ASSESSMENT OF EFFECTS ON BULL TROUT CRITICAL HABITAT RESULTING FROM OPERATION OF ALBENI FALLS DAM

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The US Fish and Wildlife Service (FWS) designated critical habitat for the Columbia Basin distinct population segment (DPS) of bull trout (*Salvelinus confluentus*) on October 6, 2004 (FR69, No. 193, 2004). Prior to this designation, the FWS proposed critical habitat designation on November 29, 2002 (FR67, No. 230, 2002). The Pend Oreille River reach, including several tributary streams, in Washington and Idaho between Boundary and Albeni Falls Dams, was designated as critical habitat for bull trout (unit 22, Northeast Washington river basins). In addition, several rivers, including the Priest and Pack, that are tributary to Lake Pend Oreille, were included in the critical habitat designation (unit 2, Clark Fork River Basin). However, Lake Pend Oreille was excluded from critical habitat designation. This assessment analyzes the potential effects on bull trout critical habitat that might occur as a result of operation of Albeni Falls Dam. The assessment begins with an analysis of effects on the primary constituent elements (PCEs) as described in the critical habitat designation (FR69, No. 193, 2004).

In general, bull trout require "space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing (or development) of offspring; and habitats that are protected from disturbance." (FR69, No. 193, 2004). Specifically, the FWS (2004) defined the following PCEs:

> ***(1) Water temperatures*** *ranging from 36 to 59 °F (2 to 15 °C), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence;*
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> ***(2) Complex stream channels*** *with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures;*
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> ***(3) Substrates of sufficient amount, size, and composition*** *to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.25 in (0.63 cm) in diameter and minimal substrate embeddedness are characteristic of these conditions;*
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> ***(4) A natural hydrograph****, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation;*
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> ***(5) Springs, seeps, groundwater sources, and subsurface water connectivity*** *to contribute to water quality and quantity;*

(6) Migratory corridors *with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows;*

(7) An abundant food base *including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish;*

(8) Few or no nonnative predatory, interbreeding, or competitive species *present; and*

(9) Permanent water of sufficient quantity and quality *such that normal reproduction, growth and survival are not inhibited.*

Context for Analyses. To address effects of the operations of Albeni Falls Dam on these PCEs, it is necessary to understand the life history stages of bull trout present in the Pend Oreille River. The following is excerpted from the 2004 report on the Corps-funded study of bull trout in the Pend Oreille River (Geist et al., 2004):

> Recent studies have indicated that adfluvial, adult bull trout, which spawn in tributaries of the Pend Oreille River located below Lake Pend Oreille, exhibit post-spawning movements where they drop out of the tributary into the mainstem of the Pend Oreille River, then swim upstream to over-winter in the lake. In the spring or early summer they make these movements in reverse, first swimming downstream to their home river, then migrating upstream to a specific home tributary where they repeatedly spawn. Albeni Falls Dam may prevent bull trout that spawn in tributaries below the dam from successfully completing this type of life-history strategy, thus contributing to the decline in their abundance. The dam may also prevent bull trout that spawn in tributaries of the lake or river above the dam from access to those tributaries if they are entrained at the dam. Entrainment could occur if a bull trout migrating downstream from Lake Pend Oreille overshoots its home tributary and arrives in the forebay. It is well documented that salmonids frequently overshoot home rivers and then backtrack to relocate them. Since their migration coincides with the spring freshet, the high discharge could increase the likelihood of entrainment of bull trout in the vicinity of the dam.
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> Albeni Falls Dam blocked the adfluvial bull trout migration corridor from tributaries below Albeni Falls to the lake, and converted the old river channel between the dam and the outlet of the lake into a reservoir which does not stratify and offers little cool water refuge for bull trout during summer months (Bennett and DuPont 1993). Fluvial populations of bull trout that remained downstream of Albeni Falls Dam would have been limited by the warm water temperatures within Box Canyon Reservoir during the summer. Adfluvial populations (as well as fluvial populations entrained over Albeni Falls Dam) would have been blocked from returning to Lake Pend Oreille. These alterations in the physical environment of the Pend Oreille River have played a key role in the observed population declines of bull trout in the basin.

Analysis of the Effects of Dam Operations on PCEs

(1) Water temperatures *ranging from 36 to 59 °F (2 to 15 °C), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence;*

The temperature of water released from Albeni Falls Dam during the summer is commonly higher than the PCE temperature range. A 2004 Corps study of water temperatures in the system showed that temperatures in the Clark Fork River below Cabinet Gorge Dam, Lake Pend Oreille, the Pend Oreille River upstream of Albeni Falls Dam, and the Priest River all exceeded 15°C during the summer (K. Easthouse Pers. Comm.). Water temperatures in the Box Canyon reservoir were measured at 22°C during July 2003 (Geist et al., 2004), causing distress to bull trout that may be in the river at that time. Bull trout have been observed clustered near cold-water refugia (e.g., Indian Creek culvert) in the lower river just below Albeni Falls Dam (Geist et al., 2004; Scholz et al., 2005).

During the summer months, Lake Pend Oreille thermally stratifies, which results in reduced mixing between warmer surface waters and cooler waters at depth. For example, in the deeper regions of the lake, water temperatures in the upper 10 meters can exceed 20°C while temperatures at depths below about 30 meters stay cool (generally less than 10°C) during the summer. Because of the large surface area and volume of Lake Pend Oreille relative to inflow water, the summer thermal stratification in the lake is likely similar to pre-dam conditions (K. Easthouse, pers. comm.).

Albeni Falls Dam regulates water levels in Lake Pend Oreille and the Pend Oreille River. During the summer, Albeni Falls Dam maintains Lake Pend Oreille at a higher-than-natural lake level, which results in the Pend Oreille River upstream of the dam becoming a slow-moving outlet arm to Lake Pend Oreille. Water flowing from the lake into the Pend Oreille River must pass over the shallow northwestern basin near Sandpoint where thermal stratification is weak. Consequently, water temperatures downstream of the lake outlet are similar to the lake surface temperatures in the shallow basin near Sandpoint. Monitoring in the Pend Oreille River at Riley Creek Campground (about halfway between Albeni Falls Dam and Lake Pend Oreille) indicates that water temperatures at Riley Creek Campground are similar to surface temperatures in the lake and also indicate that this portion of the river does not stratify in the summer (K. Easthouse, pers. comm.).

The Washington Department of Ecology has expressed concern that Albeni Falls Dam operations may influence the natural temperature increase in the Pend Oreille River by artificially keeping lake and river levels high during the summer, resulting in a slight increase in surface area and depth, a decrease in average summer flows, and reduced ground water influence. In addition, temperature studies are currently being conducted to better understand the role of Albeni Falls Dam concerning water temperatures in the Pend Oreille River, and to model the river temperatures under pre-dam and post-dam conditions. It is likely that any degree of temperature

increase that may be due to the presence and operation of Albeni Falls Dam is much smaller than the amount by which summer water temperatures (>20°C) exceed bull trout optimums (<15°C). This means that summer water temperatures in the Pend Oreille River likely exceeded bull trout optimums under both pre-dam and existing conditions. The high summer water temperatures make accessible cold water refugia very important to allow bull trout to find and access areas with suitable temperatures as the river warms up (see PCE #5 and #6).

(2) ***Complex stream channels*** *with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.*

The altered hydrograph resulting from operation of Albeni Falls Dam would have modified the pool and riffle complex and depth of the river below the dam soon after the dam became operational. However, Box Canyon Dam was completed one year after Albeni Falls Dam, and its reservoir soon inundated these physical features and continues to do so. The river below Albeni Falls Dam is now a reservoir for nearly the entire distance between the two dams. Thus, the extent of pools, riffles, woody debris, and other riverine channel features are all greatly reduced since construction of Box Canyon Dam.

Given the reservoir conditions characteristic of the critical habitat reach below Albeni Falls Dam, modification of channel morphology is unlikely to occur due to current dam operations. More detailed information on past human perturbations to this reach are is found in Appendix 1 of Battelle's report on 2004 study of bull trout in the Pend Oreille River (Scholz et al., 2005).

The design of Albeni Falls Dam incorporates a log chute through the dam structure intended to allow the transport of logs through the dam. The chute was built to aid the timber industry in the rafting of logs downstream to the Pend Oreille River. However, it is unlikely that logs with root wads could have gone through the chute and the chute is no longer operational.

(3) ***Substrates of sufficient amount, size, and composition*** *to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.25 in (0.63 cm) in diameter and minimal substrate embeddedness are characteristic of these conditions;*

Historically, bull trout in the mainstem Pend Oreille River downstream of Lake Pend Oreille most likely spawned in tributaries to the lake or the river. Surviving offspring likely remained in these tributaries until they became sub-adults, at which time they likely would have migrated to the mainstem. Operation of Albeni Falls Dam does not affect substrate characteristics in the tributaries that would be utilized for bull trout spawning, incubation, fry emergence, or young-of-year and juvenile survival.

(4) ***A natural hydrograph****, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation*

Although Lake Pend Oreille is a natural lake, Albeni Falls Dam is authorized for regulation of the lake level for flood control, navigation, fish and wildlife conservation, recreation, and power generation. Before the project became operational in 1952, the annual surface elevation of Lake Pend Oreille varied according to seasonal inflows, from an average fall/winter low of about 2,048.0 feet to an average spring runoff high of about 2,062.0 feet, with a maximum spring elevation of 2071.8 feet recorded on June 9, 1948 (Corps, 2000). After reaching a maximum elevation during spring runoff, the lake gradually receded to an elevation of about 2,050.0 feet by August and reached its minimum elevation of about 2,048.0 feet by October.

After the spring runoff period is completed (usually late May to early July), current Albeni Falls Dam operations maintain Lake Pend Oreille in a 0.5-foot summer operation range between elevations 2,062.0 and 2,062.5 feet until the end of the summer recreation season. A fall drawdown generally begins after Labor Day and the lake is stabilized at a minimum control elevation of 2,051.0 to 2,055 feet for the winter typically by December 1. The lake is held at this minimum control elevation until April 1, after which spring runoff typically occurs and the lake is refilled during May and June.

The lake level regulation results in slight modifications to the hydrograph below Albeni Falls Dam. The current operation of Lake Pend Oreille maintains the lake at a summer elevation of about 2,062.0 to 2,062.5 feet compared to pre-dam conditions where summer elevations ranged from a high of about 2,062.0 feet in June to a low of about 2,050.0 feet in August and September (Corps 2000). This means that, compared to natural conditions, Albeni Falls Dam operations tend to slightly decrease the spring and summer flows, and increase fall and early winter flows in the Pend Oreille River. The small deviations from natural flow patterns do not appear to adversely influence the suitability of habitat for bull trout.

The most apparent difference between pre- and post-dam conditions is the existence of Box Canyon Reservoir that backs up to the tailwater of Albeni Falls Dam. Discharges from Albeni Falls Dam are generally passed through Box Canyon Dam, a run-of-river project. Regardless of Albeni Falls Dam operations, the river has been transformed from a free-flowing lotic system to a lake-like lentic system. This condition would persist regardless of Albeni Falls Dam operations.

(5) ***Springs, seeps, groundwater sources, and subsurface water connectivity*** *to contribute to water quality and quantity.*

Work in 2003 and 2004 revealed a culvert downstream of Albeni Falls Dam that provides cold water refuge to bull trout under certain conditions (Scholz et al., 2005; Geist et al., 2004). There are likely other springs or cold water sources along the Pend Oreille River that also provide cold water refuge. By mid-summer, when ambient water temperatures in the Pend Oreille River typically exceed the 15°C upper optimum for bull trout, access to these sites as cold water refuge from high temperatures in the Pend Oreille River is determined primarily by the elevation of Box Canyon Reservoir, not operations of Albeni Falls Dam. Accordingly, Albeni Falls Dam operations do not appear to affect cold water sources that contribute to water quality and quantity.

(6) ***Migratory corridors*** *with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.*

Construction of Albeni Falls Dam effectively blocked upstream migration. When all spillway gates at Albeni Falls Dam are open (which occurs during peak spring flows in many years), water flows over Albeni Falls much as it did prior to dam construction, and therefore bull trout may be able to pass upstream over the dam. However, the spillway is open for only a few days in any given year, and data indicating that upstream fish movement occurs or is even physically possible are not available.

Fish tracking data from 2003 and 2004 indicate that the dam appears to block volitional upstream migration of bull trout from below the dam back to Lake Pend Oreille (Geist et al., 2004; Sholz et al., 2005). Passage is important to allow fish to access cold water refugia in Lake Pend Oreille and natal spawning tributaries. In the absence of passage, fish that move downstream past the dam are lost to their meta-population and are subject to adverse effects from high summer water temperatures in the river below the dam. Whether adfluvial fish contribute to meta-populations in tributaries below the dam is currently unknown.

Proposed studies would better clarify life history strategies for bull trout in Lake Pend Oreille and the Pend Oreille River. These studies will include investigations of migration of adult and sub-adult bull trout, including capture-and-haul upstream passage and subsequent tracking of likely adfluvial adult fish that are captured below the dam.

(7) ***An abundant food base*** *including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.*

Since dam construction, the reach of the river designated as critical habitat has changed from a free-flowing river to a reservoir, which likely altered the aquatic and terrestrial food base. Given these changed conditions, operations of Albeni Falls Dam likely have little effect on the food base for bull trout in the Pend Oreille River below the dam since these effects are caused by the existence of Box Canyon Dam, not Albeni Falls Dam or its operations.

(8) ***Few or no nonnative predatory, interbreeding, or competitive species*** *present;*
Albeni Falls Dam operations do not influence presence or abundance of non-native predatory, interbreeding, or competive species up- or downstream of the dam.

(9) ***Permanent water of sufficient quantity and quality*** *such that normal reproduction, growth, and survival are not inhibited.*

Albeni Falls Dam operations slightly alter the seasonal hydrograph of the Pend Oreille River, as discussed for PCE #4 above, but do not appreciably affect the quantity of permanent water in the mainstem Pend Oreille River below the dam.

The dam has minor effects on water quality in the mainstem river below the dam. Studies of the dynamics of total dissolved gas (TDG) at Albeni Falls Dam indicate that spillway releases from

the dam result in minor increases in TDG levels in the Pend Oreille River (Schneider 2004). . Additionally, as a result of the TDG studies, dam operations have been modified reduce TDG loadings to the Pend Oreille River during spillway releases.

Corps Proposals to Reduce Effects of Albeni Falls Dam Operations on Bull Trout Critical Habitat

The Corps proposes to continue studies of bull trout in the Pend Oreille River. These are taken from a more detailed Corps report addressing the potential actions the Corps plans to take to address bull trout issues in the Pend Oreille basin (Corps, 2005).

- Continue monitoring of adult bull trout from below Albeni Falls Dam.
- Develop and conduct a study of sub-adult bull trout from tributaries above Albeni Falls Dam.
- Conduct a water temperature study of Lake Pend Oreille and the Pend Oreille River system.
- Conduct study of use of the log chute to provide attraction flows.
- Conduct a reconnaissance study on potential fish passage alternatives.

The Corps anticipates these studies would require two to four years to develop sufficient information to necessary to support a decisions on whether and, if so, how to proceed with fish passage at Albeni Falls Dam. In the interim, these steps are proactively seeking information regarding bull trout biology and behavior in the Pend Oreille River and Clark Fork Basin while providing upstream passage where such actions further study goals. In total, the proposed actions potentially lead to a passage solution at Albeni Falls Dam.

Since the Corps is implementing actions necessary to better define the need and possible design for fish passage, which includes movement of bull trout from below to above Albeni Falls Dam where prudent, the Corps finds that operation of Albeni Falls Dam is **not likely to adversely modify designated critical habitat for bull trout.**

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