p. 2).

Whitesel et al. (2004, p. 2) noted that although there are multiple resources that contribute to the subject, Spruell et al. (2003, entire) best summarized genetic information on bull trout population structure. Spruell et al. (2003, entire) analyzed 1,847 bull trout from 65 sampling locations, four located in three coastal drainages (Klamath, Queets, and Skagit Rivers), one in the Saskatchewan River drainage (Belly River), and 60 scattered throughout the Columbia River Basin. They concluded that there is a consistent pattern among genetic studies of bull trout, regardless of whether examining allozymes, mitochondrial DNA, or most recently microsatellite loci. Typically, the genetic pattern shows relatively little genetic variation within populations, but substantial divergence among populations. Microsatellite loci analysis supports the existence of at least three major genetically differentiated groups (or evolutionary lineages) of bull trout (Spruell et al. 2003, p. 17). They were characterized as:

i. “Coastal”, including the Deschutes River and all of the Columbia River drainage downstream, as well as most coastal streams in Washington, Oregon, and British Columbia. A compelling case also exists that the Klamath Basin represents a unique evolutionary lineage within the coastal group.

ii. “Snake River”, which also included the John Day, Umatilla, and Walla Walla rivers. Despite close proximity of the John Day and Deschutes Rivers, a striking level of divergence between bull trout in these two systems was observed.

iii. “Upper Columbia River” which includes the entire basin in Montana and northern Idaho. A tentative assignment was made by Spruell et al. (2003, p. 25) of the Saskatchewan River drainage populations (east of the continental divide), grouping them with the upper Columbia River group.
Spruell et al. (2003, p. 17) noted that within the major assemblages, populations were further subdivided, primarily at the level of major river basins. Taylor et al. (1999, entire) surveyed bull trout populations, primarily from Canada, and found a major divergence between inland and coastal populations. Costello et al. (2003, p. 328) suggested the patterns reflected the existence of two glacial refugia, consistent with the conclusions of Spruell et al. (2003, p. 26) and the biogeographic analysis of Haas and McPhail (2001, entire). Both Taylor et al. (1999, p. 1166) and Spruell et al. (2003, p. 21) concluded that the Deschutes River represented the most upstream limit of the coastal lineage in the Columbia River Basin.

More recently, the USFWS identified additional genetic units within the coastal and interior lineages (Ardren et al. 2011, pp. 519-523). Based on a recommendation in the USFWS’s 5-year review of the species’ status (USFWS 2008, p. 45), the USFWS reanalyzed the 27 recovery units identified in the 2002 draft bull trout recovery plan (USFWS 2002a, p. 48) by utilizing, in part, information from previous genetic studies and new information from additional analysis (Ardren et al. 2011, entire). In this examination, the USFWS applied relevant factors from the joint USFWS and NMFS Distinct Population Segment (DPS) policy (USFWS and NMFS 1996, 61 FR 4722-4725) and subsequently identified six draft recovery units that contain assemblages of core areas that retain genetic and ecological integrity across the range of bull trout in the coterminous United States. These six recovery units were used to inform designation of critical habitat for bull trout by providing a context for deciding what habitats are essential for recovery (USFWS 2010a, 75 FR 63898). These six recovery units, which were identified in the final bull trout recovery plan (USFWS 2015a) and described further in the RUIPs (USFWS 2015b-g) include: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake.

Population Dynamics

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. 4). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991, entire). Burkey (1989, entire) 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 for local populations may be low and probability of extinction high (Burkey 1989, entire).

A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meefe and Carroll 1994, pp. 189-190). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low-rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham 2000, entire). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman and Clayton 1997, pp. 10-12; Dunham and Rieman 1999, p. 645; Spruell et al. 1999, pp. 118-120; Rieman and Dunham 2000, p. 55).
Human-induced factors as well as natural factors affecting bull trout distribution have likely limited the expression of the metapopulation concept for bull trout to patches of habitat within the overall distribution of the species (Dunham and Rieman 1999, entire). However, despite the theoretical fit, the relatively recent and brief time period during which bull trout investigations have taken place does not provide certainty as to whether a metapopulation dynamic is occurring (e.g., a balance between local extirpations and recolonizations) across the range of the bull trout or whether the persistence of bull trout in large or closely interconnected habitat patches (Dunham and Rieman 1999, entire) is simply reflective of a general deterministic trend towards extinction of the species where the larger or interconnected patches are relics of historically wider distribution (Rieman and Dunham 2000, pp. 56-57). Research does, however, provide genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River Basin of Idaho (Whiteley et al. 2003, entire). Whitesel et al. (2004 pp. 14-23) summarizes metapopulation models and their applicability to bull trout).

**Status and Distribution**

The following is a summary of the description and current status of the bull trout within the six recovery units (RUs) (shown in Figure 4, below). A comprehensive discussion is found in the Service’s 2015 RP for the bull trout (USFWS 2015a, entire) and the 2015 RUIPs (USFWS 2015b-g, entire). Each of these RUs is necessary to maintain the bull trout’s distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species’ resilience to changing environmental conditions.

**Coastal Recovery Unit**

The Coastal RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015b, entire). The Coastal RU is located within western Oregon and Washington. The RU is divided into three regions: Puget Sound, Olympic Peninsula, and the Lower Columbia River Regions. This RU contains 20 core areas comprising 84 local populations and a single potential local population in the historical Clackamas River core area where bull trout had been extirpated and were reintroduced in 2011, and identified four historically occupied core areas that could be re-established (USFWS 2015a, p. 47; USFWS 2015b, p. A-2). Core areas within Puget Sound and the Olympic Peninsula currently support the only anadromous local populations of bull trout. This RU also contains ten shared foraging, migration, and overwintering (FMO) habitats which are outside core areas and allows for the continued natural population dynamics in which the core areas have evolved (USFWS 2015b, p. A-5).
Figure 4. Map showing the location of the six bull trout Recovery Units.

There are four core areas within the Coastal RU that have been identified as current population strongholds: Lower Skagit, Upper Skagit, Quinault River, and Lower Deschutes River (USFWS 2015a, p.79). These are the most stable and abundant bull trout populations in the RU.

Most core areas in the Puget Sound region support a mix of anadromous and fluvial life history forms, with at least two core areas containing a natural adfluvial life history (Chilliwack River core area [Chilliwack Lake] and Chester Morse Lake core area). Overall demographic status of core areas generally improves as you move from south Puget Sound to north Puget Sound. Although comprehensive trend data are lacking, the current condition of core areas within the Puget Sound region are likely stable overall, although some at depressed abundances. Most core areas in this region still have significant amounts of headwater habitat within protected and relatively pristine areas (e.g., North Cascades National Park, Mount Rainier National Park, Skagit Valley Provincial Park, Manning Provincial Park, and various wilderness or recreation areas).

Within the Olympic Peninsula region, demographic status of core areas is poorest in Hood Canal and Strait of Juan de Fuca, while core areas along the Pacific Coast of Washington likely have the best demographic status in this region. The connectivity between core areas in these disjunct regions is believed to be naturally low due to the geographic distance between them. Internal connectivity is currently poor within the Skokomish River core area (Hood Canal) and is being restored in the Elwha River core area (Strait of Juan de Fuca). Most core areas in this region still
have their headwater habitats within relatively protected areas (Olympic National Park and wilderness areas).

Across the Lower Columbia River region, status is highly variable, with one relative stronghold (Lower Deschutes core area) existing on the Oregon side of the Columbia River. The Lower Columbia River region also contains three watersheds (North Santiam River, Upper Deschutes River, and White Salmon River) that could potentially become re-established core areas within the Coastal Recovery Unit. Adult abundances within the majority of core areas in this region are relatively low, generally 300 or fewer individuals.

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, loss of functioning estuarine and nearshore marine habitats, development and related impacts (e.g., flood control, floodplain disconnection, bank armoring, channel straightening, loss of instream habitat complexity), agriculture (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation, livestock grazing), fish passage (e.g., dams, culverts, instream flows) residential development, urbanization, forest management practices (e.g., timber harvest and associated road building activities), connectivity impairment, mining, and the introduction of nonnative species.

The RP identifies three categories of primary threats: Habitat (upland/riparian land management, instream impacts, water quality), demographic (connectivity impairment, fisheries management, small population size), and nonnatives (nonnative fishes). Of the 20 core areas in the Coastal RU, only one (5 percent), the Lower Deschutes River, has no primary threats identified (USFWS 2015b, Table A-1).

Conservation measures or recovery actions implemented in this RU include relicensing of major hydropower facilities that have provided upstream and downstream fish passage or complete removal of dams, land acquisition to conserve bull trout habitat, floodplain restoration, culvert removal, riparian revegetation, levee setbacks, road removal, and projects to protect and restore important nearshore marine habitats.

**Klamath Recovery Unit**

The Klamath RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015c, entire). This RU is located in southern Oregon and northwestern California. The Klamath RU is the most significantly imperiled RU, having experienced considerable extirpation and geographic contraction of local populations and declining demographic condition, and natural re-colonization is constrained by dispersal barriers and presence of nonnative brook trout (USFWS 2015a, p. 39). This RU currently contains three core areas and eight local populations (USFWS 2015a, p. 47; USFWS 2015c, p. B-1). Nine historical local populations of bull trout have become extirpated (USFWS 2015b, Table A-1).

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1 Primary Threats are factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future (4 to 10 bull trout generations, approximately 50 years).
2015c, p. B-1). All three core areas have been isolated from other bull trout populations for the past 10,000 years (USFWS 2015c, p. B-3).

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, habitat degradation and fragmentation, past and present land use practices, agricultural water diversions, nonnative species, and past fisheries management practices. Identified primary threats for all three core areas include upland/riparian land management, connectivity impairment, small population size, and nonnative fishes (USFWS 2015c, Table B-1).

Conservation measures or recovery actions implemented include removal of nonnative fish (e.g., brook trout, brown trout, and hybrids), acquiring water rights for instream flows, replacing diversion structures, installing fish screens, constructing bypass channels, installing riparian fencing, culvert replacement, and habitat restoration.

**Mid-Columbia Recovery Unit**

The Mid-Columbia RU describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015d, entire). The Mid-Columbia RU is located within eastern Washington, eastern Oregon, and portions of central Idaho. The Mid-Columbia RU is divided into four geographic regions: Lower Mid-Columbia, Upper Mid-Columbia, Lower Snake, and Mid-Snake Geographic Regions. This RU contains 24 occupied core areas comprising 142 local populations, two historically occupied core areas, one research needs area, and seven FMO habitats (USFWS 2015a, p. 47; USFWS 2015d, p. C-1 – C4).

The current demographic status of bull trout in the Mid-Columbia Recovery Unit is highly variable at both the RU and geographic region scale. Some core areas, such as the Umatilla, Asotin, and Powder Rivers, contain populations so depressed they are likely suffering from the deleterious effects of small population size. Conversely, strongholds do exist within the RU, predominantly in the Lower Snake geographic area. Populations in the Imnaha, Little Minam, Clearwater, and Wenaha Rivers are likely some of the most abundant. These populations are all completely or partially within the bounds of protected wilderness areas and have some of the most intact habitat in the recovery unit. Status in some core areas is relatively unknown, but all indications in these core areas suggest population trends are declining, particularly in the core areas of the John Day Basin. More detailed description of bull trout distribution, trends, and survey data within individual core areas is provided in Appendix II of the RU (USFWS 2015d).

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, agricultural practices (e.g., irrigation, water withdrawals, livestock grazing), fish passage (e.g. dams, culverts), nonnative species, forest management practices, and mining. Of the 24 occupied core areas, six (25 percent) have no identified primary threats (USFWS 2015d, Table C-2).

Conservation measures or recovery actions implemented include road removal, channel restoration, mine reclamation, improved grazing management, removal of fish barriers, and instream flow requirements.
Columbia Headwaters Recovery Unit

The Columbia Headwaters RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015e, entire). The Columbia Headwaters RU is located in western Montana, northern Idaho, and the northeastern corner of Washington. The RU is divided into five geographic regions: Upper Clark Fork, Lower Clark Fork, Flathead, Kootenai, and Coeur d’Alene Geographic Regions (USFWS 2015e, pp. D-2 – D-4). This RU contains 35 bull trout core areas; 15 of which are complex core areas as they represent larger interconnected habitats and 20 simple core areas as they are isolated headwater lakes with single local populations. The 20 simple core areas are each represented by a single local population, many of which may have persisted for thousands of years despite small populations and isolated existence (USFWS 2015e, p. D-1). Fish passage improvements within the RU have reconnected some previously fragmented habitats (USFWS 2015e, p. D-1), while others remain fragmented. Unlike the other RUs in Washington, Idaho and Oregon, the Columbia Headwaters RU does not have any anadromous fish overlap. Therefore, bull trout within the Columbia Headwaters RU do not benefit from the recovery actions for salmon (USFWS 2015e, p. D-41).

Conclusions from the 2008 5-year review (USFWS 2008, Table 1) were that 13 of the Columbia Headwaters RU core areas were at High Risk (37.1 percent), 12 were considered At Risk (34.3 percent), 9 were considered at Potential Risk (25.7 percent), and only 1 core area (Lake Koocanusa; 2.9 percent) was considered at Low Risk. Simple core areas, due to limited demographic capacity and single local populations were generally more inherently at risk than complex core areas under the model. While this assessment was conducted nearly a decade ago, little has changed in regard to individual core area status in the interim (USFWS 2015e, p. D-7).

The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, mostly historical mining and contamination by heavy metals, expanding populations of nonnative fish predators and competitors, modified instream flows, migratory barriers (e.g., dams), habitat fragmentation, forest practices (e.g., logging, roads), agriculture practices (e.g., irrigation, livestock grazing), and residential development. Of the 34 occupied core areas, nine (26 percent) have no identified primary threats (USFWS 2015e, Table D-2).

Conservation measures or recovery actions implemented include habitat improvement, fish passage, and removal of nonnative species.

Upper Snake Recovery Unit

The Upper Snake RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015f, entire). The Upper Snake RU is located in central Idaho, northern Nevada, and eastern Oregon. The Upper Snake RU is divided into seven geographic regions: Salmon River, Boise River, Payette River, Little Lost River, Malheur River, Jarbidge River, and Weiser River. This RU contains 22 core areas and 207 local populations (USFWS 2015a, p. 47), with almost 60 percent being present in the Salmon River Region.

The population trends for the 22 core areas in the Upper Snake RU are summarized in Table E-2 of the Upper Snake RUIP (USFWS 2015f, pp. E-5 – E-7): six are classified as increasing, two are stable; two are likely stable; three are unknown, but likely stable; two are unknown, but likely decreasing; and, seven are unknown.
The current condition of the bull trout in this RU is attributed to the adverse effects of climate change, dams, mining, forest management practices, nonnative species, and agriculture (e.g., water diversions, grazing). Of the 22 occupied core areas, 13 (59 percent) have no identified primary threats (USFWS 2015f, Table E-3).

Conservation measures or recovery actions implemented include instream habitat restoration, instream flow requirements, screening of irrigation diversions, and riparian restoration.

**St. Mary Recovery Unit**

The St. Mary RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015g). The Saint Mary RU is located in Montana but is heavily linked to downstream resources in southern Alberta, Canada. Most of the Saskatchewan River watershed, which the St. Mary flows into, is located in Canada. The United States portion includes headwater spawning and rearing habitat and the upper reaches of FMO habitat. This RU contains four core areas (St. Mary River, Slide Lake, Cracker Lake, and Red Eagle Lake), and seven local populations (USFWS 2015g, p. F-1) in the U.S. headwaters.

Current status of bull trout in the Saint Mary River complex core area (U.S.) is considered strong. The three simple core areas (Slide Lake, Cracker Lake, and Red Eagle Lake) appear to be self-sustaining and fluctuating within known historical population demographic bounds. Note: the NatureServe status assessment tool ranks this RU as imperiled (Figure 2).

The current condition of the bull trout in this RU is attributed primarily to the outdated design and operations of the Saint Mary Diversion operated by the Bureau of Reclamation (e.g., entrainment, fish passage, instream flows), and, to a lesser extent habitat impacts from development and nonnative species. Of the four core areas, the three simple core areas (all lakes) have no identified primary threats (USFWS 2015g, Table F-1).

**Status Summary**

The Service applied the NatureServe status assessment tool\(^2\) to evaluate the tentative status of the six RUs. The tool rated the Klamath RU as the least robust, most vulnerable RU and the Upper Snake RU the most robust and least vulnerable recovery unit, with others at intermediate values (Figure 5).

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\(^2\) This tool consists of a spreadsheet that generates conservation status rank scores for species or other biodiversity elements (e.g., bull trout Recovery Units) based on various user inputs of status and threats (see USFWS 2015, p. 8 and Faber-Langendoen et al. 2012, entire, for more details on this status assessment tool).
Figure 5. NatureServe status assessment tool scores for each of the six bull trout recovery units. The Klamath RU is considered the least robust and most vulnerable, and the Upper Snake RU the most robust and least vulnerable (from USFWS 2015, Figure 2).

Conservation Needs

The 2015 RP for bull trout established the primary strategy for recovery of bull trout in the coterminous United States: (1) conserve bull trout so that they are geographically widespread across representative habitats and demographically stable in six RUs; (2) effectively manage and ameliorate the primary threats in each of six RUs at the core area scale such that bull trout are not likely to become endangered in the foreseeable future; (3) build upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999, and improve our understanding of how various threat factors potentially affect the species; (4) use that information to work cooperatively with our partners to design, fund, prioritize, and implement effective conservation actions in those areas that offer the greatest long-term benefit to sustain bull trout and where recovery can be achieved; and (5) apply adaptive management principles to implementing the bull trout recovery program to account for new information (USFWS 2015a, p. 24.).

Information presented in prior draft recovery plans published in 2002 and 2004 (USFWS 2002a, entire; 2004b, entire; 2004c, entire) provided information that identified recovery actions across the range of the species and to provide a framework for implementing numerous recovery actions by our partner agencies, local working groups, and others with an interest in bull trout conservation. Many recovery actions were completed prior to finalizing the RP in 2015.

The 2015 RP (USFWS 2015a, entire) integrates new information collected since the 1999 listing regarding bull trout life history, distribution, demographics, conservation successes, etc., and integrates and updates previous bull trout recovery planning efforts across the coterminous range of the bull trout.

The Service has developed a recovery approach that: (1) focuses on the identification of and effective management of known and remaining threat factors to bull trout in each core area; (2) acknowledges that some extant bull trout core area habitats will likely change (and may be lost) over time; and (3) identifies and focuses recovery actions in those areas where success is likely
to meet our goal of ensuring the certainty of conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations so that the protections of the Act are no longer necessary (USFWS 2015a, p. 45-46).

To implement the recovery strategy, the 2015 RP establishes three categories of recovery actions for each of the six RUs (USFWS 2015a, pp. 50-51):

1. Protect, restore, and maintain suitable habitat conditions for bull trout.
2. Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity.
3. Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.
4. Work with partners to conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks, and considering the effects of climate change.

Bull trout recovery is based on a geographical hierarchical approach. Bull trout are listed as a single DPS within the five-state area of the coterminous United States. The single DPS is subdivided into six biological-based recovery units: (1) Coastal Recovery Unit; (2) Klamath Recovery Unit; (3) Mid-Columbia Recovery Unit; (4) Columbia Headwaters Recovery Unit (5) Upper Snake Recovery Unit; and (6) Saint Mary Recovery Unit (USFWS 2015a, p. 23). A viable recovery unit should demonstrate that the three primary principles of biodiversity have been met: representation (conserving the genetic makeup of the species); resiliency (ensuring that each population is sufficiently large to withstand stochastic events); and redundancy (ensuring a sufficient number of populations to withstand catastrophic events) (USFWS 2015a, p. 33).

Each of the six recovery units contain multiple bull trout core areas, 109 total, which are non-overlapping watershed-based polygons, and each core area includes one or more local populations. Currently there are 109 occupied core areas, which comprise 611 local populations (USFWS 2015a, pp. 3, 47, Appendix F). There are also six core areas where bull trout historically occurred but are now extirpated, and one research needs area where bull trout were known to occur historically, but their current presence and use of the area are uncertain (USFWS 2015a, p. 3). Core areas can be further described as complex or simple (USFWS 2015a, p. 3-4). Complex core areas contain multiple local bull trout populations, are found in large watersheds, have multiple life history forms, and have migratory connectivity between spawning and rearing habitat and FMO habitats. Simple core areas are those that contain one bull trout local population. Simple core areas are small in scope, isolated from other core areas by natural barriers, and may contain unique genetic or life history adaptations.

A core area is a combination of 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) and 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. Core areas are presumed to reflect the metapopulation structure of bull trout.

A local population is a group of bull trout that spawn within a particular stream or portion of a stream system (USFWS 2015a, p. 73). A local population is considered to be the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Gene flow may occur between local populations (e.g., those within a core population), but is assumed to be infrequent compared with that among individuals within a local population.

Federal, State, and Tribal Conservation Actions Since Listing

Since our listing of bull trout in 1999, numerous conservation measures that contribute to the conservation and recovery of bull trout have been and continue to be implemented across its range in the coterminous United States. These measures are being undertaken by a wide variety of local and regional partnerships, including State fish and game agencies, State and Federal land management and water resource agencies, Tribal governments, power companies, watershed working groups, water users, ranchers, and landowners.

In many cases, these bull trout conservation measures incorporate or are closely interrelated with work being done for recovery of salmon and steelhead, which are limited by many of the same threats. These include removal of migration barriers (culvert removal or redesign at stream crossings, fish ladder construction, dam removal, etc.) to allow access to spawning or FMO habitat; screening of water diversions to prevent entrainment into unsuitable habitat in irrigation systems; habitat improvement (riparian revegetation or fencing, placement of coarse woody debris in streams) to improve spawning suitability, habitat complexity, and water temperature; instream flow enhancement to allow effective passage at appropriate seasonal times and prevent channel dewatering; and water quality improvement (decommissioning roads, implementing best management practices for grazing or logging, setting pesticide use guidelines) to minimize impacts from sedimentation, agricultural chemicals, or warm temperatures.

At sites that are vulnerable to development, protection of land through fee title acquisition or conservation easements is important to prevent adverse impacts or allow conservation actions to be implemented. In several bull trout core areas, fisheries management to manage or suppress nonnative species (particularly brown trout, brook trout, lake trout, and northern pike) is ongoing and has been identified as important in addressing effects of nonnative fish competition, predation, or hybridization.


Contemporaneous Federal Actions

Projects subject to section 7 consultation under the Act have occurred throughout the range of bull trout. Singly or in aggregate, these projects could affect the species’ status. The Service reviewed 137 opinions produced by the Service from the time of listing in June 1998 until
August 2003 (Nuss 2003, entire). The Service analyzed 24 different activity types (e.g., grazing, road maintenance, habitat restoration, timber sales, hydropower, etc.). Twenty opinions involved multiple projects, including restorative actions for bull trout.

The geographic scale of projects analyzed in these opinions varied from individual actions (e.g., construction of a bridge or pipeline) within one basin, to multiple-project actions, occurring across several basins. Some large-scale projects affected more than one recovery unit.

The Service’s assessment of opinions from the time of listing until August 2003 (137 opinions), confirmed that no actions that had undergone section 7 consultation during this period, considered either singly or cumulatively, would appreciably reduce the likelihood of survival and recovery of the bull trout or result in the loss of any (sub) populations (USFWS 2006, pp. B-36 – B-37).

**Bull Trout Critical Habitat**

**Legal Status**

Ongoing litigation resulted in the U.S. District Court for the District of Oregon granting the Service a voluntary remand of the 2005 critical habitat designation. Subsequently the Service published a proposed critical habitat rule on January 14, 2010 (USFWS 2010b, 75 FR 2260) and a final rule on October 18, 2010 (USFWS 2010a, 75 FR 63898). The rule became effective on November 17, 2010. A justification document was also developed to support the rule and is available on our website (http://www.fws.gov/pacific/bulltrout). The scope of the designation involved the species’ coterminous range within the Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Upper Snake, and St. Mary recovery units.

Rangewide, the Service designated reservoirs/lakes and stream/shoreline miles in 32 critical habitat units (CHU) as bull trout critical habitat (see Table 2). Designated bull trout critical habitat is of two primary use types: (1) spawning and rearing; and (2) foraging, migrating, and overwintering (FMO).

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3 Note: the adverse modification analysis does not rely on recovery units.
Table 2. Stream/shoreline distance and reservoir/lake area designated as bull trout critical habitat by state.

<table>
<thead>
<tr>
<th>State</th>
<th>Stream/Shoreline Miles</th>
<th>Stream/Shoreline Kilometers</th>
<th>Reservoir/Lake Acres</th>
<th>Reservoir/Lake Hectares</th>
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<tr>
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<td>14,116.5</td>
<td>170,217.5</td>
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</table>

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 822.5 mi of streams/shorelines and 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.

The final rule continues to exclude some critical habitat segments based on a careful balancing of the benefits of inclusion versus the benefits of exclusion. Critical habitat does not include: (1) waters adjacent to non-Federal lands covered by legally operative incidental take permits for habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, in which bull trout is a covered species on or before the publication of this final rule; (2) waters within or adjacent to Tribal lands subject to certain commitments to
conserve bull trout or a conservation program that provides aquatic resource protection and restoration through collaborative efforts, and where the Tribes indicated that inclusion would impair their relationship with the Service; or (3) waters where impacts to national security have been identified (USFWS 2010a, 75 FR 63898). Excluded areas are approximately 10 percent of the stream/shoreline miles and 4 percent of the lakes and reservoir acreage of designated critical habitat. Each excluded area is identified in the relevant CHU text, as identified in paragraphs (e)(8) through (e)(41) of the final rule. It is important to note that the exclusion of waterbodies from designated critical habitat does not negate or diminish their importance for bull trout conservation. Because exclusions reflect the often complex pattern of land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments.

**Conservation Role and Description of Critical Habitat**

The conservation role of bull trout critical habitat is to support viable core area populations (USFWS 2010a, 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 associated with Physical or Biological Features (PBFs) 5 and 6, which relate to breeding habitat (see list below).

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).

The Olympic Peninsula and Puget Sound CHUs are essential to the conservation of amphidromous (i.e., migrating from fresh to salt water or from salt to fresh water at some stage of the life cycle other than the breeding period) bull trout, which are unique to the Coastal-Puget Sound population segment. These CHUs contain marine nearshore and freshwater habitats, outside of core areas, that are used by bull trout from one or more core areas. These habitats, outside of core areas, contain PBFs that are critical to adult and subadult foraging, migrating, and overwintering.

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 laid out in the
appropriate quantity and spatial arrangement for conservation of the species. 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 historical 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.

**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 historical range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (USFWS 2002b, 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 (USFWS 2010b, 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 nearshore 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).

**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.
Status of the Bull Trout in the Action Area

Northeast Washington Recovery Unit

The Columbia Headwaters Recovery Unit is one of six units comprising the Columbia River DPS of bull trout identified in the 2015 draft Recovery Plan. The Columbia Headwaters Recovery Unit includes western Montana, northern Idaho, and the northeastern corner of Washington. Major drainages include the Clark Fork River basin and its Flathead River contribution, the Kootenai River basin, and the Coeur d’Alene Lake basin.

The 2008 5-year Status Review, Northeast Washington Core Area Status Assessment Template (USFWS 2008a, p. 554) states that the LeClerc Creek local population no longer exists. At the time, the determination was based on a lack of documentation of juvenile fish or redds in LeClerc Creek since 2001 when a bull trout was observed on a redd. In 2014, a single adult bull trout was observed in LeClerc Creek during redd surveys (Kuttel, E. pers. comm., 2014). When this population was active, individuals represented a unique life history strategy of moving from spawning areas in tributary streams downstream to the Pend Oreille River and then upstream to forage and overwinter in Lake Pend Oreille. For the LeClerc Creek population, the option to move up to Lake Pend Oreille was blocked by AFD. The Pend Oreille River has been designated as foraging, migration, and over-wintering habitat for bull trout, and likely provided those same functions under pre-dam conditions.

Lake Pend Oreille Core Area

The Lake Pend Oreille Core Area is one of the largest, most complex, and best-documented bull trout core areas in the upper Columbia River watershed. The Core Area includes the Pend Oreille River in northeastern Washington, a nearly 95,000-acre lake in Idaho (Lake Pend Oreille), and the Lower Clark Fork River in western Montana. Bull trout face a variety of threats across their range; however the biggest threats to bull trout status and distribution within the Lake Pend Oreille core area are believed to be from the following (USFWS 2015a, p. 15-18):

1. Introduced species/fisheries management;
2. Forest management practices and forest roads;
3. Fish passage issues (artificial barriers to migration), connectivity, and entrainment; and
4. Residential development and urbanization.

In 1925, the U.S. Fish Commission stocked 100,000 lake trout (S. namaycush) into Lake Pend Oreille and its tributaries (Pratt and Huston 1993, p. 75). Additionally, lake trout may also have migrated downstream of Flathead Lake, where they were introduced 20 years earlier (USFWS 2002c, p. 91). Lake trout compete with native bull trout for food resources and are listed as one of the biggest threats to bull trout populations in the Lake Pend Oreille core area and in Lake Pend Oreille (LPOBTWAG 1999, p. B-4; USFWS in litt. 2008, p. 16). Findings from Donald and Alger (1993, p. 245) and Fredenberg (2002, p. 151) suggest that bull trout will not persist in the presence of lake trout. For example, Priest Lake experienced dramatic declines in bull trout numbers as corresponding lake trout numbers increased (Mauser 1986, p. 26).

Efforts to reduce competition for food resources, which benefit lake conditions for bull trout in Lake Pend Oreille, are ongoing through predator removal programs. Considerable effort has been put into controlling the lake trout population in Lake Pend Oreille through angler incentive...
programs, and trap and gill netting projects. In 2011 netting operations successfully removed 5,841 lake trout from Lake Pend Oreille. However, a total of 113 direct mortalities of bull trout occurred (Dux pers. comm. 2011). Despite the mortalities of bull trout, long term benefits to nonnative species removal are positive (Fredericks et al. 2008, p. 92). This program continues and is believed to be highly effective at reducing lake trout numbers. Since the program began, annual bull trout mortalities have ranged between 120 in 2006 to 525 in 2013, while lake trout population estimates have declined by more than 50 percent (Deeds, S. pers. comm. 2015).

The recovery goal for bull trout as identified in the Final Bull Trout Recovery Plan (USFWS 2015a, p. 43) is to manage threats and ensure sufficient distribution and abundance to improve the status of bull trout throughout their extant range in the coterminous United States so that protection under the Act is no longer necessary. In order to accomplish this goal, recovery criteria addressing distribution, abundance, habitat, and connectivity were identified for the Columbia Headwaters Recovery Unit core area (USFWS 2015a p. 46).

To monitor bull trout population trends, an extensive redd count monitoring program in Lake Pend Oreille core area has been devised by the Idaho Department of Fish and Game (IDFG) and has been in place since 1983 (USFWS in litt. 2008, p. 2). Table 3 documents the results of annual redd surveys in the Lake Pend Oreille core area (Ryan and Jakubowski 2011, p. 16, Bouwens pers. comm. 2017). Based on 2010 surveys of the Lake Pend Oreille drainage, the adult bull trout spawning population consisted of at least an estimated 2,093 fish (compared to 2,771 in 2009) (Hardy pers. comm. 2011). Survey results from 2009 also identified more than six local populations with greater than 100 individuals in each, estimated adult escapement (number of adults returning to spawn based on the number of redds observed during annual surveys) of 2,500 or more individuals, and increasing relative abundance measured as the trend in adult escapement. Recovery objectives (USFWS 2002d) were met for 5 years between 2002 and 2006, but estimated adult escapement was less than 2,500 in 2007, 2008 and 2010 and represented below average counts in several highly influential tributary spawning populations including Trestle Creek, Granite Creek, and Gold Creek (Hardy et al. 2010, p. 17; Hardy pers. comm. 2011). Despite this, regression analysis depicting trends in bull trout redds from 1983 to 2017, demonstrates that redd abundance varies annually throughout the core area (Hardy et al. 2010, p. 14, 41; Hardy pers. comm. 2011). Although the fundamental trend for bull trout redd counts from 1983 to 2017 appears positive, bull trout like other fish species demonstrate population fluctuations (as assessed by redd counts) due to a variety of factors.

Bull trout in the interconnected Lake Pend Oreille watershed appear to be entirely adfluvial (Panhandle Bull Trout Technical Advisory Team (PBTTAT) 1998, p.8). Adult bull trout make spawning migrations into the larger tributaries beginning in April (PBTTAT 1998, p. 9), with juvenile outmigration occurring as early as March and lasting until June. Fall migrations (September-October) follow a similar pattern of movement with adults moving further upstream to spawn (then returning to Lake Pend Oreille to overwinter) and juveniles moving downstream into Lake Pend Oreille (Downs et al. 2006, p. 193-194). Some of these migrations have also been shown to be very extensive (USFWS 2002d, p. 15). For example, research conducted by Dupont and Horner (2002, p. 125) suggested that migratory bull trout spawning in the Middle Fork East River and Uleda Creeks, tributaries to the East River downstream of Priest Lake, may exhibit an unusual life history strategy. These fish have been documented to migrate downstream out of Lake Pend Oreille into the Pend Oreille River, before ascending the East River drainage for spawning. It was previously believed that bull trout in this drainage were part
of the Priest Lake core area (USFWS in litt 2008, p. 3). This life history was believed to also occur in tributaries downstream of Albeni Falls prior to construction of the dam.

Fish passage barriers also influence bull trout distribution throughout the core area. Log crossings, beaver dams, large alluvial deposits and culverts are recognized as fish passage barriers across the area. To improve fish passage, many of these barriers (i.e., culverts, log crossings, etc.) have been removed or replaced. While the aforementioned barriers influence fish passage on a local scale, large hydroelectric dams have had the greatest influence on bull trout distribution throughout the core area. Beginning in 1913, with the construction of Thompson Falls Dam on a set of natural falls in the Clark Fork River, dams in the basin (Cabinet Gorge in 1952, Albeni Falls in 1955, Box Canyon in 1956, and Noxon Rapids in 1959) have permanently interrupted established bull trout migration routes, eliminating access from portions of the tributary system to the productive waters of Lake Pend Oreille and Flathead Lake (USFWS 2015a, p. 15) (Figure 6). Three dams on the lower Clark Fork River have significantly reduced the amount of spawning and rearing habitat available to Lake Pend Oreille bull trout. Other effects of these dams to bull trout habitat include changes in water quality (temperature, sediment, and nutrients) and quantity, lake drawdowns, a reduction in shoreline food sources, and direct losses of fish into water conveyance systems (turbines, spillways, or water delivery systems) (USFWS 2015a, p. 34).

Within the action area, the Pend Oreille River has been significantly altered by residential development along the shoreline. Bank armoring and recreational docks have limited complexity and large wood recruitment, modified natural hydraulic processes, and removed vegetation that provide shade and forage. These actions have furthered limited the potential for bull trout use of the river, and the persistence of the species in the action area.

![Figure 6 Dams in the Pend Oreille and Clark Fork River Systems (image from Corps).](image-url)
### Table 3. Bull trout redd counts from tributaries of Lake Pend Oreille, Clark Fork River, and Pend Oreille River, Idaho.

<table>
<thead>
<tr>
<th>STREAM (*Index)</th>
<th>Avg 1983-2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clark Fork R.</td>
<td>7</td>
</tr>
<tr>
<td>Lightning Cr.</td>
<td>10</td>
</tr>
<tr>
<td>East Fork Cr.</td>
<td>51</td>
</tr>
<tr>
<td>Savage Cr.</td>
<td>8</td>
</tr>
<tr>
<td>Char Cr.</td>
<td>11</td>
</tr>
<tr>
<td>Porcupine Cr.</td>
<td>9</td>
</tr>
<tr>
<td>Wellington Cr.</td>
<td>9</td>
</tr>
<tr>
<td>Rattle Cr.</td>
<td>22</td>
</tr>
<tr>
<td>Johnson Cr.</td>
<td>19</td>
</tr>
<tr>
<td>Twin Cr.</td>
<td>9</td>
</tr>
<tr>
<td>Morris Cr.</td>
<td>2</td>
</tr>
<tr>
<td>Strong Cr.</td>
<td>1</td>
</tr>
<tr>
<td>Trestle Cr.</td>
<td>251</td>
</tr>
<tr>
<td>Pack R.</td>
<td>23</td>
</tr>
<tr>
<td>Grouse Cr.</td>
<td>37</td>
</tr>
<tr>
<td>Granite Cr.</td>
<td>43</td>
</tr>
<tr>
<td>Sullivan Springs Cr.</td>
<td>15</td>
</tr>
<tr>
<td>North Gold Cr.</td>
<td>30</td>
</tr>
<tr>
<td>Gold Cr.</td>
<td>120</td>
</tr>
<tr>
<td>W. Gold Cr.</td>
<td>NA</td>
</tr>
<tr>
<td>M.F. East R.</td>
<td>13</td>
</tr>
<tr>
<td>Uleda Cr.</td>
<td>4</td>
</tr>
<tr>
<td>N.F. East R.</td>
<td>1</td>
</tr>
<tr>
<td>Caribou Creek</td>
<td>NA</td>
</tr>
<tr>
<td>Hellroaring</td>
<td>NA</td>
</tr>
</tbody>
</table>

* Additional approx. 0.5 km reach immediately upstream of index reach on Trestle Creek added in 2001
<sup>b</sup> Impaired observation conditions (ice, high water, etc.)
<sup>c</sup> Abundant early spawning kokanee made identification of bull trout redds in lower reaches difficult
<sup>d</sup> Partial Count
<sup>e</sup> Barrier excluded bull trout from accessing typical spawning habitat
Status of Bull Trout Critical Habitat in the Action Area

The Service designated critical habitat for the Columbia River bull trout population on September 25, 2005 (70 FR 56212). On October 18, 2010, the Service revised the 2005 critical habitat designation (75 FR 63898) based on extensive review of the previous critical habitat proposals and designation, as well as new information received during the 2010 public review process. The action area is within the Lake Pend Oreille CHU. The final rule designated the Pend Oreille River from the crest of Boundary Dam to Albeni Falls Dam, Lake Pend Oreille, and several tributaries within this range, as critical habitat for bull trout.

Bull trout from Lake Pend Oreille historically migrated downstream into the Pend Oreille River and spawned in tributaries. With the construction of the Albeni Falls and Box Canyon Dams, this life history form in the Pend Oreille River has been mostly lost. Currently this life history only exists in the East River of the Priest River drainage, upstream of Albeni Falls Dam. The Lake Pend Oreille CHU also has the second largest adfluvial core habitat area in its range. Bull trout population size within the CHU is between 2,500 and 10,000 individuals.

The final rule identified nine PCEs essential for the conservation of bull trout. All nine of the PCEs are found within the action area.

PCE #1: Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

Springs, seeps and other groundwater sources may exist in the action area, but the location, size, and number is unknown. Downstream of AFD, summer water temperatures in excess of 68°F commonly occur between late July and September (Jungblom pers. comm. 2015). Therefore, any groundwater connection provides vital coolwater refugia. Several tributaries within the upstream portion of the action area (above AFD) provide coldwater refugia including springs, seeps, groundwater sources, and subsurface flows during summer months. There are no known areas of coldwater refugia within the downstream portion of the action area.

PCE #2: Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats including but not limited to permanent, partial, intermittent, or seasonal barriers.

AFD is a complete upstream barrier to bull trout migration within the Pend Oreille River. The dam was built without fish passage. Downstream migration can occur through the spillway and turbines. See PCE #5 for water temperatures within the action area.

PCE #3: An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

The action area provides an abundant food base for subadult and adult bull trout. Numerous nonnative and native species in the action area including macroinvertebrates, centrarchids, sculpin, minnows, and native salmonids provide a forage base for bull trout.

PCE #4: Complex river, stream, lake, and reservoir shoreline aquatic environments and processes that establish and maintain the aquatic environment with features such as
large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

The shoreline within the action area is highly influenced by operation of AFD. Removal of debris during maintenance activities at AFD depletes the system of wood. Much of the land surrounding the Lake Pend Oreille is developed, armored, and lacking habitat complexity.

PCE #5: Water temperatures ranging from 2 ºC to 15 ºC (36 ºF to 59 ºF), with adequate thermal refugia available for temperatures that exceed the upper end of this range.

Water temperatures within the action area are influenced by dam operations at Box Canyon and AFD. Water temperatures in the Box Canyon reservoir are uniform throughout the summer with no thermal stratification occurring. Often in July and yearly in August, temperatures in the project area exceed 20 ºC (68 ºF) and are inhospitable to bull trout. In many years, August temperatures in the river and tailrace exceed 24 ºC (75 ºF) for several days. Coldwater refugia in the action area are found primarily in Lake Pend Oreille and its tributaries during summer months. The Pend Oreille River was listed as an impaired waterbody for temperature in 1998 (Washington Department of Ecology (WDOE, 2015)). Several tributaries to the river are also listed.

PCE #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.

Multiple tributaries to Lake Pend Oreille and the Pend Oreille River (upstream of AFD) contain spawning and rearing habitat (Table 3). However, no spawning and rearing areas are located in the immediate vicinity of AFD.

PCE #7: A natural hydrograph, including peak, high, low, and base flows within historical and season ranges, or if flows are controlled, minimal flow departure from a natural hydrograph.

A natural hydrograph does not occur in the action area. Hydrology within the action area is controlled by the operation of AFD. Annual runoff is snow melt driven, with peak flows typically occurring from April through June. Low flows occur in August and September and late winter prior to seasonal snow melt.

PCE #8: Sufficient water quality and quantity such that normal reproduction, growth and survival are not inhibited.

Water quality and quantity in the action area are influenced by operation of AFD (see temperature and hydrology descriptions in PCEs #5 and #7 above). Elevated total dissolved gas (TDG) levels exist in the action area during the spring when spill occurs at AFD. The Pend Oreille River was listed impaired for TDG in 1998 (WDOE, 2015). In 2004, WDOE also listed the Pend Oreille River for Aldrin, pH, and PCB’s.

PCE #9: Sufficiently low levels of occurrence of nonnative predatory, interbreeding, or competing species that, if present, are adequately temporally and spatially isolated from bull trout.
Numerous nonnative predator fish species, such as lake trout, smallmouth bass, largemouth bass, walleye, and northern pike are found within the action area. See Status of the Bull Trout in the action area section for a description of the history of lake trout management in the action area.

Effects of the Proposed Action

Effects of the action consider 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.

This Opinion evaluates the effects of the construction, maintenance, and long-term operation of the facility. Some of the Project activities will result in beneficial effects to bull trout, while others will result in no effects or insignificant or discountable effects to bull trout within the action area. The activities are described below and will not be addressed further in this Opinion.

Beneficial Effects to Bull Trout

Operation of the facility will provide the following beneficial effects to bull trout:

• Providing upstream fish passage over AFD. The project will provide bull trout access to move freely between FMO and spawning habitats in Lake Pend Oreille and tributaries within the Pend Oreille River drainage. Importantly, completion of the facility will allow adult and sub-adult bull trout entrained at AFD to move back upstream of AFD and escape lethal river temperatures during the summer months.
• Nonnative species (brook trout, walleye, northern pike, and goldfish) captured in the facility will not be passed upstream. This is expected to reduce the impacts to migrating and foraging bull trout through reduction of these predatory and competitive species.

No Effect to Bull Trout

The following elements of the project are anticipated to have no effect on bull trout because they will occur within the confines of the coffer dam, will occur above the ordinary high water mark (OHWM), or will be conducted during annual operational shut downs within the dewatered structure itself:

• Mobilization/staging of equipment and supplies to the project site, occurring above the OHWM.
• Rock removal and excavation occurring within the confines of the coffer dam.
• Construction activities that occur within the confines of coffer dams.
• Construction of the upper facility and sampling facility, on the rock island, above the OHWM.
• Removal of materials behind the cofferdam during demobilization.
• Routine maintenance activities completed during annual shutdown to inspect, maintain, or replace elements of the facility within the confines of the dewatered structure or above the OHWM.
• Non-routine maintenance activities completed after manual shutdown of the facility and that occur within the confines of the dewatered structure or above the OHWM.

Given current noise levels at the dam, construction noise generated within the confines of the coffer dam is not expected to be measureable over background conditions. In addition, all work within the coffer dam will be isolated from the water. During routine and non-routine maintenance activities, work that will have no effect on bull trout will be those activities that occur after dewatering of the facility and within the facility walls (not in the Pend Oreille River) or are conducted above the OHWM of the Pend Oreille River.

**Insignificant and Discountable Effects to Bull Trout**

The following effects for the different activities, as described under the Project Description, are expected to be discountable or insignificant. Conservation measures and BMPs will be used to reduce, minimize, and avoid impacts to bull trout, including, but not limited to, working within the confines of the coffer dam, monitoring for elevations in turbidity and pH, and working during periods when bull trout are extremely unlikely to be present.

*Water Quality Impacts*

A variety of activities during construction, operation, and maintenance of the facility will result in short-term decreased or degraded water quality through construction and maintenance activities. Water quality impacts from increased pH (wet concrete), turbidity, and sedimentation may result in behavioral changes to bull trout through decreased visibility and foraging opportunities and abandonment or avoidance of habitat.

Excavation of rock is expected to briefly increase turbidity. However, this effect is anticipated to be unlikely to significantly affect bull trout or designated critical habitat. Material removed will consist primarily of large pieces of limestone bedrock and concrete that is blasted or fractured. The project site contains few fines that will be disturbed further limiting the potential for significant changes to water quality during excavation. Excavation above the OHWM will employ measures to minimize the potential for debris to enter the water such as silt fencing. In addition, the Corps will monitor turbidity in compliance with their National Pollution Discharge Elimination System (NPDES) permit to minimize distance and duration of impact.

Minor changes to alkalinity could occur as a result of tremie concrete curing. The Corps will monitor pH during concrete activities as per their NPDES permit requirements and modify work as required to minimize duration and distance of impacts.

Construction of the coffer dam and rock excavation that may result in the above impacts will occur during late July and August when water temperatures at the project site often reach above 20 °C (68 °F). Within the area of impact, habitat consists of bedrock, concrete dam structure,
and riprap. There are no known areas of cold water refugia within the immediate area around AFD that would support presence of bull trout during the summer months. Bull trout are expected to migrate to cool water refugia in Lake Pend Oreille and tributaries several miles upstream of the AFD. No water quality impacts are expected upstream of AFD. Given that telemetry data indicate that bull trout leave the AFD tailrace area between July and September as temperatures rise (Blum pers. comm. 2015), it is highly unlikely that bull trout will be exposed to stressors of water quality modifications. Therefore, based on the high likelihood bull trout will not be present downstream of AFD during water quality impacts, the fact that water quality impacts are not expected to extend upstream of AFD, and the implementation of BMPs to minimize the distance and duration of any impacts, the effects to bull trout and designated critical habitat from changes to water quality are considered discountable.

Prey and Forage Area Impacts

The removal of rock for site construction and installation of the coffer dam will temporarily reduce the total foraging area at the project site. Disturbance from nearshore activities, construction of the coffer dam, and dewatering within the coffer dam will result in the loss of prey species such as macroinvertebrates and displacement of forage fish. The loss of and displacement of forage area this large could be significant to bull trout if it was located within an important foraging area for bull trout. However, habitat and forage abundance within the dam tailrace is minimal. The area is used primarily as a migratory corridor for bull trout. The area affected is small in comparison to the entirety of the Pend Oreille River and Lake Pend Oreille. Because water in the AFD tailrace has short residence time (less than 2 days), the repopulation of a disturbed area by macroinvertebrates will occur quickly after removal of the coffer dam due to drift from upstream resources. Forage fish species are also expected to return to disturbed areas quickly.

Because bull trout are migratory in the action area, effects to macroinvertebrates and forage fish will be short-term, and effects are small compared to the overall size of the AFD tailrace and Lake Pend Oreille, no measurable effects to bull trout will occur. Impacts to prey and forage area are expected to be insignificant.

Adverse Effects of the Proposed Action on Bull Trout

The following analysis is organized based on the adverse effects resulting from project components that are likely to significantly impact bull trout. The primary purpose of the proposed action is to minimize impacts or improve conditions in the Pend Oreille River for bull trout. During construction of the facility, it is anticipated that adverse effects to bull trout would occur from dewatering, fish salvage, and underwater blasting. Upon project completion and under operating conditions, sampling, tagging, measuring, anaesthetizing, transporting, and otherwise handling of bull trout as specified under operation of the facility will result in harm and harassment of bull trout.

Bull Trout Presence in Project Area

Bull trout presence has been documented in the Pend Oreille River in the vicinity of AFD, both upstream and downstream of the dam (Ashe and Scholz 1992, p. 8; Dupont and Horner 2004, p. 11; Scholz et al. 2006, p. 6). However, site-specific estimations of the number of bull trout in the AFD area have not been conducted. Therefore, in order to estimate numbers of bull trout
currently in the Project area for the purposes of describing bull trout exposure to Project activities, the Service is taking a reasonable worst-case approach based on various surveys and telemetry data.

In 1991 and 1992, IDFG conducted gill netting (15,743 hours) and electrofishing (23.7 hours) surveys of the Pend Oreille River between the outlet of Lake Pend Oreille and AFD. Of the over 45,000 fish sampled, 5 bull trout were collected (Bennett and Dupont 1993, as cited in Scholz et al. 2006, p. 6). In 2008, seven bull trout were collected via electrofishing (67.9 hours) in the reach downstream of AFD (Paluch et al. 2009, p. 21). Four of the bull trout were radio-tagged and released above AFD, and all four were documented migrating upstream to Lake Pend Oreille, suggesting that all of them were adfluvial fish from Lake Pend Oreille and had been entrained over AFD (Paluch et al. 2009, p. 19). Similar surveys targeting bull trout in the reach below AFD captured roughly the same numbers of bull trout, e.g., Geist et al. 2004 (p. 3) captured 10 bull trout and Scholz et al. 2005 (p. 18) captured 2 bull trout.

Given the telemetry data described above, we assume that bull trout present in the AFD tailrace are fish that have been entrained over AFD. Also, given the similar numbers of bull trout captured in the Pend Oreille River upstream and downstream of AFD, we assume equal numbers of bull trout will be present in the forebay and tailrace areas of AFD during Project implementation.

Therefore, based on the highest number (10) of bull trout captured in either the AFD forebay or tailrace, and assuming equal numbers of bull trout in both areas as well as assuming a capture efficiency of 20 percent for bull trout, we estimate as many as 100 bull trout may be present in the Project area near AFD (50 upstream and 50 downstream of AFD) during project implementation (20 captured/0.20 capture efficiency=100 bull trout). Based on the identified information, this is the maximum number of bull trout potentially affected by this action since it is unlikely that all of these fish would be present in the AFD Project area at the same time.

Further, during July and August when river temperatures preclude bull trout presence we estimate that the number of bull trout in the AFD forebay and tailrace will be reduced by 50 percent (i.e., 50 total bull trout in the AFD forebay and tailrace). As above, this is likely a maximum estimate.

**Effects of Elevated Sound Levels**

Both underwater and on-shore blasting will occur during initial phases of construction. Underwater blasting will be used to construct the fishway entrance, and on-shore blasting and rock-drilling will occur on the rock island to construct the above-ground portions of the facility. The Corps will employ fracturing techniques that do not require blasting to the extent possible and feasible. Noise levels from rock blasting and drilling in the terrestrial environment can far exceed ambient conditions, especially in hardened areas of concrete and bedrock. Elevated noise in the terrestrial environment may also propagate in the nearshore to a lesser extent than blasting occurring within the wetted perimeter.

Underwater blasting will result in elevated noise and overpressure that exceeds ambient conditions in the area around AFD. The use of fracturing techniques will minimize impacts to both fish within the area and to dam infrastructure. However, short-term underwater blasting will occur in the tailrace as the fishway entrance is constructed. Within the action area, the Service assessed the distance where effects from blasting are expected (Figure 7). Because of the bathymetry where blasting will occur and existing ambient noise levels, impacts from noise
are expected to be confined to the immediate area of AFD, i.e., specifically within 800 ft downstream of the tailrace where the river shallows, thereby minimizing the potential for noise to propagate further downstream. In addition, ambient noise from the turbines and existing velocities in the Pend Oreille River are high, ranging from 70 to 84 dBA depending on proximity to turbines. Mitigated blasting noise is expected to occur in short bursts and attenuate through the water quickly and at a consistent rate. The result is that ambient conditions will be attained within 800 ft of blasts. The total area anticipated to be affected by elevated noise is approximately 10 acres.

Figure 7. Expected area of impacts from underwater blasting.

Peak pressure changes from short burst blasting are expected to dissipate within a similar distance. However, the peak impact will be much higher in the immediate vicinity of the blasts and dropping to within ambient conditions at a shorter distance. Peak shock wave pressure could increase to 6,350 pound per square inch (psi) within 25 ft of a single 1,000 lb blast. Within 100 ft, shock wave pressure is below 700 psi; below 75 psi at 200 ft; approximately 10 psi at 275 ft; and near zero at 300 ft (Sulfredge et al. 2005). The underwater portion of blasting is expected to occur in short bursts (seconds for each instance) as needed for no more than 3 weeks total during the months of late July and August, when bull trout are least likely to be present.

Studies have demonstrated that size of charge and distance from blast are the two most important factors in determining effects to fish (Teleki and Chamberlain 1978; Wiley et al. 1981). Depth of water, type of substrate, and size of fish also has an impact on total effects to fish. Wright and Hopky (1998) determined that overpressure in excess of 15 psi can cause fish death, hemorrhage, and rupture of organs. Dunlap Kolden and Aimone-Martin (2013) determined that injury of salmonids occurred at pressure levels over 10 psi. Sublethal effects including behavioral changes have been observed in fish during blasting and pile driving activities elevating sound levels above ambient conditions (Wright and Hopky, 1998; Scholik et al. 2001; Hastings and
Temporary behavioral effects, such as ability to successfully feed and abandonment or avoidance of habitat, may occur during blasting.

As described above, during periods of underwater blasting (July 1 through August 31) when water temperatures naturally cause bull trout avoidance and the limited distance effect of a blast in the water, we expect that as many as 25 bull trout may be present in the Project area downstream of AFD (within 800 ft). Given the distance at which changes in overpressure exceeds ambient, effects will likely significantly disrupt normal behaviors up to the extent of injury or death. Bull trout within the area during July and August are likely to experience effects that will significantly disrupt normal behaviors and possibly death during underwater blasting.

Underwater sound levels generated by on-shore blasting and rock drilling are expected to be less than those described above for underwater blasting. Additionally, because these activities will take place on land, their effects are expected to be solely behavioral (i.e., no injury or mortality to bull trout is expected from on-shore blasting and rock drilling). However, in taking a conservative approach, we assume that these behavioral effects will occur over the area shown in Figure 7 as well as the AFD forebay. Further, because the on-shore blasting and rock drilling will not be limited to July through August, we assume that 100 bull trout (50 in the tailrace, 50 in the forebay) will be present in the Project area and experience behavioral effects.

Handling and Transport of Bull Trout

Handling and transport of bull trout occurs during several elements of construction, maintenance and operation of the facility. Specifically, handling and transport occurs during:

- Dewatering of the coffer dam
- Annual maintenance and dewatering of the facility
- Emergency shut downs
- Daily collection and transport of target species.

During dewatering of the coffer dam, any and all fish that are entrained within the coffer dam area will be electrofished or netted and removed from the area. During annual maintenance and emergency shut downs where dewatering of the facility is needed to perform certain tasks, fish will be herded out of the fish ladder as water is slowly drawn down. To the extent possible, volitional exiting of the facility will be made possible. Daily operation of the facility will involve collection, handling, surgical procedures, tagging, confinement, and transport of bull trout. Tagging studies and genetic samples will require both capture and handling of individual bull trout, with additional handling time and more invasive surgical methods to insert/apply tags to individual fish. Transport activities would require extended holding periods due to travel and additional handling. These activities occur specifically as a result of the proposed facility.

The handling (including trapping, capture, tagging, handling, and transport) of bull trout has some potential to result in injury or death. Mortality may be immediate or delayed. Handling of fish increases their stress levels and can reduce disease resistance, increase osmotic-regulatory problems, decrease growth, decrease reproductive capacity, increase vulnerability to predation, and increase chances of mortality (Kelsch and Shields 1996). Fish may suffer from thermal stress during handling, or may receive subtle injuries such as de-scaling, abrasions, and loss of slime layer. Handling can contribute directly or indirectly to disease transmission and susceptibility, or increased post-release predation. Fish that have been stressed are more
vulnerable to predation (Mesa et al. 1994; Mesa and Schreck 1989). Larger fish species may prey on smaller bull trout if both are held in the same container.

Studies investigating acute, sublethal physiological stress in captured and handled salmonids consistently document induced changes in blood chemistry (e.g., cortisol, corticosteroid, and blood sugar levels; lymphocyte numbers) (Barton and Iwama 1991, p. 3; Frisch and Anderson 2000, p. 23; Hemre and Krogdahl 1996, p. 249; Pickering et al. 1982, p. 229; Wydoski et al. 1976, p. 602). Even short and mild bouts of handling have been shown to induce protracted changes, lasting hours or days (Frisch and Anderson 2000, p. 23; Hemre and Krogdahl 1996, p. 249; Wydoski et al. 1976, p. 604). Pickering et al. (1982, p. 229) states that fish need a minimum of 2 weeks to fully recover from stress associated with handling.

Stress induced effects to blood chemistry may have consequences for metabolic scope, reproduction (i.e., altered patterns or levels of reproductive hormones), and immune system function or capability (Barton and Iwama 1991, p. 3; Frisch and Anderson 2000, p. 29; Pickering et al. 1982, p. 229). Pickering et al. (1982, p. 231) reports a marked reduction in feeding activity lasting 3 days after handling. Barton and Iwama (1991, p. 3) and Frisch and Anderson (2000, p. 23) both point to the possibility of increased disease susceptibility attributable to handling related physiological stress.

Different types of tags installed in a fish result in variable types of injury. Some tagging, such as fin clips, results in little to no injury. Surgical implantation of tags results in injury due to the opening of the abdominal cavity, increased stress associated with handling, and increased risk of infection from the wound, but typically results in low rates of mortality. Mortality from PIT- and radio tags placed in steelhead and post-tag mortality was less than 1 percent (Axel et al. 2005). PIT tagging in juvenile Chinook salmon resulted in post-tagging mortality of 8 percent (Achord 2001). All bull trout tagged experience minor injury due to the tagging, likely resulting in some significant behavioral changes as the bull trout heals.

The actual numbers of fish affected by handling and transport and degree of effect is difficult to anticipate. In most cases, the handled fish would be released shortly after their capture, minimizing stress. Depending on the number of fish that need to be handled during the operation, some injury or even deaths may occur during the handling and/or transfer process.

As stated above, electrofishing, trapping, capture, tagging, handling, and transport of bull trout may occur at any time of the year. Activities specific to dewatering such as electrofishing and herding of fish out of the facility or removing fish from the coffer dam during construction will occur when the likelihood of bull trout exposure is lower, for example, during summer months when water temperatures are elevated. Actual injury of bull trout related to tagging and genetic studies will be addressed via a future section 10 recovery permit. Specific measures to minimize impacts and number of bull trout affected by tagging activities will occur within permit conditions.

The operation of the facility, although providing substantial conservation benefits, is likely to result in delays in upstream movement of subadult and adult bull trout, and injury or mortality of subadults and adults resulting from contact with structures within the facility and during transport above the dam. A number of indirect effects may stem from temporary fatigue, which may be a function of the water velocity in the entrance structure and velocity in any holding structures, including an increased susceptibility to predation for any smaller fish, or a decreased ability to compete for cover or forage as these would be limiting in the holding facility. In
addition, increased susceptibility to infection caused by scale loss or non-lethal wounds incurred during the trap and haul operation may also result. Since the number of bull trout that will enter the facility is unknown and will depend on number of fish entrained, number of fish migrating or foraging when the facility is operational, and changes to population status over time, an accurate quantification of handling is not possible. All bull trout captured, held, and transported in the trap and haul facility will experience capture and handling stress, resulting in significant disruption of normal behavior. Although the Corps will implement measures to reduce stress or potential injury from handling, capture, and transport of bull trout from the facility to the release site upstream, it is possible that a small percentage of bull trout may be injured to the point of mortality during capture, transport or handling as a result of unforeseen circumstances. Although it is not well documented, it is possible for injured, sick, or already stressed individuals to die as a result of the added stress of capture and handling in the facility. As a result, we expect that no more than one bull trout per year will die during capture, trapping, and transport of bull trout in the facility. Compared to no passage at the dam currently, some effects and delay are an improvement over existing conditions and will have beneficial effects to migratory bull trout.

During construction and dewatering of the coffer dam, the Service anticipates that up to 100 bull trout could be in the AFD forebay and tailrace. Based on the methods and timing of coffer dam construction, it is anticipated that most bull trout will avoid the disturbance or be able to exit the area prior to construction. Therefore, we assume that no more than 10 adult or sub-adult bull trout may remain, and therefore be removed during electrofishing or netting out of the coffer dam during the initial construction. When the coffer dam is dewatered after flood flows in the second construction season, this number could be greater depending on flood flows and entrainment. It is difficult to estimate what the number of bull trout entrained during flood flows could be. Therefore, a highly conservative estimate of 35 bull trout could be removed from within the coffer dam during the second year of construction.

Annual and emergency shut downs of the facility will require herding of bull trout and other fish out of the fish ladder as dewatering of the facility occurs. It is difficult to estimate the number of bull trout that may be in the facility during a shutdown procedure, especially over time. Conservatively, the Service assumes that up to 35 bull trout are likely to experience effects that may significantly increase the likelihood for injury or mortality during annual facility shutdowns.

### Effects of the Proposed Action on Bull Trout Critical Habitat

Below, we list each critical habitat PCE, and discuss the effects to each.

**PCE #1:** Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

The proposed Project will not impact springs, seeps or groundwater sources within the action area. Construction activities will occur within the area around AFD where no groundwater sources, seeps or springs are known to be present. Within the action area, this PCE will retain its current level of function.
PCE #2:  Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats including but not limited to permanent, partial, intermittent, or seasonal barriers.

The proposed action will result in temporary impacts to this PCE during construction of the coffer dam, inwater work, and rock removal that may be significant to the habitat during the event. However, these effects will not occur when bull trout are anticipated to need or utilize the habitat due to high summer temperatures in the river. At the end of project completion, this PCE is expected to be greatly improved. Upstream passage of bull trout will be available for most months of the year. During times of shutdown (winter icing periods and late summer), AFD will still be a complete barrier to movement as it is under current conditions. Any temporary effects to this PCE will be insignificant. We expect that resulting conditions will provide improved foraging and overwintering opportunities for bull trout. Within the action area, this PCE will retain or have an improved level of function.

PCE #3:  An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

The proposed Project will not result in long-term changes to the bull trout prey base. In-water construction will result in disturbance of substrates and temporary loss of substrates that provide habitat for macroinvertebrates. The project impacts will be short-term as these disturbed areas will be repopulated by surrounding or upstream macroinvertebrates. The proposed Project will have no measurable effect to this PCE.

PCE #4:  Complex river, stream, lake, and reservoir shoreline aquatic environments and processes that establish and maintain the aquatic environment with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

Construction and operation of the proposed Facility will not change the habitat complexity of the action area. Currently, the project site offers little to no habitat complexity as it is a bedrock point. Once construction is complete, bull trout will have improved passage through the project area and ultimately through the entire action area. However, there will be no structural modifications that will improve habitat complexity. Within the action area, this PCE will retain or have an improved level of function.

PCE #5:  Water temperatures ranging from 2 °C to 15 °C (36 °F to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range.

Water temperatures within the action area are influenced by AFD operations. Maximum residence time of water in the Box Canyon reservoir downstream of AFD is less than 2 days. Lake Pend Oreille and tributary streams to the Box Canyon reservoir provide cool water thermal refugia. Due to existing river volumes, the proposed project will not measurably change or modify temperatures within the action area either during or after construction.
PCE #7: A natural hydrograph, including peak, high, low, and base flows within historical and season ranges, or if flows are controlled, minimal flow departure from a natural hydrograph.

The hydrology within the action area is controlled by AFD operations. The Project will not result in operational changes at AFD or changes to the hydrology within the action area.

PCE #8: Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

While brief increases in turbidity and/or elevated pH levels are expected during rock removal and construction of the coffer dam, long-term changes to water quality or quantity are not expected to occur as a result of Project implementation. Any temporary effects to this PCE will be insignificant due to the short duration of in-water work, short residence time of water in the reservoir, and large volumes in the river. Within the action area, this PCE will retain current function or have an improved level of function.

PCE #9: Sufficiently low levels of occurrence of nonnative predatory, interbreeding, or competing species that, if present, are adequately temporally and spatially isolated from bull trout.

Numerous nonnative predatory, competitive, and interbreeding fish species are found within the action area. The operation of the facility will have effects to nonnative species movements in the Pend Oreille River. Over the long-term, an unknown percentage of brook trout, northern pike, and walleye will either be prevented from moving into the river upstream of AFD, or removed from the river altogether, thereby benefiting bull trout critical habitat. However, the net benefit is based on the number of nonnative species that utilize the facility and the comparison of that number to total numbers in the river, which is ultimately speculative at this point. Collection and handling of all nonnative species at the facility will help to quantify species in the river, and could possibly lead to different future fisheries management strategies. Within the action area, this PCE will retain current function or have an improved level of function.

**Cumulative Effects**

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.

Lands adjacent to the action area are owned by a mixture of public and private entities, with the majority of shorelines being predominately in private ownership.

**Watershed Planning Efforts**

The following plans provide guidance for the management of aquatic resources in the Project area:
• The Northwest Power Planning Council Intermountain Province Subbasin Plan (GEI Consultants 2004)
• The Clark Fork - Pend Oreille Basin Water Quality Study: A summary of Findings and a Management Plan (USEPA 1993)

A common goal among these plans is the improvement of aquatic habitat and water quality to benefit native salmonids, especially bull trout. A comprehensive list of activities that contribute to the recovery of bull trout in the Columbia River Recovery Unit and Lake Pend Oreille area is not available because of the wide variety of State, Tribal, and non-governmental organizations that conduct activities in the region. Some of the major activities that are ongoing or have been recently completed within the region are:

• Construction of upstream fish passage facility at Box Canyon Dam (Construction began in 2016, facility expected to be operational in 2019; Pend Oreille PUD)
• Lake trout removal in Lake Pend Oreille (IDFG)
• Tributary Habitat Restoration, Enhancement, and Passage
• Kalispel resident fish project (Kalispel Natural Resources Department)
• Road abandonment and bank stabilization (Kalispel Natural Resources Department)
• Bull Trout Research and Monitoring
• Genetic inventory of bull trout in the Pend Oreille sub-basin (Kalispel Natural Resources Department)
• Kalispel resident fish project (Kalispel Natural Resources Department)
• Mainstem Pend Oreille River Water Quality
• Temperature Total Maximum Daily Limit (TMDL) implementation for the Pend Oreille River (Ecology and stakeholders)
• Water quality monitoring (Kalispel Natural Resources Department)
• Total Dissolved Gas TMDL

Implementation of some of the actions associated with the plans listed above and many of the ongoing activities rely on funding that can vary widely from year to year, some of which may be Federal funds that would require individual section 7 consultations. Because of the variability in annual funding, it is uncertain if or when activities recommended in the various plans will be implemented.

Taken together, numerous activities that improve habitat, fish passage, and water quality are likely to occur in the watershed and will contribute to the recovery of bull trout. Consequently, it is likely that the incidence of bull trout using the action area will increase, but the magnitude of the increase, the timing of increases, and whether recovery criteria will be achieved is uncertain.

Fisheries Management

The IDFG manages fisheries in the action area and regulates private and public hatchery releases. The IDFG modifies and publishes recreational fishing regulations on an annual basis. Currently, recreational anglers may not target bull trout, but may incidentally catch and release bull trout. Changes in the regulations such as seasons, closed areas, and harvestable sizes and numbers of other trout species could also change the likelihood of the incidental catch of bull trout by altering angler effort.
We anticipate that bull trout and bull trout critical habitat will be negatively impacted by unforeseen cumulative effects within the action area. However, much of the cumulative effects within the action area are expected to improve conditions in the long term. Some improvements in the functions of bull trout critical habitat are likely to occur in the future if actions such as improved water quality treatment, reduced woody vegetation removal, and other land use management measures to reduce negative changes in water quality and quantity, and improve riparian conditions are conducted.

**Conclusion**

**Bull Trout**

After reviewing the current status of bull trout, the environmental baseline for the action area, the effects of the proposed action and the cumulative effect, it is the Service’s opinion that the action, as proposed, is not likely to jeopardize the continued existence of the bull trout.

**Bull Trout Critical Habitat**

The Service has reviewed the current status of bull trout critical habitat, the environmental baseline in the action area, effects of the 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.

**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 Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps 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
Corps 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)].

**Form and Amount or Extent of Take Anticipated**

The Service anticipates that bull trout will be taken as a result of construction and long-term operation and maintenance of the proposed facility. The incidental take is expected to be in the form of harm, harassment, capture, and trapping of adult, subadult, and juvenile bull trout. Take occurring as a result of facility operation, which includes trapping, handling, and capture, is described below. Take associated with tagging, surgery, and other research elements will be addressed in a future section 10 recovery permit and is not further addressed below.

The following incidental take is anticipated during construction of the proposed facility:

1. The capture and handling of bull trout for salvage purposes will result in direct take (kill, capture, injury). However, the direct take resulting from salvage operations will minimize the incidental take of individual bull trout from dewatering activities. Incidental take of subadult and adult bull trout in the form of capture, trap, and harassment (disruption of normal behavioral effects associated with increased stress) and harm (injury or mortality) resulting from electrofishing, collection, handling, and relocation/transport of bull trout during dewatering of the coffer dam. Numbers of bull trout and timing of occurrence include:

<table>
<thead>
<tr>
<th>Location</th>
<th>Timing</th>
<th>Number Killed or Injured</th>
<th>Number with significant disruption of normal behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Coffer Dam Dewatering</td>
<td>July, August</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Dewatering of Coffer Dam after Spring Flood Event</td>
<td>June, July</td>
<td>1</td>
<td>35</td>
</tr>
</tbody>
</table>

2. Incidental take of up to 100 subadult and/or adult bull trout in the form of harm and harassment within 800 ft of on-shore blasting and rock drilling. No mortality of bull trout is anticipated.

3. Incidental take of 25 subadult and/or adult bull trout in the form of harm, harassment, injury, and/or mortality within 800 ft downstream of in-water blasting occurring between July 1 and August 31.

The following incidental take is anticipated during maintenance and operation of the proposed facility:

1. Incidental take of up to 35 (total) subadult and/or adult bull trout annually, resulting from two shut-down events per year, in the form of harassment (significant disruption of normal migration behaviors, increased stress, and delayed migration) resulting from the herding and netting of bull trout out of the facility during annual and emergency shutdowns.

2. Incidental take of two subadult and/or adult bull trout annually, resulting from two shut down events per year, in the form of harm (impingement leading to injury or
mortality) caused during herding and netting of bull trout out of the facility during annual and emergency shutdowns.

3. Incidental take of subadult, and adult bull trout in the form of harm (injury or mortality) and harassment (disruption of normal behavioral effects associated with increased stress) resulting from trapping, handling, holding, and transport of bull trout during fish ladder operations. Mortality of no more than one bull trout per year is anticipated. All bull trout that enter the facility will be harassed.

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.

Reasonable and Prudent Measures
The Service believes the following Reasonable and Prudent Measures (RPM) are necessary and appropriate to minimize impacts of incidental take to bull trout:

- RPM 1. Coordinate with the Service any construction components not finalized in the Biological Assessment and any changes to construction or operations and maintenance activities.
- RPM 2. Minimize and monitor incidental take caused by in-water blasting.
- RPM 3. Minimize and monitor incidental take caused by handling related to fish salvage, capture, and removal operations during coffer dam dewatering and facility shut-downs.
- RPM 4. Monitor and report annual operations of the facility.
- RPM 5. Coordinate with the Service on protocols for the handling, transport, and release of bull trout captured at the facility.

Terms and Conditions
In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following Terms and Conditions, which implement the reasonable and prudent measures, described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

The following terms and conditions are required for the implementation of RPM 1:

1. The Corps shall provide a pre-construction blasting plan as described in this Opinion.
2. The Corps shall coordinate any proposed change in the construction in-water work periods.
3. The Corps shall coordinate any proposed changes to the Operations and Maintenance plan.

The following terms and conditions are required for the implementation of RPM 2:

1. The Corps shall monitor and report the number of in-water blasts, charge used for each blast, noise (above ambient) and overpressure (above 10 psi) levels reached at 300 ft from blasting activities, and minimization or BMPs implemented to reduce
sound within the water. The Corps shall submit a monitoring report to the Service’s Idaho Fish and Wildlife Office in Spokane, Washington within 3 months of completing blasting activities.

The following terms and conditions are required for the implementation of RPM 3:

1. The Corps shall ensure that attempts to net or herd fish precede the use of electrofishing equipment during salvage or facility dewatering, and shall confirm that other methods have been effective in removing most or all of the adult and subadult fish before resorting to the use of electrofishing.

2. The Corps shall ensure that water quality conditions are adequate in the buckets or tanks used to hold and transport captured fish such as providing well-oxygenated water, cool temperatures, and minimize holding time.

3. Electrofishing methods shall use the minimum voltage, pulse width, and rate settings necessary to immobilize fish. Water conductivity shall be measured in the field before electrofishing to determine appropriate settings.

4. The Corps shall document and report all bull trout encountered during fish capture and removal operations within 45 days of completing fish salvage or dewatering activities.

The following terms and conditions are required for the implementation of RPM 4:

1. The Corps shall annually report all facility shut downs. The annual report shall include, but is not limited to, the dates, durations, and causes for the shut downs, as well as methods used to minimize effects to bull trout within the facility at the time of shut down. The report will also summarize number and species of fish transported and the disposition of those fish; number of injuries and mortalities; and other relevant information on trapping operations. The report will be submitted annually to the Service’s Idaho Fish and Wildlife Office in Spokane, Washington.

The following terms and conditions are required for the implementation of RPM 5:

1. The Corps shall provide protocols for the handling, transport, and release of bull trout captured at the facility.

The RPMs, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the RPMs.

The Service is to be notified within three working days upon locating a dead, injured, or sick endangered or threatened species specimen. Initial notification must be made to the nearest U.S. Fish and Wildlife Service Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a
dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact the U.S. Fish and Wildlife Service Law Enforcement Office at Spokane, Washington; telephone (509) 928-6050.

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.

The Service recommends the following to the Corps:

1. The Corps should work with stakeholders to identify methods to reduce the timing and duration of winter shutdowns.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

Reinitiation Notice

This concludes formal consultation on the proposed construction and operation of the fish passage facility at Albeni Falls Dam. 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.
LITERATURE CITED

Published Literature


**In Litteris References**


**Personal Communications**


Blum, John. 2015. Email correspondence to Erin Kuttel regarding telemetry data and bull trout movements at Box Canyon Dam. February 24, 2015.


Jungblum, Scott. 2015. Email correspondence to Erin Kuttel regarding river temperatures at Box Canyon Dam. February 12, 2015.

Kuttel, Erin. 2014. Email correspondence to Kalispel Tribe of Indians, USFS, and WDFW of single adult bull trout in West Branch LeClerc Creek. October 15, 2014.