Albeni Falls Dam
Flexible Winter Power Operations
Bonner County, Idaho

Final Environmental Assessment

October 2011

US Army Corps of Engineers ®
Seattle District

BONNEVILLE
POWER
ADMINISTRATION

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The responsible agencies for this work are the U.S. Army Corps of Engineers (Corps) and the Bonneville Power Administration (BPA).

Summary:

BPA has proposed the Corps operate Albeni Falls Dam (AFD) during the winter months to utilize a larger portion of the authorized operating range from what has occurred in recent years. The objective is to increase Federal Columbia River Power System operational flexibility for power production utilizing available storage at AFD. The action would allow BPA to more effectively meet winter power demands in the northwestern United States. The proposal includes storing and discharging water behind AFD for power purposes during the winter months. This would result in fluctuating the surface elevation of Lake Pend Oreille between the annual minimum control elevation (MCE) (usually between 2051 and 2055 feet) and 2056 feet from about mid-December until March 31 every year. The proposal is a change to the way AFD has been operated in the winter time in recent years, in which the surface elevation of Lake Pend Oreille has generally been targeted at 2051 or 2055 feet with a one foot operating range. In years where the annual MCE is set at 2055 feet, this proposal will not be different than current operations.

This Environmental Assessment (EA) evaluates effects of the proposal and will help BPA and the Corps determine whether or not a supplement to Columbia River Power System Operation Review Environmental Impact Statement is needed. The EA is intended to meet requirements under the National Environmental Policy Act consistent with implementing regulations for the Corps (ER 200-2-2) and BPA (Code of Federal Regulations, Title 10, Part 1021).

THE OFFICIAL COMMENT PERIOD FOR THIS EA WAS FROM 28 JULY 2011 TO 13 SEPTEMBER 2011.

This document is available online under the project name "Albeni Falls Dam Flexible Winter Power Operations, Bonner County, Idaho" at: http://www.nws.usace.army.mil/ers/doc_table.cfm and http://bit.ly/n0a0wx.

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Table of Contents

List of Tables

List of Figures

Acronyms and Abbreviations

µg/L	micrograms per liter
1983 AFD EIS	Final Environmental Impact Statement, Operation of Albeni Falls Dam, Idaho
AFD	Albeni Falls Dam
AFD EIS	Final Environmental Impact Statement, Operation of Albeni Falls Dam, Idaho
AFDD	accumulated freezing degree days
APE	area of potential effects
BCD	Box Canyon Dam
BiOp	Biological Opinion
BMP	best management practice
BPA	Bonneville Power Administration
CFR	Code of Federal Regulations
CRT	Columbia River Treaty
Corps	U.S. Army Corps of Engineers
EA	Environmental Assessment
ESA	Endangered Species Act of 1973, as amended
FERC	Federal Energy Regulatory Commission
FCRPS	Federal Columbia River Power System
fps	feet per second
FWPO	Flexible Winter Power Operations
GBT	gas bubble trauma
HPMPs	Historic Properties Management Plans
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
kcfs	thousand cubic feet per second
m3/s	cubic meters per second
MCE	Minimum Control Elevation
MW	megawatt
MWhr	megawatt-hour
NEPA	National Environmental Policy Act

NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NWI	National Wetland Inventory
PNCA	Pacific Northwest Coordination Agreement
POBC	Pend Oreille River Commission
POPUD	Pend Oreille Public Utility District
Reclamation	U.S. Bureau of Reclamation
RM	river mile
ROD	Record of Decision
SCL	Seattle City Light
SHPO	State Historic Preservation Officer
SOR EIS	Columbia River Power System Operation Review Environmental Impact Statement
SOP	Standard Operating Procedure
SOS	system operating strategy
SWPA	Systemwide Programmatic Agreement for the Management of Historic Properties Affected by the Multipurpose Operations of Fourteen Projects of the FCRPS
TDG	total dissolved gas
TMDL	total maximum daily load
TMT	Technical Management Team
USC	US Government Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VARQ EIS	Upper Columbia Alternative Flood Control and Fish Operations Final Environmental Impact Statement
WDOE	Washington State Department of Ecology
WQI	water quality index

Chapter 1
Introduction

Albeni Falls Dam (AFD) is a multipurpose hydroelectric project operated by the U.S. Army Corps of Engineers (Corps). It is located in northern Idaho on the Pend Oreille River, a tributary to the Columbia River. The Bonneville Power Administration (BPA) is a power marketing agency of the U.S. Department of Energy that markets the power from federal hydroelectric projects in the Columbia River Basin (known collectively as the Federal Columbia River Power System, or FCRPS). The FCRPS is jointly managed by the Corps, BPA, and the U.S. Bureau of Reclamation (Reclamation) to address an array of treaty, statutory, and regulatory responsibilities. AFD is one of the FCRPS hydroelectric projects.

BPA has proposed the Corps operate AFD during the winter months to utilize a larger portion of the authorized operating range from what has occurred in recent years. This would allow water to be stored and released to meet power needs more effectively. The proposal is referred to herein as Flexible Winter Power Operations (FWPO). This Environmental Assessment (EA) is being prepared pursuant to the National Environmental Policy Act (NEPA) (U.S. Government Code [USC], Title 42, Sections 4321 et seq.) to evaluate effects of FWPO. The Corps and BPA are acting as joint lead agencies for the purpose of the EA.

1.1. PROJECT AUTHORITY

Construction of AFD was authorized by the Flood Control Act of 1950 (Public Law 81-516, 81st Congress, 2nd Session). Flood control or flood risk reduction, hydroelectric power, and navigation were authorized under Public Law 81-516. Recreation was authorized in the Flood Control Act of 1944, Section 4 (Public Law 78-534). Fish and wildlife conservation was authorized under Public Law 85-624 (the Fish and Wildlife Coordination Act) and Public Law 96-501 (Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act).

The AFD and Pend Oreille Lake Project ("Project") is a multiple purpose facility comprising a dam, powerhouse and attendant structures and improvements and 18,629.90 acres of real estate. Corps Fee title real estate comprises 4,241.14 acres. The rest is less-than-fee estate comprising 9,310.98 acres of flowage easement estates or licenses from lands in private, U.S. Forest Service, or state or local government ownership. The remainder (5,077.78 acres) is pre-dam water surface area along the river at the ordinary high water stage, an area under jurisdiction of the Idaho Department of Lands.

AFD is operated for the multiple purposes of power generation, navigation, recreation, flood control, and fish and wildlife conservation. Its operation benefits flood management of Lake Pend Oreille, power generation, and regulation of streamflow for 15 downstream federal and non-federal hydroelectric projects. Construction began in 1951 and was completed in 1957. AFD was placed in operation in 1955.

BPA is authorized to market the power from AFD pursuant to the Bonneville Project Act of 1937, Public Law No. 75-329, as amended, as well other laws, including the Northwest Power Act. In the Northwest Power Act, Congress declared that one of the purposes of the FCRPS is to assure the Pacific Northwest of an adequate, efficient, economical, and reliable power supply.

1.2. OPERATIONS

AFD is located at river mile 90.1 on the Pend Oreille River which is the outlet of Lake Pend Oreille, a deep natural lake (Figure 1-1). AFD impounds and regulates the top 11.5 feet of the lake as well as approximately 25 miles of the Pend Oreille River between the lake and the dam.

The Corps operates AFD in a manner consistent with its congressional authorization and other applicable treaties, statutes, regulations, and agreements. One such statute, the Endangered Species Act (ESA) has influenced the operation of the FCRPS, including AFD, to ensure endangered and threatened species are protected. AFD is managed within a range of authorized maximum and minimum lake elevations, as measured at the U.S. Geological Survey (USGS) gage at Hope, Idaho, with end of month elevations determined by flood control rule curves. Hydrologic conditions may result in some variation in lake elevations from the rule curve. The gage at Hope is located on the lake itself, and the elevation at this gage can differ from the elevation of the water in the forebay at AFD, particularly during high flows.

As a multipurpose project, AFD has been operated for hydropower, one of its purposes, since it was built. Historically, winter power operations have been associated with drafting water for power. Water was stored for power operations during the winter in the 1980s and early 1990s. See Appendix B for historic winter elevations of Lake Pend Oreille. During recent years, winter lake levels have been relatively constant.

AFD is operated within the following parameters. These parameters are derived from Congressional authorization and the Water Control Manual[1].

- authorized upper limit lake regulation of 2062.5 feet[2],
- authorized lower limit lake regulation of 2049.7 feet,
- maximum daily change (up or down) in lake elevation of 0.50 feet per day below elevation 2058 feet,
- maximum daily change in discharge of 10 thousand cubic feet per second (kcfs),
- maximum hourly change in discharge of 5 kcfs, and
- minimum project discharge of 4 kcfs.

Current AFD annual operations vary depending on the time of year, generally as follows.

- **Summer conservation period.** The objective is to maintain a lake level to support recreational uses. The lake elevation is held between 2062.0 and 2062.5 feet from the end of the spring runoff (late May to early July) until early September (usually until the Labor Day holiday).
- **Fall storage drawdown.** This occurs from September to November 15. The objective is to prepare for flood season, draft for power in the fall and winter and attain a stable lake elevation to support efforts to improve kokanee survival, a prey source for ESA listed bull trout. This operation also supports flows for ESA listed salmonids in the lower Columbia River, particularly chum salmon. The lake is drafted beginning in early September, targeting an elevation of generally 2051 or 2055 feet. This is called the minimum control elevation (MCE). The MCE is determined in the fall of each year based on a combination of factors. The purpose of setting the

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1 The Corps has a process for approving deviations from the Water Control Manual to address adaptive management concerns.

2 All elevations in this document are referenced to mean sea level.

MCE is to benefit kokanee salmon spawning around the lake. The process for determining the MCE is detailed in Section 3.8.1.

- **Lake stabilization period.** The objective is to stabilize the lake within a 0.5 foot operating range above the MCE for kokanee spawning, while also preparing for floods and generating power. This generally occurs from November 15 to November 30.
- **December minimum control elevation.** The objective is to maintain lake levels to avoid dewatering kokanee redds (gravel nests). The lake is managed so that the elevation does not fall below the MCE plus 0.5 foot. If the lake elevation rises due to high inflow, the MCE is reset during December at the higher elevation to avoid dewatering kokanee redds.
- **January to March holding period.** The objective is to maintain lake levels to avoid dewatering kokanee redds, while also preparing for floods and generating power. The operations during this period also support flows for ESA listed salmonids in the lower Columbia River. The lake is generally operated within a one foot range above the MCE. Lake storage above the MCE may be used for occasional flood management or hydropower operations without resetting the MCE, but storage above elevation 2056 feet must be evacuated by April 1 for flood management.
- **April through June flood season.** The objective is to manage runoff during the flood season. AFD operations during this time also support flows in the lower Columbia River for ESA listed salmon. The lake is generally held at 2056 feet for flood storage but may be raised to manage floods. About every 10 years on average, the lake is raised to 2062.5 feet for flood management. Large floods may result in lake elevations greater than 2062.5 feet.

1.3. PURPOSE AND NEED

BPA is required to market the power from the FCRPS for Congressionally-designated purposes, including assuring the Pacific Northwest of an adequate, efficient, economical, and reliable power supply, while adhering to all applicable legal requirements. Consistent with this, BPA has proposed the Corps operate AFD during the winter months to utilize a larger portion of the authorized operating range from what has occurred in recent years. During the winter, AFD is one of only two major federal storage projects in the FCRPS where storage and release of water can be managed for power purposes. Effective and careful use of power generation from the dam helps minimize power rates. Thus, the proposal would more effectively provide adequate, efficient, economical, and reliable power supply. The proposal is consistent with the existing authorized purposes and operating restrictions of AFD.

In 1995, BPA, the Corps, and Reclamation jointly led the development of the *Columbia River Power System Operation Review Environmental Impact Statement*[3] (SOR EIS) (BPA et al. 1995). The primary purpose of the SOR EIS was to evaluate different management strategies for the 14 federal dams and reservoirs in the Columbia River Basin that have a major influence on multiple-purpose system operation, and for which power production is coordinated under the Pacific Northwest Coordination Agreement (PNCA). Five of these 14 projects, including AFD, provide necessary water storage; whereas the remaining projects operate as run-of-the-river (water is passed through them as it is received).

The purpose of the EA is therefore to evaluate effects of the FWPO and determine whether a supplemental or new EIS is required, or whether the SOR EIS, as confirmed through analyses in this EA

[3] The SOR EIS evaluated a range of operational strategies for the following FCRPS dams: Libby, Albeni Falls, Chief Joseph, Dworshak, Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, The Dalles, Bonneville (all Corps-operated) and Hungry Horse and Grand Coulee (both Reclamation-operated). The SOR EIS can be found at [http://www.nww.usace.army.mil/planning/er/reports.htm#EIS].

is sufficient. Specifically, this EA is intended to evaluate whether: (1) FWPO is a substantial change from the proposed action evaluated in the SOR EIS relevant to environmental concerns; or whether, (2) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action of the SOR EIS or its impacts (40 C.F.R. §1502.9(c)).

The Corps and BPA have tiered[4] this document from the 1995 SOR EIS. Tiering incorporates by reference all the analysis conducted in the tiered documents, allowing for a more focused analysis of the important elements of the proposal without repeating information and analysis conducted in the previous SOR EIS. Further detail on the SOR EIS alternatives and scope is provided in Section 2.1.

1.4. BACKGROUND

In addition to the SOR EIS, several other NEPA documents provide supporting analysis and background information for this EA. These documents should be consulted for detailed information on AFD operations, effects of existing operations, and associated background information. The following documents are incorporated by reference into this EA:

- *Environmental Assessment, Albeni Falls Dam & Reservoir* (NETL/RCA Environmental Consultants 1974);
- 1983 *Final Environmental Impact Statement, Operation of Albeni Falls Dam, Idaho* (Corps 1983);
- *Environmental Assessment, Albeni Falls Dam, Lake Pend Oreille Winter Test Pool Operation* (Corps 1995); and
- *Upper Columbia Alternative Flood Control and Fish Operations Final Environmental Impact Statement* (VARQ EIS) (Corps 2006).

1.4.1. Federal Columbia River Power System Biological Opinions

The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) each developed Biological Opinions (BiOps) addressing the effects of the operation of the FCRPS on ESA listed species under their jurisdiction. The implementation of these BiOps by the Corps, BPA, and Reclamation (the "Action Agencies" for ESA consultation purposes) is adaptively managed. This adaptive management process is coordinated with regional sovereigns (other federal agencies, states and tribes) through various regional groups including the Technical Management Team (TMT). The TMT makes in-season operational recommendations affecting fish species to the Action Agency with decision-making authority. Operations at AFD, including release levels, ramping rates, and lake elevations are managed consistent with the BiOps as adaptively managed.

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[4] The Council on Environmental Quality (CEQ) NEPA regulations state that "[a]gencies are encouraged to tier their environmental impact statements to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review (Sec. 1508.28). Whenever a broad environmental impact statement has been prepared … and a subsequent statement or environmental assessment is then prepared on an action included within the entire program or policy (such as a site specific action) the subsequent statement or environmental assessment need only summarize the issues discussed in the broader statement and incorporate discussions from the broader statement by reference and shall concentrate on the issues specific to the subsequent action…."(40 CFR Section 1502.20).

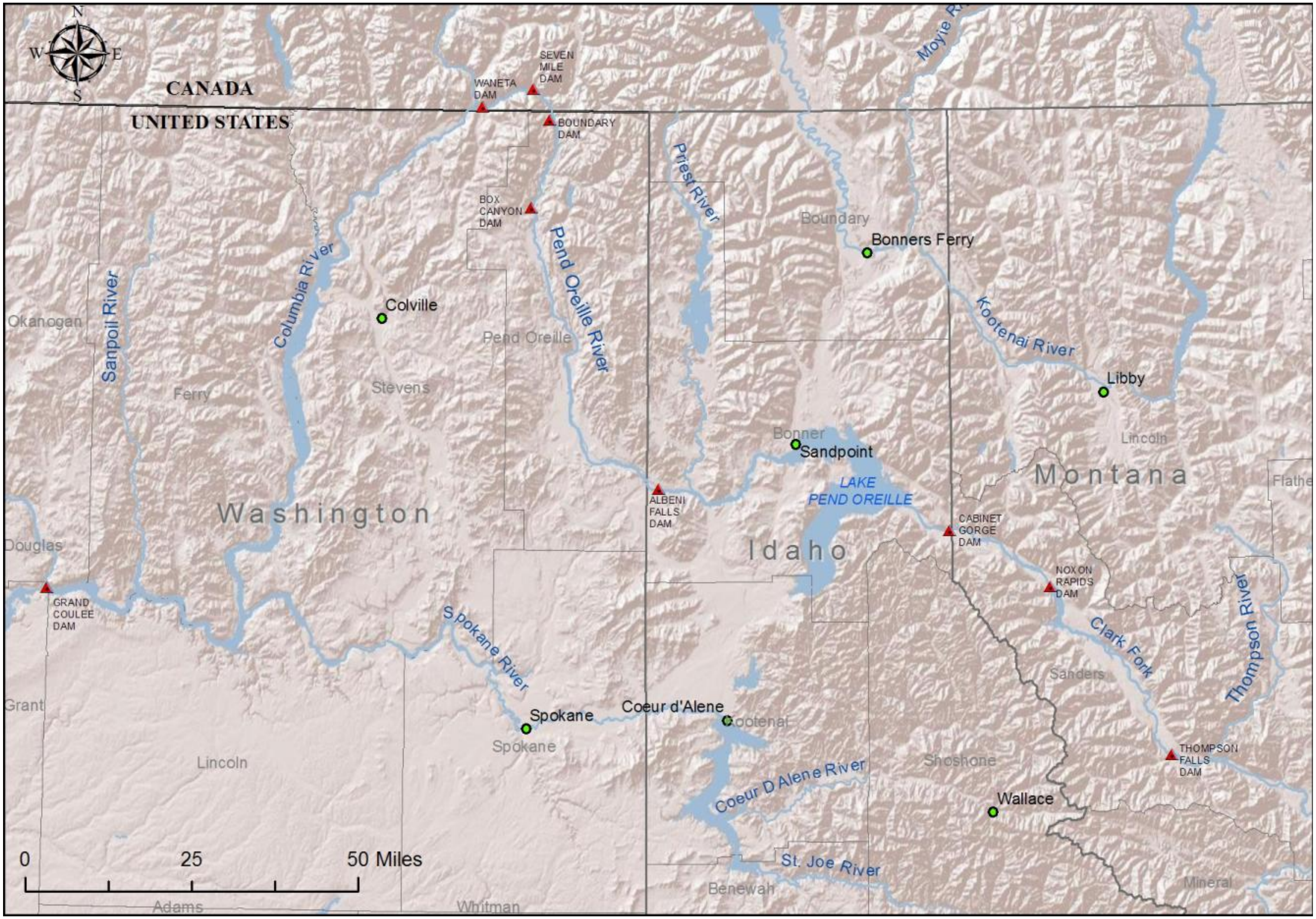

Figure 1-1. Project Vicinity Map

1.4.2. Pacific Northwest Coordination Agreement

The FCRPS is operated in a coordinated manner for power production under the PNCA. The PNCA was originally executed in 1964 in an attempt to maximize the region's hydropower resource capability. The PNCA parties include the three federal agencies responsible for the federal projects (Corps, Reclamation, and BPA) and private and public utilities in Washington, Oregon, Idaho, Montana, and California. These utilities include the Pend Oreille Public Utility District (POPUD), Seattle City Light (SCL) and Avista Corp. The PNCA was revised in 1997, extending its life through 2024.

The PNCA provides for coordination of northwestern U.S. hydroelectric resources owned and operated by PNCA Parties. The PNCA calls for annual planning, which must accommodate all of the authorized purposes of the coordinated hydroelectric projects and result in an estimate of the firm load that can reliably be served by the coordinated resources. The PNCA enables the region's power producers to optimize system reliability and power production after addressing non-power requirements. While the PNCA does not require reservoirs to follow the annually planned operation, to the extent that the operations deviate from the plan, energy obligations could apply to downstream PNCA Parties, as defined in the PNCA.

1.4.3. Columbia River Treaty

The Columbia River Treaty of 1964 (CRT) between the United States and Canada was a significant development in flood control and hydropower development in the Pacific Northwest. The CRT's provisions for coordination between Canada and the U.S. on flood control and power impart significant mutual benefits across the Columbia River Basin.

The Corps' Division Engineer and the Administrator of BPA are designated as the U.S. Entity, and have responsibility for coordinating the planning and operation of the FCRPS with the Canadian Entity to resolve power, flood control, and non-power issues through a variety of arrangements. Examples include development of assured operating plans and detailed operating plans, and arrangements with Canada for mutually beneficial non-power uses agreements. The CRT includes some provisions that expire on September 16, 2024 (60 years after the treaty's ratification), and others that continue throughout the life of the associated facilities whether the treaty continues or is terminated by either country. Currently the U.S. Entity is conducting studies evaluating the CRT to prepare a recommendation to the U.S. Department of State concerning the future of CRT. These studies include an evaluation of operations at AFD.

Chapter 2
Alternatives

2.1. COLUMBIA RIVER POWER SYSTEM OPERATION REVIEW

The SOR EIS is an overarching programmatic analysis and disclosure of environmental effects of operation of the 14 federal dams, including AFD under a broad range of alternatives. Because there is an existing environmental analysis which addresses operation of AFD, the first determination for the agencies when considering the FWPO is whether or not a supplemental or new EIS is required.

In order to undertake these evaluations, some background on the SOR EIS and how it addressed winter operations at AFD is helpful. The final SOR EIS evaluated seven system operating strategies (SOS) with a total of 13 alternatives[5]. There were also sub-alternatives embedded within the various primary alternatives. The seven operating strategies include elements of the flexible winter power operations proposed at AFD, as follows:

- **SOS 1 - "Pre-ESA Operation".** Alternative 1a under this strategy was described as normal 1983-1991 storage project operations. AFD winter lake management operations were as described under the Preferred Alternative in the 1983 AFD EIS. This included lake draft for power purposes to a minimum elevation of 2051 feet or to 2049.7 feet in a critical power year, and the use of active storage above the minimum elevation. This means that under this SOS 1a alternative, the storage space between the minimum elevation (2051 feet or 2049.7 feet) and upper rule curve (2056 feet to 2060 feet) could be used to store water for withdrawal as needed for multiple uses downstream, including power generation. Flood risk reduction activities could raise the lake as needed. Alternative 1b was the same as 1a but did not include refill target for AFD to store water to benefit anadromous fish in the Columbia River.
- **SOS 2 - "Current Operations".** This alternative represented the operation that was in effect at the time of the SOR analysis, which included interim flow improvement measures that had been implemented in response to Endangered Species Act (ESA) salmon listings. For AFD, this alternative was the same as alternative 1a.
- **SOS 4 - "Stable Storage Project Operation".** This alternative proposed operating AFD during winter at a stable lake elevation of 2056 feet, except in cases of flood risk reduction activities. A drawdown to elevation 2051 feet would occur every sixth year. One of the stated goals that differentiated this alternative from the others was to minimize reservoir fluctuations.
- **SOS 5 - "Natural River Operation" and SOS 6 "Fixed Drawdown"** were the same as SOS 1a for AFD.
- **SOS 9 - "Settlement Discussion."** There were three alternatives under this SOS. Under alternatives 9a and 9b, AFD would operate on minimum flow up to flood control rule curves year round, except during the flow augmentation period. Based on the hydro regulation models, the

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5 The system operation strategies are not numbered consecutively because some were dropped from further analysis after the draft EIS was issued.

month end elevations would have generally been at the upper rule curve (2056 to 2060 feet). Under alternative 9c, elevation targets would be established for each month, and would generally be no lower than elevation 2056 feet in December to April.

- **SOS PA - "Preferred Alternative."** This alternative represents the operations recommended by the 1995 NMFS and USFWS BiOps. Under this alternative AFD operations were modified to operate to flood control elevations by April 15 in 90 percent of the years. Based on the hydro regulation models, with this added requirement, the month end elevations at AFD would have generally been similar to alternative 1a in December through February. The average March elevation would have been 4.2 feet higher under this alternative than in alternative 1a as the model adjusted operations to meet the refill target by April 15. General objectives of the preferred alternative included: support recovery of ESA-listed species by storing water during the fall and winter to meet spring and summer flow targets; protect other resources by managing detrimental effects through maximum summer draft limits; provide public safety through flood protection; and provide for reasonable power generation.

The SOR EIS preferred alternative was selected by the Agencies and implemented throughout the FCRPS including at AFD. The Agencies' SOR EIS Records of Decision (ROD) also included an additional operation to operate Lake Pend Oreille during the winter at higher minimum lake levels for a three-year test period in an attempt to improve resident fish (particularly kokanee) spawning and production. This is further described in the *Environmental Assessment, Albeni Falls Dam, Lake Pend Oreille Winter Pool Test Operation* (Corps 1995).

Subsequent to the adoption of the SOR EIS and RODs, the agencies undertook additional consultations under the ESA with both NMFS and the USFWS, which resulted in additional BiOps addressing the FCRPS. These BiOps include NMFS BiOps in 2000, 2008 and 2010 addressing listed salmon and steelhead, and USFWS BiOps in 2000 and 2006 regarding bull trout and Kootenai River white sturgeon. The SOR EIS enabled the adaptive management approach used throughout the basin for addressing the needs of various ESA listed fish species and the complexities of operating a large hydropower system.

The study of varying minimum winter lake elevations and kokanee spawning between 1996 and 2001 concluded that lake elevations can affect success of kokanee spawning in the lake (Maiolie et al. 2002). The 2000 USFWS BiOp required an extension of the AFD three-year winter pool test period from 2001 through 2006, described above. A tool known as the decision tree was developed as a result of the 2000 BiOp implementation process to help set winter lake elevations or the MCE based on a number of different variables. In 2007, USFWS issued a letter recommending that the decision tree developed for kokanee spawning continue to be used to guide operations at AFD. The current operation to benefit resident fish is described in Section 3.8 of this EA at "Kokanee Management."

2.2. NO ACTION ALTERNATIVE

Under the No Action Alternative evaluated in this EA, AFD would continue to be operated as it has been in recent years, as described in Section 1.2. The winter lake elevation would be operated within a one foot range above the MCE following the completion of kokanee spawning through March. AFD would continue to be operated for its multiple purposes, and consistent with the NMFS and USFWS BiOps and other actions supporting ESA listed salmonids and bull trout, including those to improve kokanee spawning. Water above the one foot operating range would be impounded only as needed for flood risk reduction activities and drafted out shortly after being stored. All water would be routed through the powerhouse to generate power, except in times of flood or if total outflow exceeds the powerhouse capacity. In the latter case, the excess flow would be routed through the spillway. Winter storage and drafting would occur according to established criteria including a minimum discharge of 4 kcfs, a maximum lake elevation change of 0.5 foot per day, a maximum daily change in discharge of 10 kcfs, and a maximum hourly change in discharge of 5 kcfs. No stage-related ramping requirements exist for the downstream river. AFD would not be operated to provide winter storage flexibility for power operations above the existing one foot operating range under this alternative. The No Action alternative or current operations is the preferred alternative evaluated in the SOR EIS, as implemented in the SOR EIS RODs and as adapted to new information regarding listed species through subsequent BiOps.

2.3. FLEXIBLE WINTER POWER OPERATIONS ALTERNATIVE (PREFERRED ALTERNATIVE)

The preferred alternative for this EA, hereafter referred to as FWPO, would fluctuate the lake elevation when conditions warrant by as much as 5 feet between the established MCE and elevation 2056 feet during the winter operational period (approximately December 15th to March 31st).

The purpose of FWPO is to more efficiently use the available water storage capabilities at AFD to generate power during the winter while at the same time meeting all existing authorities, purposes, and legal requirements. This is achieved by more actively managing the storage capability so that it can be used to generate power most efficiently both at AFD and at FCRPS hydroelectric facilities downstream (Grand Coulee Dam is the downstream project that most efficiently generates power).

Like the No Action Alternative, FWPO would not affect how the winter MCE is established. A more detailed discussion of the MCE process is provided in Section 3.8. Like the No Action Alternative, flood control operations would continue to be managed consistent with the Corps' Water Control Manual and the upper and lower rule curves at AFD would not change; however, other elements of the Water Control Manual would be altered consistent with this proposal.

Under FWPO, the operation would be opportunistically utilized, taking advantage of weather and streamflow forecasts as well as energy needs throughout the system to store and use water to maximize benefits of the available storage within project operating limits. FWPO would provide an opportunity for BPA to request water to be stored when:

- There is an expectation that storing water in the near term will provide power benefits at a future date when that water is released. This depends on power prices, load demand, and conditions at Grand Coulee.
- Inflow to the project increases significantly (weather related) and there is an opportunity to store that water to prepare for future power needs.

Because of the opportunistic nature of the preferred alternative, there are a nearly infinite number of potential possible water storage/drafting scenarios. For purposes of this EA, the MCE is assumed to be set at 2051 ft each year and the maximum possible extent of this flexibility is described given the operating constraints described in Chapter 1, Introduction. This provides a "bookend" approach, by using a scenario that fluctuates the lake elevation as frequently as streamflows and the operational constraints allow. This "bookend" approach is unlikely to occur because the analysis does not account for factors such as power demand, weather, and system conditions that would trigger the need to utilize the available storage. Using this bookend approach ensures that we have thoroughly analyzed potential impacts associated with FWPO.

Utilizing the available storage during this period would only occur when a power marketing value to the region can be forecasted. Based on these analyses, the maximum use of the flexibility if all the conditions aligned would result in 3 cycles of a complete fill of the reservoir followed by a complete draft in one winter.

Under FWPO, there is an increased risk of ice break up, ice jams, and resultant flooding downstream of AFD. As a result, a best management practice (BMP) would be implemented as part of FWPO in order to minimize this risk. The BMP would be triggered based on temperature and forecast, and result in a decrease in the rate of change in outflow from the dam. The BMP is detailed in Appendix A. There is some uncertainty associated with the modeling used to evaluate ice conditions, so monitoring is an important component of the BMP that will be used to verify the model results. There is a remote possibility that FWPO could increase the risk of damage to overwater structures around Lake Pend Oreille. A new standard operating procedure (SOP) has been developed to reduce this risk. The SOP includes monitoring ice conditions and a minimum amount of lake fluctuation. Existing AFD operational parameters described in Section 1.2 would apply under FWPO. The following additional criteria would further restrict FWPO:

- maximum discharge of 45 kcfs,
- maximum lake elevation of 2,056 feet,
- minimum lake elevation of 2,051 feet or the annual MCE,
- BMP to minimize ice-related damages downstream of AFD.
- Minimum fluctuation SOP to reduce risk of damage to overwater structures.

Note that higher discharges and lake elevations than those described above may still occur during the winter period in response to flood risk reduction activities.

FWPO would be implemented for the life of AFD. The Water Control Manual for AFD would be updated to reflect this operation.

2.4. ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER CONSIDERATION

The alternatives below were developed based on an analysis of the Water Control Manual for AFD, existing operational criteria, hydrologic information, and potential energy value provided.

2.4.1. Flexible Winter Operations to Elevation 2060 Feet

Operating above elevation 2056 feet was considered but rejected as an alternative because of potential flood impacts. AFD serves as a storage project for the FCRPS and thus is used for flood risk reduction for the broader Columbia River. If water was stored to 2060 feet for power operations and a flood occurred, AFD would be less able to respond. This additional flood storage capacity was considered more important than the potential power benefits and as a result this alternative was rejected.

2.4.2. Flexible Winter Operations with Maximum Discharge of 60kcfs

A maximum discharge of 60 kcfs for power operations was considered but rejected. Relatively high inflows would be required to meet this discharge level at AFD, meaning that a rather large regional storm event would need to occur. Such an event would increase flows throughout the region, increasing the regional power generation and thereby reducing the value of power discharges from AFD. The utility of this alternative is further minimized by a channel constriction between AFD and Lake Pend Oreille that controls flow out of the lake depending on the lake elevation. The lake would need to be about 2056.5 feet before 60 kcfs could be discharged from the lake and thus through AFD. This alternative was therefore not feasible.

Chapter 3
Affected Environment

The environment around Lake Pend Oreille and the Pend Oreille River has been extensively characterized in the 1983 AFD EIS, the 1995 SOR EIS, the 1995 EA, and the 2006 VARQ EIS. These documents have been referenced where appropriate and briefly summarized where necessary to provide appropriate context. The reader should consult these documents for more detailed information on the affected environment. New information is provided, where necessary, to address specific issues related to FWPO not addressed in these previous documents. The existing conditions described in this chapter serve as a basis for comparing the effects of FWPO described in Chapter 4, Environmental Consequences, with the current operation.

The SOR EIS evaluated various alternatives on the following resource areas: earth resources, water quality, air quality, anadromous fish, resident fish, wildlife, cultural resources, Native Americans, recreation, flood control, navigation, power, and irrigation. For the purpose of this EA, this list of resource areas has been modified as follows.

- The earth resources section is renamed shoreline erosion.
- Air quality, navigation, and irrigation are not addressed, because these resource areas would not be affected by FWPO.
- The Native Americans section is replaced with a Tribal Coordination section.
- Flood control is renamed flood risk reduction.
- The following areas are also included in this EA specific to FWPO: hydrology, ice, docks infrastructure and ice, vegetation and wetlands, threatened and endangered species, and socioeconomics.

The geographic area of potential effect was determined based on the hydrologic footprint of FWPO. Upstream of AFD, the area of analysis includes Lake Pend Oreille, the reach of the Pend Oreille River between AFD and Lake Pend Oreille, and the adjacent shorelines (Figure 3-1). Downstream of AFD, the hydrologic footprint of FWPO is difficult to determine due to the influence of numerous dams in the downstream Pend Oreille River. For the purpose of this analysis, it was assumed that each of the dams between AFD and Grand Coulee Dam, including Box Canyon, Boundary, Seven Mile, and Waneta Dams, operate as run-of-the-river facilities from the perspective of an average daily and weekly flow. The Corps makes this assumption for most hydraulic modeling of the Columbia River Basin. While some of the dams between AFD and Grand Coulee do have the ability to reregulate flow within a single day, their influence is limited by their relatively small reservoirs. For some resources, daily reregulation of the river at these intermediate dams does play an important role in determining the influence of FWPO. Where applicable, this daily reregulation is discussed in the context of the affected resource and FWPO. The area of analysis does not extend downstream of Grand Coulee Dam because this dam completely reregulates the river flow. Grand Coulee Dam could either store or pass downstream watered received as a result of FWPO. Its operations are expected to be independent of FWPO. Operations of each of the dams between AFD and Grand Coulee Dam are briefly summarized in Section 3.1. For some resource sections, the geographic area of analysis is more restricted due to the nature of the resource and potential effects.

The temporal influence of FWPO is primarily limited to the period from mid-December to March 31, and so the focus for analyses in this document is on this winter time frame.

3.1. HYDROLOGY

As described above, the hydrologic footprint of FWPO extends from Lake Pend Oreille downstream to Grand Coulee Dam. The sections below provide a summary of the existing hydrology within this reach including the influence of the various dams that occur.

3.1.1. Upstream of Albeni Falls Dam

There are a number of dams upstream of AFD that affect flow into Lake Pend Oreille and operations at AFD (Figure 1-1). The dam immediately upstream of AFD is Cabinet Gorge Dam on the Clark Fork River, the main tributary to Lake Pend Oreille.

Cabinet Gorge Dam

Cabinet Gorge Dam is a concrete gravity-arch hydroelectric dam located about 50 miles upstream of Albeni Falls Dam on the Clark Fork River near the state line of Idaho and Montana. The dam is a 395-foot-long, 208-foot-high concrete gravity arch dam. The Cabinet Gorge Reservoir extends into Montana, nearly to Noxon Rapids Dam. Construction of the Cabinet Gorge Dam began in 1951 and ended in April of 1952. The dam has 4 generating units with a licensed generating capacity of 231MW. The dam has a storage capacity of 42,780 acre feet and has a minimum flow of 5 kcfs. The dam is operated in tandem with Noxon Rapids Dam which is about 58 miles upstream. Both are operated as peaking facilities used

Table 3-1. Streamflow Statistics for the Pend Oreille and Clark Fork Rivers

	Clark Fork River below Noxon Rapids Dam (thousand cubic feet per second)	Pend Oreille River at Newport (thousand cubic feet per second)		
	USGS Gage No. 12391400 (1960–2009)	USGS Gage No. 12395500 (1960–2010)		
Month	Monthly Mean	Monthly Mean	Daily Minimum	Daily Maximum
October	11.4	21.9	4.1	40.1
November	12.9	20.9	8.0	43.8
December	14.1	17.7	5.5	48.9
January	14.1	17.1	3.2	51.3
February	14.8	18.6	3.3	54.9
March	15.8	21.5	3.9	54.9
April	22.2	28.6	3.1	69.8
May	40.7	46.8	4.3	124.0
June	50.3	56.8	7.9	133.0
July	23.0	26.6	4.2	116.0
August	10.6	12.3	2.9	27.5
September	10.1	14.4	2.4	28.2

Daily minimum and maximum refers to the minimum or maximum of the daily mean values for that month.
Source: U.S. Geological Survey 2009, 2010

to meet the daily, weekly, and seasonal power needs. Cabinet Gorge typically reregulates flows on a daily basis. Highest discharges are typically during the day ranging from 10 to 30 kcfs depending on the level of inflow to the dam and power demand. Discharges are reduced at night and on the weekends often to near minimum flows. The minimum instantaneous discharge is 5 kcfs.

Albeni Falls Dam and Lake Pend Oreille

AFD is located at river mile 90.1 on the Pend Oreille River. The dam impounds and regulates the top 11.5 feet of Lake Pend Oreille as well as approximately 25 miles of the Pend Oreille River downstream of the lake outlet. The minimum authorized lake elevation is 2049.7 feet. The normal high pool is elevation 2062.5 feet. Operations are further detailed in Section 1.2. Appendix B presents graphics of winter lake elevations from 1960 to 2011, illustrating that the annual winter lake elevation has been relatively constant over the last decade compared to previous years. The management of the lake in the winter is based in part on protection of kokanee spawning as a result of the 2000 USFWS BiOp for ESA-listed bull trout, as kokanee are an important prey base for bull trout.

The Clark Fork River is the primary tributary to Lake Pend Oreille. Streamflow statistics for the Clark Fork and the Pend Oreille River downstream of AFD are illustrated in Table 3-1. AFD operations typically establish an average discharge based on the daily average discharge (day and night) at Cabinet Gorge Dam. This tends to remove the day/night flow fluctuations from the river caused by the peaking operations at Cabinet Gorge described above.

A channel constriction exists upstream of AFD at the outlet of Lake Pend Oreille. This channel constriction controls outflow from the lake depending on the lake elevation. The maximum outflow from the lake at certain lake elevations is illustrated in Table 3-2. This constriction limits the ability of AFD to regulate the lake elevation and discharge because AFD can only discharge the volume of water that can pass through the channel constriction.

Table 3-2. Maximum natural outflow from Lake Pend Oreille

Lake elevation at Hope (feet)	Maximum natural outflow from the lake (kcfs)
2050.0	20
2051.0	24
2052.0	30
2053.0	35
2054.0	42
2055.0	50
2056.0	56
2057.0	63
2058.0	70
2059.0	76
2060.0	84

The AFD maximum powerhouse hydraulic capacity is about 35 kcfs at lake elevation 2062.5 feet. When the lake is drawn down during the winter, the hydraulic capacity is reduced. For lake elevations between 2056 feet and 2051 feet, the powerhouse hydraulic capacity ranges between about 32 kcfs and 24 kcfs.

Outflow greater than the powerhouse capacity is routed through the spillway. The spillway consists of 10 spillway gates that are generally used together depending on outflow. The minimum flow for a single spillway bay is 1 kcfs. A total of 10 kcfs is therefore required before all the gates can be opened. As flow increases, the gates are generally raised in unison to pass the additional flow.

3.1.2. Downstream of Albeni Falls Dam

AFD discharge is managed within the following ramping rates when possible. The maximum hourly change in discharge is 5 kcfs. The maximum change in average daily discharge in any 24-hour period is 10 kcfs. There are no restrictions tied to changes in downstream river stage. The minimum AFD discharge is 4 kcfs.

There are four dams located downstream of AFD on the Pend Oreille River (Figure 1-1). The Pend Oreille River then joins the Columbia River and enters Lake Roosevelt, the impoundment created by Grand Coulee Dam. The operations of each of these dams and their effect on river flow are briefly summarized below.

Box Canyon Dam

Box Canyon Dam (BCD), operated by the POPUD, is located at river mile (RM) 34.4 of the Pend Oreille River. It impounds an approximately 55 mile long reservoir that extends to the base of AFD. It is operated for power and has a current powerhouse capacity of about 28 kcfs. It is operated within two constraints, 1) the water surface elevation at Cusick, located at RM 70.1, must not exceed 2,041.0 feet, and 2) the backwater at AFD must not exceed 2 feet (FERC 2005). This equates to a normal operating pool elevation of 2,030.6 feet. The project operates as a run of the river dam, such that flows released from the project approximate flows released from AFD. However, because of the reservoir's length, gradient, and volume, flows entering the project at AFD take an average of 3.5 days to reach BCD in low to moderate flow conditions. Thus, small changes in flows from AFD are not realized at BCD immediately. Larger changes cause a surge that can arrive at the downstream project in less than a day. For this reason, BCD may alter its discharge from actual inflow to ramp up or down, as appropriate, to compensate for the reservoir retention time and the resulting delay in flows.

Boundary Dam

Boundary Dam, operated by Seattle City Light, is located at RM 17.0 of the Pend Oreille River. It maintains a 17.5 mile reservoir that extends upstream to the base of BCD. It has a powerhouse capacity of about 55 kcfs and is operated in a load-following mode that shapes available water to deliver power during peak-load hours. The project typically begins generating in the early morning hours and continues to generate throughout the day, rising and falling in response to customer demand, with peaks experienced in the morning and evening. It typically shuts down during the night to store water for the next day. The project primarily operates between the elevations of 1,994 feet and 1,974 feet (with a storage capacity of approximately 27,000 acre-feet), with additional storage between 1,974 feet and 1,954 feet reserved for extreme load requirements. These operations result in daily water surface elevation fluctuations ranging from about 11 to 18 feet in the Boundary Dam forebay (FERC 2011).

Seven Mile and Waneta Dams

Seven Mile Dam is located in Canada at RM 6.0 of the Pend Oreille River. The Seven Mile Reservoir extends 9 miles upstream across the U.S. border to the toe of Boundary Dam. The reservoir is about 1,040 acres in area. It has sufficient capacity only for daily pondage and, as such, does not affect weekly or seasonal Pend Oreille River flows. The powerhouse capacity of Seven Mile Dam is 52 kcfs. Seven Mile Dam is operated by BC Hydro in conjunction with Waneta Dam (operated by Teck Cominco, Ltd) which is about five miles downstream at RM 0.5 just upstream of the confluence with the Columbia River. The powerhouse capacity of Waneta is 33 kcfs. Two key factors govern the operation of the Seven Mile/Waneta system, 1) the daily flow range from Boundary Dam upstream, and 2) the desire to minimize spill at Waneta in order to maximize power generation and minimize gas supersaturation of the downstream river (BC Hydro 2006). Typical daily flows from Boundary Dam are released in a 15-hour maximum flow block (6:00 a.m. to 9:00 p.m.) and a 9-hour minimum block (9:00 p.m. to 6:00 a.m.). The maximum flow block can be up to about 51 kcfs and the minimum flow block is often zero discharge. Reregulation of inflows from Boundary to minimize spill at Waneta causes the Seven Mile reservoir level to fluctuate significantly on a daily basis. To determine the amount of re-regulation necessary, BC Hydro takes into account expected Boundary discharges, potential spills, head losses due to reservoir drawdown, expected Salmo River inflows, environmental constraints, and variations in energy values throughout the day. Benefits from reregulation can be achieved at any time the flow in the river is less than the hydraulic capacity of Boundary. This situation occurs most of the year, except for the freshet period from May to early July. Short-term peaking operations (i.e., running three or four Seven Mile units for a few hours a day) can also affect reservoir levels, particularly at Waneta. The need for short-term peaking occurs primarily during the winter months (generally mid-November to mid-February but occasionally extending into other months). Because the turbines at Seven Mile can pass more water than those at Waneta, it is occasionally necessary to draw down Waneta reservoir overnight to create pondage space in the reservoir to absorb the extra discharge from the Seven Mile units the next day without causing spill at Waneta. Occasionally, short-term peaking operations at Seven Mile may cause additional spill at Waneta.

Grand Coulee Dam

Grand Coulee Dam, operated by Reclamation, is located downstream of the confluence of the Pend Oreille River and the Columbia River (Figure 1-1). The dam forms Lake Roosevelt, which extends upstream 151 miles to the Canadian border. The lake has a 600-mile shoreline and a surface area of 82,000 acres. The total storage capacity of the reservoir is about 9.4 million acre-feet, and the active capacity is about 5.2 million acre-feet. In general, Grand Coulee is operated to maintain the forebay elevation between elevation 1208 feet and 1290 feet, but within that range there is a narrower operating band that varies from year to year. From January through March, Grand Coulee operates between two rule curves. The lower limit of operation is set by the Variable Draft Limit and is meant to ensure an 85% reliability of meeting the April 10th target elevation as required by NMFS BiOp. The upper limit is set by the Storage Reservation Diagram and is meant to ensure adequate space for Grand Coulee to perform its flood control functions. Operations between the curves are constrained by a 1.5 foot/24 hour draft rate in the lake, flow requirements for Hanford Reach fall Chinook, and flow requirements at Bonneville Dam for chum salmon. At the end of December, lake elevation is kept above elevation 1270 feet. The day average discharge from Grand Coulee must be sufficient to support the downstream operating constraints. Greater detail on the operations of Grand Coulee Dam can be found in the SOR EIS.

3.2. ICE

The geographic area for the ice analysis extends from Lake Pend Oreille downstream to BCD. Downstream of BCD, daily fluctuations of the Boundary Dam reservoir range up to 18 feet as described in Section 3.1. These daily fluctuations will tend to reduce ice formation in the reservoir and river from this point downstream. The management of this reservoir by Boundary Dam is thus the dominant factor for determining ice conditions downstream of BCD.

3.2.1. Upstream of Albeni Falls Dam

Lake Pend Oreille often experiences sufficiently cold temperatures to form an ice cover in the winter. An ice cover can also form on the Clark Fork River above the lake. Ice formation on the lake is influenced primarily by air and water temperature conditions. Circulation patterns, shoreline configuration, and the topography of the surrounding land also influence how the lake ice forms. More complete descriptions of ice processes can be found in Ashton (1986), Beltaos (1995), and Zabilansky (2011a).

The main body of the lake is oriented north-south, with deep water (greater than 1,000 feet) in the southern end near Bayview and shallow water (less than 100 feet) in the northern end near Sandpoint (Figure 3-1). In the exposed area along the northern shore of the lake, the shoreline is wetted by wave action that freezes and forms a protective band of ice along the shore. During windy cold days when the water is choppy, spray droplets freeze in the air and drop back into the water. In the cold water, the ice crystals grow, but surface turbulence prevents consolidation into a solid ice surface. The ice crystals, or frazil, have the consistency of slush and freeze into floating ice pans. As the ice pans are pushed ashore they collide with each other, forming ridges around their perimeters. As the pans accumulate, they attenuate the waves and freeze together to form the initial cover.

Ice is an important feature of the winter regime of the lake. The freeze-up elevation is typically near 2051 or 2055 feet in most years under current operations (although this could vary). Ice conditions may be influenced by fluctuations of the lake elevation. Existing AFD operations include some water level fluctuations in the winter, as the lake level is managed within a one foot operating range above the MCE. This gradual rate of increase allows the ice to relieve internal stresses so that it doesn't break up.

Lake level fluctuations due to sustained wind or high inflow/floods can occur periodically. Typically, periods of increasing or high inflow upstream of AFD are correlated with air temperature. This is due to the relationship between storms, which increase the inflow, and warmer air. When the air temperature is cold enough to promote freezing conditions, the local weather is often clear with low potential for precipitation. And if there is precipitation, it typically falls as snow which would not raise inflow. It is thus unusual for there to be rapidly increasing inflow with below freezing conditions, although it does occur. A recent example was 1996, which is further described below in Section 3.3. As described in Section 3.1, the channel constriction at the lake outlet controls outflow from the lake depending on the lake elevation. When the MCE is set at 2051 feet, the lake would rise more quickly during a storm event simply because the water would be stored in the lake until the lake level increased high enough to allow enough water to escape the lake to match the inflow condition.

The prevailing winds are from south to north along the long axis of the lake. Sustained winds can thus create waves and potentially stack the water at the north end of the lake. When the wind subsides, a sloshing or seiche action can cause a slow moving (low-period) reflective wave in the lake. This naturally occurring water level fluctuation may be most noticeable in bays with north-south orientation (e.g., Bottle Bay and Garfield Bay). In narrowing bays like Bottle Bay, where ice damage has been reported under existing conditions, the bathymetry (i.e., contours of the bay floor) may amplify wave and ice motion. In areas sheltered from the wind and where there is little exchange or mixing with the relatively warmer water in the lake, the water is allowed to stratify and a skim layer of ice forms on the calm water surface.

Water level fluctuation creates a hinge crack that smoothly follows the contour of the shoreline. This buffers ice impacts on the shoreline and shore structures. Ice on the landward side of the crack is stationary; whereas ice on the lakeward side floats up and down with the water surface. The crack also allows the floating ice to rotate with respect to the stationary shore ice.

The mechanisms that form ice on the lake also form ice in the Pend Oreille River between Lake Pend Oreille and AFD. Similar to conditions on the lake, wave action and water level fluctuation on the river

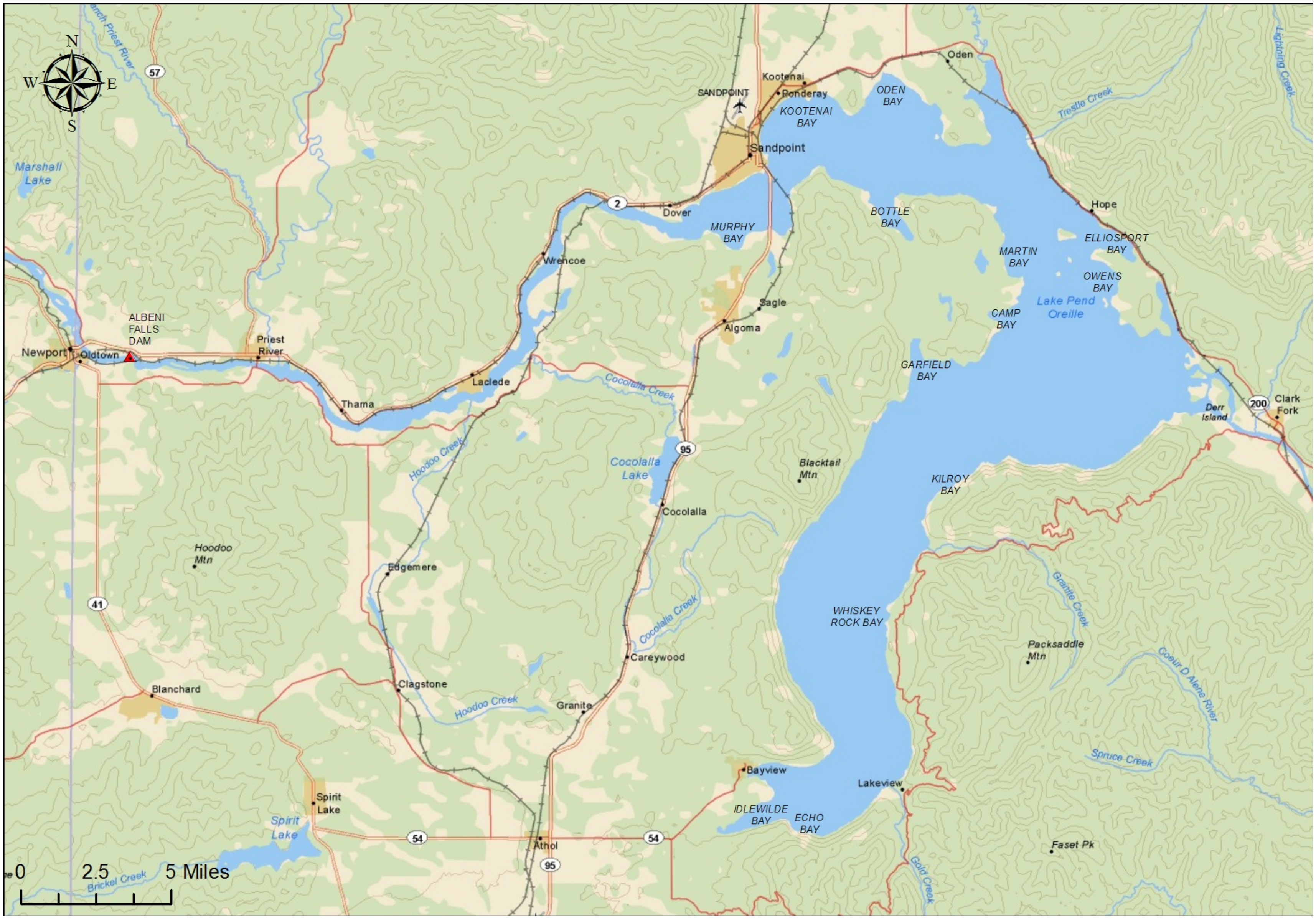

Figure 3-1. Lake Pend Oreille Vicinity Map

wet the shoreline and provide a protective band of ice along the shore. River freeze-up starts in the shallow areas along the shore where water velocity is low and allows the static water to cool and stratify. When the water surface is calm, skim ice forms, reducing near-surface water velocities. With the lower velocity near the ice, the ice thickens and migrates toward the channel. In wide reaches of the river where the water velocity decreases, skim ice may form overnight. During the day, the skim ice may melt, which, in turn, may cool the water or break up and contribute to ice cover formation downstream. Railroad bridge piers and Route 95 bridges restrict the amount of ice that can enter the river from the lake. Ice formation near the town of Dover between Tank Hill and Springy Point further restricts the volume of ice entering the river from the lake, causing ice formation in the river to be essentially independent of the lake.

3.2.2. Downstream of Albeni Falls Dam

Ice formation in the river downstream of AFD is independent of ice formation in the lake. Ice formation in the river downstream of AFD is similar to that described above for the river upstream of AFD. A protective band of ice develops along the river banks in the initial stages of freeze-up. During periods of low discharge and water velocity, skim ice forms along the shore and freezes toward the channel center. As discharge increases, the ice cover is subject to hydrostatic pressure and buoyant forces as the river stage increases and higher water velocities increase the drag force on the underside of the ice. If these forces on the ice cover exceed its structural integrity, the ice cover will break up. As a rough rule of thumb, break-up will occur when the stage increases two to three times the ice thickness depending on the river system and location (Donchenko 1975). If the stage rise is below the break-up threshold, heat stored in the water combined with the current may melt the ice in place. Stage increases in excess of two to three times the ice thickness commonly result in ice break-up with the potential for ice jamming and flooding. As described above, these conditions are uncommon under current operations due to the typical weather and steady flow conditions experienced in the winter.

3.3. DOCKS, INFRASTRUCTURE, AND ICE

Water recreation is a major attraction for both local residents and out-of-area recreationists who visit Lake Pend Oreille and the Pend Oreille River. Residences adjacent to the lake or river commonly have private docks, and a number of public and private marinas are located throughout the area. The lake is actively managed for the multiple authorized purposes of the AFD and authorized structures on the lake should be designed and built to withstand lake level management. This section provides background information on docks and infrastructure and discusses these in the context of ice. The geographic area of analysis for the dock, infrastructure, and ice section is Lake Pend Oreille and the Pend Oreille River downstream to BCD.

3.3.1. Upstream of Albeni Falls Dam

Above AFD, marinas are located at Garfield Bay, Glengary, Bottle Bay, Sandpoint, Hope, and several at Bayview. Many docks, especially in marinas, float because of lake level fluctuation (normally 11.5 feet over the course of the year). Floating dock structures are typically restrained by piles and may rest on the substrate during winter drawdown. For docks fixed on pilings above elevation 2062.5, their pilings may extend down to an approximate low-pool elevation of 2051 feet. According to a recent Corps study, 2,179 docks and 1,967 slips (within marinas) are located on Lake Pend Oreille and the Pend Oreille River above AFD (Hillard 2009).

Based upon conversations with local experts, the cost of constructing a new private dock structure is between $20,000 and $33,000 depending on the size and type of dock constructed (C. Kramer, Cramer

Crane and Contracting, pers. comm., 2010). Smaller private docks are usually a minimum of 400 square feet and range in cost from $20,000 to $25,000 depending on whether the dock is fixed or floating and the type of materials used for construction. Larger private docks may be up to 700 square feet and range in cost between $30,000 and $33,000 depending on the type of dock and materials used.

Repairs to docks from ice damage could cost roughly between $2,000 and $4,000, depending on the damages sustained (C. Kramer, Cramer Crane and Contracting, pers. comm., 2010). For example, installation of a new pile is approximately $1,200/pile. Repairs could include re-driving pilings, replacing dock deck pieces, and rebalancing docks to remove waves in the dock created from upheaval of pilings.

In addition to docks and marinas, many other types of structures are either in or above the water. Table 3-3 provides an overview of the types of structures that have been permitted by the Idaho Department of Lands in Lake Pend Oreille or the Pend Oreille River above AFD over the past several years. Docks include floating docks, piers, and boat lifts (both private and commercial). Riprap is typically used for bank stabilization. Water lines include both public and private lines and may be used for drinking water, irrigation, or other water needs such as waste water. Buoys include private, county, and navigational buoys. Non-recreational uses of the lake and river include activities such as floating home remodels or moves, floating restaurant moves, boat garage rebuilds, minor dredging, railroad bridge repair, and utility line installation and repairs.

Table 3-3. Docks and Infrastructure Permitted (by Year) on Lake Pend Oreille and the Pend Oreille River Upstream of Albeni Falls Dam

Structure	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Docks	63	66	62	68	104	131	138	83	106	86	63
Riprap	20	21	29	14	28	32	37	16	14	37	18
Water lines	5	2	5	6	12	15	13	6	12	13	14
Buoys	14	3	12	6	13	18	19	10	27	8	6
Launch rails	6	1	0	5	2	3	2	0	4	0	3
Transfer	2	10	6	14	15	11	11	8	10	17	9
Other	6	2	5	5	2	3	10	8	8	9	7
Total	116	105	119	118	176	213	230	131	181	170	120

Source: Idaho Department of Lands 2010

In recent winters, the level of Lake Pend Oreille and the Pend Oreille River above AFD has been maintained within a one foot operating range. Structures around the lakeshore remained generally unaffected by ice during these winters. However, the lake can rise several feet under current operations as a result of flood conditions or high inflow. If this occurs when ice exists on the lake, potential effects include flooding of moored boats and damage to floating docks frozen to the substrate as the water rises, damage to docks caused by pile extraction. In 1996, the nominal lake elevation was 2055 feet until a rain event occurred in February. This resulted in the lake level rising over 4 feet in 4 days to 2060 feet. Boats left in the water were frozen into the ice and in some cases chopped free by local residents to avoid water damage. Other items found damaged included boat lifts and private docks. Except for the flooding of ice-bound boats, all other reported damage was above a lake elevation of 2056 feet. These water level changes in response to floods are part of the currently required operating responsibilities of AFD. Structures within the AFD operating range should be designed and maintained to withstand these fluctuations in order to avoid damage.

When ice is present and the lake elevation changes, in-water infrastructure is subject to vertical forces as the floating ice cover responds to increases in water level. These vertical forces are also the dominant issue for structures in the river between the lake and the dam. When the water level increases, the buoyancy force generated by the ice cover is transmitted to the piles frozen into the ice. If the resistance of the pile is less than the uplift force, the pile is extracted. As the water level recedes, the weight of the ice attached to the pile is opposed by the driving resistance of the pile. If the driving resistance exceeds the weight of the ice, the ice fails near the pile before the pile is re-driven to the original elevation. After the ice cover drops to the lower water surface, it refreezes to the pile at the lower elevation, and the process can repeat if the water level continues to fluctuate.

Two areas of potential failure with floating systems are utilities and the bottom of the support members. The differential movement of the offshore ice relative to the ice frozen to the shoreline plays an important role in any potential failure and is thus important to dock design. It requires that connections between the dock sections frozen in the shore ice and the dock sections frozen to the offshore floating ice allow for the relative movement between the units as the ice moves. This allowance for relative movement between dock units has to be carried over to the utility services installed on the docks. Some manufacturers design the flotation system so that the floats are ejected from the ice as the ice compresses them. If the deck framing or support steel becomes frozen into the ice, the float design is defeated and the float will fail.

Free-floating ice floes driven by the wind or current occasionally occur. The Clark Fork River is one potential source of these ice floes. This ice may have sufficient mass and velocity to impact existing structures and cause damage.

3.3.2. Downstream of Albeni Falls Dam

Based on an aerial photo analysis (2010 photo), there are about 648 overwater dock structures, and one marina along the Pend Oreille River between AFD and BCD. These structures can be affected by ice and fluctuating river levels similar to that described above upstream of AFD. As the water level fluctuates downstream due to the changing discharge, a hinge crack forms that follows the contour of the shoreline. This crack has a gentle curvature, smoothing out any perturbations along the shoreline. Ice on the landward side of the hinge crack is relatively stationary, providing a level of protection from floating ice floes. Structures extending beyond the hinge crack are subjected to ice movement and impact from floating ice floes. The precise location where the hinge crack forms is related to the shoreline geometry, water depth, and shoreline structures.

3.4. FLOOD RISK REDUCTION

The geographic area for the flood risk reduction analysis is Lake Pend Oreille and the Pend Oreille River downstream to BCD.

3.4.1. Upstream of Albeni Falls Dam

The Corps operates AFD to manage flooding upstream along the impounded reach of the Pend Oreille River and on Lake Pend Oreille. Flood risk reduction benefits are achieved by decreasing the lake stage by about 1 foot for inflows between 80 kcfs and 220 kcfs (Corps 2002a). The flood-control rule curve is displayed in Table 3-4. AFD is managed to keep the lake within these elevations during the winter and spring to provide flood risk reduction when a flood occurs. The National Weather Service has designated the flood stage at elevation 2063.5 feet.

Table 3-4. Lake Pend Oreille Elevation Rule Curve (mean sea level)

Date	Lake Elevations[1] at Hope Gage	
	Maximum (feet)	Minimum (feet)
July 31	2,062.5	2,062.0
August 31	2,062.5	2,062.0
September 30	2,062.5	2,060.0
October 31	2,060.0	2,054.0
November 15–20	2,056.0	2,051.0
December 31	2,056.0	2,051.0
January 31	2,060.0	2,051.0
February 28	2,060.0	2,051.0
March 31	2,056.0	2,051.0
April 30	2,056.0	2,054.0
May 31	2,062.5	2,054.0
June 30	2,062.5	2,054.0

[1] Flood runoff may force the lake higher than these elevations.

3.4.2. Downstream of Albeni Falls Dam

Flows at the Newport gage immediately downstream of AFD that exceed 100 kcfs are considered to be "flood" flows. This is the zero-damage flow as defined by the National Weather Service. In the Box Canyon reservoir immediately below AFD, several earthen dikes and railroad grades extend from Usk to Jared to protect the floodplains on the west side of the river. Additional dikes are located around Calispell and Trimble Creeks to protect the local farming districts against backwater from the Pend Oreille River. These levees are owned and operated by local owners, and are not certified by the Federal Emergency Management Agency. The 100-year flood will overtop the majority of these levees (Corps 2002a).

Flooding on lands along tributaries of the Box Canyon Reservoir such as Calispell and Trimble Creeks has been a concern to farmers near Cusick, Washington. McGrane (1999) discussed their concerns and the factors involved in the flooding of these locations. The creeks' ability to drain runoff is affected when Box Canyon Reservoir levels are too high, causing local flooding. The reservoir level is influenced by various factors, including outflow from AFD, power generation at BCD, and tributary runoff volume. The POPUD has a pumping plan and agreement for conditions that require its assistance to manage the flood risk.

AFD contribution to the flood risk reduction in this reach is limited. Discharge is reduced to minimize flood risk downstream only if upstream flood risk reduction activities are not affected.

3.5. SHORELINE EROSION

The geographic area for the shoreline erosion analysis is Lake Pend Oreille and the Pend Oreille River downstream to Grand Coulee Dam.

3.5.1. Upstream of Albeni Falls Dam

Lake Pend Oreille and the Pend Oreille River

AFD has altered the hydrograph of Lake Pend Oreille, thereby affecting shoreline vegetation. By maintaining high lake levels throughout the summer, vegetation around the reservoir at points below this elevation has decreased substantially. This has resulted in relatively barren shorelines during lower winter lake elevations, increasing susceptibility of the shoreline to erosion relative to the pre-dam condition. Shoreline erosion in Lake Pend Oreille outside the deltas is caused by a combination of erosion from wind-generated waves, freeze-thaw processes at the air-water interface of the lake, groundwater-induced sliding, and boat wakes (Gatto and Doe 1987). The same processes that cause erosion on the lakeshore also cause erosion on the Pend Oreille River between Lake Pend Oreille and AFD. Additional erosion occurs in the Pend Oreille River as a result of high flows during the spring runoff events. Boat wakes are a major cause of erosion on the Pend Oreille River above AFD (Brengle 2008).

When the lake level is operated at either elevation 2051 feet or 2055 feet during the winter months, the shoreline erosion is typically concentrated at or very near this targeted elevation. Wind-wave and freeze-thaw effects occur at a fixed location along the shoreline for the duration of the operation period, maximizing scour at that location. The erosion rates vary widely and are dependent on the exposure of the shoreline to the wind-generated waves, as well as on the type of substrate along the shoreline. Some bank protection actions have been implemented by both public and private entities to address erosion issues in certain areas.

Clark Fork Delta

Parametrix (1998) and Findlay Engineering (2000) investigated shoreline erosion at the Clark Fork Delta. Both came to the conclusion that the most significant factor influencing erosion at the delta is the duration and elevation (2062.5 feet) of the lake during summer, combined with wind-generated waves and boat wakes. This is consistent with the SOR EIS which states “erosion of reservoir shores is most severe and costly in terms of habitat and facility losses when reservoirs are at full pool.” Findlay Engineering (2000) goes on to say that during low lake levels (such as during winter operations), wind-generated waves are not an active erosion force acting on the delta islands.

The Idaho Department of Fish and Game (IDFG) has been monitoring erosion rates using “pins” made of rebar up to 5 feet long installed horizontally and vertically in series at various locations in sandy banks in the delta, and has documented events and erosion rates over time. During 10 years of data collection, horizontal erosion rates of 1.0 to 8.0 feet per year have been recorded.

Several factors likely contribute to this high rate of shoreline erosion. Sediment impoundment by dams upstream on the Clark Fork (Cabinet Gorge, Noxon Rapids, and Thompson Falls) has halted downstream transport of much of the sediment load that fed the delta. Additionally, large woody debris (e.g., logs and rootwads), which once provided structural diversity and facilitated trapping of sediment in places to create and maintain islands, has been altered. Large woody debris is no longer available to the extent it was, again as a result of dam impoundments and watershed modification. The Clark Fork Delta area is highly susceptible to erosion due to the combination of large areas of uninterrupted water in the direction of the maximum winds (i.e., southeast) and the fine alluvial soil deposited from the river.

3.5.2. Downstream of Albeni Falls Dam

The Washington Department of Fish and Wildlife (2007) identifies toe erosion, scour, bank seepage and piping, and mass failure as the primary erosion mechanisms for the Pend Oreille River downstream of AFD through Box Canyon Reservoir. Vegetation removal, rapid drawdown, wave action, freeze-thaw and ice are identified as site-specific causes of erosion along the river banks. The majority of shoreline erosion downstream of AFD is a result of high flows during the spring runoff events, where discharges from the dam can exceed 90 kcfs (Morlin 2010).

The water surface elevation downstream of AFD is dependent on the combination of discharge from AFD and operation of BCD. Under existing winter operations, the lake level is held at a relatively constant elevation, and the discharge from Albeni Falls fluctuates in accordance with the naturally occurring inflows from upstream sources. Shoreline erosion is ongoing at the banks due to wind-generated waves, resulting in toe erosion and bank seepage and piping due to water level variations.

Downstream of BCD, the river acts as a series of reservoirs whose water level fluctuation is determined by the combination of inflow from upstream dams and the operation of the downstream dam. Erosion is ongoing in these downstream reaches due to the combination of reservoir fluctuation, wind wave and boat wake attack, and high flows during the spring runoff events.

3.6. WATER QUALITY—NUTRIENTS

The geographic area for the nutrients analysis is Lake Pend Oreille downstream to BCD. The nutrient concern is primarily an issue of concern around Lake Pend Oreille.

3.6.1. Upstream of Albeni Falls Dam

Water quality has been monitored at several deepwater sites and shallow nearshore sites in Lake Pend Oreille since the late 1980s. Studies by Falter et al. (1992) and Woods (2004) indicated that concentrations of phosphorus and nitrogen are low in Lake Pend Oreille. They considered the lake to be oligotrophic or nutrient-poor. Assessment of nearshore water quality data collected between 1989 and 2003 (Falter 2004) and from 2003 through 2007 (TSWQC 2009) indicated no significant trend in nearshore nutrients, chlorophyll a, or transparency, as measured during the summer months. Falter (2004) concluded that nearshore littoral zones maintained a meso-oligotrophic classification between 1989 and 2003.

Winter water quality data were collected in 2005 and 2006 by the Corps (Easthouse 2009) at one shallow nearshore station near Sandpoint and one deepwater station near Hope. Winter total phosphorus concentrations ranged from 5 to 6 micrograms per liter (µg/L) at the nearshore station to 4 to 6 µg/L at the deepwater station. Winter total nitrogen concentrations ranged from 73 to 151 µg/L at the nearshore station to 56 to 163 µg/L at the deepwater station.

In response to public concern over the presence of nuisance algae, Lake Pend Oreille was placed on the State of Idaho 303(d) list in 1994 and retained on the 303(d) list in 1996 and 1998. No specific pollutant was identified. In 1999, the Idaho Department of Environmental Quality (IDEQ) prepared a water quality assessment and concluded that the shallow nearshore littoral zone was determined likely to degrade over time. Several likely sources of nutrients to the lake were identified including residential development, septic tanks, and urban runoff (TSWQC 2002). IDEQ formulated the *Pend Oreille Lake Subbasin Assessment and TMDL* in 2001 (IDEQ 2001). The goal of the nearshore nutrient total maximum daily load (TMDL) is to track and manage increasing nutrient enrichment and biological productivity with the ultimate goal of reducing the nutrient load over time so that existing water quality standards will continue to be met. It established a lakewide nearshore average water quality target of 9 µg/L total phosphorus with an action threshold of 12 µg/L during the critical summer months of June through September (IDEQ et al. 2004).

The Idaho section of the Pend Oreille River was included in the 2002 and 2008 Section 303(d) list as impaired for temperature, and total phosphorus. A TMDL for nutrients in the Idaho portion of the Pend Oreille River is currently being studied but none has been implemented yet.

3.6.2. Downstream of Albeni Falls Dam

Immediately downstream of AFD, the Pend Oreille River flows into the state of Washington. The Washington State Department of Ecology (WDOE) has developed a water quality index (WQI) designed to rate the quality of the water as compared to water quality criteria (WDOE 2002). The WQI ranges from 1 to 100 with scores below 40 representing poor water quality, scores between 41 and 79 representing moderate water quality, and scores greater than 80 representing good water quality. Based on data collected between January and December from 1993 through 2008, WDOE rated the total phosphorus and total nitrogen concentrations as good with a median WQI score of 95.5 for total phosphorus and 100 for total nitrogen.

Water quality data collected by the Corps (Easthouse 2009) in the Pend Oreille River downstream of AFD between February and November for 2005 through 2007 were similar to data collected between January and December by WDOE. In general, concentrations of nutrients were low in the Pend Oreille River year-round. Total phosphorus concentrations ranged from 4µg/L to 13µg/L, and total nitrogen concentrations ranged from less than 50 µg/L to 180 µg/L. Soluble reactive phosphorus concentrations ranged from less than 1 µg/L to 1 µg/L, and nitrate concentrations ranged from less than 10 µg/L to 30 µg/L. A TMDL for the mainstem Pend Oreille River is currently under review for total phosphorus.

3.7. WATER QUALITY—GAS SUPERSATURATION

The geographic area for the gas supersaturation analysis is Lake Pend Oreille downstream to Grand Coulee Dam.

When dams discharge water over spillways, they can alter the saturation level of gases such as nitrogen that are dissolved in the water column. This occurs because the spillway tends to plunge aerated spill water to depths where hydrostatic pressure increases the solubility of atmospheric gases. The water then becomes supersaturated with gas. This is measured as the saturation level of total dissolved gas (TDG) in the water. High TDG has the potential to cause gas bubble trauma (GBT), also called gas bubble disease, in fish and other aquatic species (Weitkamp 1980; Weitkamp et al. 2002). GBT is similar to decompression sickness, or “the bends,” in human divers. Symptoms in fish include bubbles in fins, eyes, or tissues and occasionally death.

Much of the research focuses on TDG and GBT has been on salmonids. Under field conditions, GBT is observed in adult salmonids when TDG saturation levels exceed 125% (Backman and Evans 2002). Juvenile salmonids begin to show symptoms when TDG approaches 120% saturation (Backman et al. 2002). The prevalence and severity of symptoms at these saturation levels is low. As TDG increases, both prevalence and severity of GBT increase. Other species may show slightly different vulnerabilities to high TDG levels. Most instances of mortality or severe cases of GBT in salmonids have occurred where TDG was greater than 130% or water depths were less than 1 meter. A case at Grand Coulee Dam in 1997 showed effects to various species, including walleye, kokanee, rainbow trout, sculpin, carp, sucker, and whitefish; these species were observed dead or dying almost daily during a period of spill from May to June. The daily average TDG concentrations ranged from about 122% to 136% (AquaTechnics, Inc. 1998).

Water depth is an important factor in determining whether GBT will occur. For every meter below the surface, a reduction of 10% TDG is measured in the water column. This is called “depth compensation.” For example, a TDG saturation of 120% at the surface means all aquatic life 1 meter deep would experience a depth-compensated TDG saturation level equivalent to 110%. Therefore, species at the surface are particularly susceptible to effects of TDG, whereas species that live at depth are less affected. In laboratory studies where depths were limited, effects of TDG occur when saturation levels begin to exceed 110%. Symptoms are not necessarily permanent. Fish can recover if TDG decreases or if they swim to greater depths.

The states of Idaho and Washington and the Kalispel Tribe of Indians have established a water quality standard of 110% saturation for TDG. Idaho and Washington provide an exemption to the TDG standard for flows above the 7-day, 10-year average (7Q10) flood. Idaho is also in the process of developing a TMDL for TDG in the Pend Oreille River (IDEQ 2008). A TMDL for TDG has been developed for the Pend Oreille River in the state of Washington (WDOE and EPA 2007).

3.7.1. Albeni Falls Dam

TDG saturation levels in Lake Pend Oreille and at AFD are likely influenced by the operation of Cabinet Gorge Dam, which is about 50 miles upstream on the Clark Fork River. Parametrix (1999) reported that only minor degassing occurred in the Clark Fork–Pend Oreille River system between Cabinet Gorge Dam and AFD during the 1998 runoff. IDEQ has also indicated that elevated TDG at the forebay of AFD is likely due to operations of Cabinet Gorge Dam (IDEQ 2008). The maximum powerhouse capacity of Cabinet Gorge Dam is about 36 kcfs. When the powerhouse capacity is exceeded and water is spilled, TDG levels increase. Spill on the order of 10 kcfs at Cabinet Gorge tends to increase downstream TDG levels (Avista 2004). At a total discharge of about 40 kcfs (4 kcfs of spill), TDG levels are typically around 110% of saturation. At flows of about 50 kcfs (14 kcfs of spill), TDG on the order of 120% saturation can occur. The mean flow of the Clark Fork River is between 13 kcfs and 16 kcfs from December to March. Under mean flows for this time of year, sufficient powerhouse capacity exists to avoid spill and therefore avoid creating high TDG levels. Winter rain storms could lead to spill at Cabinet Gorge Dam and relatively high TDG levels in the forebay of AFD.

The effect of AFD on TDG levels was evaluated in a study conducted in 2003. The study indicated that AFD spillway discharges result in relatively small increases in TDG under a variety of spillway flows ranging from about 2 kcfs to 50 kcfs. (Schneider et al. 2007). On average, TDG saturation increased by 1.1%. The maximum increase measured was 4.1%, from 111.2% in the forebay to 115.3 % at the tailwater. This occurred when the project was spilling 60% of the river over six of 10 spillway bays (spillway flow was 36 kcfs). The relatively small average increase in TDG was attributed to the low project head, shallow stilling basin channel, and wide spillway. The study concluded that AFD can spill up to 1 kcfs per spillway bay without increasing tailwater TDG saturation levels if a uniform spill pattern is followed. This equates to a total of 10 kcfs of spill through the 10 spillway bays.

TDG has been measured at the forebay and tailwater of AFD from April through October since 2005. The data indicate that during the high-flow spring runoff period, TDG levels in the forebay often exceed 110%. The tailwater TDG level is typically no more than 5% higher than the forebay TDG level. The maximum increase detected was 9% in 2011. In general, the greatest increase in TDG occurred during spillway releases less than about 25 kcfs when the difference in elevation between forebay and tailwater (net head) is greatest, the project is not using a uniform spill pattern, and the project is spilling from fewer than six spillway bays. The Corps collected limited TDG data between 2005 and 2011 at the AFD forebay during the winter. This data indicated that winter TDG was typically between 95 and 100% from

December 15 to mid-March. During the latter part of March, TDG was measured between 100 and 105% with one data point of 108%. At high spillway flows, the tailwater elevation increases which results in a relatively free-flow condition at the dam. The increase in the tailwater elevation decreases the plunging flows that elevate TDG levels. High spillway flows therefore do not create high TDG at AFD.

3.7.2. Downstream of Albeni Falls Dam

Four dams are located downstream of AFD on the Pend Oreille River before it joins with the Columbia River. These include Box Canyon and Boundary dams in the United States, and Seven Mile and Waneta dams in Canada. Stream conditions are such that TDG decreases only minimally (approximately 5%) from AFD to the forebay of BCD, the next facility downstream.

Box Canyon Dam

BCD has a current powerhouse capacity of about 28 kcfs. In general, the dam begins to generate TDG above 110% when the spillway discharge exceeds 5 kcfs, above 120% when the spillway discharge exceeds 12 kcfs, above 130% when the spillway discharge exceeds 20 kcfs, and 140% when the spillway discharge exceeds 40 kcfs (WDOE and EPA 2007).

As part of the Federal Energy Regulatory Commission (FERC) Relicensing TDG Abatement Plan, the powerhouse will be upgraded to about 33 kcfs by 2013 and an auxiliary spillway bypass installed by 2015 (FERC 2005). The bypass will be able to route about 27 kcfs through the dam rather than over the spillway. When construction is complete, the dam should be able to discharge about 60 kcfs without increasing TDG downstream of BCD (EES 2005). During the construction period, one turbine unit will be out of service each year. Therefore, the powerhouse capacity will be reduced to about 24 kcfs in 2012 and about 25.5 kcfs in 2013, requiring use of the spillway at lower flows during those 2 years. In 2002 (amended in 2003), WDOE issued a Section 401 water quality certification (02WQER-5121) that acknowledged the potential for increased TDG at Box Canyon during the upgrades. The certification requires the POPUD to develop a plan to comply with the state TDG criterion of 110% saturation within 10 years.

Boundary Dam

The powerhouse capacity at Boundary Dam is 55 kcfs. TDG generation at Boundary Dam is not well understood and is complicated by the fact that air is injected into turbines to prevent cavitation during ramp up and down. The dam is estimated to generate TDG above 110% when the spillway discharge exceeds 4 to 8 kcfs, and 120% TDG when spillway discharge exceeds 20 kcfs (WDOE and EPA 2007).

Seven Mile and Waneta Dams

The powerhouse capacity of Seven Mile Dam is 52 kcfs. Spill at the dam generally does not increase TDG and may in fact reduce the saturation level when it spills. This is likely due to the existence of spillway deflectors and the unique orientation of the spillway (WDOE et al. 2004). Waneta Dam is immediately downstream of Seven Mile Dam and immediately upstream of the confluence with the Columbia River. Its tailwater extends into the Columbia River. It has a powerhouse capacity of 33 kcfs. WDOE (2004) speculated that Waneta Dam likely increases TDG saturations during spill based on information collected from other dams with a similar configuration.

3.8. RESIDENT FISH

The geographic area for the resident fish analysis is Lake Pend Oreille downstream to BCD. Downstream of BCD, the operations of other dams are the dominant factor in aquatic habitat conditions and any effects on resident fish species.

3.8.1. Upstream of Albeni Falls Dam

Lake Pend Oreille and the Pend Oreille River are home to a variety of native and nonnative fish. Species sought by sport fishers include several trout species, kokanee, bass, and walleye. The state of Idaho actively targets lake trout for the purpose of suppressing the population of this non-native species to benefit kokanee (IDFG 2007). DuPont and Bennett (1993) found mountain whitefish, peamouth chub, northern pikeminnow, and redside shiner were most abundant in the Pend Oreille River above AFD. Lake Pend Oreille is also habitat for bull trout, which is currently listed as threatened under the ESA. More detail on fish species in the Pend Oreille Basin can be found in the SOR EIS and the VARQ EIS.

Habitat

Coldwater species such as trout and kokanee tend to occupy the deeper waters of the main lake while the warmwater species are more prevalent in the near-shore areas and the Pend Oreille River between Sandpoint and AFD. AFD provides habitat value, especially to the nonnative warmwater species in the summer, by decreasing velocities in the river between the lake and the dam. Available habitat for warmwater species is negatively affected by the annual winter drawdown. Water velocities are generally higher and off-channel habitat more limited during the winter lake elevations. Habitat with zero velocity is reduced as quiet bays and backwaters are dewatered. DuPont and Bennett (1993) stated that winter drawdown reduces numbers of tench, largemouth bass, pumpkinseed, and black crappie.

Kokanee Management

While not native to the Pend Oreille system, kokanee have historically been an important fishery in the lake and have become an important prey species for bull trout. Kokanee have been declining since the 1960s in Lake Pend Oreille. As a result, certain management actions have been undertaken to try to increase the population, including managing the winter lake elevation for kokanee spawning. Kokanee dig their gravel nests, known as redds, in shallow water along the lakeshore and lay their eggs in November and December. Before 1996, the lake was typically drawn down to a minimum elevation of 2051 feet for the winter. At this elevation, spawning locations around the lake are more limited than at higher elevations such as 2055 feet. Based on experiments conducted in the late 1990s, winter lake elevations were set as high as 2055 feet to try and improve conditions for kokanee spawning around the lake (Maiolie et al. 2002). As described in Chapter 2, Alternatives, these experiments ultimately led to the development of a decision tree which is used to assist in making the determination as to each year's minimum winter lake elevation.

Under the decision tree, each year an interagency team evaluates a number of factors and then generally recommends a minimum winter lake elevation target. The annual lake elevation target is referred to as the MCE. USFWS then submits the interagency recommendation as a System Operation Request to the Corps. The request is considered by the TMT, which provides in-season management recommendations concerning fish species to the federal agency with decision-making authority. In this instance, the Corps then makes the implementation decision taking into account TMT's recommendation and other appropriate factors.

November 15 is the target date for drafting the lake to the MCE to insure a stable lake elevation for kokanee spawning. To prevent redds from dewatering, the lake cannot be drafted below the MCE. The operating range is limited to 0.5 foot above the MCE until the end of December or the end of kokanee spawning, at which time the operating range increases to 1 foot above the MCE. Should the lake rise due to storm events before the end of kokanee spawning, the MCE is reset and maintained at a higher lake elevation to protect eggs of kokanee that may have spawned during high water.

Entrainment

NMFS defines entrainment as the unintended diversion of fish into an unsafe passage route (NMFS 2008a). It can also be defined as the incidental pulling of fish and other aquatic organisms into the current and subsequently transporting them through a hydropower plant's conduits and generation equipment. Entrainment can result in fish injury or death. In the case of AFD, it also results in transporting fish to the downstream river where they cannot regain access to the upper river or lake, because AFD currently does not have fish passage facilities. This is a greater issue for migratory species, particularly when spawning habitat exists above AFD but not necessarily below. Fish entrainment through AFD does occur under existing operations (Entz 2010) and likely affects most fish species in the river.

The AFD powerhouse is equipped with three Kaplan style turbines. No studies have been conducted on the effects of fish passing through the turbines at AFD. Kaplan type turbines are used throughout the FCRPS. Studies at other FCRPS facilities indicate survival of yearling Chinook salmon and steelhead ranging from 86.5% to 93.4% (NMFS 2000). Fish greater than 8 inches in length are likely to be killed at higher rates, ranging from approximately 10 to 30 percent for Kaplan style turbines (Franke et al., 1997; Stone and Webster, 1992). Fish can also be routed through the spillway at AFD. In general, spillway passage is considered a safer passage route than through the turbines (NMFS 2008a). Survival rates of resident fish species are uncertain at AFD because no studies have been conducted.

Fish entrainment during the winter is generally lower than at other times of the year (HTI 2009). This is likely due to the relative inactivity of fish during the winter. Relatively high outflow, which typically translates to high river velocities, can also affect fish entrainment as fish can be swept downstream to dams by the high currents. At AFD, outflow and river velocity is relatively low during the winter. Outflow is usually higher during the spring (see Table 3-1), and often can exceed 100 kcfs. Fish entrainment at AFD is likely highest during the spring and summer when fish are more active and river flows increase.

3.8.2. Downstream of Albeni Falls Dam

Fish species found downstream of AFD are similar to those found upstream. Common species downstream of AFD include tench, pumpkinseed, largemouth bass, and black crappie (DuPont and Bennett 1993). More detail can be found in the VARQ EIS. The Kalispel Tribe raise largemouth bass in a hatchery along the downstream river to improve fisheries in the river.

Habitat

Aquatic habitat downstream of AFD is greatly influenced by BCD as well as outflows from AFD. The BCD reservoir has historically been maintained at 2030 feet during the winter months (FERC 2004). At this elevation, the reservoir backwaters AFD by about 2 feet. This results in more aquatic habitat than would exist without BCD, especially under lower flow conditions. At typical winter flows, average river velocities are on the order of 1 foot per second (fps) or lower depending on the location (Figure 4-7). Velocities would be higher in the center of the river, relative to this average, and slower along the margins. This creates habitat conditions suitable for nonnative warmwater species such as bass. At a flow of 40 kcfs, average river velocities increase by 1 fps to about 2 fps depending on the location. As flow increases, backwater habitats become flooded providing additional habitat for aquatic species. A qualitative analysis of river cross sections surveyed about every quarter mile in 2006 and 2007 between AFD and BCD indicates that this backwater habitat becomes flooded as flows increase above 30 kcfs. At lower flows, the river is relatively confined in its channel.

Stranding

EES Consulting (2008) identified 13 potential fish stranding locations between AFD and BCD, primarily along the east side of the river along the Kalispel Indian Reservation. The criterion used to make this determination was a 3-foot drop in river stage within 12 hours. The study correlated the 3-foot stage change with a flow change of about 20 kcfs. They predicted that at all the sites identified, a 3-foot stage change over a 12-hour period would result in a potential stranding event, if flows were at least 45 kcfs when the stage drop occurred. The AFD ramping rates of 10 kcfs per day and 5 kcfs per hour are below the criterion identified in the study indicating that these ramp rates were thought to be sufficient to avoid stranding fish. Thirteen fish species were collected in the potential stranding areas. Most of the fish were nonnative warmwater species with perch, pumpkinseed, tench, and largemouth bass constituting the vast majority. Given the propensity of many nonnative warmwater fish species to seek quiet shallow backwater habitat, they would probably be the most vulnerable to isolation or dewatering in a stranding event.

Winter flows are usually quite steady. This limits the potential for fish stranding. The Box Canyon Reservoir is typically held at a constant elevation of 2030 feet during the winter months. This also minimizes the variability in river stage during the winter, making stranding unlikely during the winter between AFD and BCD.

Downstream of BCD, the reservoir for Boundary Dam fluctuates between elevations 1,990 feet and 1,970 feet on a daily basis during the winter. This likely results in stranding of fish in this reach.

Entrainment

Fish entrainment occurs at Box Canyon, Boundary, Seven Mile, and Waneta dams downstream of AFD. Entrainment studies have not been conducted at BCD, but turbine passage mortality rates were estimated at approximately 5.5 percent for fish less that 8 inches in length and 10 to 30 percent for fish greater than eight inches long (FERC 2004). A study at Boundary Dam conducted from March 2008 to February 2009 found that fish entrainment was lowest during the winter with an estimated 736 fish passing through the dam in December, 755 in January, 1,064 in February, and 3,293 in March (HTI 2009). Entrainment was greatest during the late spring and summer months, from May to September, with peak passage observed in July 2008 (13,209 fish). Black crappie and burbot represented the primary species in November 2008. Black crappie was most common in both December 2008 and January 2009. Burbot was the most common species during the late winter months (February 2009 and March 2008). No bull trout were collected.

3.9. ANADROMOUS FISH

A number of anadromous species such as salmon and steelhead occupy the Columbia River Basin. These species historically did not migrate as far upstream as AFD due to natural fish passage barriers downstream. Today, anadromous fish migrate as far upstream as Chief Joseph Dam on the Columbia River. Although no anadromous species are found in the Pend Oreille River, the FCRPS (including AFD) is managed to provide flows for downstream salmon. The SOR EIS, FCRPS BiOps, and Section 3.12 should be consulted for more detail.

3.10. VEGETATION AND WETLANDS

The geographic area for the vegetation and wetlands analysis is Lake Pend Oreille downstream to Grand Coulee Dam.

3.10.1. Upstream of Albeni Falls Dam

Shoreline composition at the summer lake elevation of 2062.5 feet can generally be categorized as non-vegetated or vegetated. The non-vegetated shoreline consists of human-made structures such as retaining walls, riprap bank protection, boat ramps or imported sand beaches, or natural features such as native rock or gravel bars. Vegetated areas consist of plant communities that have been introduced, such as lawns or ornamental plantings, or naturally occurring communities that are directly influenced by the effects of the lake elevation fluctuations.

Wetlands occur throughout the shoreline of Lake Pend Oreille. An extensive discussion of wetland habitat and vegetation around Lake Pend Oreille can be found in the 1983 AFD EIS. In general, functional wetlands around the lake including the Clark Fork Delta have largely disappeared from elevations between 2062.5 and 2055 feet due to holding the summer lake elevation to 2062.5 for several months. The construction of AFD and subsequent operation resulted in a change from the natural lake elevations in spring and summer. Prior to the dam, the natural lake level would reach higher than 2062.5, but only for a week or two. The lake level then dropped down to about 2056 feet or so. Wetlands surrounding the edge of the natural lake drowned as a result of the reservoir operation. Since the time of construction of AFD, annual lake level fluctuations have continued to erode shorelines and destroy remaining wetlands. Wetlands that still exist between 2051 and 2056 feet elevations are the lacustrine, littoral type. Native species likely to occur within this band include Chara (*Chara* spp.), northern watermilfoil (*Myriophyllum sibiricum*), coontail (*Ceratophyllum demersum*), elodea (*Elodea canadensis*), leafy pondweed (*Potamogeton foliosus*) and other native pondweeds (*Potamogeton* and *Stuckenia* spp.). Nonnative species likely to occur include curlyleaf pondweed (*Potamogeton crispus*) and Eurasian watermilfoil (*Myriophyllum spicatum*) (Madsen et al. 2008). Flowering rush (*Butomus umbellatus*), another nonnative, appears to be spreading in certain areas of the lake within the upper end of the elevation band. Erosion around the lake has also contributed to wetland loss. An erosion line often develops around the lake at the winter lake elevation. This erosion has potential to affect wetland types at higher elevations as it progresses and begins to undercut root systems.

Invasive Plant Species

Lake Pend Oreille and the Pend Oreille River upstream of AFD are impacted primarily by two invasive aquatic plants, Eurasian watermilfoil and flowering rush. Each has become established in the lake and river in recent years. Both species outcompete and displace the native vegetation.

Flowering rush is an emergent aquatic perennial considered an invasive noxious weed. This species was first confirmed in the lake in 2008, covering nearly 12 acres at the Clark Fork Driftyard. Already (in 2011) the plant has increased its extent to approximately 20 acres in the Clark Fork Driftyard area. Other smaller infestations exist around the lake and the Pend Oreille River. It is found in riparian zones, wetlands, and aquatic environments to depths of about 13 feet, including a few plants found in Oden Bay (Hull 2011). Transport through water and ice have been identified as important dispersal mechanisms for flowering rush (Eckert et al. 2003). It probably originated from sources upstream as most of the upstream water bodies have substantial populations of rush with the largest population in Flathead Lake (Parkinson et al. 2010). Fluctuating lake water levels and, in particular, drawdowns that expose unvegetated sediments provide ideal sites for its establishment (Delisle et al. 2003). Therefore, existing AFD operations, especially during spring refill and fall drawdown, likely contribute to the spread of flowering rush around the lake.

Eurasian watermilfoil is a rooted perennial dicot and is considered an invasive noxious weed. Watermilfoil was identified in the Pend Oreille River upstream of AFD in 1992 (Dupont and Bennett 1993). It is currently located in most bays throughout the lake and numerous areas along the shoreline of the Pend Oreille River. Eurasian watermilfoil has been found at depths of 3 to almost 30 feet, with most at 6 to 25 feet (Madsen and Wersal 2008). It is primarily spread through the water (the plant is easily broken and the floating parts can easily re-establish at other locations). Eurasian watermilfoil can be killed by freezing and desiccation (i.e., by exposure of the substrate above water in winter). Stanley (1976) found that plants were killed when exposed to below-freezing temperatures for 96 hours after water drawdown. Short-term drafting of Tennessee Valley Authority reservoirs during cold conditions reduced infestations without increasing spread in deeper water (Goldsby et al. 1978). This method of control has been observed around Lake Pend Oreille. Prolonged exposure to freezing temperatures with no snow blanket is most useful and provides some control above the winter minimum elevation (2051 to 2055 feet depending on the MCE). In years when the MCE is set at 2055 feet, watermilfoil typically covers a greater extent during the following summer compared to years when the MCE is 2051 feet, since less is killed during the winter (i.e., the additional 4 feet band of plants that aren't killed give the plant a "head start" of growth in the spring) (Hull 2011). The winter and spring air tempertures also play a role in determining the summer extent of watermilfoil. If temperatures are colder than average during this time, watermilfoil is generally less extensive compared to winters that are warmer. Establishment of milfoil several feet deeper than the lowest minimum winter elevations has made elimination by winter exposure impossible.

The Corps has a representative on the Bonner County Aquatic Invasive Species Task Force. The taskforce helps to lend guidance to the Idaho Department of Agriculture which performs aquatic surveys for the presence of invasive species around the lake. Depending on the depth of the winter drawdown, and on survey results, herbicides and other means of control including hand harvesting are used to address the spread of invasive plants in the system.

3.10.2. Downstream of Albeni Falls Dam

Numerous wetlands exist downstream of AFD that are periodically inundated at higher river flows. As discharge varies, wetlands, particularly littoral wetlands, may alternatively be dewatered and inundated. Operations at BCD that result in fluctuating reservoir elevations at various times of the year may also affect these wetlands.

Invasive Plant Species

Flowering rush had not been found downstream of AFD until recently, when a few plants were observed at the upstream end of an island not far below AFD (Hull 2011). This indicates that the plant is beginning to spread through the reservoir and is finding its way over or through the dam. Eurasian watermilfoil exists downstream of AFD, but is not affected by current operations.

3.11. WILDLIFE

The geographic area for the wildlife analysis is Lake Pend Oreille downstream to Grand Coulee Dam.

3.11.1. Upstream of Albeni Falls Dam

The shoreline of Lake Pend Oreille and the river deltas of the Pack River and Clark Fork provide a diverse range of aquatic and upland habitat types. These habitat areas support species of small and large mammals, several species of amphibians and reptiles, and numerous bird species. Various raptor species and 22 species of waterfowl nest around the lake. The redhead duck (*Aythya americana*) population that overwinters on the lake may be the largest in the U.S. More detail on wildlife species can be found in the 1983 AFD EIS.

AFD operations affect wildlife predominantly through effects on habitat. As described in Section 3.5, significant erosion is occurring around the lake that negatively affects riparian vegetation and wetland habitat used by many wildlife species. This has likely affected wildlife populations around the lake.

3.11.2. Downstream of Albeni Falls Dam

Wildlife species found downstream of AFD are similar to those upstream. AFD has likely had minimal effect on downstream wildlife. Effects would be from modifications of the natural hydrology, which is not extensive. These effects are probably limited to some likely, but unknown, decrease in wetland habitat along the river as a result of removing flood peaks.

Daily power operations of dams downstream of AFD affect areas along unarmored (especially steep) banks. The hydraulic effects destabilize banks by removing material at their toes, destabilizing the strength of the supporting column and resulting in collapse of surfaces. While these erosional affects manifest themselves primarily at steeper locations, decreases in wetland habitat might also occur as a result of removing flood peaks. Effects to wildlife are generally minimal, as steep banks are poor locations for most species; however, those that nest in sandy banks, such as kingfishers, bank swallows, barn owls, even beavers and other aquatic furbearing mammals, could be affected by the collapse of portions of their burrows.

3.12. THREATENED AND ENDANGERED SPECIES

In accordance with Section 7(a)(2) of the ESA, federally funded, constructed, permitted, or licensed projects must take into consideration impacts on federally listed and proposed threatened or endangered species. The Corps, BPA, and Reclamation have previously consulted with NMFS and USFWS on the effects of the operation of the FCRPS on ESA listed species. The action area for the consultation extended throughout the Columbia River basin. Details on this history can be found in the following documents.

- *Endangered Species Act Section 7(a)(2) Consultation Supplemental Biological Opinion, Supplemental Consultation on Remand for Operation of the Federal Columbia River Power System, 11 Bureau of Reclamation Projects in the Columbia Basin and ESA Section 10(a)(I)(A) Permit for Juvenile Fish Transportation Program* (NMFS 2010).
- *Endangered Species Act Section 7(a)(2) Consultation Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation. Consultation on Remand for Operation of the Federal Columbia River Power System, 11 Bureau of Reclamation Projects in the Columbia Basin and ESA Section 10(a)(I)(A) Permit for Juvenile Fish Transportation Program (Revised and reissued pursuant to court order, NWF v. NMFS, Civ. No. CV 01-640-RE (D. Oregon))* (NMFS 2008b).
- *Biological Opinion. Effects to Listed Species from Operations of the Federal Columbia River Power System* (U.S. Fish and Wildlife Service 2000).

The NMFS BiOps evaluated FCRPS effects on a number of anadromous salmonids, green sturgeon, and southern resident killer whale. This included analysis of the effect on critical habitat for most of the salmonids and killer whale. None of these species is currently or was historically present in the Pend Oreille River. Historically, natural migration barriers prevented anadromous salmonids from accessing the river. However, because downstream salmonids are potentially affected by alterations in streamflow, the BiOp includes recommended FCRPS flow objectives. As an FCRPS storage project, AFD plays a role in meeting these flow objectives.

The USFWS BiOp (USFWS 2000) concluded that the FCRPS is not likely to adversely affect the following ESA listed species:

- endangered grizzly bear (*Ursus arctos horribilis*),
- endangered gray wolf (*Canis lupus*), (gray wolf was recently delisted)
- endangered woodland caribou (*Rangifer tarandus caribou*),
- threatened Canada lynx (*Lynx canadensis*),
- threatened Northern Idaho ground squirrel (*Spermophilus brunneus brunneus*),
- threatened Macfarlane's four o'clock (*Mirabilis macfarlanei*),
- threatened water howellia (*Howellia aquatilis*),
- threatened Ute ladies'-tresses (*Spiranthes diluvialis*), and
- threatened Spalding's catchfly (*Silene spauldinii*)

These species are either not aquatic or are aquatic but do not occur in the areas directly affected by operation of the FCRPS. Indirect effects are either not likely to occur, or are very minor for the above species, and are not likely to rise to the level of adverse effects, regardless of how the FCRPS is operated. At the time of the consultation, critical habitat had not been designated for any of the listed species within the action area or covered by the BiOp. Effects to critical habitat were therefore not analyzed in the BiOp.

The USFWS BiOp concluded that the FCRPS is not likely to jeopardize the continued existence of the threatened bull trout (*Salvelinus confluentus*). Effects identified included migration, downstream fish passage, entrainment, gas supersaturation, power peaking, temperature, isolation of spawning habitat. The BiOp also found "harm to bull trout in Lake Pend Oreille through changes in the water level elevations, which in turn may reduce kokanee egg to fry survival and, subsequently, the kokanee forage base. This may exacerbate predator-competitor interactions among top-end predators, including bull trout." USFWS issued an incidental take statement and reasonable and prudent measures. USFWS estimated that an unquantifiable number of bull trout will be taken annually as a result of the FCRPS.

Reasonable and prudent measures specifically relevant to AFD include:

(1) 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.

(2) The action agencies shall continue the lake winter elevation study to promote kokanee spawning/ recruitment along the shore of Lake Pend Oreille.

These measures are being implemented.

Fish passage is currently being studied at the feasibility level. The feasibility investigation will likely include the construction and operation of a prototype facility. The lake winter elevation study for kokanee has been completed and annual operations are conducted to promote kokanee spawning and recruitment.

Critical habitat has recently been redesignated for the Columbia Basin distinct population segment of bull trout and includes Lake Pend Oreille and the Pend Oreille River (USFWS 2010). The Corps, BPA and Reclamation are currently coordinating with the USFWS concerning reinitiation of consultation to evaluate the effects of the FCRPS on the newly designated critical habitat. In the interim, the agencies determined that current operations including measures adopted under the USFWS and NMFS BiOps are sufficient, and no irretrievable or irreversible actions are occurring that would preclude additional reasonable and prudent alternatives that may be discussed during the consultation (Reclamation 2011).

A draft recovery plan for Pend Oreille basin bull trout was completed by USFWS in 2002 (USFWS 2002). Important elements of the plan include limiting water quality impacts associated with TDG, restoring normative hydrologic function, providing AFD fish passage, limiting entrainment, and meeting minimum instream flows below AFD.

3.13. CULTURAL RESOURCES

The geographic area for the cultural resources analysis is Lake Pend Oreille downstream to Grand Coulee Dam.

3.13.1. Upstream of Albeni Falls Dam

There are 394 prehistoric and historic archaeological sites and other cultural resources (totaling approximately 910 acres) at the Project that are important to the region's Indian tribes (Corps 2008). Of the total number, 175 are on public lands. Two Archaeological Districts proposed for listing in the National Register of Historic Places—East Pend Oreille Lake Rock Art District and Upper Pend Oreille River Archaeological District—also are present.

Most of the sites are located between elevation 2062.5 and 2051 feet. The 323 total sites in that range cover 456 acres; the 148 sites on public lands cover 354 acres. The sites within this elevation range all have been degraded to varying extents (mostly severe) by erosion that occurs as a result of AFD operations. This integrity assessment is based mainly on comparing records of surface inspections at all non-petroglyph sites during inventory and monitoring from the mid 1980s to the present with the results of evaluation at 45 sites with similar slope, fetch, and soil erodability characteristics. The areas within the drafting zone at 270 sites have been assessed through such comparison.

The kind of effect at any given site depends on beach slope, sediments, and fetch and reach factors. Whether an effect is adverse or not depends upon whether the site has significance under one or more of the criteria for establishing eligibility for inclusion on the National Register of Historic Places. Site areas submerged close to the water surface may also be subject to loss of stratigraphic integrity through erosion by plucking and scour from wave turbulence; however, this kind of effect is less likely than that resulting from scarp-cutting at the pool margin. Sites also may be affected by plowing caused by high winds driving broken ice into them, although adverse effect from this mechanism probably is a rare occurrence, and effect on sites with remaining significance in the drawdown zone could occur in only a few locations. On the east side of Lake Pend Oreille, petroglyphic (graven) rock art sites that have glyphs in the zone affected by winter drafting also have been damaged and would be affected by continuing the existing operation at AFD. Effects result mainly from erosion caused by the action of wave-suspended abrasive particles, rock spalling from wave-induced hydraulic pressure in joints and voids in the rock, and mechanical effects of ice expansion in substrate joints.

Management and Compliance with National Historic Preservation Act

The SOR EIS evaluated cultural resource site damage based on erosion at a number of specific projects, including AFD, and concluded that the effects are significant under NEPA and adverse under the National Historic Preservation Act (NHPA) and its implementing regulation (36 CFR Part 800). To formalize commitments made by the Corps, BPA, and Reclamation in their respective RODs, a Systemwide Programmatic Agreement for the Management of Historic Properties Affected by the Multipurpose Operations of Fourteen Projects of the FCRPS ("SWPA") was developed to address adverse effects. The SWPA was ratified by the agencies in October, 2009. The SWPA defined the undertaking as all project operations (reservoir management and implementation of Minor Construction in Support of Operations), including future modifications to the operating regime of any or all of the 14 identified FCRPS projects. The SWPA called for development of project-specific Historic Properties Management Plans (HPMPs) to inventory, evaluate, assess effects (e.g., by monitoring erosion at known or potential sites), and develop treatments for historic properties including archaeological sites and Traditional Cultural Properties being adversely affected by AFD operations.

At AFD, cultural resources are managed according to an HPMP (Corps 2008) that details resource management actions and priorities in compliance with provisions in the SWPA. Actions include monitoring of erosion at specific sites, minor data recovery of threatened features at archaeological sites, bank stabilization for erosion control, and curation of recovered data. The Area of Potential Effects (APE) for the HPMP is defined as the geographic area within which historic properties could be either directly or indirectly affected by AFD operations for all authorized present and foreseeable future purposes on federal fee lands and other real property where the U.S. Government has a current and future legal interest, and non-federal lands where AFD operations cause an adverse effect. The APE generally is Lake Pend Oreille and the Pend Oreille River upstream of AFD, between elevation 2,051 feet and 2,080 feet, or the limits of fee parcels taken for recreation and wildlife management purposes.

3.13.2. Downstream of Albeni Falls Dam

Approximately 120 prehistoric and historic (post-Euroamerican settlement) archaeological sites downstream of AFD (in the Pend Oreille River reach from BCD all the way upstream to AFD) are affected directly by erosion related to BCD or AFD operations. The character and extent of cultural resources potentially affected within this reach would be similar to those described above around Lake Pend Oreille, with the exception of rock art sites, which are not known in this area. Effects also occur in the reservoir of Grand Coulee Dam. Sites along unarmored banks in that reach are being affected by erosion at variable stages that result from daily power operations. The hydraulic effects destabilize banks by removing material at their toes, destabilizing the strength of the supporting column and resulting in collapse of surfaces containing archaeological deposits. The APE referenced above is limited to the federal lands surrounding AFD. It thus does not extend to any notable degree downstream of the dam.

3.14. RECREATION

The geographic area for the recreation analysis is Lake Pend Oreille downstream to BCD.

3.14.1. Upstream of Albeni Falls Dam

Lake Pend Oreille and the Pend Oreille River are recreation destinations for boaters, fishers, hunters, and other recreationists on a year-round basis. Warm weather options include a variety of activities such as boating, fishing, swimming, and kayaking. Based on an IDFG survey in 2003, Lake Pend Oreille was the most popular destination for fishing trips in Bonner County, with 60,297 trips and expenditures of $17.8 million (2003 dollars) (Grunder et al. 2008). Average spending per trip was $295. Cold weather activities include ice fishing, ice skating, and various hunting activities. Popular ice fishing spots are located at various locations around the lake including a spot north of Sandpoint and another near Sunnyside (Brady 2010). Approximately 100 to 200 fishermen will gather near Sandpoint to participate in ice fishing. Waterfowl hunting on and near Lake Pend Oreille and the Pend Oreille River is popular in the fall.

Both motor boats and sailboats are commonly used on the lake. Some boat owners store their boats in the water year-round. Boat ramps are available for launching boats in several locations both on the lake and on the river, when the lake and river are ice-free. Lake elevations affect accessibility of boat ramps, and usability of docks; many dock platforms are fixed above high pool elevation and are thus well above water when the lake is drawn down.

3.14.2. Downstream of Albeni Falls Dam

Boating activities also occur on the river downstream of AFD. Waterfowl hunting is common on and along the river with hunters often times using boats and canoes on the river to travel to popular hunting locations. Downstream ice fishing is less common due to river conditions.

3.15. POWER

The geographic area for the power analysis is Lake Pend Oreille downstream to Grand Coulee Dam.

3.15.1. Albeni Falls Dam

Inflows to AFD are influenced by Cabinet Gorge Dam which lies upstream on the Clark Fork River and is operated as a peaking facility. AFD operation tends to smooth out the large peaks in inflow to Lake Pend Oreille while maintaining the 1-foot winter operating range in the lake. AFD provides power benefits both through its direct ability to generate power and its water storage capacity. While AFD operates as a storage project during part of the year, it is currently operated as a run-of-the-river facility during the winter except when water is stored and released for power purposes (within the one foot operating range) or for flood risk reduction. AFD generates power to help supply regional needs. The powerhouse contains three Kaplan-type turbines. Its generators have a combined nameplate rating[6] of 43 megawatts (MW), and generate an average of 24 MW year-round, enough power to serve approximately 20,000 average U.S. homes. Approximately 20% of the annual power generated at AFD is generated during the winter months between January and March. Throughout the year, water is passed through the AFD turbines generating power for the region. Storage in Lake Pend Oreille reduces peak downstream flows and reduces the amount of water spilled (i.e., not used to generate power) at AFD and downstream projects.

The price of power varies with the time of year and weather conditions. During periods of high runoff in spring and summer, power supply in the system is abundant and, consequently, power prices are generally lower. Storing water during periods of high runoff for flood management purposes and releasing it gradually provides power benefits, because less water is spilled in the system during a time of abundant

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[6] The full-load electrical quantities assigned by the designer to a generator and its prime mover or other piece of electrical equipment, such as transformers and circuit breakers, under standardized conditions; usually indicated on a nameplate attached to the individual machine or device.

water runoff. The stored water is generally released later in the year during periods of higher power value when the water can be used to generate power at AFD and downstream projects to help meet regional power needs. Water storage at AFD for downstream use is important because of high efficiency of power generation at downstream facilities. For example, if it is assumed that one unit of water produces one unit of energy at AFD, then at Grand Coulee that same unit of water would produce about 10 units of energy due to its higher hydraulic head. Therefore, the ability to alter the timing of downstream water delivery from AFD to Grand Coulee Dam can be important in generating energy to help meet regional loads. Additionally, many of downstream facilities have the capability to vary the release of the water during the day to take advantage of price differences during the day.

As described in the SOR EIS, power production on the Columbia River system traditionally has involved three primary objectives within a variety of system and project constraints:

- meeting the region's energy demands,
- optimizing future energy production by refilling storage reservoirs, and
- maximizing energy production to keep regional power rates as low as possible.

BPA sells power to preferred customers at rates known as Priority Firm Power Rates (the current rate went into effect beginning October 1, 2009). The non-slice[7] priority firm rate (average[8], undelivered) is $28.77 per megawatt-hour (MWhr). Applying this rate to the average generation at AFD, the value of the AFD generation would be approximately $6 million annually. However, if this energy were to be replaced with market purchases, the cost would be approximately $8 million. These estimates do not include the value that is derived from capturing and storing water at AFD for later use at downstream projects like Grand Coulee Dam.

3.15.2. Downstream of Albeni Falls Dam

BCD planned turbine upgrades will increase the generation capacity from 69 MW to 90 MW when all four of the new units are placed in service in 2013.

Boundary Dam provides more than one-third of SCL's power. The dam is operated to follow load by shaping water discharges to deliver power during peak-load hours. The dam is SCL's primary load-following resource and its power is used to meet within-hour load needs. The plant generation capability is approximately 1,040 MW when discharging the maximum of 53 kcfs. The reservoir has relatively little active storage (40,843 acre-feet) within the maximum drawdown of 40 feet. SCL uses the Boundary Dam output to serve retail load and to provide up to 48 MW to POPUD under an agreement with the POPUD. In addition, SCL sells non-firm output on the secondary market.

Downstream of Boundary Dam is BC Hydro's Seven Mile Project. The Seven Mile Project, which has a plant capacity of 790 MW, was designed to be in hydraulic balance with the upstream Boundary Dam and is operated in a coordinated fashion with Waneta Dam (plant capacity of 450 MW) to maximize overall benefits of the two projects under the Canal Plant Agreement between BC Hydro and other parties including Fortis BC and Teck Cominco.

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[7] A portion of BPA's customers have signed long-term contracts to purchase a "slice of the system" for a fixed price. Other customers pay a price per MWhr purchased. For the purposes of this analysis we are using the per MWhr rate known as the non-slice priority firm rate.

[8] The actual rate paid by an individual customer will vary according to the shape of the load and the products and services purchase.

Downstream of the confluence of the Pend Oreille River and the Columbia River lies Grand Coulee Dam, the first federal project downstream of AFD. Grand Coulee Dam is the largest hydropower producer in the United States, with a total generating capacity of 6,809 MW.

3.16. SOCIOECONOMICS

The socioeconomic conditions of the analysis area are provided as background on the human environment. The geographic area for the socioeconomics analysis is Lake Pend Oreille downstream to BCD. In addition the topics of docks and infrastructure, recreation, and power generation are also important to the human environment and are discussed in other sections of the EA.

3.16.1. Upstream of Albeni Falls Dam

AFD is located in Bonner County, Idaho. The incorporated communities of Sandpoint, Ponderay, Kootenai, Hope, and Clark Fork are located adjacent to the lake. Priest River is located along the Pend Oreille River upstream of AFD. Sandpoint is the largest city in Bonner County with a 2010 population of 7,365, growing at 0.8% annually from 2000 through 2010 (U.S. Census Bureau 2010). Bonner County's population was 40,877 in 2010. The County grew by 1.1% annually from 2000 through 2010. The other incorporated communities' populations for 2010 were Ponderay with 1,137 residents, Kootenai with 678 residents, Hope with 86 residents, and Clark Fork with 536 residents.

A number of water supply intakes exist around Lake Pend Oreille (Table 3-2). These intakes are generally not affected by existing AFD operations or have been upgraded to function throughout the range of lake elevations that could occur in response to AFD management activities.

3.16.2. Downstream of Albeni Falls Dam

Immediately downstream of AFD is the town of Oldtown (in Bonner County) and Pend Oreille County in Washington State. The towns of Newport, Cusick, Ione, Usk, and Metaline Falls are all located in Pend Oreille County along the river near AFD, some of which are located within the Kalispel Indian Reservation. Newport is the largest of the towns, with a population of 2,045 in 2010 (U.S. Census Bureau 2010). It grew at an annual average rate of 0.7% from 2000 to 2010. Pend Oreille County's population was 13,100 in 2010. The County grew by 1.2% annually from 2000 through 2010. The other incorporated communities' populations for 2010 were Cusick with 190 residents, Ione with 440 residents, and Metaline Falls with 275 residents.

Chapter 4
Environmental Consequences

The SOR EIS and the 1983 AFD EIS evaluated the effects AFD operations across a range of environmental, social, and economic resources. For the purpose of this EA, the analysis has been limited to those resources potentially affected by FWPO or where new information is available that was not described in the previous documents but is relevant to FWPO. The current AFD operating conditions and influence of those conditions are presented in Chapter 3, Affected Environment. Chapter 4 evaluates effects of FWPO compared to the current operations or No Action Alternative. Current operations and the No Action Alternative are used interchangeably within the following discussion.

As described in the introduction to Chapter 3, the geographic scope of FWPO extends from Lake Pend Oreille downstream to Grand Coulee Dam. The temporal scope is primarily limited to the winter (mid-December to March 31) since that is the time frame of FWPO.

Because of the opportunistic nature of FWPO, countless potential water storage and drafting scenarios could be analyzed. For this reason, a “bookend” scenario was used to analyze effects of FWPO operating within the maximum and minimum lake elevations allowed and using the maximum draft and fill rates possible. This analysis assumes that the MCE is set at 2051 every year. The bookend operations were developed using actual inflows to the project based on historical data. Hydrographs are presented to illustrate how FWPO could vary with years that contained high, medium and low inflows. This helps put FWPO in context so that the reader can compare and contrast potential impacts between current operations (the No Action Alternative) and FWPO. Based on these analyses, FWPO could result in a maximum of three cycles of a complete fill of Lake Pend Oreille from 2051 to 2056 feet followed by a complete draft back to 2051 feet in one winter. The model and its assumptions are further described in Section 4.1.

The bookend scenario is considered unlikely to occur because it does not account for variables such as power demand, weather, and system conditions that would trigger the need to utilize the available storage. The purpose of using the bookend scenario to evaluate FWPO is to ensure that potential impacts have been thoroughly described. Because this bookend scenario is unlikely, the probabilities and specific effects described below, depending on the specific resource, would likely be less than that described for most years. In some cases the bookend scenario does not capture the range of possible effects under FWPO. These cases are identified in the following sections where applicable. Section 4.15, Power is an exception that does not consider the bookend scenario in evaluating FWPO. In this case, use of this scenario would overstate the benefits of FWPO. The approach to analyzing power-related effects is described in that section.

4.1. HYDROLOGY

Under FWPO, there could be greater fluctuation of AFD discharge and the elevation of Lake Pend Oreille during the winter period (December 15 to March 31) compared to the No Action Alternative. In order to evaluate effects of FWPO, a model was developed to simulate these fluctuations based on the bookend scenario. The model fluctuates the lake the maximum extent possible within the constraints established for the project. These constraints include 1) minimum discharge of 4 kcfs, 2) maximum discharge of 45 kcfs, 3) maximum daily change in discharge of 10 kcfs, and 4) maximum change in lake elevation of 0.5 feet per day. The model assumes a starting lake elevation of 2051 feet and that kokanee spawning is complete by December 15. It further assumes that outflow is reduced to minimums to store water as quickly as possible beginning December 15. Once the lake reaches 2056 feet, the outflow is increased up to 45 kcfs to discharge water from the lake. The natural channel constriction at the outlet of Lake Pend Oreille also plays an important role in the model results by limiting discharge depending on the lake elevation. As illustrated in Table 3-2, the lake elevation must be over 2054 feet before 45 kcfs can outflow from the lake and then be discharged at AFD.

The model simulated operations for the last 51 years of historical data from 1961 to 2011. The three winters presented in Figure 4-1 represent the 10th (low), 50th (median), and 90th percentile (high) of the total winter inflow to the dam for the years modeled. This means that of the 51 years modeled, 10 % or 5 of the years modeled had inflow less than that illustrated in Figure 4-1 for the low flow year. Similarly, 10% of the years modeled had inflow greater than the high flow year shown in Figure 4-1.

In order to compare FWPO to the No Action Alternative, two additional models were developed for the No Action Alternative. One model assumed an MCE of 2051 feet (Figure 4-2). The second model assumed an MCE of 2055 feet (Figure 4-3). Each of these models assumes 1) a one-foot operating range above the MCE, 2) minimum discharge of 4 kcfs, 3) maximum daily change in discharge of 10 kcfs, and 4) maximum change in lake elevation of 0.5 feet per day. The models simulated discharge based on a four day average of the future inflow. This assumption was considered sufficient to approximate real time dam regulation which is typically done through a combination of engineering judgment taking into account the near term forecast. These conditions were also modeled for the 51 years of historical inflow. Similar to the FWPO model, the 10^{th} (low), 50^{th} (median), and 90^{th} percentile (high) of the 51 modeled winters are presented below.

4.1.1. Upstream of Albeni Falls Dam

The model indicates that during most winters, it is possible to complete three cycles of draft and fill of the lake from 2051 to 2056 feet. In only two of the modeled years were the results different. The model indicates that during the highest flow year (winter 1995-1996) and the lowest flow year (winter 2000-2001), it is only possible to complete two cycles of draft and fill from 2051 to 2056 feet. In the case of the low flow year, there simply isn’t enough inflow to refill the lake more than twice during the winter period. In the case of the high flow year, the upstream channel constriction does not allow sufficient discharge to lower the lake to 2051 feet.

For the median inflow year, it takes about two weeks to raise the lake from 2051 feet to 2056 feet, and another two weeks to draft the lake back down to 2051 feet. This cycling rate is slightly faster or slower depending on the amount of inflow to the lake. The rate of increase in lake elevation from 2051 to 2056 feet is primarily governed by the amount of inflow and the minimum discharge. This is evident in the variable amount of time it takes to fill the lake to 2056 feet for the three years in Figure 4-1. Occasionally the lake filling is limited by the 0.5 foot per day rate of change.

The decrease in lake elevation from 2056 to 2051 feet is primarily controlled by a combination of the FWPO maximum discharge rate of 45 kcfs (when lake is above 2054 feet), the channel constriction between the lake and the dam (when lake is between 2054 and 2051.5), and the 10 kcfs daily change in discharge (when lake is below 2051.5).

As illustrated in Figures 4-1, 4-2, and 4-3, FWPO fluctuates the lake over a greater magnitude of lake elevation (maximum of 5 feet change) compared to the No Action Alternative which maintains a relatively stable lake elevation (maximum of 1 foot change). This is the primary difference between the alternatives. The bookend scenario assumes that the MCE is set at 2051 feet every year. When the MCE is set at 2055 feet for a given year, there is essentially no difference between FWPO and the No Action Alternative. This is due to the one foot operating range above the MCE that exists for the No Action Alternative. FWPO would not exceed 2056.0 feet.

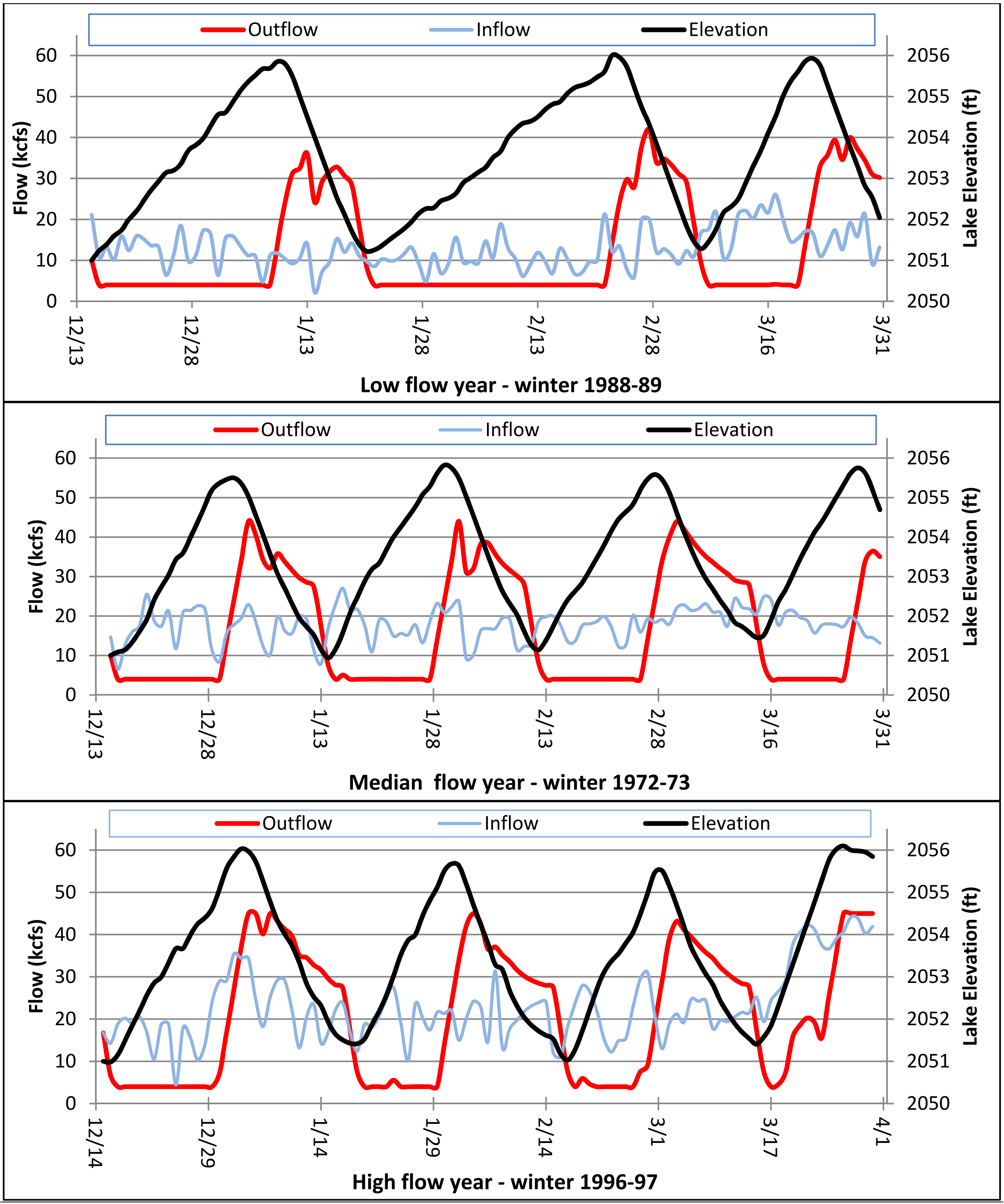

Figure 4-1. Flexible Winter Power Operations Inflow, Outflow, and Lake Elevation for Low (10th percentile), Median (50th percentile), and High (90th percentile) Inflow Years.

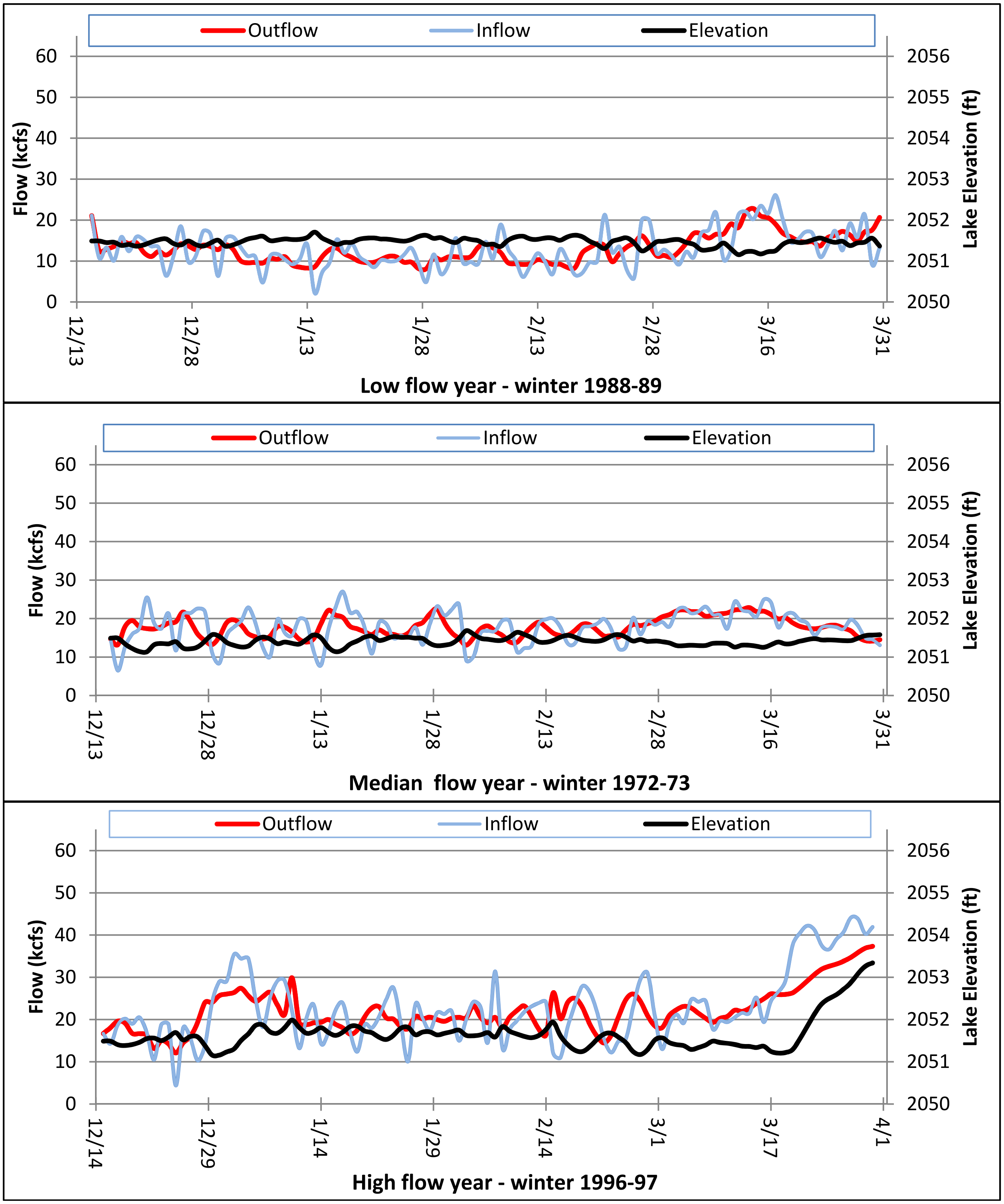

Figure 4-2. No Action Alternative Operations Inflow, Outflow, and Lake Elevation with MCE of 2051 feet for Low (10th percentile), Median (50th percentile), and High (90th percentile) Flow Years.

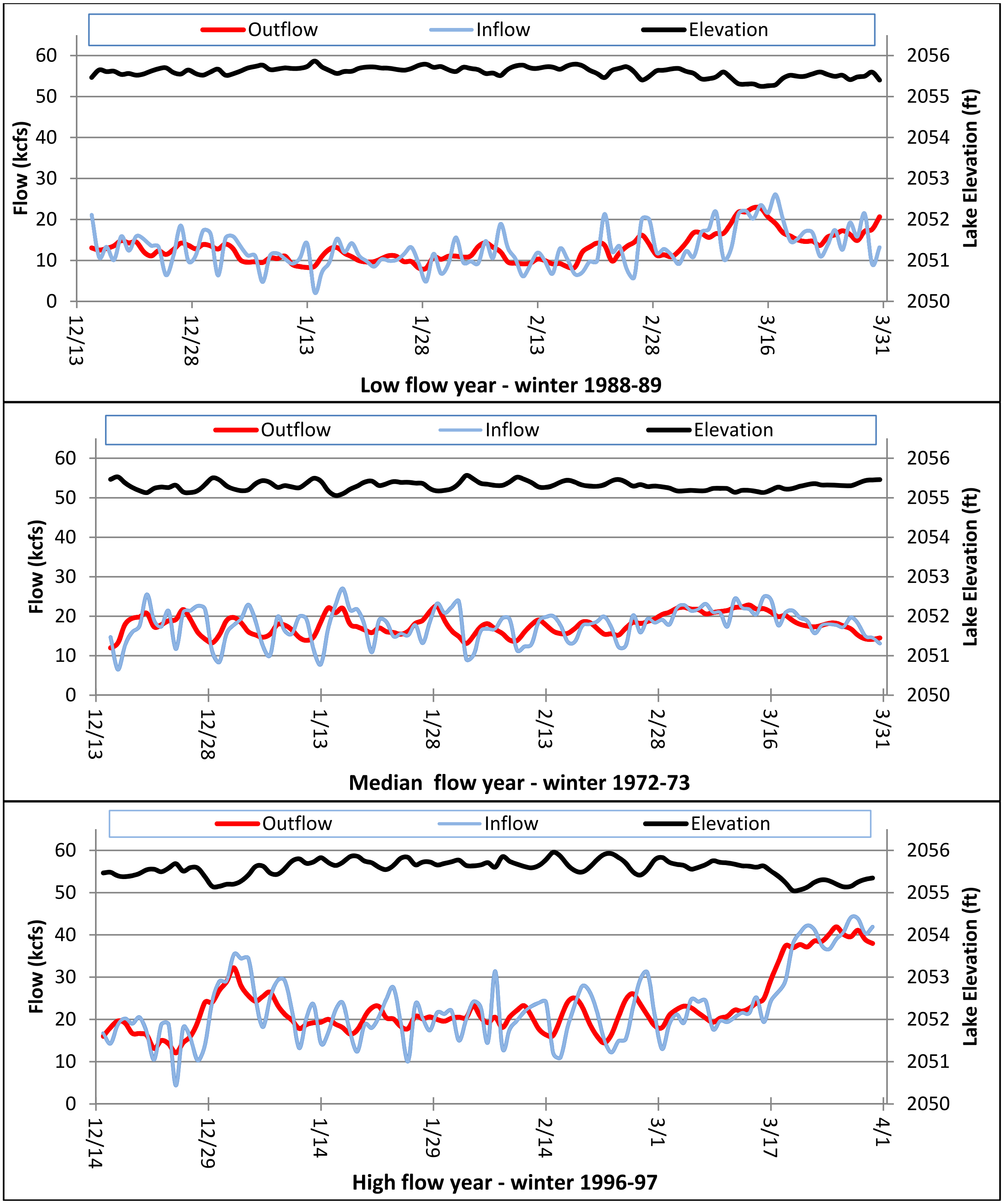

Figure 4-3. No Action Alternative Operations Inflow, Outflow, and Lake Elevation with MCE of 2055 feet for Low (10th percentile), Median (50th percentile), and High (90th percentile) Flow Years.

The hydraulic capacity of the AFD powerhouse is directly related to the lake elevation. For lake elevations between 2056 feet and 2051 feet, the powerhouse capacity ranges from about 32 kcfs to 24 kcfs. Therefore, depending on the lake elevation and desired outflow for FWPO, water could be spilled at the dam. The maximum amount of spill would occur when the lake elevation is 2056 feet and the desired outflow is 45 kcfs. Under this scenario, about 13 to 15 kcfs (45 kcfs total outflow – 32 kcfs powerhouse capacity at 2056 feet depending on turbine efficiency) would be spilled. All other potential spill scenarios would involve a lesser volume of spill. Under FWPO, there are thus likely to be more days of spill during the winter compared to the No Action Alternative. Under current operations as illustrated in Figures 4-2 and 4-3, the spillway is rarely used during the winter.

Figure 4-1 indicates that on March 31, the lake elevation could range between 2051 and 2056 feet under FWPO. It is unlikely that the lake will remain at the higher end of this elevation range until March 31 simply due to the desire to use this stored water for power purposes. AFD operations after March 31 would likely be driven by flood forecasts and downstream flow augmentation requirements. If flood flows are forecast, the lake may be lowered to make storage space available for a flood. Operations (after March 31) would be similar under FWPO and the No Action Alternative.

4.1.2. Downstream of Albeni Falls Dam

The hydrology downstream of AFD is affected by both AFD outflow and the management of BCD. As described previously, the BCD forebay is typically maintained at about elevation 2030 feet. At this forebay elevation, the river is pooled all the way to AFD. As described above, the bookend model scenario indicates that it takes about two weeks to fill the lake from 2051 to 2056 feet on average. During the fill part of the cycle, the discharge is typically reduced to about 4 kcfs which can last two weeks or longer in years with low inflow. As the lake reaches 2056 feet, the discharge can be increased quickly at a rate of 10 kcfs per day from 4 kcfs up to 45 kcfs. This upramp in outflow typically occurs over 4 days. At 4 kcfs, the water surface elevation is about 2031 feet immediately downstream of AFD. With a discharge of 44 kcfs, the modeled water surface elevation is about 2042 feet. This represents a stage change of about 11 feet over a four day period. Each 10 kcfs change in outflow equates to about a 2- to 3-foot stage change immediately downstream of AFD. At river mile 70 near the town of Cusick, there is about a 1.5 to 2-foot stage change with each 10 kcfs change in outflow. This equates to a maximum upramp in the river of 7 feet over four days at Cusick.

The draft of the lake from 2056 to 2051 feet also takes about two weeks on average. As illustrated in Figure 4-1, the changes in discharge (and thus downstream river stage) follow a similar declining trend over this two week period but with more variability. As described above, this is in part due to the channel constriction between the lake and AFD which prevents the maximum discharge of 45 kcfs from occurring. As the lake draft to 2051 is completed, the discharge is reduced at the maximum rate possible. This typically ranges from a change in discharge from about 27-30 kcfs down to about 7-10 kcfs over two days with a final decrease down to 4 kcfs on the third day. This is a common pattern for most of the years modeled. Just downstream of AFD, this equates to about a 5 foot change in stage over two days and another 1-2 feet of stage change on the third day (see Figure 4-4). This stage change gradually flattens out as the river moves downstream. At river mile 70, this equates to about a 4 foot stage drop over two days and another foot or less stage drop on the third day.

With respect to magnitude of stage changes over time, the bookend scenario presented in Figure 4-1 does not necessarily encompass the range of stage changes possible under FWPO. It is possible to manage the lake in a manner that limits the lake fluctuation to elevation 2054 to 2056 feet for instance, and at the same time regulate discharge based on the 10 kcfs per day rate of change constraint during the draft part of the cycle. Under this scenario, discharge could decrease from 44 kcfs down to 4 kcfs over 4 days. Similar to that described above for the upramp under the bookend scenario, this would equate to a drop in river stage of about 11 feet over 4 days immediately downstream of AFD and about a 7 foot drop in stage over 4 days at river mile 70 near Cusick.

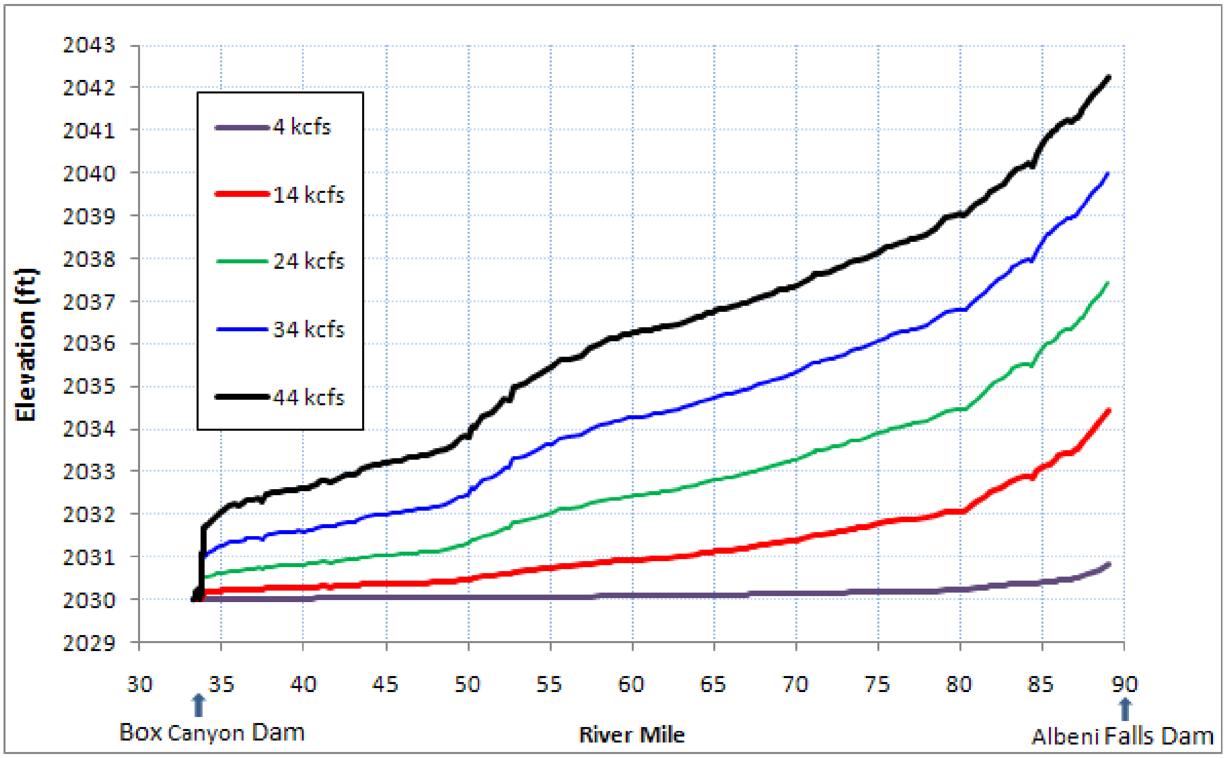

Figure 4-4. Modeled River Stage and Discharge (non-ice conditions) in the Pend Oreille River between Albeni Falls Dam and Box Canyon Dam for the Range of Flows Possible under FWPO (assumes BCD forebay = 2030 feet).

The description provided above is for ice free conditions in the river. When an ice cover exists across the Pend Oreille River, the river stage is generally about one foot higher than that presented in Figure 4-4 depending on the discharge. At a discharge of 44 kcfs, the river stage is about 1.5 feet higher than the non-ice condition. At 4 kcfs, the river stage is only a few inches higher than the non-ice condition.

BCD would likely pass the fluctuations from AFD directly downstream with minimal alteration. Boundary Dam would likely reregulate the flow. Daily flow fluctuations would likely be within the ranges described in Section 3.1 as determined by operations at Boundary Dam. Daily shaping of the flow would also be expected at Seven Mile and Waneta Dams consistent with each project's operations described in 3.1. The effect of FWPO would be seen in the increase or decrease in flow averaged across the entire day. As a daily average, the mean flow in January is about 15.5 kcfs under the No Action Alternative. With FWPO, this daily average could alternately increase to 45 kcfs and decrease to 4 kcfs depending on how FWPO were operated. These average flows would then be passed into the Columbia River. The net effect is that when FWPO is releasing about 45 kcfs, an average of 45 kcfs would enter the Columbia River from the Pend Oreille River. When FWPO is releasing 4 kcfs, an average of 4 kcfs would enter the Columbia River from the Pend Oreille River. Boundary, Seven Mile, and Waneta Dams would likely affect the exact shaping of the flow as described above, but FWPO would nevertheless result in flow and stage fluctuations in the Columbia River. The mean flow for the Columbia River in January is about 70 kcfs at the international boundary. A change in 40 kcfs results in a stage change of about 5 feet in the river at that flow under non-ice conditions (the Columbia River does not freeze over). The FWPO effect on Columbia River stage above Lake Roosevelt would decrease as flows in the Columbia increased. Fluctuations in Lake Roosevelt are due to operations at Grand Coulee Dam. A general rule of thumb is that a 1-foot change in the elevation of Lake Pend Oreille results in a 1-foot change in Lake Roosevelt. This stage change would depend in part on how Grand Coulee was operated.

The difference between FWPO and the No Action Alternative downstream of AFD is the potential fluctuation in outflow from 4 kcfs up to 45 kcfs under FWPO compared to a relatively constant outflow under the No Action Alternative. The mean winter outflow under the No Action Alternative is about 16 kcfs (see Table 3-1). As presented in Figure 4-1, FWPO could result in extended periods of up to two weeks or longer at the minimum outflow of 4 kcfs. This could occur as many as three times for a total of 6 weeks of 4 kcfs outflow during the winter on average. During a low water year, the minimum outflow could occur for about 9 weeks over the winter period. This level of outflow is rare both during the winter and at other times of the year based on historical data (see Table 3-1). Similarly, outflow between 30 and 45 kcfs is relatively uncommon during the winter. This level of outflow is not unusual during other times of the year and flow much greater than 45 kcfs typically occurs during the spring.

4.1.3. Significance and the SOR EIS

The SOR EIS modeled hydrologic conditions for each of the alternatives analyzed. The model simulated average monthly flows and end of month reservoir elevations for 50 years of historical data from 1928 to 1978 for each of the 14 dams evaluated including AFD. AFD relevant results for the 50 modeled years under the SOR EIS preferred alternative are illustrated in Table 4-1. As described in Chapter 2, Alternatives, current operations include the SOR EIS preferred alternative as adopted in the ROD, and as adaptively managed to new information regarding ESA listed species. The post-EIS adaptive management includes managing the elevation of Lake Pend Oreille to support kokanee spawning pursuant to the 2000 USFWS BiOp for the ESA listed bull trout. This is further detailed in Section 3.8. This latter management is not reflected in Table 4-1 but is part of the current operating conditions at AFD.

Table 4-1. Model Results from SOR EIS Preferred Alternative for Albeni Falls Dam (results averaged for 50 years of inflow from 1928 to 1978).

Month	End of Month Elevation of Lake Pend Oreille (feet)	Average Monthly Outflow (kcfs)
October	2054.0	22.8
November	2051.0	21.5
December	2051.1	14.9
January	2051.3	13.5
February	2051.5	17.7
March	2056.0	18.2
April 15	2056.0	27.6
April 30	2056.5	39.5
May	2061.0	52.6
June	2062.8	60.3
July	2062.5	30.0
August	2062.5	10.2
September	2060.0	12.6

The relative significance of the hydrologic effects described under FWPO above is dependent on how they affect the various environmental resources in the project area. This is discussed in subsequent sections of the EA. As illustrated in Table 4-1, the SOR EIS evaluated the hydrologic effect of AFD based on monthly average outflow and end of month lake elevations. The daily hydrologic fluctuations that occur under FWPO both upstream and downstream of AFD were not specifically described or evaluated. The information provided in the EA thus provides additional detail to the effects previously disclosed in the EIS.

4.2. ICE

4.2.1. Upstream of Albeni Falls Dam

Freeze-up under the No Action Alternative would occur near 2051 feet in most years, but could occur anywhere between elevation 2051 and 2056 feet depending on where the MCE was established. Under FWPO, the freeze-up conditions are highly dependent on how the lake is managed. Freeze-up could occur at any elevation between 2051 and 2056 feet with an uncertain probability for any individual elevation. The purpose of the bookend scenario is to capture the range of potential effects that are possible under FWPO. Under the constantly fluctuating lake elevation scenario illustrated in Figure 4-1, the lake ice cover interacts differently with the shoreline compared to a stable lake. Under stable conditions, the ice freezes to the shoreline. When the lake fluctuates, a hinge crack develops between the ice and the shoreline. A minimum of about 24 hours of temperature below about 20 °F is required at a constant elevation to refreeze the hinge crack. As the lake level drops, ice outside the hinge crack or "floating" on the water surface would drop as the water receded. Without the water foundation under the shore-fast ice, the weight of the ice would be supported by the structural integrity of the ice spanning between supports (e.g., large rocks on the shore, piles, and docks). If the weight of the ice or loads on the ice exceeded the bending strength of the ice, the shore-fast ice would break and come to rest on the shoreline or water surface.

If FWPO were operated such that the lake elevation was held constant for some period of time, a thicker ice cover would form at that lake elevation. Similar to the No Action Alternative, a hinge crack would occur along the shoreline separating the floating ice from the shore-fast ice. The hinge crack would have a gentle curvature, smoothing out any perturbations along the shoreline. If the lake elevation was then fluctuated after the formation of a relatively thick ice cover, the 5 foot fluctuation range under FWPO would cause the ice on the water side of the hinge crack to break off and float around the lake. This is less likely to occur under the No Action Alternative. Gouging of the shore by the free-floating ice can occur but would be minimal as the ice floe loses momentum and becomes grounded on the frozen shore.

Under current operations, the winter lake is operated within a 1-foot operating range or less. The day-to-day fluctuation is typically on the order of a couple inches. This gradual rate of change causes the ice cover to freeze with only thermal cracks and no stress-relieving cracks (Corps 2002b). FWPO results in a maximum increase in the lake level of 0.5 feet per day. This rate of increase is gradual enough to allow the ice to relieve stresses internally and maintain active cracks to limit structural loading. If temperatures are below freezing and the lake elevation is relatively static, the active cracks will refreeze. In order to determine how frequently this storage rate is possible while freezing conditions exist, the last 50 years of historical inflow data were evaluated for the bookend scenario. Based on this historical data we estimated how frequently a 0.2 foot and 0.5 foot increase in the lake would occur under FWPO when the previous two days were below freezing. If outflow from the dam was reduced to 4 kcfs, there was at least one day during each of the 50 years analyzed when the lake increased at a rate greater than 0.2 feet per day, and at the same time the two previous days were below freezing. In 7 out of the last 50 years, there was at least one day when the lake increased at a rate greater than 0.5 feet per day while the two previous days were below freezing. As stated above, the ramp rate constraint would limit the lake elevation change to 0.5

feet per day. The above analysis provides some indication of how often this rate of increase in the lake elevation (i.e. 0.5 feet per day) would occur under freezing conditions.

The majority of inflow to Lake Pend Oreille is from the Clark Fork River (Cabinet Gorge Dam) with added contribution from the Priest River (Priest Lake Dam). Under the No Action Alternative, winter inflows from these sources are generally matched with discharge from AFD within the 1 foot operating range. Due to the geometry of the lake, much of this inflow travels quickly to the lake outlet and spends little time actually mixing in the lake. During periods when water is stored in the lake under FWPO, the colder Clark Fork river water is likely to spend more time in the lake possibly allow better mixing with the warmer water in the Bayview area. This could result in better mixed and therefore slightly warmer lake water exiting the lake compared to the No Action Alternative. This warmer water slightly suppresses ice formation on the river above the dam compared to the No Action Alternative.

4.2.2. Downstream of Albeni Falls Dam

Under FWPO, downstream discharge and stage fluctuations from AFD would be more common compared to the No Action Alternative. As stated in Section 3.2, an approximate rule of thumb is that if the increase in river stage is less than two times the existing ice thickness, the ice cover will remain intact. The higher velocity flows combined with slightly warmer water from the lake may melt the ice creating open channels in the ice cover. By the above-mentioned rule of thumb, if river stage increases more than about three times the ice thickness, the existing ice cover will likely break up. Since the change in river stage decreases with greater distance from AFD (Figure 4-4), the ice would not uniformly break up all the way down the river. This means that ice that breaks up further upstream could form an ice jam against the remaining intact ice cover further downstream. Break-up may occur as a progression of ice releases and jams that move downstream. In extreme conditions, the break-up may progress to BCD with ice accumulating in the BCD forebay which interferes with operation of the dam and power production. This scenario is more likely to occur under FWPO because of the more frequent stage fluctuations illustrated in Figure 4-1 (more detail can be found in Tuthill and Zabilansky 2011). Because of this increased risk of ice jams, an Ice Best Management Practice (BMP) has been developed for FWPO. The purpose of the BMP is to minimize the risk of creating an ice jam. The BMP includes real time operational changes in response to ice cover conditions followed by monitoring to confirm what is happening in the river. The detailed BMP can be found in Appendix A. The effect of the BMP is to reduce the risk of forming ice jams to a level similar to that of the No Action Alternative.

4.2.3. Significance and the SOR EIS

The SOR EIS did not specifically describe ice conditions around Lake Pend Oreille or AFD nor effects of the EIS alternatives on ice. The EIS ice discussion was limited to the potential for ice to contribute to erosion along the shoreline. Erosion is further described in Section 3.5. The information and effects described above are thus considered new information relative to the EIS. This new information relative to ice behavior is not considered significant relevant to environmental concerns. Similar to the hydrologic effects described in Section 4.1, the significance of the ice effects is dependent on how they affect environmental resources in the project area.

4.3. DOCKS, INFRASTRUCTURE, AND ICE

4.3.1. Upstream of Albeni Falls Dam

As discussed in Section 3.3, in recent winters the level of Lake Pend Oreille and the Pend Oreille River above AFD has been maintained within a one foot operating range. Structures around the lakeshore remained generally unaffected by ice during these winters. However, the lake can rise several feet under current operations as a result of flood conditions or high inflow. If this occurs when ice exists on the lake, potential effects include 1) flooding of moored boats frozen to the lake bed, 2) damage to floating docks frozen to the lake bed as the water rises, and 3) damage to docks/piles as piles are extracted from the bed. Damage to structures caused by moving ice floes is also possible (primarily during the spring ice break-up), in the river between Lake Pend Oreille and AFD. These scenarios could occur with or without implementation of FWPO.

Under the FWPO bookend scenario illustrated in Figure 4-1, the lake elevation is constantly changing. This scenario would typically maintain an active crack around structures in the lake, and therefore limit the ice forces transferred to the structure and the risk of damage. This scenario could flood boats or damage structures that become frozen to the bed between the elevations 2051 and 2056 feet.

If FWPO were implemented in a manner where the lake was stable for some period of time allowing ice to freeze directly to piles and structures, and then fluctuated, this could result in different effects to structures around the lake. The level of effect would vary depending on the amount of time the lake remains stable and the duration of freezing temperatures. Some considerations related to the level of effect include:

- The exact freeze-up elevation is important in determining the level of potential impact.
    - If freeze-up occurs at 2056 feet, potential for structure damage under FWPO is minimal. This is because a decrease in the lake elevation is not expected to present a vertical ice force problem to shore structures. Potentially, damage may occur if the ice cover upstream of AFD breaks up, creating drifting ice floes that could impact shore structures. Fluctuation in the water level would likely maintain a hinge crack waterward of structures that should isolate them from the ice floes. This should minimize the risk of damage.
    - If freeze-up occurs when the lake is at 2051 feet, there is greater potential for damage due to a rising lake. An increase in the elevation of the lake from 2051 feet to 2056 feet causes additional vertical forces to act on floating docks compared to the No Action Alternative. Docks resting and frozen into the substrate at low lake levels could be restrained from responding to increasing water depth. If all elements of the dock structure are frozen to the bed, they may be submerged depending on the buoyancy of the dock relative to the grasp of the ice. This should not be a structural issue for the dock because there will be no relative displacement. Dock systems that extend below 2051 feet could be damaged as the floating portion of the structure responds to the rising water level while the grounded portion is frozenly securely to the substrate. As the floating portion of the structure responds to the rising water level, the connections between the floating and frozen sections could be damaged. Utilities integrated into the dock system could also be damaged. Effects would depend on the freeze-up elevation and the relative location of the dock to the water line.
- Fixed platform structures (i.e., platform does not float) are also susceptible to damage. Fixed docks' pilings can be unevenly extracted from the substrate by ice causing the dock to develop waves that have to be repaired by redriving pilings. Floating dock systems could experience similar effects to pilings.
- Structures outside the shoreline hinge crack would be subject to uplifting ice forces and could be damaged. If the water level increases, the shore-fast ice would be flooded, while the ice outside the crack would be able to rotate at the hinge crack and relieve the buoyancy force. If the water level change exceeded the ice thickness, the shear strength of the hinge would be exceeded and the ice would move vertically along the hinge to relieve the shear stresses. If the change in water level

exceeded twice the ice thickness, ice beyond the crack would float above the shore-fast ice, defeating protection provided by the shore ice.

- Due to the ice and wind patterns that exist on the lake, damage to dock structures in or near Sandpoint is more likely than in other locations around the lake. The city of Sandpoint constructed a marina with floating docks in 2009 that could be susceptible to damage. Some of the docks are sitting on the lake bed at elevation 2051 feet, while some would be encased in ice. Some of the docks at Sandpoint are supported by a flotation element that is a smooth plastic tub. In these cases, the plastic may limit the bond with the frozen substrate, minimizing distortion of the dock elements.

Existing AFD operations include some water level fluctuations in the winter, as the lake level is managed within a one foot operating range above the MCE. A gradual rate of increase allows the ice to deform around the pile relieving forces on the pile. FWPO results in a maximum increase in the lake level of 0.5 feet per day. This rate of increase is still considered gradual enough to allow these ice-pile stresses to be relieved. It is anticipated that the 0.5 foot ramp rate for Lake Pend Oreille will reduce the damage to docks around the lake compared to a situation without the ramp rate. Docks constructed in a manner outside of the normal construction practice around the lake (i.e. less structurally sound docks) could be susceptible to damage at the 0.5 foot daily ramp rate. Based on recent observations of the lake, most of the less structurally sound docks are located above elevation 2056 feet and would therefore not be influenced by lake fluctuations between 2051 and 2056 feet under FWPO (Zabilansky 2011b). As described in Section 3.3, structures within the AFD operating range should be designed to withstand fluctuations as they can occur under both the No Action Alternative and FWPO. Additional awareness and maintenance of the shoreline structures will be important to minimizing effects for structures not already constructed to withstand such forces.

A model of ice conditions based on temperatureindicates that the entire lake will typically have an ice cover. Based on local observations, a complete ice cover across the lake rarely occurs. This is likely due to wind causing mixing of the relatively warm water in the lake. Ice is more common in sheltered areas. The model therefore appears to more accurately reflect ice conditions in these more sheltered areas of the lake, and would be considered conservative for most parts of the open lake. Due in part to this model uncertainty, there is some uncertainty associated with potential dock damage caused by FWPO. Weather conditions and other factors also contribute to this uncertainty. Under FWPO, there are many factors that would work together to limit dock damage. These include:

1. A gradual change in lake elevation of less than 0.5 feet per day. Usually this will be much less, more likely on the order of 0.2 feet per day during freezing conditions. These rates of change should not result in damage to docks even if ice is present. Rates near 0.5 feet per day would only occur when there is relatively high inflow to the lake. These high inflow conditions would typically occur when weather is above freezing and dock damage is not a concern. In rare cases when high inflow occurs and freezing conditions exist (such as in 1996), dock damage is possible as stated above. In 1996, the rate of increase was 4 feet over 4 days. This latter scenario exists with or without FWPO and would not be exacerbated by FWPO.

2. Implementation of the ice BMP. This is designed to reduce risks downstream of AFD, but it would have incidental benefits upstream by further limiting the amount of change in the lake elevation when ice conditions exist around the lake.

3. The relative warmth of the lake. Temperature of the water in the lake has to be below 39.2°F before any significant ice can form. The volume of water in the lake would subsequently delay the ice growth.

4. Typical weather conditions. Freezing conditions typically persist for only about two weeks or less at a time around Lake Pend Oreille. This is the absolute minimum amount of time necessary to sufficiently lock floating structures into the ice so that they are unable to float when the lake is raised. In order for floating structures to become locked into the ice, the two straight weeks of freezing conditions must also coincide with at least three weeks of dry air conditions (starting one week prior to the two week freeze). For pile related damage to occur, the lake would have to be relatively stable during the minimum two week period of freezing temperatures in order to allow ice to form a tight bond to any piles or other structures. As soon as the air temperature rises above freezing, any ice bond to piles or other structures would melt thereby eliminating the potential for damage.

5. A stable lake at low elevation. In order for pile related dock damage to occur, freezing conditions are required when the lake is low (i.e. 2051 feet) followed by raising the lake. Under FWPO, water is more likely to be stored raising the lake level to 2056 feet. If freezing conditions occur when the lake is at 2056 feet, there is minimal concern for damage to docks, as stated in the EA. When the lake is lowered, ice around any structures would fail due to gravity.

6. More regular lake fluctuations under FWPO. Fluctuations tend to maintain a small space or active crack between the ice and any structures such as piles. This prevents the ice from freezing directly to the pile. The active crack limits the load transferred to the structure reducing potential for damage.

All of these factors together support the conclusion that FWPO would not increase the risk of dock damage around the lake compared to current operations. Having said this, there are some differences in the nature of this risk under FWPO compared to current operations. Currently, the lake is maintained at a relatively stable elevation throughout the winter. If there is high inflow that occurs after a period of freezing temperatures (such as occurred in 1996), there is potential for dock damage. Under FWPO, this scenario is less likely to cause dock damage because the lake may be fluctuating (as opposed to stable) which would maintain active cracks around any structures. The presence of these active cracks would limit the potential for damage when the lake rises. This is contrasted with the scenario whereby the Corps and BPA have maintained a relatively stable lake and then decided to store water after a period of freezing conditions. The factors identified above would have to line up for this scenario to increase the risk of dock damage.

Due to this remote scenario and the model uncertainty described above, the Corps and BPA intend to implement a new minimum lake level fluctuation SOP under FWPO. The SOP would entail monitoring ice conditions around structures on Lake Pend Oreille and actively fluctuating the lake during the winter when power operations are not occurring. The purpose of the SOP is to maintain some minimum lake fluctuation sufficient to maintain the active cracks around structures (i.e. piles) and a hinge crack along the shoreline of the lake. The SOP is intended to help minimize the risk of damage to structures around Lake Pend Oreille. The implementation of the SOP may over the long term decrease the overall risk of damage to structures from all scenarios combined including those scenarios that occur independent of FWPO. The SOP will not eliminate all risk of damage. For example, flooding of boats and structures frozen to the bed between 2051 and 2056 feet could still occur.

4.3.2. Albeni Falls Dam

As described previously, the AFD spillway gates are typically not used during the winter period because of the generally lower discharge requirements and minimal ice received under current operations. Since FWPO results in more lake fluctuation, there is greater potential for ice to break from the shoreline and be transported to AFD. This ice needs to be passed downstream thru the spillway in order to prevent it from collecting at the dam. FWPO would thus likely increase the need to use the spillway to pass ice downstream.

4.3.3. Downstream of Albeni Falls Dam

Stage fluctuation in the river downstream of AFD under FWPO would maintain the hinge crack that smoothly follows the contour of the shoreline. Structures on the landward side of the crack would be protected from the ice floes in the river. Structures extending beyond the crack would be subject to impact from floating floes. If the water level decreases by three times the ice thickness, the ice outside the shoreline crack will drop with the water level and may break free. If the ice floes do break free, shore structures extending beyond the shoreline crack could be damaged by the drifting floes. If the change in water level increases by more than three times the ice thickness and the ice cover breaks up, shore structures will be damaged as the ice jam progresses downstream. As described above, a BMP has been developed to reduce ice break up and ice jam formation in the downstream river. The BMP should reduce the risk of damage to structures in the downstream river.

4.3.4. Significance and the SOR EIS

The SOR EIS did not discuss or analyze effects of ice and water level fluctuations on docks and infrastructure around AFD. The information and analysis presented in this EA is thus considered new information relative to the EIS. There are potential effects to docks and infrastructure both upstream and downstream of AFD under FWPO. The ice BMP implemented as part of FWPO is expected to reduce the risk of ice jam formation downstream of AFD. With the BMP, FWPO should not increase the rate of ice jams or structure damage downstream of AFD compared to the No Action Alternative. The lake ramping rate of 0.5 feet per day along with the minimum fluctuation SOP and ice BMP are expected to reduce the risk of damage to structures around Lake Pend Oreille to a level where there is no difference between FWPO and the No Action Alternative. The one exception is the increased risk of damage to less structurally sound docks around the lake under FWPO. Since most of these docks are above the range of lake fluctuations under FWPO, the prevalence of this effect is expected to be low.

4.4. FLOOD RISK REDUCTION

4.4.1. Upstream of Albeni Falls Dam

Existing flood risk reduction activities would take precedence over implementation of FWPO. Therefore, no change in flood risk would occur as a result of FWPO. FWPO could cause an ice jam in the Pend Oreille River between the lake and AFD, which could result in flooding. This would depend on temperature, ice, and discharge conditions. Based on modeling data, the lake ramping restriction of 0.5-foot per day appears to be sufficient to avoid formation of an ice jam at this location. However, as models have a certain degree of uncertainty, the Corps will monitor temperature and ice conditions to verify that ice jam formation does not occur. If ice jam conditions develop, operations will be adjusted to minimize risk of creating an ice jam. As stated previously, a BMP has been developed to minimize the risk of creating an ice jam downstream of AFD as a result of FWPO. When implemented, the BMP would have a secondary effect of minimizing conditions that would create an ice jam upstream of the dam. As stated previously, no change in the existing flood risk is anticipated as a result of FWPO.

Ice jam formation in the river between the lake and AFD is more likely to occur when high flows immediately follow a prolonged cold period. The flood could cause a relatively rapid rise in the lake elevation, causing the ice to break and then collect in the river creating an ice jam. This latter scenario could occur under both the No Action and FWPO Alternatives.

4.4.2. Downstream of Albeni Falls Dam

FWPO could increase the risk of flooding downstream of AFD if the downstream river is sufficiently frozen and AFD discharge is increased. These conditions could result in the breakup of the river ice and formation of an ice jam that blocks the river and causes flooding. To minimize the possibility of this occurring, FWPO will be adjusted under these conditions by implementing the Ice BMP described in Appendix A. The BMP was developed to take into account temperature, ice conditions, discharge, and real time monitoring and will guide management of FWPO with the aim to minimize the likelihood of an ice jam downstream of AFD. The BMP would not be considered a restriction on existing operations when a flood risk exists upstream of the dam. Existing flood risk reduction activities will take precedence over any FWPO operation request. In this case, FWPO is no different than the No Action Alternative.

The Corps' management of downstream flood risk (independent of ice jams and the Ice BMP) will continue in the same manner as under current operations and is not changed by FWPO (Corps 2002a).

4.4.3. Significance and the SOR EIS

The SOR EIS discussed and evaluated flooding and damages around Lake Pend Oreille and the downstream river for the various SOR EIS alternatives. This included a discussion of Columbia River System and local flood risk reduction. The EIS indicated that AFD was not regulated for system flood risk reduction. FWPO would not change the flood risk reduction benefits or responsibilities of AFD as described in Section 3.3. FWPO could increase the risk of ice jam formation upstream and downstream of AFD. This risk is reduced to a level comparable to the No Action Alternative with the implementation of the ice BMP. FWPO should therefore not change the risk of flooding either upstream or downstream of AFD. The information on flood risk reduction presented in the EA is considered additional detail to the discussion presented in the SOR EIS. No new flood risk effects from FWPO are anticipated.

4.5. SHORELINE EROSION

4.5.1. Upstream of Albeni Falls Dam

Under FWPO, the maximum winter lake elevation would be 2056 feet followed by drawdown to potentially as low as the annual MCE of 2051 feet, a difference of 5 feet. The variation of lake levels between 2051 feet and 2056 feet up to three times during winter, under FWPO, would result in an increase in net shoreline erosion between these elevations over the No Action Alternative. This increase would be an extension of existing processes related to soil sloughing and piping from the repeated wetting and drying of sediments caused by the water level variation and associated freeze-thaw effects. The magnitude of this increase would vary widely depending on the shoreline substrate and location and would require detailed surveys to quantify. Current operations typically maintain the winter lake at a minimum elevation of either 2051 feet or 2055 feet within either a 0.5 foot operating range in December, or a 1 foot operating range in January through March. This focuses erosion at these specific elevations as described in Section 3.5. Under FWPO, erosion would be decreased at these specific elevations. Wind-wave energy would instead be focused over a broader range of shoreline elevations between 2051 feet and 2056 feet. Erosion also would therefore occur over a broader range of shoreline elevations.

FWPO would result in as many as three draft cycles during the winter, resulting in increased erosion, primarily due to an increase in bank seepage and piping. This impact would be most likely when shore ice is not protecting the upper lake elevations. These increases are expected to be incremental relative to the rate of erosion that occurs throughout the year particularly in the summer.

4.5.2. Downstream of Albeni Falls Dam

The variation in discharge under FWPO would also result in an increase in the frequency and magnitude of water level variation downstream of AFD compared to the No Action Alternative. An increase in the frequency and magnitude of water level change would result in increased erosion, primarily due to an increase in bank seepage and piping. This increase would be an extension of existing processes related to soil sloughing and piping from the repeated wetting and drying of sediments caused by water level variation and associated freeze-thaw effects. These increases are expected to be incremental relative to the existing erosion rate. The above description applies from AFD down to Grand Coulee Dam. The flows associated with the winter operations are expected to be significantly lower than the peak flows experienced annually during the spring snowmelt. For example, in spring 2011, peak flows downstream of AFD were in excess of 100 kcfs. Therefore, impacts on downstream structures or levee systems as a result of the FWPO would be the same as under the No Action Alternative.

4.5.3. Significance and the SOR EIS

The SOR EIS characterized erosion around the FCRPS reservoirs including at AFD and Lake Pend Oreille as a significant effect of the alternatives analyzed. At AFD, the SOR EIS specifically described shoreline erosion and bank recession as an ongoing process related to wave action, soil sloughing and piping from repeated wetting and drying of sediments, and freeze-thaw processes. FWPO could incrementally increase the rate of erosion. This increase in erosion would not be above the levels described in the SOR EIS. As a result, the effects described in this EA are not considered new effects requiring supplementation of the EIS.

4.6. WATER QUALITY—NUTRIENTS

4.6.1. Upstream of Albeni Falls Dam

As described above, FWPO could incrementally increase erosion around the shoreline of Lake Pend Oreille. This incremental erosion along with the constant rewetting of sediments associated with the fluctuating lake could result in an incremental increase in nutrients in the water column. In general, field and laboratory data collected during winter drawdowns of lakes and reservoirs are inconclusive about nutrient release from sediments during refill. Studies at some lakes and reservoirs have found increases in water column nutrients from rewetted sediments (Cooke et al. 1986; Fabre 1988; James et al. 2001). Other studies have documented little to no change in nutrient concentrations (Ladewig and Neilsen 2010; Turner et al. 2005).

For Lake Pend Oreille, the relatively low concentration of phosphorus in the water column (generally less than 10 µg/L) and high pH (generally greater than 8.0) could promote sediment phosphorus release. As a natural lake, Lake Pend Oreille has undergone annual fluctuations for thousands of years. AFD has manipulated lake elevations for the last 50 years. To date, elevated phosphorus levels have not been measured. It is unlikely that the additional fluctuations of the lake under FWPO would result in any detectable increases in phosphorous concentrations above the No Action Alternative. The Corps conducts annual water quality monitoring of the lake. This monitoring activity will verify this assumption.

4.6.2. Downstream of Albeni Falls Dam

Concentrations of nutrients in the river downstream of AFD could increase as a result of erosion of the river bank, fluctuating river levels rewetting the river bank, or water with elevated nutrients discharged from Lake Pend Oreille. Under FWPO, none of these processes is likely to produce measurable concentrations of nutrients in the river. As stated previously, the level of river bank erosion is expected to be inconsequential; therefore, it should not add nutrients to the river. Few studies exist on the impacts of water level drawdown on river sediments and river water quality (Fabre 1992). Fabre (1992) speculated that exposed river sediments could release nutrients when rewetted, but was uncertain about the ultimate impact on the river system. Given that the anticipated stage changes are well within the annual flow range that occurs in the Pend Oreille River, unusual releases of nutrients from bank sediments are not expected.

4.6.3. Significance and the SOR EIS

The SOR EIS analyzed effects of the various alternatives on a number of water quality parameters. The emphasis was on temperature and dissolved gas effects. Turbidity, contaminants and nutrients were also discussed. Chemical contaminants, nutrients, suspended sediments, and aquatic weeds were identified as water quality concerns in the Pend Oreille River subbasin. Detailed background or effects information was not provided for AFD. The information described above under FWPO is more detailed information than was provided in the EIS. No new effects on nutrients are expected as a result of FWPO.

4.7. WATER QUALITY—GAS SUPERSATURATION

4.7.1. Albeni Falls Dam

Compared to the No Action Alternative, FWPO is expected to increase use of the spillway which could increase TDG at the tailwater and persist further downstream of AFD. The spill volume anticipated would typically be less than 10 kcfs when it does occur. Section 4.1 indicates that the maximum volume of spill possible under FWPO is about 13 to 15 kcfs depending on turbine efficiency.

As described in Section 3.7, AFD can spill up to 1 kcfs per spillway bay for a total of 10 kcfs, using a uniform spill pattern, without increasing downstream TDG saturation levels. Spill volumes greater than 10 kcfs could increase TDG saturation levels. Increases in TDG of less than 5% would be expected at spill levels that could be seen under FWPO assuming a uniform spill pattern.

The Idaho water quality standard for TDG is 110% saturation. Potential exceedances of this standard are dependent on both FWPO operations and TDG levels in waters that arrive at the dam from upstream. As described previously, spill activities from upstream dams such as Cabinet Gorge play an important role in the TDG levels both at the AFD forebay and at downstream locations. If TDG levels in the forebay of AFD were just below 110%, it is possible that FWPO could bump the TDG level over 110%. The limited data available indicate AFD forebay TDG is typically between 95% and 105% during the winter period of FWPO (see Section 3.7). This is probably due to the fact that flows this time of year are typically well below the 36-kcfs powerhouse capacity of Cabinet Gorge Dam (see Table 3-1 for mean monthly flows for the Clark Fork River). However, during periods of higher flow the AFD forebay saturation levels could be relatively high.

The above analysis indicates that AFD is unlikely to increase TDG levels under FWPO except on rare occasions. To insure that FWPO does not bump TDG levels above the 110% TDG water quality standard, the Corps would expand its current monitoring of TDG to include the winter months. During the rare occasions when there is potential for AFD discharge to exceed the water quality standard, TDG would be monitored and operations adjusted as necessary to insure there is no exceedance.

4.7.2. Downstream of Albeni Falls Dam

As described in Section 3.7, two dams on the Pend Oreille River downstream of AFD, BCD and Waneta Dam, have powerhouse capacities less than the 45 kcfs maximum discharge anticipated under FWPO. This means spillways at these dams would be used to pass any flow in excess of their respective powerhouse capacities. This, in turn, could increase TDG saturation levels downstream of each dam. After upgrades are completed to BCD in 2015, it should be able to discharge flows greater than 45 kcfs without increasing TDG. Similarly, upgrades to Waneta Dam are expected to increase the powerhouse capacity to about 52 kcfs by 2016.

For the interim period that BCD is being upgraded, winter TDG saturation levels were modeled for the last 51 years of historical data for both alternatives (Table 4-2). The model results presented below represent the total number of days during the winter period that TDG saturation levels are predicted to exceed 110%, 120%, and 130%. For the 51 years modeled, the 10th percentile year (low), 50th percentile year (median), and 90th percentile year (high) are presented. The model indicates that FWPO could result in TDG saturation levels downstream of BCD higher than the No Action Alternative until upgrades to BCD are completed. FWPO discharges greater than 29 kcfs (24 kcfs powerhouse + 5 kcfs spill) would

Table 4-2. Number of Days between December 15 and March 31 Box Canyon Dam Is Predicted to Generate TDG Saturation Levels Greater than 110% under Both Alternatives.

		No Action - lake at 2051 feet			No Action - lake at 2055 feet			FWPO		
		Low	Median	High	Low	Median	High	Low	Median	High
2012 powerhouse = 24 kcfs	Days over 110% TDG (5 kcfs spill)	0	0	15	0	0	20	23	33	49
	Days over 120% TDG (12 kcfs spill)	0	0	3	0	0	9	6	15	25
	Days over 130% TDG (20 kcfs spill)	0	0	0	0	0	0	0	1	8
2013 powerhouse = 25.5 kcfs	Days over 110% TDG (5 kcfs spill)	0	0	12	0	0	18	20	28	42
	Days over 120% TDG (12 kcfs spill)	0	0	0	0	0	7	4	11	21
	Days over 130% TDG (20 kcfs spill)	0	0	0	0	0	0	0	0	0
2014-15 powerhouse = 33 kcfs	Days over 110% TDG (5 kcfs spill)	0	0	0	0	0	7	3	11	20
	Days over 120% TDG (12 kcfs spill)	0	0	0	0	0	0	0	0	0
	Days over 130% TDG (20 kcfs spill)	0	0	0	0	0	0	0	0	0

likely result in 110% TDG saturation levels. Discharges exceeding 36 kcfs (24 kcfs powerhouse + 12 kcfs spill) would be required to reach 120% saturation. The model predicts more total days of TDG above 110% between 2012 and 2016 under FWPO compared to the No Action Alternative. The years 2012 and 2013 are noticeably higher compared to 2014 and 2015. The type of flow year is important in determining the degree of effect. For a median flow year, there are predicted to be a total of 33 days with 110% TDG or greater in 2012. This decreases to 11 days in 2014 due to BCD powerhouse upgrades. When these high TDG levels do occur, they could occur anywhere from one day up to about 10 or more consecutive days.

TDG greater than 110% saturation is a exceedance of water quality standards as administered by the State of Washington (WAC 173-201A-200(1)(f)) and the Kalispel Tribe of Indians. As described in Section 3.7, BCD is currently being upgraded. This construction includes a water quality certification from WDOE that requires the POPUD to develop a plan to comply with the state TDG criterion of 110% saturation within 10 years.

The Waneta Dam spillway is currently used when its discharge is greater than 33 kcfs. As described in Section 4.1, Boundary, Seven Mile, and Waneta Dams re-regulate flow on a daily basis. One of the goals of this re-regulation is to minimize generation of TDG downstream of Waneta Dam. The shape of this re-regulation will therefore determine the degree to which TDG is increased downstream of Waneta Dam. When the daily FWPO discharge is greater than 33 kcfs over several consecutive days, there is not sufficient storage capacity between Boundary, Seven Mile, and Waneta Dams to prevent spill at Waneta. The exact nature of the spill cannot be predicted but is likely to be less than 12 to 13 kcfs. This is the 45 kcfs maximum discharge under FWPO plus 1 kcfs for local inflow between AFD and Waneta Dam (primarily from the Salmo River) minus the Waneta Dam powerhouse capacity (46 kcfs – 33 kcfs). Since the Waneta Dam tailwater mixes with the Columbia River, it is difficult to precisely measure the effect of Waneta Dam on TDG levels. Based on its configuration, it is assumed to increase downstream TDG levels (WDOE 2004). If Waneta does generate relatively high TDG as a result of FWPO, the fact that the Columbia River joins the Pend Oreille River immediately downstream should minimize any effect on aquatic life in the river. This is due to the mixing effects from the generally larger flow of the Columbia. The Columbia River mean flow during the winter period of FWPO ranges from 71 kcfs in December to 60 kcfs in March. Mixing is dependent on several factors including total flow in each river. It is uncertain how far downstream complete mixing occurs once the two rivers meet. Typical TDG saturation levels measured in the Columbia River at the international border are between 100 and 105% during the winter months (WDOE 2004).

This analysis indicates that relatively high TDG levels and resultant effects on aquatic life including GBT are possible downstream of BCD between 2012 and 2015 when the facility is being upgraded. Similarly, GBT effects on aquatic life are possible downstream of Waneta Dam until 2016.

4.7.3. Significance and the SOR EIS

The relative importance of the increased TDG levels described above is dependent on their effects on fish and other aquatic species. As stated in Section 3.7, GBT effects on fish and other aquatic life have been documented when TDG exceeds 120% under field conditions and 110% under laboratory conditions. Most cases of fish mortality have been documented when TDG was greater than 130%. Based on the above analysis, it is possible that FWPO could result in GBT (TDG greater than 120%) downstream of BCD for the next two years and possibly downstream of Waneta Dam for the next four years. Beyond this time period, upgrades to each dam should eliminate the need to spill and thus also eliminate the potential to increase TDG at the flows anticipated under FWPO. If the upgrades are delayed, the time period for these effects could be extended. TDG in excess of water quality standards (greater than 110%) is possible during this interim time period as well until upgrades are completed.

Another important factor in determining the relative importance of the TDG effects described above is the seasonal hydrology of the Pend Oreille River. Lower flows generally occur during the winter and high flows during the spring. From about mid-April to mid-July, the median flow in the Pend Oreille River is above 30 kcfs (see Table 3-1). This is sufficient flow to increase TDG above 110% saturation levels downstream of BCD for this entire three month period. For most of this period, flows are such that TDG is greater than 120% saturation. TDG levels as high as 140% are not uncommon (WDOE et al. 2007). Certainly these spring TDG levels are a dominant factor in the health of the aquatic ecosystem in this reach of the river. FWPO would add another month on average when TDG exceeds 110%. FWPO would add another two weeks on average when TDG exceeds 120%. The FWPO TDG effect is greatly overshadowed by TDG levels that occur in the river during the spring months. It is doubtful that the additional time the river contains high TDG as a result of FWPO would be significant to the aquatic species in this stretch of the river.

It is possible that the generally lower level of fish activity during the winter may make these species more vulnerable to high TDG if they are simply staying in one location near the surface of the river. However, the reach between Box Canyon and Boundary Dam on the Pend Oreille River is heavily influenced by daily reservoir fluctuations from Boundary Dam. This likely requires fish to be more active or reside in deeper waters where they are less susceptible to GBT due to the depth compensation described in Section 3.7. ESA listed bull trout are occasionally found within the affected reach and could be affected by the high TDG levels. These species would also likely move around or reside in deeper waters at least during part of the day limiting the effect of high TDG levels (Muhlfeld 2003). Section 4.12 contains more detail on effects to bull trout.

As stated previously, the degree of effect downstream of Waneta Dam is uncertain due to the limited data available, uncertainty about operations of that dam which would influence TDG levels, and the mixing with the Columbia River.

The SOR EIS discussed gas supersaturation in a general sense. The EIS evaluated effects of the various alternatives on TDG at many of the SOR dams. It did not discuss or specifically identify any effects that might occur as a result of operations at AFD. In general, the EIS indicated that exceedances of 110%, 120%, and 130% TDG were occurring and would continue to occur as a result of the EIS preferred alternative. It further stated that if gas levels are sufficiently high, they can kill fish exposed to the saturated waters. The effects described above under FWPO, while not specifically detailed in the SOR EIS, are consistent with the general effects described in the EIS and the specific effects described for the other dams that were evaluated in more detail. As a result, the effects described in this EA are not considered new effects requiring supplementation of the EIS. The information provided above is considered additional detail to the effects previously disclosed in the EIS.

4.8. RESIDENT FISH

4.8.1. Upstream of Albeni Falls Dam

<u>Habitat</u>

Available aquatic habitat upstream of AFD should not be appreciably affected by FWPO. In years when the MCE is established at 2051 feet, a slight increase in available habitat would occur during periods when water is stored and the lake raised above 2051 feet. This increase might result in an incremental benefit for warmwater species, although this habitat may not persist through the winter. Compared to years in which the MCE is set at 2055 feet under current operations, slightly less aquatic habitat may be available. The fluctuating outflow under FWPO would affect velocities in the river between AFD and the lake. At most locations, the change in river velocity between 4 kcfs and 45 kcfs is minimal and

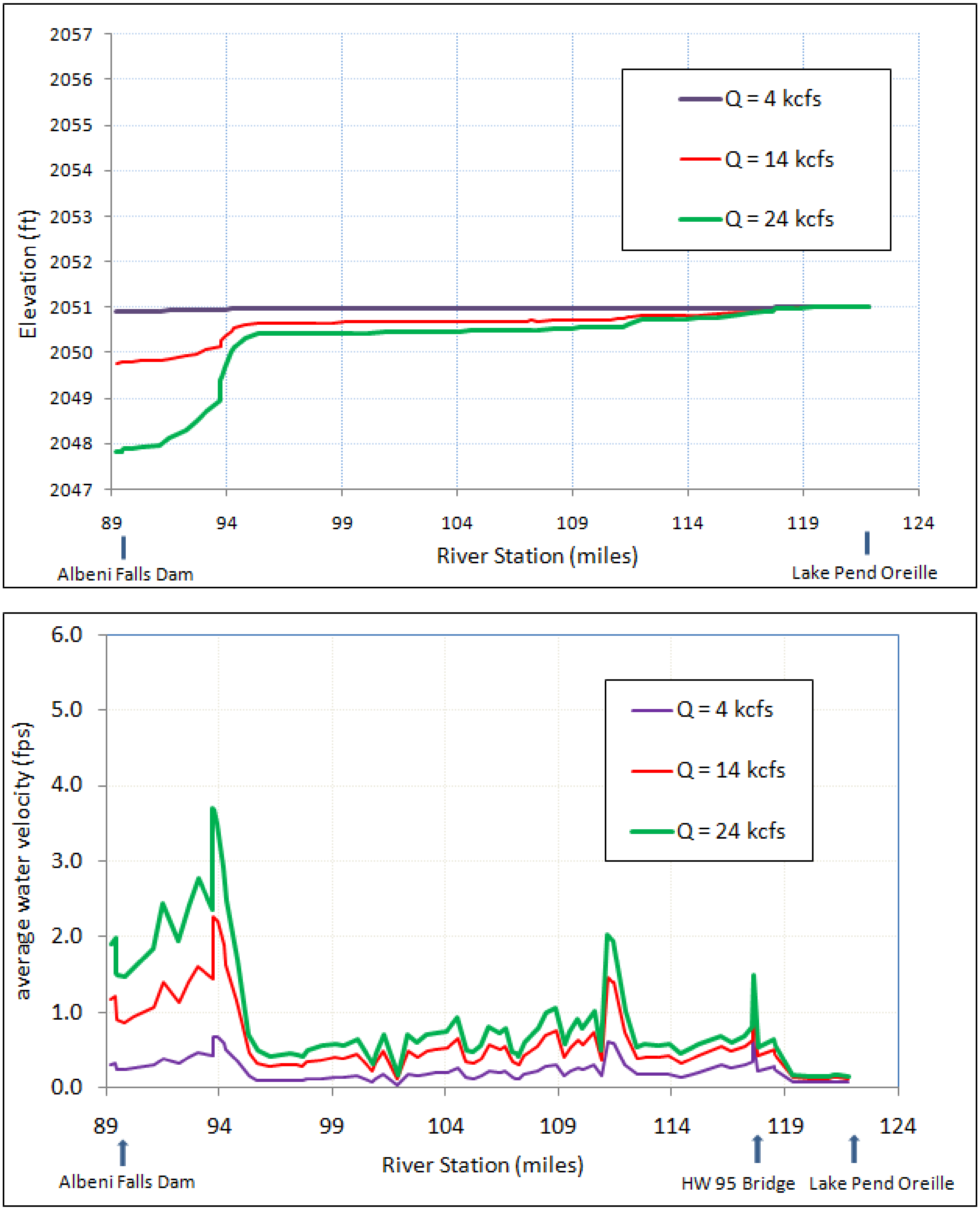

Figure 4-5. Modeled Stage and Velocity (non-ice conditions) in the Pend Oreille River between Lake Pend Oreille and Albeni Falls Dam when Lake Pend Oreille is 2051 feet as measured at Hope.

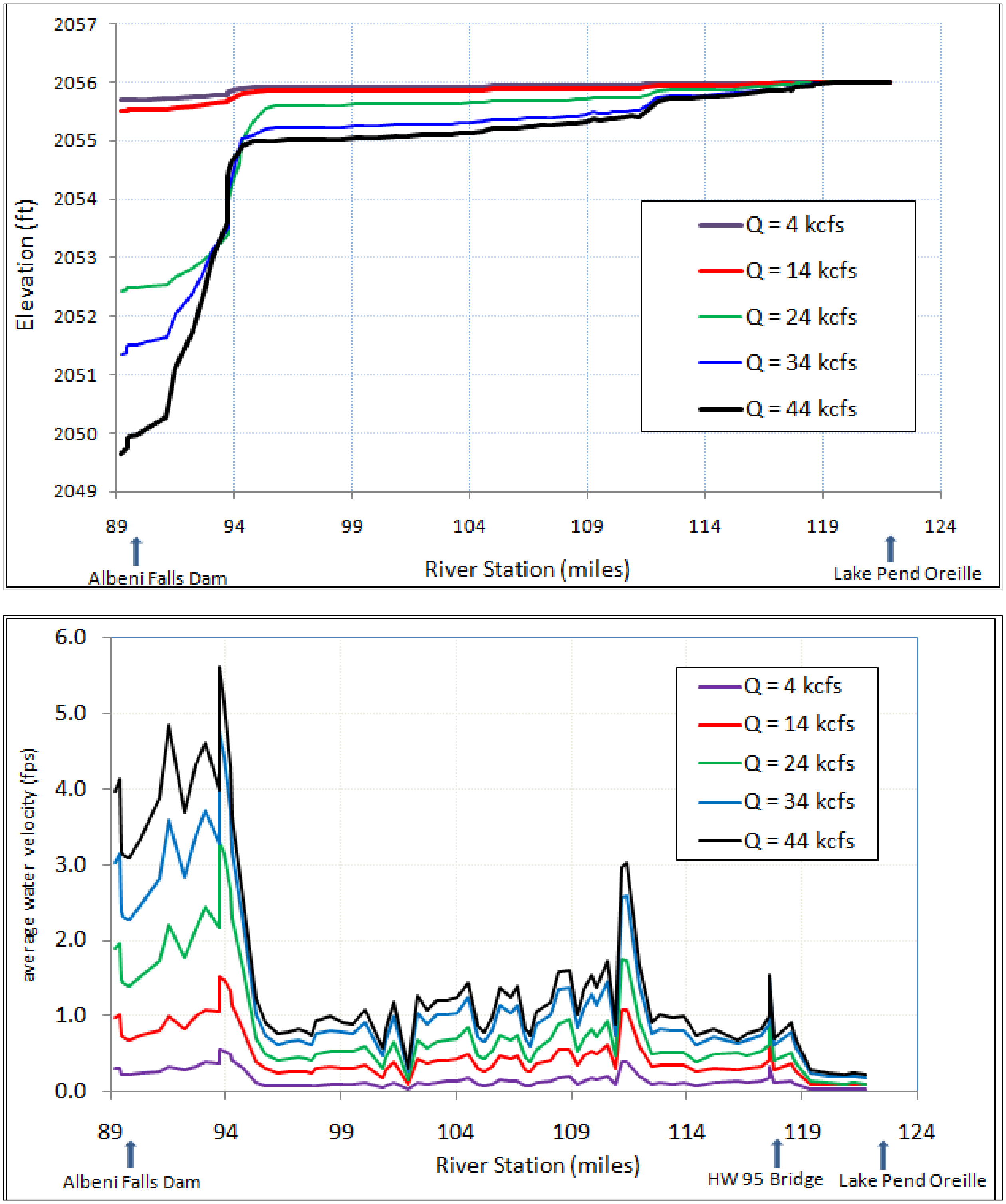

Figure 4-6. Modeled Stage and Velocity (non-ice conditions) in the Pend Oreille River between Lake Pend Oreille and Albeni Falls Dam when Lake Pend Oreille is 2056 feet as measured at Hope.

generally remains below 1 fps throughout the range of FWPO flows (Figures 4-5 and 4-6). Where constrictions in the river occur, velocities can be slightly higher. Velocities are highest just downstream of where the Priest River meets the Pend Oreille River. At this location, FWPO would fluctuate average velocities between about 0.5fps (4 kcfs) and 5.5 fps (45 kcfs). Under current operations, river velocity at this location would be about 1.5 to 2.0 fps under median flow conditions. As stated in Section 3.8, the Pend Oreille River upstream of AFD is generally poor habitat for warmwater species during the winter due in part to the more riverine like velocities (IDFG 2007). FWPO is not expected to change these riverine conditions although velocity would be less (compared to existing conditions) when water is being stored in the lake and discharge is reduced. The reach of the Pend Oreille River between the Priest River confluence and AFD would experience relatively high velocities when AFD discharge is increased to the higher range of flows. To the degree that any warmwater species occur in this reach during the winter, these higher velocity conditions would make the habitat even less favorable for these species. Under FWPO, the winter lake elevation would continue to be managed to support kokanee spawning. This includes not raising the lake until spawning is concluded in order to prevent dewatering redds. In years when the MCE is set to 2051 feet, the lake would fluctuate 5 feet above the redds compared to only 1 foot above the redds under current operations. This additional water over the redds should not result in any adverse effects. Redds depths under current operations range down to 8 feet below the water surface (Maiolie et al. 2002). Redd vulnerability to erosion, deposition of fine sediment, and redd predation should be similar under FWPO compared to current operations. The effect of FWPO on kokanee spawning is therefore expected to be no different than the No Action Alternative. Entrainment

As described in Section 3.8, fewer fish were entrained at Boundary Dam during the winter months. This is likely due to the relative inactivity of fish at this time of year. This pattern would also be expected at AFD. It is possible that the increase in discharge up to 45 kcfs for FWPO would result in a small incremental increase in fish entrainment. Similarly, it is possible that entrainment may be slightly lower during times when discharge is decreased to 4 kcfs. Modeling indicates that the average velocity in the river immediately upstream of AFD would fluctuate between about 0.5 fps (at 4 kcfs) up to about 4.0 fps (at 45 kcfs). Under current operations, river velocity at this location would be about 1.0 fps under median flow conditions. This is well within the swimming speed capabilities of the adult fish observed in the river (Corps 1990). Juvenile kokanee and warmwater species, to the degree that they are present in the Pend Oreille River during the winter, will likely not remain in the reach between AFD and the Priest River when discharge is increased under FWPO. These fish may be entrained at the dam when flows are increased. Since this habitat is not conducive to these species under current operations, their numbers should be very limited in this stretch of the river if they are present at all. While it is possible that the flow fluctuations under FWPO could affect entrainment rates (especially when velocities are at the higher end of this range), it is more likely that fish behavior will be the dominant factor. For this reason, FWPO is not expected to measurably affect fish entrainment rates at AFD. Fish entrainment during the winter under both the No Action and FWPO Alternatives is expected to be much less than that which occurs during the spring and summer. This is primarily due to the increased activity of fish and the generally higher flows during the spring.

4.8.2. Downstream of Albeni Falls Dam

<u>Habitat</u>

Compared to the No Action Alternative, aquatic habitat conditions downstream of AFD are likely to be more variable under FWPO. As illustrated in Figure 4-1, the bookend scenario results in 2 to 8 consecutive weeks of minimum flow conditions (4 kcfs). This is followed by a 2 week period when flows are quickly ramped up to 40 to 45 kcfs and maintained above 30 kcfs for about 2 weeks. This is followed by a quick ramp down to minimum flows. This cycle can repeat up to 3 times per winter. Under the No Action Alternative, flows typically remain within a tight range between 15 and 20 kcfs. This more variable flow pattern under FWPO has several potential effects on aquatic species and their habitat, but these effects are moderated by the backwater effect of the BCD reservoir as described in Section 3.8. This is illustrated in the fact that just below AFD, the minimum FWPO flow of 4 kcfs is equivalent to a natural flow (i.e., without a reservoir present) of about 9.5 kcfs (Corps 2002a). This moderating effect increases as the river travels downstream.

This moderating effect of the BCD reservoir is evident in an analysis of the wetted width of the river at 4 kcfs compared to 45 kcfs. Based on an analysis of river cross sections surveyed in 2006 and 2007, the width of the river typically decreases by only about 10% or less as flows are reduced from 45 kcfs to 4 kcfs depending on the specific location. Compared to median winter flows under the No Action Alternative (15 to 19 kcfs), the decrease in the wetted width of the river is about 5% at 4 kcfs. Effects to fish species in these areas due to the fluctuating flows under FWPO are negligible. In some areas, there is more extensive off channel habitat that is flooded when flow increases above 30 kcfs. In these locations, this off channel habitat would be alternately watered and dewatered under FWPO. Any aquatic invertebrates present in these river margin areas that are dewatered will likely not survive. Similarly, any fish that access off channel habitat during the 'high' flow cycle of FWPO would have to vacate this habitat or potentially be stranded as the water recedes and the habitat dries up. Since FWPO would not decrease outflow to 4 kcfs until mid-December at the earliest, it is likely that these off channel habitats will be dewatered before the start of FWPO simply due to the lower natural flows. Fish would thus have to seek out these off channel areas during the high flow cycle of FWPO. The relative inactivity of fish during the winter should limit the numbers of fish that migrate to these off channel areas when the flow increases.

The maximum river stage change under FWPO is about 11 feet which occurs immediately downstream, of AFD. As described previously, this stage change decrease as the river travels downstream. About 20 miles downstream near Cusick, the stage change is about 7 feet. The moderating effect of the BCD reservoir is evident in the river depths. At 4 kcfs, depths in the center of the channel range from 30 feet to 15 feet about 20 miles downstream of AFD. So while, 4 kcfs is very near the historical monthly minimums for the river (see Table 3-1), the river is still quite deep and wide even at this relatively low flow due in large part to the BCD reservoir.

Due to daily reregulation of flow at Boundary, Seven Mile, and Waneta Dams, FWPO is unlikely to have any noticeable effect on aquatic habitat downstream of BCD. Daily discharge fluctuations can be as high as 50 kcfs at Boundary Dam which is then passed downstream. This is reflected in river stage changes both upstream and downstream of the dam as described previously. These latter operations would overshadow any potential effect of FWPO on aquatic habitat.

Entrainment

As described in Section 3.8, fish behavior and river velocity can contribute to fish entrainment in dams. FWPO would have the effect of temporarily increasing river velocity during the high outflow part of the cycle illustrated in Figure 4-1. When the flow is 45 kcfs, average river velocities would generally be between 1 and 4 fps depending on the specific location (Figure 4-7). Most locations would experience velocities of approximately 2 fps. Median outflow under the No Action Alternative is generally between 15 and 20 kcfs. River velocity at this flow is generally between 0.5 and 1.5 fps and ranges up to about 2.5 fps depending on the locations. In locations where the channel is confined, velocity can be higher for each alternative. In general, the maximum velocity under FWPO is about 1 to 2 fps higher than under the No Action Alternative. The average velocity in the forebay of BCD is about 2 to 3 fps at 45 kcfs. This is well within swimming speeds of fish typically found in the river. While it is possible that FWPO could slightly increase entrainment rates at times of high discharge and then slightly decrease entrainment at times of low discharge, fish behavior is likely to be a more important factor in determining whether individual fish are entrained than this increase in velocity.

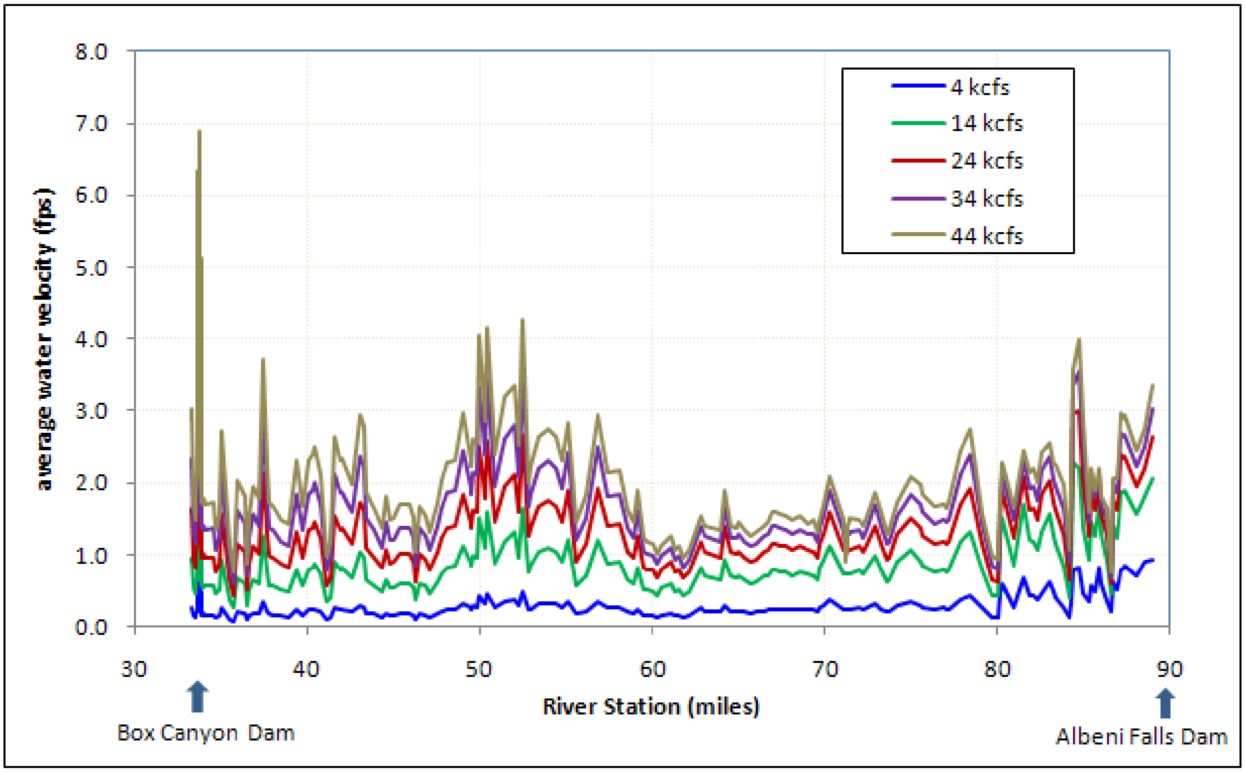

Figure 4-7. Average Modeled Water Velocity (non-ice conditions) in the Pend Oreille River between Albeni Falls Dam and Box Canyon Dam for the Range of Flows under FWPO. Velocity is slightly less for ice cover conditions.

Due to daily reregulation of flow at Boundary, Seven Mile, and Waneta Dams, FWPO is unlikely to have an effect on fish entrainment through these facilities. Daily discharge fluctuations can be as high as 50 kcfs at Boundary Dam which is then passed downstream. Any entrainment effect of FWPO at Boundary Dam or dams further downstream would be masked by operations at Boundary Dam.

Stranding

FWPO would fluctuate river flows downstream of AFD much more than would occur under the No Action Alternative. This fluctuation could result in fish stranding downstream of AFD. The change in river stage from 45 to 4 kcfs is about 11 feet at the AFD tailwater, and about 7 feet near river mile 70 which is 20 miles downstream. According to the model results presented in Section 4.1, this stage drop would occur over a period of 10 days or longer. The flow drop from 40 to 30 kcfs would be relatively gradual. The flow drop from about 30 kcfs down to 4 kcfs would occur over 3 days (see Section 4.1 for more detail on these stage changes). A scenario that results in a more rapid fluctuation in discharge than illustrated in the bookend scenario is also possible as described in Section 4.1. In this latter scenario, outflow would be decreased from about 44 kcfs down to 4 kcfs over 4 days.

The risk of stranding in the above scenarios would be minimized by the AFD ramp rates and the backwater effect of the BCD reservoir described above. The AFD ramping rates are 10 kcfs per 24-hour period and 5 kcfs per 1-hour period. It is expected that current ramping rates would continue to minimize stranding under FWPO, although there has been very limited history with flows near 4 kcfs. As stated above, the potential for stranding appears to be greatest when flows are in the range of 30 to 40 kcfs and subsequently decreased. This would potentially dewater off channel habitat. The bookend scenario results in a relatively gradual drop in flow through this range. There appears to be minimal off channel habitat between the 4 and 14 kcfs flow range based on an analysis of river cross sections, so stage drops within this range appear to present more limited stranding potential. To date, no fish stranding issues have been documented under current operations using existing ramping guidelines. This would indicate they are relatively effective at limiting fish stranding. As described in Section 3.8, criteria to limit stranding and initiate monitoring were established as part of the BCD relicensing effort. The monitoring trigger is a 3 foot stage drop over a 12 hour period. The maximum stage drop under the FWPO ramp rates is about 3 feet in 24 hours. This is much less than the BCD criterion that was identified as the stranding concern threshold and therefore a trigger for monitoring. This further indicates that the FWPO ramping rates should minimize the potential for stranding fish.

Fish are expected to be less active and thus more stationary during the winter. This should further reduce the stranding potential. If fish do become stranded when flow is reduced, operations would reconnect any isolated parts of the river when water is discharged for power. This could take a period of weeks or longer depending on the need for power operations. Survival of any stranded fish would likely be dependent on freezing temperatures and/or whether the isolated habitat remains watered. Based on the bookend scenario, these habitats are likely to be dewatered so any stranded fish would not survive. If fish are stranded, they are likely to be warmwater species that tend to favor backwaters and shallow, calm areas near the shoreline (EES 2008).

As a result of operations at Boundary Dam, daily water surface elevation fluctuations range from 11 to 18 feet in the forebay (FERC 2011). This degree of fluctuation would mask any river fluctuations caused by FWPO in this reach. For this reason, any stranding effect caused by FWPO would be limited to the river reach between AFD and BCD.

4.8.3. Significance and the SOR EIS

The analysis above indicates that resident fish species are likely to be affected by FWPO compared to the No Action Alternative. These effects include minor decreases in available aquatic habitat during large parts of the winter, increased potential for fish stranding, and some loss of aquatic invertebrates that serve as prey items. These effects would primarily occur in the Pend Oreille River between AFD and BCD. It is doubtful that FWPO would result in increased fish entrainment at either AFD or BCD due to the relatively minor increases in velocity that would occur and more importantly the relative inactivity of fish species during the winter.

The SOR EIS evaluated effects of the various EIS alternatives on resident fish species both upstream and downstream of AFD. The analysis indicated that operations did have adverse effects on resident fish species. This included a discussion of the negative effects to warmwater species associated with the low winter reservoir and discussion on effects to kokanee. Effects of AFD operations on kokanee were further evaluated in the 1995 EA as described in Chapter 2, Alternatives. The SOR EIS evaluated effects based on average flows and end of month lake elevations. Any effects associated with a more frequent rate of lake or outflow fluctuation were not specifically evaluated because the EIS model did not provide that level of detail. The EIS did indicate that it was possible that operations could dewater shallow habitat stranding or killing fish and food organisms under EIS alternative SOS 1. AFD operations under SOS 1 and the EIS preferred alternative were similar for AFD as described in Chapter 2. The effects described above are therefore not new effects relative to those effects previously disclosed in the EIS. The information provided above is considered additional detail to the effects previously disclosed in the EIS. Since these effects have been previously disclosed, supplementation of the SOR EIS is not necessary.

4.9. ANADROMOUS FISH

Flow management for anadromous fish species would not change under FWPO, because water would not be stored at AFD if it was needed downstream of Grand Coulee Dam to support ESA listed salmon flows particularly flows for chum salmon below Bonneville Dam and to support Hanford Reach flow commitments. Utilizing water stored at AFD under FWPO also has the potential to support spring elevation objectives at Grand Coulee Dam. Utilizing storage at AFD contributes to meeting these objectives in a cost effective manner.

The SOR EIS discussed and evaluated effects of downstream flows on salmonids in the Columbia River. This was a primary emphasis of the EIS. FWPO does not result in any new effects on anadromous fish in the Columbia River.

4.10. VEGETATION AND WETLANDS

4.10.1. Upstream of Albeni Falls Dam

Under FWPO, the elevation zone between 2051 and 2056 feet would be alternately inundated and then dewatered. Under existing conditions, the habitat is typically inundated (2055 feet) or dewatered (2051 feet) for the entire winter period depending on where the MCE is established. FWPO would thus expose the rooting substrate to air during lower water periods and to water during periods of inundation. The rooting substrate could freeze during periods when dewatered. This could also occur under No Action Alternative. But as a result of FWPO, the cycle of dewatering and inundation could occur up to three times over the winter. As the native species are dormant during the winter, it is not anticipated that alternating between wet and dry conditions would be detrimental to the vegetation populations. Wetlands above elevation 2056 feet would not be affected differently than under the No Action Alternative.

As described in Section 4.5, the fluctuating winter lake elevation under FWPO could result in some incremental erosion around the lake compared to the No Action Alternative. To the degree this occurs, it would affect wetland habitat just as it would other areas around the lake. This effect is expected to be inconsequential relative to erosion that occurs as a result of the annual fill-draft cycle to achieve the summer lake elevation of 2062.5 feet under existing operations.

Invasive Plant Species

Under FWPO, fluctuations in winter lake elevation could potentially reduce the duration of Eurasian watermilfoil exposure to freezing temperatures, compared to the No Action Alternative. As described in Section 3.10, at least 96 hours of exposure to freezing temperatures is required to kill milfoil. Based on the lake level fluctuations illustrated in Figure 4-1, milfoil would likely experience freezing temperatures for 96 consecutive hours. However, if stored water is not readily discharged under FWPO, but instead maintained in the lake throughout the winter, opportunities to freeze milfoil would be more limited. Under these latter conditions, it is possible that the summer extent of watermilfoil could be greater under FWPO compared to current operations when the MCE is 2051 feet. Compared to current operations with an MCE of 2055 feet, there would be no difference in the summer extent of watermilfoil under FWPO. It is also possible that lake level fluctuations under FWPO would periodically melt snow (between 2051 and 2056 ft) that is protecting watermilfoil from freezing thus making it more vulnerable to freezing once the lake level is lowered. Over the life of the project, conditions necessary to control milfoil are expected to occur on a regular basis. Therefore, over the long term FWPO is not expected to increase the occurrence of this invasive species.

Extensive growth of flowering rush results in competition with native aquatic plants for space, and, in the long term, decreases the extent of native plants around the lake as it is a very effective colonizer and aggressive competitor. This results in a reduced food source for overwintering waterfowl such as redhead ducks. In addition, flowering rush serves as a refuge habitat for piscivorous fish such as bass, and reduces the open water habitat available for bull trout and kokanee (Parkinson 2010). Thus, bull trout and kokanee suffer not only habitat loss but also increased predation. Flowering rush is already found in many locations around the lake, including the river both above and below AFD. Ice transport has been observed at other reservoirs (Eckert et al. 2003), and is considered a primary mode of expansion for this species (Parkinson, et al, 2010). Ice transport in Lake Pend Oreille occurs principally during the spring thaw and reservoir refill. This ice transport during the spring would be virtually the same under FWPO compared to the No Action Alternative.

FWPO could result in incrementally more ice movement around Lake Pend Oreille, which could accelerate the transport of flowering rush to new locations around the reservoir. The existing monitoring program described in Section 3.10 should detect flowering rush if it is spread to new locations around the lake. However, even under the current operation, the plant is already found in many locations around the lake, including the river both above and below AFD. The Corps coordinates with the State of Idaho and local stakeholders in attempting to control rush and other invasive species. This includes application of herbicides in 2011 at several locations to evaluate their effectiveness (Hull, 2011). We expect to continue these efforts to control invasive species in cooperation with the local community.

4.10.2. Downstream of Albeni Falls Dam

FWPO would have minimal impacts on riparian vegetation downstream of AFD, because the anticipated range of flows (4 kcfs to 45 kcfs) is far below flows that occur during the spring. Spring flows are the dominant factor affecting shoreline erosion and, in turn, riparian vegetation.

FWPO could have incremental impacts on wetlands immediately adjacent to the river, as a result of potential periodic low discharges. Minimum discharges of 4 kcfs may dewater these wetlands for up to a couple weeks at a time, which is not expected to affect the long-term vitality of these wetlands, since the dewatering would occur during the non-growing season, when plants are dormant.

Invasive Plant Species

Under FWPO, more ice is expected to be transported downstream of AFD through the spillway compared to the No Action Alternative. Because ice is an important mechanism for transporting flowering rush, it is possible that FWPO could spread rush downstream of the dam. As stated above, rush has recently been found downstream of AFD. However, since the plant has already been discovered in the river below the dam, the potential effect of FWPO is to incrementally accelerate the inevitable expansion of this invasive species.

Under FWPO, low flows downstream of AFD would be more common than under the No Action Alternative. This could increase the opportunity to expose Eurasian watermilfoil to freezing temperatures. Therefore, FWPO could incrementally decrease Eurasian milfoil downstream of AFD. This effect is expected to be negligible.

4.10.3. Significance and the SOR EIS

The SOR EIS evaluated the effects of the various EIS alternatives on vegetation and wetland plant communities in a general sense. As described in Section 4.5, effects from erosion were discussed and evaluated in the EIS. The erosion related effects described above are therefore not new effects relative to the EIS. The information provided above is considered additional detail to the effects previously disclosed in the EIS. Aside from a general concern in the SOR EIS that project operations would affect wetland plant communities, the effect of operations on invasive plant species was not considered under the SOR, but was considered in the context of the 1995 EA for watermilfoil. The effects disclosed in this EA on invasive species described above are thus considered new information in addition to that provided in the 1995 EA. This new information relative to the potential accelerated expansion of flowering rush is not considered a significant effect. This is due primarily to the very limited role FWPO could play in the seemingly inevitable spread of this species.

4.11. WILDLIFE

4.11.1. Upstream of Albeni Falls Dam

The primary wildlife concern is related to loss of habitat around the lake from erosion. Compared to the No Action Alternative, FWPO could result in some incremental erosion around the lake during the winter. This incremental erosion would occur at lake elevations where the habitat is already quite degraded and consists of predominantly mudflat. The incremental increase in erosion of the mudflat caused by FWPO is not likely to be important to wildlife species around the lake. The incremental erosion and potential expansion of flowering rush could incrementally affect the availability of food resources for overwintering waterfowl, especially redhead duck. Incremental effects to mitigation areas established around the lake and maintained by IDFG for the benefit of waterfowl could also occur.

4.11.2. Downstream of Albeni Falls Dam

Effects on wildlife habitat downstream of AFD to Grand Coulee Dam are associated with river bank erosion. As stated in Section 4.5, any incremental winter erosion under FWPO would be inconsequential relative to erosion during the spring high-flow period.

FWPO could accelerate the expansion of flowering rush downstream from AFD (see Section 4.10). However, this is speculative and the incremental effect that FWPO would have as compared to current operations is negligible.

4.11.3. Significance and the SOR EIS

The SOR EIS considered the EIS preferred alternative to have neither negative nor beneficial effects to wildlife and no further action was recommended. As described in Section 4.5, effects from erosion were discussed and evaluated in the EIS. The erosion related effects described above are therefore not new effects relative to those effects previously disclosed in the EIS. The information provided above is considered additional detail to the effects previously disclosed in the EIS. The SOR EIS did not anticipate such operational effects on the potential increase in invasive aquatic plants, and the potential effects this has on wildlife. The effects disclosed in this EA on invasive species described above are thus considered new information. This new information relative to effects on wildlife due to the potential accelerated expansion of flowering rush is not considered a significant effect. As stated above in Section 4.10, this is due primarily to the very limited role FWPO could play in the seemingly inevitable spread of this species.

4.12. THREATENED AND ENDANGERED SPECIES

As described in Section 3.12, consultation with NMFS and USFWS on existing AFD operations has occurred and the dam is being operated consistent with the BiOps that were issued. FWPO does not result in any new effects on ESA listed anadromous fish in the Columbia River. Reinitiation of consultation is required when "the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion." FWPO was contained within the project description consulted on during the original consultation and as confirmed in a letter from USFWS dated July 19, 2011 (Appendix C). As a result, the effects of FWPO on listed species are covered under the existing BiOps.

4.12.1. Effects on Bull trout

Detailed descriptions of bull trout use of the Pend Oreille River and Lake Pend Oreille can be found in the USFWS BiOp. The population in the lake is considerably reduced from historical numbers, but is considered one of the strongest remaining. In the downstream river, small numbers of bull trout have been observed. These are likely fish from the upstream lake that have passed through AFD. Downstream of BCD, bull trout are rarely observed or caught (USFWS 2005).

Effects of FWPO on bull trout are similar to those described for resident fish in Section 4.8 which are further discussed below.

Prey Resources

Kokanee provide an important prey resource for bull trout in Lake Pend Oreille. Lake management for kokanee spawning is therefore required as a reasonable and prudent measure in the USFWS BiOp. As stated in Sections 3.8 and 4.8, winter lake management for kokanee spawning would continue to be a management priority under FWPO. FWPO would not result in any additional effects on kokanee spawning compared to the No Action Alternative.

Gas Supersaturation

Section 4.7 discusses potential TDG effects on fish species in the Pend Oreille River. Effects on bull trout are expected to be similar to the effects described in this section. Data collected during a spill test at Libby Dam indicated that bull trout responded to high TDG levels in a manner similar to other species sampled during the study including whitefish and rainbow trout (Dunnigan et al. 2003). GBT is further discussed in Section 3.7.

Elevated TDG is possible immediately downstream of BCD during upgrades to the powerhouse and installation of a spillway bypass (2012–2015). The discharge limitations that result from the construction in combination with higher winter flows from FWPO could produce TDG saturation levels above 120%. High TDG could also be produced immediately downstream of Waneta Dam as a result of FWPO. This would only occur until 2016 when the Waneta powerhouse upgrade is scheduled to be completed. High TDG levels could result in GBT symptoms in bull trout present within these reaches. Bull trout are likely to be deeper in the water column and less active during the winter, reducing any potential effects from high TDG. After the interim construction period, high TDG should not occur in the river at the FWPO range of flows.

Stranding

Bull trout stranding could occur in the Pend Oreille River downstream of AFD as a result of flow fluctuations under FWPO. Bull trout are expected to be in deeper water during the day, but they may utilize shallow waters at night (Muhlfeld et al. 2003). The potential for stranding is greatly minimized as a result of project ramping rates and the backwater effect provided by BCD. As described in Section 4.8, FWPO should not have any effect on stranding downstream of BCD because of the daily reregulation of Boundary reservoir.

Habitat

The effects of FWPO on bull trout habitat would be similar to those described for resident fish in Section 4.8. BPA, the Corps and Reclamation are currently coordinating with the USFWS concerning reinitiation of consultation under the ESA to address the effects of the FCRPS on the newly designated critical habitat for bull trout, see Section 3.12. Although that consultation is underway, we have considered the effect of the FWPO on the elements of habitat determined by the USFWS as critical for bull trout.

Important features of bull trout habitat include water quality, fish passage barriers, prey base, habitat structure, spawning substrate, water quantity, and competition with nonnative species. As described in Section 4.8, FWPO would alter the natural hydrograph of the Pend Oreille River by fluctuating outflow from AFD. This results in a more variable aquatic habitat relative to water quantity with more time at minimum flows followed by more time at relatively high flows during the winter period of FWPO. These fluctuations would affect the prey base in the river by dewatering aquatic habitat occupied by aquatic invertebrates along the river margins. Invertebrates that are dewatered would likely not survive. FWPO is not expected to affect water quality (other than TDG described above), habitat structure, or spawning substrate for bull trout. It should not affect existing or introduce new barriers to migration. It may result in some minor effects on nonnative species as described in Section 4.8.

4.12.2. Bull Trout Recovery Plan

A draft recovery plan for Pend Oreille basin bull trout was completed by USFWS in 2002 (USFWS 2002). Important elements of the plan relevant to FWPO include limiting water quality impacts associated with TDG, restoring normative hydrologic function, providing AFD fish passage, limiting entrainment, and meeting minimum instream flows below AFD.

FWPO could result in TDG exceeding 110% at BCD and Waneta Dam in the short term (2012–2016). FWPO further alters the natural hydrograph in the winter, which is counter to the recovery plan goals. The effects of this flow alteration are described above and in Section 4.8. Their effects on bull trout appear minor, in part because the reaches affected are reservoirs that would minimize decreases in aquatic habitat associated with FWPO discharge fluctuations. No minimum instream flows have been established downstream of AFD as part of the recovery plan goals. As stated above, the potential benefits of a minimum instream flow in this reach are minimized by the presence of reservoirs. Minimum instream flows may be beneficial in summer to the extent that such flows are able to moderate high temperatures in the river. This is not a concern during the winter.

4.12.3. Significance and the SOR EIS

The SOR EIS preferred alternative was selected to support BiOps for species listed under the ESA, primarily anadromous fish species. Effects to listed species were thus evaluated in the EIS. Bull trout were listed as threatened under the ESA in 1998. This listing is therefore new information relative to the 1995 SOR EIS. The effects to bull trout were considered along with other resident fish species in the EIS. So while the listing would be considered new information, the specific effects detailed above and in Section 4.8 would be considered additional detail to effects previously disclosed in the SOR EIS.

4.13. CULTURAL RESOURCES

4.13.1. Upstream of Albeni Falls Dam

As described in Section 4.5, some incremental erosion could occur along the shoreline under FWPO. The character of the erosion is slightly different under FWPO compared to the No Action Alternative because of the differing amounts of time the lake would spend at various lake elevations. Under the No Action Alternative, the winter lake elevation is set at either 2051 or 2055 feet. Consequently, erosion is focused at these elevations. Under FWPO, erosion likely would occur less at these specific elevations and more at stands between these elevations. This affects cultural resources by focusing wave energy and erosion on different parts of a given site potentially resulting in the loss of stratigraphic integrity of the site.
Table 4-3 summarizes how many sites and how much area would be affected by each 1-foot increment under FWPO. All of the sites and areas in each single foot range are also being affected by current operations. While it is not feasible to quantitatively determine the magnitude of effect caused by existing operations compared to the effect caused by FWPO, it is possible to qualitatively describe these effects. The effect of FWPO would be to change the nature of the erosion of these sites. There likely would be less erosion at sites that exist closer to the 2051 foot elevation due to the higher on average lake elevations of FWPO compared to current operations. Similarly, there may be more erosion of those sites at the higher elevations within this range.

Table 4-3. Counts and Extents of Cultural Resource Sites within the Exemplary Elevation Zones Used to Analyze Effects of FWPO and the No Action Alternative

FWPO Elevation Range (feet amsl, 1929 Datum)	Acres Affected in Range	Total Site Acres Affected	Total Site Count Affected in the Range	Rock Art Sites in Range
2051–2052	1,124.7	37.3	126	1
2052–2053	812.6	37.5	152	1
2053–2054	855.5	52.3	194	2
2054–2055	644.6	55.4	225	2
2055–2056	720.9	53.7	251	2
Total	4,158.3	236.2	Not Cumulative	Not Cumulative

The types of erosion would be similar to those described in Section 3.13. Whether damage actually could occur as a result of FWPO at any given site depends on the site's elevation, beach slope, sediments, and fetch and reach factors. New damage on glyphs at rock art sites at lake elevations between 2051 and 2056 feet probably is the most important risk. Alternatively, some reduction in erosional effects on glyphs located near 2051 and 2056 feet could also likely occur, if the reservoir dwell time at those elevations is reduced.

Higher winter elevation (i.e., greater than 2051 feet) also could interfere with site evaluation or mitigation work that might be planned during years that the MCE is nominally set to 2051 feet, making it difficult to assess whether affected sites were eligible for the National Register of Historic Places, or even to tell what kinds of effects the undertaking might have on them.

The potential for erosion of archaeological sites was documented at the system level in the SOR EIS and was considered a significant impact. FWPO is not likely to significantly change or accelerate the adverse effect of existing AFD operations on cultural resources for two reasons. First, sites within the affected area have very little, if any, archaeological integrity; the zone between 2051 and 2056 feet has been subjected to these severe erosional forces for nearly 60 years, with the possible exception of some glyphs at some of the rock art sites on Lake Pend Oreille. Second, any difference in erosional effects under FWPO, compared to what has already occurred over the past 60 years, is likely to be very slight or undetectable. The Corps and BPA will rely on monitoring programs already in place to assess FWPO impacts on sites that are or may be eligible for the National Register of Historic Places, focusing primarily on rock art sites. Adjustments to those program elements (including amendments to contracts) that may be required to achieve the necessary results will be made as necessary. Adverse effects would be addressed by any of the general responses identified in Section 3.13 and described in the project's HPMP, but tailored to the specific problem at each site (Corps 2008). The overall effect of FWPO is within the analysis and conclusions reached by the SOR for operational effects at the Project.

4.13.2. Downstream of Albeni Falls Dam

FWPO will result in periods with higher flow during the winter compared to the No Action Alternative. This may incrementally increase the erosion of existing cultural resources within this reach. However, this effect is not expected to significantly increase above the existing conditions, because much higher flows and, therefore, greater potential for erosion occurs during the spring snowmelt, as stated in Section 4.5. FWPO could have an effect on cultural resources at the downstream reach of Grand Coulee Dam. A 1-foot stage change on Lake Pend Oreille generally results in a 1-foot stage change in Lake Roosevelt, the reservoir behind Grand Coulee Dam, which could cause some incremental erosion of cultural resource sites within that reservoir. It is unlikely, however, that a detectable change in the rate of site erosion attributable to FWPO would occur in Lake Roosevelt.

If FWPO causes effects on cultural resources at Box Canyon Reservoir or in the Grand Coulee Dam reach of the Columbia River, appropriate responses (primarily construction of erosion control measures) may be required of the agencies responsible for cultural resource management in the affected areas. This may require adjustments to budget timing and amounts to ensure adequate mitigation. For BPA and Reclamation (who undertake the joint cultural resources program at Grand Coulee for addressing FCRPS effects), the most likely scenario is to tailor mitigation already planned to address adverse effects of current operations to any new needs identified.

4.13.3. Significance and the SOR EIS

The SOR EIS evaluated cultural resource site damage based on erosion at a number of specific project dams, including AFD, and concluded that the effects are significant under NEPA and adverse under the NHPA, as described in Section 3.13. The effects described above under FWPO, while not specifically detailed in the SOR EIS, are consistent with the general effects described in the EIS. As a result, the effects described in this EA are not considered new effects requiring supplementation of the EIS. The information provided above is considered additional detail to the effects previously disclosed in the EIS.

4.14. RECREATION

4.14.1. Upstream of Albeni Falls Dam

FWPO could affect recreation activities on Lake Pend Oreille. As described earlier, lake level fluctuation would create a hinge crack that delineates the shore ice from the floating ice. If the water level increase is less than the ice thickness, the area along the hinge crack will be flooded. This is a natural occurring process and typically does not impede activity on the ice. If the water level decrease is greater than the ice thickness, the ice on the landward side of the crack will be unsupported and break, allowing the ice pieces to rest on the water or shoreline. Ice that comes to rest on the substrate could become elevated as it bridges rocks or other structure. This creates a potential hazard for recreationists who could fall through the ice where it is elevated and unsupported. Ice on the lake side of the crack may shift vertically along the crack to restore the water support. Ice enthusiasts could be caught off guard by the sudden shift in the ice and displacement along the crack could limit vehicle access. This may require walking through some shallow water before stepping onto the ice pack. If the water level exceeds the ice thickness, the shore ice will be flooded and floating ice will shift vertically along the crack to relieve the buoyancy forces. It is possible that the floating ice could break away from the shore ice and drift away from the shore. Although the ice conditions will appear similar to previous winters, FWPO would cause more flexing of the ice and recreationists on the ice would have to be aware of changing conditions. In some instance, access and activity on the ice may be limited. The ice pack would not be affected by FWPO. It floats on top of the lake regardless of the lake elevation.

FWPO would lead to changing navigational conditions throughout the winter due to lake fluctuations that may periodically expose and submerge sandbars, pilings, wood debris, or other navigation hazards.

4.14.2. Downstream of Albeni Falls Dam

Impacts on recreation downstream of AFD are likely to be minimal. River conditions would continue to make ice fishing and ice skating uncommon downstream of AFD even under FWPO. Impacts on downstream hunting activities are not anticipated.

Similar to the description in Section 4.14.1, FWPO would result in conditions more hazardous to boaters in the Pend Oreille River downstream of AFD as compared to existing operations. River fluctuations may periodically expose and submerge sandbars, pilings, wood debris, or other navigation hazards.

4.14.3. Significance and the SOR EIS

The SOR EIS evaluated effects of the various EIS alternative on recreation. Much of the recreation focus at AFD was on summer activities associated with the summer lake elevation. Potential impacts to recreation from winter fluctuation of the lake were not specifically analyzed in the SOR EIS. The information and effects described above are thus considered new information relative to the EIS. This new information relative to recreation is not considered significant relevant to environmental concerns.

4.15. POWER

4.15.1. Albeni Falls Dam

Under FWPO, stored water in Lake Pend Oreille could be used to generate additional power at AFD and also to increase flows at downstream projects. Though power may be produced at other operating projects, Grand Coulee Dam is the facility where the benefit from releasing stored water under FWPO can be maximized. An increase in Grand Coulee inflow is especially important and useful at those times when its outflow would otherwise be limited due to its daily draft limit (typically 1.5 feet over a running 24-hour period), as the flow can be passed directly through the powerhouse. The power generated at Grand Coulee is significantly greater per unit of water than power generated at AFD for the same quantity of water. If 1 foot of stored water from AFD is moved to Grand Coulee, the short-term generation is considerably increased. For these reasons, it could be beneficial, on occasion, to spill water in excess of AFD powerhouse capacity (sacrificing some future generation there) so that Grand Coulee can use it to meet short-term power system requirements. Additionally, the water can be released from Grand Coulee to maximize variation of power demand during each day.

Because FWPO would be opportunistically enacted, making the most of conditions as they develop to store and use water to maximize its power value within project operating limits, a nearly infinite number of potential scenarios are possible. The value of FWPO is in its flexibility, similar to saving money during periods of high income or low expenses to pay for unexpected expenses or make the most of investment opportunities in the future. BPA uses system flexibility to shape generation from periods of lower value into periods of higher value.

An operation for power purposes would consider the conditions that would warrant storage and release, rather than arbitrarily storing and releasing water just because it was possible to do so. Because the bookend scenario would overstate the value of the operation, coupling the maximum draft and fill rates with perfect timing regarding power prices, it was not used to evaluate the power effects of FWPO.

For the purposes of evaluating power-related impacts, several example scenarios were developed using actual AFD inflows from eight historical years selected to provide a mix of years with higher inflows and years with lower inflows. Using these scenarios and assuming that power values during the period of release were $10[9] per MWhr higher than during the period of storage, the potential value of the operation would range between about $61,000 and $163,000 per year at site and between about $2 million and $5 million per year at the federal projects downstream. In general, for each 10 ksfd[10] of water that can be shaped into a period that is $10/MWhr more valuable, there is a potential positive benefit of $150,000 for federal generation. The ability to derive value from this flexibility is dependent on predicting with some level of accuracy future market conditions including projected system resources and demands. BPA routinely assesses future market conditions to make operational and marketing decisions. In years where the necessary factors for this operation to be predicted to be beneficial do not align, operational flexibility would have zero expected value and would not be requested. There is also a risk that water will be stored anticipating higher value in a future period that does not occur. In this case, the water may be released at a lower value than when it was stored, creating a negative value. This situation is not unlike the purchase of insurance. In some years, one only incurs expense associated with paying the premiums but receives no benefit from the policy. However, this is still a wise thing to do under the right circumstance, because should one suffer a loss, the value of the insurance is very high.

4.15.2. Downstream of Albeni Falls Dam

Generally, when BPA chooses to store and release water for power purposes it benefits downstream utilities in both the United States and in Canada by providing water to them when it is more cost-effective to generate power. Because of AFD's position in the hydroelectric system, this water moves downstream generating power through several non-federal dams in addition to the federal dams included in this analysis. BPA estimates that for each 10 ksfd that can be shaped into a period that is $10 per MWhr more valuable, there is a potential positive impact on power value of $125,000 for non-federal generation. If the full 5 feet of flexibility (equivalent to approximately 200 ksfd) at AFD could be used for fill and draft even once during the winter at that price differential, the potential financial value to downstream non-federal generators would be about $2.5 million. Additionally, many of these dams downstream of AFD have the capability to reshape their inflow during the day to match the within-day variation in power demand further adding to the potential value of water released under the FWPO.

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[9] A valuation of a $10 per MWhr was used to demonstrate a simple "unit" price to use against a "unit" volume of water released. A price differential of $10 per MWhr is generally in the bottom third of a likely range of values that have been historically achieved with similar operations elsewhere on the hydrosystem.

[10] ksfd: One thousand cubic feet per second, maintained over a 24-hour period. One sfd is one cubic foot per second (cfs) of flow, maintained over a 24-hour period, and equates roughly to 2 acre-feet in volume. An acre-foot is the volume of water that would cover an acre of land to a depth of one foot. One ksfd would amount to about 2,000 acre-feet.

There may be circumstances where that is not the case for specific downstream operators. For example, a downstream utility may experience a localized cold weather event during a period when BPA is requesting that water be stored because demand is low on its system. Another example would be when storage is released from AFD, resulting in flow higher than downstream powerhouse and storage capability and the downstream utility is forced to spill. BPA, POPUD, and SCL are all signatories to the PNCA, which has procedures for energy exchange when reservoir operations differ from the PNCA planned operation as a result of power operating decisions.

For example, when AFD discharge is reduced to store water for power purposes, resulting in a deviation from the PNCA planned reservoir level downstream, PNCA parties may request water releases above planning levels. The reservoir owner may provide energy in lieu of the requested water release. Later, when the water that has been stored at AFD for power purposes is released, energy produced by the downstream party from the release would be returned to BPA. In this way, the downstream utilities are protected from impacts on their power operations resulting from unanticipated changes in upstream storage releases. Similar provisions work in reverse, if power operations draft a project below its PNCA planning level.

If downstream PNCA parties exercise their PNCA rights, FWPO should have little adverse impact on downstream operators' power generation. Active communication and coordination with downstream operators regarding AFD drawdown activities would help further reduce power-related impacts.

4.15.3. Significance and the SOR EIS

Appendix I of the SOR EIS provides a discussion and analysis of power generation. The SOR estimates the changes in the 50-year average annual hydroelectric generation for each alternative at the system level, providing limited information about the projections at the individual project level. The information provided above is considered additional detail to the information previously disclosed in the EIS.

4.16. SOCIOECONOMICS

FWPO is not expected to have impacts on future population trends for communities located above and below AFD. FWPO should not affect any of the water intakes around Lake Pend Oreille. In recent years, the lake has been managed down to 2051 feet. Since FWPO would not result in lake elevations below this, any intakes that have been designed to function during existing operations should function similarly under FWPO.

The SOR EIS included a discussion and analysis of the economic and social impacts of various operating scenarios. Socioeconomic effects anticipated under FWPO are described elsewhere in Section 4.2 (Docks, Infrastructure and Ice), Section 4.14 (Recreation), and Section 4.15 (Power). No additional socioeconomic effects are anticipated under FWPO. The SOR EIS was completed in 1995. Section 3.16 provides updated information on population growth for communities and counties within the study area.

4.17. SUMMARY

The FWPO effects described in this chapter include a combination of new information and effects that had not previously been disclosed in the SOR EIS, and more detailed information on general effects that were previously disclosed in the SOR EIS. These effects include:

- Alteration in the hydrology of Lake Pend Oreille and the Pend Oreille River both upstream and downstream of AFD.

- Alteration in potential for ice to interact with the shoreline and structures around AFD.
- Incremental increases in erosion upstream and downstream of AFD. This incremental erosion results in incremental effects on vegetation, wetlands, wildlife habitat, and cultural resources in the affected area.
- Effects on resident fish species including bull trout due to gas supersaturation, altered aquatic habitat, some loss of prey species, and potential stranding due to fluctuating flows.
- Potential effects on vegetation due to a potentially accelerated spread of the invasive flowering rush. The spread of rush could affect native fish and wildlife species.
- Potential socioeconomic effects include some effects on hydropower distribution, winter recreation, and dock structures. Some less structurally sound docks could be damaged.

In addition to the new information provided generally in this EA, the new effects of FWPO analyzed in this EA include potential damage to structures around Lake Pend Oreille, potential effects on winter lake recreation, and potential acceleration in the spread of the invasive flowering rush. The remaining effects identified above are considered additional detail to effects that were previously disclosed in the SOR EIS.

Chapter 5
Comparison of FWPO to SOR EIS Proposed Action

As discussed in Section 1.3, one of the purposes of this EA is to evaluate whether the FWPO is a substantial change from the proposed action evaluated in the SOR EIS relevant to environmental concerns (see 40 CFR 1502.9(c)(1)(i)). The SOR EIS did not have an explicit "proposed action;" rather, the EIS evaluated a range of management strategies. The agencies selected the EIS preferred alternative, which was adopted with additional measures for kokanee management testing in agency RODs, and further adapted following subsequent BiOps under the ESA.

In the absence of an identified proposed action in the SOR EIS, one way to evaluate whether the FWPO is a substantial change is to compare the FWPO to the SOR EIS preferred alternative. The SOR EIS preferred alternative did not include the current management strategy to protect kokanee spawning in support of bull trout as FWPO does. The SOR EIS preferred alternative allowed for greater winter lake fluctuation for power than FWPO: the SOR EIS preferred alternative allowed for a lake elevation range of 2051 feet to 2056 feet (by November 30 and December 31) or 2060 feet (by January 31 and February 28); FWPO, on the other hand, would restrict discharge for power to a maximum elevation of 2056 feet in all winter months (December through March). Similarly, the SOR EIS preferred alternative did not restrict discharges for power; whereas under FWPO discharges for power purposes are limited to 45 kcfs. These operating differences under FWPO could lessen environmental concerns because they are more restrictive than under the preferred alternative. The more restrictive operating parameters could result in less lake and river fluctuation and resultant environmental effects compared to the EIS preferred alternative. However, the operating parameters must be evaluated in the context of a management strategy to appropriately assess environmental concerns.

A more meaningful comparison for public consideration is whether or not the FWPO is a substantial change relative to environmental concerns when compared to current AFD winter operations. Current winter operations include the SOR EIS preferred alternative, as modified by the RODs that adopted that alternative and subsequent modifications to operations primarily to address listed species. Current winter operations have not utilized the full range of the flexibility provided by the SOR EIS preferred alternative, which has been adaptively managed by the RODs. The current winter operation is defined as the No Action Alternative for purposes of this EA's analysis since this is the management strategy in the wintertime that the public is most familiar with.

Under FWPO, AFD would be managed more actively for power purposes compared to current operations/ No Action Alternative, resulting in greater lake level fluctuations in the winter than are currently undertaken for power (though such fluctuations are authorized by the SOR EIS preferred alternative). In addition to the new operating parameters for power (maximum lake elevation of 2056 feet and maximum discharge of 45 kcfs) mentioned above, FWPO includes an ice BMP that would further limit fluctuations in discharge and lake elevation under certain conditions.

Environmental concerns relevant to the proposed FWPO management strategy for power are assessed in Chapter 4, Environmental Consequences, and summarized in Section 4.17. The new operating parameters provide a limit on the power operations, but do not by themselves provide a meaningful basis for determining environmental effects. Effects of using the new operating parameters to their maximum extent (i.e., the bookend scenario) are similarly described in Chapter 4. The only new (i.e., not previously disclosed in the SOR EIS) effect relevant to environmental concerns under FWPO is the potential acceleration in the spread of flowering rush. As described in Section 4.10, this is not considered a significant effect. Therefore, FWPO is not considered a substantial change as compared to current operations in regards to these environmental issues.

Chapter 6
Cumulative Impacts

Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." 40 CFR 1508.7.

As discussed in 1.3, this EA tiers from the SOR EIS and is intended to evaluate effects of the FWPO and determine whether a supplemental or new EIS is required, or whether the SOR EIS as confirmed through analyses in this EA is sufficient. The cumulative effects analysis in the SOR EIS considered two dimensions. The first dimension relates to the accumulation of localized or project-specific effects of the SOS actions for the entire river system. The second dimension focused upon the effects of SOS alternatives within the context of other actions that have been affecting or will affect the same resources. (See Section 4.3 of the SOR EIS Main Report).

Both FWPO and the No Action alternative of this EA would result in a continuation of the incremental impact of operating the FCRPS when added to past, present, and reasonably foreseeable incremental impacts of operating the FCRPS. The significance of these effects has already been disclosed in the SOR EIS.

This cumulative effects analysis seeks to identify, (1) if there are any new cumulative effects upon resource(s) that were not previously disclosed in the SOR EIS and prior NEPA documentation incorporated by reference, and (2) actions that have been affecting or will affect the same system resources since the SOR EIS was published. This section concludes by determining if there are significant new circumstances or information relevant to environmental concerns and bearing upon the prior cumulative impact analysis in the SOR EIS.

Present and reasonably foreseeable future actions relevant to the impacts identified in this EA are outlined below. The incremental effect of FWPO added to the cumulative effects of these actions is then evaluated for each resource area to determine whether the incremental contribution of FWPO results in a significant cumulative effect. The focus of the cumulative effects section is on resources that are affected by FWPO. For this reason, not all resource categories are discussed. Headings have been modified from those in Chapter 4, Environmental Consequences, to reflect this focus on resource areas affected by FWPO.

6.1. GAS SUPERSATURATION

6.1.1. Clark Fork Settlement Agreement Protection, Mitigation, and Enhancement Measures

A forebay goal of 120% TDG for up to a 10 year flow has been established at Cabinet Gorge Dam. As part of the Agreement, Avista is currently evaluating methods to decrease TDG. A feasibility study was initiated in 2010 to evaluate five alternatives. These included modify existing spillway crest, Howell-Bunger valves/modify gates in spillway bays, spillway at left abutment, and powerhouse on diversion tunnels and flood channels/rapids downstream (Avista 2011).

6.1.2. Box Canyon Dam relicensing

As discussed previously in Section 3.7, Box Canyon is planning to modify operations so that a total of 60 kcfs can be passed downstream without increasing TDG. The project is scheduled to be completed in 2015.

6.1.3. Waneta Hydroelectric Expansion Project

As discussed previously in Section 4.7, Waneta Dam plans to upgrade its facilities so that it can pass whatever flow it receives from Boundary Dam (up to about 50 kcfs) without increasing TDG. The project is scheduled to be completed in 2016.

6.1.4. Summary

FWPO will be managed to limit TDG levels below 110% saturation downstream of AFD. As described in Section 4.7, the maximum discharge range of FWPO could result in an increase in TDG levels below BCD and Waneta dams during the time period before project upgrades are completed. The projects identified above should cumulatively decrease levels of TDG in the water column in the future. The Cabinet Gorge project, if successful, would likely decrease AFD forebay TDG levels. This would result in decreased AFD tailwater levels of TDG when water is spilled at the dam. Since FWPO would be managed to the 110% standard, the net result immediately downstream of AFD may simply be the creation of a larger buffer between actual TDG levels and the water quality standard. This buffer would then be transported to downstream facilities and likely result in decreased occurrences of high TDG at these downstream projects. The incremental effect of FWPO in the short term is not considered a significant effect as described in Section 4.7. Over the long term, the cumulative effect of the projects listed above should result in reduced TDG levels.

6.2. FISH AND AQUATIC HABITAT

6.2.1. Albeni Falls Dam Bull Trout Passage

Fish passage is currently being studied at the feasibility level at AFD as a result of ESA bull trout consultation and the USFWS BiOp. The feasibility investigation will likely include the construction and operation of a prototype facility.

6.2.2. Clark Fork Hydroelectric Project and Settlement Agreement

Current operations of the Clark Fork dams contribute to aquatic habitat effect as a result of flow manipulation, fish entrainment, and they represent fish passage barriers.

The Settlement Agreement was completed in 1999. It included a collection of aquatic habitat improvement measures in tributaries to the Clark Fork River to offset power peaking impacts of Cabinet Gorge and Noxon Rapids dam. Many aquatic habitat projects have been implemented to date. Additional projects are being planned. The Settlement Agreement also included a feasibility study of fish passage which is ongoing. It is uncertain if this will result in future fish passage at the dams beyond the current trap and haul operation that uses the fish ladder at the Cabinet Gorge hatchery.

The Cabinet Gorge hatchery was built in 1985 on the Clark Fork River in an effort to restore the Lake Pend Oreille kokanee fishery. At the time of construction it was the largest kokanee hatchery in the world. The hatchery represented a cooperative effort among BPA, Washington Water Power Company, and

IDFG. Cabinet Gorge Hatchery was operational by November 1985, and at full capacity, can provide up to 20 million kokanee fry for release into Lake Pend Oreille.

6.2.3. *Box Canyon Dam Operations and relicensing*

Current operations of Boundary Dam are described in Section 4.1. Aquatic habitat effects include altered hydrology, fish entrainment and the dam represents a migration barrier. Continued operations would maintain a relatively constant reservoir elevation between AFD and BCD. As a result of the relicensing, POPUD has provided habitat enhancement/restoration in the tributaries of the Box Canyon Reservoir, annual funding to the Kalispel Natural Resources Department for bull trout and westslope cutthroat trout restoration, and 100 underwater habitat enhancement structures for rearing habitat for salmonids and largemouth bass in the reservoir and sloughs. Planned upgrades to the dam include incorporating fish-friendly runners in two of the turbine upgrades to improve fish survival and fish passage facilities. A temporary trap-and-haul device has been proposed.

6.2.4. *Boundary Dam Operations and Relicensing*

Current operations of Boundary Dam are described in Section 4.1. SCL is currently renewing its FERC license to continue operations consistent with the way it has operated in the past. Operations affect aquatic habitat through daily fluctuation of its reservoir and downstream discharges. The dam results in fish entrainment and is a migration barrier. As part of ongoing relicensing efforts, a Fish and Aquatics Management Plan has been developed that includes the following components to improve fish habitat: mainstem fish community and aquatic habitat measures, upstream fish passage, measures to reduce project related entrainment mortality, tributary non-native trout suppression and eradication, tributary fish community and aquatic habitat measures, Mill Pond dam site monitoring and maintenance, native salmonid conservation program, and a recreational fish stocking program.

6.2.5. *Sullivan Creek Project*

Sullivan Creek is a tributary to the Boundary Reservoir and is connected to the operation of Boundary Dam. The project would remove Mill Pond dam and restore Sullivan Creek from Mill Pond dam up to its confluence with Outlet Creek.

6.2.6. *Waneta Hydroelectric Expansion Project*

The project would increase the capacity of the dam so that it can pass the range of daily flow fluctuations (up to 50 kcfs) from Boundary Dam upstream. Currently Seven Mile Dam is used to meter flow to Waneta with the goal of keeping flows below that which would result in spill at Waneta. This will end with the completed expansion project. The result will be a decrease in the magnitude of daily lake fluctuations in both the Seven Mile and Waneta reservoirs thus improving the aquatic habitat conditions.

6.2.7. *Kalispel Tribe Memorandum of Agreement*

The Corps, BPA, Reclamation, and the Kalispel Tribe are proposing to enter into a Memorandum of Agreement (MOA). Pursuant to the MOA, BPA would commit to long-term funding and the Corps would commit to implementation activities to support the protection and recovery of fish and wildlife affected by the FCRPS particularly the Albeni Falls Project, in a manner that recognizes the Kalispel Tribe as a governmental partner in the pursuit of protection and recovery of the affected fish and wildlife. In addition to the continuation of funding for several on-going projects, several new projects would be implemented over the life of the MOA. Descriptions of each new project or program are referenced in the relevant resource area subheading of the cumulative effects chapter of this EA (i.e. Section 6.2.10 and Section 6.3.3).

6.2.8. Lake Pend Oreille MCE Decision Tree

The Corps, BPA, and Reclamation are currently coordinating with the USFWS on reinitiating consultation concerning the designation of critical habitat for bull trout. It is possible that the MCE decision tree as discussed in Section 3.8 could be revised as part of this effort, or other measures adopted. At this point, as the agencies are coordinating on consultation activities, any such modifications or new measures are not reasonably foreseeable.

6.2.9. Lake Pend Oreille Kokanee Mitigation (BPA Project No. 1994-047-00)

This project is on-site, partial mitigation for impacts of Albeni Falls Dam. The Lake Pend Oreille Kokanee Mitigation project entails several work elements aimed at restoring kokanee abundance in Lake Pend Oreille so that it is capable of sustaining a harvest of 300,000 kokanee on an annual basis. One work element is to assist the USFWS with long-term lake level management planning. The project monitors shoreline spawning habitat to see if lake level management is producing the desired habitat. Removal of lake and rainbow trout by trap nets and/or gill nets is being implemented to reduce predation of kokanee. As part of a cooperative effort, Avista Power Company is funding a $15/fish bounty program on rainbow and lake trout to help reduce predator numbers. Under BPA Project No. 1994-0477-00, IDFG assesses nutrient dynamics in Lake Pend Oreille and the role this plays in kokanee recovery, including investigating the potential for adding nutrients to increase survival. Restoration actions aimed at kokanee survival and production levels can be reasonably certain to occur in some capacity over the life of the Albeni Falls Dam.

6.2.10. Resident Fish: Assessment of Effects of Albeni Falls Dam (Kalispel MOA)

This 2-year losses assessment project would support the evaluation of the ecosystem conditions and function affected by the construction, inundation, and operation of Albeni Falls Dam, and would cooperatively develop biological and environmental objectives that would relate the performance outcomes for resident fish as mitigation for impacts from Albeni Falls. If, as a result of this assessment, the Parties to the MOA mutually agree that there are FCRPS impacts to resident fish that are not already addressed by past and on-going mitigation, then BPA would provide funding to help address those impacts.

6.2.11. Pend Oreille Basin Initiative (Kalispel MOA)

This project would support implementing larger-scale projects to improve local watershed health and ecosystem conditions and function within the Pend Oreille subbasin, consistent with the NPCC Sub-Basin Plan. Land management and watershed restoration would be based upon the jointly-developed objectives and expected performance outcomes. Expense funds under this project may be used to support the planning, beginning in about year 5, for a westslope cutthroat and/or bull trout conservation facility. The Tribe would initiate discussions between the Kalispel Natural Resource Department and BPA staff to develop a shared understanding of the scale, underlying assumptions and premises for project purposes related to future hatchery production. The Tribe would obtain BPA concurrence about purpose and need, and project objectives to be served through conservation production, including agreement about appropriate cost-share (relative to the magnitude of the impacts attributable to the FCRPS and Albeni

Falls Dam in particular) before beginning the NPCC's Major Projects Review (3-STEP) process in approximately years 5 through 7.

In addition to these new proposed projects, the proposed Kalispel MOA also includes an effort by the Corps, BPA and Kalispel Tribe to investigate operational changes at the Albeni Falls Project that could help improve water quality for bull trout and other species, as described in Section 6.2.12.

6.2.12. Pend Oreille River water temperature study (Kalispel MOA)

The long term objective identified in the proposed Kalispel MOA is to operate Albeni Falls Dam in late summer and early fall to improve downstream water temperature for bull trout and other aquatic species in the Pend Oreille River. The first priority toward this objective is to assess whether releases from Albeni Falls Dam can decrease downstream water temperature during this critical time period. To make this assessment, the Corps and Tribe will engage in a joint investigation of operational adjustments through modeling analyses and experimental releases for downstream water temperature moderation. This investigation will be conducted in three phases.

In phase 1, a technical team will evaluate the relationship between potential operational adjustments and downstream water temperatures. Both post and pre-Labor Day operational releases for downstream water temperature moderation will be evaluated using models. In phase 2, information derived from the phase 1 modeling effort will be used to develop criteria for the timing and duration of post-Labor Day experimental releases to be implemented. If modeling results indicate that pre-Labor Day releases may result in improved water temperatures, the Corps, with the support of the Tribe and BPA, will also initiate the requisite processes to assess effects associated with pre-Labor Day releases, including coordination with the public and regional forums such as the Technical Management Team. As part of phase 2, the Corps, Tribe and BPA will develop a monitoring plan for experimental releases for downstream water temperature moderation. In phase 3, the Corps and Tribe will use information from the modeling effort, experimental releases, and results from the monitoring to inform future operations and if appropriate, the requisite processes necessary to consider a decision to implement a pre-Labor Day release in a revised long term operational plan. The Corps and the Tribe agree that a primary objective in a revised long term operational plan is moderation of downstream water temperatures supportive of bull trout and other aquatic species in the Pend Oreille River to the maximum extent practicable.

6.2.13. Climate Change

Climate change is expected to affect the future Pend Oreille River hydrograph. Many experts believe climate change is a major contributing factor to the 25% reduction in average snowpack in the Northwest over the past 40 to 70 years. A continued decline in snowpack would further decrease the amount of water available during the warm season. Alternatively, warmer winter temperatures may increase flow during the winter resulting in a higher flood frequency and potentially higher base winter flows. This would potentially increase the rate at which FWPO filling could occur in the future.

6.2.14. Summary

FWPO effects on aquatic habitat include alteration of the hydrology in the form of lake level fluctuations, changes to river velocity and stage both above and below AFD, periodic dewatering of aquatic habitat between AFD and BCD resulting in loss of invertebrates and potentially stranding fish.

The management of BCD, natural river fluctuations, and potentially climate change could affect habitat in the BCD reach in the future. The hydroelectric projects listed above cause similar aquatic habitat effects in other reaches of the Pend Oreille River. Without fish passage between the dams, there is no cumulative effect of these actions on individual fish or the segregated fish populations. If fish passage is established, a cumulative effect from the flow manipulations may become more apparent as the fish population is no longer disconnected. These losses in aquatic habitat are offset to some degree by the habitat enhancement projects described above.

FWPO could result in some fish stranding between AFD and BCD. Natural river fluctuations, as modified by operations at AFD, and AFD refill and draft operations outside of the winter are the only other mechanisms by which stranding would occur in this reach. These latter mechanisms would occur at different times of the year, but would still affect the same populations of fish. The stranding effect is important to the degree that it results in the loss of individual fish. The amount of fish injury and mortality expected as a result of FWPO is small and not significant relative to the fish populations in the river as a whole.

6.3. WILDLIFE AND WETLAND HABITAT

6.3.1. Albeni Falls Wildlife Mitigation-IDFG (BPA Project No. 1992-061-03)

The Idaho Department of Fish and Game (IDFG) developed a mitigation plan in 1987, for the construction of Albeni Falls Dam. The NWPCC reviewed and approved the Albeni Falls plan in 1990. Since 1997, IDFG has acquired approximately 1,780 acres of land with BPA funding to mitigate for impacts to wildlife associated with the construction of Albeni Falls Dam. IDFG developed and finalized a new wildlife management plan in 2008. Reasonable and foreseeable actions entail long-term management activities necessary for the protection, enhancement and maintenance of wildlife habitat, including wetlands and floodplains, on mitigation parcels.

6.3.2. Albeni Falls Wildlife Mitigation-Kalispel Tribe (BPA Project No. 1992-061-02)

The construction of Albeni Falls Dam resulted in the loss of over 28,000 Habitat Units in wetland and riparian habitat types. Through the acquisition of property rights, property protection and habitat enhancement, the Kalispel Tribe is continuing to mitigate for these losses with funding from BPA. To date, land acquired and managed for mitigation totals 4,539 acres (2,903 acres in Washington and 1,636 acres in Idaho).

BPA Project No. 1992-061-02 provides for enhancement, operation, maintenance and monitoring, and evaluation for all properties managed by the Kalispel Tribe in this mitigation project. The properties acquired to date by the Kalispel Tribe fall into two general categories. These include properties that are conservation type with limited enhancement work necessary in the Idaho management area [Beaver Lake, Gamlin Lake and West Branch Priest River] and properties that have high potential habitat value but require active enhancement activities to realize their potential [the Flying Goose Ranch, two Tacoma Creek properties, three Trimble Creek properties and two Calispell Creek properties]. Reasonable and foreseeable management activities include hydraulic restoration, wetland enhancement, shoreline protection and vegetation restoration. BPA Project No. 1992-061-02 also provides for data collection to provide scientific support for the continuation of these types of enhancement activities on additional properties as they become part of this project.

6.3.3. *Albeni Falls Dam Wildlife Operational Effects Assessment Project (Kalispel MOA)*

This project would identify and analyze the impacts of Albeni Falls Dam operations on wildlife, taking into account prior and on-going mitigation related to construction and inundation. The project would be funded by BPA. If, as a result of this assessment, the Parties to the MOA mutually agree that there are operational impacts to wildlife from the Albeni Falls Project that are not already addressed by past and on-going mitigation, then BPA would provide funding to help address those impacts.

6.3.4. *Summary*

The primary driver for effects on wildlife habitat around Lake Pend Oreille is the continued operation of AFD to maintain a summer lake elevation of 2062.5 followed by drafting for flood risk reduction in the winter. Habitat enhancement actions such as those described above help to offset this impact. The incremental effect on habitat around the lake caused by FWPO is completely masked by AFD operations at other times of the year.

6.4. FLOWERING RUSH

6.4.1. *Idaho Invasive Species Council*

The Idaho Department of Agriculture performs aquatic surveys to monitor the spread of invasive species around the lake. The department works in collaboration with a local task force, which includes a representative from the Corps, to identify problem locations and an acceptable method of control (herbicide application or diver dredging). The department then authorizes the necessary treatment.

6.4.2. *Box Canyon Dam Integrated Weed Management Plan*

The FERC license includes a provision to survey, monitor, and manage noxious weeds on all PUD-controlled lands as part of the Integrated Weed Management Plan framework.

6.4.3. *Summary*

The primary mechanism behind the spread of flowering rush are natural propagation and general human activities around the lake. FWPO could help disperse flowering rush around Lake Pend Oreille and the downstream river as described in Section 4.10. Based on its distribution and apparent migration pattern, it will be difficult to prevent rush from establishing downstream of AFD. FWPO has the potential to accelerate the broader distribution of rush over Lake Pend Oreille, as well as below AFD, though the incremental effect the FWPO has as compared to the existing operation is difficult to determine. Since the expansion of flowering rush is expected to be inevitable over time, the incremental effect of FWPO on spread of rush is not considered a significant cumulative effect.

6.5. CULTURAL RESOURCES

6.5.1. *Albeni Falls Dam Operations*

Significant erosion is occurring around Lake Pend Oreille as a result of the operation of AFD which results in the erosion of cultural resources around the lake. Impacts on cultural resources from the construction and operation of AFD are currently managed through the FCRPS system wide Programmatic

Agreement. The Corps and BPA have developed an HPMP for the AFD and Lake Pend Oreille Project that will be used to guide a range of activities including inventory, bank protection, and curation of cultural resources. A number of bank protection projects have been implemented to date and more will occur in the future in response to current operational effects. FWPO is unlikely to add to the bank protection roster.

6.5.2. Summer Recreation Activities

Boat traffic and associated waves has been documented as an important contributor to erosion at cultural resource sites around Lake Pend Oreille.

6.5.3. Summary

The primary driver behind the erosion of cultural resources around Lake Pend Oreille is the continued operation of AFD. FWPO may cause some incremental erosion during the winter on sites that have already been adversely affected, but this is expected to be inconsequential relative to that caused by existing operations where erosion at high summer pools affects intact parts of sites.

6.6. RECREATION

6.6.1. Kokanee/Fishery Management Activities

IDFG actively manages fishery populations around Lake Pend Oreille with a goal of improving fishing opportunities and associated recreation around the lake. These activities could improve fishing opportunities in the future.

6.6.2. Pend Oreille River Water Temperature Study (Kalispel MOA)

As mentioned in Section 6.2, part of the proposed Kalispel MOA there may be a study to investigate whether temperatures in the lake are affected by alternative management plans at AFD including an earlier draw down, both post and pre-labor day, of Lake Pend Oreille. This could affect recreation by altering the summer lake elevation at Lake Pend Oreille as early as mid-August.

6.6.3. Summary

The recreation effects identified in this EA are associated with accessing and recreating on Lake Pend Oreille when it is frozen. Effects are primarily associated with accessing the ice on the lake from the shore. There may also be some additional ice hazards for those recreating near the shoreline of Lake Pend Oreille during the winter. These socioeconomic effects should not result in significant cumulative effects relevant to environmental concerns.

6.7. ECONOMIC AND SOCIAL EFFECTS

Section 3.16 provides information on historical permits for docks and other infrastructure around Lake Pend Oreille. While a permit does not necessarily represent a constructed dock, it serves as a relative measure for past and potential future dock construction activities. The potential effects on docks identified under FWPO are not expected to alter this trend or significantly affect the total number of docks around the lake. FWPO may result in a general improvement in the quality and structural integrity of docks built around the lake. These socioeconomic effects should not result in significant cumulative effects relevant to environmental concerns.

6.8. SIGNIFICANCE AND THE SOR EIS

The SOR EIS concluded that the various SOS alternatives result in cumulative impacts throughout the Columbia River basin. The environmental effects described above under FWPO, while not specifically detailed in the SOR EIS, are consistent with the general cumulative effects previously disclosed in the EIS. While social and recreation effects were evaluated in the SOR EIS in the context of cumulative impacts, the specific effects identified in this EA were not previously disclosed in the SOR EIS and are thus new effects. The analysis above indicates that there are not significant new circumstances or information relevant to environmental concerns and bearing upon the prior cumulative impact analysis in the SOR EIS.

Chapter 7
Coordination

FWPO was originally discussed at the annual interagency lake level meeting held on September 17, 2009, to develop a recommendation for that year's MCE for Lake Pend Oreille. This meeting was attended by representatives from the Corps, USFWS, IDFG, NMFS, the Kalispel Tribe, the Pend Oreille Basin Commission, the Pend Oreille River Commission (POBC), and others. The group provided comments on the proposal but did not make a recommendation. At the September 30, 2009, TMT meeting, BPA requested that the Corps consider using the full operating range of Lake Pend Oreille between the end of kokanee spawning (approximately December 15) and March 31 to better meet the region's power needs. The Corps proceeded to develop this EA.

7.1. COORDINATION WITH THE PUBLIC, ELECTED OFFICIALS, AND STAKEHOLDERS

Corps and BPA coordination with the public, elected officials, and stakeholders has continued throughout the EA development process in the form of meetings, conference calls, and site visits. Coordination was initiated with a press release in early October 2009. A notice was published in the local newspaper in December 2009. Public meetings were held in December 2009, May 2010, and June 2010. There was at least one conference call with elected officials in January 2010, and one with the POBC also in January 2010. There have been numerous meetings, calls, and correspondence with the POBC, elected officials, IDFG, Idaho Department of Lands, the Kalispel Tribe of Indians, POPUD and SCL. In April 2010, a notice of preparation for this EA was published. In July 2011, a public notice was published with the draft EA describing and soliciting public comment on the draft EA.

Numerous comments have been received by letter and email, and at the public meetings. Comments received have been used to evaluate effects of FWPO. The Corps and BPA have addressed these comments in the EA.

7.2. TRIBAL COORDINATION

Six federally recognized Indian Tribes have reservations in the project area. These include the Kalispel Tribe of Indians, the Kootenai Tribe of Idaho, the Confederated Salish and Kootenai Tribes of the Flathead Reservation, the Coeur d'Alene Indian Tribe, the Spokane Tribe of Indians, and the Confederated Tribes of the Colville Reservation. Each potentially affected tribe was formally notified of the proposal by letter that included an interest on the part of the Government to meet with each tribe on a government-to-government basis. To date, the Corps and BPA have met with the Kalispel Tribe on two occasions to discuss FWPO. Additional coordination has occurred at the staff level with the six potentially affected tribes, including quarterly meetings of the AFD Cultural Resource Management Cooperating Group.

Chapter 8
Environmental Compliance

The SOR EIS addressed compliance with environmental statutes, executive orders, and regulations of AFD operations. In some cases, the effects of FWPO required additional analysis and coordination where new issues were raised or regulatory requirements had been updated since the SOR EIS. These issues are discussed below. The SOR EIS should be consulted for a more complete summary of project environmental compliance.

8.1. NATIONAL ENVIRONMENTAL POLICY ACT

Federal agencies are required to evaluate and consider the environmental effects of major federal actions under NEPA (42 USC 4321 et seq.). The SOR EIS and associated RODs satisfied NEPA requirements for current AFD operations. The purpose of the EA is to evaluate effects of the FWPO and determine whether a supplemental or new EIS is required, or whether the SOR EIS, as confirmed through analyses in this EA is sufficient. Specifically, this EA is intended to evaluate whether: (1) FWPO is a substantial change from the proposed action evaluated in the SOR EIS relevant to environmental concerns; or whether, (2) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action of the SOR EIS or its impacts (40 C.F.R. §1502.9(c)). The public comment period for the draft EA was from July 28 to September 13, 2011. Comments and responses are provided in Appendix D of the EA.

8.1. ENDANGERED SPECIES ACT

The ESA (16 USC 1531 et seq.), as amended in 1988, establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants and the habitat upon which they depend. Section 7(a) of the ESA requires that federal agencies consult with USFWS and NMFS, as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their critical habitats. As described in Section 3.12, consultation on ESA species has occurred for existing project operations. FWPO is contained within the description of the action consulted on previously. Consultation for bull trout critical habitat will be completed as part of the general FCRPS reconsultation with USFWS.

8.2. FEDERAL WATER POLLUTION CONTROL ACT (CLEAN WATER ACT OR CWA)

The Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.) is more commonly referred to as the Clean Water Act (CWA). This act is the primary legislative vehicle for federal water pollution control programs and the basic structure for regulating the discharge of pollutants into waters of the United States. The CWA was established to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." The CWA sets goals to eliminate discharge of pollutants into navigable waters, protect fish and wildlife, and prohibit the discharge of toxic pollutants in quantities that could adversely affect the environment.

The Corps' policy is to comply with the CWA to the extent practicable. Pursuant to the CWA, the States of Idaho and Washington, and the Kalispel Tribe have delegated authority from the Environmental Protection Agency (EPA) to establish water quality standards and regulate the water quality of water bodies under their jurisdiction. The Corps believes a critical component for achieving water quality standards is the establishment of clear, implementable TMDLs for all users who contribute to the non-attainment of those limits. The EA addresses the effects of implementation of FWPO on water quality, in particular nutrients and gas supersaturation. The Corps's assessment is that implementation of FWPO is consistent with these Corps' CWA responsibilities.

8.3. PACIFIC NORTHWEST ELECTRIC POWER PLANNING AND CONSERVATION ACT

Under the Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act), the Corps is to exercise its responsibilities for operating the FCRPS in a manner that provides equitable treatment for fish and wildlife with other purposes for which the Corps facilities are operated and managed; and, to take into consideration in its decision-making the Northwest Power and Conservation Council's (NPCC) Fish and Wildlife Program and Mainstem Amendments to the fullest extent possible.

The Corps considered the NPCC's Amendments to the Fish and Wildlife Program in the preparation of the EA and believes the preferred alternative is consistent with its Northwest Power Act responsibilities.

Under the Northwest Power Act, in addition to its obligations to help provide for an adequate, efficient, economical, and reliable power supply, BPA is required to use its Bonneville Fund and other authorities available to protect, mitigate, and enhance fish and wildlife to the extent affected by the development and operation of the FCRPS. BPA's Fish and Wildlife Program (including many of the specific projects addressing the effects of AFD as described in the cumulative impact chapter) provides BPA's Northwest Power Act compliance.

8.4. NATIONAL HISTORIC PRESERVATION ACT

Section 106 of the NHPA (16 USC 470 et seq.) requires that federal agencies evaluate the effects of federal undertakings on eligible historical properties, archeological, and cultural resources and afford the Advisory Council on Historic Preservation or State Historic Preservation Officer (SHPO) and other consulting parties opportunities to comment on the proposed undertaking. The Corps and BPA have an established program to address the requirements of NHPA Sections 106 and 110 at AFD, and have an approved Historic Property Management Plan that governs implementation of the program. The program addresses effects of all project operations, which would include those that may occur under FWPO. Therefore, additional NHPA coordination for FWPO is not necessary.

8.5. AMERICAN INDIAN RELIGIOUS FREEDOM ACT

The American Indian Religious Freedom Act of 1978 (AIRFA) (42 U.S.C. 1996) establishes protection and preservation of Native Americans' rights of freedom of belief, expression, and exercise of traditional religions. Courts have interpreted AIRFA to mean that public officials must consider Native Americans' religious interests before undertaking actions that might harm those interests. The Corps and BPA will continue to coordinate with affected Native American Tribes on this proposal and future implementation plans. No alternative or alternative combination would have any effect upon Native Americans' rights of freedom of belief, expression, and exercise of traditional religions.

8.6. FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act of 1980 (FWCA) (16 U.S.C. 661 et seq.) requires federal agencies to coordinate with USFWS and state wildlife agencies when planning new projects or when modification of an existing project occurs. The USFWS and state agencies charged with administering wildlife resources conduct surveys and investigations to determine the potential damage to wildlife. The USFWS incorporates the concerns and findings of the state and federal agencies, including NOAA Fisheries, into a report that addresses fish and wildlife factors and provides recommendations for mitigating or enhancing impacts to fish and wildlife affected by a federal project. The FWCA does not require the Corps and BPA to coordinate with the USFWS for continuing operation of existing water resource projects; however, the Corps and Reclamation routinely coordinate with the USFWS on their operations.

8.7. MIGRATORY BIRD TREATY ACT

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703 et seq.) establishes a federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, ... or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird." This prohibition applies to birds included in the respective international conventions between the United States and Great Britain, the United States and Mexico, the United States and Japan, and the United States and the former Union of Soviet Socialist Republics.

The alternatives considered in this EA are evaluated with regard to effects on birds and their habitat in wetlands and riparian areas. The preferred alternative may result in acceleration of growth of flowering rush, which results in competition with native aquatic plants for space, and, in the long term, decreases the extent of native plants around the lake as it is a very effective colonizer and aggressive competitor. Further, this could result in a reduced food source for overwintering waterfowl such as redhead ducks. Compared to existing operations, this effect is considered to be only a minor incremental effect and does not result in a significant adverse effect on migratory birds.

8.8. RIVERS AND HARBOR ACT OF 1899

The Rivers and Harbor Act of 1899 regulates structures or work in or affecting navigable waters of the United States including discharges of dredged or fill material into waters of the United States. Structures include without limitation, any pier, boat dock, weir, revetment, artificial islands, piling, aid to navigation or any other obstacle or obstruction. No such structures, dredging or filling are planned as part of any alternative evaluated in this EA. Potential impacts to structures that either will be or have already been permitted under either the Rivers and Harbor Act or the Clean Water Act Section 404, however, have been evaluated as part of the effects of alternatives under this EA. Permit holders should review their individual permit for details as to their permit's applicable terms and conditions, such as the permit holder's continuing responsibility to maintain authorized structures in good condition, as well as to limitations upon the authorization provided by the permit and federal liability.

8.9. WATER RESOURCES DEVELOPMENT ACT OF 1990

The Water Resources Development Act of 1990 (WRDA) has several purposes. It establishes a goal of no overall net loss of the nation's remaining wetland base and increasing the quality and quantity of the wetlands. The Act also directs the Secretary of the Army to include environmental protection as one of the primary missions of the Corps. The NEPA process satisfies the requirements of Section 310(b) of WRDA, which requires public participation in developing or revising changes to reservoir operation criteria.

8.10. EXECUTIVE ORDER 11988, FLOODPLAIN MANAGEMENT GUIDELINES

Executive Order 11988, dated May 24, 1977, outlines the responsibilities of federal agencies in the role of floodplain management. Each agency shall evaluate the potential effects of actions on floodplains and should avoid undertaking actions that directly or indirectly induce growth in the floodplain or adversely affect natural floodplain values. This EA evaluates effects of alternative water operations on flooding and floodplains. No development in any floodplain is anticipated as a result of the alternatives considered.

8.11. EXECUTIVE ORDER 11990, PROTECTION OF WETLANDS

Executive Order 11990 encourages federal agencies to take actions to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands when undertaking federal activities and programs. Minor, short-term, indirect impacts to wetlands adjacent to the levees or roadways could occur during construction of improvements.

This EA assesses effects on wetlands and riparian areas. FWPO would likely result in incremental additional erosion of wetlands compared to the ongoing wetland erosion that occurs under current operations/No Action Alternative.

8.12. EXECUTIVE ORDER 12898, FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS

Executive Order 12898, dated February 11, 1994, requires federal agencies to consider and address environmental justice by identifying and assessing whether agency actions may have disproportionately high and adverse human health or environmental effects on minority or low-income populations. Disproportionately high and adverse effects are those effects that are predominantly borne by minority and/or low-income populations and are appreciably more severe or greater in magnitude than the effects on non-minority or non-low income populations. Considering the nature and expected impacts of FWPO, disproportionate impacts on minority or non-low income populations are not anticipated.

8.13. EXECUTIVE ORDER 13007, NATIVE AMERICAN SACRED SITES

Executive Order 13007, dated May 24, 1996, directs federal agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners. Agencies are to avoid adversely affecting the physical integrity of such sacred sites and to maintain the confidentiality of sacred sites when appropriate. The act encourages government-to-government consultation with tribes concerning sacred sites. Some sacred sites may qualify as historic properties under the NHPA. No alternative or alternative combination would have any effect on compliance with EO 13007 at the project.

8.14. EXECUTIVE ORDER 13084, CONSULTATION AND COORDINATION WITH INDIAN TRIBAL GOVERNMENTS

This order requires federal agencies to be guided by Tribal sovereignty and rights when making policy affecting Tribal governments, and to have a process for Tribal representatives to have meaningful and timely input on regulatory policies significantly or uniquely affecting their communities.

The Corps and BPA provided opportunities, via government-to-government consultation and other coordination, for Tribes to provide meaningful and timely comment on the FWPO to address concerns tribes may have with the FWPO.

8.15. EXECUTIVE ORDER 13514 ON FEDERAL LEADERSHIP IN ENVIRONMENTAL, ENERGY, AND ECONOMIC PERFORMANCE

This order establishes an integrated strategy toward sustainability in the Federal Government and makes reduction of greenhouse gases a priority for federal agencies. This EA evaluates a proposed operation that continues and optimizes use of a renewable energy source that does not emit greenhouse gases.

Chapter 9
Conclusions and Findings

In 1995, the Bonneville Power Administration (BPA), the U.S. Army Corps of Engineers (Corps), and the Bureau of Reclamation jointly led the development of the Columbia River Power System Operation Review Environmental Impact Statement (SOR EIS). The purpose of the SOR EIS was to evaluate different management strategies for the 14 federal dams and reservoirs in the Columbia River Basin that have a major influence on multiple purpose system operations. The SOR environmental analysis was comprehensive, evaluating the potential impacts of the alternatives on the following topics: earth resources, water quality, air quality, anadromous fish, resident fish, wildlife, cultural resources, Native Americans, aesthetics, recreation, flood control, navigation, power, irrigation, municipal and industrial water supply, economics, and social impacts. The Corps and BPA have tiered this Environmental Assessment (EA) to the 1995 SOR EIS.

Since the implementation of the SOR preferred alternative in 1995 as modified by the agency Records of Decision (RODs) and subsequent Biological Opinions (BiOps) for addressing endangered species, winter operations at Albeni Falls Dam (AFD) have been largely guided by the interagency coordination on management actions for kokanee spawning, described in Section 3.8 of this EA, and flood risk reduction activities. BPA has proposed to more actively utilize storage behind AFD consistent with existing operational criteria for power generation. The proposal is called Flexible Winter Power Operations (FWPO). This proposal changes the way the dam has operated in recent years, but it is similar to historical winter operations. FWPO includes a new ice best management practice and minimum fluctuation standard operating procedure. The purpose of this EA is to determine whether, 1) FWPO is a substantial change from the SOR EIS proposed action relevant to environmental concerns, or whether 2) there are significant new circumstances or information relevant to environmental concerns and bearing on the SOR EIS proposed action or its impacts (40 C.F.R. §1502.9(c)). The SOR EIS did not have an explicit "proposed action;" rather, the EIS evaluated a range of management strategies. The agencies selected the EIS preferred alternative, which was adopted with additional measures for kokanee management testing in agency RODs, and further adapted primarily as a result of subsequent BiOps under the Endangered Species Act. Current winter operations have not utilized the full range of the flexibility provided by the SOR EIS preferred alternative. The current winter operation is defined as the No Action Alternative for purposes of this EA's analysis since this is the management strategy in the wintertime that the public is most familiar with. This represents current AFD operations and functions as the SOR EIS "proposed action" and the No Action Alternative for the purpose of the analysis in the EA.

Chapter 4, Environmental Consequences, and Chapter 5, Comparison of FWPO to SOR EIS Proposed Action, evaluate effects of FWPO relative to current operations/No Action Alternative. Because of the opportunistic nature of FWPO, countless potential water storage and drafting scenarios could be analyzed. For this reason, a "bookend" scenario was used to analyze effects of FWPO operating within the maximum range of outflows and lake elevations allowed. The purpose of evaluating FWPO this way is to ensure that potential impacts have been thoroughly described. The bookend scenario is considered unlikely to occur, because it does not account for important variables such as power demand, weather, and system conditions that would trigger the need to utilize the available storage.

The effects identified include a combination of new information and effects that had not previously been disclosed in the SOR EIS, and more detailed information on effects that were previously disclosed in the SOR EIS. The new environmental and socioeconomic effects include:

- Potential for increased damage to less structurally sound docks as a result of winter lake fluctuations and certain ice conditions on the lake.

- Potential effects on winter lake recreation as a result of lake level fluctuations and ice interaction with the shoreline.
- Potential increase in the rate that the invasive flowering rush is spread around Lake Pend Oreille and to locations downstream of AFD. This is due to the species' tendency to be transported by moving ice, which is predicted to increase with implementation of FWPO.

The effects on docks and recreation are considered socioeconomic effects of FWPO with limited environmental concern. The effect on flowering rush is not considered a significant environmental concern in the context of 40 C.F.R. §1508.27. This is due primarily to the very limited role FWPO could play in the seemingly inevitable spread of this invasive species.

Since 1995 the Eurasian watermilfoil population has expanded around Lake Pend Oreille and the Pend Oreille River. However, we do not consider this to be a significant new circumstance as a result of existing operations. This expansion would have occurred with or without implementation of existing operations. As identified in this EA, FWPO should not significantly affect this expansion as compared to under existing operations.

The remaining effects identified in this EA are considered additional detail to effects, including those that were previously identified as significant, that were previously disclosed in the SOR EIS. These effects include:

- An increase in shoreline erosion around the lake and related erosion of cultural resources and wildlife habitat. This is due to the increased lake fluctuation compared to the relatively constant winter lake elevation considered in the No Action Alternative.
- Alteration of winter flows from AFD downstream to Box Canyon Dam (BCD). This is about 45 miles of the Pend Oreille River. This would result in greater fluctuations in river stage and velocity than would otherwise occur leading to the dewatering of aquatic habitat along the margins of the river, loss of invertebrate populations in the dewatered areas, and potential stranding of fish including bull trout.
- Water quality impacts associated with gas supersaturation and related potential for gas bubble trauma in fish in the Pend Oreille River downstream of BCD and downstream of Waneta Dam. In each case, this effect would potentially occur prior to 2016. At this time, both Box Canyon and Waneta dams are scheduled to have completed upgrades to their facilities that would allow passage of the maximum flow contemplated for FWPO without creating supersaturated gas levels.

Based on the analysis presented in Chapter 5 in this EA, FWPO, as compared to actions addressed in the SOR EIS, results in a different winter management strategy (including some differences in operating parameters for power operations). The environmental concerns of the management strategy for FWPO have been assessed and are summarized above.

Findings:

As a result of the analysis in this EA, I have the following findings. I find that: 1) the FWPO is not a substantial change from the SOR EIS proposed action relevant to environmental concerns; and, 2) there are no significant new circumstances or information relevant to environmental concerns and bearing on the SOR EIS proposed action or its impacts (40 C.F.R. §1502.9(c)). I have determined for my respective agency that preparation of a new or supplemental Environmental Impact Statement is not warranted to implement FWPO. As a result of the analysis in this EA, I also find that the actions proposed and evaluated in this EA do not result in any new significant impacts to the human environment within the meaning of the National Environmental Policy Act. Accordingly, I have decided to proceed with adoption of FWPO as a winter management operation at Albeni Falls Dam at this time.

November 4, 2011	*/s/ William C Maslen for*
Date	F. Lorraine Bodi, VP Environment, Fish & Wildlife, Bonneville Power Administration

November 4, 2011	*/s/ Bruce A Estok*
Date	Bruce A. Estok Colonel, Corps of Engineers District Commander

Chapter 10
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