AMENDMENT OF LICENSE
OPAL SPRINGS HYDROELECTRIC PROJECT
FERC PROJECT NUMBER 5891-000

REVISONS TO EXHIBIT A

Below is a tabulation of the Opal Springs Hydroelectric Project facilities. Refer to the revised Exhibit F and G drawings for additional details.

Note on project elevations: All elevations are reported in National Geodetic Vertical Datum of 1929 (NGVD 29), except construction drawings that are in a local project datum (LPD), which is greater than NGVD 29 by 1.79 feet.

Diversion Structure

Type	Concrete-capped rockfill
Height from toe of Dam	25.5

Crest Elevation at normal fish ladder operations	
Elevation of normal water surface	2007.21 ft. NGVD '29
Estimated pool area	14.4 acres
Estimated pool storage	119 acre-feet

Fish Ladder

Type	Vertical Slot
Height	31.2
Number of cells	38
Design flow (cfs)	30
Jump Height (inches)	9

Intake Structure

Type	Concrete

Size	44 x 33 feet in plan
Height	32 ft
Parapet Elevation	2012.21 ft. NGVD '29

<u>Conduits</u>

Type	Corrugated metal
Number	Two
Diameter	12.5 feet
Length	1,157 feet each
Lining	Full cement mortar
Cover	Minimum 5 feet of earth and rock for protection from falling rock

<u>Bifurcation</u>

Type	Concrete
Size	52 x 33 feet in plan
Height	19 feet
Transition	Two 12.5 foot diameter to one 16 foot diameter

<u>Surge Tank</u>

Type	Steel
Diameter	30 feet
Height	37 feet
Orifice Diameter	6 feet

<u>Penstock</u>

Type	Steel
Diameter	16 feet
Length	160 feet

<u>Powerhouse</u>

Type	Indoor, two level
Size	99 feet x 63 feet
Turbine Type	3-meter horizontal tube type
Turbine Manufacturer	Allis Chalmers
Gross Head	52 feet
Generator	4.3 MW 4,160 V synchronization
Speed	150 rpm
Generator manufacturer	Siemens-Allis

<u>Turbine Water Driven Pumps</u>	Pump Units	
Description	Unit 1	Unit 3
Rating (hp)	175	480
Turbine flow capacity (cfs)	65	140
Pumping capacity (gpm)	600	1,400
Penstock Dimensions	4 feet diameter	6' feet diameter

	x 64 feet long	x 100 feet long

Project Operations

The OSHP will continue to be operated as a run-of-river facility, and the minimum instream flow requirement of the current license (License Article 36) will be maintained. Gate 1 and the associated concrete-lined spill channel are sized to provide a minimum total flow of 344 cfs, which, combined with the ladder flow of 30 cfs and the maximum turbine flow of 1,772.5 cfs, is slightly less than the 5% annual exceedance streamflow of 2,667 cfs.

Pool level is maintained with the aid of level sensor and computer. Changes in flow are automatically sensed and the turbine wicket gates adjust to maintain the pool level. The setting of the pool level is calibrated to the nearest tenth of a foot in elevation.

UPDATED EXHIBIT E

APPLICANT PREPARED ENVIRONMENTAL ASSESSMENT

OPAL SPRINGS HYDROELECTRIC PROJECT

FERC NO. 5891

Prepared for:

DESCHUTES VALLEY WATER DISTRICT

Madras, Oregon

Prepared by:

Kleinschmidt

Portland, Oregon
www.KleinschmidtGroup.com

October 2015 (revised, October 2017)

This Page Left Intentionally Blank

UPDATED EXHIBIT E
APPLICANT PREPARED ENVIRONMENTAL ASSESSMENT
OPAL SPRINGS HYDROELECTRIC PROJECT
FERC NO. 5891

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APEA ATTACHMENTS

J:\4267\001\Docs\Amendment\Enclosure 3 - APEA\001 APEA-OPAL_20151002.docx

ACRONYMS AND ABBREVIATIONS

APE	area of potential effects
APEA	applicant-prepared environmental assessment
AWS	alternative water supply
BA	biological assessment
BFAA	Bypass Flow Accrual Account
BIA	U.S. Bureau of Indian Affairs
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
CFR	Code of Federal Regulations
cfs	cubic feet per second
CRWC	Crooked River Watershed Council
CTWS	Confederated Tribes of the Warm Springs Reservation of Oregon
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DLCD	Oregon Department of Land Conservation and Development
DO	dissolved oxygen
DMM	downstream migrant mortality
DPS	distinct population segment
DVWD	Deschutes Valley Water District
EFH	essential fish habitat
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FMO	foraging, migration, overwintering
FPA	Federal Power Act
FPWG	Fish Passage Work Group
IDF	inflow design flood
kV	kilovolt
LPD	local project datum
MCR	Mid-Columbia River
MSA	Magnuson-Stevens Act
MW	megawatt
NEPA	National Environmental Policy Act
NGVD 29	National Geodetic Vertical Datum of 1929
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	U.S. National Marine Fisheries Service
NOI	Notice of Intent
O&M	operation and maintenance
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife Service
OEDD	Oregon Economic Development Department
OSHP	Opal Springs Hydroelectric Project

OWEB	Oregon Watershed Enhancement Board
PGE	Portland General Electric
PLA	proposed license article
PME	protection, mitigation, and enhancement measure
PRB	Pelton Round Butte
PURPA	Public Utility Regulatory Policies Act
PSA	power sales agreement
RM	river mile
rkm	river kilometer
SHPO	State Historic Preservation Office
SWW	selective water withdrawal facility
TMDL	total maximum daily load
TWG	Technical Work Group
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
WM	Willamette Meridian
WSEL	water surface elevation

UPDATED EXHIBIT E
APPLICANT PREPARED ENVIRONMENTAL ASSESSMENT
OPAL SPRINGS HYDROELECTRIC PROJECT
FERC NO. 5891

1.0 INTRODUCTION

The Deschutes Valley Water District (DVWD) is filing this updated applicant-prepared environmental assessment (APEA) with the Federal Energy Regulatory Commission (FERC) as part of an ongoing application for a non-capacity amendment of its license for the Opal Springs Hydroelectric Project (OSHP), FERC No. 5891. This APEA updates the previously provided APEA submitted on October 8, 2015 which was prepared pursuant to the requirements of FERC's regulations at 18 CFR §4.38 and §4.61 and FERC's guidance document, *Preparing Environmental Documents: Guidelines for Applicants, Contractors, and Staff* (FERC 2008). The Updated APEA is necessary because certain project features have been modified since the October 8 2015 submittal, even the Proposed Action has not been significantly altered. FERC will use the APEA to satisfy its responsibilities under the National Environmental Policy Act (NEPA) to assess the environmental effects of the Proposed Action, an Alternative Action, and the No-Action Alternative.

This APEA incorporates by reference the Settlement Agreement, Joint Explanatory Statement, filed previously on October 8, 2015, and updated Technical Appendices

- Exhibit A: Biological Assessment/Evaluation (BA) of the Effects of the Proposed Action on Listed Species, with a supplemental report to conform the BA with changes proposed since its original filing.
- Exhibit B: Consultation Summary
- Exhibit C: Supplemental Information

Under separate cover, the DVWD is re-filing revised Exhibits A (Project Description), G (maps) and F (drawings) reflecting the changes necessary to bring these exhibits into conformance with the proposed amendment. For convenience, DVWD is also providing a "crosswalk" document that summarizes the changes from the 2015 proposal.

Amendment of the OSHP's FERC license is needed because anadromous fish are being reintroduced to the upper Deschutes River basin. The reintroduction is underway as the result of fish passage measures required by Portland General Electric Company's (PGE’s) FERC license for the Pelton Round Butte (PRB) Project (FERC No. 2030) (see Section 3). As a result of the reintroduction, fish passage barriers within the three major tributaries upstream of the PRB Project, including the OSHP on the Crooked River need to be addressed systematically. Multiple agencies and other interested organizations have addressed 13 barriers to fish passage in the Crooked River subbasin upstream of the OSHP (Figure 1-1). These organizations include the Oregon Department of Fish and Wildlife (ODFW), the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWS), PGE, the Crooked River Watershed Council (CRWC), Ochoco Irrigation District, and others. Passage structures have been installed at 10 diversion dams, and 3 dams have been removed. These actions have reconnected approximately 108 miles of river. The four remaining passage barriers in the lower Crooked River subbasin (including the OSHP) are being addressed.

In developing the Proposed Action, DVWD has engaged federal and state agencies, and non-governmental organizations in extensive pre-filing consultation. Most significantly, the *Settlement Agreement Concerning License Amendment for Fish Passage at the Opal Springs Hydroelectric Project* (“Original Agreement”) was executed in October 2011. A revised and restated settlement agreement was signed in October 2015 (Settlement Agreement). The restated Settlement Agreement reflected more complete understandings of the designed facilities and their operations. The parties (Parties) to the Settlement Agreement include the DVWD, NMFS, USFWS, the U.S. Bureau of Indian Affairs (BIA), the U.S. Bureau of Land Management (BLM), ODFW, and Trout Unlimited (TU). The Settlement Agreement is being filed concurrently with the application for amendment and this APEA.

As agreed among the Parties, the proposed amendment will authorize DVWD to provide for upstream and downstream passage at the OSHP and to provide an adaptive structure for managing the fish passage facilities throughout the term of the amended license. Specifically, DVWD proposes to:

1. construct a fish ladder to provide passage for migratory bull trout and anadromous summer steelhead, which both are listed as threatened according to the Endangered Species Act (ESA), into the Crooked River subbasin; and to provide passage for spring Chinook; the passage facilities also will reconnect populations of native redband trout upstream and downstream of the OSHP;
2. modify the dam to raise the maximum operating elevation of the OSHP reservoir from 2,004.21 feet to 2,007.21 feet.[1,2] This new elevation will enable the DVWD to construct alternative downstream passage routes for migrating fish and facilitate the establishment of a water bank known as the Bypass Flow Accrual Account (BFAA), which the Oregon Department of Fish and Wildlife (ODFW) and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWS) (hereafter referred to as the Fish Managers) will use to supplement flow into the OSHP's bypass reach as needed; and
3. adaptively manage the OSHP to meet fish passage performance objectives through a monitoring and evaluation program and tiered measures that are designed to respond to the findings of the monitoring and evaluation program.

The specific elements of the Proposed Action (described in greater detail in Section 4 of this APEA) are (1) constructing a fish ladder to provide upstream fish passage at the OSHP, (2) increasing the maximum operating elevation of the OSHP reservoir from 2,004.21 feet NGVD 29 to 2,007.21 feet by modifying the dam, (3) establishing a water bank to be used for facilitating upstream and downstream fish passage effectiveness, (4) implementing an adaptive management approach to facilitate decision-making for the duration of the term of OSHP's current FERC license, and (5) modifying the FERC boundary of the OSHP to encompass the proposed works and the larger pool.

The proposed increase in the elevation of the reservoir will inundate an additional 700 longitudinal feet (3.9 acres) of riverine habitat immediately upstream of the existing OSHP

[1] All elevations are reported in National Geodetic Vertical Datum of 1929 (NGVD 29), except construction drawings that are in a local project datum (LPD), which is greater than NGVD 29 by 1.79 feet. For purposes of keeping the construction and engineering simple, this LPD is used in an engineering context.

[2] The OSHP is authorized to operate at a maximum pool elevation of 2,005 feet NGVD 29; surveys conducted in 2009 by DVWD indicate that the current elevation of the impoundment is at 2,004.21feet. The proposal is to increase the impoundment elevation by 3 feet, making the new maximum operating elevation 2,007.21 NGVD 29 (2,007 feet LPD).

impoundment. The new pool will approach, but not encroach on, the downstream boundary of the Wild and Scenic segment of the Crooked River.

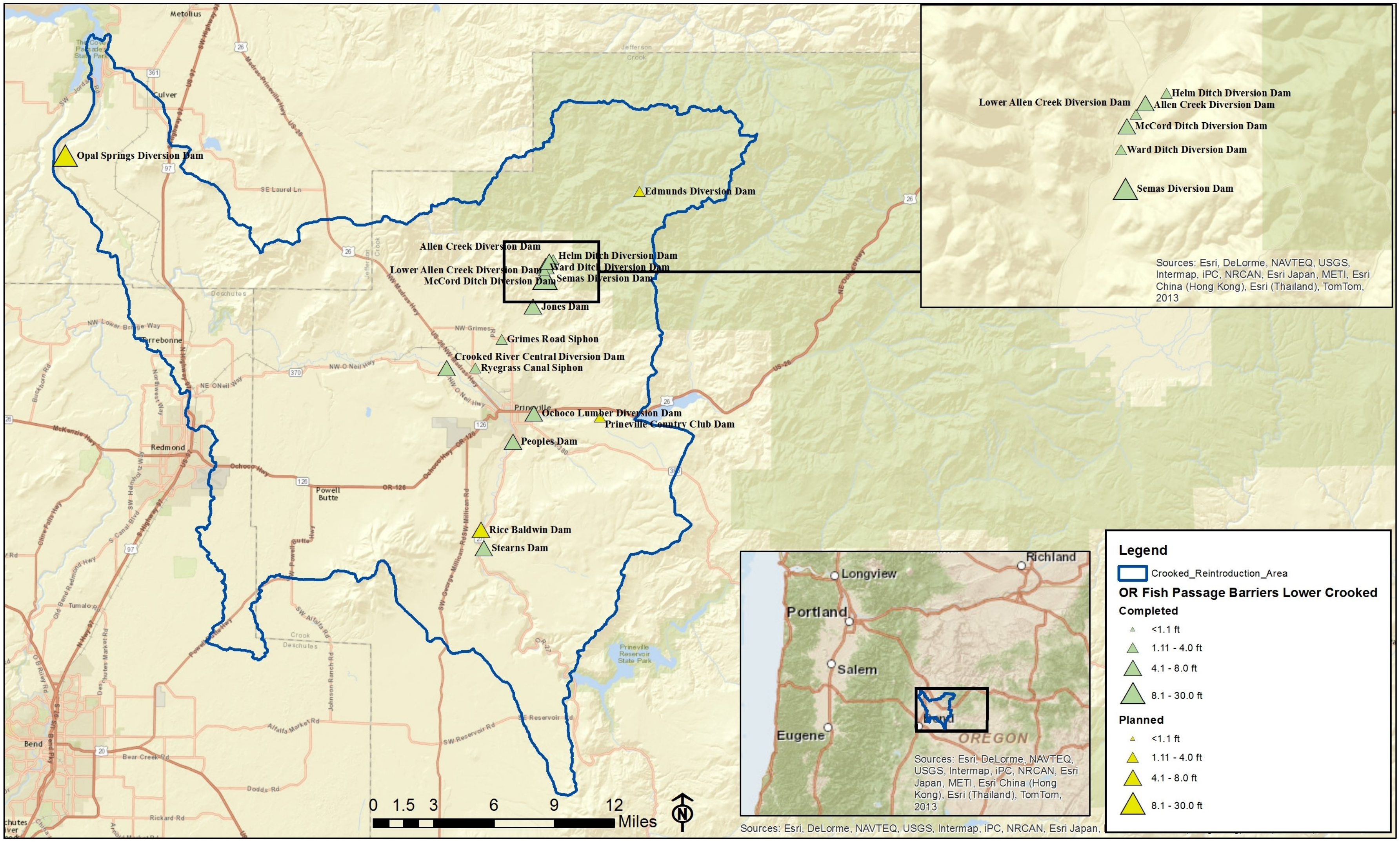


FIGURE 1-1 LOWER CROOKED RIVER

The map indicates barriers to anadromous fish migration and shows that provision of passage around the facility at Opal Springs is crucial for providing access for fish to the entire sub-basin (Source: Sanders 2015).

2.0 APPLICATION

2.1 APPLICATION TYPE

Non-capacity license amendment**.**

2.2 DATE FILED

October 7, 2015

2.3 APPLICANT

Deschutes Valley Water District.

2.4 WATER BODY

Crooked River, a tributary to the Deschutes River, Oregon.

2.5 COUNTY AND STATE

Jefferson County, Oregon.

3.0 PURPOSE OF ACTION AND NEED FOR POWER

On October 8, DVWD filed an application for a non-capacity amendment of its FERC license for the OSHP. DVWD requested FERC's approval to construct a fish ladder and increase the maximum operating pool of the OSHP impoundment by 6 feet to 2,010.21 feet (2,012 LPD). In 2016, the project underwent value-engineering when fish ladder proposal costs exceeded the amount affordable for DVWD. With the addition of new funding sources, and through the value-engineering process, minor modifications were made to the design resulting in a 3-foot pool raise to 2007.21 feet. The fish ladder is needed to provide upstream passage of native anadromous and resident fish at the OSHP.

A selective water withdrawal (SWW) facility has modified surface currents in Lake Billy Chinook (the reservoir above Round Butte Dam, downstream of the OSHP and the uppermost dam of the PRB Project) to attract outmigrating juvenile salmonids. The SWW is equipped with a fish screen to collect and sort outmigrants for release in the Deschutes River downstream of the PRB Project. The fish screen commenced operation in November 2009. A fish trap-and-haul operation, already in place below the PRB Project, will be used to transport returning adult salmonids to the tributaries upstream of the PRB Project.

The passage barrier posed by the OSHP is significant because it blocks access by migrating fish to the entire lower Crooked River subbasin. Providing fish passage at Opal Springs Dam will open access to about 108 miles of upstream fish habitat, including 58 miles reconnected by improvements at the Crooked River Central and Peoples’ Irrigation District dams. Providing upstream passage at the OSHP will help establish self-sustaining, harvestable populations of summer steelhead trout (steelhead) and spring-run Chinook salmon (spring Chinook) in the Crooked River. Non-anadromous native fish, including bull trout, are also expected to use the proposed fish ladder to migrate upstream of the OSHP.

The proposed increase in the elevation of the reservoir also will provide additional water on demand to facilitate upstream and downstream fish passage. DVWD will manage additional water, in collaboration with the resource agencies, via a water bank (i.e., BFAA). This water will serve both as attraction flow for adult fish that may be holding in the OSHP's tailrace and as alternative passage for downstream migrants through a spillway that will be constructed as part of the Proposed Action. Increased head resulting from increasing the elevation of the reservoir will allow DVWD to generate additional power to partially offset the cost of fish ladder construction and operation as well as costs associated with the monitoring and evaluation program.

FERC will determine whether to issue an amended license to DVWD to allow construction of the fish ladder and to increase the maximum allowable water surface elevation of the OSHP impoundment. FERC will also identify any conditions to be placed on the amended license. Issuing the amended license would allow DVWD to provide upstream and downstream fish passage as well as to generate additional hydropower at the OSHP for the remainder of the current license term.

The OSHP provides hydroelectric generation to meet part of Oregon's power requirements, resource diversity, and capacity needs. The OSHP has an installed capacity of 4.3 megawatts (MW) and generates approximately 29,509 megawatt-hours (MWh) per year.

DVWD provides water to approximately 4,000 residential and commercial customers in Jefferson County. Water is provided through wells that tap into deep artesian springs from the bottom of the 846-foot canyon in which the OSHP is located. From there, the water is pumped up to the canyon rim and distributed throughout the DVWD's service area. The OSHP is a vital part of the DVWD's operations because it enables DVWD to keep water rate increases to a minimum. These rates in turn help local business to thrive. These businesses include bottling companies that market the Opal Springs water, such as Earth H2O and the Opal Springs Water Company.

4.0 PROPOSED ACTION AND ALTERNATIVES

4.1 PROJECT DESCRIPTION

The OSHP is located southwest of the town of Culver in Jefferson County, at river mile (RM) 7.2 on the Crooked River in Central Oregon. The dam is about 0.75 mile upstream of the head of Lake Billy Chinook in the northeast quarter of the northwest quarter of Section 33, Township 12S, Range 12E, Willamette Meridian (WM) (Figure 4-1). The upstream end of the reservoir is located on BLM land in the northeast quarter of the northwest quarter of Section 4, Township 13S, Range 12E, WM (Figure 4-1). Figure 4-2 shows the OSHP facilities, surrounding geographic features, and land ownership.

The OSHP consists of the following elements:

- a 21-foot-high, 175.2-foot-long, concrete-capped, rockfill diversion dam topped with 5 feet of flashboards that create a pool with a storage capacity of 106.4 acre-feet and a surface area of 11.1 acres at normal maximum pool elevation of 2004.21 feet;[3,4]
- a 44-foot by 33-foot rectangular concrete intake structure 32 feet in height on the left abutment of the diversion dam;
- two 12.5-foot-diameter, 1,157-foot-long buried corrugated metal conduits;
- a 30-foot-diameter steel surge-tank bifurcator;
- a 16-foot-diameter, 160-foot-long steel penstock;
- two turbine-driven pumps, one rated at 175 horsepower and the other at 480 horsepower;
- a powerhouse containing one turbine generating unit with a nameplate capacity of 4.3 MW at a power factor of 0.85 providing 1,800 cubic feet per second (cfs) of powerhouse capacity;
- a 250-foot-long, 20.8-kilovolt (kV) underground transmission line interconnecting to the Pacific Power and Light transmission system; and

[3] All elevations are reported in National Geodetic Vertical Datum of 1929 (NGVD 29) except construction drawings that are in the local project datum (LPD), which is greater than NGVD 29 by 1.79 feet. For purposes of keeping the construction and engineering simple, this LPD is used in an engineering context.

[4] The OSHP is authorized to operate at a maximum pool elevation of 2,005 feet NGVD 29; surveys conducted in 2009 by DVWD indicate that the current elevation of the impoundment is at 2004.21 feet. The proposal is to increase the impoundment elevation by 6 feet, making the new maximum operating elevation 2,010.21 feet NGVD 29 (2,012 feet LPD)

- appurtenant facilities.

FIGURE 4-1 PROJECT LOCATION MAP

FIGURE 4-2 PROJECT FEATURES, LAND OWNERSHIP, AND FERC BOUNDARY (EXISTING AND PROPOSED)

4.2 EXISTING PROJECT OPERATIONS

The OSHP is operated as a run-of-river facility. As required by Article 36 of the current OSHP license, DVWD maintains the discharge from the Opal Springs Dam at a continuous minimum flow of 50 cfs or the inflow to the reservoir, whichever is less, for the purpose of protecting and enhancing aquatic resources in the Crooked River downstream of the OSHP. The OSHP's water right is for 1,772.5 cfs, which may be fully used when river flows exceed 1,822.5 cfs. Once the powerhouse capacity (1,772.5 cfs) is exceeded, excess streamflows during periods of high runoff (typically in the spring) are passed over the stoplogs as the impoundment is allowed to rise.

4.3 PROPOSED ACTION

According to the Proposed Action, FERC will authorize DVWD to build a fish ladder and to increase the maximum pool elevation of the OSHP to 2,007.21 feet. The proposed normal water surface elevation of the pool, for purposes of ensuring continuous operation of the fish ladder, will be 2007.21 feet NGVD 29FERC will also authorize DVWD to operate the OSHP in accordance with an adaptive management framework that includes establishing a water bank to facilitate upstream and downstream fish passage (see Fish Passage and Protection Plan, Appendix B to the Settlement Agreement).[5]

At the proposed increased water surface elevation, the OSHP impoundment will store 119 acre-feet and have a surface area of 14.4 acres. The proposed upstream extent of the pool will approach, but not encroach on, the downstream boundary of the Lower Crooked River Wild and Scenic River Area (the east-west centerline of the Wild and Scenic boundary is at the northern half of the northern half of Section 4, Township 13S, Range 12E, WM, approximately RM 8). The OSHP boundary would be amended to reflect the inclusion of additional BLM lands (Figure 4-3).

The OSHP will continue to operate as a run-of-river facility. As described in Appendices A and B of the Settlement Agreement, DVWD would manage a water bank for the benefit of upstream

[5] For convenience, DVWD is providing a "crosswalk" document that summarizes the changes from the 2015 proposal. This crosswalk accompanies is in Exhibit C of this APEA

and downstream fish passage, for use at the request of the Fish Managers. The Fish Managers will base their requests on a planning process involving all parties to the Settlement Agreement to generate a BFAA Annual Allocation Plan (described in Section 4.3.3). The DVWD will modify its operations to supply additional water through a spillway, which will be part of the facilities.

The following sections describe the elements of the Proposed Action.

4.3.1 PROPOSED BOUNDARY

The FERC boundary of the OSHP will be amended to include additional BLM lands and to incorporate features necessary for operating the new and existing facilities. Proposed changes include the following:

- The FERC boundary below the diversion will be extended to include the fish ladder and an extended portion of the tailrace below the OSHP where potential adaptive measures could be implemented pursuant to the proposed adaptive management plan.
- On the west side of the reservoir, the boundary will include the upstream portions of the fish ladder and the boat ramp.
- Elsewhere above the diversion, the boundary will follow the 2,010.21-foot contour. This elevation ensures that the boundary will not encroach on the Lower Crooked River Wild and Scenic River Area.

FIGURE 4-3 PROJECT DETAIL
(three sheets)

.

4.3.2 PROPOSED FACILITIES

The proposed facilities, which are described in detail in the following sections, include a fish ladder, flashboards and a pneumatic crest gate to raise the pool elevation. The following subsections describe these facilities in detail.

The Parties, including the Fish Agencies (NMFS, USFWS, ODFW, BIA), have reviewed the preferred design for the fish ladder (Figure 4-4). Prior to construction, as required by the Settlement Agreement, agencies will be providing their approvals, subject to consistency with any final license conditions that FERC may issue as a result of the proposed amendment (see Exhibit B, Consultation Record). The design documents include the following:

- 100% Specifications Vol 1, Vol 2
- 100% Standard Details
- 100% Supporting Design Report
- 100% Drawings

FIGURE 4-4 FISH LADDER

[fish ladder image-layout]

[This Page Intentionally Left Blank]

4.3.2.1 Fish Ladder

The Proposed Action includes constructing a vertical-slot fish ladder on the right abutment of Opal Springs Dam to allow volitional upstream passage of fish. The ladder will include five key features:

- entrance
- attraction spill
- exit structure
- temporary adult trap
- other facilities for monitoring and evaluation

The fish ladder will accommodate a static forebay water surface elevation of 2,007.21 feet (2,009 feet LPD). The tailwater surface elevation with 50 cfs is 1,979.01; therefore, the maximum hydraulic differential between headwater and tailwater will be approximately 28.2 feet. As a result, the proposed layout describes 38 pools with hydraulic drops of 9 inches each.

Entrance. The ladder is designed to pass both salmon and trout. An entrance approximately 1 foot 10 inches wide by 3 feet high will deliver 30 cfs with 12 inches of differential. The ladder entrance is located based on field observations with the resource agencies and the results of flow testing conducted in late August 2012. During testing, the spill flow varied from approximately 30 cfs to 1,030.0 cfs, which encompasses the 95% to 5% exceedance streamflow range for bypass flows.

The ladder entrance is positioned to take advantage of a back-eddy pool that forms on the downstream side of a large boulder on the right bank adjacent to the stilling basin. Spill flows are expected to create a whitewater shear zone near the boulder that will guide fish moving upstream from the stilling basin tailout over the short distance to the fishway entrance. The maximum length of this whitewater shear zone is estimated to be between approximately 5 to 40 feet for Chute No. 1 flow rates ranging from 20 cfs to 300 cfs. The water jet discharging from the fish ladder entrance will intersect the Chute No. 4 flows at a large angle, and the resultant velocity vectors will be directed toward the stilling basin tailout and downstream boulder field.

Attraction Spill. No piped auxiliary water supply system will be provided. The minimum bypass flow of 50 cfs will be supplied by the 30 cfs fish ladder flow and 20 cfs of spill flow. Spill flow normally will be supplied by Gate No. 4 adjacent to the fish ladder.

Exit Structure. The fish ladder will have a single exit pool located within the forebay to accommodate the full range of potential static forebay water surface elevations in 3-inch increments, resulting in 13 discrete set-points.

Temporary Adult Trap. A temporary trap for adult fish will be provided as part of the monitoring and evaluation program requirements to assess the performance of the fish passage facilities and demonstrate that the requirements of the Settlement Agreement have been met. The temporary adult trap will be located in the channel upstream of a transport channel and before the exit pool. It will consist of a trapping mechanism, holding pool, upstream diffuser, and a brail with hopper. The trapping mechanism will be an in-ladder, removable vee-trap with brail.

Facilities for Monitoring and Evaluation. The fish ladder will include other provisions for monitoring and evaluating fish, including designated space, conduit, electrical, and instrumentation and control connections for a future fish-counting system (designed by the DVWD) and the possible future addition of devices for detecting passive integrated transponder (PIT) tags. The DVWD anticipates using a VAKI Riverwatcher system with digital video camera to count and identify fish. This equipment will be placed at the downstream end of the transport channel. A conduit embedded in the sides and invert of the transport channel or other provisions will be made to facilitate future installation of a PIT-tag detector.

4.3.2.2 Pneumatic Crest Gate and fixed flashboards

A fixed wooden flashboard section along with one inflatable weir (or gate) will together span the crest of the dam to establish and control the increased pool elevation. The inflatable weir or gate provides alternative downstream passage routes for adult migratory fish that move downstream through the OSHP area. Both the fish ladder and the gate are designed to improve upstream and downstream passage conditions for migratory fish.

A single 12-foot wide pneumatic crest gate will be located on the right abutment, adjacent to the fishway. This Gate No. 1 will provide instream flow releases, will make BFAA releases for downstream fish passage, and will provide additional attraction water adjacent to the fish ladder entrance. A concrete-lined spillway chute located immediately downstream will safely delivery fish into the tailwater pool. It is also anticipated that the gate will be the primary location for the release of the 20 cfs balance of instream flows (with the fish ladder providing 30 cfs). The maximum capacity of the gate will be approximately 340 cfs at the 2007.21 ft. (2,009 FT LPD) forebay water surface elevation.

Fish bypass releases would enter a stilling basin adjacent to the proposed fish ladder entrance. The purpose of the stilling basin is to ensure optimal laminar flows in Chute 1 to the base of the dam.

The Fish Passage Working Group (FPWG)[6] will develop detailed protocols for operating the inflatable weir or gate and for using BFAA releases to facilitate fish passage as part of the adaptive management effort.

Fish bypass releases would enter a stilling basin adjacent to the proposed fish ladder entrance. The Fish Passage Working Group (FPWG)[7] will develop detailed protocols for operating the

[6] As described in the Settlement Agreement, the Fish Passage Working Group means all signatories to the October, 2015, SA (DVWD, NMFS, USFWS, BIA, ODFW, TU, and CTWS (provided that the CTWS is a signatory to the Settlement Agreement)). This is the working group whose purpose is to advise the Licensee on fisheries and habitat issues as specified in this Agreement and the Amended License.

[7] As described in the Settlement Agreement, the Fish Passage Working Group means all signatories to the October, 2011, SA (DVWD, NMFS, USFWS, BIA, ODFW, TU, and CTWS (provided that the CTWS is a

gates and for using BFAA releases to facilitate fish passage as part of the adaptive management effort. Section 4.3.3 describes an initial operational approach.

4.3.3 Proposed Operations

The OSHP will continue to be operated as a run-of-river facility, and the minimum instream flow requirement of the current license (License Article 36) will be maintained. Gate 1 and the associated concrete-lined spill channel are sized to provide a minimum total flow of 344 cfs, which, combined with the ladder flow of 30 cfs and the maximum turbine flow of 1,772.5 cfs, is slightly less than the 5% annual exceedance streamflow of 2,667 cfs.

As part of the Settlement Agreement, the DVWD will be implementing the BFAA as directed by the Fish Managers. The BFAA will be used to provide additional flow releases in the bypass reach (in addition to the instream flow requirement of 50 cfs) to facilitate upstream and downstream fish passage. The total annual BFAA volumes are estimated to be on the order of 20,000 to 30,000 acre-feet. In terms of flow releases, this volume will provide a year-round BFAA flow release of 30 to 40 cfs, approximately 9 weeks of flow releases at 200 cfs, or approximately 2 weeks of flow releases at 864.5 cfs.

The Fish Managers will base their requests for additional releases on a planning process involving all parties to the Settlement Agreement to generate a BFAA Annual Allocation Plan (described in Appendices A and B of the Settlement Agreement). The DVWD will modify its operations to supply additional water, when called for, through Gate 1 (see Section 4.3.2.6 above).

The ability to direct flow up to the design capacity of the bypass weir provides greater control of the river over a wide range of flow conditions. The ability serves two important functions:

- minimizing injury and mortality of fish passing over the roughened spillway; and

---

signatory to the Settlement Agreement)). This is the working group whose purpose is to advise the Licensee on fisheries and habitat issues as specified in this Agreement and the Amended License.

- balancing the amount and location of flow in relation to the ladder entrance to provide attraction water;

4.3.4 Fish Monitoring

Fish migrating through the OSHP area will be monitored to evaluate the biological performance of the new fish ladder, inform adaptive management of the BFAA, and determine whether other fish passage measures might be needed to achieve the biological performance objectives described in Appendix B of the Settlement Agreement. The monitoring and evaluation program will have upstream and downstream fish passage components, each implemented at 5-year intervals so that point estimates have an appropriate level of precision and represent a range of environmental conditions. Determinations of achievement of the biological performance objectives will be based on point estimates of aggregated data at the end of each 5-year monitoring interval.

Enumeration of fish using the fish ladder will begin upon completion of the fish ladder and elevation of the pool, but monitoring upstream passage will begin when migrating adult salmonids are passed upstream of the PRB Project and begin approaching and moving through the OSHP area. Efforts to monitor upstream fish passage at the OSHP will be designed to identify obvious problems with passage of adult fish within a few years to provide the FPWG with sufficient information to manage the BFAA for upstream fish passage and to inform decisions regarding fish passage improvements that may be needed to meet the explicit Performance Objectives. Uncertainties to be resolved by monitoring include species-specific run timing, the potential for migratory delay at the tailrace and at the base of the dam due to false attraction, rates of successful upstream fish passage, rates of adult fall-back, and whether or how management of the BFAA affects these rates.

Appendix B of the Settlement Agreement provides greater detail regarding the proposed fish monitoring program and actions based on monitoring results.

4.3.5 PERFORMANCE OBJECTIVES

The primary purpose of installing the new fish ladder, increasing pool elevation and creating the BFAA is to provide safe, timely and effective passage for migratory and resident fish species in the Crooked River at the OSHP. Conditions that meet the objectives will accommodate the natural timing of key life-history events (such as spawning) of the migratory species present, and will not cause excessive injury, mortality, or a high frequency of aberrant migratory behaviors by the salmonids entering the area (for example, false attraction of adults to the powerhouse tailrace, extended holding immediately above or below the dam, or unintended adult fall-back after passing upstream over the dam).

The Settlement Agreement describes specific fish passage Performance Objectives for safe, timely, and effective upstream passage at the OSHP as follows:

Upstream Fish Passage Performance Objectives

Species	**Standard (to be met)**	**Goal (to be strived for)**
Steelhead and Chinook Salmon adults	≥90% successful upstream passage of migratory adults, with ≥90% of those adults that do successfully pass the Project doing so by a specified date each year[8]. Fish that perish when falling-back after dam passage will be considered unsuccessful migrants.	≥97% successful upstream passage of migratory adults destined for areas above the Project. Fish that perish when falling-back after dam passage will be considered unsuccessful migrants.
Bull trout adults and subadults	≥90% successful upstream passage, with the standard assumed to be met if that for steelhead adults is met at the Project.	≥97% successful upstream passage, with the goal assumed to be met if that for steelhead adults is met at the Project.

Specific fish passage Performance Objectives for safe, timely, and effective downstream passage at the OSHP are as follows:

Downstream Fish Passage Performance Objectives

Species	**Standard**	**Goal**
Steelhead and Chinook Salmon smolts	≥90% passage survival	≥97% passage survival
Bull trout adults and subadults	Assumed to be met if the ≥90% passage survival standard for steelhead smolts is met and levels of upstream passage by bull trout >12" at the Project do not exceed 1,000 fish on an annual basis.	Assumed to be met if the ≥97% goal for steelhead smolts is met.

The Settlement Agreement specifies that the identified Standards will be met by the end of the 3rd 5-year Performance Assessment Interval and the Goals by the end of the current license period: *"The Licensee shall achieve the fish passage Performance Objectives through the implementation of the Adaptive Management program. The Licensee shall be considered in compliance with these requirements so long as the fish passage Performance Objectives are met or the Licensee is working towards meeting the fish passage Performance Objectives*

[8] This objective implies that there is a target date each year by which the specified proportion of adult spawners should have passed the project in order for the run to reach the spawning grounds above the project at an appropriate time of year. The target date is unknown, and will be the subject of ongoing research as part of the reintroduction plan. Appendix B of the Agreement indicates that the FPWG will strive to establish this date within five years of adult release upstream of the PRB Project.

through implementation of the Adaptive Management program". *S*ee Section 4.3.6, below, for a description of the adaptive management approach.

4.3.6 ADAPTIVE MANAGEMENT

The proposed adaptive management program includes (1) increasing BFAA allocations at specified intervals determined by being out of compliance with biological performance objectives (described in Appendix A of the Settlement Agreement and Section 4.3.5 above), (2) implementing two tiers (Tier 1 and Tier 2) of fish passage improvement measures as necessary to improve fish passage efficacy or meet biological performance objectives, (3) implementing other changes of the BFAA allocation, (4) modifying spill gate operation, and (5) modifying trash racks. Data for making adaptive management decisions will be obtained via monitoring the following parameters in three 5-year intervals:

- adult salmonid counts in the OSHP area
- adult salmonid migration timing
- real-time adult salmonid passage effectiveness
- aggregate adult salmonid passage performance
- juvenile salmonid relative abundance
- juvenile salmonid emigration timing
- real-time juvenile salmonid passage effectiveness
- aggregate smolt passage performance

Any modifications of the OSHP's trash racks will automatically restart the 5-year monitoring interval, beginning the year in which the modifications are implemented. Appendix B of the Settlement Agreement has greater detail regarding the proposed adaptive management program.

4.3.6.1 TIER 1 MEASURES

Over a period of at least 15 years (consistent with ~4 steelhead lifecycles) following completion of the fish ladder and pool raise, the DVWD will implement, monitor, and adjust Tier 1 fish passage measures at the direction of the FPWG, subject to constraints identified in this Plan, the amended Project license, and federal biological opinions. 5 –year Performance Intervals are proposed to measure success against relevant fish passage performance objectives.

Tier 1 measures include changes in operation of the proposed fish ladder as needed to ensure safe, timely, and effective fish passage; implementation of the BFAA; and minor physical modifications at the OSHP and in the bypass reach. Tier 1 measures include specific physical modifications at the dam or in the bypass reach.

The following set of upstream and downstream measures will be implemented, as agreed to by the FPWG, during any 5-year Performance Assessment Interval or in response to any 5-year Performance Assessment Interval (described in Section 5.4 below) in order to achieve the relevant fish passage Performance Objective (Section 5.3). Tier 1 measures include a variety of potential actions that would not require additional ESA consultation between the agencies and FERC following issuance of the amendment order.

Upstream passage Tier 1 measures include the following:

- removal of the peninsula that currently separates the tailrace from the bypass channel to reduce unacceptable delay of upstream migrating adult salmonids at the powerhouse;
- construction of structures in the bypass channel to concentrate flows and provide necessary cues to help adult migrants reach and find the fish ladder entrance;
- movement of rocks and boulders in the bypass reach downstream of the fish ladder entrance to provide for adult passage under most flow conditions;
- other enhancements of the bypass channel;
- adjustments or minor ("fit and finish") modifications of the ladder to optimize performance; and
- installation and operation of behavioral deterrents to prevent movement toward and into the OSHP intake (i.e., due to adult "fall-back").

Downstream passage Tier 1 measures include the following:

- installation or modification of flow guidance devices on the downstream face of the dam to concentrate flow or otherwise improve smolt survival;
- enhancements of the bypass channel;

- installation and operation of behavioral deterrents, which could include experimental technologies, of movement toward and into the OSHP intake;
- other physical modifications that may be suggested by the members of the FPWG and approved by DVWD, in lieu of additional BFAA water; and
- predation control in the impoundment for which need will be determined by periodic assessments, as agreed to by the FPWG.

4.3.6.2 Tier 2 Measures

Unlike Tier 1 measures, Tier 2 measures may require additional approvals from the agencies and FERC. If the biological performance objectives, as described in Section 5.3 of Appendix B of the Settlement Agreement, have not been met after three 5-year monitoring intervals, the FPWG will meet to discuss possible implementation of Tier 2 measures pursuant to Section 5.4.3 of Appendix B of the Settlement Agreement (4.2.5 above) Tier 2 measures will be considered after all applicable Tier 1 measures have been implemented, or if the FPWG determines that further implementation of Tier 1 measures is unlikely to enable the OSHP to meet the performance objectives. Examples of Tier 2 fish passage measures include the following:

- increasing the water allocated to the BFAA;
- changing the powerhouse turbine to a more fish-friendly configuration;
- installing training walls between the fish ladder exit and the turbine intake;
- extending the fish ladder upstream into the forebay;
- installing barriers or deterrents in the tailrace; and
- installing experimental devices in the forebay to facilitate guidance of fish downstream past the OSHP.

4.3.6.3 Other Fish Passage Measures

Appendix B of the Settlement Agreement identifies other fish passage measures that may be implemented, as approved by the FPWG, to improve-performance of fish passage facilities and achieve biological performance objectives. They include:

- utilization of BFAA

- changes to BFAA allocation
- modification of spill gate operation
- trash rack modifications

4.4 No Action Alternative

According to the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without additional environmental measures. Any effects of the OSHP would continue. DVWD is using this alternative to establish baseline environmental conditions for comparison with the Proposed Action.

4.5 Actions Considered but Eliminated from Detailed Study

4.5.1 Trap-and-Haul

A permanent trap-and-haul approach to providing fish passage at the OSHP was discussed with the resource agencies, but was eliminated from further evaluation. Trap-and-haul is incompatible with agency goals because it would not provide safe, timely, and effective upstream fish passage at the OSHP.

DVWD has been providing interim trap-and-haul voluntarily since 2012 to facilitate reintroduction. Data from monitoring conducted since the initiation of trap-and-haul indicate that it may increase the potential for delaying upstream migration relative to volitional passage. DVWD and the agencies agree that according to the Proposed Action, fish will be able to locate and use the fish ladder. The resource agencies identified no advantages of trap-and-haul relative to volitional passage at the OSHP.

4.5.2 Fish Ladder Only, No Increase in Reservoir Elevation

The Parties discussed the feasibility of constructing a fish ladder only, without raising the pool. This option was discarded because (1) engineering constraints associated with breaching the dam would be significant, (2) the alternative would limit the DVWD's ability to manage potential upstream migration delay with additional flows, and (3) downstream passage would not be improved. For these reasons, the Parties agreed to focus on raising the pool as an integral component of the Proposed Action.

5.0 CONSULTATION AND COMPLIANCE

The proposed amendment of the Opal Springs license will not increase the capacity of the OSHP; however, it involves modification of a dam that will result in a significant change in the normal maximum surface area or elevation of an impoundment; therefore, three-stage consultation is required pursuant to 18 CFR §4.38(a)(4)(v).

5.1 PRE-FILING CONSULTATION

DVWD has engaged agencies and other interested stakeholders regularly since 2008, when the Parties first met to discuss introducing fish passage at the OSHP.

5.1.1 OPAL SPRINGS FISH PASSAGE SETTLEMENT NEGOTIATIONS

After several years of discussion with agencies about fish passage, DVWD began formal negotiations in the spring of 2009. DVWD engaged the resource agencies and other interested stakeholders through the formation of a Settlement Work Group and a Technical Work Group (TWG) to define technical information needs to support the license amendment application and to structure the monitoring and evaluation and adaptive management provisions of the Agreement.

The TWG evaluated needs for both upstream and downstream passage at the OSHP. Although the initial focus was on the need for a fish ladder, the TWG also identified a need to address the potential for false attraction at the OSHP tailrace. The concern was that at times of average or low river flow, when the majority of the Crooked River's flows are concentrated through the generating unit and into the tailrace, fish may not be attracted to the bypass reach and may not find the entrance to the proposed fish ladder upstream at the diversion dam. The TWG also explored options for creating effective downstream passage and determined that shaping downstream flows to provide alternative fish passage routes past the powerhouse intake is also needed.

The Parties agreed to evaluate raising the pool for the OSHP to (1) provide additional capability for managing flows from the OSHP's diversion pool to enhance upstream attraction to the fish ladder entrance, and (2) shape downstream flows to benefit down-migrant survival. In addition, the DVWD would be able to use the increased hydraulic pressure resulting from the increased head to increase the OSHP's generation, which would partially offset the cost of constructing fish passage.

The DVWD commissioned a feasibility study, completed in 2010, that confirmed that the OSHP can handle an increase in normal maximum pool elevation to 2,010.21 feet (2,012 feet LPD). This upper limit is imposed by the presence of a Wild and Scenic River boundary upstream of the OSHP impoundment. Given the margin of between the normal maximum pool elevation of 2007.21 (2009 feet LPD) and the boundary, and the safety mechanisms afforded by the flashboards (which "trip" at certain flows), the BLM has indicated that maintenance of the pool at this elevation for purposes of facilitating fish passage would not be inconsistent with the Outstanding Resource Values of the Lower Crooked River Wild and Scenic River, but the BLM will not make a formal determination until it has received the request for additional rights of way to new federal lands (J. Eisner, BLM, Prineville Office, personal communication).

The desire to manipulate water through the OSHP provided by raising the pool led to the development of the BFAA. The BFAA is a mechanism for providing additional flows at the request of Fish Managers to enhance fish passage conditions. The BFAA establishes an accounting method for converting a portion of new hydropower generation (as a result of the pool raise) into water The DVWD will administer the BFAA and respond to requests from the Fish Managers to release additional flows into the bypass reach.

5.1.2 Settlement Agreement

In October 2011, the Parties signed a Settlement Agreement (Original Settlement Agreement) that includes proposed license articles. The Settlement Agreement was revised and restated in October of 2015 to reflect a more current understanding of the proposed facilities and their operation (Settlement Agreement). The Settlement Agreement also specifies actions the Parties will undertake to develop the amendment application and to implement the provisions of the Settlement Agreement throughout term of the amended license. The following Parties signed the Settlement Agreement:

- Deschutes Valley Water District
- U.S. DOI Bureau of Indian Affairs
- U.S. DOI Bureau of Land Management
- U.S. DOI Fish & Wildlife Service
- National Marine Fisheries Service
- Oregon Department of Fish & Wildlife
- Trout Unlimited

The CTWS have been monitoring discussions regarding fish passage at OSHP and have been regularly briefed by the federal trustees and ODFW (as co-manager) throughout the negotiation process. In a letter dated August 16, 2011, the federal agencies formally notified the CTWS of their intent to sign the Settlement Agreement and invited the CTWS to submit any objections; no objections were received.

Given their status as natural resource co-managers, the CTWS may participate in implementation of the Settlement Agreement through the FPWG; however, they will not have voting privileges until they formally sign the Agreement. The CTWS may sign the Agreement at any time without further approval of the Parties. Upon doing so, the CTWS will have all the rights and obligations described in the Settlement Agreement and its appendices.

The Settlement Agreement comprises three parts:

1. General Provisions that include the legal definitions and standards of the Agreement.
2. Proposed License Articles (PLAs, Appendix A to the Agreement) that establish the licensee’s obligations that will be enforceable by the FERC if they are included in the license. The PLAs specify the design requirements of the fish passage facilities, the monitoring and evaluation program, and the adaptive management provisions. The Parties intended to draft the PLAs to meet FERC’s need to monitor and enforce DVWD’s compliance during the remaining term of the amended license.

3. The Fish Passage and Protection Plan (Appendix B to the Agreement) is a technical appendix that provides details on the fish passage facilities to be constructed, the monitoring and evaluation program, the adaptive management options, and DVWD's roles and responsibilities of under the license amendment, and the roles and responsibilities of the other Parties under the Agreement. Appendix B establishes the FPWG, which will coordinate communication and consult on decisions as needed to implement the Agreement.

5.1.3 STAGE 1 CONSULTATION

Table 5-1 summarizes the key milestones of DVWDs' Stage 1 consultation steps.

TABLE 5-1 STAGE 1 CONSULTATION MILESTONES

ACTIVITY	DATE	RELEVANT REGULATORY GUIDANCE	DOCUMENTATION
First Stage Consultation			
File Initial Consultation Document, Public Notice	December 21, 2011	18 CFR § 4.38, §4.201	FERC E-library (Accession No. 20111221-5011)
Notify FERC of date for Joint Meeting (Public Meeting)	January 23, 2012	18 CFR §4.38(b)(4)	Exhibit B FERC E-Library (Accession Number 20120120-5042)
Designation of DVWD as FERC's non-federal representative to conduct consultation with USFWS and NMFS	January 19, 2012		Exhibit B FERC E-Library (Accession Number 20120123-0011)
Hold Joint (Public) Meeting	February 7, 2012	18 CFR §4.38(b)(3)(B)	Exhibit B FERC E-Library (Accession Number 20120307-0002)
Comments, Information Requests from Stakeholders		18 CFR §4.38(b)(5)	Exhibit B
	April 3, 2012 (National Oceanic and Atmospheric Administration)		FERC E-Library (Accession Number 20120307-0002)
	April 5, 2012 (Oregon Department of Fish & Wildlife)		FERC E-Library (Accession Number 20120405-517)

ACTIVITY	DATE	RELEVANT REGULATORY GUIDANCE	DOCUMENTATION
	April 9, 2012 (Bureau of Land Management)		FERC E-Library (Accession Number 20120409-5044)

5.1.4 STAGE 2 CONSULTATION

Stage 2 consultation is the information-gathering phase of the pre-filing process and involves completing studies and developing information that will be used in the NEPA process. Table 5-2 summarizes the information needs identified in the Initial Consultation Document and subsequent agency comments. The status of each item is indicated.

TABLE 5-2 STAGE 2 CONSULTATION GOALS – INFORMATION DEVELOPMENT

W-1: Water Quality	In anticipation of needing a Water Quality Certification from the Oregon Department of Environmental Quality (ODEQ) according to Section 401 of the Clean Water Act, DVWD has begun collecting data from the OSHP forebay and tailrace. These data will inform the assessment of the Proposed Action's potential effects, positive or negative, on water quality. **Status:** Data have been collected and reviewed. Section 6.3.2 summarizes the key findings. Per agreement with ODEQ; a Draft 401 Certification Application will be filed in the fall of 2015
F1: Facility Design	A final design of the fish ladder and associated facilities is critical for determining how the OSHP will operate to benefit fish and aquatic resources. Key information to be developed will include: • location of the ladder entrance and exit cell in relation to OSHP features; • size and configuration of the fish ladder and any Alternative Water Supply (AWS) system; • location, configuration, and hydraulic capacity of proposed spillway gates; • configuration and energy dissipation characteristics of the spillway below the spillway gates; • anticipated construction methods, timing, and permitting needs; and • any necessary modifications of boulders below the diversion structure to facilitate access to the ladder. **Status:** The Fish Agencies have approved a final design subject to review and approval of FERC's Regional Engineer and the Division of Dam Safety and Inspections.
F2: Facility Operation	Operation of the facility, particularly the spillway gates, will require additional understanding of the relationship between down-migrant timing, river flows, and up-migrant timing, since delivery of spillway flows may influence ladder entrance cell characteristics. This will require further development of a model of downstream migrant mortality (DMM) to establish operating rules for water management through the spillway facilities. The DMM model will establish survival estimates for spillway and turbine passage under current and proposed conditions using existing information and established relationships from recent fish passage literature. **Status:** A DMM model has been completed and is summarized in Section 6.4.4 and in the Biological Assessment (BA).
F3: Swimming Speed Analysis	A swimming speed analysis is needed for key fish species to understand any risks of turbine strike for upstream migrating fish that explore the powerhouse draft tubes under a range of normal operating conditions. **Status:** Complete and summarized in Section 6.4.2 and in the BA.

B-1: Invasive Species Investigation	An investigation is needed into the presence and potential extent of the invasive species *Phragmites australis* on the east bank in the area that will be inundated by the higher pool. Results of this investigation will be used to determine potential protection, mitigation, and enhancement measures (PMEs). **Status:** According to correspondence with the BLM, this information request has been deemed unnecessary (see Consultation Record, Exhibit B).
R2: Project Boundary Delineation	Existing Exhibit G maps for the OSHP are out of date and will need to be brought up to current FERC standards described in 18 CFR §4.39. This analysis will also be important to clarify implications for a right-of-way request to the BLM. **Status:** The application includes revised preliminary Exhibit G maps showing the proposed boundary and land ownership information. The proposed Exhibit G maps are being prepared in conformance with 18 CFR §4.39.
R3: Visual Impact Study	DVWD will contract with a qualified consultant to provide an assessment of the visual effects of the proposed alternatives. This analysis will help inform the BLM's Wild and Scenic Rivers 7(d) Analysis (Study R1, not referenced here). **Status:** A draft study report has been reviewed by the BLM. Comments will be incorporated into a final report and filed as supplemental information. However, comments and recommendations from the BLM have been incorporated into the section 6.8 of this APEA and are included in the Consultation Record (Exhibit B).

5.2 Consultation on APEA

The DVWD issued a draft APEA and Biological Assessment (BA) on July 13, 2015. At that time, DVWD requested comments within 60 days. As documented in Exhibit B, comments on the APEA were received from the BLM, NMFS, USFWS, and ODEQ. Concurrent to the comment period, Parties reviewed the 2011 Settlement Agreement, as amended, for necessary updates. A restated settlement agreement, with updated appendices is being filed concurrently with the amendment application. The restated settlement agreement incorporates a previously adopted amendment and makes conforming changes to the appendices to reflect minor changes to the proposed facilities.

On April 6, 2016 FERC provided Notice of the availability of the Environmental Assessment, in which FERC adopted the 2015 APEA as its own. No comments on the substance of the APEA were submitted in response.

5.3 CONSULTATION ON APEA

In December of 2016, the DVWD opened construction bids for the new facilities, in anticipation of receiving a license amendment in early 2017. The cost of construction was significantly higher than expected. The DVWD was unable to justify bridging the gap between available funds for construction and the low bid with its own resources.; therefore, DVWD asked FERC for an abeyance on the amendment proceeding in order to consult with Parties to the 2015 Agreement.

DVWD held several meetings with Parties in early 2017; it was determined that the project would be modified to eliminate some features and reduce the scale of the intended pool-raise. The Parties met several times in the spring and summer of 2017 ensure the revised plans aligned with the intent of the agreement and the Proposed Action from the 2015 APEA.

5.4 STATUTORY AND REGULATORY REQUIREMENTS

5.4.1 FEDERAL POWER ACT

5.4.1.1 SECTION 18

According to Section 18 of the Federal Power Act (FPA), the USFWS and NMFS have the authority to prescribe fishways at dams. No prescriptions were filed when the OSHP license was issued in 1982, nor did agencies request a reservation of authority to prescribe fishways in the future. DVWD and the resource agencies have determined, however, that it would be beneficial to amend the existing license to allow for fish passage to occur at the OSHP. The USFWS and NMFS have the authority to prescribe Section 18 conditions in the context of the license amendment.

It is anticipated that NMFS and USFWS will provide mandatory conditions pursuant to their Section 18 authority that will be consistent with the PLAs of the Settlement Agreement.

5.4.1.2 SECTION 4(E)

Section 4(e) of the FPA provides that any license issued by FERC for a project within a federal reservation shall be subject to and contain conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. The BLM is the federal land manager for much of the project area upstream of the OSHP impoundment. The expanded reservoir will require an amended right-of-way. DVWD provided the BLM with an SF-299 describing the proposed activities and identifying the federal lands that will be necessary to construct and operate the proposed project.

The BLM anticipates that its 4(e) conditions will be consistent with the Settlement Agreement. This could include a requirement to obtain a right-of-way from the BLM.

5.4.1.3 SECTION 10(J)

Under Section 10(j) of the FPA, each license issued by FERC shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project. FERC is required to include these conditions in a license or license amendment order unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable laws.

ODFW anticipates that its 10(j)s will be consistent with the Settlement Agreement. When Section 10(j) recommendations are submitted, then FERC will be required to make a determination regarding whether the recommendations of the federal and state fish and wildlife agencies are consistent with the purpose and requirements of Part I of the FPA and applicable law. Section 10(j) of the FPA states that whenever FERC believes that a fish and wildlife agency's recommendation may be inconsistent with the purposes and requirements of the FPA or other applicable law, FERC and the agency shall attempt to resolve any such inconsistency, giving due weight to recommendations, expertise, and statutory responsibilities of such agency.

5.4.2 ENDANGERED SPECIES ACT

Pursuant to Section 7 of the ESA, federal agencies are required to consult with the USFWS and NMFS (collectively, the Services) to ensure that their actions will not jeopardize the continued existence of any federally listed species or adversely modify designated critical habitats. On January 19, 2012, FERC designated DVWD as its non-federal representative for the purpose of initiating consultation with the Services under Section 7. Federally listed species exist in the OSHP area, which is located within designated critical habitat for bull trout and essential fish habitat (EFH) for Pacific Salmon (see Section 5.3.7). Analyses of the potential effects of the Proposed Action are addressed in Section 6.4 of this APEA. A draft BA is included as Exhibit A to this APEA.

5.4.3 CLEAN WATER ACT

Under Section 401 of the Clean Water Act (CWA), an applicant for a project license or license amendment must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. The appropriate agency in Oregon is the Oregon Department of Environmental Quality (ODEQ). Relevant analyses of the potential effects of the Proposed Action are addressed in Section 6.3 of this APEA. An Application for Section 401 Certification is included as Attachment 3 to this APEA.

Section 404 of the CWA regulates removal and fill of materials in public waterways. The U.S. Army Corps of Engineers (USACE) regulates removal and fill activities on the federal level, and the Division of State Lands (DSL) administers the complementary program for the State of Oregon, pursuant to Oregon's Removal-Fill Law (ORS 196.795.990). DSL and USACE use the same joint application form but process and issue state and federal permits separately.

5.4.4 NATIONAL HISTORIC PRESERVATION ACT

The National Historic Preservation Act (NHPA) requires federal agencies to manage cultural resources under their jurisdiction and authorizes the Secretary of the Department of the

Interior to maintain the National Register of Historic Places (National Register). Section 106 of the NHPA requires federal agencies to take into account the effect of a proposed undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The agency must afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such an undertaking.

In a letter dated November 13, 2009, the Oregon Parks and Recreation Department, State Historic Preservation Office (SHPO) concurred with BLM's determination of No Historic Properties Affected by the Proposed Action (SHPO 2009).

5.4.5 WILD AND SCENIC RIVERS ACT

Section 7(a) of the Wild and Scenic Rivers Act bars FERC from licensing the construction of any dam, water conduit, or other project works on or directly affecting any river that is designated a component of the national Wild and Scenic Rivers System. This prohibition also applies to river segments designated by Congress as "study rivers" while the segment is under study. This does not, however, preclude licensing developments below or above a wild, scenic, or recreational river or any stream tributary thereto that would not invade or unreasonably diminish the scenic, recreational, and fish and wildlife values present when the river was designated a component of the Wild and Scenic Rivers System. Under Section 7(d) of the Wild and Scenic Rivers Act, the administering Secretary makes determinations regarding consistency of a project with the provisions of the Wild and Scenic Rivers Act. The Lower Crooked Wild and Scenic River boundary is described in the Middle Deschutes/Lower Crooked Wild and Scenic Rivers' Management Plan, dated December 1992. The boundary is described as "River Mile 8, south of Opal Springs," and further described as "the North 1/16th line of Section 4, in the Metes and Bounds description under T. 13 S., R. 12 E., W.M." Because of the importance of establishing the boundary elevation with precision and confidence, DVWD contracted with CH2M Hill and a local surveyor to perform survey work to tie the metes and bounds description of the boundary to existing surveys of key Project elevations. The key findings from the survey efforts are as follows (CH2M Hill 2010):

- The metes and bounds description of the Wild and Scenic River boundary appears to be inconsistent with the designation of the River Mile (RM) 8 marker. T. 13 S., R. 12 E., WM is the more conservative description, downstream of where DVWD believes RM 8 to be.
- The surveyed elevation of the metes and bounds description where the boundary crosses the stream had a surface elevation of just above 2,010.66 feet (2,012.45 feet LPD). This elevation was measured in October 2009 during a period of low flows and, therefore, should be considered conservative. The top of the riffle below the assumed boundary was surveyed at 2,010.56 feet (2,012.35 feet LPD).
- Given that the maximum extent of the proposed increase in the pool will be to 2,010.21 feet (2,012 feet LPD) and below the visible riffle that is downstream of the Wild and Scenic River boundary, the upstream end of the impoundment under the Proposed Action will be downstream of the Wild and Scenic River boundary, and a visible break will be discernable under most flow conditions by the cascade at the downstream end of the riffle. . Note that under the 2017 revised proposal, the separation between the proposed head of pool and the lower end of the boundary is more distinct.

CH2M Hill (2010) evaluated potential effects of raising the pool on the Wild and Scenic River boundary during extreme flood conditions. An updated flood-frequency analysis identifies a peak inflow design flood (IDF) of 8,000 cfs (approximate 100-year event) based on a 48-year period of record at U.S. Geological Survey (USGS) Gage No. 14087400 on the Crooked River below Opal Springs. Under current OSHP operations, the flashboards would be removed during a 100-year flood, and the flood flows would pass the dam's crest elevation of 2,000.21 feet without exceeding 2,008.21 feet. Under the Proposed Action, flood flows are controlled by the behavior of the flashboards, which are designed to "break away" under a critical load. This is a dam safety measure, intended to prevent a Potential Failure Mode, but it also ensures prevents encroachment on the Wild and Scenic River boundary even during the IDF.

Prior to construction, DVWD will need to obtain a determination from the BLM regarding consistency of a project with the provisions of the Wild and Scenic Rivers Act.

5.4.6 Pacific Northwest Power Planning and Conservation Act

Under Section 4(h) of the Northwest Power Act of 1980, the Northwest Power and Conservation Council develops the Columbia River Basin Fish and Wildlife Program to protect, mitigate, and enhance fish and wildlife adversely affected by the development and operation of hydroelectric projects on the Columbia River and its tributaries. The Council reviews and revises the Fish and Wildlife Program every 5 years; the current version is the 2014 Columbia River Basin Fish and Wildlife Program.[9] Pursuant to Section 4(h)(11) of the same act, all of the federal agencies responsible for managing, operating, and regulating the hydroelectric facilities in the Columbia basin (which includes FERC) have an obligation to exercise their statutory responsibilities while taking the Council's Fish and Wildlife Program into account at each relevant stage of decision making to the fullest extent practicable. According to Sections 4(d) and 4(e) of the Northwest Power Act, the Council also develops and periodically reviews a regional conservation and electric power plan to recommend new conservation and generating resources to be added to the region's power supply. The Fish and Wildlife Program is part of the Power Plan; the current version is the Sixth Northwest Power Plan, and the Council is at work on the Seventh.[10] Along with the provisions in the Northwest Power Act linking FERC to the Council's programs and plans, FERC has also recognized both the Council's Fish and Wildlife Program and the Council's Power Plan as comprehensive plans for the waterways in each of the four states of the Columbia basin and Pacific Northwest, according to the FPA.

With regard to the OSHP, the Council's Fish and Wildlife Program includes measures and objectives seeking improvements in fish habitat and fish population status in the Deschutes River and its tributaries, provisions found largely in the program's Deschutes Subbasin Plan. Section 3.5.1 of the Crooked River section of the Deschutes Subbasin Plan in particular calls for ODFW, the CTWS, NOAA Fisheries, USFWS and the DVWD to work together to re-establish anadromous fish passage at the Opal Springs Hydroelectric Project.[11]The proposal here is consistent with the Fish and Wildlife Program's measures and objectives for habitat and fish populations in the Deschutes River Subbasin.

[9] http://www.nwcouncil.org/fw/program/2014-12/program/
[10] http://www.nwcouncil.org/energy/powerplan/

[11] http://www.nwcouncil.org/fw/subbasinplanning/deschutes/plan

The Council's Fish and Wildlife Program also includes provisions and conditions regarding the development, licensing, and re-licensing of non-federal hydroelectric projects in any subbasin, intended to protect valuable fish and wildlife resources (See 2014 Fish and Wildlife Program, at pages 52-53 and Appendix F). A review of the proposal against these conditions indicates the proposal is consistent with the protections the program seeks. This portion of the Council's Fish and Wildlife Program also designates certain river reaches in the Pacific Northwest as protected from hydroelectric development. The protected areas provisions do not apply to existing hydroelectric projects, such as the OSHP.

Finally, the program encourages consultation by project operators and proponents with federal and state fish and wildlife agencies, appropriate Indian tribes, and the Council itself during the study, design, construction, and operation of any hydroelectric development in the basin. DVWD has been consulting with the agencies and tribes as described elsewhere and communicated with the Council's staff about the proposal in June 2015.

5.4.7 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirements of Section 305(b)(2) of the Magnuson-Stevens Act (MSA) provide that federal agencies must consult with the Secretary of Commerce on all actions, or proposed actions, authorized, funded, or undertaken, that may adversely affect EFH. This section documents EFH that may be affected by the Proposed Action and briefly discusses each managed species and life-stage for which EFH has been designated.

In a notice dated January 19, 2012, FERC formally designated DVWD as its non-federal representative for consultation with NMFS under Section 305(b) of the MSA and implementing regulations at 50 CFR Section 600.920.

The Pacific Fishery Management Council (PFMC) designated EFH for Pacific salmon in 1999 (PFMC 1999). The Lower Crooked River was designated as EFH for Chinook salmon in 2008, and the OSHP is identified as an impassible man-made barrier (73 FR 60988). The Proposed Action will result in fish passage at the OSHP and will enable adult migrants to access currently inaccessible habitat upstream of the OSHP.

Section 6.4 of this APEA and the draft BA (Exhibit A) provide an analysis of the effects of the proposed increase in the pool elevation on salmonid habitat in the Crooked River upstream of the OSHP impoundment. The Proposed Action consists of conservation measures that will benefit listed fish species, and these benefits greatly offset any minor adverse effects on the EFH of pacific salmon resulting from the inundation of 700 feet of riverine fish habitat immediately upstream of the existing OSHP impoundment. No net adverse effects will result in areas of EFH or Habitat Areas of Particular Concern for the relevant fish species.

5.4.8 COASTAL ZONE MANAGEMENT ACT

Section 307(c)(3) of the Coastal Zone Management Act (CZMA) requires that all federally licensed and permitted activities be consistent with approved state Coastal Zone Management Programs. If a project is located within a designated state coastal zone or would affect a resource located within the coastal zone, the applicant must certify that the project is consistent with the state CZMA.

Federal consistency potentially applies to any project having effects on land and water uses or natural resources of the Oregon coastal zone, but reviews by the Oregon Department of Land Conservation and Development (DLCD), the state agency in charge of implementing the CZMA, are generally only required for projects located west of the Coast Range boundary. DLCD has confirmed that it has no enforceable policies that could influence the analysis of the Proposed Action (personal communication with Bob Bailey, Oregon Coastal Zone Management Program Director; November 30, 2010).

6.0 ENVIRONMENTAL ANALYSIS

This section describes the existing environment in the OSHP area and the potential effects of the Proposed Action on the following resource areas: geology and soils; water resources; fish and aquatic resources; wildlife; threatened, endangered, and special status species; botanical and riparian resources; recreation, land use, and aesthetics; cultural resources; and socioeconomic resources. The potential cumulative effects of the Proposed Action are also described in this section. These specific resource areas are addressed based on early agency consultation, and the discussion reflects the information the agencies thought would be necessary to facilitate an informed decision about the Proposed Action.

6.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The existing and proposed facilities are located in southern Jefferson County, Oregon, at Opal Springs on the Crooked River, which is a tributary of the Deschutes River. The city of Culver is approximately 7 miles east of the OSHP, and the city of Madras is approximately 15 miles to the northeast. U.S. Highway 97 passes about 5 miles east of the site. Figure 6-1 shows the OSHP's location.

The OSHP is located in the Deschutes River Basin, a major subbasin of the Columbia River, which covers over 10,000 square miles. The OSHP is located in a steep, 846-foot-deep canyon. The current impoundment is bounded by a sheer, basalt cliff face on the west and a steep boulder slide on the east. This eastern area comprises primarily dredged material from OSHP construction in the 1980s.

Figure 6-1 illustrates the position of the OSHP relative to the lower Crooked River subbasin. The Crooked River flows east to west from headwaters in the North Fork, South Fork, and Beaver Creek systems to Prineville Reservoir (RM 70), which was formed by Bowman Dam. Downstream of Prineville Reservoir are two major tributaries, Ochoco and McKay creeks, that meet the Crooked River at RMs 46 and 45, respectively. Another major impoundment in the basin is Ochoco Reservoir, impounded by Ochoco Dam at RM 10 on Ochoco Creek. The river flows out of the reservoir, passes the OSHP at RM 7, and joins the Deschutes River at

Lake Billy Chinook, which was formed by Round Butte Dam at RM 111 on the Deschutes River. The head of Lake Billy Chinook is approximately one-half mile from the OSHP's powerhouse.

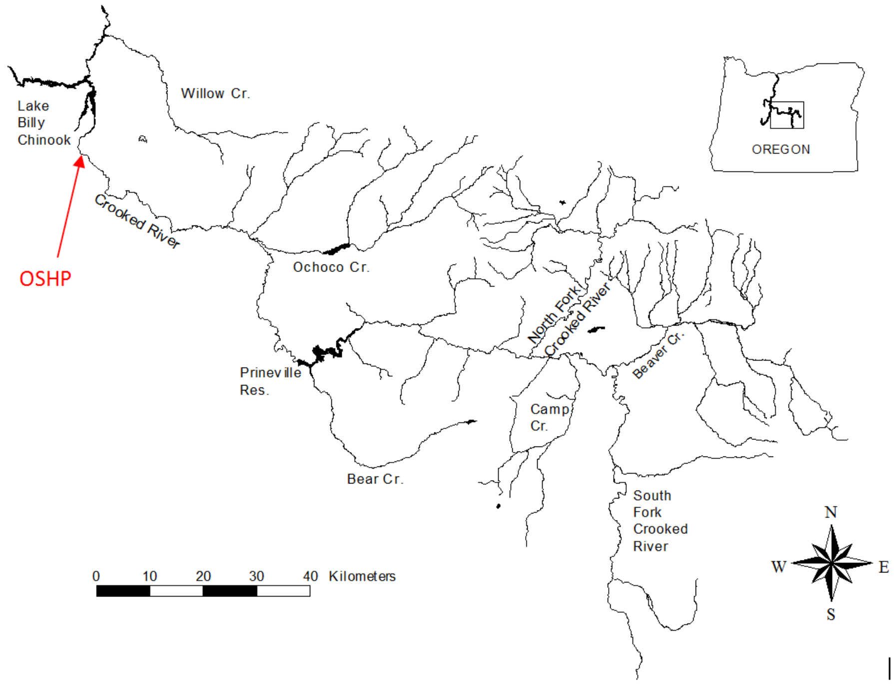


FIGURE 6-1 CROOKED RIVER BASIN

The figure shows the location of the Opal Springs Hydroelectric Project (OSHP) in relation to basin tributaries and features (modified from ODFW 1996).

The Crooked River is delineated by two subbasins: Prineville Reservoir (Bowman Dam) delineates the boundary between the upper Crooked River Basin and the Lower Crooked River Basin. Some of Crooked River's drainage basin lies within Ochoco National Forest and Crooked River National Grassland, and both the North Fork and Ochoco Creek draining the Ochoco Mountains (PGE 2010).

6.1.1 WATER USE

The Crooked River hydrograph is strongly influenced by water retention, diversion structures located throughout the basin, and spring water contributions. The Crooked River provides:

- irrigation water to approximately 20,000 acres of agricultural lands;
- recreational opportunities; and
- warm water and cold-water habitat for aquatic life.

Thousands of people visit the Crooked River every year to participate in boating, fishing, swimming, and other on-water activities (BLM 2007). Periods of high flow are a result of seasonal precipitation and runoff from the basin's tributary streams, which can contribute to water quality issues associated with non-point-source pollution (ODEQ 2010), and water quality tends to deteriorate as it moves downstream.

6.1.2 DIVERSIONS AND IMPOUNDMENTS

The diversions and impoundments listed in Table 6-1 have been noted in the upper Deschutes River Basin.

TABLE 6-1 MAJOR DAMS AND DIVERSIONS IN THE DESCHUTES BASIN
Source: Portland General Electric Company 2010

Name	River/Water Body
Round Butte Dam	Deschutes, Crooked, and Metolius Rivers
Prineville Res. (Bowman)	Crooked River
Wickiup Reservoir	Deschutes River
Crescent Lake Dam	Crescent Lake
Crane Prairie	West Fork Deschutes River
Ochoco Reservoir	Ochoco Creek
Pelton Dam	Deschutes River
Wasco Dam	Clear Creek
Haystack Reservoir	Deschutes River
Pine Hollow Reservoir	Badger Creek and Pine Hollow Creek
Pelton Regulating Dam	Deschutes River
Allen Creek	Allen Creek
Watson Reservoir	Watson Creek
Antelope Flat	Bear and Faught Creeks and two tributaries
Brewer Reservoir	Hay Creek
Rock Creek Dam	Rock, N. Fork Gate, and Threemile Creeks
Big Three Creeks Lake	Three Creek
Little Willow Creek Res.	Little Willow Creek
Upper Tumalo Reservoir	Tumalo Creek
Lillard Dam	Twelve Mile Creek, South Fork
Bonnie View Dam	Horse Heaven Creek
Fisher-Joe Reservoir	Lytle Creek
Badger Lake	Badger Creek
Bear Creek	Bear Creek
Camp Creek No.2	West Fork Camp Creek

Name	River/Water Body
Three Sisters ID Reservoir	Squaw Creek
Mainline 1	Maury Creek
North Canal Diversion Dam	Deschutes River
Palmer Res.	South Fork Beaver Creek
Opal Springs Hydro	Crooked River
New Canyon Res.	S. Fork Crooked River

6.2 GEOLOGY AND SOILS

6.2.1 AFFECTED ENVIRONMENT

Soils in the Crooked River Basin are a mixture of series derived from the mid-Tertiary Columbia Plateau geology, the early Tertiary clayey tuffaceous sedimentary John Day and Clarno formations, and much older Cretaceous to Paleozoic marine sedimentary formations in the Suplee-Izee area (Silvernale et al. 1976). Some soil associations are on floodplains, terraces, low benches, and alluvial fans and are formed mainly of sediments deposited by streams (USDA 1966). Other soil associations occur on the basaltic plateau, consist of soils with hardpan formed from pumiceous material, and are shallow and stony. Soils formed on forested highlands are derived from volcanic ash and soft tuffaceous rocks and are very stony soils over basalt. Soils on uplands and buttes are derived from rhyolite rock and tuff, or basalt. Most of the north-facing slopes and drainages are covered with Mount Mazama ash, giving rise to higher productivity (Jim David, Ochoco National Forest Soil Scientist, personal communication, cited in ODFW 1996). Soils in low areas often have calcic horizons and a higher pH than mountain soils.

6.2.2 ENVIRONMENTAL EFFECTS

6.2.2.1 PROPOSED ACTION

Direct and Indirect Effects. Implementing the Proposed Action will have limited direct effects on soils as a result of inundation. Basalt cliff is the primary substrate to be inundated. Some areas on the east bank composed of fill from the original construction will be inundated; however, reservoir fluctuation will be minimal because this is a run-of-river project.

Cumulative Effects. Cumulative effects for geology and soils were assessed at the watershed scale. Because no other projects have been identified within the watershed, no cumulative effects will occur as a result of the Proposed Action.

6.2.2.2 No Action Alternative

According to the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without any new facilities or environmental measures. Any effects of the OSHP on geology and soils would continue, as would existing environmental measures.

6.2.3 Proposed Mitigation Measures

No specific mitigation measures are proposed at this time. Permits for facilities construction will require DVWD to ensure best practices to manage short-term disturbance of soils.

The following best management practices (BMPs) will be implemented to protect soil resources from construction-related effects:

- Prevent soil contamination by (1) collecting used oil, oil filters, and grease tubes; (2) requiring equipment operators to carry absorbent pads; (3) providing containment and clean-up for portable fuel tanks (including hose and nozzle); (4) following approved disposal methods for waste products; and (5) promptly repairing equipment leaks.
- Provide ground cover to minimize soil erosion in construction and laydown areas.
- Re-vegetate disturbed areas.
- Implement measures to minimize the erosion from cut slopes, fill slopes, and the road surface and consequently reduce the risk of sediment production.
- Incorporate drainage controls to minimize the erosive effects of concentrated water flows from road surfaces.
- Complete erosion control work prior to seasonal or extended shutdowns to minimize erosion of and sedimentation from disturbed ground.
- Use erosion control measures such as jute netting, filter fabric, mulching, slash windrows, sediment ponds, straw bale dams, or rock gabions where necessary to control erosion and stabilize side casts.

- Maintain all roads in a manner that provides for soil and water resource protection by minimizing rutting, road prism failures, side casting, and blockage of drainage facilities.
- Prepare and implement an erosion control plan for areas where ground is cleared of vegetation.

At this time, no mitigation measures have been proposed or identified related to floodplain inundation or shoreline erosion.

6.3 WATER RESOURCES

6.3.1 AFFECTED ENVIRONMENT

The Crooked River and Upper Crooked River Watershed in central Oregon is a sub-unit of the larger Deschutes Subbasin (OWEB 2007). The primary use of the OSHP impoundment is for power generation. The Crooked River receives substantial input from rain and snowmelt, and its flow has distinct seasonal variations (Nehlsen 1995). Tributaries northeast of the Crooked River are the primary sources of snowmelt and rain. These tributaries include McKay Creek, Ochoco Creek, North Fork Crooked River, and Beaver Creek. Bear Creek and Camp Creek arise in plains south of the basin, and their contribution to flow is relatively small, except in very wet years. The South Fork of the Crooked River, also a southern tributary, is fed by significant springs (Nehlsen 1995). Bowman Dam, built in 1961, and Ochoco Dam, built in 1922, have moderated the hydrograph to reduce or eliminate threats from flooding (Nehlsen 1995).

As discussed above, the OSHP will continue to take advantage of existing flows in the Crooked River to operate in a run-of-river manner. Table 6-2 presents a summary of daily average flows at the OSHP from January 1, 1980, through October 31, 2011.

TABLE 6-2 DATA FROM USGS GAGE 14087400

Corrected to account for spring flow between the diversion and the gauge. The correction is 263 cfs, based on 240 cfs of flows at the springs, and 23 cfs of groundwater accretion in the OSHP bypass reach.

DATA	AVERAGE FLOW (CFS)	MAXIMUM FLOW (CFS)	MINIMUM FLOW (CFS)
January	1,361	5,257	887
February	1,476	4,847	907
March	1,650	5,147	897
April	1,852	4,707	877
May	1,436	5,327	827
June	1,117	4,807	857
July	1,006	1,617	837
August	1,031	1,797	837
September	1,097	1,427	837
October	1,155	1,537	877
November	1,105	2,937	897
December	1,224	5,867	857
Summary	1,291	5,867	827

6.3.1.1 DRAINAGE AREA

The OSHP impoundment has a surface area of approximately 11.1 acres and a storage capacity of 106.4 acre-feet at normal maximum pool elevation of 2,004.21 feet NGVD 29. The OSHP resides in the Jefferson County Hydrologic Unit 17070305 and drains approximately 4,300 square miles, of which 500 square miles is noncontributing (CH2M Hill 2010). Flow has been regulated since 1960 by the Prineville Reservoir, with an active capacity of 152,800 acre-feet, and Ochoco Reservoir, with an active capacity of 46,500 acre-feet. There are many diversions for irrigation upstream from the OSHP, such that a significant portion of the summertime flow comes from springs within 15 miles of the OSHP (CH2M Hill 2010).

6.3.1.2 STREAMFLOW AND GAGE DATA

The average flow at Opal Springs Dam is 1,307 cfs based on data from USGS Gage 14087400 (Crooked River below Opal Springs, near Culver, Oregon). Peak flows occur in spring; low flows occur in the summer, particularly in July and August. Flow duration curves are included in Exhibit E.

6.3.1.3 Existing and Proposed Uses of Water

The primary role of the OSHP is for power generation. The proposed increase in the operating pool will result in additional generation using the same flows. The full potential for additional generation will be offset to the extent that flows are allocated to the bypass reach through the BFAA. The BFAA will provide a mechanism for the Fish Managers to determine the best use of water accrued to the BFAA to benefit upstream and downstream fish passage.

6.3.1.4 Existing Instream Flow Uses

The existing FERC license for the OSHP requires a minimum bypass flow of 50 cfs to benefit fish and aquatic resources. The proposed amendment will not modify the minimum flow requirement, but through the use of the BFAA this flow will be supplemented at the request of the Fish Managers. The amount of water accrued in the BFAA will be subject to variable hydrologic conditions and to verification of actual OSHP performance once the facilities are completed; however, it is estimated that the supplemental flow available for release to the bypass reach could average 23,885 acre-feet per year (subject to verification as described in the Settlement Agreement, Appendix A). This water will not be stored, but will be redirected in requested increments from the OSHP intake and into the bypass reach.

6.3.1.5 Existing Water Rights

DVWD has an existing Permit to Appropriate the Public Waters dated from 1982 for 1,772.5 cfs. The proposed facilities will require DVWD to file an amendment to Permit 47591 pursuant to ORS 534.092 and update its exhibit drawings with the Oregon Water Resources Department to reflect the proposed pool elevation. The application to amend the permit was submitted on October 6, 2015.

6.3.1.6 WATER QUALITY

Available data indicate that Crooked River water quality is relatively good in the vicinity of the OSHP due to the strong influence of groundwater springs. However, the OSHP is embedded within a 51-mile segment of the Crooked River (extending upstream from the mouth) that is on Oregon's 303(d) list of streams with impaired water quality. The 303(d) listing is due to elevated summer temperatures and high pH in areas well upstream of the OSHP (ODEQ 2011b). Those areas are less influenced by large inputs of cool, high-quality groundwater.

The ODEQ has designated a dozen beneficial uses of the lower Crooked River that must be protected (ODEQ 2011a):

-- public/domestic water supply
-- private/domestic water supply
-- industrial water supply
-- irrigation
-- livestock watering
-- fish and aquatic life
-- wildlife and hunting
-- fishing
-- boating
-- water contact recreation
-- aesthetic quality
-- hydropower

In order to protect these beneficial uses, ODEQ has established water quality standards that must be met. Specific water quality standards that apply to the segment of Crooked River within which the OSHP is embedded are given in Table 6-3.

TABLE 6-3 OREGON WATER QUALITY STANDARDS FOR LOWER CROOKED RIVER, INCLUDING THE OPAL SPRINGS HYDROELECTRIC PROJECT (ODEQ 2011A)

WATER QUALITY PARAMETER	RULE	STANDARD
Temperature	340-041-0028	The 7-day average maximum temperature may not exceed 17.8°C
Dissolved oxygen	340-041-0016	Not less than 8.5 mg/l year-round
Total dissolved gas	340-041-0031	No value above 110% saturation
pH	340-041-0021	No values below 6.5 or above 8.5
Bacteria (*E. coli*)	340-011-0009	30-day log mean ≤126 E. coli organisms per 100 ml based on a minimum of 5 samples; no single sample >406 organisms per 100 ml

WATER QUALITY PARAMETER	RULE	STANDARD
Nuisance algae	340-041-0019	Chlorophyll-a concentrations >0.015 mg/l identify reservoir situations requiring further study
Biocriteria	340-041-0011	Sufficient quality to support aquatic species without detrimental changes in the resident biological communities

Information available on water quality in the vicinity of the OSHP comes from multiple sources, including ODEQ, the BLM, a study by researchers at the USGS, and evaluations by consultants to DVWD. This information is summarized by water quality parameter of interest.

***Water temperature*.** Water temperatures at and near the OSHP are cool, moderated by groundwater inflows, and meet the quality criteria established by ODEQ (7-day maximum <17.8^{o}C). Available data show 7-day maximum water temperatures a short distance upriver from the OSHP diversion pool peaked at 15.4^{o}C in 2004 (M. McSwain, Prineville BLM, unpublished data). continuous records for the USGS gauge on Crooked River less than half a mile downstream of the OSHP (No. 14087400) show annual peaks in 7-day maximum temperatures ranging from 14.0^{o}C to 14.4^{o}C during 2006 through 2014 (USGS Gage 14087400 [Crooked River below Opal Springs, near Culver, Oregon]).

Water temperature data collected at the OSHP during 2009 by consultants to DVWD (Figure 6-2) show very minor differences in temperature between inflows and outflows from the OSHP diversion pool. Those data also show measurable (and favorable) decreases in temperature from the upper to lower end of the project diversion reach. Approximately 23 cfs of cool groundwater entering within that reach is diluted less by Crooked River flows than it would be under natural conditions.

***Dissolved oxygen*.** All measurements that have been taken of dissolved oxygen at or near the OSHP meet ODEQ water quality standards. Measurements taken during summer by ODEQ (2011c) ranged from 9.5 to 10.0 mg/l. Dissolved oxygen data collected at the OSHP during 2011 by consultants to DVWD suggest no water quality problems. These data are going through a quality assurance process at present and will soon be available for discussion.

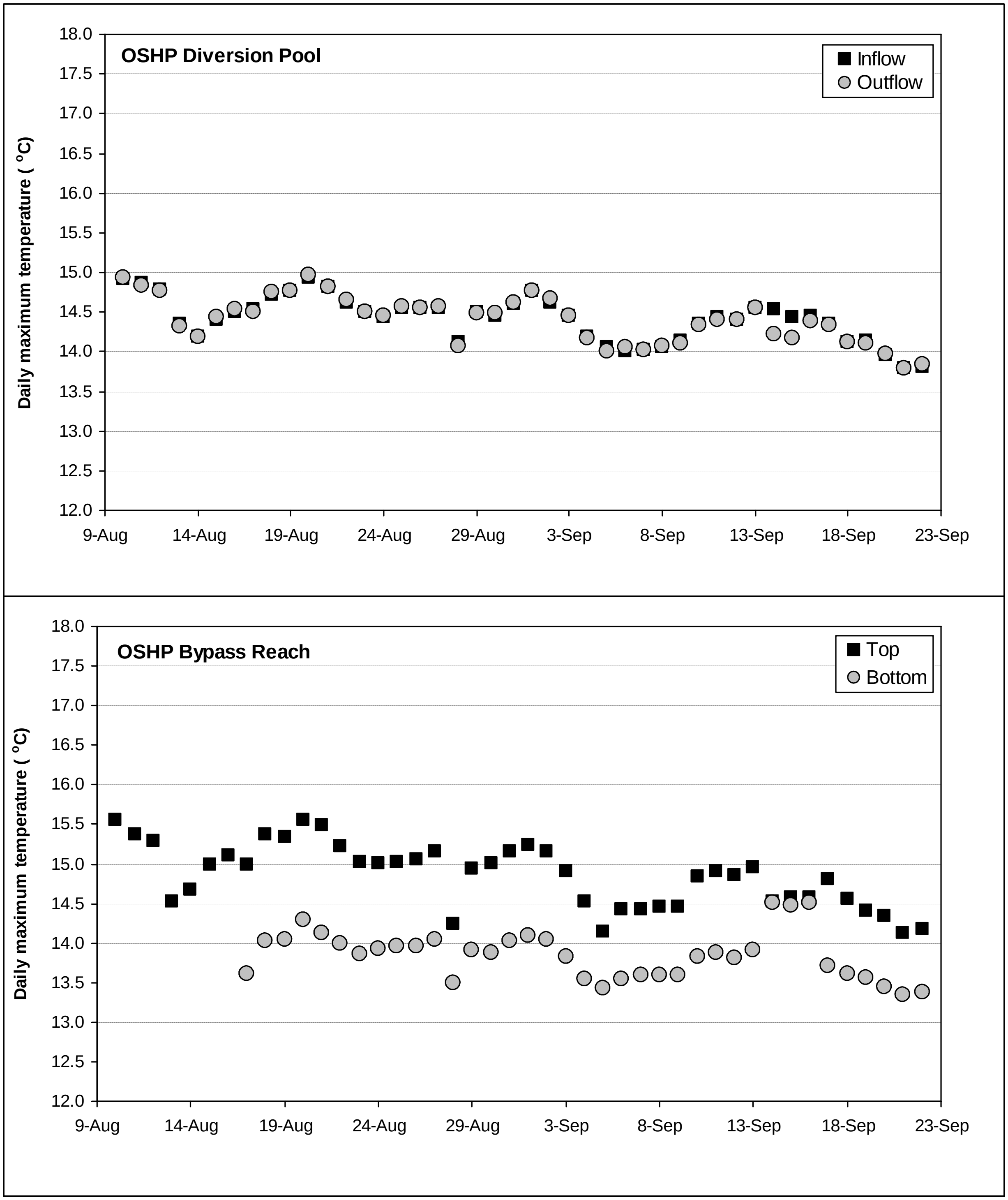
Total dissolved gas. There are no indications that total dissolved gas levels at the OSHP exceed state standards.

pH. Judging from the measured water chemistry of profuse springs discharging into the Crooked River canyon in and above the vicinity of the OSHP, natural pH levels in the area exceed 8 during at least portions of the year but fall within a desired range of 6.5 to 8.5. ODEQ (2011c) measured pH to be 8.3-8.4 at the OSHP during an afternoon in early August 2005 and recorded a mid-morning pH value of 7.9 at the OSHP in late July 2009. The ODEQ measurements were within about the same range recorded by USGS researchers examining the Crooked River just above the OSHP diversion pool during 2005. Those researchers measured pH at 8.0-8.2 on an afternoon in May and at 8.2-8.4 on an August afternoon (M. McSwain, Prineville BLM, pers comm.). The pH values measured by ODEQ and by the USGS are reasonably consistent with data collected by consultants to DVWD during 2011 in and downstream of the OSHP diversion pool. These more recent data suggest that there may be infrequent, brief, and localized exceedances of the Oregon standard for pH at the OSHP associated with seasonally abundant aquatic macrophytes in portions of the OSHP diversion pool. Consultants to DVWD are working with ODEQ to develop a better understanding of these exceedances, to estimate the extent to which the proposed increase in the pool might influence their frequency or magnitude, and to identify any mitigation measures that might be appropriate if further monitoring suggests that such measures would be beneficial.

Bacteria (E. coli). *E. coli* bacteria are a potential concern along segments of the Crooked River that are a considerable distance upstream from the OSHP. Most potential sources of this contaminant are found above the Highway 97 bridge, *E. coli* in the river at or above the bridge become diluted by profuse groundwater discharges that occur in the canyon within which the OSHP is located.

Nuisance algae. Water passing through and past the OSHP is very clear during seasons that plankton might bloom, and there are no indications that chlorophyll-a reaches threshold levels at the OSHP.

Biocriteria. There are no indications that water quality at the OSHP is not fully supportive of



native aquatic species.

FIGURE 6-2 WATER TEMPERATURES MEASURED AT THE OPAL SPRINGS HYDROELECTRIC PROJECT DURING AUGUST AND SEPTEMBER, 2009

6.3.2 Environmental Effects

6.3.2.1 Proposed Action

Direct and Indirect Effects. As a result of the proposed action, the timing and volume of bypass flows will be modified to benefit fish resources. Preliminary modeling of the BFAA indicates that 23,885 acre-feet[12] will be available to the Fish Managers annually under initial conditions following completion of the facilities. These values are unchanged between the 2015 Proposed Action and the 2017 Proposed Action, as revised. These quantities are subject to verification and modification as described in the Settlement Agreement, Appendices A and B, and could become as great as an estimated 42,993 acre-feet by the end of the license period if necessary to meet agreed upon fish passage performance objectives. The two BFAA levels just mentioned would be equivalent to annual supplements to bypass flows averaging approximately 33 cfs and 59 cfs, respectively. Downstream of the bypass reach, below the OSHP, flows are expected to remain unchanged.

Water quality effects of the proposed action are likely to be localized, brief, and within state standards. For example, the residence time of water in the pool will increase, but preliminary modeling indicates that the effect will be minimal and the OSHP will continue to meet state standards. The temperature of water in the pools below the dam will benefit at certain times of the year because the new facilities will reduce the amount of thin sheet flow that currently flows over the dam face (through seepage through the flashboards).

A 401 certificate will be required as part of the amendment process. DVWD has been collecting OSHP-specific data on parameters of interest to ODEQ, and more robust water quality analyses are being conducted to support that process.

[12] This value is derived from looking at average flows at the OSHP over a 50-year period and estimating turbine discharge after factoring in hydraulic capacity and bypass flow requirements to derive an average estimated turbine discharge. This estimate is then converted to acre-feet based on formulae provided in Appendix A to the Settlement Agreement.

***Cumulative Effects*.** Cumulative effects for water resources were assessed at the watershed scale. Because no other projects have been identified within the watershed, no cumulative effects will occur as a result of the Proposed Action.

6.3.2.2 No Action Alternative

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, with no new facilities and no environmental measures. Any effects of the OSHP on water quality or quantity would continue, as would existing environmental measures. There would no mechanism for banking water under the BFAA.

6.3.3 Proposed Mitigation Measures

No mitigation measures are proposed at this time. Permits for facilities construction are likely to require DVWD to ensure best practices to manage short-term disturbance of water quality parameters, and the state water quality certification through Section 401 of the Clean Water Act may result in additional measures (mandatory conditions).

6.4 Fish and Aquatic Resources

6.4.1 Affected Environment

Bowman Dam delineates the Lower and Upper Crooked River subbasins. The reservoir provides irrigation water during the summer. Consequently, flows immediately below that dam result in locally cooler water, benefitting coldwater fisheries (NPCC 2004; USDI 1992). ODFW manages that cooler section of river primarily for native redband trout (CRWC 2002). Threatened and endangered fish species in the OSHP area include bull trout (*Salvelinus confluentis*) and summer steelhead (*Oncorhynchus mykiss*) that are part of the Mid-Columbia River (MCR) distinct population segment (DPS). These species and potential effects on them are described generally here; information specific to their regulatory status is described in Section 6.6. Chinook salmon (*Oncorhynchus tshawytscha*) are also addressed in Section 6.6 because of the overlapping management priorities.

6.4.1.1 Existing and Historic Fish Use

Table 6-4 lists historic and current fish species in the Crooked River. The lower river section upstream of Opal Springs currently supports native redband trout and a common assemblage of nongame fish. Although hatchery trout have not been stocked below Prineville Reservoir (and Bowman Dam) since 1975, some emigration from that reservoir has resulted in small numbers of brown and bullhead trout, and largemouth, and smallmouth bass in the Crooked River downstream (BOR 2003). Below Opal Springs Dam, kokanee, mountain whitefish, redband, bull, brown, and hatchery rainbow trout are present. As described below, since 2007 the Crooked River has been seeded with juvenile Chinook and steelhead and has provided rearing habitat for these fish.

OSHP has been a near-complete to complete barrier to upstream migrations of game fish including redband and bull trout, and mountain whitefish, since the dam was renovated and retrofitted in 1982. Anecdotal reports suggest that upstream passage may have occurred during periods of peak runoff in some years, although the magnitude of any such passage is unknown. Given the implementation of the anadromous fish reintroduction plan, restoring fish passage at OSHP is a high priority.

Table 6-4 Historical and Current Fish Species in the Crooked River Basin
(Updated from ODFW, 1996; Brett Hodgson, personal communication)

Common Name	Scientific Name	Origin	Status	Abundance
Pacific lamprey	*Entosphenus tridentatus*	Native	Extirpated	
Summer steelhead	*Oncorhynchus mykiss*	Native	Present	Reintroduced fry and smolts only
Redband trout	*Oncorhynchus mykiss*	Native	Present	Moderate
Bull trout[1]	*Salvelinus confluentis*	Native	Present	Rare
Kokanee[1]	*Oncorhynchus nerka*	Native	Present	Abundant
Chinook salmon	*Oncorhynchus tshawytscha*	Native	Present	Reintroduced fry and smolts only
Mountain whitefish	*Prosopium williamsoni*	Native	Present	Abundant
Brown trout[1]	*Salmo trutta*	Introduced	Present	Locally abundant
Brown bullhead	*Ictalurus nebulosus*	Introduced	Present	Moderate
Largemouth bass[2]	*Micropterus salmoides,*	Introduced	Present	Rare
Smallmouth bass[2]	*Micropterus dolomieui*	Introduced	Present	Rare
Black crappie[2]	*Pomixis nigromaculatus,*	Introduced	Present	Rare
Bluegill	*Lepomis macrochirus,*	Introduced	Present	Moderate

COMMON NAME	SCIENTIFIC NAME	ORIGIN	STATUS	ABUNDANCE
Shorthead sculpin	*Cottus confuses*	Native	Present	Unknown
Torrent sculpin	*Cottus rhotheus*	Native	Present	Unknown
Slimy sculpin	*Cottus cognatus*	Native	Present	Unknown
Mottled sculpin	*Cottus bairdi*	Native	Present	Unknown
Prickly sculpin	*Cottus asper*	Native	Present	Unknown
Goldfish	*Carassius auratus*	Introduced	Present	Rare
Longnose dace	*Rhinichthys cataractae*	Native	Present	Moderate
Speckled dace	*Rhinichthys osculus*	Native	Present	Abundant
Chiselmouth	*Acrocheilus alutaceus,*	Native	Present	Abundant
Largescale sucker	*Catostomus macrocheilus,*	Native	Present	Abundant
Bridgelip sucker	*Catostomus columbianus*	Native	Present	Very abundant
Northern squawfish	*Ptychocheilus oregonensis*	Native	Present	Moderate
Carp	*Cyprinus carpio*	Introduced	Present	Rare
Crayfish	*Pacifastacus leniusculus*	Native	Present	Very abundant

[1]Present only below OSHP
[2]Present in upper tributaries or otherwise not in immediate vicinity of OSHP

With anadromous fish passage blocked by the PRB Project, fish concerns at the OSHP in the early 1980s were primarily for loss of passage for resident fish species and mortality from the turbines. CH2M Hill conducted a downstream passage study in the spring of 1982. The study captured 118 fish, of which 48 were trout or kokanee; CH2M Hill estimated annual mortality of 10 salmonid fish from the turbines. On the basis of estimated low fish mortality from fish entering the power facilities, no screens or louvers were required for the diversion. To mitigate possible losses, the DVWD released hatchery Chinook salmon and rainbow and brown trout at Opal Springs from the time the dam was rebuilt in 1985 until 2009. Typically 10,000 rainbow trout were released annually below the OSHP, and brown trout were occasionally raised as well. All fish were fin clipped. Spring Chinook salmon were released there in 1985-86. Since 2009, the hatchery at Opal Springs has been rearing summer steelhead from the Pelton Round Butte Hatchery as part of the anadromous fish reintroduction effort.

Fish habitat that may be affected by proposed changes of the OSHP includes the 0.26-mile-long OSHP bypass reach, the existing impoundment, and three habitat units immediately upriver: a boulder riffle about 130 feet long, a riverine pool about 450 feet long, and a boulder cascade/rapid about 140 feet long. Habitat in the bypass reach is of high quality; supports high numerical densities of redband trout and mountain whitefish; and is also occupied by brown trout, bull trout, sculpin, suckers, and northern pikeminnow (DVWD, unpublished data). Cursory snorkel surveys suggest that fish numbers within the OSHP diversion pool are relatively low (Hodgson pers. comm. 2009; ODFW, pers. comm.). USGS researchers have sampled the three habitat units immediately upstream of the impoundment. During late July 2004 they found a fish assemblage dominated by abundant redband (rainbow) trout from 2 to 18 inches long (Torgerson et al. 2007). Other species present included sculpin, suckers, sticklebacks, and minnows, including northern pikeminnow from 9.5 to 12 inches long.

A habitat survey completed by ODFW in 1997 found no spawning gravel in the three habitat units immediately upstream of the OSHP impoundment (ODFW 2009). However, a habitat survey conducted in this area during 2004 by the USGS (Torgerson et al. 2007), suggests that spawning gravel is present in the boulder cascade/rapid (approximately 900 ft^2).

Turbine Conditions. At flows below 1,822.5 cfs nearly all downstream migrants would pass through the unscreened OSHP powerhouse and turbine. No turbine passage studies have been performed at OSHP, but a site-specific literature review suggests that the survival rate for parr and smolt steelhead passing through the Opal Springs turbine is likely to fall within the range of those estimated for other small Kaplan-equipped installations where passage of salmonids has been investigated. Survival estimates in those studies ranged from 86.4% to 100.0% and averaged 93.5% (Ecological Services 2006). The survival of bull trout and larger rainbow trout that might be entrained at Opal Springs is more difficult to predict due to the general lack of entrainment studies on large salmonids. However, fish length has been found to be one of the most important variables affecting turbine mortality (CH2MHill 2003), and larger fish generally experience greater mortality. EPRI (1987) indicated that turbine operating and design characteristics affect fish mortality rates. Generally, rapid pressure drops (including cavitation), higher head differential across the turbine, and low turbine efficiency may increase fish mortality. Characteristics of the Opal Springs facility would tend to make it “fish friendly” in regards to these mortality factors (Ecological Services 2006).

Spillway Conditions. At flows greater than 1,822.5 cfs, water spills over the existing flashboards. Any fish that also pass over the dam drop approximately 6 feet and must navigate a roughened dam face. According to the Proposed Action, DVWD will greatly increase its ability to control where and when water spills at the OSHP with the addition of Gate 1. The preliminary design for the new dam crest will include a downstream flow control gate, dedicated to fish passage. The downstream dam face below the gate will be smoothed and provisions will be made to soften the transition from the pool to spillway within areas dedicated to fish passage.

Turbine Strike. There is no tailrace barrier below the OSHP powerhouse, and discharge from the powerhouse could attract fish. The draft tubes extending from the turbines are 63 feet long and unlighted. Velocities exiting the draft tubes are high, but a swimming speed analysis suggests that salmon and steelhead being reintroduced to the area may be physically capable of reaching the OSHP turbine and being struck by turbine blades if strongly attracted to powerhouse discharges (Huntington 2015). Despite having the physical ability to reach the turbine from the OSHP tailrace, none of the nearly 100 salmon and steelhead that have entered the tailrace in the last few years have exhibited a strong attraction to the powerhouse, and most have migrated up into the bypass reach. The swimming speed analysis suggests that resident trout and other species in the area probably are incapable of reaching the turbine (Huntington 2015).

6.4.1.2 Operations and Run Timing

The precise migration timing of anadromous salmonids and other resident fish that will pass the OSHP is uncertain and will affect the pattern of use of the BFAA, as well as how water is physically managed at the OSHP through proposed gates, weirs, and any AWS associated with the diversion structure. Section 5.7.1 describes initial assumptions about how flows at the OSHP may relate to run-timing. However, this will be an adaptive management opportunity as described in Attachment 1 and its associated appendices; a preliminary Operating Plan will be developed in conjunction with the facility design.

6.4.2 Environmental Effects

6.4.2.1 Proposed Action

Direct and Indirect Effects. Under the Proposed Action, the direct and indirect effects on fish and aquatic resources would be providing fish passage and raising the pool. The implementation of upstream and downstream fish passage, combined with operation of the BFAA is described in the 4.3.3 above. Little information is available with regard to timing of fish runs and how they will interact with the facilities and operations. During final design of the fish ladder and flow structures, a preliminary operating plan will be developed that can be refined through the adaptive management process.

The most immediate and significant effects of providing fish passage through the proposed facilities is the reconnection of habitat above and below the OSHP, which will complement critical life-history needs of many species of management concern. This includes reestablishing access to productive spawning and foraging habitats upstream of the OSHP and creating alternative fish-friendly routes of downstream passage for out-migrating fish.

Potential adverse effects of the proposed action include:

- increased injury and mortality for fish that use the new ladder and then fall back through the OSHP's turbine, include foraging bull trout;
- increase in predator habitat in the Opal Spring's impoundment; and
- loss of a small portion of potentially productive habitat in the pool-riffle area immediately upstream of the current impoundment.

Cumulative Effects. Cumulative effects for fish and aquatic resources were assessed at the basin and sub-basin scale. The proposed action will significantly enhance the effort in progress to improve habitat conditions and provide passage in the Lower Crooked River and will improve the chances of success of the reintroduction overall.

6.4.2.2 No Action Alternative

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any effects of the OSHP on geology and soils would continue, as would existing environmental measures.

6.4.3 Proposed Mitigation Measures

Appendices A and B of the Settlement Agreement describe agreed-to performance metrics for upstream and downstream passage, and these metrics are thought to be both realistic and sustainable. The appendices also describe the adaptive management opportunities that are available if performance objectives are not reached.

6.5 Wildlife

6.5.1 Affected Environment

The terrestrial wildlife sin the Lower Crooked River subbasin includes 77 species of mammal, 181 species of bird, 16 species of reptile, and 10 species of amphibian (ODFW 2002). Noting that the aquatic environment and associated riparian vegetation of the subbasin are critical features for wildlife, ODFW identified the species listed in Table 6-5 as potentially dependent on riparian habitat in the lower Crooked River Basin (CRWC 2002). Inclusion in this list does not necessarily indicate that a given species uses riparian habitat in the OSHP area.
From 1988 through 1998, PGE surveyed waterfowl, water birds, and raptors in the PRB Project area (Concannon 1998) and recorded the following numbers of species: 30 species of duck, goose, merganser, and swan; 14 raptor species; 10 species of grebe, loon, cormorant, and coot; 6 species of gull and tern; and 13 species of heron and shorebird. Some of these species may occur in the OSHP area.

Section 6.7 identifies sensitive or strategic species identified by BLM that may be in the area. During a fall 2010 tour of the OSHP area, BLM personnel noted that they did not see any potential effects on these species, including bats, eagles, and peregrine falcon.

TABLE 6-5 WILDLIFE SPECIES IDENTIFIED BY ODFW (2002) AS POTENTIALLY FOUND IN ASSOCIATION WITH RIPARIAN HABITAT IN THE LOWER CROOKED RIVER BASIN.

COMMON NAME[1]	SCIENTIFIC NAME
Tailed frog[2]	*Ascaphus truei*
Oregon spotted frog	*Rana pretiosa*
Long-toed salamander	*Ambystoma macrodactylum*
Garter snake	*Thamnophis elegans; T. sirtalis*
Gopher snake	*Pituophis catenifer*
Western rattlesnake	*Crotalus viridis*
Barrow's goldeneye	*Bucephala islandica*
Bufflehead	*Bucephala albeola*
Mallard	*Anas platyrhynchos*
American bittern	*Botaurus lentiginosus*
Mountain quail	*Oreortyx pictus*
Ruffed grouse	*Bonasa umbellus*
Bald eagle	*Haliaeetus leucocephalus*
Osprey	*Pandion haliaetus*
Willow flycatcher	*Empidonax traillii*
American dipper	*Cinclus mexicanus*
Bank swallow	*Riparia riparia*
Beaver	*Castor canadensis*
Otter	*Lontra canadensis*
Muskrat	*Ondatra zibethicus*
Raccoon	*Procyon lotor*
Mink	*Neovison vison*
Rocky Mountain elk	*Cervus canadensis*
Mule deer	*Odocoileus hemionus*
Townsend's big-eared bat	*Corynorhinus townsendii*
Long-eared bat	*Myotis evotis*
Silver-haired bat	*Lasionycteris noctivagans*
Coyote	*Canis latrans*
Bobcat	*Lynx rufus*
Cougar	*Puma concolor*
Black bear	*Ursus americanus*

[1] Species lists are not exhaustive, and species identified in the table may or may not be found in or adjacent to the OSHP area

[2]ODFW (CRWC 2002) indicates that the distribution of the western toad (*Anaxyrus boreas*) and Columbia spotted frog (*Rana luteiventris*) are limited to the upper Crooked River basin.

The peregrine falcon (*Falco peregrinus*) was delisted from the ESA in 1999, although BLM continues to consider it a sensitive species. It is not known to be a permanent resident of the

OSHP area (USFS 1989). There appear to be no records of this species being found in the OSHP area, and it was not observed during the 1988–1998 surveys conducted in the PRB Project area (Concannon 1998). Other BLM-identified species of interest are listed in Exhibit C, Attachment 4.

6.5.2 Environmental Effects

6.5.2.1 Proposed Action

Direct and Indirect Effects. To the extent that raising the pool affects riparian vegetation is affected by the pool raise, so also will it affect riparian-dependent wildlife species. Potential effects of the Proposed Action should be limited in spatial area, and over time. As plant species colonize the new shoreline, these wildlife species are likely to exist at levels similar to those under existing conditions.

Cumulative Effects. Cumulative effects for wildlife resources were assessed at the watershed scale. Because no other projects have been identified within the watershed, no cumulative effects will occur as a result of the Proposed Action.

6.5.2.2 No Action Alternative

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any effects of the OSHP on wildlife would continue, as would existing environmental measures.

6.5.3 Proposed Mitigation Measures

No specific mitigation measures are proposed at this time. Permits for facilities construction are likely to require DVWD to ensure best practices to manage short-term disturbance of wildlife.

6.6 THREATENED, ENDANGERED, AND SPECIAL STATUS SPECIES

6.6.1 AFFECTED ENVIRONMENT

The USFWS, NOAA, and ODFW have identified threatened and endangered species in Jefferson County as of November 2011 (USFWS 2015). This includes species that are federally listed as threatened or endangered under the ESA, and species that are candidates for federal listing under ESA. Table 6-6 shows species listed by USFWS, NOAA, and Oregon.

TABLE 6-6 THREATENED AND ENDANGERED SPECIES IN JEFFERSON COUNTY

LISTED SPECIES[1]		
Mammals		
Canada lynx[2]	*Felis lynx Canadensis*	T
Birds		
Northern spotted owl [3]	*Strix occidentalis caurina*	CH, T
Fish		
Steelhead (Middle Columbia River)[4]	*Oncorhynchus mykiss* ssp.	T[5] (experimental)
Bull trout (Columbia River Basin)[6]	*Salvelinus confluentus*	CH, T
Proposed Species		
None		
CANDIDATE SPECIES7		
Amphibians and Reptiles		
Columbia spotted frog	*Rana luteiventris*	
Oregon spotted frog	*Rana pretiosa*	
Northern American wolverine	*Gulo gulo luscus*	
SPECIES OF CONCERN8		
Mammals		
Fisher	*Martes pennanti*	PT
Spotted bat	*Euderma maculatum*	
Silver-haired bat	*Lasionycteris noctivagans*	
Small-footed bat	*Myotis ciliolabrum*	
Long-eared bat	*Myotis evotis*	
Long-legged bat	*Myotis volans*	
Yuma bat	*Myotis yumanensis*	
Palid bat	*Antrozous pallidus pacificus*	
Townsend’s western big-eared bat	*Corynorhinius townsendii townsedii*	
Birds		
Northern goshawk	*Accipiter gentilis*	
Greater sage-grouse	*Centrocercus urophasianus*	PE
Western burrowing owl	*Athene cunicularia hypugea*	
Ferruginous hawk	*Buteo regalis*	
Black tern	*Chlidonias niger*	

Olive-sided flycatcher	*Contopus cooperi*	
Willow flycatcher	*Empidonax trailli adastus*	
Harlequin duck	*Histrionicus histrionicus*	
Yellow-breasted chat	*Icteria virens*	
Lewis's woodpecker	*Melanerpes lewis*	
Mountain quail	*Oreortyx pictus*	
White-headed woodpecker	*Picoides albolarvatus*	
Amphibians and Reptiles		
Tailed frog	*Ascaphus truei*	
Oregon slender salamander	*Batrachoseps wrighti*	
Cascades frog	*Rana cascadae*	
Northern sagebrush lizard	*Sceloporus graciosus graciosus*	
Coastal tailed frog	*Ascaphus truei*	
Fishes		
Pacific lamprey	*Lampetra tridentata*	
Interior Redband Trout	*Oncorhynchus mykiss gibbsi*	
Invertebrates		
Cascades apataniuan caddisfly	*Apatania tavala*	
Plants		
Wallawa ricegrass	*Achnatherum wallowaensis*	
Estes' artemesia	*Artemisia ludoviciana* ssp. *estesii*	
Dissapearing monkeyflower	*Mimulus evanescens*	
Little mousetail	*Myosurus minimus* ssp. *apus (var. sessiliflorus)*	
Peck's penstemon	*Penstemon peckii*	
Lichen		
Sessile mousetail	*Myosurus sessilis*	
Woven-spored Lichen	*Texosporium sancti-jacobi*	
(E) Listed Endangered *(T) Listed Threatened* *(CH) Critical Habitat has been designated for this species*	*(PE) Proposed Endangered* *(PT) Proposed Threatened* *(PCH) Critical Habitat has been proposed for this species*	

[1] U.S. Department of Interior, Fish and Wildlife Service, October 31, 2000, Endangered and Threatened Wildlife and Plants, 50 CFR §17.11 and 17.12
[2]Federal Register Vol. 65, No. 58, Mar 24, 2000, Final Rule - Canada lynx
[3]Federal Register Vol. 57, No. 10, January 15, 1992, Final Rule - Critical Habitat for the Northern Spotted Owl
[4] Federal Register Vol. 64, No. 57, March 25, 1999, Final Rule - Middle Columbia and Upper Willamette River Steelhead
[5] Consultation with NOAA's National Marine Fisheries Service may be required.
[6] Federal Register Vol. 63, No. 111, June 10, 1998, Final Rule - Columbia River and Klamath River bull trout
[7] Federal Register Vol. 69, No. 86, May 4, 2004, Notice of Review - Candidate or Proposed Animals and Plants
[8] Taxa whose conservation status is of concern to the USFWS (many previously known as Category 2 candidates) but for which further information is still needed.

BLM personnel visited the OSHP area in 2010. Except for the fish species identified in the following sections, the BLM observed no instances of threatened and endangered species in the OSHP area (J. Eisner, BLM, Prineville Office, personal communication), nor do any site-specific reports identify occurrences.

6.6.1.1 Bull Trout (*Salvelinus confluentis*)

USFWS issued a final rule listing the bull trout (*Salvelinus confluentus*) in the coterminous United States as a threatened species under the ESA on June 10, 1998 (63 Fed. Reg. 31647). Oregon has also listed the bull trout as a state sensitive species. In central Oregon's Deschutes River Basin upstream of the PRB Project dams at river kilometer (rkm) 167.5 (RM 100.5), bull trout currently inhabit the Metolius River Basin, the Deschutes River upstream to Steelhead Falls, the lower reaches of Whychus Creek, the lower kilometer of the Crooked River upstream to the Opal Springs Dam, and Lake Billy Chinook (Ratliff et al. 1996). Of these areas, only the Metolius River Basin has suitable habitat for bull trout spawning. The other riverine and reservoir habitats provide foraging, migration, and overwintering (FMO) habitat (USFWS 2002). The first extensive fish surveys in the Crooked River were conducted in the 1950s. By that time, the basin was degraded due to severe water withdrawal and radically altered riparian areas (Nehlsen 1995). Foraging subadult and adult bull trout were occasionally caught in the Crooked River as far upstream as the city of Prineville at rkm 85 (RM 51) through the early 1980s (Ratliff et al. 1996, cited in Buchanan 1997).

USFWS issued a final rule designating critical habitat for the bull trout on October 18, 2010 (75 Fed. Reg. 63898). The Crooked River from its confluence with Lake Billy Chinook at rkm 189.85 (RM 117.7) upstream 1.7 kilometer (km; 1.18 miles) to Opal Springs Dam was designated as occupied FMO habitat. From Opal Springs Dam upstream 17.9 km (11.1 miles) to the Highway 97 bridge crossing was designated as unoccupied FMO habitat. Because numerous large, cold springs enter this section of the Crooked River, the habitat is currently suitable for cold-water salmonids (Torgerson et al. 2007) such as bull trout.

USFWS's *Deschutes River Basin Bull Trout Draft Recovery Plan* (USFWS 2002) calls for restoring connectivity and opportunities for migration in the Crooked River by constructing upstream fish passage at Opal Springs Dam (Task 1.2.4). This area is important because it would allow bull trout in Lake Billy Chinook to disperse out of the reservoir, which would decrease the potential for population loss from cannibalism. Cannibalism can have significant effects on populations, particularly when other forage species are not available (Beauchamp and Shepard 2008). In 2014 the USFWS issued a revised draft bull trout recovery plan and in 2015, the six draft recovery unit implementation plans were issued.

Adult and subadult bull trout are already present in the reservoir's Crooked River Arm and in the Crooked River upstream to Opal Springs Dam. However, it is not clear how many of those bull trout will use the Opal Springs fish ladder to move upstream of the OSHP, when they will move, or when they will return downstream. The number, size, and migration timing of bull trout passage at Opal Springs are important factors regarding the final determination of ESA effects likely to result from the Proposed Action. These factors will also influence decisions on protection and mitigation actions taken as part of the OSHP's Fish Passage and Protection Plan. USFWS will work with DVWD under the terms and conditions of their respective biological opinions after formal consultation regarding the Proposed Action is concluded, and also through the amended license's proposed FPWG.

6.6.1.2 SUMMER STEELHEAD (*ONCORHYNCHUS MYKISS*)

In the Deschutes Subbasin MCR steelhead currently range from its mouth at the Columbia River up to the PRB Project at RM 100, including east and west side tributaries. Before hydroelectric and irrigation development, steelhead used the Deschutes River up to Big Falls (RM 132), Whychus Creek (a Deschutes River tributary above the PRB Project), and the Crooked River Watershed. Within the Crooked River Watershed, steelhead were documented in McKay, Ochoco (below Ochoco Dam), Horseheaven, Newsome, Drake, Twelvemile, and Beaver Creeks and the North Fork Crooked River (Figure 6-1) (Nehlsen 1995).

The completion in 1920 of Ochoco Dam east of Prineville blocked access into most of the Ochoco Creek Watershed. In 1961, Bowman Dam was completed on the Crooked River at RM 70, about 20 miles southeast of Prineville, creating Prineville Reservoir and blocking fish passage into the upper Crooked River Watershed. On the Deschutes River, the Pelton and Reregulating Dams (RM 103 and RM 100, respectively) were completed in 1958. Even though these dams had fish passage, steelhead numbers in the upper Deschutes River basin had substantially declined by that time (Nehlsen 1995). By 1968, it was concluded that fish passage was not working due to the inability to collect juvenile fish from the reservoir (Lake Billy Chinook) behind Round Butte Dam. To mitigate for lost passage and habitat, PGE constructed a fish hatchery at Round Butte Dam to produce spring-run Chinook salmon and steelhead (Ratliff and Shulz 1999). By the time the OSHP was completed in 1985, MCR steelhead had been extirpated from the basin.

Endangered Species Act Listing. On March 25, 1999, NMFS published a final rule listing the MCR steelhead DPS under the ESA as threatened (NMFS 1999). It is one of 15 Pacific Coast steelhead distinct population segments extending from southern California to the Canadian border in Washington State. Eleven of the 15 Pacific Coast steelhead DPSs are now listed under the ESA. The MCR Steelhead DPS covers an area of approximately 35,000 square miles in the Columbia Plateau of eastern Oregon and eastern Washington. It includes all populations of steelhead in Columbia River tributaries upstream of the Wind River (excluded) in Washington and the Hood River (excluded) in Oregon to, and including, the Yakima River in Washington. Snake River steelhead are excluded. Seven artificial propagation programs, including the Deschutes River hatchery programs, were included in the MCR DPS in 2006 (71 Fed. Reg. 834, January 5, 2006). The DPS also includes four major population groups based on ecoregion characteristics, life history, and other geographic and genetic factors. MCR steelhead from the Deschutes River and tributaries contribute three of five populations to the Cascade Eastern Slope population group: Deschutes Eastside, Deschutes Westside, and the Crooked River (extirpated) (NMFS 2011).

As described in Section 6.4, the reintroduction of anadromous fish to the basin above the PRB Project began in 2007 as required in the PRB license, and under the direction of the Fish Managers (ODFW and CTWS 2008), with appropriate oversight by NMFS (NMFS 2011). The goals of the reintroduction effort are to establish a population of MCR steelhead in historic habitat, help recovery by improving spatial structure for the Deschutes Westside population, and restore the extirpated Crooked River population by giving them access to historically occupied habitat. Although providing passage over the PRB Project addressed these biological objectives, the fish passage barrier imposed by OSHP is significant.

This reintroduction effort relies heavily on stock from the Round Butte Hatchery, and because this hatchery was included in the DPS in 2006, progeny that are reintroduced above the Round Butte Dam as either fry or smolts are currently an ESA-listed threatened species.

Recovery Plan. Pursuant to Section 4(f) of the ESA, NMFS has developed and is implementing a plan for the conservation and recovery of listed MCR steelhead. The plan describes specific management actions, establishes objectives and measurable criteria for delisting, and estimates time and cost to carry out these measures. The recovery plan for Cascade Eastern Slope Tributaries of the MCR Steelhead DPS requires that both the Deschutes River populations, Eastside and Westside, be viable (i.e., less than a 5% risk of extinction within 100 years). The Deschutes Eastside population, below the PRB Project, is considered viable, but the Deschutes Westside population is not: spatial distribution, diversity, and abundance are restricted, primarily due to blocked passage to historically productive habitat above the PRB Project (NMFS 2009). However, recovery is not completely dependent on providing passage because spawning habitat is available in downstream tributaries such as the Warm Springs River and Shitike Creek (NMFS 2011).

Reintroduction of fish above the PRB Project, therefore, will be a long-term effort aimed at strengthening the Cascades Eastern Slope major population group of MCR steelhead. The action will improve spatial structure for the Eastside population because it will increase the amount of spawning habitat available. Over time, this will improve population numbers and help alleviate risk to their survival and recovery.

In order to facilitate development of conservation measures that support reintroduction above the PRB Project to implement the recovery plan, in 2011 NMFS designated MCR Steelhead above the PRB Project as an experimental population, pursuant to Section 10(j) of the ESA (76 Fed. Reg. 28715, May 18, 2011). This designation was made because:

- MCR Steelhead reintroduced above the PRB Project will be completely separate geographically for the part of their lifecycle that is above the dams; and
- designation will further the conservation of the species by encouraging development of conservation measures to support the reintroduction effort.

This rule allows for incidental take of steelhead released above the PRB Project as long as the take is incidental to an otherwise lawful activity (NMFS 2012). The rule includes an expiration date 12 years after spawners are allowed to pass above the PRB Project.

6.6.1.3 PACIFIC SALMON (*ONCHORHYNCHUS TSHAWYTSCHA*)

Spring Chinook salmon historically spawned in the Warm Springs River system, Shitike Creek, the mainstem Deschutes River upstream from the PRB Project, Whychus Creek, and the Metolius River. Historic use of the Crooked River by spring Chinook has also been documented, but when this population was extirpated is unknown (Nelson 1995). Despite its extirpation from the upper Deschutes Basin and Crooked River Basin, the ESA listing status is "not warranted" for all naturally spawned populations of Chinook salmon from the Deschutes River (NMFS 1999).

Construction of the PRB Project blocked salmon from their historic habitats upstream. Chinook salmon fry and smolts have been released into the selected tributaries above PRB, including the Crooked River, since 2008. The Deschutes River below Big Falls and the Crooked River below OSHP are EFH according to the Magnuson-Stevens Act.

6.6.1.4 ANADROMOUS FISH REINTRODUCTION

In 1996, ODFW developed a fishery management plan for the Crooked River, which includes the reach through OSHP (ODFW 1996). The plan sets a management direction for the Crooked River with the following policies:

Policy 1. Restore anadromous and migratory resident fish to their historic range in the Crooked River Basin by improving upstream and downstream passage over artificial barriers.

Policy 2. Reconnect isolated and fragmented populations of redband trout by restoring and improving passage over man-made barriers.

Policy 3. Require passage over all proposed dams on fish-bearing streams.

In December 2003, ODFW adopted a rule that directs ODFW to restore anadromous MCR summer steelhead into portions of its historic range upstream from the PRB Project. Specific areas targeted for reintroduction include the Metolius River and tributaries, the Deschutes River from Lake Billy Chinook upstream to Big Falls, Whychus Creek, and the Crooked River and tributaries upstream to Bowman and Ochoco dams.

The plan gained significant momentum with the relicensing of the PRB Project in 2005. The new federal license for the PRB Project requires implementation of a fish passage plan (PGE and CTWSRO 2004) to reinitiate fish passage through PRB. One of the key provisions of the license and fish passage plan was a requirement that the licensees (PGE and CTWRSO) construct a new fish passage system known as the Selective Water Withdrawal (SWW), at Lake Billy Chinook at RM 110.

In the spring of 2007 steelhead fry from Round Butte Hatchery were released into the Crooked River, upstream to Les Schwab Park, in Prineville. In fall 2008, ODFW and the Confederated Tribes of the Warm Springs Branch of Natural Resources completed a *Reintroduction and Conservation Plan for Anadromous Fish in the Upper Deschutes River Sub-basin, Oregon* (ODFW and CTWS 2008). Each spring since that plan was completed, both steelhead and Chinook salmon fry have been released into the Crooked River system above the OSHP. More than 50,000 Chinook and steelhead smolts have been captured in the SWW at Round Butte and released into the lower Deschutes River.

OSHP has been a near-complete to complete barrier to upstream migrations of game fish, including redband and bull trout, and mountain whitefish, since the renovation and retrofit of the dam was completed in 1984. Since the reintroduction plan is in the process of being implemented, passage at OSHP is a high priority.

6.6.1.5 Other Threatened or Sensitive Species

The USFWS list of species under its jurisdiction in Jefferson County (USFWS 2015) includes the threatened bull trout, which is known to be present in the OSHP area; NMFS ESA listed steelhead are also present. Aside from these species, no USFWS or NMFS ESA listed species are currently known to be present in the OSHP area. Redband trout (*Oncorhynchus mykiss* *ssp.)* is known to occur in the Crooked River. Other USFWS listed species in Jefferson County include the threatened Northern spotted owl (*Strix occidentalis caurina*), proposed species including Fisher (*Martes pennant*) and candidate species including North American wolverine (*Gulo gulo luscus*), Greater sage grouse (*Centrocercus urophasianus*), and whitebark pine (*Pinus albicaulis*).

The DVWD has worked with USFWS and NMFS to evaluate what species may be present in the OSHP area, and how the Proposed Action could affect them. A final determination regarding the proposed OSHP's effects on listed species or their habitats will be made at the conclusion of formal ESA consultation.

6.6.1.6 Operations and Run Timing

Timing of potential wild steelhead smolt emigration past the Opal Springs site can be approximated as a composite of that observed at the Pelton skimmer in 1959–1963 (Lewis 2005) and more recently at multiple other sites still accessible to the species in the lower Deschutes Subbasin (Figure 6-1). These data suggests that most emigration will occur between March 1 and July 30. Accumulated data on the timing of smolt outmigration will affect the pattern of use of the BFAA, as well as how water is physically managed at the OSHP through proposed gates, weirs, and any AWS associated with the diversion structure. This will be an adaptive management opportunity as described in the Settlement Agreement and its associated appendices.

For planning purposes, the timing of smolt outmigration corresponds to periods of high flow at the OSHP, when flow is often expected to spill. Under existing conditions, outmigrants that bypass the intake pass the OSHP primarily via the roughened spillway. According to the Proposed Action, most spilled water (and the fish attracted to it) will bypass the powerhouse and travel downstream via routes that are more fish-friendly.

Huntington (2015) developed a preliminary model of down-migrant mortality (DMM) for the OSHP. The model relies upon available information on the sizes and migration timing of salmon and steelhead smolts, variations in river flows, characteristics of the OSHP, and likely passage route selections by smolts given variable daily flow conditions, to estimate annual mortality rates for specific types of downstream migrants. It has been used to develop estimates for steelhead and spring Chinook smolt losses that might occur under existing and proposed conditions. Modeled estimates of these losses are being refined but suggest improved survival rates at the OSHP given the proposed (new) conditions relative to those that occur under existing conditions.

Figure 6-3 provides a graphic summary of some of the quantitative information on fish migration timing and sizes on which the DMM model is based. With regard to migration timing, the model is based on species-specific data from the Crooked River itself (M. Hill, PGE, pers comm.), the Pelton Round Butte hydro-complex (Newton 1973; Lewis 2005), and from other Deschutes River tributaries (Montgomery 1955; Burck 1981; Nelson 2008). As for the size of migrants anticipated at the OSHP, the model relies upon information from Ratliff (2001), Lewis (2006), and others. Ratliff (2001) summarized information on sizes of anadromous outmigrants captured in the Deschutes River Basin upstream of the PRB Project. He reported that steelhead smolts captured in the 1960s averaged 200 millimeters (mm) in length. He also cited 1999 and 2000 data from Trout Creek that showed emigrating smolts ranged from 100 mm to 260 mm, and averaged 175 mm. In 1960, wild steelhead smolts were trapped in the Deschutes River downstream of the Crooked River confluence. Their length–frequency distribution provides an estimate of the sizes of wild steelhead smolts that might be expected to be entrained at the OSHP. These fish ranged from 140 to 270 mm fork length with a mean of 190 mm (Lewis 2006).

As described in Section 5.5, mortality and injury of entrained fish appear to be functions of size, such that salmonids less than 250 mm long tend to have higher survival rates.

Estimates of smolt emigration timing that are applied in the DMM model (Figure 6-3) were based on species-specific data from the Crooked River itself (M. Hill, PGE, pers comm.), the PRB Project (Newton 1973; Lewis 2005), and from other Deschutes River tributaries (Montgomery 1955; Burck 1981; Nelson 2008).

(Montgomery 1955; Burck 1981; Nelson 2008).

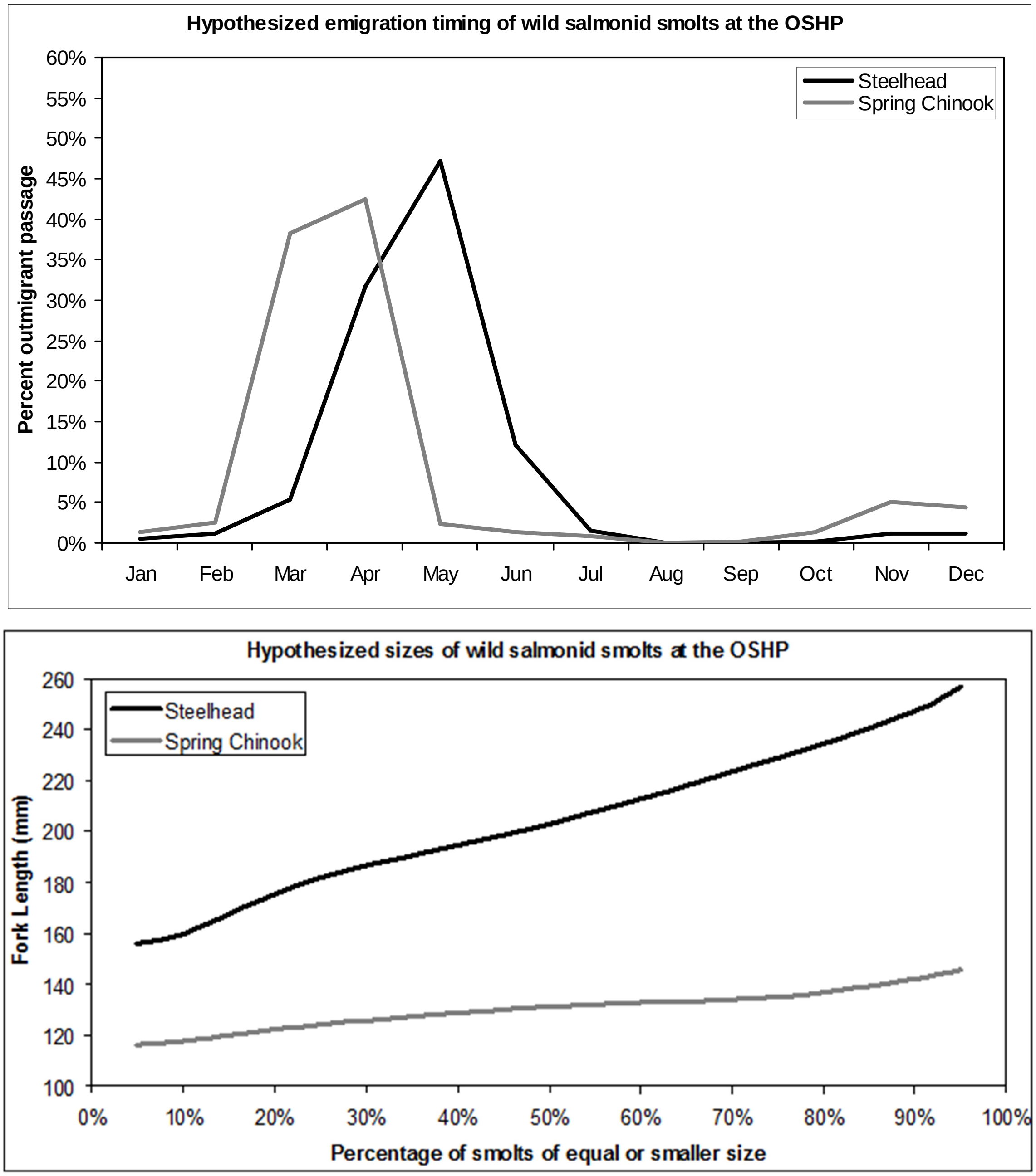


FIGURE 6-3 ESTIMATED FUTURE EMIGRATION TIMING (TOP) AND SIZE (BOTTOM) FOR SUMMER STEELHEAD AND SPRING CHINOOK SALMON SMOLTS AT THE OSHP

6.6.2 Environmental Effects

6.6.2.1 Proposed Action

Direct and Indirect Effects. The purpose of the Proposed Action is to mitigate the OSHP's effects on threatened fish species; therefore, the environmental effects of this action are seen to be positive in terms of connecting fish habitat and facilitating fish passage. The Proposed Action does not include screening of the powerhouse intakes; therefore, the downstream migrants that do not pass through the alternative routes provided will travel through the turbine. Turbine passage survival is discussed in Section 6.4.2. For larger sub-adult and adult bull trout that use the ladder to explore foraging areas above the OSHP, this presents a potential source of injury and mortality. Other sources of direct and indirect injury and mortality are also discussed in Section 6.4.2.

Cumulative Effects. Cumulative effects for fish and aquatic resources were assessed at the basin and sub-basin scale. Because an effort to improve habitat conditions and provide passage in the Lower Crooked River is underway, the proposed action will significantly enhance those efforts above the OSHP and improve the chances of success of the reintroduction effort overall.

6.6.2.2 No Action Alternative

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any effects of the OSHP on threatened, endangered, and special status species would continue, as would existing environmental measures.

Under the No Action Alternative, there would be:

- injury and mortality of fish, including foraging bull trout and migrating steelhead that must be trapped and hauled around the OSHP; and
- delay or holding in the powerhouse tailrace with no mechanism for cueing behavior, since the BFAA would not be available.

6.6.3 Proposed Mitigation Measures

Section 4.3.5 describes agreed-to performance metrics for upstream and downstream passage, and these metrics are thought to be both realistic and sustainable. Section 4.3.6 describes the adaptive management opportunities that are available if performance objectives are not reached. Additional detail is found in Appendices A and B of the Settlement Agreement.

6.7 Botanical and Riparian Resources

6.7.1 Affected Environment

BLM assessed riparian and spring/seep vegetation associations in the Crooked River Gorge immediately upstream of the OSHP area in 2005 (Hardin-Davis 2006). A total of 103 plant species were found in the BLM's study area, of which 30 species were introduced. The most common introduced species in the riparian zone was reed canarygrass (*Phalaris arundinacea*), an invasive species that appeared to be competitively excluding other species (Hardin-Davis 2006). Estes wormwood (*Artemesia ludoviciana* spp. *estesii*), a rare perennial forb, was encountered during the surveys (Hardin-Davis 2006).

Hardin-Davis (2006) concluded that the riparian zone in the lower Crooked River was dominated by mockorange (*Philadelphus lewisii*) and red-osier dogwood (*Cornus sericea* ssp. sericea), and that riparian vegetation appeared homogenous throughout much of the survey area. Plant diversity was highest where shrubs and trees were not dominant. The more common native species found in the riparian area are common in riparian settings throughout the region. Dominant riparian plant species in the OSHP area include white alder (*Alnus rhombifolia*), red osier dogwood, mockorange, blue elderberry (*Sambucus mexicana*), reed canarygrass, torrent sedge (*Carex nudata*), chokecherry (*Prunus virginiana*), and Mexican elder (*Sambucus mexicana*) (Huntington 2009).

During a fall 2010 reconnaissance trip to the area, BLM personnel reported what looked like an invasive species, *Phragmites australis*, on the east bank in the area that would be inundated by the higher pool. Staff noted that care should be taken not to disturb this species for fear of spreading it. In an email dated April 2, 2015, the BLM has indicated that if the species in question is confirmed, then the BLM would not require its removal. Further, information gathering relative to the presence/absence of this plant should not be pursued.

As required for removal fill permitting for DSL and USACE, DVWD had a wetland survey completed in 2014. The purpose was to determine and establish the presence and location of Jurisdictional Wetlands along the shorelines of the OSHP. It was found that the area of wetlands that would be inundated as a result of the survey would be 0.018 acres.

6.7.2 ENVIRONMENTAL EFFECTS

6.7.2.1 PROPOSED ACTION

Direct and Indirect Effects. Implementing the Proposed Action would have limited direct effects on botanical resources as a result of inundation. The primary substrate inundated is composed of basalt cliffs. Some areas on the west bank composed of fill from the original construction will be inundated; however, as this is a run-of-river project, reservoir fluctuation will be minimal.

During an April 16, 2009, reconnaissance, Huntington (2009) determined that the proposed increase in the elevation of the pool will inundate some existing riparian vegetation. In addition, a small near-channel spring will become backwatered.

Vegetation bordering the existing water surface will be inundated (Huntington 2009), including 0.018 acres of jurisdictional wetlands (Sage West 2014). Riparian vegetation not inundated but near the edge of the newly inundated area will respond to the change in water surface, which could include mortality of a few mature white alder trees. Regeneration patterns along the existing diversion pool suggest that natural replacement of these white alder and other vegetation affected by the raised pool could be slow because growing conditions within the predominantly boulder-covered surfaces near the river channel provide limited locations for trees and shrubs to become established. The plant surveys conducted by Hardin-Davis (2006) along the river segment that will be inundated did not identify any designated sensitive, threatened, or endangered species as being present.

Cumulative Effects. Cumulative effects for botanical and riparian resources were assessed at the watershed scale. Because no other projects have been identified within the watershed, no cumulative effects will occur as a result of the Proposed Action.

6.7.2.2 No Action Alternative

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any ongoing effects of the OSHP on botanical and riparian resources would continue, as would existing environmental measures.

6.7.3 Proposed Mitigation Measures

No mitigation measures for the potential effects on riparian and botanical resources are proposed.

6.8 Recreation, Land Use, and Aesthetics

6.8.1 Affected Environment

6.8.1.1 Recreation

The segment of the lower Crooked River from RM 17.8 downstream to RM 8 is a federally designated Wild and Scenic River, with identified Outstandingly Resource Values that include recreation (USDI 1992). The Crooked River Wild and Scenic area is readily accessible and provides a variety of year-round recreation opportunities, including fishing, hiking, camping, hunting, photography, wildlife viewing, and boating (USDIBLM 1992). A survey conducted by the BLM indicated that the area received 29,750 visits annually in the early 1990s (BLM and BOR 1992), a level that probably has increased as the human population has expanded in the region. Angling is the primary recreational activity, particularly for redband trout and mountain whitefish. Camping at group campgrounds as well as at dispersed sites is a popular activity. The area's recreational opportunities are well advertised through the State Scenic Highway and National Back Country Byway publications (USDIBLM 1992).

The OSHP lies within an approximately 27-mile segment of the Crooked River used for whitewater kayaking, and recreational fishing takes place within the OSHP vicinity. A boat ramp exists in the reservoir to allow safe transit past the dam.

FIGURE 6-4 WARNING SIGN TO AID BOATERS IN SAFE TRANSIT PAST THE FACILITIES AT THE OPAL SPRINGS HYDROELECTRIC PROJECT

6.8.1.2 LAND USE

General Land Use Characteristics. The OSHP vicinity is part of a vast, high desert prairie interspersed with mountain ranges and isolated peaks. The region is a non-metropolitan region in Oregon's Jefferson County with a population of approximately 28,000 people (U.S. Census Bureau 2010). All or parts of seven Oregon counties are included in the Crooked River Basin, including Crook, Deschutes, Grant, Jefferson, Harney, Lake, and Wheeler. Land use within the basin is focused primarily on livestock, including beef cattle, large numbers of sheep, dairy herds, horses, and swine as well as significant acres of irrigated land. Agriculture and forestry dominate more than 90% of the basin, and rural residential is the third largest category (CRWC 2002). The CRWC (2002) concluded that lumber and wood products form the basis of the region's economic structure. Since the late 1970s, the proportion of irrigated lands has increased relative to grazed lands, while forest lands have remained stable.

Federal agencies manage nearly 57% of the land in the basin. The BLM manages 35.2% of the basin (1,023,215-acres), and 22.8% is managed by the United States Forest Service. Private ownership (41%) makes up most of the remaining land, and a small percentage is owned by the state of Oregon.

***Lower Crooked Wild and Scenic River*.** Because of its proximity to the easternmost boundary of the Lower Crooked Wild and Scenic River, the potential upstream hydrologic effects are of special significance. Section 7(a) of the Wild and Scenic Rivers Act bars FERC from licensing the construction of any dam, water conduit, or other project works on or directly affecting any river that is designated a component of the national Wild and Scenic Rivers System. This does not, however, preclude licensing of developments below or above a wild, scenic, or recreational river or any stream tributary that would not invade or unreasonably diminish the scenic, recreational, and fish and wildlife values present when the river was designated a component of the Wild and Scenic Rivers System. Under Section 7(d) of the Wild and Scenic Rivers Act, the administering Secretary makes determinations regarding consistency of a project with the provisions of the Wild and Scenic Rivers Act.

The Lower Crooked Wild and Scenic River boundary is described in the *Middle Deschutes/Lower Crooked Wild and Scenic Rivers' Management Plan*, dated December 1992. The boundary is described as "River Mile 8, south of Opal Springs," and further described as "the North 1/16th line of Section 4, in the Metes and Bounds description under T. 13 S., R. 12 E., W.M." Because of the importance of establishing the boundary elevation with precision and confidence, DVWD contracted with CH2M Hill and a local surveyor (CH2M Hill 2010) to perform survey work to tie the metes and bounds description of the boundary to existing surveys of key OSHP elevations. The key findings from the survey efforts are described below:

- The metes and bounds description of the Wild and Scenic River boundary appears to be inconsistent with the designation of the RM 8 marker. T. 13 S., R. 12 E., WM is the more conservative description, downstream of where DVWD believes RM 8 to be.
- The surveyed elevation of the metes and bounds description where the boundary crosses the stream had a surface elevation of just above 2,010.66 feet. This elevation was measured in October 2009 during a period of low flows and, therefore, should be considered conservative. The top of the riffle below the assumed boundary was surveyed at 2,010.56 feet.
- Given that the maximum extent of the proposed increase in the pool would be to 2,010.21 feet, and below the visible riffle that is downstream of the Wild and Scenic boundary, it appears that the upstream end of the impoundment under the Proposed Action will be downstream of the Wild and Scenic boundary, with a discernible visible break provided by the cascade at the downstream end of the riffle under most flow conditions.

Note that under the 2017 revised proposal, the separation between the proposed head of pool at 2007.21 feet and the lower end of the boundary is more distinct.

6.8.1.3 Aesthetic/Visual Resources

The segment of the lower Crooked River from RM 17.8 downstream to RM 8 is a federally designated Wild and Scenic River with identified Outstanding Resource Values ORVs that include scenic and recreation resources (USDIBLM 1992). The river canyon is unique in that its geologic characteristics represent a smaller, more accessible example of the Lower Deschutes and John Day basin formations (USDIBLM 1992). Scenic features within the canyon include massive walls and escarpments of deeply eroded rust-brown basalt, upland vegetation, and the Crooked River and its associated riparian vegetation. State Scenic Highway 27 provides views of the geologic formations and eroded lava flows throughout the canyon. Highway 27 has received awards from the Federal Highway Administration for its natural looking construction and its compatibility with the surrounding environment (BLM and BOR 1992). The lower Crooked River adjacent to the highway led to the designation of the route as a National Back Country Byway.

Because of its proximity to the Wild and Scenic River boundary, the BLM requested that a Visual Resources Survey be completed to understand potential impacts of the project on the ORV's. Three Visual Resource Management (VRM) objectives were identified for the OSHP area. These include:

- VRM II- Upland and upper riparian zone: The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color and texture found in the predominant natural features of the characteristic landscape.
- VRM III- Lower riparian zone and reservoir pool: The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- VRM IV – Dam, Fish ladder and power generating facilities: The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

6.8.2 Environmental Effects

6.8.2.1 Proposed Action

Implementing the Proposed Action will have direct effects on recreation, land use, and aesthetic resources. DVWD's survey efforts have identified the upstream extent of the higher pool. Figure 6-4 illustrates the position of the Lower Crooked Wild and Scenic River boundary in relation to the head of the OSHP diversion pool (top). A boulder rapid-cascade located below the boundary drops approximately 4.7 feet and provides a clear separation between the head of the proposed OSHP pool and the boundary.

FIGURE 6-5 WILD AND SCENIC RIVER BOUNDARY

Recreation. The proposed increase in the pool will inundate a pool-and-riffle habitat downstream of the cascade that will act as a hydraulic barrier to pool encroachment into the Wild and Scenic River reach. Two recreational opportunities that will be minimally affected by the proposed increase in the pool are boating and sport fishing (Huntington 2009). A segment of river popular with some boating enthusiasts extends from Lone Pine Bridge above

Smith Rocks State Park down to Lake Billy Chinook and has two distinct whitewater runs separated by a boater take-out at China Dam. The lower run is 9 miles long and includes a short portage around the OSHP diversion dam and bypass reach. The ability of boaters to transit past the project will not be impacted. The upper 18-mile run includes some Class 3 and 4 whitewater. ODFW habitat survey data suggest that raising the pool will inundate about 1.6% of the total length of whitewater now being boated within the lower run from China Dam to Lake Billy Chinook and will be well below 1% of the whitewater within the full 27-mile river segment between Lone Pine Bridge and Lake Billy Chinook. None of the affected whitewater is in the Wild and Scenic River segment, which ends immediately upstream.

Trout fishing in the canyon upstream of the OSHP diversion pool is excellent (USDIBLM 1992), although difficult access limits anglers' use of the area. To the extent that the higher pool modifies habitat and changes the use of this area by trout species, localized angling opportunities may be reduced minimally.

Land Use. As stated above, the Proposed Action envisions that the increase in the size of the impoundment will approach, but will neither invade nor unreasonably diminish the scenic, recreational, and fish and wildlife values present when the river was designated a component of the Wild and Scenic Rivers System. The BLM will make that determination during the amendment proceeding.

Aesthetics. Effects on visual resources associated with the Proposed Action will be negligible. The proposed increase in the pool will inundate approximately 700 linear feet of riverine habitat upstream of the current head of the Opal Springs impoundment, but given that the OSHP facilities and reservoir already exist, the basic visual character of the OSHP area, including views from the upstream Wild and Scenic River area, will be very similar to existing conditions.

The most dramatic change will be elimination of a rapid immediately downstream of the Wild and Scenic boundary. This rapid will serve as a hydraulic control, and the upstream end of the rapid will be discernible under most hydraulic conditions.

The VRM analysis (Sage West, 2015) evaluated visual impacts at key observation points (KOPs). Two viewpoints were selected and represent sites on public land and water that is accessible by walking the Otter Bench Trail or floating upstream of the dam. Analysis of potential impacts were determined by superimposing potential characteristics under the Proposed Action. KOP#1 is the publicly accessible and frequently visited Otter Bench Trail System. As described in the analysis, the Proposed Action will meet the VRM objectives when viewed from KOP#1:

1. VRM II: Uplands are retained. The upland/riparian fringe will reestablish naturally in a short time period (3-7 years).
2. VRM III: The pool will be raised 6 feet and the shoreline will be flooded near the dam and grading to 0 feet to the end of the pool where there will be no impact. The river rapid at the upper end of the pool will be partially flooded during high water levels. The reservoir pool will be +/- 25% larger and once flooded will not be noticeable.
3. VRM III: The existing character of the landscape will be retained. The lower 6 ft. of the cliff and talus slopes will be inundated, but the landscape above is the same and will remain intact.

KOP #2 is from the river and viewable from a floating device near the take out point and above the dam/fish ladder. The Project also meets the VRM objectives when viewed from this KOP:

1. VRM II: Uplands are retained. The shoreline is cliff and talus slopes.
2. VRM III: The pool will be raised 6 feet and the shoreline will be flooded near the dam. The water will cover existing basalt cliffs and talus slopes. The remaining cliffs and talus will be visually identical for several hundred feet upward.
3. VRM III: The existing character of the landscape will be retained. The lower 6 ft. of the cliff and talus slopes will be inundated, but the landscape above is the same and will remain intact. After flooding, the upland/riparian fringe will reestablish naturally in a short time period (3-7 years).

Additional indirect or short-term effects include visual impacts from construction. For approximately two years, there will be construction equipment and materials in the immediate area of the diversion.

6.8.2.2 No Action Alternative

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any effects of the OSHP on recreation, land use, and aesthetic resources would continue, as would existing environmental measures.

6.8.3 Proposed Mitigation Measures

Land Use. To ensure that the higher pool will not invade or unreasonably diminish the scenic, recreational, and fish and wildlife values present when the river was designated a component of the Wild and Scenic Rivers System, the proposed facilities include an ability to control pool elevation, such that it will not exceed 2,010.21 feet NGVD 29 (2012 feet LPD). The weirs that span the crest of the diversion will be capable of being lowered as flows increase in the Crooked River; CH2M Hill (2010) estimated that the weirs, when lowered to 2,003.41 NGVD 29, will pass the IDF of 8,000 cfs without exceeding 2,010.21 feet. When fully deflated, it is anticipated that the facility will pass 12,700 cfs.

Recreation and Aesthetics: In order to address potential visual impacts of raising an existing control tower on the dam, the licensee proposes to utilize a dark brown color paint or other natural materials to blend in with the environment. Prior to selecting a color for mitigation, the BLM will conduct a site-specific color matching on site using BLM Standard Environmental Colors to select appropriate colors for facilities. This includes potential mitigation for roof material.

6.9 Cultural Resources

6.9.1 Affected Environment

The Lower Crooked River, in general, has been a significant contributor to the lifestyles and cultural history of the early inhabitants. Early settlers used the area for travel, lodging, and fishing. Native Americans inhabited the region for at least 13,000 years before Europeans arrived and used the area for hunting and gathering. The OSHP impoundment and Prineville Reservoir are within the ceded lands of the CTWS (BLM 2004).

The Warm Springs Reservation, created by the Treaty of 1855, covers an area of approximately 641,000 acres. The Tribes ceded 10 million acres of lands to the Oregon Territory, reserving the Reservation for their exclusive use and retaining their rights to harvest fish, game, and other foods from their usual and accustomed places. Although lands of the Warm Springs Tribal Reservation extend over approximately 7% of the Deschutes Subbasin, the OSHP is located within the Warm Springs Tribes ceded area and does not encroach on any Reservation lands or known lands of ceremonial or religious significance (BLM 2007; PNHO n.d.; BLM 2004).

On August 10, 2009, BLM conducted a cultural resources survey of the OSHP area (Griffin 2009). The area of potential effects (APE) was determined to be a 0.7-mile reach of the Crooked River beginning at Opal Springs Dam and ending upstream at the NAD83 Universal Transverse Mercator (UTM) coordinates 635250E, 4926099N (Figure 6-5). Talus slopes range from approximately 35 to 45 degrees and are concentrated at the southern half of the APE. Sheer rock faces dominate the northern half of the OSHP area. The survey results indicate that there are no cultural resources sites or isolates in the OSHP area, and as a result, Griffin (2009) made no eligibility or protection recommendations.

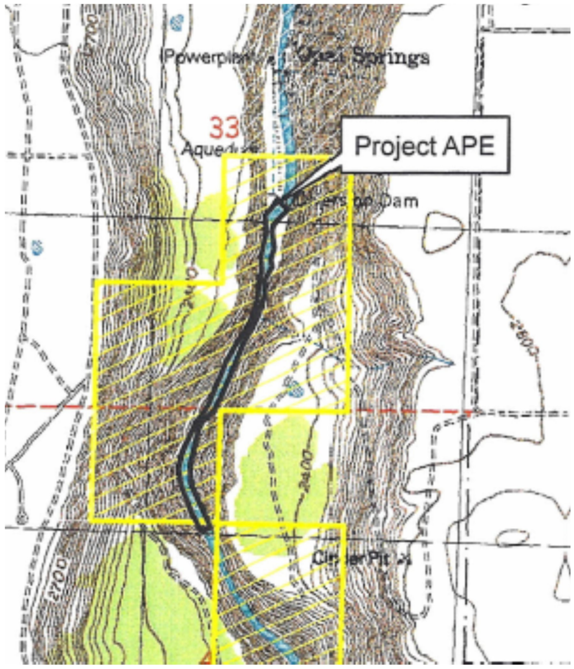


FIGURE 6-6 PROJECT APE AS DETERMINED BY THE BLM
Yellow hatching indicates BLM land (Griffin 2009).

6.9.2 ENVIRONMENTAL EFFECTS

6.9.2.1 PROPOSED ACTION

Direct and Indirect Effects. The SHPO concurred with BLM's determination (Griffin 2009) that no historic properties will be affected by raising pool, or any other elements of the Proposed Action (Exhibit E).

Cumulative Effects. Cumulative effects for cultural resources were assessed at the watershed scale. Because no other projects have been identified within the watershed, no cumulative effects will occur as a result of the Proposed Action.

6.9.2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any effects of the OSHP on cultural resources would continue, as would existing environmental measures.

6.9.3 Proposed Mitigation Measures

No mitigation measures are proposed for this resource.

6.10 Socioeconomic Resources

6.10.1 Affected Environment

The following is a summary of CRWC's (2008) characterization of socioeconomic conditions in the Crooked River vicinity.

Primary industries in the vicinity include livestock, secondary wood products, agriculture, and recreation and tourism. The recreation and tourism sector of the economy is growing. The Crooked River, Smith Rocks State Park, Crooked River National Grasslands, and Ochoco National Forest provide a variety of activities that bring people to the area. Although the primary wood products industry was the major employer for most of the twentieth century, reductions in locally harvested timber have shifted the industry to secondary manufacturing. Crop production includes hay, mint, potatoes, wheat, and alfalfa.

Data from the United States Census Bureau (2010) indicate that Jefferson County is economically distressed relative to the rest of the state and the country (Table 6-7). As of 2015, unemployment in Jefferson County was 14.4%. This compares to 9.3% statewide and 8.3% nationally ((U.S. Census Bureau 2015).

Table 6-7 Comparative Economic Statistics for Jefferson County as Compared to the United States and the State of Oregon

	United States	Oregon	Jefferson County
Persons in Poverty (percent)	15.5%	16.5%	20.5%
Persons without Health Insurance	13%	12.3%	17.6%
Median household income (2013 Dollars)	$53,889	$51,243	$46,366
Per capita income	$28,930	$27,684	$21,341

	United States	Oregon	Jefferson County
Persons in Poverty (percent)	14.5%	16.7%	21.8%
Persons without Health Insurance	15.3%	17.2%	24.3%
Median household income (2013 Dollars)	$53,046	$50,229	$43,373
Per capita income	$28,155	$26,809	$32,678

6.10.2 Environmental Effects.

6.10.2.1 Proposed Action

Direct and Indirect Effects. Investments in watershed restoration have substantial economic effects, generating both equipment-intensive and labor-intensive work opportunities that, in turn, create jobs and stimulate economic activity in several ways (Nielsen-Pincus and Moseley 2009). First, direct jobs are created by hiring equipment and labor contractors to implement restoration projects. Second, jobs are created indirectly through the sourcing of materials and services needed to implement the project (e.g., equipment rentals, materials vendors, fuel purchases). Last, employees and contractors spend wages on goods and services to support their livelihoods, which creates additional economic activity and supports additional jobs (called induced jobs).

Restoration efforts in the Upper Deschutes Basin (upstream of the Pelton Round Butte Dams) are large-scale collaborations among non-profit groups, private individuals, state, federal, and local governments, and the Confederated Tribes of Warms Springs Reservation of Oregon (CRWC 2008). The jobs that are supported from the Opal Springs Fish Passage Project will influence the local economy by increasing demand for design and planning services, construction services, and goods needed to fabricate and construct the passage structure and weir.

Max Nielsen-Pincus (personal communication, 2009) estimated that design and construction of the passage structure and supporting infrastructure will create an estimated 43 direct jobs ranging from principal engineers to equipment operators and laborers. It is unclear how many of these jobs will be supported locally through various phases of the project, but Neilson-Pincus stated that employment multipliers could enhance the effect in the Jefferson County area (Nielsen-Pincus and Moseley 2009).

DVWD plans to use existing staff to help maintain the fish ladder and monitor fish use of the OSHP area and facilities once they are constructed.

***Cumulative Effects*.** Cumulative effects for socioeconomic resources were assessed at the watershed scale. Because no other projects have been identified within the watershed, no cumulative effects will occur as a result of the Proposed Action.

6.10.2.2 No Action Alternative

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any ongoing effects of the OSHP on socioeconomic resources would continue, as would existing environmental measures.

6.10.3 Proposed Mitigation Measures

No mitigation measures are proposed for this resource.

7.0 DEVELOPMENTAL ANALYSIS

7.1 POWER AND ECONOMIC BENEFITS OF THE PROPOSED ACTION

The dependable capacity of OSHP will increase because the applied head of the OSHP will increase as a result of raising the pool. This capacity increase will have little effect on the actual ability to displace future diesel generation; therefore, capacity considerations were discarded in the economic analysis. The present-day OSHP plant, with a nameplate capacity of 4.3 MVA, operates with a capacity factor of 85%. The increase in storage does not require a capacity increase to realize a gain in energy output.

The long-term benefit of the OSHP is that it provides additional hydropower resources for sale into the interconnected Pacific Power and Light (PP&L) transmission and distribution system. These increased sales will help offset annual costs of operating the fish passage facilities and implementing the monitoring and evaluation program.

DVWD plans on seeking certification from the Low Impact Hydropower Institute (LIHI), and this certification will make the OSHP eligible to sell its power as renewable resource, pursuant to PP&L's published avoided cost schedule of August 11, 2014.

The total cost to the DVWD, including all costs for license amendment, permitting, engineering, and construction, is forecasted to be $4,000,000 in 2017 dollars. The DVWD is seeking outside support to offset the balance of the construction costs (including construction management), thought to be about $10,700,000. The future incremental operating costs for operating the fish passage facilities, conducting monitoring and evaluation studies, and implementing agreed to adaptive management measures is estimated to be $30,000 annually. As DVWD intends to self-finance, annual payments are excluded from the analysis.

DVWD developed a generation inflow model to evaluate the effect of the raising the pool on the energy generation capabilities of the OSHP (CH2M Hill 2010). The model accounts for an assumed accrual reduction by 50% of the potential incremental generation as a result of the

BFAA. The model used a 30-year period-of-record based on available hydrology. Results of this model indicate that that hydro generation at the OSHP will increase as shown in Table 7-1.

TABLE 7-1 MODEL OUTPUT FOR ANNUAL ENERGY AT PROPOSED OPERATING ELEVATION 2007.21 (MINIMUM). BFAA IS REFLECTED AS AN ADJUSTMENT TO THE INCREMENTAL GENERATION.

Flows	Turbine Flow	EL 2004.21	EL 2007.21	
		Base Case (KWH)	Incremental KWH	w/ BFA
20-year minimum	856	24,941,590	1,688,572	844,286
20-year average	1,177	29,509,406	2,021,347	1,010,673
20-year maximum	1,700	34,880,782	2,435,859	1,217,929

7.2 COMPARISON OF ALTERNATIVES

OSHP was licensed as a Qualifying Faculty pursuant to the Public Utility Regulatory Policies Act (PURPA; 18 CFR § 292.203) and is compensated pursuant to an existing power sales agreement (PSA). In establishing the price for power, the PSA uses avoided cost rates. The term of the PSA will expire in 2021, and the new power sales rate has not been established. The principal economic distinction between the Proposed Action and the No Action Alternative is the potential power sales and costs associated with the capital project.

7.2.1 PROPOSED ACTION

According to the Proposed Action, the OSHP will generate an average of 1,010,673 kilowatt-hours (KWh) of power above its base generation of 29,509,406 KWh. Using the most recently available avoided cost rates raising the pool will generate additional revenue as shown in Table 7-2, through the balance of the license term. The OSHP's PSA provides for an additional capacity payment as a result of a "Demonstrated Capacity" calculation. This is the actual demonstrated ability of the facility to generate and deliver electric power to meet the buyer's capacity requirements.

TABLE 7-2 ASSUMED PRICE OF POWER THROUGH LICENSE TERM

Capacity Payment of $36,000 represents premium paid for demonstrated capacity. Price of Power may increase if the output can be classified as "renewable" under Oregon's Integrated Resources Portfolio.

YEAR	PRICE OF POWER	INCREMENTAL O&M	INCREMENTAL CAPACITY PAYMENT	NET REVENUE (INCREMENTAL)
2018	0.043	$ 30,000	$ 16,000	$51,500
2019	0.046	$ 30,000	$ 16,000	$89,526
2020	0.048	$ 30,000	$ 16,000	$36,213
2021	0.049	$ 30,000	$ 16,000	$36,820
2022	0.056	$ 30,000	$ 16,000	$37,444
2023	0.048	$ 30,000	$ 16,000	$63,603
2024	0.070	$ 30,000	$ 16,000	$64,487
2025	0.071	$ 30,000	$ 16,000	$65,397
2026	0.073	$ 30,000	$ 16,000	$66,332
2027	0.075	$ 30,000	$ 16,000	$67,292
2028	0.077	$ 30,000	$ 16,000	$68,277
2029	0.080	$ 30,000	$ 16,000	$69,288
2030	0.083	$ 30,000	$ 16,000	$70,349
2031	0.084	$ 30,000	$ 16,000	$71,461
2032	0.086	$ 30,000	$ 16,000	$71,461
			Total	**$929,450**

Over the term of the new license, raising the pool raise does not pay for the cost of the new facilities. However, it is expected that the benefits of the Proposed Action will carry over into any new license term, and the cost of doing nothing would generate additional regulatory, legal, and operational costs for DVWD without the ability to offset these costs with new revenue. Moreover, the public interest considerations of providing fish passage to these introduced species are considerable.

7.2.2 NO ACTION ALTERNATIVE

A status quo approach would not provide additional head to increase generation, and this course of action would not provide operational flexibility to firm the output from future, planned renewable sources in the region, and would not provide operational flexibility to address potential needs for mitigation related to fish passage. The No Action Alternative would increase the future carbon footprint of the Pacific Northwest, compared to the Proposed

Action. Additional costs at the OSHP would be expected from continuing to mitigate for the lack of fish passage via trap-and-haul or other efforts sought by the regional Fish Managers.

However, the capital cost of the Propose Action would be avoided and the OSHP would continue to generate revenue through the current license term at the avoided cost rate of a PURPA Qualifying Facility.

7.3 Cost of Environmental Measures

Throughout consultation with stakeholders, no environmental measures have been requested and DVWD proposes none to mitigate for the Proposed Action, which is itself an environmental measure costing the DVWD approximately $4,000,000 in capital construction. As a result, the cost of environmental measures is not included in the economic analysis.

8.0 CONCLUSIONS AND RECOMMENDATIONS

"Developmental" benefits of a hydropower project include power generation, water supply, flood control, irrigation, and river navigation. "Non-developmental" values of a waterway include fish and wildlife resources, recreational opportunities, and other aspects of environmental quality.

Table 8-1 summarizes the relative effects on developmental and non-developmental resources of each alternative analyzed as described in this APEA (i.e., the Proposed Action and the No Action Alternative).

TABLE 8-1 DEVELOPMENTAL AND NON-DEVELOPMENTAL EFFECTS

	PROPOSED ACTION	NO ACTION
DEVELOPMENTAL		
Power generation	Annual increase of 1,010,673MWh in power generation.	No change in power generation
Water supply	N/A	N/A
Flood control	N/A	N/A
Irrigation	N/A	N/A
River navigation	N/A	N/A
Socioeconomic resources	Would ensure continued delivery of cost effective potable water to service area and provide for continued operation of bottling plants. Construction activity would provide direct and indirect economic benefit to the area.	N/A
NON-DEVELOPMENTAL		
Fish and aquatic resources	Would result in significant gains in access to upstream habitat for anadromous fish and migratory bull trout.	No change from existing conditions.
Recreation	Public use facilities would continue to be used as they are today.	No change from existing conditions.
Geology and soils	Would subject approximately 3.9 acres of soils to inundation, but with limited reservoir fluctuation. This would be similar to existing conditions.	No change from existing conditions.
Water resources	Would not affect stream flow or beneficial use of water, and would not cause any significant change in water quality.	No change from existing conditions.
Wildlife	No long-term adverse effects anticipated to threatened, endangered, and candidate species and sensitive species.	No change from existing conditions.

	PROPOSED ACTION	NO ACTION
Botanical and riparian resources	No change from existing conditions	No change from existing conditions.
Wetlands	Anticipated loss of approximately 0.018 acres of wetlands due to inundation on BLM property.	No change from existing conditions.
Cultural and tribal resources	No changes anticipated from existing conditions.	No change from existing conditions.

8.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require FERC to consider all uses of the waterway on which an action is proposed. When FERC reviews a hydropower project, the recreational, fish and wildlife, and other non-developmental values of the involved waterway are considered equally with its electric energy and other developmental values. In determining whether, and under what conditions, to approve the Proposed Action, FERC weighs the various economic and environmental tradeoffs involved in the decision.

This section contains the basis for, and a summary of, DVWD's recommendations to FERC for the approval of the Proposed Action. DVWD weighs the costs and benefits of the recommended alternative against other proposed measures.

Based on DVWD's review of and evaluation of the Proposed Action and the No Action Alternative, DVWD has selected the Proposed Action as the preferred and recommended alternative.

DVWD recommends this alternative because (1) authorization for increasing the maximum surface elevation of the operating pool to 2,007.21 feet will facilitate the engineering and construction associated with the fish ladder on the east bank and will result in additional power output and sales, (2) the increase in pool height coupled with the controllable weirs will provide for adaptive management capabilities to influence upstream and downstream passage, (3) the environmental and social benefits of connecting 108 miles of upstream habitat to the lower Deschutes Basin will maximize the investment that has been made in the basin to implement salmon and steelhead reintroduction, and (4) the Proposed Action will meet all relevant statutory and regulatory requirements. Overall, the public benefits of the Proposed Action exceed those of the No Action Alternative because DVWD has addressed issues through early and extensive consultation with stakeholders.

8.2 Unavoidable Adverse Effects

The Proposed Action would inundate 0.018 acre of wetland surrounding the OSHP impoundment as a result of raising the pool.

8.3 Summary of Section 10(j) Recommendations and 4(e) Conditions

Under the provisions of Section 10(j) of the FPA, each hydroelectric license issued by FERC shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project. Section 10(j) of the FPA states that, whenever FERC believes that any fish and wildlife agency's recommendation is inconsistent with the purpose and requirements of the FPA or other applicable law, FERC and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency. Provisions of Section 4(e) of the FPA require FERC to include mandatory conditions from federal land managers in a FERC license for hydropower projects located on federal lands.

The project was developed with the consensus of the agencies that have the statutory and regulatory responsibility to submit 10(j) recommendations and 4(e) conditions. No 10(j) recommendations have been proposed, but nothing precludes the agencies from filing 10(j) recommendations pursuant to FERC notice. DVWD anticipates that 4(e) BLM will provide conditions that pertain to management of federal land within the existing FERC boundary.

This section will be completed by FERC in its NEPA document following Public Notice of Agency Final Terms, Conditions, and Recommendations.

8.4 Consistency with Comprehensive Plans

Section 10(a) (2) of the FPA requires FERC to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, and conserving waterways affected by the project. Under Section 10(a) (2), federal and state agencies filed a total of 72 plans that address various resources in Oregon. Of these, DVWD identified and reviewed 14 plans potentially relevant to the proposed action at the OSHP:

1. Bureau of Land Management. 1990. Issues and alternatives for management of the lower Deschutes River. Department of the Interior, Prineville, Oregon. January 1990.
2. Bureau of Land Management. Bureau of Reclamation. 1992. Lower Crooked Wild and Scenic River (Chimney Rock segment) management plan. Department of the Interior, Prineville, Oregon. October 1992.
3. Bureau of Land Management. Forest Service. Oregon State Parks and Recreation Department. 1992. Middle Deschutes/Lower Crooked Wild and Scenic Rivers management plan. Department of the Interior, Prineville, Oregon. Department of Agriculture, Ochoco National Forest. December 1992.
4. Department of the Army, Corps of Engineers. Portland District. 1993. Water resources development in Oregon. Portland, Oregon.
5. Forest Service. 1989. Ochoco National Forest and Crooked River National Grassland Plan. Department of Agriculture, Bend, Oregon. October 1989.
6. Oregon Department of Environmental Quality. 1978. Statewide water quality management plan. Salem, Oregon. November 1978.
7. National Park Service. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. 1993.
8. Oregon Department of Fish and Wildlife. 1996. Crooked River Fish Management Plan. Prineville, Oregon. April 24, 1996.
9. Oregon Department of Fish and Wildlife. 1997. Oregon plan for salmon and watersheds. Salem, Oregon. December 1997.
10. Oregon State Parks and Recreation Department. Oregon Outdoor Recreation Plan (SCORP): 2003-2007. Salem, Oregon. January 2003.
11. Oregon State Parks and Recreation Division. n.d. The Oregon scenic waterways program. Salem, Oregon.
12. Oregon Water Resources Commission. 1987. State of Oregon water use programs. Salem, Oregon.
13. Oregon Water Resources Department. 1988. Oregon water laws. Salem, Oregon.
14. U.S. Fish and Wildlife Service. n.d. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C.

No inconsistencies were found in any approved plans listed above.

9.0 FINDING OF NO SIGNIFICANT IMPACT

This APEA was developed pursuant to NEPA requirements, which direct all federal agencies to consider and report the potential environmental effects of proposed federal actions. As outlined in the Initial Consultation Document this APEA examines the potential effects of the Proposed Action on the following areas: geology and soils; water resources; fish and aquatic resources; wildlife; threatened, endangered, and special status species; botanical and riparian resources; recreation, land use, and aesthetics; socioeconomic resources; and cultural resources.

After consulting with stakeholders, DVWD gathered additional information to determine the optimal configuration of the fish ladder and the potential effects of raising the pool, to identify wetland and visual resources, and to address specific questions relative to upstream and downstream fish passage success. The final results of these additional information gathering efforts are described herein and incorporated into this APEA and as technical appendices.

In developing and conducting environmental studies and throughout Second Stage consultation, DVWD consulted with stakeholders, including state, local, and federal agencies; Tribal groups; local municipalities; and non-governmental entities. Communication included public and agency meetings, site visits, presentations, phone calls, e-mails, and online postings. The consultation record is provided in Exhibit C.

On the basis that the Proposed Action (a) involves proactive measures intended to benefit reintroduced salmon and steelhead and (b) will have no direct, indirect, or cumulative negative effects as documented in this APEA, the Proposed Action will not affect the human or natural environment significantly. DVWD believes, therefore, that FERC can find that issuing an amended license for the OSHP will not constitute a major federal action significantly affecting the human or natural environment.

10.0 LITERATURE CITED

Beauchamp, D. A. and M. F. Shepard. 2008. Evaluation of factors affecting kokanee production in Lake Billy Chinook Final Report to the Pelton Round Butte Committee.

Bureau of Land Management (BLM). 2004. Deschutes Subbasin Plan. [Online] URL: http://www.nwcouncil.org/fw/subbasinplanning/deschutes/plan/ Accessed October 15, 2011.

Bureau of Land Management (BLM). 2007. Draft Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management Districts. [Online] URL: http://www.blm.gov/or/plans/wopr/deis/ Accessed October 15, 2011.

Bureau of Reclamation (BOR). June 2003. Prineville Reservoir Management Plan and Master Plan: Final Environmental Assessment. Prepared by U.S. Department of Interior, Bureau of Reclamation (Pacific Northwest Region.) [Online] URL: http://www.usbr.gov/pn/programs/rmp/prineville/rmp-prineville2003.pdf Accessed September 18, 2015.

CH2MHill. 2003. Literature based characterization of resident fish entrainment and turbine-induced mortality, Klamath Hydroelectric Project, (FERC No. 2082), Draft Technical Memorandum.

CH2MHill. 2010. Diversion Structure Elevation 2012 Pool Raise Feasibility Report; Opal Springs Hydroelectric Project. Prepared for the Deschutes Valley Water District.

Concannon, G. 1998. 1988-1998 Wildlife studies summary report, Pelton Round Butte Hydroelectric Project, FERC No. 2030. Prepared for Portland General Electric Company.

CRWC. 2002. Crooked River watershed assessment. Edited by Max Nielsen-Pincus, Ph.D., Executive Director, Crooked River Watershed Council (CRWC).

CRWC. 2008. Lower Crooked River watershed assessment. Prepared by Tina Whitman, Crooked River Watershed Council.

Ecological Services, Inc. 2006. Review of Literature to Estimate Potential Turbine Mortality of Bull Trout and Steelhead/Rainbow Trout at the Opal Springs Hydroelectric Facility. Prepared for Jefferson Soil and Water Conservation Services.

Electric Power Research Institute (EPRI). 1987. Turbine-related fish mortality: review and evaluation of studies. Prepared by Eicher Associates, Inc., Portland, OR. EPRI AP-5480.

FERC (Federal Energy Regulatory Commission). 2008. Preparing environmental documents, guidelines for applicants, contractors, and staff. Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing. September 2008.

Griffin, R. M. 2009. Oregon cultural resources survey report, Opal Springs Hydroelectric fish passage improvements. BLM Report No.: 05050600486P.

Hardin-Davis, Inc. 2006. Crooked River gorge riparian vegetation survey. Consultant report to the U.S. Bureau of Land Management, Prineville District, Prineville, Oregon. Hardin-Davis, Inc., Albany, Oregon.

Huntington, C. 2009. Environmental “Fatal Flaws” Analysis for an Opal Springs Pool-Raise of about 4 Feet. Prepared for the Opal Springs Fish Passage Settlement Working Group.

Huntington, C. 2015. Memorandum Regarding Smolt Mortality at the Opal Springs Hydroelectric Project. Prepared for Gary Lytle, DVWD.

Lewis, S. D. 2005. Graph of historic smolt emigration for wild spring chinook and summer steelhead at the Pelton skimmer from 1959-1963, and sizes of summer steelhead smolts captured from the Deschutes River downstream of the confluence with Crooked River, 1960. Portland General Electric, Madras, Oregon.

Lewis, S. D. 2006. Graph of sizes of summer steelhead smolts captured from the Deschutes River downstream of the confluence with Crooked River, 1960. Portland General Electric, Madras, Oregon.

Montgomery, M. 1955. Deschutes River Investigations, Central Region. River Basin Investigations, Oregon State Game Commission.

Nehlsen, W. 1995. Historic Salmon Steelhead Runs of the Upper Deschutes River Basin and Their Environments. Prepared for Portland General Electric, Hydro Licensing Department. Portland, Oregon.

Nelson. 2008. Trout Creek 1998-2007 summer steelhead outmigrant trapping results. Oregon Department of Fish and Wildlife, Madras, OR. 25 p.

Newton, J. 1973. Deschutes River spring Chinook salmon (*Oncorhynchus tshawytscha*) Walbaum. A literature review. Oregon Wildlife Commission. Central Region Administrative Report No. 74-1. December.

Nielsen-Pincus, M, and C. Moseley. 2009. A Preliminary Estimate of Economic Impact and Job Creation from the Oregon Watershed Enhancement Board's Restoration Investments. Ecosystem Workforce Program Briefing Paper #13. University of Oregon.

NMFS 2012. Endangered and Threatened Species: Designation of a Nonessential Experimental Population for Middle Columbia River Steelhead above the Pelton Round Butte Hydroelectric Project in the Deschutes River Basin, OR. [Federal Register Vol. 78, No. 10, January 15, 2013].

NMFS. 1999. Endangered and Threatened Species: Threatened Status for Two ESUs of Steelhead in Washington and Oregon (Final Rule). [Federal Register Vol. 64, No. 57, March 25, 1999].

NMFS. 2009. Middle Columbia River Steelhead Distinct Population Segment: ESA Recover Plan. Prepared by National Marine Fisheries Service Northwest Region.

NMFS. 2011. Draft Environmental Assessment for Non-essential Experimental Population Designation for Middle Columbia River Steelhead Reintroduced above the Pelton Round Butte Hydroelectric Project. Prepared by National Marine Fisheries Service, Northwest Region. May 18, 2011. RIN Number: 0648-BB04.

Northwest Power and Conservation Council (NPCC). 2004. Deschutes Subbasin Plan. [Online] URL: http://www.nwcouncil.org/fw/subbasinplanning/deschutes/plan/ Accessed April 15, 2010.

ODEQ. 2010. Oregon Water Quality Index Report for Deschutes and Hood Basins. [Online] URL: http://www.deq.state.or.us/lab/wqm/wqindex/deshood3.htm. Accessed October, 2011.

ODEQ. 2011a. Water quality standards applicable to the lower Crooked River and (thus) Opal Springs Hydroelectric Project. Available at: http://www.deq.state.or.us/wq/standards/standards.htm.

ODEQ. 2011b. Oregon's integrated 2010 water quality assessment database. [Online] URL: http://www.deq.state.or.us/wq/assessment/rpt2010/results303d10.asp.

ODEQ. 2011c. Assorted water quality data for the lower Crooked River, Oregon, acquired from the web-accessible LASAR database at: http://deq12.deq.state.or.us/lasar2/.

ODFW and CTWS. 2008. Reintroduction and Conservation Plan for Anadromous Fish in the Upper Deschutes River Sub-basin, Oregon. Edition 1: Spring Chinook Salmon and Summer Steelhead.

ODFW. 1996. Crooked River Fish Management Plan. Prineville, Oregon. May 1996.

ODFW. 2009. Aquatic inventory data from a 1997 survey of the lower Crooked River, Oregon. Available at: http://oregonstate.edu/dept/ODFW/freshwater/inventory/nworgis.html.

OEDD 2015. Workforce and Economic Research Division, https://www.qualityinfo.org/ed. Accessed May 19, 2015.

OWEB. 2007. Oregon Watersheds. [Online] URL: http://www.oregonwatersheds.org/councils/oregon-watershed-councils Accessed September 18, 2015.

PGE and CTWSRO. 2004. Fish Passage Plan: Exhibit D to Settlement Agreement Concerning the Relicensing of the Pelton Round Butte Project No. 2030.

Portland General Electric Company. 2010. Crooked River Hydroelectric Project (FERC No 13527): Preliminary Application Document.

Ratliff, D. E., S. L. Thiesfeld, M. D. Riehle and D. V. Buchanan. 1996. Distribution, Life History, Abundance, Harvest, Habitat, and Limiting Factors of Bull Trout in the Metolius River and Lake Billy Chinook, Oregon, 1983-94. Oregon Department of Fish and Wildlife Information Report No. 96-7.

Ratliff, D. E., and E. Schulz. 1999. Fisheries program at the Pelton Round Butte Hydroelectric Project (Oregon) 1956-1995. Portland General Electric Company. Portland, Oregon

Sage West. 2014. Wetland Delineation Report to Oregon State Division of State Lands.

Sanders, G. 2015. A Progress Report of the CRWC Connecting Waters Program. Poster session presented at the Pelton Round Butte Fisheries Workshop, Madras, OR.

SHPO. 2009. Letter to Molly Brown, BLM, Prineville District Office re: Opal Springs hydro fish passage improvement project. State Historic Preservation Office (SHPO) Case No. 09-2332.

Silvernale, C.E., G.H. Simonson, and M.E. Harward. 1976. Soil and watershed characteristics in relation to turbidity of the Prineville Reservoir. Special Report 453, Agricultural Experiment Station, Oregon State University, Corvallis.

Torgerson, C.E., D.P. Hockman-Wert, D.S. Bateman, D.W. Leer, and R.E. Gresswell. 2007. Longitudinal patterns of fish assemblages, aquatic habitat, and water temperature in the lower Crooked River, Oregon. USGS, OF 2007-1125, 37 p.

U.S. Census Bureau. 2010. Guide to State and Local Census Geography, accessed online October 2011. [Online] URL: http://www.census.gov/geo/www/guidestloc/guide_main.html.

U.S. Department of Agriculture (USDA). 1966. Soil survey Prineville area, Oregon. Soil Conservation Service, in cooperation with Oregon Agricultural Experiment Station. Series 1955, No. 12.

U.S. Department of Interior (USDI). 1992. Lower Crooked Wild and Scenic River (Chimney Rock Segment) Management Plan. Prepared by U.S. Department of Interior, Bureau of Land Management (Prineville District), and Bureau of Reclamation (Pacific Northwest Region). Report No. BLM-OR-FT-93-02-1792.44 pp. plus appendices. BLM and USFS (US Forest Service). 1992. Middle Deschutes/Lower Crooked Wild and Scenic Rivers' management plan. BLM-OR-PT-93-11-1792.

U.S. Fish and Wildlife Service (USFWS). 2002. Chapter 7, Deschutes Recovery Unit, Oregon. 62 p. In: U.S. Fish and Wildlife Service. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland. Oregon.

U.S. Forest Service (USFS). 1989. Land and resource management plan for the Ochoco National Forest/Crooked River National Grassland, Final Environmental Impact Statement. SDIBLM. 1992. Middle Deschutes/Lower Crooked Wild and Scenic Rivers' Management Plan. BLM-OR-PT-11-1792. Prineville District Office: Prineville, Oregon.

USFWS. 2010. Bull Trout Final Critical Habitat Justification: Justification: Rationale for Why Habitat is Essential, and Documentation of Occupancy. U.S. Fish & Wildlife Service Idaho Fish and Wildlife Office, Boise, Idaho. Pacific Region, Portland, Oregon

USFWS. 2015. US Fish & Wildlife Service, Information for Planning and Conservation (IPAC) Accessed on September 18, 2015.

USFWS. 2015. Official Species List, generated from Information for Planning and Conservation (IPaC) website [http://ecos.fws.gov/ipac/], Accessed May 21, 2015.

EXHIBIT A

BIOLOGICAL ASSESSMENT

In preparation and under review by USFWS and NMFS

[This page intentionally left blank]

EXHIBIT B

CONSULTATION RECORD

[This page intentionally left blank]

EXHIBIT C

SUPPLEMENTAL INFORMATION

[This page intentionally left blank]

APPENDIX A:
PROPOSED LICENSE ARTICLES
OPAL SPRINGS HYDROELECTRIC PROJECT (FERC NO. 5891)

Article 1: Opal Springs Fish Passage and Protection Plan

The Licensee shall implement the Opal Springs Fish Passage and Protection Plan (Attached).

Article 2: Fish Passage Facilities

The Licensee shall provide safe, timely, and effective fish passage at the Opal Springs Hydroelectric Project (Project) through implementation of the Amended License.

The Licensee shall design, construct, operate, maintain and monitor a volitional upstream fish ladder located at the Project dam structure to provide salmon and steelhead access to historic spawning and rearing habitats in the Crooked River basin and to provide native fish with foraging and migratory opportunities above the project. The fish ladder shall adhere to the National Marine Fisheries Service (NMFS) 2008 Anadromous Salmonid Passage Facility Design Manual.

The Licensee shall also design, construct, operate, maintain and monitor facilities at the Project to increase the normal maximum diversion pool elevation up to 2,07.31 feet National Geodetic Datum 1929. The increased diversion pool elevation will make water available for bypassing juvenile fish around the turbine penstock and for attracting adult fish up through the bypass reach to the fish ladder entrance.

The Licensee shall develop final design plans and specifications for the installation, operation, maintenance, and monitoring of the fish passage facilities in consultation with and for review by the Fish Passage Work Group (FPWG). Specifically, the detailed fish ladder design phases (50 percent and 90 percent completion stages) will be completed in consultation with the FPWG. Final design plans and specifications shall include: (1) final construction drawings; (2) construction schedule; and (3) a preliminary operation and maintenance (O&M) plan that includes daily, above water visual inspections of all areas within the fish ladder that are accessible to fish and annual dewatered fish ladder inspections. The Licensee shall file the final O&M Plan with the Commission within 120 days after construction is completed, following review and approval of the FPWG. The Licensee shall, within 60 days after issuance of the Amended License, provide the final design plans and specifications to the appropriate Fish Agencies for their approval pursuant to their statutory authority.

The Licensee shall, within 120 days after issuance of the Amended License, file the final design plans and specifications with the Commission for approval. When filing final plans and specifications with the Commission, the Licensee shall include documentation of consultation with the FPWG, copies of comments and recommendations, and specific descriptions of how comments and recommendations from FPWG members have been accommodated. If the Licensee does not adopt an FPWG recommendation, the filing shall include its reasons based on project specific information. If the Licensee files final plans and specifications without first obtaining approvals by the appropriate Fish Agencies pursuant to their statutory authorities, the Licensee shall include specific reasons for doing so.

The Commission reserves the right to require changes to the final fish facility design plans and specifications. Any such changes required by the Commission may also require additional approvals by the appropriate Fish Agencies pursuant to their statutory authorities.

The Licensee shall complete construction of the fish passage facilities within two years of Commission approval.

Article 3: **Fish Passage Work Group**

The Licensee shall, within 30 days after issuance of the Amended License, establish and convene a Fish Passage Work Group (FPWG) for the purpose of consulting on all aspects of the Settlement Agreement, associated license articles and the Fish Passage and Protection Plan. The Licensee shall convene the FPWG annually, or more frequently if a majority of the FPWG so desire, by no later than February 1 to review the Bypass Flow Accrual Account Allocation Plan and proposed actions for the coming year. The Licensee shall bear all costs associated with conducting FPWG meetings.

The Licensee shall arrange, administer, and chair all meetings. Upon request of a majority of the FPWG members, the Licensee shall provide a meeting facilitator. The facilitator shall be selected by consensus of the FPWG. The Licensee shall provide no fewer than 14 days prior notice of any meeting, unless otherwise agreed to by the FPWG or required to meet a license deadline or other emergency circumstance.

The Licensee shall, within 30 days of each meeting, provide draft meeting minutes for concurrence by the FPWG prior to final distribution. Meeting minutes will include FPWG action items, a summary of issues discussed, decisions reached, and member concerns.

For fish passage related purposes, consultation or consult means that the Licensee shall obtain the views of, and attempt to reach consensus among members of the FPWG. Consultation does not mean consultation under section 7 of the Endangered Species Act or other federal laws requiring consultation unless specifically provided.

Article 4: Bypass Flow Accrual Account

Upon completion of the fish passage facilities, the Licensee shall establish a Bypass Flow Accrual Account (BFAA). The BFAA will identify "water credits" (in acre-feet) which will be used to identify water available for aiding upstream and downstream fish passage. Water credits will be accrued in lieu of actual stored water, given that the Project has no storage capacity, and turbine discharge will be reduced when exchanging water credits for actual bypass flows. The Licensee shall administer the BFAA for the term of the amended license as follows:

1. <u>Accumulating Credits</u>

The Licensee shall accrue water credits in the BFAA beginning concurrently with the start of Project operations under the new diversion pool elevation and shall continue to accrue water credits in the BFAA for the License Term. Water credits will accrue as a percentage of instantaneous turbine flow (initially 1.53% and hereinafter referred to as the "Accrual Rate") under all flow conditions up to the maximum controlled hydraulic capacity of the Project. The maximum controlled hydraulic capacity of the Project is initially 1,913 cfs [the sum of hydraulic capacity at new head (estimated at 1,600 cfs), the license required bypass flow (50 cfs), and spring water and ground water accreting into the bypass reach (263 cfs)]. Water credits will not accrue at total river discharge greater than the maximum controlled hydraulic capacity of the Project.

The Licensee shall, within one year of commencing operations at the new diversion pool elevation, verify all estimates used for determining the maximum controlled hydraulic capacity of the Project. The Licensee shall provide this information to the FPWG at least 45 days prior to filing any proposed modifications with the Commission. The Licensee shall not file with the Commission any proposed modifications of the information used to calculate water credits until any disputes raised by the FPWG have been addressed under the dispute resolution provisions of the Settlement Agreement. Upon Commission approval of any modifications to the information used for calculating water credits, the Licensee shall calculate all subsequent BFAA credits pursuant to the new information.

The Licensee shall periodically reassess spring water and ground water accretion estimates throughout the license term as requested by the FPWG. Any future changes recommended by the Licensee pursuant to periodic review of these parameters, will be further approved by the FPWG prior to the Licensee submitting the new information to the Commission. Upon Commission approval, the Licensee shall calculate all subsequent BFAA credits pursuant to the new information.

The Licensee shall calculate all BFAA credits based on: 1) direct measurements of the hourly turbine discharge data and 2) the gage data from USGS Gage No. 14087400, near Culver, Oregon, below Opal Springs.

The Licensee shall accrue water credits in the BFAA at a rate of between 50% and 70% ("Allocation Percent") of the increase in power generation attributable to the head increase at the Project. Adjustments to the Allocation Percent will only occur following each successive 5-year Performance Assessment Interval, and only if necessary, pursuant to the Adaptive Management program. The potential for asynchronous monitoring periods notwithstanding, the BFAA Allocation Percent will not be increased more than one time every five years. Allocation Percent increases above 70% may only occur with the approval of the Licensee.

The Licensee shall, until the turbine performance calculation is modified, accrue water credits at a rate of 2.89% of instantaneous turbine flow [(50% Allocation Percent) X (6.52% increase in power generation) = 2.89% Accrual Rate]. The Licensee shall convert real-time accruals into acre-feet for purposes of developing a BFAA Annual Allocation Plan. The Licensee shall develop the BFAA Annual Allocation Plan in consultation with and for approval by the FPWG. The BFAA Annual Allocation Plan will include a current accounting of BFAA water credits (less any water credits advanced the prior year for emergency purposes); a flow forecast for the upcoming year; and an estimate of the water credits that will be accrued over the coming year. The Licensee shall include the BFAA Annual Allocation Plan in its Annual Reports.

The Licensee shall maintain a record of withdrawal requests and actual discharged bypass flows, and shall provide a monthly status of available BFAA water credits to the FPWG within two business days of a request by Oregon Department of Fish and Wildlife and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWS) ("Fish Managers") (provided that the CTWS is a signatory to the Settlement Agreement). Water credits not used within a given year will be carried over from year to year until expended, but will not extend beyond the term of the Amended License. The Licensee shall include this information in its Annual Reports.

2. Bypass Flow Releases

The Licensee shall provide bypass flows from the BFAA within two business days of receiving a request from the liaison designated by the Fish Managers within the limitations of the approved BFAA Annual Water Plan. The Licensee shall make 10% of the forecasted annual accrual in the BFAA available for emergency use if insufficient water credits are available in the BFAA. Otherwise, only water credits accrued in the BFAA will be available for release. Any water credits advanced to the BFAA by the Licensee will be offset by a debit to the BFAA as soon as possible but by no later than one year from disbursement, unless otherwise agreed to by the Licensee.

The Licensee shall be exempted from providing BFAA flows that would result in a Critical Circumstance, which is potential damage or excess wear and tear to project equipment. The Licensee shall, within one year of initial operations at the new diversion pool elevation and periodically during the term of the amended license, in consultation with the FPWG and supported by engineering concerns, determine specific turbine unit loading that would result in a

Critical Circumstance. If the Licensee determines that a request for flow releases will cause a Critical Circumstance, the Fish Managers may request a lower BFAA flow release that will not cause a Critical Circumstance, or the Fish Managers may request and the Licensee shall shut down the powerhouse and direct all river flows into the bypass reach as long as sufficient water credits are available in the BFAA. The Licensee shall not be required to shut down the powerhouse in response to a BFAA flow request more than one time per week.

If the Project shuts down for other operational, safety, or maintenance reasons resulting in spill, water credits will not be removed from the BFAA.

Article 5: Upstream Fish Passage Monitoring, Data Collection, Fish Passage Performance, and Reporting

The Licensee shall use accepted scientific practices as approved by NMFS, USFWS, BIA, and ODFW for all data collection and monitoring, and shall ensure that data collection standards are being met. The Licensee shall provide raw monitoring data to the FPWG within two business days of a Fish Manager request. The Licensee shall include all data in its Annual Reports.

1. Fish Ladder Monitoring

The Licensee shall, upon completion of the fish passage facilities, continuously monitor the passage of adult fish >12” in length through the fish ladder for the term of the Amended License (Table 1). The Licensee shall identify and enumerate fish migrating through the fish ladder using video, electronic counter and/or adult trapping as determined by the FPWG, to identify species, passage date, and passage time. The Licensee shall provide this information to the FPWG within two business days of a Fish Manager request and shall include all fish passage information (for example, number by species, passage date, and passage time) in its Annual Reports.

2. Fish Migration Delay

The Licensee shall, for the initial five years after the release of adult steelhead or Chinook salmon upstream of the Pelton Round Butte Project, unless otherwise agreed to by the FPWG, implement observational techniques (in addition to radio-telemetry monitoring, as specified in this article) to identify any potential adult fish migration delays in the Project tailrace and bypass reach. The Licensee shall make direct observations on foot, by snorkel and/or through hydroacoustic spot-checks of the Project tailrace and bypass reach at least every two to three days, as determined by the FPWG, during the steelhead and Chinook salmon upstream passage seasons and shall provide this information to the FPWG within two business days of a Fish Manager request. The Licensee shall include all information from these observations in its Annual Reports. The Licensee shall report any indications of fish delay to the FPWG within 24 hours of the observation.

3. Fish Passage Performance

The Licensee shall, for the duration of the three 5-year Performance Assessment Intervals identified in the Adaptive Management program, or until any 5-year Performance Assessment Interval demonstrates that the 97% upstream fish passage Performance Goals have been met for adult steelhead and Chinook salmon, monitor adult steelhead and Chinook salmon passing through the lower Crooked River, Project tailrace, bypass reach, fish ladder, and diversion pool (either as upstream migrants or fish that fall back after passing upstream using the ladder). The Licensee shall calculate the percent passage success for adult steelhead and Chinook salmon as the number of fish that passed upstream through the fish ladder and diversion pool, minus any fish killed during fallback, divided by the number that entered the Project tailrace (after subtracting fish known to have exited the Crooked River or to have spawned successfully below the Project).

The Licensee shall monitor upstream fish passage performance during the initial 5-year Performance Assessment Interval using radio-telemetry. For radio-telemetry, the Licensee shall monitor at least 25 radio-tagged adult salmon (adult steelhead, adult Chinook salmon, or a combination of adult steelhead and Chinook salmon), annually. Should the FPWG make a determination that fewer than 25 radio-tagged adult steelhead and Chinook salmon are expected to enter the Crooked River from downstream radio-tagging studies during any annual monitoring period, the Licensee shall radio tag a sufficient number of adult steelhead and Chinook salmon, if available from a trap located within the Project fish ladder, to make up the anticipated short fall.

The Licensee shall release the radio-tagged fish downstream of the Project tailrace within the Crooked River. The Licensee shall monitor these radio-tagged adult steelhead and Chinook salmon, and any additional adult steelhead and Chinook salmon that are radio-tagged downstream of the Project by other parties, through an array of fixed-station antennae installed, operated, and maintained by the Licensee to record fish movements through the Project tailrace, bypass reach, fish ladder and diversion pool.

The Licensee shall assess the fish passage Performance Objectives during the second and third 5-year Performance Assessment Intervals using external tags and a mark and recapture protocol, or, by agreement of the FPWG, through some other appropriate method.

Once the Licensee has demonstrated, through the results of any of the 5-year Performance Assessment Intervals, that the 97% upstream fish passage Performance Goals for adult steelhead and Chinook salmon have been met, upstream fish passage performance assessment monitoring shall be limited to a one year fish passage performance monitoring assessment every five years to determine if the goals are continuing to be met. If the upstream fish passage Performance Goals for adult steelhead and Chinook salmon fall below the required fish passage Performance Goals, as determined by a one year fish passage performance monitoring assessment, the

Licensee shall resume annual monitoring assessments and Adaptive Management as described in this Amended License.

The Licensee is solely responsible for implementing the upstream fish passage performance monitoring requirements. Costs incurred by the Licensee above an annual amount of $50,000 solely for implementation of the monitoring required in section 3 of this license article to assess the fish passage performance standards may be off-set by a reduction in the BFAA annual Allocation Percent under the following conditions: 1) available monitoring information must demonstrate that the 90% upstream and downstream fish passage Performance Standards for steelhead and Chinook salmon are being met, and will continue to be met under the proposed BFAA reduction; 2) reductions in the BFAA annual Allocation Percent may be up to, and shall not exceed 5% in any one year; and 3) the Licensee shall provide the FPWG an accounting of the capital, expense, and labor costs incurred on an annual basis for upstream fish passage monitoring, and a determination of the value of the BFAA Allocation Percent reduction in then current dollars, to account for any reduction of the annual BFAA Allocation Percent.

At a minimum, the Licensee shall provide an assessment of the following adult steelhead and Chinook salmon metrics in the applicable Annual Reports: 1) total Project passage; 2) percent passage success, number of fallback fish, and cumulative passage timing of steelhead and Chinook salmon; and, 3) travel time through the bypass reach, fish accumulation (if any) within the bypass reach, variation in rates of ladder passage, and the time elapsed from first entering the Project tailrace until exiting the diversion pool.

For bull trout, the Licensee shall provide in its Annual Reports, an assessment of the number, size, and passage timing (diel and seasonal) of bull trout passing through the fish ladder.

Following each 5-year Performance Assessment Interval the Licensee shall, in that year's Annual Report, provide a 5-year assessment of its status in meeting the fish passage Performance Objectives.

Table 1: Upstream Monitoring Schedule

Monitoring Term	Monitoring Start Time	
	Upon Completion of Fish Passage Facilities	Upon Release of Adult Fish at Pelton Round Butte
Duration of Amended License	Continuous monitoring of fish >12" in length migrating through the fish ladder to identify species, passage date, and passage time.	
Five Years		Implement observational techniques to identify any potential adult fish migration delays in the Project tailrace and bypass reach every other day during the steelhead and Chinook salmon upstream passage seasons.
Duration of Adaptive Management Program		Monitor steelhead and Chinook salmon passing through the lower Crooked River, Project tailrace, bypass reach, fish ladder, and diversion pool, through radio-telemetry or other methods as necessary to assess fish passage Performance Objectives.

Article 6: Downstream Fish Passage Monitoring, Fish Passage Performance, Data Collection, and Reporting

The Licensee shall use accepted scientific practices as approved by NMFS, USFWS, BIA, and ODFW for all data collection and monitoring and shall ensure that data collection standards are being met. The Licensee shall provide raw monitoring data to the FPWG within two business days of a Fish Manager request. The Licensee shall include all data in its Annual Reports.

1. <u>Diurnal, Seasonal, and Inter-Annual Variation</u>

The Licensee shall, for the initial seven years following fish facility construction, or as otherwise agreed to by the FPWG, monitor by acoustic detection, or other appropriate method as agreed to by the FPWG, diurnal, seasonal and inter-annual variation in the relative abundance and timing of juvenile salmonids (particularly smolts) emigrating downstream through Project facilities.

This information is intended to provide the FPWG sufficient information to manage the BFAA for downstream fish passage and to establish migration trends over time. The Licensee shall include annual assessments of juvenile fish relative abundance and emigration timing in its Annual Reports, and shall provide this information to the FPWG within two business days of a Fish Manager request.

2. Fish Passage Performance

The Licensee shall, for the duration of the three 5-year Performance Assessment Intervals required by the Adaptive Management program, monitor at least 25 radio-tagged steelhead smolts annually. The Licensee's monitoring program may utilize radio-tagged juvenile steelhead that are radio-tagged upstream by other parties. Should the FPWG make a determination that less than 25 radio-tagged steelhead smolts will pass through the Project by May 1 of any given year, the Licensee shall tag a sufficient number of smolts to make up the shortfall. The Licensee shall monitor these juvenile steelhead as they enter the diversion pool, enter the turbine penstock or fish ladder, pass over each operable spillway gate, exit the bypass reach, exit the Project tailrace, and exit the lower Crooked River. The Licensee shall include this information in its Annual Reports.

The Licensee shall install, operate, and maintain fixed-station antennae positioned to record these fish movements. Antennae will be capable of differentiating between individual spillway gates, the turbine penstock, tailrace, and bypass reaches, and exit from the Crooked River into Lake Billy Chinook.

Following each 5-year Performance Assessment Interval the Licensee shall, in that year's Annual Report, provide a 5-year assessment of its status in meeting the fish passage Performance Objectives. The Licensee shall calculate percent survival estimates for downstream migrants from aggregated 5-year telemetry data as the number of radio-tagged fish that passed through the Project area to reach Lake Billy Chinook (minus any mortalities) divided by the number that originally entered the Project diversion pool, with possible adjustments to this algorithm dependent on agreement by the FPWG.

Table 2: Downstream Monitoring Schedule

Monitoring Term	Monitoring Requirements to Begin Upon Completion of Fish Passage Facilities
Seven Years	Monitor by acoustic detection, or other appropriate method, diurnal, seasonal and inter-annual variation in the relative abundance and timing of juvenile salmonids (particularly smolts) emigrating downstream through Project facilities.
Duration of Adaptive Management Program	Monitor at least 25 radio-tagged steelhead smolts annually.

Article 7: Fish Passage Performance Objectives

The Licensee shall strive to achieve the following fish passage Performance Objectives through the implementation of the Adaptive Management program. The License shall be considered in compliance with this license article so long as the fish passage Performance Objectives are met, or the Licensee is working towards meeting the fish passage Performance Objectives through implementation of the Adaptive Management program.

Upstream Fish Passage Performance Objectives:

Species	Standard	Goal
Steelhead and Chinook salmon adults	≥90% successful upstream passage of migratory adults, with ≥90% of those adults that do successfully pass the Project doing so by a specified date each year (date to be determined by FPWG through project evaluations). Fish that perish when falling-back after dam passage will be considered unsuccessful migrants.	≥97% successful upstream passage of migratory adults destined for areas above the Project. Fish that perish when falling-back after dam passage will be considered unsuccessful migrants.
Bull trout adults and sub-adults	≥90% successful upstream passage, with the standard assumed to be met if the standard for steelhead adults is met at the Project.	≥97% successful upstream passage, with the goal assumed to be met if the goal for steelhead adults is met at the Project.

Downstream Fish Passage Performance Objectives:

Species	Standard	Goal
Steelhead and Chinook salmon smolts	≥90% passage survival	≥97% passage survival
Bull trout adults and sub-adults	Assumed to be met if the ≥90% passage survival standard for steelhead smolts is met and levels of upstream passage by bull trout >12” at the Project do not exceed 1,000 fish on an annual basis.	Assumed to be met if the ≥97% passage survival goal for steelhead smolts is met.

Following each 5-year Performance Assessment Interval the Licensee shall, in that year's Annual Report, provide a 5-year assessment of its status in meeting the fish passage Performance Objectives.

Article 8: Adaptive Management

The Licensee shall implement this Adaptive Management program for the term of the Amended License to help it meet or exceed the fish passage Performance Objectives.

The Adaptive Management program includes: (1) increases to the BFAA at specified intervals if the fish passage Performance Objectives are not met; (2) two tiers of fish passage improvement measures (Tier 1 and Tier 2) that may be necessary to improve fish passage efficiency or to meet the fish passage Performance Objectives; (3) Monitoring, Data Collection, and Reporting as required in this amended license; and (4) modification of Project turbine intake trash racks if necessary to address adult steelhead turbine mortality.

The Licensee shall implement the Adaptive Management program in three 5-year Performance Assessment Intervals and shall provide an assessment of its status in meeting the fish passage Performance Objectives following each 5-year Performance Assessment Interval. The Licensee shall continue upstream and downstream fish passage monitoring for the duration of the three 5-year Performance Assessment Intervals regardless of whether it has met the fish passage Performance Objectives. If any of the fish passage Performance Goals have not been met by the end of the third 5-year Performance Assessment Interval, additional fish passage improvement measures and related monitoring activities will be determined by the FPWG, and implemented by the Licensee. The Licensee shall include annual monitoring information and 5-year assessments in its Annual Reports.

1. <u>Implementation</u>

The Licensee shall implement additional fish passage measures based on information collected during project monitoring and the status of achieving the fish passage Performance Objectives. Additional measures are organized into two tiers (Tier 1 and Tier 2 - see part 3 of this license article). The Licensee shall implement specific Tier 1 measures at any time as directed by the FPWG (or as required through Dispute Resolution as defined in the Settlement Agreement) in response to Obvious Fish Passage Problems (for example, indications that upstream or downstream fish migrants are not effectively bypassing the Project) or, in response to any 5-year performance assessment if needed to achieve the applicable fish passage Performance Objective.

If additional Tier 1 measures are directed by the FPWG in response to upstream or downstream Obvious Fish Passage Problems, the Licensee shall implement the measures within one year of FPWG approval, unless otherwise agreed to by the FPWG. With the exception of modifications to Project trash racks, implementation of Tier 1 measures will neither re-start nor increase the then current 5-year Performance Assessment Interval. However, any modifications to Project trash racks will automatically restart the then current 5-year Performance Assessment Interval.

If Tier 1 measures are required to meet an applicable fish passage Performance Objective following a complete 5-year Performance Assessment Interval, the Licensee shall implement the measures as soon as possible but in no case shall implementation take longer than one year unless otherwise agreed to by the FPWG. The next 5-year Performance Assessment Interval shall begin following implementation of the Tier 1 measures. The Licensee shall continue annual monitoring regardless of its status in implementing Tier 1 measures.

The Licensee shall implement Tier 2 measures following the third 5-year Performance Assessment Interval if the fish passage Performance Goals have not been met.

2. Required Actions

Following each 5-year Performance Assessment Interval the Licensee shall, in that year's Annual Report, provide a 5-year assessment of its status in meeting the fish passage Performance Objectives. The assessment will rely upon information collected annually from upstream and downstream fish passage monitoring.

2.1 1st 5-year Performance Assessment Interval: The Licensee shall, following the first 5-year Performance Assessment Interval, take actions in one of the following categories based on the point estimate of the aggregated annual data:

- 97 percent or greater passage effectiveness or survival. No additional Tier 1 measures and no increase to the BFAA Allocation Percent will occur at this time.

  The Licensee may, at its discretion, develop a study of BFAA effectiveness, for approval by the FPWG, to determine whether the BFAA has been over-allocated (less water is needed to meet fish passage Performance Goals or, for resident species, to ensure safe, timely, and effective passage). If it is determined by the FPWG that the BFAA is over-allocated, the Allocation Percent will be reduced consistent with the level of over allocation, upon agreement of the FPWG.

- 90 percent or greater, but less than 97 percent passage effectiveness or survival. The Licensee shall implement applicable Tier 1 measures, as required by the FPWG, in an effort to achieve the Fish Passage Performance Standards.

- Less than 90 percent passage effectiveness or survival. The Licensee shall implement applicable Tier 1 measures, as required by the FPWG, and shall increase the BFAA Allocation Percent to 60%.

- If more than 1,000 bull trout use the ladder annually, and measured performance of downstream steelhead smolt survival is less than 97%, the Licensees shall implement Tier 1 measures as required by the FPWG.

2.2 **2nd 5-year Performance Assessment Interval**: The Licensee shall, following the second 5-year Performance Assessment Interval, take actions in one of the following categories based on the point estimate of the aggregated annual data:

- 97 percent or greater passage effectiveness or survival. No additional Tier 1 measures and no increase to the BFAA Allocation Percent will occur at this time.

  The Licensee may, at its discretion, develop a study of BFAA effectiveness over a range of flow conditions, for approval by the FPWG, to determine whether the BFAA has been over-allocated (less water is needed to meet fish passage Performance Goals or, for resident species, to ensure safe, timely, and effective passage). If it is determined by the FPWG that the BFAA is over-allocated, the Allocation Percent will be reduced consistent with the level of over allocation, upon agreement of the FPWG.

- 90 percent or greater, but less than 97 percent passage effectiveness or survival. The Licensee shall implement all remaining and applicable Tier 1 measures, as required by the FPWG, in an effort to achieve the Fish Passage Performance Standards.

- Less than 90 percent passage effectiveness or survival. The Licensee shall implement all remaining and applicable Tier 1 measures, as required by the FPWG, and shall increase the fisheries BFAA Allocation Percent to 70%.

- If more than 1,000 bull trout use the ladder annually, and measured performance of downstream steelhead smolt survival is less than 97%, the Licensees shall implement Tier 1 measures as required by the FPWG.

2.3 **3rd 5-year Performance Assessment Interval**: The Licensee shall, following the third 5-year Performance Assessment Interval, take actions in one of the following categories based on the point estimate of the aggregated annual data:

- If all Fish Passage Performance Goals have been met: No additional Tier 1 measures and no increase to the BFAA Allocation Percent will occur at this time. The Licensee shall continue monitoring fish passage for the term of the Amended License and shall provide summaries of this monitoring information, and other salmonid data that may be available from other sources within the project area, annually.

  The Licensee may, at its discretion, develop a study of BFAA effectiveness over a range of flow conditions, for approval by the FPWG, to determine whether the BFAA has been over-allocated (less water is needed to meet Fish Passage Performance Goals or, for resident species, to ensure safe, timely and effective passage). If it is determined by the FPWG that the BFAA is over-allocated, the Allocation Percent will be reduced consistent with the level of over allocation, upon agreement of the FPWG.

- If one or more of the Fish Passage Performance Goals have not been met: The Licensee shall meet with the FPWG as soon as possible, but by no later than February 1 of the next year, to determine: (1) whether implementation of any remaining Tier 1 measures is likely to meet the applicable Goal; or (2) whether major improvements are required (a "Tier 2 Determination").

  - If the FPWG determines that additional Tier 1 measures are warranted, the Licensee shall implement the relevant measures as soon as possible and shall resume monitoring as described for upstream and downstream fish passage for a period of 3 years. Following this 3-year monitoring cycle, the Licensee shall meet again with the FPWG to determine whether the applicable Goals have been met, or whether additional major improvements are required.

  - If the FPWG determines that Tier 2 major improvements are required, the Licensee shall, in consultation with and subject to the approval of the FPWG, identify specific Tier 2 measures and a necessary monitoring and evaluation plan for implementation. The Licensee shall, within 90 days of this determination, propose an action plan and schedule for implementing the Tier 2 measures. After review and approval by the FPWG, the Licensee shall file the action plan with the Commission for its approval.

  - The Commission reserves the right to require changes to any Tier 2 measure. Any such changes required by the Commission may also require additional approvals by the appropriate Fish Agencies pursuant to their statutory authorities. The Licensee shall implement the Tier 2 measures and the monitoring and evaluation plan upon Commission approval.

- If more than 1,000 bull trout use the ladder annually, and measured performance of downstream steelhead smolt survival is less than 97%, the Licensees shall implement additional measures as required by the FPWG.

3. Tier 1 Measures

Upstream Passage Measures:

- Remove peninsula that currently separates the tailrace from the bypass channel in order to reduce unacceptable adult delay at the powerhouse.
- Construct structures in the bypass channel to concentrate flows and provide necessary cues to help adult migrants reach and find the fish ladder entrance.
- Move rocks and boulders in the bypass reach downstream of the fish ladder entrance to provide for adult passage in most flow conditions.
- Other enhancements to the bypass channel.
- Adjustments or minor ("fit and finish") modifications to the ladder to optimize performance.
- Install and operate behavioral deterrents to fish movement toward and into the Project intake.
- Modify spill gate operations.
- Other measures proposed by the FPWG, and approved by the Licensee.

Downstream Passage Measures:

- Install or modify flow guidance devices on the downstream face of the dam to concentrate flow or otherwise improve smolt survival.
- Other enhancements to the bypass channel.
- Install and operate behavioral deterrents, which could include experimental technologies, to guide fish away from the Project intake.
- Other physical modifications that may be suggested by the FPWG, and agreed to the Licensee, in lieu of additional BFAA water.
- Predation control in the impoundment; the need for which will be determined by periodic assessments as agreed to by the FPWG.
- Modify spill gate operations.
- Other measures proposed by the FPWG, and approved by the Licensee.

4. Trash Rack Modifications

If the adult steelhead or the downstream bull trout fish passage Performance Standard is not likely to be met due to high turbine mortality in any two of three years of a 5-year assessment interval, the Licensee shall modify its trash racks in an effort to reduce adult turbine mortality, unless the FPWG decides otherwise or identifies an alternative solution. The following guidelines will govern trash rack modifications:

- New racks will be located in the existing stop-log slots and will be supplemental to the existing racks unless otherwise agreed to by the Licensee.
- New racks will only be deployed seasonally, during the applicable adult migrations, as determined by FPWG.
- The then current Performance Assessment Interval will restart once the new trash racks are installed.

5. Tier 2 Measures

- Increase water allocated to the BFAA.
- Modify powerhouse turbines to include a more fish friendly configuration.
- Extend the fish ladder upstream into the forebay.
- Install fish barriers or deterrents in the trailrace.
- Install experimental devices in the Project diversion pool to facilitate guidance of fish downstream past the project.
- Other measures proposed by the FPWG, and approved by the Licensee.

The Licensee may, at any time, propose to implement Tier 2 measures. After review and approval by the FPWG, the Licensee shall develop a plan and schedule in consultation with the FPWG and shall implement the proposed measure following all required approvals. Implementation of Tier 2 measures will be followed by a continuation of the Adaptive Management program described above.

Article 9: Annual Report

The Licensee shall file Annual Reports for the term of this Amended License. The Licensee shall, by December 15 annually, provide a draft Annual Report to the FPWG and provide at least 30-days for review and approval. The Annual Report will address all activities within that calendar year and will include: (1) Operations and Maintenance (O&M) relating to the fish passage facilities and planned O&M for the upcoming year; (2) annual BFAA Allocation Plan; (3) Monitoring and Evaluation (M&E) relating to the Adaptive Management program and the Fish Passage and Protection Plan; (4) description of planned monitoring activities for the upcoming year; (5) status of the Adaptive Management program and related measures; (6) the 5-year assessments required by the Adaptive Management program; and (7) any proposed changes to the Fish Passage and Protection Plan.

The Licensee shall file Annual Reports with the Commission by March 1. When filing Annual Reports with the Commission, the Licensee shall include documentation of consultation; copies of comments and recommendations; and specific descriptions of how comments and recommendations from FPWG members have been accommodated. If the Licensee does not adopt a recommendation, the filing shall include its reasons based on Project specific information. If the Licensee files an Annual Report without obtaining concurrence from the FPWG, the Licensee shall include specific reasons for doing so.

The Licensee shall implement planned O&M measures, requests for releases of BFAA accumulated water, M&E measures, and Tier 1 and Tier 2 measures as described in its Annual Reports.

Article 10: Inspection and Notice

The Licensee shall permit members of the Fish Passage Work Group, at any reasonable time, access to, through, and across Project lands and works for the purpose of inspecting fish passage facilities and related records pertaining to the operation of the Project and implementation of the Amended License. The Licensee shall require reasonable notice of such inspections and shall establish reasonable safety and security procedures for parties engaged in such inspections.

Article 11: Abandonment of Anadromous Fish Reintroduction

In the event that the NMFS, U.S. Fish and Wildlife Service, and ODFW, each notify the Commission that all efforts to re-introduce anadromous fish to the Upper Deschutes River Sub-basin have failed and have been discontinued, the Licensee's responsibilities to achieve steelhead and Chinook salmon performance standards shall cease and any associated monitoring and evaluation responsibilities shall terminate. The Licensee shall continue to operate the ladder for use by native resident fish, including bull trout, conduct associated monitoring for native resident fish, and provide water credits to the Bypass Flow Accrual Account for purposes of providing an ongoing benefit to native resident fish. The allocation shall be 25% of the increased hydroelectric potential resulting from the new diversion pool elevation.

The Licensee may, at its discretion, develop a study of BFAA effectiveness over a range of flow conditions, for approval by the FPWG, to determine whether the BFAA has been over-allocated (less water is needed) to meet fish passage needs of resident native fish. If it is determined by the FPWG that the BFAA is over-allocated, the allocation rate will be reduced consistent with the level of over allocation, upon agreement of the FPWG.

Article 12: Revised Exhibits

Within 90 days of the completion of any construction of facilities, modification of project boundaries, or any other action required by this license that results in changes to Exhibits A, F and G, the Licensee shall file for Commission approval revised Exhibits A, F, and G, as appropriate, to show those project facilities and lands as built or modified. The exhibits shall have sufficient detail to adequately delineate the relative location of project features. The Licensee shall submit six copies to the Commission, one copy to the Commission's Portland Regional Engineer, and one to the Director, Division of Hydropower Administration and Compliance.

Article 13: Review and Approval of Final Plans and Specifications

At least 60 days before starting any license-related construction activities, the Licensee shall submit one copy to the Division of Dam Safety and Inspections, Portland Regional Engineer and two copies to the Commission (one of these shall be a courtesy copy to the Director, Division of Dam Safety and Inspections), of a supporting design report and final contract plans and specifications. Construction may not commence until authorized by the Regional Engineer.

Article 14: Quality Control and Inspection Program

At least 60 days before starting any license-related construction activities, the Licensee shall submit one copy to the Division of Dam Safety and Inspections, Portland Regional Engineer and two copies to the Commission (one of these shall be a courtesy copy to the Director, Division of Dam Safety and Inspections), of the Quality Control and Inspection Program (QCIP) for the Commission's review and approval. The QCIP shall include a sediment and erosion control plan.

Article 15: Cofferdam Construction Drawings

Before starting construction, the Licensee shall review and approve the design of contractor designed cofferdams and deep excavations. At least 30 days before starting construction of the cofferdams, the Licensee shall submit one copy to the Division of Dam Safety and Inspections, Portland Regional Engineer and two copies to the Commission (one of these copies shall be a courtesy copy to the Director, Division of Dam Safety and Inspections), of the approved cofferdam construction drawings and specifications and the letters of approval.

Article 16: Temporary Emergency Action Plan

At least 60 days before starting construction, the Licensee shall submit one copy to the Division of Dam Safety and Inspections, Portland Regional Engineer and two copies to the Commission (one of these shall be a courtesy copy to the Director, Division of Dam Safety and Inspections), of the Temporary Emergency Action Plan (TEAP) for the Commission's review and approval. The TEAP shall describe emergency procedures in case failure of a cofferdam, large sediment control structure, or any other water retaining structure could endanger construction workers or the public. The TEAP shall include a notification list of emergency response agencies, a plan drawing of the proposed cofferdam arrangement, the location of safety devices and escape routes, and a brief description of testing procedures.

October 30, 2017

VIA ELECTRONIC FILING

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

Subject: Updated Project Description and Environmental Assessment for Non-Capacity Amendment for Opal Springs Fish Passage Project (FERC No 5891).

Dear Secretary Bose,

The Deschutes Valley Water District (DVWD), Licensee for the above referenced project, hereby submits an updated project description for the application for non-capacity license amendment, originally submitted on October 8, 2015. As well, DVWD requests that the Federal Energy Regulatory Commission (FERC or Commission) lifts the abeyance granted on April 5, 2017, and issue the requested license amendment, as modified by this filing, as soon as practical. The updated project description is necessary because the facilities, proposed as part of the Proposed Action, have been modified as a result of a value engineering effort.

Background

The Opal Springs Hydroelectric Project (OSHP) was authorized in 1982 and commissioned in 1985. Anadromous fish had been extirpated from the Upper Deschutes Basin since the 1960s due to the downstream Pelton Round Butte Project (PRB Project, FERC No. 2030); therefore, fish passage was not required or provided at the time of the initial licensing of the project.

In 2007, salmon and steelhead trout were reintroduced in the Upper Deschutes Basin, upstream of the PRB Project following the completion of upstream and downstream passage facilities. The reintroduced fish began repopulating three major tributaries to the Deschutes River: the Upper Deschutes River, the Metolius River, and the Crooked River, on which the OSHP is situated.

The first adult salmon and steelhead returning to the PRB Project were documented in 2012 and the species has been observed in the OSHP vicinity since that time. Located at the lower end of the Crooked River, the OSHP is a barrier to passage into this tributary, which would otherwise provide spawning, rearing, and foraging habitat for these anadromous species. Bull trout, a species listed under the federal Endangered Species Act (ESA), also is present below the OSHP, which is considered critical habitat under the ESA. In response to a request from the Oregon Department of Fish and Wildlife (ODFW), DVWD has been passing fish above the OSHP through a trap-and-haul effort voluntarily since 2012.

Because of these changing conditions and to facilitate upstream migration at the OSHP, DVWD voluntarily engaged with the relevant government agencies and non-governmental organizations in 2008. For more than 4 years, DVWD and interested parties investigated, discussed, and negotiated a collaborative solution. In October 2011, DVWD and the following agencies and entities (the Parties) came to a balanced agreement for construction and maintenance of fish passage facilities and fisheries management at the OSHP:

United States Department of the Interior (US DOI) Bureau of Indian Affairs (BIA)
US DOI Bureau of Land Management (BLM)
US DOI Fish & Wildlife Service (USFWS)
National Marine Fisheries Service (NMFS)
Oregon Department of Fish & Wildlife (ODFW)
Trout Unlimited (TU)

Fish passage was proposed to be accomplished by construction of a volitional fish ladder on the east bank of the facilities, and a pool raise to help provide supplementary water in the bypass reach by means of a water credit system.

Settlement Agreement

The Settlement Agreement, which was amended and restated in 2015 to ensure consistency with this license amendment application, provides a framework for connecting important habitat in the Crooked River with the lower Deschutes Basin, while recognizing the voluntary nature of the DVWD's action. For a more detail explanation of the Settlement Agreement, its terms and conditions, and proposed license articles and amendment, please refer to the following documents, provided with the October 8, 2015 filing:

(1) Joint Explanatory Statement; and
(2) Settlement Agreement, originally executed in October 2011, and revised and restated in September 2015, plus:
    - Settlement Agreement Appendix A (Proposed License Articles)
    - Settlement Agreement Appendix B (Fish Passage and Protection Plan)

<u>License Amendment and 2016 Abeyance</u>

In December 2016, the DVWD requested a short-term abeyance of the processing of the license amendment to consult with the Parties regarding the economic feasibility of the project, as proposed. On March 28, 2017, DVWD provided an update to FERC on agreements among the Parties on the desirability to conduct a value engineering effort to reduce the costs of the proposed project. The Parties agreed that by reducing the scope and scale of the proposed pool raise, costs could be reduced, without significantly impacting the Proposed Action (see Supplemental Consultation Summary, Exhibit B of the enclosed and updated Applicant Prepared Environmental Assessment [APEA]). By letter dated April 5, 2017, the Commission agreed to continue to hold the application in abeyance, and asked for an update by December 31, 2017.

The proposed modifications were agreed to with the Parties, and have now been incorporated into the final design. For purposes of the modified 2017 project description, the Parties have agreed that neither the proposed modifications, nor the conforming edits to the Proposed License Articles will be interpreted to materially modify the settlement agreement (see Supplemental Consultation Record in the APEA).

This submittal includes the following[1]:

- An updated Applicant Prepared Environmental Assessment, which includes:
    - An updated project description;
    - An updated Supplemental Consultation Record (reflecting communication with settlement parties ("Parties");
    - A supplemental report for the Biological Assessment, summarizing how the proposed modifications may affect endangered species; and
    - A "crosswalk" of changes to the facilities and proposed operations.

[1] By separate submittal, DVWD intends to provide FERC staff with "track-changes" versions of the key documents.

- Revised, Proposed License Articles (Appendix A to the 2015 Settlement Agreement (Agreement) with respect to Fish Passage at the Opal Springs Hydroelectric Project;
- Revised Exhibit A (Project Description) and Exhibit F (Facilities); and
- The previously submitted Exhibit G drawing, reflecting no changes in the Project boundary as proposed in 2015.

Service and Distribution

With regard to service on DVWD relating to the Settlement Agreement, final license amendment application, and any related dockets and sub-dockets, DVWD requests that service be made on the following persons:

Edson Pugh, General Manager
Deschutes Valley Water District
881 SW Culver Highway
Madras, Oregon 97741
Ph: (541) 475-3849
edson@dvwd.org

Finlay Anderson
Sr. Regulatory Consultant
Kleinschmidt Associates
1500 NE Irving Street, Suite 550
Portland, Oregon 97232
Ph: (503) 345-0517
finlay.anderson@kleinschmidtgroup.com

Todd Glass
Wilson Sonsini Goodrich & Rosati PC
701 Fifth Avenue Suite 5100
Seattle, WA 98104
Ph: (206)883-2571
tglass@wsgr.com

With regard to service on the Parties to the Settlement Agreement relating to the Settlement Agreement, final license amendment application, and any related dockets and sub-dockets, they request that that service be made on the persons designated on Service List:

- Service List of Parties to Opal Springs Fish Passage Settlement Agreement, Joint Explanatory Statement, and License Amendment Application

We are providing electronic copies of this application to the entities on the attached distribution list. The entities include the resource agencies and non-governmental organizations that were party to the Settlement Agreement and Indian tribes who are also co-managers of the Deschutes Basin's fish resources. We will also be communicating with the numerous organizations that have expressed interest in the proceedings but who may never have attended meetings or joined FERC's Service List.

We greatly appreciate the continued collaboration with all Parties, and the ongoing assistance of FERC staff. We are very happy to be in a position to continue this process towards providing fish passage at the Project. If you have questions regarding this filing, please contact Finlay Anderson at (503)345-0517.

Respectfully Submitted,

Edson Pugh

Edson Pugh
General Manager

Enclosures:

Cc: Distribution list (see attached)
Settlement Parties
Service List
Interested Parties

CERTIFICATE OF SERVICE
Opal Springs Hydroelectric Project (FERC No. 5891)
Final License Application

I, Edson Pugh, General Manager, Deschutes Valley Water District, hereby certify that a link to the foregoing document on the Commission website has been transmitted to the following parties on October 30, 2017.

Edson Pugh

Edson Pugh

One copy, via e-filing to:
Ms. Kimberly D. Bose
Federal Energy Regulatory Commission
888 First Street N.E., Dockets Room
Washington, DC 20426

Via email to:

The following individuals are being contacted via email to alert them of the availability of the updated project material at www.opalspringspassage.org . The list includes those identified on the FERC Service List for Docket P-5891

Full Name	Affiliation
Jennifer Frozena	*Bureau of Indian Affairs*†
Jim Eisner	*Bureau of Land Management-Deschutes Region*
Dawn Wiedmeier	Bureau of Reclamation -Pacific Northwest Region
Brad Houslet	Confederated Tribes of Warm Springs
Robert Brunoe	Confederated Tribes of Warm Springs
Chris Gannon	Crooked River Watershed Council
Tod Heisler	Deschutes River Conservancy
Scott Carlon	*National Marine Fisheries Service*†
Michael Tehan	*National Marine Fisheries Service*†
Mike Britton	North Unit Irrigation District †
Yancy Lind	NW Steelheaders
Mike Kasberger	Ochoco Irrigation District†

Full Name	Affiliation
Russell Rhoden	Ochoco Irrigation District†
Chris Stine	Oregon Department of Environmental Quality†
Marilyn Fonseca	Oregon Department of Environmental Quality
Brett Hodgson	*Oregon Department of Fish and Wildlife*
Ken Holmolka	*Oregon Department of Fish and Wildlife*
Ted Wise	*Oregon Department of Fish and Wildlife*
Steve Sanders	Oregon Department of Justice
Dennis Griffin	Oregon State Historic Preservation Office
Mary S. Grainey	Oregon Water Resources Department†
Ann Reece	Oregon Water Resources Department†
Richard Golb	PacificComm LLC
Loretta Mabinton	Portland General Electric †
David E. Filippi	Stoel Rives, LLP †
Chandra Ferrrari	*Trout Unlimited* †
Darek Staab	Trout Unlimited
Nancy Gilbert	*US Fish and Wildlife Service*
Peter Lickwar	*US Fish and Wildlife Service*
John DeVoe	WaterWatch of Oregon
Kimberley Priestley	WaterWatch of Oregon

† = service list

italics = Party to Agreement

AMENDMENT OF LICENSE
OPAL SPRINGS HYDROELECTRIC PROJECT
FERC PROJECT NUMBER 5891-000

REVISIONS TO EXHIBIT A

Below is a tabulation of the Opal Springs Hydroelectric Project facilities. Refer to the revised Exhibit F and G drawings for additional details.

Note on project elevations: All elevations are reported in National Geodetic Vertical Datum of 1929 (NGVD 29), except construction drawings that are in a local project datum (LPD), which is greater than NGVD 29 by 1.79 feet.

Diversion Structure	
Type	Concrete-capped rockfill
Height from toe of Dam	25.5
Crest Elevation at normal fish ladder operations	
Elevation of normal water surface	2007.21 ft. NGVD ‘29
Estimated pool area	14.4 acres
Estimated pool storage	119 acre-feet
Fish Ladder	
Type	Vertical Slot
Height	31.2
Number of cells	38
Design flow (cfs)	30
Jump Height (inches)	9
Intake Structure	
Type	Concrete
Size	44 x 33 feet in plan
Height	32 ft
Parapet Elevation	2012.21 ft. NGVD ‘29
Conduits	
Type	Corrugated metal
Number	Two
Diameter	12.5 feet
Length	1,157 feet each
Lining	Full cement mortar
Cover	Minimum 5 feet of earth and rock for protection from falling rock

Bifurcation	
Type	Concrete
Size	52 x 33 feet in plan
Height	19 feet
Transition	Two 12.5 foot diameter to one 16 foot diameter
Surge Tank	
Type	Steel
Diameter	30 feet
Height	37 feet
Orifice Diameter	6 feet
Penstock	
Type	Steel
Diameter	16 feet
Length	160 feet
Powerhouse	
Type	Indoor, two level
Size	99 feet x 63 feet
Turbine Type	3-meter horizontal tube type
Turbine Manufacturer	Allis Chalmers
Gross Head	52 feet
Generator	4.3 MW 4,160 V synchronization
Speed	150 rpm
Generator manufacturer	Siemens-Allis

Turbine Water Driven Pumps	Pump Units	
Description	Unit 1	Unit 3
Rating (hp)	175	480
Turbine flow capacity (cfs)	65	140
Pumping capacity (gpm)	600	1,400
Penstock Dimensions	4 feet diameter x 64 feet long	6’ feet diameter x 100 feet long

PROJECT OPERATIONS

The OSHP will continue to be operated as a run-of-river facility, and the minimum instream flow requirement of the current license (License Article 36) will be maintained. Gate 1 and the associated concrete-lined spill channel are sized to provide a minimum total flow of 344 cfs, which, combined with the ladder flow of 30 cfs and the maximum turbine flow of 1,772.5 cfs, is slightly less than the 5% annual exceedance streamflow of 2,667 cfs.

Pool level is maintained with the aid of level sensor and computer. Changes in flow are automatically sensed and the turbine wicket gates adjust to maintain the pool level. The setting of the pool level is calibrated to the nearest tenth of a foot in elevation.

UPDATED EXHIBIT E

APPLICANT PREPARED ENVIRONMENTAL ASSESSMENT

OPAL SPRINGS HYDROELECTRIC PROJECT

FERC NO. 5891

Prepared for:

Madras, Oregon

Prepared by:

Portland, Oregon
www.KleinschmidtGroup.com

October 2015 (revised, October 2017)

This Page Left Intentionally Blank

UPDATED EXHIBIT E
APPLICANT PREPARED ENVIRONMENTAL ASSESSMENT
OPAL SPRINGS HYDROELECTRIC PROJECT
FERC NO. 5891

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APEA ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

APE	area of potential effects
APEA	applicant-prepared environmental assessment
AWS	alternative water supply
BA	biological assessment
BFAA	Bypass Flow Accrual Account
BIA	U.S. Bureau of Indian Affairs
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
CFR	Code of Federal Regulations
cfs	cubic feet per second
CRWC	Crooked River Watershed Council
CTWS	Confederated Tribes of the Warm Springs Reservation of Oregon
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DLCD	Oregon Department of Land Conservation and Development
DO	dissolved oxygen
DMM	downstream migrant mortality
DPS	distinct population segment
DVWD	Deschutes Valley Water District
EFH	essential fish habitat
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FMO	foraging, migration, overwintering
FPA	Federal Power Act
FPWG	Fish Passage Work Group
IDF	inflow design flood
kV	kilovolt
LPD	local project datum
MCR	Mid-Columbia River
MSA	Magnuson-Stevens Act
MW	megawatt
NEPA	National Environmental Policy Act
NGVD 29	National Geodetic Vertical Datum of 1929
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	U.S. National Marine Fisheries Service
NOI	Notice of Intent

O&M	operation and maintenance
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife Service
OEDD	Oregon Economic Development Department
OSHP	Opal Springs Hydroelectric Project
OWEB	Oregon Watershed Enhancement Board
PGE	Portland General Electric
PLA	proposed license article
PME	protection, mitigation, and enhancement measure
PRB	Pelton Round Butte
PURPA	Public Utility Regulatory Policies Act
PSA	power sales agreement
RM	river mile
rkm	river kilometer
SHPO	State Historic Preservation Office
SWW	selective water withdrawal facility
TMDL	total maximum daily load
TWG	Technical Work Group
USACE	U.S. Army Corps of Engineers
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
WM	Willamette Meridian
WSEL	water surface elevation

UPDATED EXHIBIT E
APPLICANT PREPARED ENVIRONMENTAL ASSESSMENT
OPAL SPRINGS HYDROELECTRIC PROJECT
FERC NO. 5891

1.0 INTRODUCTION

The Deschutes Valley Water District (DVWD) is filing this updated applicant-prepared environmental assessment (APEA) with the Federal Energy Regulatory Commission (FERC) as part of an ongoing application for a non-capacity amendment of its license for the Opal Springs Hydroelectric Project (OSHP), FERC No. 5891. This APEA updates the previously provided APEA submitted on October 8, 2015 which was prepared pursuant to the requirements of FERC's regulations at 18 CFR §4.38 and §4.61 and FERC's guidance document, *Preparing Environmental Documents: Guidelines for Applicants, Contractors, and Staff* (FERC 2008). The Updated APEA is necessary because certain project features have been modified since the October 8 2015 submittal, even the Proposed Action has not been significantly altered. FERC will use the APEA to satisfy its responsibilities under the National Environmental Policy Act (NEPA) to assess the environmental effects of the Proposed Action, an Alternative Action, and the No-Action Alternative.

This APEA incorporates by reference the Settlement Agreement, Joint Explanatory Statement, filed previously on October 8, 2015, and updated Technical Appendices

- Exhibit A: Biological Assessment/Evaluation (BA) of the Effects of the Proposed Action on Listed Species, with a supplemental report to conform the BA with changes proposed since its original filing.
- Exhibit B: Consultation Summary
- Exhibit C: Supplemental Information

Under separate cover, the DVWD is re-filing revised Exhibits A (Project Description), G (maps) and F (drawings) reflecting the changes necessary to bring these exhibits into conformance with the proposed amendment. For convenience, DVWD is also providing a "crosswalk" document that summarizes the changes from the 2015 proposal.

Amendment of the OSHP's FERC license is needed because anadromous fish are being reintroduced to the upper Deschutes River basin. The reintroduction is underway as the result of fish passage measures required by Portland General Electric Company's (PGE’s) FERC license for the Pelton Round Butte (PRB) Project (FERC No. 2030) (see Section 3). As a result of the reintroduction, fish passage barriers within the three major tributaries upstream of the PRB Project, including the OSHP on the Crooked River need to be addressed systematically.

Multiple agencies and other interested organizations have addressed 13 barriers to fish passage in the Crooked River subbasin upstream of the OSHP (Figure 1-1). These organizations include the Oregon Department of Fish and Wildlife (ODFW), the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWS), PGE, the Crooked River Watershed Council (CRWC), Ochoco Irrigation District, and others. Passage structures have been installed at 10 diversion dams, and 3 dams have been removed. These actions have reconnected approximately 108 miles of river. The four remaining passage barriers in the lower Crooked River subbasin (including the OSHP) are being addressed.

In developing the Proposed Action, DVWD has engaged federal and state agencies, and non-governmental organizations in extensive pre-filing consultation. Most significantly, the Settlement Agreement Concerning License Amendment for Fish Passage at the Opal Springs Hydroelectric Project (“Original Agreement”) was executed in October 2011. A revised and restated settlement agreement was signed in October 2015 (Settlement Agreement). The restated Settlement Agreement reflected more complete understandings of the designed facilities and their operations. The parties (Parties) to the Settlement Agreement include the DVWD, NMFS, USFWS, the U.S. Bureau of Indian Affairs (BIA), the U.S. Bureau of Land Management (BLM), ODFW, and Trout Unlimited (TU). The Settlement Agreement is being filed concurrently with the application for amendment and this APEA.

As agreed among the Parties, the proposed amendment will authorize DVWD to provide for upstream and downstream passage at the OSHP and to provide an adaptive structure for managing the fish passage facilities throughout the term of the amended license. Specifically, DVWD proposes to:

1. construct a fish ladder to provide passage for migratory bull trout and anadromous summer steelhead, which both are listed as threatened according to the Endangered Species Act (ESA), into the Crooked River subbasin; and to provide passage for spring Chinook; the passage facilities also will reconnect populations of native redband trout upstream and downstream of the OSHP;
2. modify the dam to raise the maximum operating elevation of the OSHP reservoir from 2,004.21 feet to 2,007.21 feet.[1,2] This new elevation will enable the DVWD to construct alternative downstream passage routes for migrating fish and facilitate the establishment of a water bank known as the Bypass Flow Accrual Account (BFAA), which the Oregon Department of Fish and Wildlife (ODFW) and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWS) (hereafter referred to as the Fish Managers) will use to supplement flow into the OSHP's bypass reach as needed; and
3. adaptively manage the OSHP to meet fish passage performance objectives through a monitoring and evaluation program and tiered measures that are designed to respond to the findings of the monitoring and evaluation program.

The specific elements of the Proposed Action (described in greater detail in Section 4 of this APEA) are (1) constructing a fish ladder to provide upstream fish passage at the OSHP, (2) increasing the maximum operating elevation of the OSHP reservoir from 2,004.21 feet NGVD 29 to 2,007.21 feet by modifying the dam, (3) establishing a water bank to be used for facilitating upstream and downstream fish passage effectiveness, (4) implementing an adaptive management approach to facilitate decision-making for the duration of the term of OSHP's current FERC license, and (5) modifying the FERC boundary of the OSHP to encompass the proposed works and the larger pool.

The proposed increase in the elevation of the reservoir will inundate an additional 700 longitudinal feet (3.9 acres) of riverine habitat immediately upstream of the existing OSHP impoundment. The new pool will approach, but not encroach on, the downstream boundary of the Wild and Scenic segment of the Crooked River.

[1] All elevations are reported in National Geodetic Vertical Datum of 1929 (NGVD 29), except construction drawings that are in a local project datum (LPD), which is greater than NGVD 29 by 1.79 feet. For purposes of keeping the construction and engineering simple, this LPD is used in an engineering context.

[2] The OSHP is authorized to operate at a maximum pool elevation of 2,005 feet NGVD 29; surveys conducted in 2009 by DVWD indicate that the current elevation of the impoundment is at 2,004.21feet. The proposal is to increase the impoundment elevation by 3 feet, making the new maximum operating elevation 2,007.21 NGVD 29 (2,007 feet LPD).

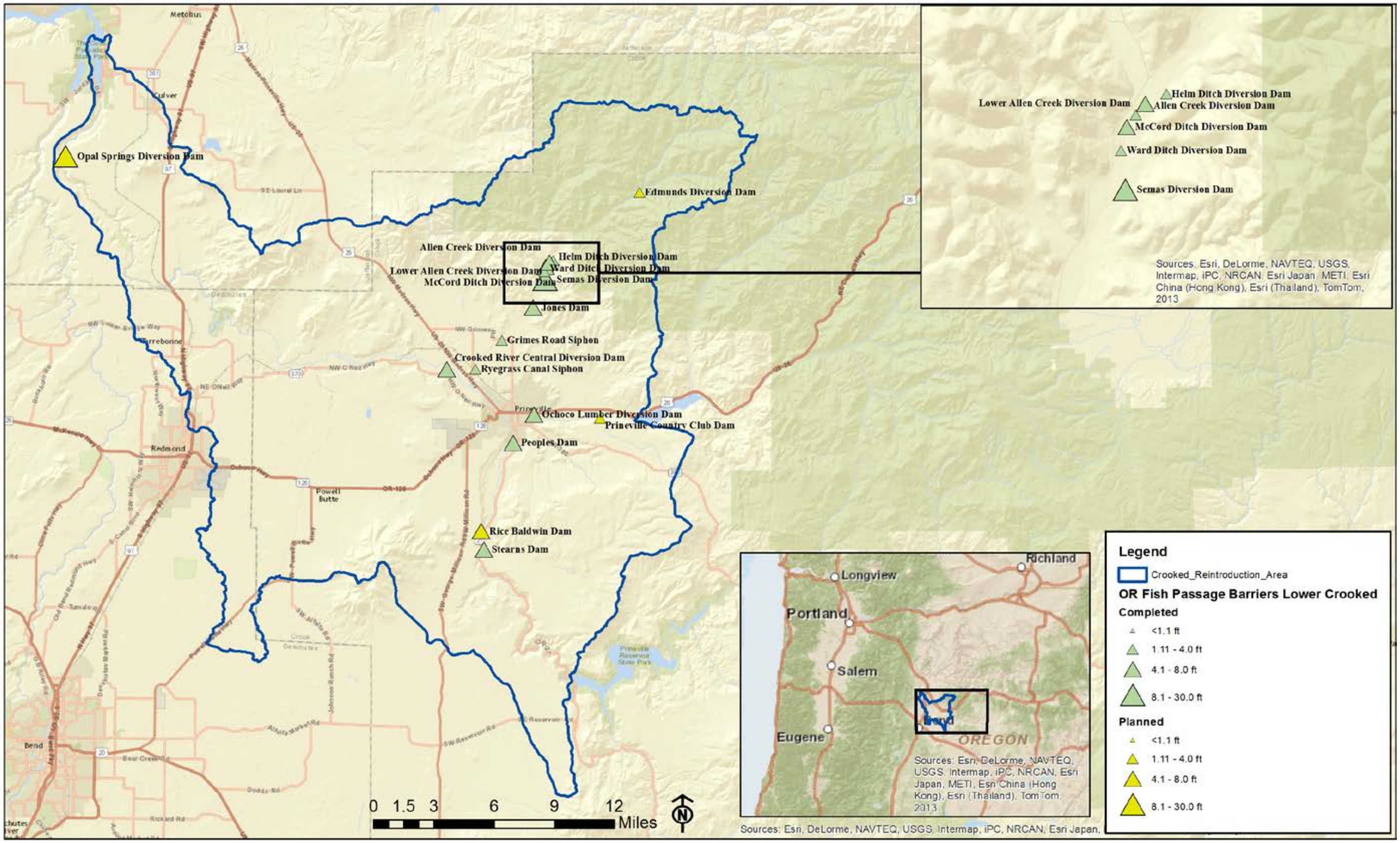


FIGURE 1-1 LOWER CROOKED RIVER

The map indicates barriers to anadromous fish migration and shows that provision of passage around the facility at Opal Springs is crucial for providing access for fish to the entire sub-basin (Source: Sanders 2015).

2.0 APPLICATION

5.3 APPLICATION TYPE

Non-capacity license amendment**.**

4.5 DATE FILED

October 7, 2015

4.5 APPLICANT

Deschutes Valley Water District.

4.5 WATER BODY

Crooked River, a tributary to the Deschutes River, Oregon.

4.5 COUNTY AND STATE

Jefferson County, Oregon.

3.0 PURPOSE OF ACTION AND NEED FOR POWER

On October 8, DVWD filed an application for a non-capacity amendment of its FERC license for the OSHP. DVWD requested FERC's approval to construct a fish ladder and increase the maximum operating pool of the OSHP impoundment by 6 feet to 2,010.21 feet (2,012 LPD). In 2016, the project underwent value-engineering when fish ladder proposal costs exceeded the amount affordable for DVWD. With the addition of new funding sources, and through the value-engineering process, minor modifications were made to the design resulting in a 3-foot pool raise to 2007.21 feet. The fish ladder is needed to provide upstream passage of native anadromous and resident fish at the OSHP.

A selective water withdrawal (SWW) facility has modified surface currents in Lake Billy Chinook (the reservoir above Round Butte Dam, downstream of the OSHP and the uppermost dam of the PRB Project) to attract outmigrating juvenile salmonids. The SWW is equipped with a fish screen to collect and sort outmigrants for release in the Deschutes River downstream of the PRB Project. The fish screen commenced operation in November 2009. A fish trap-and-haul operation, already in place below the PRB Project, will be used to transport returning adult salmonids to the tributaries upstream of the PRB Project.

The passage barrier posed by the OSHP is significant because it blocks access by migrating fish to the entire lower Crooked River subbasin. Providing fish passage at Opal Springs Dam will open access to about 108 miles of upstream fish habitat, including 58 miles reconnected by improvements at the Crooked River Central and Peoples' Irrigation District dams. Providing upstream passage at the OSHP will help establish self-sustaining, harvestable populations of summer steelhead trout (steelhead) and spring-run Chinook salmon (spring Chinook) in the Crooked River. Non-anadromous native fish, including bull trout, are also expected to use the proposed fish ladder to migrate upstream of the OSHP.

The proposed increase in the elevation of the reservoir also will provide additional water on demand to facilitate upstream and downstream fish passage. DVWD will manage additional water, in collaboration with the resource agencies, via a water bank (i.e., BFAA). This water will serve both as attraction flow for adult fish that may be holding in the OSHP's tailrace and as alternative passage for downstream migrants through a spillway that will be constructed as part of the Proposed Action. Increased head resulting from increasing the elevation of the reservoir will allow DVWD to generate additional power to partially offset the cost of fish ladder construction and operation as well as costs associated with the monitoring and evaluation program.

FERC will determine whether to issue an amended license to DVWD to allow construction of the fish ladder and to increase the maximum allowable water surface elevation of the OSHP impoundment. FERC will also identify any conditions to be placed on the amended license. Issuing the amended license would allow DVWD to provide upstream and downstream fish passage as well as to generate additional hydropower at the OSHP for the remainder of the current license term.

The OSHP provides hydroelectric generation to meet part of Oregon’s power requirements, resource diversity, and capacity needs. The OSHP has an installed capacity of 4.3 megawatts (MW) and generates approximately 29,509 megawatt-hours (MWh) per year.

DVWD provides water to approximately 4,000 residential and commercial customers in Jefferson County. Water is provided through wells that tap into deep artesian springs from the bottom of the 846-foot canyon in which the OSHP is located. From there, the water is pumped up to the canyon rim and distributed throughout the DVWD’s service area. The OSHP is a vital part of the DVWD’s operations because it enables DVWD to keep water rate increases to a minimum. These rates in turn help local business to thrive. These businesses include bottling companies that market the Opal Springs water, such as Earth H2O and the Opal Springs Water Company.

4.0 PROPOSED ACTION AND ALTERNATIVES

5.3 PROJECT DESCRIPTION

The OSHP is located southwest of the town of Culver in Jefferson County, at river mile (RM) 7.2 on the Crooked River in Central Oregon. The dam is about 0.75 mile upstream of the head of Lake Billy Chinook in the northeast quarter of the northwest quarter of Section 33, Township 12S, Range 12E, Willamette Meridian (WM) (Figure 4-1). The upstream end of the reservoir is located on BLM land in the northeast quarter of the northwest quarter of Section 4, Township 13S, Range 12E, WM (Figure 4-1). Figure 4-2 shows the OSHP facilities, surrounding geographic features, and land ownership.

The OSHP consists of the following elements:

- a 21-foot-high, 175.2-foot-long, concrete-capped, rockfill diversion dam topped with 5 feet of flashboards that create a pool with a storage capacity of 106.4 acre-feet and a surface area of 11.1 acres at normal maximum pool elevation of 2004.21 feet;[3,4]
- a 44-foot by 33-foot rectangular concrete intake structure 32 feet in height on the left abutment of the diversion dam;
- two 12.5-foot-diameter, 1,157-foot-long buried corrugated metal conduits;
- a 30-foot-diameter steel surge-tank bifurcator;
- a 16-foot-diameter, 160-foot-long steel penstock;
- two turbine-driven pumps, one rated at 175 horsepower and the other at 480 horsepower;
- a powerhouse containing one turbine generating unit with a nameplate capacity of 4.3 MW at a power factor of 0.85 providing 1,800 cubic feet per second (cfs) of powerhouse capacity;
- a 250-foot-long, 20.8-kilovolt (kV) underground transmission line interconnecting to the Pacific Power and Light transmission system; and
- appurtenant facilities.

[3] All elevations are reported in National Geodetic Vertical Datum of 1929 (NGVD 29) except construction drawings that are in the local project datum (LPD), which is greater than NGVD 29 by 1.79 feet. For purposes of keeping the construction and engineering simple, this LPD is used in an engineering context.

[4] The OSHP is authorized to operate at a maximum pool elevation of 2,005 feet NGVD 29; surveys conducted in 2009 by DVWD indicate that the current elevation of the impoundment is at 2004.21 feet. The proposal is to increase the impoundment elevation by 6 feet, making the new maximum operating elevation 2,010.21 feet NGVD 29 (2,012 feet LPD)

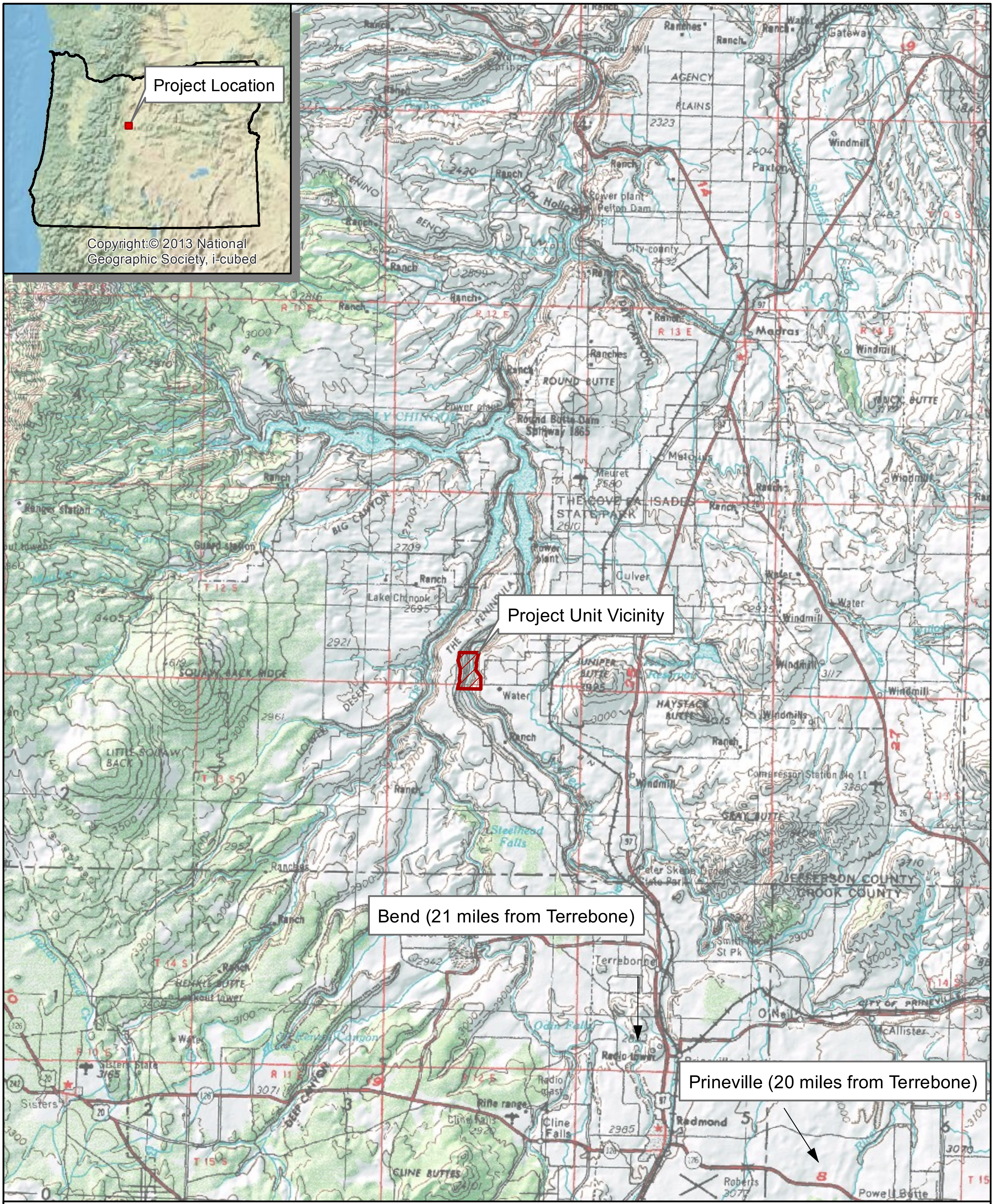


Figure 4-1 Opal Springs Project Location

Special Investment Partnership
Technical Assistance Grant
Opal Springs Hydroelectric Project
Fish Passage Final Design

0 2.5 5 10 Miles

1:260,000

True North

Source: USGS/Esri.


Range 12E
Willamette Meridian
Control Point 1
Northing: 301549.889
Easting: 7991784.300
Legend
Public Land Survey Quarter-Section Corners
Spillway and Fish Ladder
Public Land Survey Sections
Project Boundary
Existing
Proposed
Land Ownership
Bureau of Land Management
Other Federal
Private/Unknown
Control Point 2
Northing: 298854.642
Easting: 7994410.500
Township 12S
Township 13S
Control Point 3
Northing: 296373.787
Easting: 7991727.400
Figure 4-2 Opal Springs Fish Passage
Project Boundary and Land Ownership
Special Investment Partnership
Technical Assistance Grant
Opal Springs Hydroelectric Project
Fish Passage Final Design
0
125
250
500
Feet
1:2,000
True North

4.5 EXISTING PROJECT OPERATIONS

The OSHP is operated as a run-of-river facility. As required by Article 36 of the current OSHP license, DVWD maintains the discharge from the Opal Springs Dam at a continuous minimum flow of 50 cfs or the inflow to the reservoir, whichever is less, for the purpose of protecting and enhancing aquatic resources in the Crooked River downstream of the OSHP. The OSHP's water right is for 1,772.5 cfs, which may be fully used when river flows exceed 1,822.5 cfs. Once the powerhouse capacity (1,772.5 cfs) is exceeded, excess streamflows during periods of high runoff (typically in the spring) are passed over the stoplogs as the impoundment is allowed to rise.

4.5 PROPOSED ACTION

According to the Proposed Action, FERC will authorize DVWD to build a fish ladder and to increase the maximum pool elevation of the OSHP to 2,007.21 feet. The proposed normal water surface elevation of the pool, for purposes of ensuring continuous operation of the fish ladder, will be 2007.21 feet NGVD 29FERC will also authorize DVWD to operate the OSHP in accordance with an adaptive management framework that includes establishing a water bank to facilitate upstream and downstream fish passage (see Fish Passage and Protection Plan, Appendix B to the Settlement Agreement).[5]

At the proposed increased water surface elevation, the OSHP impoundment will store 119 acre-feet and have a surface area of 14.4 acres. The proposed upstream extent of the pool will approach, but not encroach on, the downstream boundary of the Lower Crooked River Wild and Scenic River Area (the east-west centerline of the Wild and Scenic boundary is at the northern half of the northern half of Section 4, Township 13S, Range 12E, WM, approximately RM 8). The OSHP boundary would be amended to reflect the inclusion of additional BLM lands (Figure 4-3).

The OSHP will continue to operate as a run-of-river facility. As described in Appendices A and B of the Settlement Agreement, DVWD would manage a water bank for the benefit of upstream and downstream fish passage, for use at the request of the Fish Managers. The Fish Managers will base their requests on a planning process involving all parties to the Settlement Agreement

---

[5] For convenience, DVWD is providing a "crosswalk" document that summarizes the changes from the 2015 proposal. This crosswalk accompanies is in Exhibit C of this APEA

to generate a BFAA Annual Allocation Plan (described in Section 4.3.3). The DVWD will modify its operations to supply additional water through a spillway, which will be part of the facilities.

The following sections describe the elements of the Proposed Action.

4.3.3 PROPOSED BOUNDARY

The FERC boundary of the OSHP will be amended to include additional BLM lands and to incorporate features necessary for operating the new and existing facilities. Proposed changes include the following:

- The FERC boundary below the diversion will be extended to include the fish ladder and an extended portion of the tailrace below the OSHP where potential adaptive measures could be implemented pursuant to the proposed adaptive management plan.
- On the west side of the reservoir, the boundary will include the upstream portions of the fish ladder and the boat ramp.
- Elsewhere above the diversion, the boundary will follow the 2,010.21-foot contour. This elevation ensures that the boundary will not encroach on the Lower Crooked River Wild and Scenic River Area.

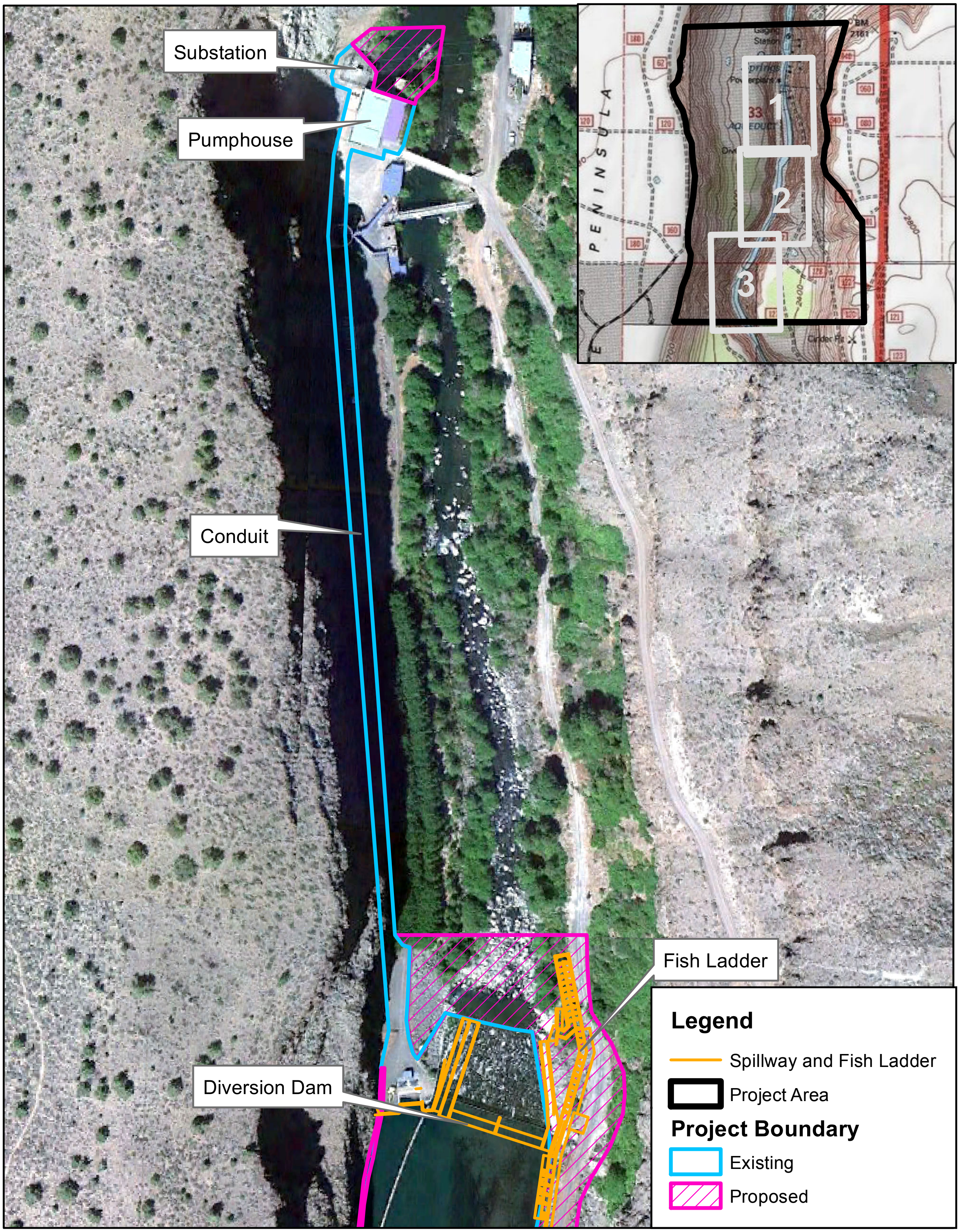


Figure 4-3 Opal Springs Fish Passage
Project Detail: Sheet 1

Special Investment Partnership
Technical Assistance Grant
Opal Springs Hydroelectric Project
Fish Passage Final Design

0 125 250 500 Feet
1:2,400

True North

20171031-5322 FERC PDF (Unofficial) 10/31/2017 3:15:38 PM

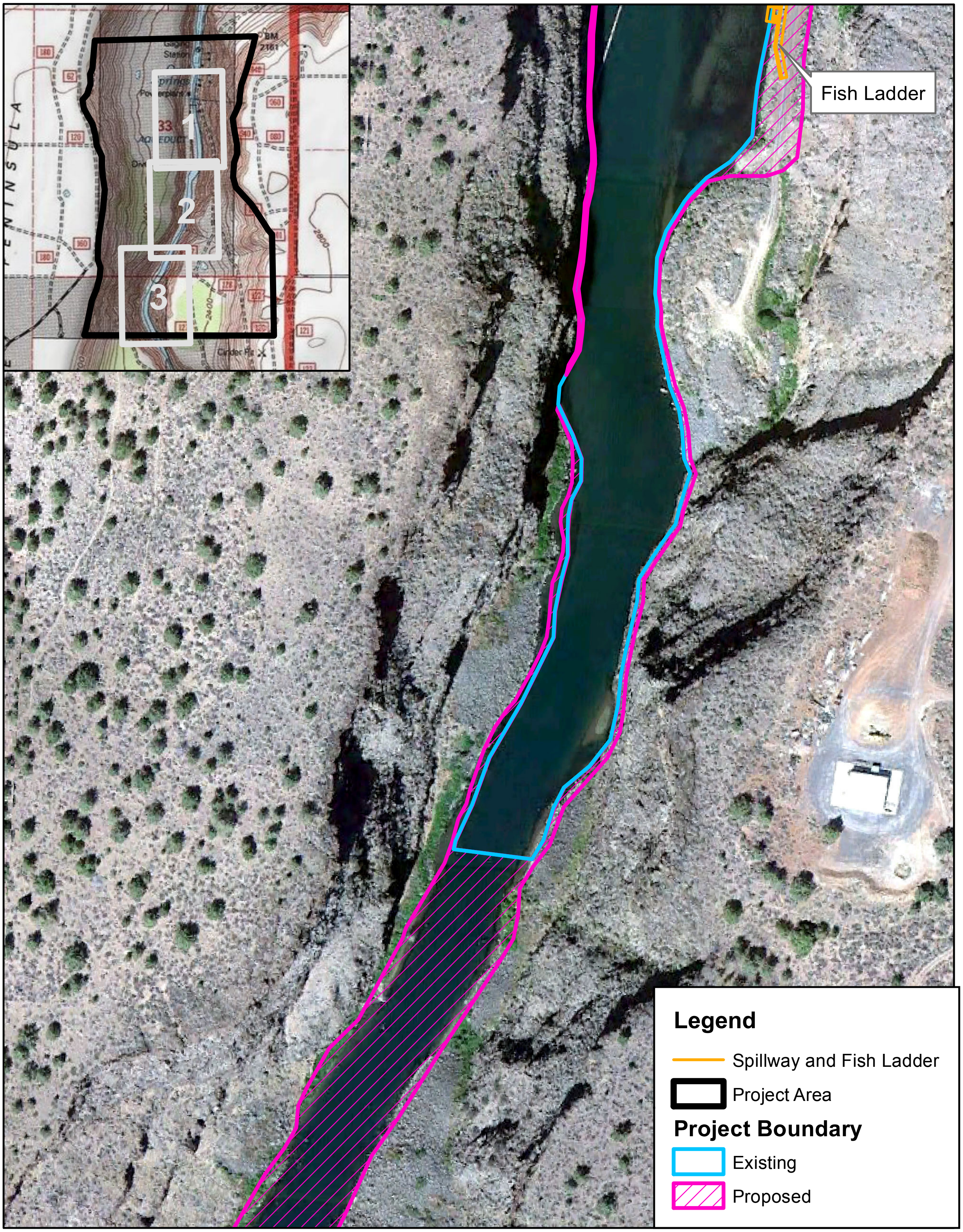


Figure 4-3 Opal Springs Fish Passage
Project Detail: Sheet 2

Special Investment Partnership
Technical Assistance Grant
Opal Springs Hydroelectric Project
Fish Passage Final Design

0 125 250 500 Feet

1:2,400

True North

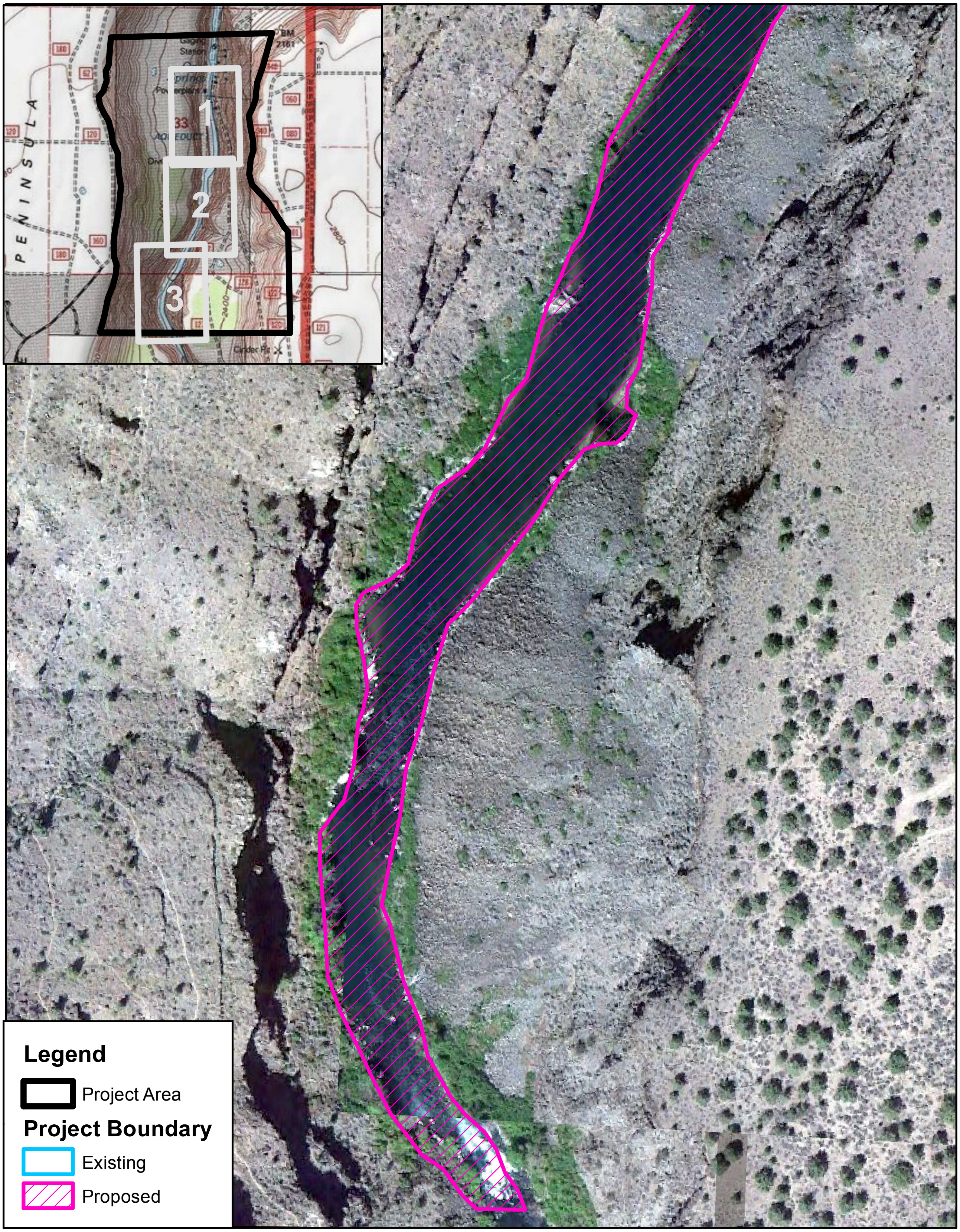


Figure 4-3 Opal Springs Fish Passage
Project Detail: Sheet 3

True North

0 125 250 500 Feet

1:2,400

Special Investment Partnership
Technical Assistance Grant
Opal Springs Hydroelectric Project
Fish Passage Final Design

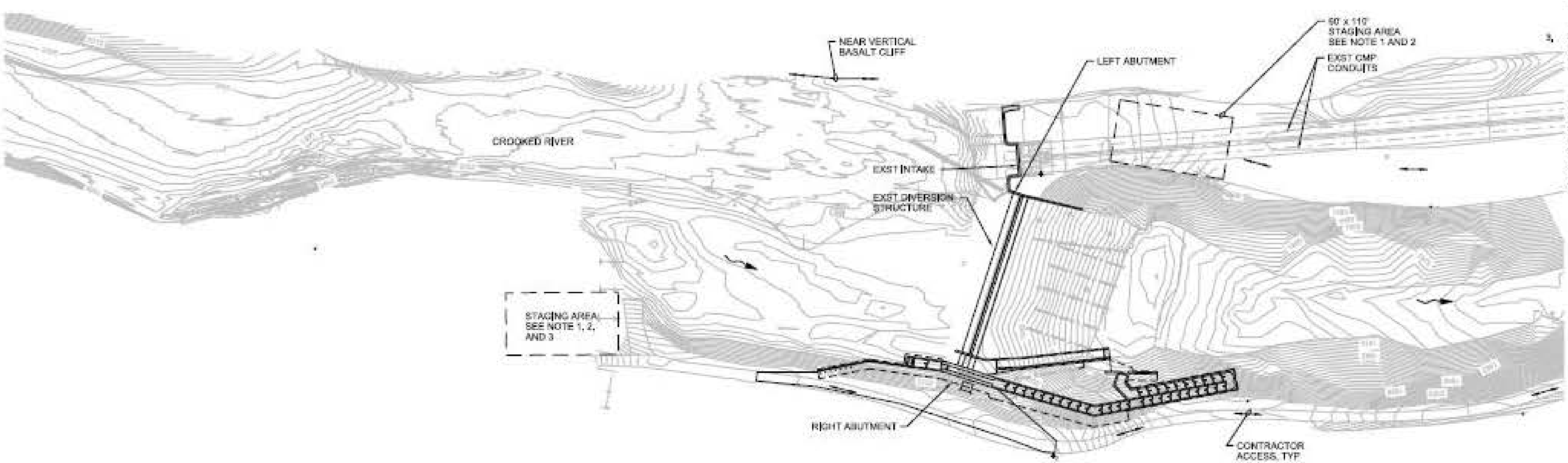
DESCHUTES VALLEY WATER DISTRICT

4.3.2 PROPOSED FACILITIES

The proposed facilities, which are described in detail in the following sections, include a fish ladder, flashboards and a pneumatic crest gate to raise the pool elevation. The following subsections describe these facilities in detail.

The Parties, including the Fish Agencies (NMFS, USFWS, ODFW, BIA), have reviewed the preferred design for the fish ladder (Figure 4-4). Prior to construction, as required by the Settlement Agreement, agencies will be providing their approvals, subject to consistency with any final license conditions that FERC may issue as a result of the proposed amendment (see Exhibit B, Consultation Record). The design documents include the following:

- 100% Specifications Vol 1, Vol 2
- 100% Standard Details
- 100% Supporting Design Report
- 100% Drawings



0 60 120 180
Scale In Feet

GENERAL NOTE:

A. SEE DRAWING C-1013 FOR MINIMUM REQUIRED BMPs NEAR THE DIVERSION STRUCTURE.

NOTES:

1. MAINTAIN ACCESS FOR OWNER'S STAFF THROUGH STAGING AREA DURING CONSTRUCTION.
2. INSTALL SILT FENCE ON DOWNHILL SIDE OF STAGING AREA IN ACCORDANCE WITH 6 / C-1014
   COVER STOCKPILES WITH PLASTIC SHEETING PER 1 / C-1014
3. FIELD LOCATE AND CONSTRUCT SEDIMENT BASIN IN ACCORDANCE WITH DETAIL 6 / C-1015
   BASIN SHALL BE LOCATED NEAR UPHILL CLIFF FACE ON EAST SIDE OF STAGING AREA AWAY FROM RIVER TO AVOID CAUSING A SLOPE FAILURE OF THE RIVER BANK. PERIMETER BERM MAY BE CONSTRUCTED OF COMPACTED BACKFILL OR SAND BAGS. PROVIDE RIPRAP IN ACCORDANCE WITH RIPRAP CHANNEL 4 / C-1015.

DRAFT SUBMITTAL

NO.	DATE	REVISION	BY	APVD

DSGN N WILLIAMS | DR | CHK AR HOWE | APVD MR LITTLE | DM McCLELLAND

CH2MHILL®

Opal Springs Hydroelectric Project
Pool Raise and Fish Passage Improvements
Deschutes Valley Water District

EROSION CONTROL
OVERALL EROSION CONTROL PLAN

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JULY 2017
PROJ	456995
DWG	C-1012
SHEET	20 of 72

FILENAME: 06-C-1012_456995.dgn PLOT DATE: 7/19/2017 PLOT TIME: 12:22:53 PM

[This Page Intentionally Left Blank]

4.3.2.1 FISH LADDER

The Proposed Action includes constructing a vertical-slot fish ladder on the right abutment of Opal Springs Dam to allow volitional upstream passage of fish. The ladder will include five key features:

- entrance
- attraction spill
- exit structure
- temporary adult trap
- other facilities for monitoring and evaluation

The fish ladder will accommodate a static forebay water surface elevation of 2,007.21 feet (2,009 feet LPD). The tailwater surface elevation with 50 cfs is 1,979.01; therefore, the maximum hydraulic differential between headwater and tailwater will be approximately 28.2 feet. As a result, the proposed layout describes 38 pools with hydraulic drops of 9 inches each.

Entrance. The ladder is designed to pass both salmon and trout. An entrance approximately 1 foot 10 inches wide by 3 feet high will deliver 30 cfs with 12 inches of differential. The ladder entrance is located based on field observations with the resource agencies and the results of flow testing conducted in late August 2012. During testing, the spill flow varied from approximately 30 cfs to 1,030.0 cfs, which encompasses the 95% to 5% exceedance streamflow range for bypass flows.

The ladder entrance is positioned to take advantage of a back-eddy pool that forms on the downstream side of a large boulder on the right bank adjacent to the stilling basin. Spill flows are expected to create a whitewater shear zone near the boulder that will guide fish moving upstream from the stilling basin tailout over the short distance to the fishway entrance. The maximum length of this whitewater shear zone is estimated to be between approximately 5 to 40 feet for Chute No. 1 flow rates ranging from 20 cfs to 300 cfs. The water jet discharging from the fish ladder entrance will intersect the Chute No. 4 flows at a large angle, and the resultant velocity vectors will be directed toward the stilling basin tailout and downstream boulder field.

Attraction Spill. No piped auxiliary water supply system will be provided. The minimum bypass flow of 50 cfs will be supplied by the 30 cfs fish ladder flow and 20 cfs of spill flow. Spill flow normally will be supplied by Gate No. 4 adjacent to the fish ladder.

Exit Structure. The fish ladder will have a single exit pool located within the forebay to accommodate the full range of potential static forebay water surface elevations in 3-inch increments, resulting in 13 discrete set-points.

Temporary Adult Trap. A temporary trap for adult fish will be provided as part of the monitoring and evaluation program requirements to assess the performance of the fish passage facilities and demonstrate that the requirements of the Settlement Agreement have been met. The temporary adult trap will be located in the channel upstream of a transport channel and before the exit pool. It will consist of a trapping mechanism, holding pool, upstream diffuser, and a brail with hopper. The trapping mechanism will be an in-ladder, removable vee-trap with brail.

Facilities for Monitoring and Evaluation. The fish ladder will include other provisions for monitoring and evaluating fish, including designated space, conduit, electrical, and instrumentation and control connections for a future fish-counting system (designed by the DVWD) and the possible future addition of devices for detecting passive integrated transponder (PIT) tags. The DVWD anticipates using a VAKI Riverwatcher system with digital video camera to count and identify fish. This equipment will be placed at the downstream end of the transport channel. A conduit embedded in the sides and invert of the transport channel or other provisions will be made to facilitate future installation of a PIT-tag detector.

4.3.2.2 PNEUMATIC CREST GATE AND FIXED FLASHBOARDS

A fixed wooden flashboard section along with one inflatable weir (or gate) will together span the crest of the dam to establish and control the increased pool elevation. The inflatable weir or gate provides alternative downstream passage routes for adult migratory fish that move downstream through the OSHP area. Both the fish ladder and the gate are designed to improve upstream and downstream passage conditions for migratory fish.

A single 12-foot wide pneumatic crest gate will be located on the right abutment, adjacent to the fishway. This Gate No. 1 will provide instream flow releases, will make BFAA releases for downstream fish passage, and will provide additional attraction water adjacent to the fish ladder entrance. A concrete-lined spillway chute located immediately downstream will safely delivery fish into the tailwater pool. It is also anticipated that the gate will be the primary location for the release of the 20 cfs balance of instream flows (with the fish ladder providing 30 cfs). The maximum capacity of the gate will be approximately 340 cfs at the 2007.21 ft. (2,009 FT LPD) forebay water surface elevation.

Fish bypass releases would enter a stilling basin adjacent to the proposed fish ladder entrance. The purpose of the stilling basin is to ensure optimal laminar flows in Chute 1 to the base of the dam.

The Fish Passage Working Group (FPWG)6 will develop detailed protocols for operating the inflatable weir or gate and for using BFAA releases to facilitate fish passage as part of the adaptive management effort.

Fish bypass releases would enter a stilling basin adjacent to the proposed fish ladder entrance. The Fish Passage Working Group (FPWG)7 will develop detailed protocols for operating the gates and for using BFAA releases to facilitate fish passage as part of the adaptive management effort. Section 4.3.3 describes an initial operational approach.

4.3.2 PROPOSED OPERATIONS

The OSHP will continue to be operated as a run-of-river facility, and the minimum instream flow requirement of the current license (License Article 36) will be maintained. Gate 1 and the associated concrete-lined spill channel are sized to provide a minimum total flow of 344 cfs, which, combined with the ladder flow of 30 cfs and the maximum turbine flow of 1,772.5 cfs, is slightly less than the 5% annual exceedance streamflow of 2,667 cfs.

[6] As described in the Settlement Agreement, the Fish Passage Working Group means all signatories to the October, 2015, SA (DVWD, NMFS, USFWS, BIA, ODFW, TU, and CTWS (provided that the CTWS is a signatory to the Settlement Agreement)). This is the working group whose purpose is to advise the Licensee on fisheries and habitat issues as specified in this Agreement and the Amended License.

[7] As described in the Settlement Agreement, the Fish Passage Working Group means all signatories to the October, 2011, SA (DVWD, NMFS, USFWS, BIA, ODFW, TU, and CTWS (provided that the CTWS is a signatory to the Settlement Agreement)). This is the working group whose purpose is to advise the Licensee on fisheries and habitat issues as specified in this Agreement and the Amended License.

As part of the Settlement Agreement, the DVWD will be implementing the BFAA as directed by the Fish Managers. The BFAA will be used to provide additional flow releases in the bypass reach (in addition to the instream flow requirement of 50 cfs) to facilitate upstream and downstream fish passage. The total annual BFAA volumes are estimated to be on the order of 20,000 to 30,000 acre-feet. In terms of flow releases, this volume will provide a year-round BFAA flow release of 30 to 40 cfs, approximately 9 weeks of flow releases at 200 cfs, or approximately 2 weeks of flow releases at 864.5 cfs.

The Fish Managers will base their requests for additional releases on a planning process involving all parties to the Settlement Agreement to generate a BFAA Annual Allocation Plan (described in Appendices A and B of the Settlement Agreement). The DVWD will modify its operations to supply additional water, when called for, through Gate 1 (see Section 4.3.2.6 above).

The ability to direct flow up to the design capacity of the bypass weir provides greater control of the river over a wide range of flow conditions. The ability serves two important functions:

- minimizing injury and mortality of fish passing over the roughened spillway; and
- balancing the amount and location of flow in relation to the ladder entrance to provide attraction water.

4.3.2 FISH MONITORING

Fish migrating through the OSHP area will be monitored to evaluate the biological performance of the new fish ladder, inform adaptive management of the BFAA, and determine whether other fish passage measures might be needed to achieve the biological performance objectives described in Appendix B of the Settlement Agreement. The monitoring and evaluation program will have upstream and downstream fish passage components, each implemented at 5-year intervals so that point estimates have an appropriate level of precision and represent a range of environmental conditions. Determinations of achievement of the biological performance objectives will be based on point estimates of aggregated data at the end of each 5-year monitoring interval.

Enumeration of fish using the fish ladder will begin upon completion of the fish ladder and elevation of the pool, but monitoring upstream passage will begin when migrating adult salmonids are passed upstream of the PRB Project and begin approaching and moving through the OSHP area. Efforts to monitor upstream fish passage at the OSHP will be designed to identify obvious problems with passage of adult fish within a few years to provide the FPWG with sufficient information to manage the BFAA for upstream fish passage and to inform decisions regarding fish passage improvements that may be needed to meet the explicit Performance Objectives. Uncertainties to be resolved by monitoring include species-specific run timing, the potential for migratory delay at the tailrace and at the base of the dam due to false attraction, rates of successful upstream fish passage, rates of adult fall-back, and whether or how management of the BFAA affects these rates.

Appendix B of the Settlement Agreement provides greater detail regarding the proposed fish monitoring program and actions based on monitoring results.

4.3.2 PERFORMANCE OBJECTIVES

The primary purpose of installing the new fish ladder, increasing pool elevation and creating the BFAA is to provide safe, timely and effective passage for migratory and resident fish species in the Crooked River at the OSHP. Conditions that meet the objectives will accommodate the natural timing of key life-history events (such as spawning) of the migratory species present, and will not cause excessive injury, mortality, or a high frequency of aberrant migratory behaviors by the salmonids entering the area (for example, false attraction of adults to the powerhouse tailrace, extended holding immediately above or below the dam, or unintended adult fall-back after passing upstream over the dam).

The Settlement Agreement describes specific fish passage Performance Objectives for safe, timely, and effective upstream passage at the OSHP as follows:

Upstream Fish Passage Performance Objectives

Species	Standard (to be met)	Goal (to be strived for)
Steelhead and Chinook Salmon adults	$\geq$90% successful upstream passage of migratory adults, with $\geq$90% of those adults that do successfully pass the Project	$\geq$97% successful upstream passage of migratory adults destined for areas above the Project. Fish that perish when

	doing so by a specified date each year[8]. Fish that perish when falling-back after dam passage will be considered unsuccessful migrants.	falling-back after dam passage will be considered unsuccessful migrants.
Bull trout adults and subadults	≥90% successful upstream passage, with the standard assumed to be met if that for steelhead adults is met at the Project.	≥97% successful upstream passage, with the goal assumed to be met if that for steelhead adults is met at the Project.

Specific fish passage Performance Objectives for safe, timely, and effective downstream passage at the OSHP are as follows:

Downstream Fish Passage Performance Objectives

Species	**Standard**	**Goal**
Steelhead and Chinook Salmon smolts	≥90% passage survival	≥97% passage survival
Bull trout adults and subadults	Assumed to be met if the ≥90% passage survival standard for steelhead smolts is met and levels of upstream passage by bull trout >12" at the Project do not exceed 1,000 fish on an annual basis.	Assumed to be met if the ≥97% goal for steelhead smolts is met.

The Settlement Agreement specifies that the identified Standards will be met by the end of the 3rd 5-year Performance Assessment Interval and the Goals by the end of the current license period: *"The Licensee shall achieve the fish passage Performance Objectives through the implementation of the Adaptive Management program. The Licensee shall be considered in compliance with these requirements so long as the fish passage Performance Objectives are met or the Licensee is working towards meeting the fish passage Performance Objectives through implementation of the Adaptive Management program".* *S*ee Section 4.3.6, below, for a description of the adaptive management approach.

[8] This objective implies that there is a target date each year by which the specified proportion of adult spawners should have passed the project in order for the run to reach the spawning grounds above the project at an appropriate time of year. The target date is unknown, and will be the subject of ongoing research as part of the reintroduction plan. Appendix B of the Agreement indicates that the FPWG will strive to establish this date within five years of adult release upstream of the PRB Project.

4.3.2 ADAPTIVE MANAGEMENT

The proposed adaptive management program includes (1) increasing BFAA allocations at specified intervals determined by being out of compliance with biological performance objectives (described in Appendix A of the Settlement Agreement and Section 4.3.5 above), (2) implementing two tiers (Tier 1 and Tier 2) of fish passage improvement measures as necessary to improve fish passage efficacy or meet biological performance objectives, (3) implementing other changes of the BFAA allocation, (4) modifying spill gate operation, and (5) modifying trash racks. Data for making adaptive management decisions will be obtained via monitoring the following parameters in three 5-year intervals:

- adult salmonid counts in the OSHP area
- adult salmonid migration timing
- real-time adult salmonid passage effectiveness
- aggregate adult salmonid passage performance
- juvenile salmonid relative abundance
- juvenile salmonid emigration timing
- real-time juvenile salmonid passage effectiveness
- aggregate smolt passage performance

Any modifications of the OSHP's trash racks will automatically restart the 5-year monitoring interval, beginning the year in which the modifications are implemented. Appendix B of the Settlement Agreement has greater detail regarding the proposed adaptive management program.

4.3.6.1 TIER 1 MEASURES

Over a period of at least 15 years (consistent with ~4 steelhead lifecycles) following completion of the fish ladder and pool raise, the DVWD will implement, monitor, and adjust Tier 1 fish passage measures at the direction of the FPWG, subject to constraints identified in this Plan, the amended Project license, and federal biological opinions. 5 –year Performance Intervals are proposed to measure success against relevant fish passage performance objectives.

Tier 1 measures include changes in operation of the proposed fish ladder as needed to ensure safe, timely, and effective fish passage; implementation of the BFAA; and minor physical modifications at the OSHP and in the bypass reach. Tier 1 measures include specific physical modifications at the dam or in the bypass reach.

The following set of upstream and downstream measures will be implemented, as agreed to by the FPWG, during any 5-year Performance Assessment Interval or in response to any 5-year Performance Assessment Interval (described in Section 5.4 below) in order to achieve the relevant fish passage Performance Objective (Section 5.3). Tier 1 measures include a variety of potential actions that would not require additional ESA consultation between the agencies and FERC following issuance of the amendment order.

Upstream passage Tier 1 measures include the following:

- removal of the peninsula that currently separates the tailrace from the bypass channel to reduce unacceptable delay of upstream migrating adult salmonids at the powerhouse;
- construction of structures in the bypass channel to concentrate flows and provide necessary cues to help adult migrants reach and find the fish ladder entrance;
- movement of rocks and boulders in the bypass reach downstream of the fish ladder entrance to provide for adult passage under most flow conditions;
- other enhancements of the bypass channel;
- adjustments or minor (“fit and finish”) modifications of the ladder to optimize performance; and
- installation and operation of behavioral deterrents to prevent movement toward and into the OSHP intake (i.e., due to adult "fall-back").

Downstream passage Tier 1 measures include the following:

- installation or modification of flow guidance devices on the downstream face of the dam to concentrate flow or otherwise improve smolt survival;
- enhancements of the bypass channel;
- installation and operation of behavioral deterrents, which could include experimental technologies, of movement toward and into the OSHP intake;
- other physical modifications that may be suggested by the members of the FPWG and approved by DVWD, in lieu of additional BFAA water; and

- predation control in the impoundment for which need will be determined by periodic assessments, as agreed to by the FPWG.

4.3.6.2 TIER 2 MEASURES

Unlike Tier 1 measures, Tier 2 measures may require additional approvals from the agencies and FERC. If the biological performance objectives, as described in Section 5.3 of Appendix B of the Settlement Agreement, have not been met after three 5-year monitoring intervals, the FPWG will meet to discuss possible implementation of Tier 2 measures pursuant to Section 5.4.3 of Appendix B of the Settlement Agreement (4.2.5 above) Tier 2 measures will be considered after all applicable Tier 1 measures have been implemented, or if the FPWG determines that further implementation of Tier 1 measures is unlikely to enable the OSHP to meet the performance objectives. Examples of Tier 2 fish passage measures include the following:

- increasing the water allocated to the BFAA;
- changing the powerhouse turbine to a more fish-friendly configuration;
- installing training walls between the fish ladder exit and the turbine intake;
- extending the fish ladder upstream into the forebay;
- installing barriers or deterrents in the tailrace; and
- installing experimental devices in the forebay to facilitate guidance of fish downstream past the OSHP.

4.3.6.3 OTHER FISH PASSAGE MEASURES

Appendix B of the Settlement Agreement identifies other fish passage measures that may be implemented, as approved by the FPWG, to improve-performance of fish passage facilities and achieve biological performance objectives. They include:

- utilization of BFAA
- changes to BFAA allocation
- modification of spill gate operation
- trash rack modifications

4.5 NO ACTION ALTERNATIVE

According to the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without additional environmental measures. Any effects of the OSHP would continue. DVWD is using this alternative to establish baseline environmental conditions for comparison with the Proposed Action.

4.5 ACTIONS CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

4.3.3 TRAP-AND-HAUL

A permanent trap-and-haul approach to providing fish passage at the OSHP was discussed with the resource agencies, but was eliminated from further evaluation. Trap-and-haul is incompatible with agency goals because it would not provide safe, timely, and effective upstream fish passage at the OSHP.

DVWD has been providing interim trap-and-haul voluntarily since 2012 to facilitate reintroduction. Data from monitoring conducted since the initiation of trap-and-haul indicate that it may increase the potential for delaying upstream migration relative to volitional passage. DVWD and the agencies agree that according to the Proposed Action, fish will be able to locate and use the fish ladder. The resource agencies identified no advantages of trap-and-haul relative to volitional passage at the OSHP.

4.3.2 FISH LADDER ONLY, NO INCREASE IN RESERVOIR ELEVATION

The Parties discussed the feasibility of constructing a fish ladder only, without raising the pool. This option was discarded because (1) engineering constraints associated with breaching the dam would be significant, (2) the alternative would limit the DVWD's ability to manage potential upstream migration delay with additional flows, and (3) downstream passage would not be improved. For these reasons, the Parties agreed to focus on raising the pool as an integral component of the Proposed Action.

5.0 CONSULTATION AND COMPLIANCE

The proposed amendment of the Opal Springs license will not increase the capacity of the OSHP; however, it involves modification of a dam that will result in a significant change in the normal maximum surface area or elevation of an impoundment; therefore, three-stage consultation is required pursuant to 18 CFR §4.38(a)(4)(v).

5.3 PRE-FILING CONSULTATION

DVWD has engaged agencies and other interested stakeholders regularly since 2008, when the Parties first met to discuss introducing fish passage at the OSHP.

4.3.3 OPAL SPRINGS FISH PASSAGE SETTLEMENT NEGOTIATIONS

After several years of discussion with agencies about fish passage, DVWD began formal negotiations in the spring of 2009. DVWD engaged the resource agencies and other interested stakeholders through the formation of a Settlement Work Group and a Technical Work Group (TWG) to define technical information needs to support the license amendment application and to structure the monitoring and evaluation and adaptive management provisions of the Agreement.

The TWG evaluated needs for both upstream and downstream passage at the OSHP. Although the initial focus was on the need for a fish ladder, the TWG also identified a need to address the potential for false attraction at the OSHP tailrace. The concern was that at times of average or low river flow, when the majority of the Crooked River's flows are concentrated through the generating unit and into the tailrace, fish may not be attracted to the bypass reach and may not find the entrance to the proposed fish ladder upstream at the diversion dam. The TWG also explored options for creating effective downstream passage and determined that shaping downstream flows to provide alternative fish passage routes past the powerhouse intake is also needed.

The Parties agreed to evaluate raising the pool for the OSHP to (1) provide additional capability for managing flows from the OSHP's diversion pool to enhance upstream attraction to the fish ladder entrance, and (2) shape downstream flows to benefit down-migrant survival. In addition, the DVWD would be able to use the increased hydraulic pressure resulting from the increased head to increase the OSHP's generation, which would partially offset the cost of constructing fish passage.

The DVWD commissioned a feasibility study, completed in 2010, that confirmed that the OSHP can handle an increase in normal maximum pool elevation to 2,010.21 feet (2,012 feet LPD). This upper limit is imposed by the presence of a Wild and Scenic River boundary upstream of the OSHP impoundment. Given the margin of between the normal maximum pool elevation of 2007.21 (2009 feet LPD) and the boundary, and the safety mechanisms afforded by the flashboards (which "trip" at certain flows), the BLM has indicated that maintenance of the pool at this elevation for purposes of facilitating fish passage would not be inconsistent with the Outstanding Resource Values of the Lower Crooked River Wild and Scenic River, but the BLM will not make a formal determination until it has received the request for additional rights of way to new federal lands (J. Eisner, BLM, Prineville Office, personal communication).

The desire to manipulate water through the OSHP provided by raising the pool led to the development of the BFAA. The BFAA is a mechanism for providing additional flows at the request of Fish Managers to enhance fish passage conditions. The BFAA establishes an accounting method for converting a portion of new hydropower generation (as a result of the pool raise) into water The DVWD will administer the BFAA and respond to requests from the Fish Managers to release additional flows into the bypass reach.

4.3.2 SETTLEMENT AGREEMENT

In October 2011, the Parties signed a Settlement Agreement (Original Settlement Agreement) that includes proposed license articles. The Settlement Agreement was revised and restated in October of 2015 to reflect a more current understanding of the proposed facilities and their operation (Settlement Agreement). The Settlement Agreement also specifies actions the Parties will undertake to develop the amendment application and to implement the provisions of the Settlement Agreement throughout term of the amended license. The following Parties signed the Settlement Agreement:

- Deschutes Valley Water District
- U.S. DOI Bureau of Indian Affairs

- U.S. DOI Bureau of Land Management
- U.S. DOI Fish & Wildlife Service
- National Marine Fisheries Service
- Oregon Department of Fish & Wildlife
- Trout Unlimited

The CTWS have been monitoring discussions regarding fish passage at OSHP and have been regularly briefed by the federal trustees and ODFW (as co-manager) throughout the negotiation process. In a letter dated August 16, 2011, the federal agencies formally notified the CTWS of their intent to sign the Settlement Agreement and invited the CTWS to submit any objections; no objections were received.

Given their status as natural resource co-managers, the CTWS may participate in implementation of the Settlement Agreement through the FPWG; however, they will not have voting privileges until they formally sign the Agreement. The CTWS may sign the Agreement at any time without further approval of the Parties. Upon doing so, the CTWS will have all the rights and obligations described in the Settlement Agreement and its appendices.

The Settlement Agreement comprises three parts:

1. General Provisions that include the legal definitions and standards of the Agreement.
2. Proposed License Articles (PLAs, Appendix A to the Agreement) that establish the licensee's obligations that will be enforceable by the FERC if they are included in the license. The PLAs specify the design requirements of the fish passage facilities, the monitoring and evaluation program, and the adaptive management provisions. The Parties intended to draft the PLAs to meet FERC's need to monitor and enforce DVWD's compliance during the remaining term of the amended license.
3. The Fish Passage and Protection Plan (Appendix B to the Agreement) is a technical appendix that provides details on the fish passage facilities to be constructed, the monitoring and evaluation program, the adaptive management options, and DVWD's roles and responsibilities of under the license amendment, and the roles and responsibilities of the other Parties under the Agreement. Appendix B establishes the FPWG, which will coordinate communication and consult on decisions as needed to implement the Agreement.

4.3.3 STAGE 1 CONSULTATION

Table 5-1 summarizes the key milestones of DVWDs' Stage 1 consultation steps.

TABLE 5-1 STAGE 1 CONSULTATION MILESTONES

ACTIVITY	DATE	RELEVANT REGULATORY GUIDANCE	DOCUMENTATION
First Stage Consultation			
File Initial Consultation Document, Public Notice	December 21, 2011	18 CFR § 4.38, §4.201	FERC E-library (Accession No. 20111221-5011)
Notify FERC of date for Joint Meeting (Public Meeting)	January 23, 2012	18 CFR §4.38(b)(4)	Exhibit B FERC E-Library (Accession Number 20120120-5042)
Designation of DVWD as FERC's non-federal representative to conduct consultation with USFWS and NMFS	January 19, 2012		Exhibit B FERC E-Library (Accession Number 20120123-0011)
Hold Joint (Public) Meeting	February 7, 2012	18 CFR §4.38(b)(3)(B)	Exhibit B FERC E-Library (Accession Number 20120307-0002)
Comments, Information Requests from Stakeholders		18 CFR §4.38(b)(5)	Exhibit B
	April 3, 2012 (National Oceanic and Atmospheric Administration)		FERC E-Library (Accession Number 20120307-0002)
	April 5, 2012 (Oregon Department of Fish & Wildlife)		FERC E-Library (Accession Number 20120405-517)
	April 9, 2012 (Bureau of Land Management)		FERC E-Library (Accession Number 20120409-5044)

4.3.2 STAGE 2 CONSULTATION

Stage 2 consultation is the information-gathering phase of the pre-filing process and involves completing studies and developing information that will be used in the NEPA process. Table 5-2 summarizes the information needs identified in the Initial Consultation Document and subsequent agency comments. The status of each item is indicated.

TABLE 5-2 STAGE 2 CONSULTATION GOALS – INFORMATION DEVELOPMENT

W-1: Water Quality	In anticipation of needing a Water Quality Certification from the Oregon Department of Environmental Quality (ODEQ) according to Section 401 of the Clean Water Act, DVWD has begun collecting data from the OSHP forebay and tailrace. These data will inform the assessment of the Proposed Action's potential effects, positive or negative, on water quality. **Status:** Data have been collected and reviewed. Section 6.3.2 summarizes the key findings. Per agreement with ODEQ; a Draft 401 Certification Application will be filed in the fall of 2015
F1: Facility Design	A final design of the fish ladder and associated facilities is critical for determining how the OSHP will operate to benefit fish and aquatic resources. Key information to be developed will include: • location of the ladder entrance and exit cell in relation to OSHP features; • size and configuration of the fish ladder and any Alternative Water Supply (AWS) system; • location, configuration, and hydraulic capacity of proposed spillway gates; • configuration and energy dissipation characteristics of the spillway below the spillway gates; • anticipated construction methods, timing, and permitting needs; and • any necessary modifications of boulders below the diversion structure to facilitate access to the ladder. **Status:** The Fish Agencies have approved a final design subject to review and approval of FERC's Regional Engineer and the Division of Dam Safety and Inspections.
F2: Facility Operation	Operation of the facility, particularly the spillway gates, will require additional understanding of the relationship between down-migrant timing, river flows, and up-migrant timing, since delivery of spillway flows may influence ladder entrance cell characteristics. This will require further development of a model of downstream migrant mortality (DMM) to establish operating rules for water management through the spillway facilities. The DMM model will establish survival estimates for spillway and turbine passage under current and proposed conditions using existing information and established relationships from recent fish passage literature. **Status:** A DMM model has been completed and is summarized in Section 6.4.4 and in the Biological Assessment (BA).
F3: Swimming Speed Analysis	A swimming speed analysis is needed for key fish species to understand any risks of turbine strike for upstream migrating fish that explore the powerhouse draft tubes under a range of normal operating conditions. **Status:** Complete and summarized in Section 6.4.2 and in the BA.

B-1: Invasive Species Investigation	An investigation is needed into the presence and potential extent of the invasive species *Phragmites australis* on the east bank in the area that will be inundated by the higher pool. Results of this investigation will be used to determine potential protection, mitigation, and enhancement measures (PMEs). **Status:** According to correspondence with the BLM, this information request has been deemed unnecessary (see Consultation Record, Exhibit B).
R2: Project Boundary Delineation	Existing Exhibit G maps for the OSHP are out of date and will need to be brought up to current FERC standards described in 18 CFR §4.39. This analysis will also be important to clarify implications for a right-of-way request to the BLM. **Status:** The application includes revised preliminary Exhibit G maps showing the proposed boundary and land ownership information. The proposed Exhibit G maps are being prepared in conformance with 18 CFR §4.39.
R3: Visual Impact Study	DVWD will contract with a qualified consultant to provide an assessment of the visual effects of the proposed alternatives. This analysis will help inform the BLM's Wild and Scenic Rivers 7(d) Analysis (Study R1, not referenced here). **Status:** A draft study report has been reviewed by the BLM. Comments will be incorporated into a final report and filed as supplemental information. However, comments and recommendations from the BLM have been incorporated into the section 6.8 of this APEA and are included in the Consultation Record (Exhibit B).

4.5 CONSULTATION ON APEA

The DVWD issued a draft APEA and Biological Assessment (BA) on July 13, 2015. At that time, DVWD requested comments within 60 days. As documented in Exhibit B, comments on the APEA were received from the BLM, NMFS, USFWS, and ODEQ. Concurrent to the comment period, Parties reviewed the 2011 Settlement Agreement, as amended, for necessary updates. A restated settlement agreement, with updated appendices is being filed concurrently with the amendment application. The restated settlement agreement incorporates a previously adopted amendment and makes conforming changes to the appendices to reflect minor changes to the proposed facilities.

On April 6, 2016 FERC provided Notice of the availability of the Environmental Assessment, in which FERC adopted the 2015 APEA as its own. No comments on the substance of the APEA were submitted in response.

4.5 CONSULTATION ON APEA

In December of 2016, the DVWD opened construction bids for the new facilities, in anticipation of receiving a license amendment in early 2017. The cost of construction was significantly higher than expected. The DVWD was unable to justify bridging the gap between available funds for construction and the low bid with its own resources.; therefore, DVWD asked FERC for an abeyance on the amendment proceeding in order to consult with Parties to the 2015 Agreement.

DVWD held several meetings with Parties in early 2017; it was determined that the project would be modified to eliminate some features and reduce the scale of the intended pool-raise. The Parties met several times in the spring and summer of 2017 ensure the revised plans aligned with the intent of the agreement and the Proposed Action from the 2015 APEA.

4.5 STATUTORY AND REGULATORY REQUIREMENTS

4.3.3 FEDERAL POWER ACT

5.4.1.1 SECTION 18

According to Section 18 of the Federal Power Act (FPA), the USFWS and NMFS have the authority to prescribe fishways at dams. No prescriptions were filed when the OSHP license was issued in 1982, nor did agencies request a reservation of authority to prescribe fishways in the future. DVWD and the resource agencies have determined, however, that it would be beneficial to amend the existing license to allow for fish passage to occur at the OSHP. The USFWS and NMFS have the authority to prescribe Section 18 conditions in the context of the license amendment.

It is anticipated that NMFS and USFWS will provide mandatory conditions pursuant to their Section 18 authority that will be consistent with the PLAs of the Settlement Agreement.

5.4.1.2 SECTION 4(E)

Section 4(e) of the FPA provides that any license issued by FERC for a project within a federal reservation shall be subject to and contain conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation.

The BLM is the federal land manager for much of the project area upstream of the OSHP impoundment. The expanded reservoir will require an amended right-of-way. DVWD provided the BLM with an SF-299 describing the proposed activities and identifying the federal lands that will be necessary to construct and operate the proposed project.

The BLM anticipates that its 4(e) conditions will be consistent with the Settlement Agreement. This could include a requirement to obtain a right-of-way from the BLM.

5.4.1.3 SECTION 10(J)

Under Section 10(j) of the FPA, each license issued by FERC shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project. FERC is required to include these conditions in a license or license amendment order unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable laws.

ODFW anticipates that its 10(j)s will be consistent with the Settlement Agreement. When Section 10(j) recommendations are submitted, then FERC will be required to make a determination regarding whether the recommendations of the federal and state fish and wildlife agencies are consistent with the purpose and requirements of Part I of the FPA and applicable law. Section 10(j) of the FPA states that whenever FERC believes that a fish and wildlife agency's recommendation may be inconsistent with the purposes and requirements of the FPA or other applicable law, FERC and the agency shall attempt to resolve any such inconsistency, giving due weight to recommendations, expertise, and statutory responsibilities of such agency.

4.3.2 ENDANGERED SPECIES ACT

Pursuant to Section 7 of the ESA, federal agencies are required to consult with the USFWS and NMFS (collectively, the Services) to ensure that their actions will not jeopardize the continued existence of any federally listed species or adversely modify designated critical habitats. On January 19, 2012, FERC designated DVWD as its non-federal representative for the purpose of initiating consultation with the Services under Section 7. Federally listed species exist in the OSHP area, which is located within designated critical habitat for bull trout and essential fish habitat (EFH) for Pacific Salmon (see Section 5.3.7). Analyses of the potential effects of the Proposed Action are addressed in Section 6.4 of this APEA. A draft BA is included as Exhibit A to this APEA.

4.3.3 CLEAN WATER ACT

Under Section 401 of the Clean Water Act (CWA), an applicant for a project license or license amendment must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. The appropriate agency in Oregon is the Oregon Department of Environmental Quality (ODEQ). Relevant analyses of the potential effects of the Proposed Action are addressed in Section 6.3 of this APEA. An Application for Section 401 Certification is included as Attachment 3 to this APEA.

Section 404 of the CWA regulates removal and fill of materials in public waterways. The U.S. Army Corps of Engineers (USACE) regulates removal and fill activities on the federal level, and the Division of State Lands (DSL) administers the complementary program for the State of Oregon, pursuant to Oregon’s Removal-Fill Law (ORS 196.795.990). DSL and USACE use the same joint application form but process and issue state and federal permits separately.

4.3.2 NATIONAL HISTORIC PRESERVATION ACT

The National Historic Preservation Act (NHPA) requires federal agencies to manage cultural resources under their jurisdiction and authorizes the Secretary of the Department of the Interior to maintain the National Register of Historic Places (National Register). Section 106 of the NHPA requires federal agencies to take into account the effect of a proposed undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The agency must afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such an undertaking.

In a letter dated November 13, 2009, the Oregon Parks and Recreation Department, State Historic Preservation Office (SHPO) concurred with BLM's determination of No Historic Properties Affected by the Proposed Action (SHPO 2009).

4.3.2 WILD AND SCENIC RIVERS ACT

Section 7(a) of the Wild and Scenic Rivers Act bars FERC from licensing the construction of any dam, water conduit, or other project works on or directly affecting any river that is designated a component of the national Wild and Scenic Rivers System. This prohibition also applies to river segments designated by Congress as "study rivers" while the segment is under study. This does not, however, preclude licensing developments below or above a wild, scenic, or recreational river or any stream tributary thereto that would not invade or unreasonably diminish the scenic, recreational, and fish and wildlife values present when the river was designated a component of the Wild and Scenic Rivers System. Under Section 7(d) of the Wild and Scenic Rivers Act, the administering Secretary makes determinations regarding consistency of a project with the provisions of the Wild and Scenic Rivers Act.

The Lower Crooked Wild and Scenic River boundary is described in the Middle Deschutes/Lower Crooked Wild and Scenic Rivers' Management Plan, dated December 1992. The boundary is described as "River Mile 8, south of Opal Springs," and further described as "the North 1/16th line of Section 4, in the Metes and Bounds description under T. 13 S., R. 12 E., W.M." Because of the importance of establishing the boundary elevation with precision and confidence, DVWD contracted with CH2M Hill and a local surveyor to perform survey work to tie the metes and bounds description of the boundary to existing surveys of key Project elevations. The key findings from the survey efforts are as follows (CH2M Hill 2010):

- The metes and bounds description of the Wild and Scenic River boundary appears to be inconsistent with the designation of the River Mile (RM) 8 marker. T. 13 S., R. 12 E., WM is the more conservative description, downstream of where DVWD believes RM 8 to be.
- The surveyed elevation of the metes and bounds description where the boundary crosses the stream had a surface elevation of just above 2,010.66 feet (2,012.45 feet LPD). This elevation was measured in October 2009 during a period of low flows and, therefore, should be considered conservative. The top of the riffle below the assumed boundary was surveyed at 2,010.56 feet (2,012.35 feet LPD).
- Given that the maximum extent of the proposed increase in the pool will be to 2,010.21 feet (2,012 feet LPD) and below the visible riffle that is downstream of the Wild and Scenic River boundary, the upstream end of the impoundment under the Proposed Action will be downstream of the Wild and Scenic River boundary, and a visible break will be discernable under most flow conditions by the cascade at the downstream end of the

riffle. Note that under the 2017 revised proposal, the separation between the proposed head of pool and the lower end of the boundary is more distinct.

CH2M Hill (2010) evaluated potential effects of raising the pool on the Wild and Scenic River boundary during extreme flood conditions. An updated flood-frequency analysis identifies a peak inflow design flood (IDF) of 8,000 cfs (approximate 100-year event) based on a 48-year period of record at U.S. Geological Survey (USGS) Gage No. 14087400 on the Crooked River below Opal Springs. Under current OSHP operations, the flashboards would be removed during a 100-year flood, and the flood flows would pass the dam's crest elevation of 2,000.21 feet without exceeding 2,008.21 feet. Under the Proposed Action, flood flows are controlled by the behavior of the flashboards, which are designed to "break away" under a critical load. This is a dam safety measure, intended to prevent a Potential Failure Mode, but it also ensures prevents encroachment on the Wild and Scenic River boundary even during the IDF.

Prior to construction, DVWD will need to obtain a determination from the BLM regarding consistency of a project with the provisions of the Wild and Scenic Rivers Act.

4.3.2 Pacific Northwest Power Planning and Conservation Act

Under Section 4(h) of the Northwest Power Act of 1980, the Northwest Power and Conservation Council develops the Columbia River Basin Fish and Wildlife Program to protect, mitigate, and enhance fish and wildlife adversely affected by the development and operation of hydroelectric projects on the Columbia River and its tributaries. The Council reviews and revises the Fish and Wildlife Program every 5 years; the current version is the 2014 Columbia River Basin Fish and Wildlife Program.[9] Pursuant to Section 4(h)(11) of the same act, all of the federal agencies responsible for managing, operating, and regulating the hydroelectric facilities in the Columbia basin (which includes FERC) have an obligation to exercise their statutory responsibilities while taking the Council's Fish and Wildlife Program into account at each relevant stage of decision making to the fullest extent practicable. According to Sections 4(d) and 4(e) of the Northwest Power Act, the Council also develops and periodically reviews a regional conservation and electric power plan to recommend new conservation and generating resources to be added to the

[9] http://www.nwcouncil.org/fw/program/2014-12/program/

region's power supply. The Fish and Wildlife Program is part of the Power Plan; the current version is the Sixth Northwest Power Plan, and the Council is at work on the Seventh.[10] Along with the provisions in the Northwest Power Act linking FERC to the Council's programs and plans, FERC has also recognized both the Council's Fish and Wildlife Program and the Council's Power Plan as comprehensive plans for the waterways in each of the four states of the Columbia basin and Pacific Northwest, according to the FPA.

With regard to the OSHP, the Council's Fish and Wildlife Program includes measures and objectives seeking improvements in fish habitat and fish population status in the Deschutes River and its tributaries, provisions found largely in the program's Deschutes Subbasin Plan. Section 3.5.1 of the Crooked River section of the Deschutes Subbasin Plan in particular calls for ODFW, the CTWS, NOAA Fisheries, USFWS and the DVWD to work together to re-establish anadromous fish passage at the Opal Springs Hydroelectric Project.[11]The proposal here is consistent with the Fish and Wildlife Program's measures and objectives for habitat and fish populations in the Deschutes River Subbasin.

The Council's Fish and Wildlife Program also includes provisions and conditions regarding the development, licensing, and re-licensing of non-federal hydroelectric projects in any subbasin, intended to protect valuable fish and wildlife resources (See 2014 Fish and Wildlife Program, at pages 52-53 and Appendix F). A review of the proposal against these conditions indicates the proposal is consistent with the protections the program seeks. This portion of the Council's Fish and Wildlife Program also designates certain river reaches in the Pacific Northwest as protected from hydroelectric development. The protected areas provisions do not apply to existing hydroelectric projects, such as the OSHP.

Finally, the program encourages consultation by project operators and proponents with federal and state fish and wildlife agencies, appropriate Indian tribes, and the Council itself during the study, design, construction, and operation of any hydroelectric development in the basin. DVWD

[10] http://www.nwcouncil.org/energy/powerplan/

[11] http://www.nwcouncil.org/fw/subbasinplanning/deschutes/plan

has been consulting with the agencies and tribes as described elsewhere and communicated with the Council's staff about the proposal in June 2015.

4.3.2 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirements of Section 305(b)(2) of the Magnuson-Stevens Act (MSA) provide that federal agencies must consult with the Secretary of Commerce on all actions, or proposed actions, authorized, funded, or undertaken, that may adversely affect EFH. This section documents EFH that may be affected by the Proposed Action and briefly discusses each managed species and life-stage for which EFH has been designated.

In a notice dated January 19, 2012, FERC formally designated DVWD as its non-federal representative for consultation with NMFS under Section 305(b) of the MSA and implementing regulations at 50 CFR Section 600.920.

The Pacific Fishery Management Council (PFMC) designated EFH for Pacific salmon in 1999 (PFMC 1999). The Lower Crooked River was designated as EFH for Chinook salmon in 2008, and the OSHP is identified as an impassible man-made barrier (73 FR 60988). The Proposed Action will result in fish passage at the OSHP and will enable adult migrants to access currently inaccessible habitat upstream of the OSHP.

Section 6.4 of this APEA and the draft BA (Exhibit A) provide an analysis of the effects of the proposed increase in the pool elevation on salmonid habitat in the Crooked River upstream of the OSHP impoundment. The Proposed Action consists of conservation measures that will benefit listed fish species, and these benefits greatly offset any minor adverse effects on the EFH of pacific salmon resulting from the inundation of 700 feet of riverine fish habitat immediately upstream of the existing OSHP impoundment. No net adverse effects will result in areas of EFH or Habitat Areas of Particular Concern for the relevant fish species.

4.3.2 COASTAL ZONE MANAGEMENT ACT

Section 307(c)(3) of the Coastal Zone Management Act (CZMA) requires that all federally licensed and permitted activities be consistent with approved state Coastal Zone Management Programs. If a project is located within a designated state coastal zone or would affect a resource located within the coastal zone, the applicant must certify that the project is consistent with the state CZMA.

Federal consistency potentially applies to any project having effects on land and water uses or natural resources of the Oregon coastal zone, but reviews by the Oregon Department of Land Conservation and Development (DLCD), the state agency in charge of implementing the CZMA, are generally only required for projects located west of the Coast Range boundary. DLCD has confirmed that it has no enforceable policies that could influence the analysis of the Proposed Action (personal communication with Bob Bailey, Oregon Coastal Zone Management Program Director; November 30, 2010).

6.0 ENVIRONMENTAL ANALYSIS

This section describes the existing environment in the OSHP area and the potential effects of the Proposed Action on the following resource areas: geology and soils; water resources; fish and aquatic resources; wildlife; threatened, endangered, and special status species; botanical and riparian resources; recreation, land use, and aesthetics; cultural resources; and socioeconomic resources. The potential cumulative effects of the Proposed Action are also described in this section. These specific resource areas are addressed based on early agency consultation, and the discussion reflects the information the agencies thought would be necessary to facilitate an informed decision about the Proposed Action.

5.3 GENERAL DESCRIPTION OF THE RIVER BASIN

The existing and proposed facilities are located in southern Jefferson County, Oregon, at Opal Springs on the Crooked River, which is a tributary of the Deschutes River. The city of Culver is approximately 7 miles east of the OSHP, and the city of Madras is approximately 15 miles to the northeast. U.S. Highway 97 passes about 5 miles east of the site. Figure 6-1 shows the OSHP's location.

The OSHP is located in the Deschutes River Basin, a major subbasin of the Columbia River, which covers over 10,000 square miles. The OSHP is located in a steep, 846-foot-deep canyon. The current impoundment is bounded by a sheer, basalt cliff face on the west and a steep boulder slide on the east. This eastern area comprises primarily dredged material from OSHP construction in the 1980s.

Figure 6-1 illustrates the position of the OSHP relative to the lower Crooked River subbasin. The Crooked River flows east to west from headwaters in the North Fork, South Fork, and Beaver Creek systems to Prineville Reservoir (RM 70), which was formed by Bowman Dam. Downstream of Prineville Reservoir are two major tributaries, Ochoco and McKay creeks, that meet the Crooked River at RMs 46 and 45, respectively. Another major impoundment in the basin is Ochoco Reservoir, impounded by Ochoco Dam at RM 10 on Ochoco Creek. The river flows out of the reservoir, passes the OSHP at RM 7, and joins the Deschutes River at Lake Billy Chinook, which was formed by Round Butte Dam at RM 111 on the Deschutes River. The head of Lake Billy Chinook is approximately one-half mile from the OSHP's powerhouse.

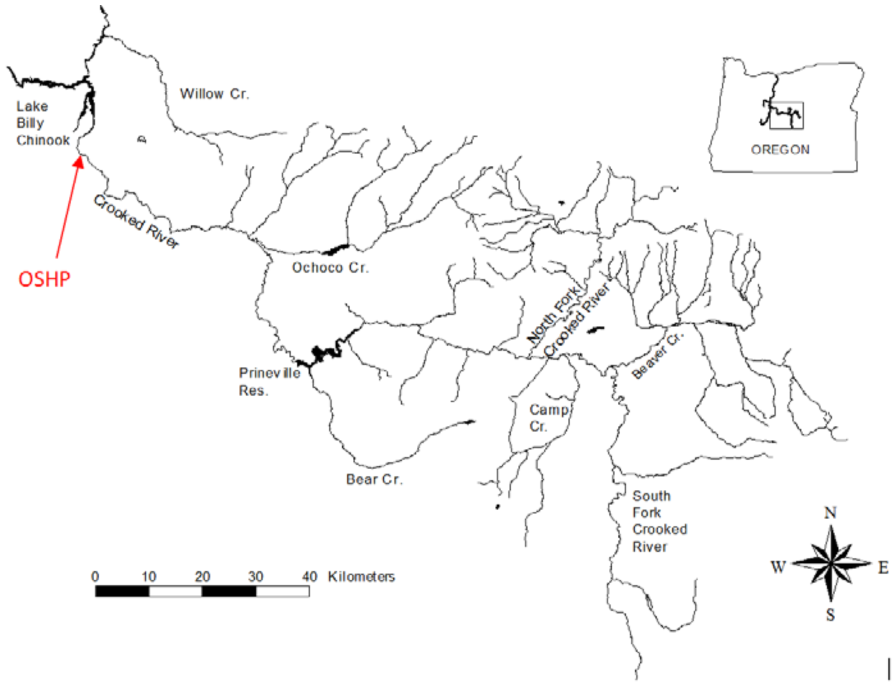


FIGURE 6-1 CROOKED RIVER BASIN
The figure shows the location of the Opal Springs Hydroelectric Project (OSHP) in relation to basin tributaries and features (modified from ODFW 1996).

The Crooked River is delineated by two subbasins: Prineville Reservoir (Bowman Dam) delineates the boundary between the upper Crooked River Basin and the Lower Crooked River Basin. Some of Crooked River's drainage basin lies within Ochoco National Forest and Crooked River National Grassland, and both the North Fork and Ochoco Creek draining the Ochoco Mountains (PGE 2010).

4.3.3 WATER USE

The Crooked River hydrograph is strongly influenced by water retention, diversion structures located throughout the basin, and spring water contributions. The Crooked River provides:

- irrigation water to approximately 20,000 acres of agricultural lands;
- recreational opportunities; and
- warm water and cold-water habitat for aquatic life.

Thousands of people visit the Crooked River every year to participate in boating, fishing, swimming, and other on-water activities (BLM 2007). Periods of high flow are a result of seasonal precipitation and runoff from the basin's tributary streams, which can contribute to water quality issues associated with non-point-source pollution (ODEQ 2010), and water quality tends to deteriorate as it moves downstream.

4.3.2 Diversions and Impoundments

The diversions and impoundments listed in Table 6-1 have been noted in the upper Deschutes River Basin.

Table 6-1 Major Dams and Diversions in the Deschutes Basin
Source: Portland General Electric Company 2010

Name	River/Water Body
Round Butte Dam	Deschutes, Crooked, and Metolius Rivers
Prineville Res. (Bowman)	Crooked River
Wickiup Reservoir	Deschutes River
Crescent Lake Dam	Crescent Lake
Crane Prairie	West Fork Deschutes River
Ochoco Reservoir	Ochoco Creek
Pelton Dam	Deschutes River
Wasco Dam	Clear Creek
Haystack Reservoir	Deschutes River
Pine Hollow Reservoir	Badger Creek and Pine Hollow Creek
Pelton Regulating Dam	Deschutes River
Allen Creek	Allen Creek
Watson Reservoir	Watson Creek
Antelope Flat	Bear and Faught Creeks and two tributaries
Brewer Reservoir	Hay Creek
Rock Creek Dam	Rock, N. Fork Gate, and Threemile Creeks
Big Three Creeks Lake	Three Creek
Little Willow Creek Res.	Little Willow Creek
Upper Tumalo Reservoir	Tumalo Creek
Lillard Dam	Twelve Mile Creek, South Fork
Bonnie View Dam	Horse Heaven Creek
Fisher-Joe Reservoir	Lytle Creek
Badger Lake	Badger Creek
Bear Creek	Bear Creek
Camp Creek No.2	West Fork Camp Creek
Three Sisters ID Reservoir	Squaw Creek
Mainline 1	Maury Creek

Name	River/Water Body
North Canal Diversion Dam	Deschutes River
Palmer Res.	South Fork Beaver Creek
Opal Springs Hydro	Crooked River
New Canyon Res.	S. Fork Crooked River

4.5 Geology and Soils

4.3.3 Affected Environment

Soils in the Crooked River Basin are a mixture of series derived from the mid-Tertiary Columbia Plateau geology, the early Tertiary clayey tuffaceous sedimentary John Day and Clarno formations, and much older Cretaceous to Paleozoic marine sedimentary formations in the Suplee-Izee area (Silvernale et al. 1976). Some soil associations are on floodplains, terraces, low benches, and alluvial fans and are formed mainly of sediments deposited by streams (USDA 1966). Other soil associations occur on the basaltic plateau, consist of soils with hardpan formed from pumiceous material, and are shallow and stony. Soils formed on forested highlands are derived from volcanic ash and soft tuffaceous rocks and are very stony soils over basalt. Soils on uplands and buttes are derived from rhyolite rock and tuff, or basalt. Most of the north-facing slopes and drainages are covered with Mount Mazama ash, giving rise to higher productivity (Jim David, Ochoco National Forest Soil Scientist, personal communication, cited in ODFW 1996). Soils in low areas often have calcic horizons and a higher pH than mountain soils.

4.3.2 Environmental Effects

6.2.2.1 Proposed Action

Direct and Indirect Effects. Implementing the Proposed Action will have limited direct effects on soils as a result of inundation. Basalt cliff is the primary substrate to be inundated. Some areas on the east bank composed of fill from the original construction will be inundated; however, reservoir fluctuation will be minimal because this is a run-of-river project.

Cumulative Effects. Cumulative effects for geology and soils were assessed at the watershed scale. Because no other projects have been identified within the watershed, no cumulative effects will occur as a result of the Proposed Action.

6.2.2.2 NO ACTION ALTERNATIVE

According to the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without any new facilities or environmental measures. Any effects of the OSHP on geology and soils would continue, as would existing environmental measures.

4.3.3 PROPOSED MITIGATION MEASURES

No specific mitigation measures are proposed at this time. Permits for facilities construction will require DVWD to ensure best practices to manage short-term disturbance of soils.

The following best management practices (BMPs) will be implemented to protect soil resources from construction-related effects:

- Prevent soil contamination by (1) collecting used oil, oil filters, and grease tubes; (2) requiring equipment operators to carry absorbent pads; (3) providing containment and clean-up for portable fuel tanks (including hose and nozzle); (4) following approved disposal methods for waste products; and (5) promptly repairing equipment leaks.
- Provide ground cover to minimize soil erosion in construction and laydown areas.
- Re-vegetate disturbed areas.
- Implement measures to minimize the erosion from cut slopes, fill slopes, and the road surface and consequently reduce the risk of sediment production.
- Incorporate drainage controls to minimize the erosive effects of concentrated water flows from road surfaces.
- Complete erosion control work prior to seasonal or extended shutdowns to minimize erosion of and sedimentation from disturbed ground.
- Use erosion control measures such as jute netting, filter fabric, mulching, slash windrows, sediment ponds, straw bale dams, or rock gabions where necessary to control erosion and stabilize side casts.
- Maintain all roads in a manner that provides for soil and water resource protection by minimizing rutting, road prism failures, side casting, and blockage of drainage facilities.
- Prepare and implement an erosion control plan for areas where ground is cleared of vegetation.

At this time, no mitigation measures have been proposed or identified related to floodplain inundation or shoreline erosion.

4.5 WATER RESOURCES

4.3.3 AFFECTED ENVIRONMENT

The Crooked River and Upper Crooked River Watershed in central Oregon is a sub-unit of the larger Deschutes Subbasin (OWEB 2007). The primary use of the OSHP impoundment is for power generation. The Crooked River receives substantial input from rain and snowmelt, and its flow has distinct seasonal variations (Nehlsen 1995). Tributaries northeast of the Crooked River are the primary sources of snowmelt and rain. These tributaries include McKay Creek, Ochoco Creek, North Fork Crooked River, and Beaver Creek. Bear Creek and Camp Creek arise in plains south of the basin, and their contribution to flow is relatively small, except in very wet years. The South Fork of the Crooked River, also a southern tributary, is fed by significant springs (Nehlsen 1995). Bowman Dam, built in 1961, and Ochoco Dam, built in 1922, have moderated the hydrograph to reduce or eliminate threats from flooding (Nehlsen 1995).

As discussed above, the OSHP will continue to take advantage of existing flows in the Crooked River to operate in a run-of-river manner. Table 6-2 presents a summary of daily average flows at the OSHP from January 1, 1980, through October 31, 2011.

TABLE 6-2 DATA FROM USGS GAGE 14087400

Corrected to account for spring flow between the diversion and the gauge. The correction is 263 cfs, based on 240 cfs of flows at the springs, and 23 cfs of groundwater accretion in the OSHP bypass reach.

DATA	AVERAGE FLOW (CFS)	MAXIMUM FLOW (CFS)	MINIMUM FLOW (CFS)
January	1,361	5,257	887
February	1,476	4,847	907
March	1,650	5,147	897
April	1,852	4,707	877
May	1,436	5,327	827
June	1,117	4,807	857
July	1,006	1,617	837
August	1,031	1,797	837
September	1,097	1,427	837
October	1,155	1,537	877
November	1,105	2,937	897
December	1,224	5,867	857
Summary	1,291	5,867	827

6.3.1.1 DRAINAGE AREA

The OSHP impoundment has a surface area of approximately 11.1 acres and a storage capacity of 106.4 acre-feet at normal maximum pool elevation of 2,004.21 feet NGVD 29. The OSHP resides in the Jefferson County Hydrologic Unit 17070305 and drains approximately 4,300 square miles, of which 500 square miles is noncontributing (CH2M Hill 2010). Flow has been regulated since 1960 by the Prineville Reservoir, with an active capacity of 152,800 acre-feet, and Ochoco Reservoir, with an active capacity of 46,500 acre-feet. There are many diversions for irrigation upstream from the OSHP, such that a significant portion of the summertime flow comes from springs within 15 miles of the OSHP (CH2M Hill 2010).

6.3.1.2 STREAMFLOW AND GAGE DATA

The average flow at Opal Springs Dam is 1,307 cfs based on data from USGS Gage 14087400 (Crooked River below Opal Springs, near Culver, Oregon). Peak flows occur in spring; low flows occur in the summer, particularly in July and August. Flow duration curves are included in Exhibit E.

6.3.1.3 EXISTING AND PROPOSED USES OF WATER

The primary role of the OSHP is for power generation. The proposed increase in the operating pool will result in additional generation using the same flows. The full potential for additional generation will be offset to the extent that flows are allocated to the bypass reach through the BFAA. The BFAA will provide a mechanism for the Fish Managers to determine the best use of water accrued to the BFAA to benefit upstream and downstream fish passage.

6.3.1.4 EXISTING INSTREAM FLOW USES

The existing FERC license for the OSHP requires a minimum bypass flow of 50 cfs to benefit fish and aquatic resources. The proposed amendment will not modify the minimum flow requirement, but through the use of the BFAA this flow will be supplemented at the request of the Fish Managers. The amount of water accrued in the BFAA will be subject to variable hydrologic conditions and to verification of actual OSHP performance once the facilities are completed; however, it is estimated that the supplemental flow available for release to the bypass reach could average 23,885 acre-feet per year (subject to verification as described in the Settlement Agreement, Appendix A). This water will not be stored, but will be redirected in requested increments from the OSHP intake and into the bypass reach.

6.3.1.5 EXISTING WATER RIGHTS

DVWD has an existing Permit to Appropriate the Public Waters dated from 1982 for 1,772.5 cfs. The proposed facilities will require DVWD to file an amendment to Permit 47591 pursuant to ORS 534.092 and update its exhibit drawings with the Oregon Water Resources Department to reflect the proposed pool elevation. The application to amend the permit was submitted on October 6, 2015.

6.3.1.6 WATER QUALITY

Available data indicate that Crooked River water quality is relatively good in the vicinity of the OSHP due to the strong influence of groundwater springs. However, the OSHP is embedded within a 51-mile segment of the Crooked River (extending upstream from the mouth) that is on Oregon’s 303(d) list of streams with impaired water quality. The 303(d) listing is due to elevated summer temperatures and high pH in areas well upstream of the OSHP (ODEQ 2011b). Those areas are less influenced by large inputs of cool, high-quality groundwater.

The ODEQ has designated a dozen beneficial uses of the lower Crooked River that must be protected (ODEQ 2011a):

-- public/domestic water supply	-- private/domestic water supply
-- industrial water supply	-- irrigation
-- livestock watering	-- fish and aquatic life
-- wildlife and hunting	-- fishing
-- boating	-- water contact recreation
-- aesthetic quality	-- hydropower

In order to protect these beneficial uses, ODEQ has established water quality standards that must be met. Specific water quality standards that apply to the segment of Crooked River within which the OSHP is embedded are given in Table 6-3.

TABLE 6-3 OREGON WATER QUALITY STANDARDS FOR LOWER CROOKED RIVER, INCLUDING THE OPAL SPRINGS HYDROELECTRIC PROJECT (ODEQ 2011A)

WATER QUALITY PARAMETER	RULE	STANDARD
Temperature	340-041-0028	The 7-day average maximum temperature may not exceed 17.8ºC
Dissolved oxygen	340-041-0016	Not less than 8.5 mg/l year-round
Total dissolved gas	340-041-0031	No value above 110% saturation
pH	340-041-0021	No values below 6.5 or above 8.5
Bacteria (*E. coli*)	340-011-0009	30-day log mean $\leq$126 E. coli organisms per 100 ml based on a minimum of 5 samples; no single sample >406 organisms per 100 ml
Nuisance algae	340-041-0019	Chlorophyll-a concentrations >0.015 mg/l identify reservoir situations requiring further study
Biocriteria	340-041-0011	Sufficient quality to support aquatic species without detrimental changes in the resident biological communities

Information available on water quality in the vicinity of the OSHP comes from multiple sources, including ODEQ, the BLM, a study by researchers at the USGS, and evaluations by consultants to DVWD. This information is summarized by water quality parameter of interest.

***Water temperature*.** Water temperatures at and near the OSHP are cool, moderated by groundwater inflows, and meet the quality criteria established by ODEQ (7-day maximum <17.8ºC). Available data show 7-day maximum water temperatures a short distance upriver from the OSHP diversion pool peaked at 15.4ºC in 2004 (M. McSwain, Prineville BLM, unpublished data). continuous records for the USGS gauge on Crooked River less than half a mile downstream of the OSHP (No. 14087400) show annual peaks in 7-day maximum temperatures ranging from 14.0ºC to 14.4ºC during 2006 through 2014 (USGS Gage 14087400 [Crooked River below Opal Springs, near Culver, Oregon]).

Water temperature data collected at the OSHP during 2009 by consultants to DVWD (Figure 6-2) show very minor differences in temperature between inflows and outflows from the OSHP diversion pool. Those data also show measurable (and favorable) decreases in temperature from the upper to lower end of the project diversion reach. Approximately 23 cfs of cool groundwater entering within that reach is diluted less by Crooked River flows than it would be under natural conditions.

***Dissolved oxygen*.** All measurements that have been taken of dissolved oxygen at or near the OSHP meet ODEQ water quality standards. Measurements taken during summer by ODEQ (2011c) ranged from 9.5 to 10.0 mg/l. Dissolved oxygen data collected at the OSHP during 2011 by consultants to DVWD suggest no water quality problems. These data are going through a quality assurance process at present and will soon be available for discussion.

***Total dissolved gas*.** There are no indications that total dissolved gas levels at the OSHP exceed state standards.

***pH*.** Judging from the measured water chemistry of profuse springs discharging into the Crooked River canyon in and above the vicinity of the OSHP, natural pH levels in the area exceed 8 during at least portions of the year but fall within a desired range of 6.5 to 8.5. ODEQ (2011c) measured pH to be 8.3-8.4 at the OSHP during an afternoon in early August 2005 and recorded a mid-morning pH value of 7.9 at the OSHP in late July 2009. The ODEQ measurements were within about the same range recorded by USGS researchers examining the Crooked River just above the OSHP diversion pool during 2005. Those researchers measured pH at 8.0-8.2 on an afternoon in May and at 8.2-8.4 on an August afternoon (M. McSwain, Prineville BLM, pers comm.). The pH values measured by ODEQ and by the USGS are reasonably consistent with data collected by consultants to DVWD during 2011 in and downstream of the OSHP diversion pool. These more recent data suggest that there may be infrequent, brief, and localized exceedances of the Oregon standard for pH at the OSHP associated with seasonally abundant aquatic macrophytes in portions of the OSHP diversion pool. Consultants to DVWD are working with ODEQ to develop a better understanding of these exceedances, to estimate the extent to which the proposed increase in the pool might influence their frequency or magnitude, and to identify any mitigation measures that might be appropriate if further monitoring suggests that such measures would be beneficial.

***Bacteria (E. coli)*.** *E. coli* bacteria are a potential concern along segments of the Crooked River that are a considerable distance upstream from the OSHP. Most potential sources of this contaminant are found above the Highway 97 bridge, *E. coli* in the river at or above the bridge become diluted by profuse groundwater discharges that occur in the canyon within which the OSHP is located.

Nuisance algae. Water passing through and past the OSHP is very clear during seasons that plankton might bloom, and there are no indications that chlorophyll-a reaches threshold levels at the OSHP.

Biocriteria. There are no indications that water quality at the OSHP is not fully supportive of native aquatic species.

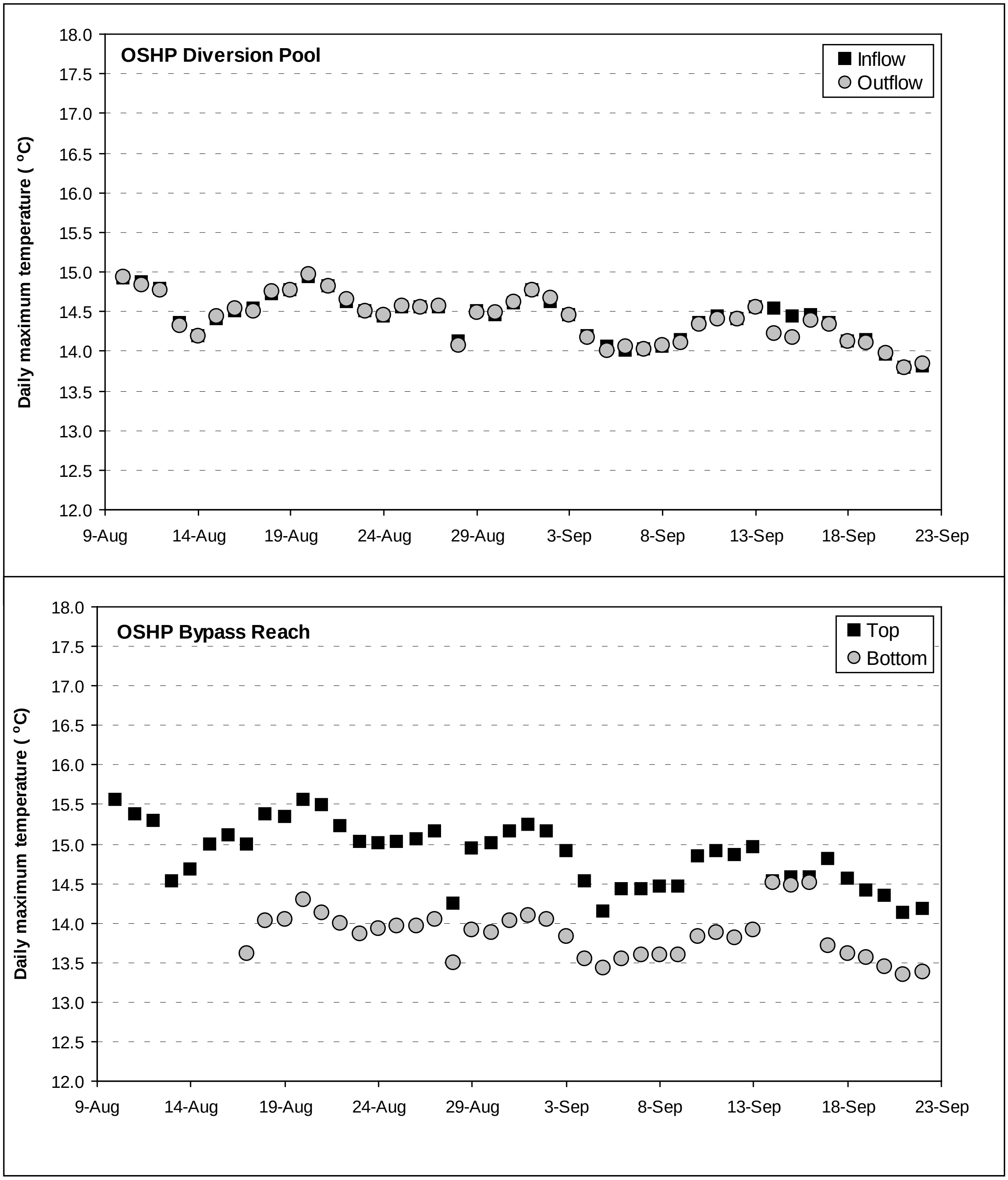


FIGURE 6-2 WATER TEMPERATURES MEASURED AT THE OPAL SPRINGS HYDROELECTRIC PROJECT DURING AUGUST AND SEPTEMBER 2009

4.3.2 ENVIRONMENTAL EFFECTS

6.3.2.1 PROPOSED ACTION

Direct and Indirect Effects. As a result of the proposed action, the timing and volume of bypass flows will be modified to benefit fish resources. Preliminary modeling of the BFAA indicates that 23,885 acre-feet[12] will be available to the Fish Managers annually under initial conditions following completion of the facilities. These values are unchanged between the 2015 Proposed Action and the 2017 Proposed Action, as revised. These quantities are subject to verification and modification as described in the Settlement Agreement, Appendices A and B, and could become as great as an estimated 42,993 acre-feet by the end of the license period if necessary to meet agreed upon fish passage performance objectives. The two BFAA levels just mentioned would be equivalent to annual supplements to bypass flows averaging approximately 33 cfs and 59 cfs, respectively. Downstream of the bypass reach, below the OSHP, flows are expected to remain unchanged.

Water quality effects of the proposed action are likely to be localized, brief, and within state standards. For example, the residence time of water in the pool will increase, but preliminary modeling indicates that the effect will be minimal and the OSHP will continue to meet state standards. The temperature of water in the pools below the dam will benefit at certain times of the year because the new facilities will reduce the amount of thin sheet flow that currently flows over the dam face (through seepage through the flashboards).

A 401 certificate will be required as part of the amendment process. DVWD has been collecting OSHP-specific data on parameters of interest to ODEQ, and more robust water quality analyses are being conducted to support that process.

Cumulative Effects. Cumulative effects for water resources were assessed at the watershed scale. Because no other projects have been identified within the watershed, no cumulative effects will occur as a result of the Proposed Action.

[12] This value is derived from looking at average flows at the OSHP over a 50-year period and estimating turbine discharge after factoring in hydraulic capacity and bypass flow requirements to derive an average estimated turbine discharge. This estimate is then converted to acre-feet based on formulae provided in Appendix A to the Settlement Agreement.

6.3.2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, with no new facilities and no environmental measures. Any effects of the OSHP on water quality or quantity would continue, as would existing environmental measures. There would no mechanism for banking water under the BFAA.

4.3.3 PROPOSED MITIGATION MEASURES

No mitigation measures are proposed at this time. Permits for facilities construction are likely to require DVWD to ensure best practices to manage short-term disturbance of water quality parameters, and the state water quality certification through Section 401 of the Clean Water Act may result in additional measures (mandatory conditions).

4.5 FISH AND AQUATIC RESOURCES

4.3.3 AFFECTED ENVIRONMENT

Bowman Dam delineates the Lower and Upper Crooked River subbasins. The reservoir provides irrigation water during the summer. Consequently, flows immediately below that dam result in locally cooler water, benefitting coldwater fisheries (NPCC 2004; USDI 1992). ODFW manages that cooler section of river primarily for native redband trout (CRWC 2002). Threatened and endangered fish species in the OSHP area include bull trout (*Salvelinus confluentis*) and summer steelhead (*Oncorhynchus mykiss*) that are part of the Mid-Columbia River (MCR) distinct population segment (DPS). These species and potential effects on them are described generally here; information specific to their regulatory status is described in Section 6.6. Chinook salmon (*Oncorhynchus tshawytscha*) are also addressed in Section 6.6 because of the overlapping management priorities.

6.4.1.1 EXISTING AND HISTORIC FISH USE

Table 6-4 lists historic and current fish species in the Crooked River. The lower river section upstream of Opal Springs currently supports native redband trout and a common assemblage of nongame fish. Although hatchery trout have not been stocked below Prineville Reservoir (and Bowman Dam) since 1975, some emigration from that reservoir has resulted in small numbers of brown and bullhead trout, and largemouth, and smallmouth bass in the Crooked River downstream (BOR 2003). Below Opal Springs Dam, kokanee, mountain whitefish, redband, bull, brown, and hatchery rainbow trout are present. As described below, since 2007 the Crooked River has been seeded with juvenile Chinook and steelhead and has provided rearing habitat for these fish.

OSHP has been a near-complete to complete barrier to upstream migrations of game fish including redband and bull trout, and mountain whitefish, since the dam was renovated and retrofitted in 1982. Anecdotal reports suggest that upstream passage may have occurred during periods of peak runoff in some years, although the magnitude of any such passage is unknown. Given the implementation of the anadromous fish reintroduction plan, restoring fish passage at OSHP is a high priority.

TABLE 6-4 HISTORICAL AND CURRENT FISH SPECIES IN THE CROOKED RIVER BASIN

(Updated from ODFW, 1996; Brett Hodgson, personal communication)

COMMON NAME	SCIENTIFIC NAME	ORIGIN	STATUS	ABUNDANCE
Pacific lamprey	*Entosphenus tridentatus*	Native	Extirpated	
Summer steelhead	*Oncorhynchus mykiss*	Native	Present	Reintroduced fry and smolts only
Redband trout	*Oncorhynchus mykiss*	Native	Present	Moderate
Bull trout[1]	*Salvelinus confluentis*	Native	Present	Rare
Kokanee[1]	*Oncorhynchus nerka*	Native	Present	Abundant
Chinook salmon	*Oncorhynchus tshawytscha*	Native	Present	Reintroduced fry and smolts only
Mountain whitefish	*Prosopium williamsoni*	Native	Present	Abundant
Brown trout[1]	*Salmo trutta*	Introduced	Present	Locally abundant
Brown bullhead	*Ictalurus nebulosus*	Introduced	Present	Moderate
Largemouth bass[2]	*Micropterus salmoides,*	Introduced	Present	Rare
Smallmouth bass[2]	*Micropterus dolomieui*	Introduced	Present	Rare
Black crappie[2]	*Pomixis nigromaculatus,*	Introduced	Present	Rare
Bluegill	*Lepomis macrochirus,*	Introduced	Present	Moderate
Shorthead sculpin	*Cottus confuses*	Native	Present	Unknown
Torrent sculpin	*Cottus rhotheus*	Native	Present	Unknown
Slimy sculpin	*Cottus cognatus*	Native	Present	Unknown
Mottled sculpin	*Cottus bairdi*	Native	Present	Unknown
Prickly sculpin	*Cottus asper*	Native	Present	Unknown
Goldfish	*Carassius auratus*	Introduced	Present	Rare
Longnose dace	*Rhinichthys cataractae*	Native	Present	Moderate
Speckled dace	*Rhinichthys osculus*	Native	Present	Abundant
Chiselmouth	*Acrocheilus alutaceus,*	Native	Present	Abundant
Largescale sucker	*Catostomus macrocheilus,*	Native	Present	Abundant

COMMON NAME	SCIENTIFIC NAME	ORIGIN	STATUS	ABUNDANCE
Bridgelip sucker	*Catostomus columbianus*	Native	Present	Very abundant
Northern squawfish	*Ptychocheilus oregonensis*	Native	Present	Moderate
Carp	*Cyprinus carpio*	Introduced	Present	Rare
Crayfish	*Pacifastacus leniusculus*	Native	Present	Very abundant

[1]Present only below OSHP
[2]Present in upper tributaries or otherwise not in immediate vicinity of OSHP

With anadromous fish passage blocked by the PRB Project, fish concerns at the OSHP in the early 1980s were primarily for loss of passage for resident fish species and mortality from the turbines. CH2M Hill conducted a downstream passage study in the spring of 1982. The study captured 118 fish, of which 48 were trout or kokanee; CH2M Hill estimated annual mortality of 10 salmonid fish from the turbines. On the basis of estimated low fish mortality from fish entering the power facilities, no screens or louvers were required for the diversion. To mitigate possible losses, the DVWD released hatchery Chinook salmon and rainbow and brown trout at Opal Springs from the time the dam was rebuilt in 1985 until 2009. Typically, 10,000 rainbow trout were released annually below the OSHP, and brown trout were occasionally raised as well. All fish were fin clipped. Spring Chinook salmon were released there in 1985-86. Since 2009, the hatchery at Opal Springs has been rearing summer steelhead from the Pelton Round Butte Hatchery as part of the anadromous fish reintroduction effort.

Fish habitat that may be affected by proposed changes of the OSHP includes the 0.26-mile-long OSHP bypass reach, the existing impoundment, and three habitat units immediately upriver: a boulder riffle about 130 feet long, a riverine pool about 450 feet long, and a boulder cascade/rapid about 140 feet long. Habitat in the bypass reach is of high quality; supports high numerical densities of redband trout and mountain whitefish; and is also occupied by brown trout, bull trout, sculpin, suckers, and northern pikeminnow (DVWD, unpublished data). Cursory snorkel surveys suggest that fish numbers within the OSHP diversion pool are relatively low (Hodgson pers. comm. 2009; ODFW, pers. comm.). USGS researchers have sampled the three habitat units immediately upstream of the impoundment. During late July 2004 they found a fish assemblage dominated by abundant redband (rainbow) trout from 2 to 18 inches long (Torgerson et al. 2007). Other species present included sculpin, suckers, sticklebacks, and minnows, including northern pikeminnow from 9.5 to 12 inches long.

A habitat survey completed by ODFW in 1997 found no spawning gravel in the three habitat units immediately upstream of the OSHP impoundment (ODFW 2009). However, a habitat survey conducted in this area during 2004 by the USGS (Torgerson et al. 2007), suggests that spawning gravel is present in the boulder cascade/rapid (approximately 900 ft^2).

Turbine Conditions. At flows below 1,822.5 cfs nearly all downstream migrants would pass through the unscreened OSHP powerhouse and turbine. No turbine passage studies have been performed at OSHP, but a site-specific literature review suggests that the survival rate for parr and smolt steelhead passing through the Opal Springs turbine is likely to fall within the range of those estimated for other small Kaplan-equipped installations where passage of salmonids has been investigated. Survival estimates in those studies ranged from 86.4% to 100.0% and averaged 93.5% (Ecological Services 2006). The survival of bull trout and larger rainbow trout that might be entrained at Opal Springs is more difficult to predict due to the general lack of entrainment studies on large salmonids. However, fish length has been found to be one of the most important variables affecting turbine mortality (CH2MHill 2003), and larger fish generally experience greater mortality. EPRI (1987) indicated that turbine operating and design characteristics affect fish mortality rates. Generally, rapid pressure drops (including cavitation), higher head differential across the turbine, and low turbine efficiency may increase fish mortality. Characteristics of the Opal Springs facility would tend to make it “fish friendly” in regards to these mortality factors (Ecological Services 2006).

Spillway Conditions. At flows greater than 1,822.5 cfs, water spills over the existing flashboards. Any fish that also pass over the dam drop approximately 6 feet and must navigate a roughened dam face. According to the Proposed Action, DVWD will greatly increase its ability to control where and when water spills at the OSHP with the addition of Gate 1. The preliminary design for the new dam crest will include a downstream flow control gate, dedicated to fish passage. The downstream dam face below the gate will be smoothed and provisions will be made to soften the transition from the pool to spillway within areas dedicated to fish passage.

Turbine Strike. There is no tailrace barrier below the OSHP powerhouse, and discharge from the powerhouse could attract fish. The draft tubes extending from the turbines are 63 feet long and unlighted. Velocities exiting the draft tubes are high, but a swimming speed analysis suggests that salmon and steelhead being reintroduced to the area may be physically capable of reaching the OSHP turbine and being struck by turbine blades if strongly attracted to powerhouse discharges (Huntington 2015). Despite having the physical ability to reach the turbine from the OSHP tailrace, none of the nearly 100 salmon and steelhead that have entered the tailrace in the last few years have exhibited a strong attraction to the powerhouse, and most have migrated up into the bypass reach. The swimming speed analysis suggests that resident trout and other species in the area probably are incapable of reaching the turbine (Huntington 2015).

6.4.1.2 OPERATIONS AND RUN TIMING

The precise migration timing of anadromous salmonids and other resident fish that will pass the OSHP is uncertain and will affect the pattern of use of the BFAA, as well as how water is physically managed at the OSHP through proposed gates, weirs, and any AWS associated with the diversion structure. Section 5.7.1 describes initial assumptions about how flows at the OSHP may relate to run-timing. However, this will be an adaptive management opportunity as described in Attachment 1 and its associated appendices; a preliminary Operating Plan will be developed in conjunction with the facility design.

4.3.2 ENVIRONMENTAL EFFECTS

6.4.2.1 PROPOSED ACTION

Direct and Indirect Effects. Under the Proposed Action, the direct and indirect effects on fish and aquatic resources would be providing fish passage and raising the pool. The implementation of upstream and downstream fish passage, combined with operation of the BFAA is described in the 4.3.3 above. Little information is available with regard to timing of fish runs and how they will interact with the facilities and operations. During final design of the fish ladder and flow structures, a preliminary operating plan will be developed that can be refined through the adaptive management process.

The most immediate and significant effects of providing fish passage through the proposed facilities is the reconnection of habitat above and below the OSHP, which will complement critical life-history needs of many species of management concern. This includes reestablishing access to productive spawning and foraging habitats upstream of the OSHP and creating alternative fish-friendly routes of downstream passage for out-migrating fish.

Potential adverse effects of the proposed action include:

- increased injury and mortality for fish that use the new ladder and then fall back through the OSHP's turbine, include foraging bull trout;
- increase in predator habitat in the Opal Spring's impoundment; and
- loss of a small portion of potentially productive habitat in the pool-riffle area immediately upstream of the current impoundment.

Cumulative Effects. Cumulative effects for fish and aquatic resources were assessed at the basin and sub-basin scale. The proposed action will significantly enhance the effort in progress to improve habitat conditions and provide passage in the Lower Crooked River and will improve the chances of success of the reintroduction overall.

6.4.2.2 No Action Alternative

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any effects of the OSHP on geology and soils would continue, as would existing environmental measures.

4.3.3 Proposed Mitigation Measures

Appendices A and B of the Settlement Agreement describe agreed-to performance metrics for upstream and downstream passage, and these metrics are thought to be both realistic and sustainable. The appendices also describe the adaptive management opportunities that are available if performance objectives are not reached.

4.5 Wildlife

4.3.3 Affected Environment

The terrestrial wildlife in the Lower Crooked River subbasin includes 77 species of mammal, 181 species of bird, 16 species of reptile, and 10 species of amphibian (ODFW 2002). Noting that the aquatic environment and associated riparian vegetation of the subbasin are critical features for wildlife, ODFW identified the species listed in Table 6-5 as potentially dependent on riparian habitat in the lower Crooked River Basin (CRWC 2002). Inclusion in this list does not necessarily indicate that a given species uses riparian habitat in the OSHP area.

From 1988 through 1998, PGE surveyed waterfowl, water birds, and raptors in the PRB Project area (Concannon 1998) and recorded the following numbers of species: 30 species of duck, goose, merganser, and swan; 14 raptor species; 10 species of grebe, loon, cormorant, and coot; 6 species of gull and tern; and 13 species of heron and shorebird. Some of these species may occur in the OSHP area.

Section 6.7 identifies sensitive or strategic species identified by BLM that may be in the area. During a fall 2010 tour of the OSHP area, BLM personnel noted that they did not see any potential effects on these species, including bats, eagles, and peregrine falcon.

TABLE 6-5 WILDLIFE SPECIES IDENTIFIED BY ODFW (2002) AS POTENTIALLY FOUND IN ASSOCIATION WITH RIPARIAN HABITAT IN THE LOWER CROOKED RIVER BASIN.

COMMON NAME[1]	SCIENTIFIC NAME
Tailed frog[2]	*Ascaphus truei*
Oregon spotted frog	*Rana pretiosa*
Long-toed salamander	*Ambystoma macrodactylum*
Garter snake	*Thamnophis elegans; T. sirtalis*
Gopher snake	*Pituophis catenifer*
Western rattlesnake	*Crotalus viridis*
Barrow’s goldeneye	*Bucephala islandica*
Bufflehead	*Bucephala albeola*
Mallard	*Anas platyrhynchos*
American bittern	*Botaurus lentiginosus*
Mountain quail	*Oreortyx pictus*
Ruffed grouse	*Bonasa umbellus*
Bald eagle	*Haliaeetus leucocephalus*
Osprey	*Pandion haliaetus*
Willow flycatcher	*Empidonax traillii*
American dipper	*Cinclus mexicanus*
Bank swallow	*Riparia riparia*
Beaver	*Castor canadensis*
Otter	*Lontra canadensis*
Muskrat	*Ondatra zibethicus*
Raccoon	*Procyon lotor*
Mink	*Neovison vison*
Rocky Mountain elk	*Cervus canadensis*
Mule deer	*Odocoileus hemionus*
Townsend’s big-eared bat	*Corynorhinus townsendii*
Long-eared bat	*Myotis evotis*
Silver-haired bat	*Lasionycteris noctivagans*
Coyote	*Canis latrans*

COMMON NAME[1]	SCIENTIFIC NAME
Bobcat	*Lynx rufus*
Cougar	*Puma concolor*
Black bear	*Ursus americanus*

[1] Species lists are not exhaustive, and species identified in the table may or may not be found in or adjacent to the OSHP area

[2]ODFW (CRWC 2002) indicates that the distribution of the western toad (*Anaxyrus boreas*) and Columbia spotted frog (*Rana luteiventris*) are limited to the upper Crooked River basin.

The peregrine falcon (*Falco peregrinus*) was delisted from the ESA in 1999, although BLM continues to consider it a sensitive species. It is not known to be a permanent resident of the OSHP area (USFS 1989). There appear to be no records of this species being found in the OSHP area, and it was not observed during the 1988–1998 surveys conducted in the PRB Project area (Concannon 1998). Other BLM-identified species of interest are listed in Exhibit C, Attachment 4.

4.3.2 ENVIRONMENTAL EFFECTS

6.5.2.1 PROPOSED ACTION

Direct and Indirect Effects. To the extent that raising the pool affects riparian vegetation is affected by the pool raise, so also will it affect riparian-dependent wildlife species. Potential effects of the Proposed Action should be limited in spatial area, and over time. As plant species colonize the new shoreline, these wildlife species are likely to exist at levels similar to those under existing conditions.

Cumulative Effects. Cumulative effects for wildlife resources were assessed at the watershed scale. Because no other projects have been identified within the watershed, no cumulative effects will occur as a result of the Proposed Action.

6.5.2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any effects of the OSHP on wildlife would continue, as would existing environmental measures.

4.3.3 PROPOSED MITIGATION MEASURES

No specific mitigation measures are proposed at this time. Permits for facilities construction are likely to require DVWD to ensure best practices to manage short-term disturbance of wildlife.

4.5 THREATENED, ENDANGERED, AND SPECIAL STATUS SPECIES

4.3.3 AFFECTED ENVIRONMENT

The USFWS, NOAA, and ODFW have identified threatened and endangered species in Jefferson County as of November 2011 (USFWS 2015). This includes species that are federally listed as threatened or endangered under the ESA, and species that are candidates for federal listing under ESA. Table 6-6 shows species listed by USFWS, NOAA, and Oregon.

TABLE 6-6 THREATENED AND ENDANGERED SPECIES IN JEFFERSON COUNTY

LISTED SPECIES[1]		
Mammals		
Canada lynx[2]	*Felis lynx Canadensis*	T
Birds		
Northern spotted owl [3]	*Strix occidentalis caurina*	CH, T
Fish		
Steelhead (Middle Columbia River)[4]	*Oncorhynchus mykiss* ssp.	T[5] (experimental)
Bull trout (Columbia River Basin)[6]	*Salvelinus confluentus*	CH, T
Proposed Species		
None		
CANDIDATE SPECIES7		
Amphibians and Reptiles		
Columbia spotted frog	*Rana luteiventris*	
Oregon spotted frog	*Rana pretiosa*	
Northern American wolverine	*Gulo gulo luscus*	
SPECIES OF CONCERN8		
Mammals		
Fisher	*Martes pennanti*	PT
Spotted bat	*Euderma maculatum*	
Silver-haired bat	*Lasionycteris noctivagans*	
Small-footed bat	*Myotis ciliolabrum*	
Long-eared bat	*Myotis evotis*	
Long-legged bat	*Myotis volans*	
Yuma bat	*Myotis yumanensis*	
Palid bat	*Antrozous pallidus pacificus*	
Townsend’s western big-eared bat	*Corynorhinius townsendii townsedii*	

Birds		
Northern goshawk	*Accipiter gentilis*	
Greater sage-grouse	*Centrocercus urophasianus*	PE
Western burrowing owl	*Athene cunicularia hypugea*	
Ferruginous hawk	*Buteo regalis*	
Black tern	*Chlidonias niger*	
Olive-sided flycatcher	*Contopus cooperi*	
Willow flycatcher	*Empidonax traillii adastus*	
Harlequin duck	*Histrionicus histrionicus*	
Yellow-breasted chat	*Icteria virens*	
Lewis's woodpecker	*Melanerpes lewis*	
Mountain quail	*Oreortyx pictus*	
White-headed woodpecker	*Picoides albolarvatus*	
Amphibians and Reptiles		
Tailed frog	*Ascaphus truei*	
Oregon slender salamander	*Batrachoseps wrighti*	
Cascades frog	*Rana cascadae*	
Northern sagebrush lizard	*Sceloporus graciosus graciosus*	
Coastal tailed frog	*Ascaphus truei*	
Fishes		
Pacific lamprey	*Lampetra tridentata*	
Interior Redband Trout	*Oncorhynchus mykiss gibbsi*	
Invertebrates		
Cascades apataniuan caddisfly	*Apatania tavala*	
Plants		
Wallawa ricegrass	*Achnatherum wallowaensis*	
Estes' artemesia	*Artemisia ludoviciana* ssp. *estesii*	
Dissapearing monkeyflower	*Mimulus evanescens*	
Little mousetail	*Myosurus minimus* ssp. *apus (var. sessiliflorus)*	
Peck's penstemon	*Penstemon peckii*	
Lichen		
Sessile mousetail	*Myosurus sessilis*	
Woven-spored Lichen	*Texosporium sancti-jacobi*	
(E) Listed Endangered *(T) Listed Threatened* *(CH) Critical Habitat has been designated for this species*	*(PE) Proposed Endangered* *(PT) Proposed Threatened* *(PCH) Critical Habitat has been proposed for this species*	

[1] U.S. Department of Interior, Fish and Wildlife Service, October 31, 2000, Endangered and Threatened Wildlife and Plants, 50 CFR §17.11 and 17.12
[2]Federal Register Vol. 65, No. 58, Mar 24, 2000, Final Rule - Canada lynx
[3]Federal Register Vol. 57, No. 10, January 15, 1992, Final Rule - Critical Habitat for the Northern Spotted Owl
[4] Federal Register Vol. 64, No. 57, March 25, 1999, Final Rule - Middle Columbia and Upper Willamette River Steelhead
[5] Consultation with NOAA's National Marine Fisheries Service may be required.
[6] Federal Register Vol. 63, No. 111, June 10, 1998, Final Rule - Columbia River and Klamath River bull trout
[7] Federal Register Vol. 69, No. 86, May 4, 2004, Notice of Review - Candidate or Proposed Animals and Plants
[8] Taxa whose conservation status is of concern to the USFWS (many previously known as Category 2 candidates) but for which further information is still needed.

BLM personnel visited the OSHP area in 2010. Except for the fish species identified in the following sections, the BLM observed no instances of threatened and endangered species in the OSHP area (J. Eisner, BLM, Prineville Office, personal communication), nor do any site-specific reports identify occurrences.

6.6.1.1 BULL TROUT (SALVELINUS CONFLUENTIS)

USFWS issued a final rule listing the bull trout (*Salvelinus confluentus*) in the coterminous United States as a threatened species under the ESA on June 10, 1998 (63 Fed. Reg. 31647). Oregon has also listed the bull trout as a state sensitive species. In central Oregon's Deschutes River Basin upstream of the PRB Project dams at river kilometer (rkm) 167.5 (RM 100.5), bull trout currently inhabit the Metolius River Basin, the Deschutes River upstream to Steelhead Falls, the lower reaches of Whychus Creek, the lower kilometer of the Crooked River upstream to the Opal Springs Dam, and Lake Billy Chinook (Ratliff et al. 1996). Of these areas, only the Metolius River Basin has suitable habitat for bull trout spawning. The other riverine and reservoir habitats provide foraging, migration, and overwintering (FMO) habitat (USFWS 2002). The first extensive fish surveys in the Crooked River were conducted in the 1950s. By that time, the basin was degraded due to severe water withdrawal and radically altered riparian areas (Nehlsen 1995). Foraging subadult and adult bull trout were occasionally caught in the Crooked River as far upstream as the city of Prineville at rkm 85 (RM 51) through the early 1980s (Ratliff et al. 1996, cited in Buchanan 1997).

USFWS issued a final rule designating critical habitat for the bull trout on October 18, 2010 (75 Fed. Reg. 63898). The Crooked River from its confluence with Lake Billy Chinook at rkm 189.85 (RM 117.7) upstream 1.7 kilometer (km; 1.18 miles) to Opal Springs Dam was designated as occupied FMO habitat. From Opal Springs Dam upstream 17.9 km (11.1 miles) to the Highway 97 bridge crossing was designated as unoccupied FMO habitat. Because numerous large, cold springs enter this section of the Crooked River, the habitat is currently suitable for cold-water salmonids (Torgerson et al. 2007) such as bull trout.

USFWS's *Deschutes River Basin Bull Trout Draft Recovery Plan* (USFWS 2002) calls for restoring connectivity and opportunities for migration in the Crooked River by constructing upstream fish passage at Opal Springs Dam (Task 1.2.4). This area is important because it would allow bull trout in Lake Billy Chinook to disperse out of the reservoir, which would decrease the potential for population loss from cannibalism. Cannibalism can have significant effects on populations, particularly when other forage species are not available (Beauchamp and Shepard 2008). In 2014 the USFWS issued a revised draft bull trout recovery plan and in 2015, the six draft recovery unit implementation plans were issued.

Adult and subadult bull trout are already present in the reservoir's Crooked River Arm and in the Crooked River upstream to Opal Springs Dam. However, it is not clear how many of those bull trout will use the Opal Springs fish ladder to move upstream of the OSHP, when they will move, or when they will return downstream. The number, size, and migration timing of bull trout passage at Opal Springs are important factors regarding the final determination of ESA effects likely to result from the Proposed Action. These factors will also influence decisions on protection and mitigation actions taken as part of the OSHP's Fish Passage and Protection Plan. USFWS will work with DVWD under the terms and conditions of their respective biological opinions after formal consultation regarding the Proposed Action is concluded, and also through the amended license's proposed FPWG.

6.6.1.2 SUMMER STEELHEAD (*ONCORHYNCHUS MYKISS*)

In the Deschutes Subbasin MCR steelhead currently range from its mouth at the Columbia River up to the PRB Project at RM 100, including east and west side tributaries. Before hydroelectric and irrigation development, steelhead used the Deschutes River up to Big Falls (RM 132), Whychus Creek (a Deschutes River tributary above the PRB Project), and the Crooked River Watershed. Within the Crooked River Watershed, steelhead were documented in McKay, Ochoco (below Ochoco Dam), Horseheaven, Newsome, Drake, Twelvemile, and Beaver Creeks and the North Fork Crooked River (Figure 6-1) (Nehlsen 1995).

The completion in 1920 of Ochoco Dam east of Prineville blocked access into most of the Ochoco Creek Watershed. In 1961, Bowman Dam was completed on the Crooked River at RM 70, about 20 miles southeast of Prineville, creating Prineville Reservoir and blocking fish passage into the upper Crooked River Watershed. On the Deschutes River, the Pelton and Reregulating Dams (RM 103 and RM 100, respectively) were completed in 1958. Even though these dams had fish passage, steelhead numbers in the upper Deschutes River basin had substantially declined by that time (Nehlsen 1995). By 1968, it was concluded that fish passage was not working due to the inability to collect juvenile fish from the reservoir (Lake Billy Chinook) behind Round Butte Dam. To mitigate for lost passage and habitat, PGE constructed a fish hatchery at Round Butte Dam to produce spring-run Chinook salmon and steelhead (Ratliff and Shulz 1999). By the time the OSHP was completed in 1985, MCR steelhead had been extirpated from the basin.

Endangered Species Act Listing. On March 25, 1999, NMFS published a final rule listing the MCR steelhead DPS under the ESA as threatened (NMFS 1999). It is one of 15 Pacific Coast steelhead distinct population segments extending from southern California to the Canadian border in Washington State. Eleven of the 15 Pacific Coast steelhead DPSs are now listed under the ESA. The MCR Steelhead DPS covers an area of approximately 35,000 square miles in the Columbia Plateau of eastern Oregon and eastern Washington. It includes all populations of steelhead in Columbia River tributaries upstream of the Wind River (excluded) in Washington and the Hood River (excluded) in Oregon to, and including, the Yakima River in Washington. Snake River steelhead are excluded. Seven artificial propagation programs, including the Deschutes River hatchery programs, were included in the MCR DPS in 2006 (71 Fed. Reg. 834, January 5, 2006). The DPS also includes four major population groups based on ecoregion characteristics, life history, and other geographic and genetic factors. MCR steelhead from the Deschutes River and tributaries contribute three of five populations to the Cascade Eastern Slope population group: Deschutes Eastside, Deschutes Westside, and the Crooked River (extirpated) (NMFS 2011).

As described in Section 6.4, the reintroduction of anadromous fish to the basin above the PRB Project began in 2007 as required in the PRB license, and under the direction of the Fish Managers (ODFW and CTWS 2008), with appropriate oversight by NMFS (NMFS 2011). The goals of the reintroduction effort are to establish a population of MCR steelhead in historic habitat, help recovery by improving spatial structure for the Deschutes Westside population, and restore the extirpated Crooked River population by giving them access to historically occupied habitat. Although providing passage over the PRB Project addressed these biological objectives, the fish passage barrier imposed by OSHP is significant.

This reintroduction effort relies heavily on stock from the Round Butte Hatchery, and because this hatchery was included in the DPS in 2006, progeny that are reintroduced above the Round Butte Dam as either fry or smolts are currently an ESA-listed threatened species.

Recovery Plan. Pursuant to Section 4(f) of the ESA, NMFS has developed and is implementing a plan for the conservation and recovery of listed MCR steelhead. The plan describes specific management actions, establishes objectives and measurable criteria for delisting, and estimates time and cost to carry out these measures. The recovery plan for Cascade Eastern Slope Tributaries of the MCR Steelhead DPS requires that both the Deschutes River populations, Eastside and Westside, be viable (i.e., less than a 5% risk of extinction within 100 years). The Deschutes Eastside population, below the PRB Project, is considered viable, but the Deschutes Westside population is not: spatial distribution, diversity, and abundance are restricted, primarily due to blocked passage to historically productive habitat above the PRB Project (NMFS 2009). However, recovery is not completely dependent on providing passage because spawning habitat is available in downstream tributaries such as the Warm Springs River and Shitike Creek (NMFS 2011).

Reintroduction of fish above the PRB Project, therefore, will be a long-term effort aimed at strengthening the Cascades Eastern Slope major population group of MCR steelhead. The action will improve spatial structure for the Eastside population because it will increase the amount of spawning habitat available. Over time, this will improve population numbers and help alleviate risk to their survival and recovery.

In order to facilitate development of conservation measures that support reintroduction above the PRB Project to implement the recovery plan, in 2011 NMFS designated MCR Steelhead above the PRB Project as an experimental population, pursuant to Section 10(j) of the ESA (76 Fed. Reg. 28715, May 18, 2011). This designation was made because:

- MCR Steelhead reintroduced above the PRB Project will be completely separate geographically for the part of their lifecycle that is above the dams; and
- designation will further the conservation of the species by encouraging development of conservation measures to support the reintroduction effort.

This rule allows for incidental take of steelhead released above the PRB Project as long as the take is incidental to an otherwise lawful activity (NMFS 2012). The rule includes an expiration date 12 years after spawners are allowed to pass above the PRB Project.

6.6.1.3 PACIFIC SALMON (ONCHORHYNCHUS TSHAWYTSCHA)

Spring Chinook salmon historically spawned in the Warm Springs River system, Shitike Creek, the mainstem Deschutes River upstream from the PRB Project, Whychus Creek, and the Metolius River. Historic use of the Crooked River by spring Chinook has also been documented, but when this population was extirpated is unknown (Nelson 1995). Despite its extirpation from the upper Deschutes Basin and Crooked River Basin, the ESA listing status is “not warranted” for all naturally spawned populations of Chinook salmon from the Deschutes River (NMFS 1999).

Construction of the PRB Project blocked salmon from their historic habitats upstream. Chinook salmon fry and smolts have been released into the selected tributaries above PRB, including the Crooked River, since 2008. The Deschutes River below Big Falls and the Crooked River below OSHP are EFH according to the Magnuson-Stevens Act.

6.6.1.4 ANADROMOUS FISH REINTRODUCTION

In 1996, ODFW developed a fishery management plan for the Crooked River, which includes the reach through OSHP (ODFW 1996). The plan sets a management direction for the Crooked River with the following policies:

- Policy 1. Restore anadromous and migratory resident fish to their historic range in the Crooked River Basin by improving upstream and downstream passage over artificial barriers.
- Policy 2. Reconnect isolated and fragmented populations of redband trout by restoring and improving passage over man-made barriers.
- Policy 3. Require passage over all proposed dams on fish-bearing streams.

In December 2003, ODFW adopted a rule that directs ODFW to restore anadromous MCR summer steelhead into portions of its historic range upstream from the PRB Project. Specific areas targeted for reintroduction include the Metolius River and tributaries, the Deschutes River from Lake Billy Chinook upstream to Big Falls, Whychus Creek, and the Crooked River and tributaries upstream to Bowman and Ochoco dams.

The plan gained significant momentum with the relicensing of the PRB Project in 2005. The new federal license for the PRB Project requires implementation of a fish passage plan (PGE and CTWSRO 2004) to reinitiate fish passage through PRB. One of the key provisions of the license and fish passage plan was a requirement that the licensees (PGE and CTWRSO) construct a new fish passage system known as the Selective Water Withdrawal (SWW), at Lake Billy Chinook at RM 110.

In the spring of 2007 steelhead fry from Round Butte Hatchery were released into the Crooked River, upstream to Les Schwab Park, in Prineville. In fall 2008, ODFW and the Confederated Tribes of the Warm Springs Branch of Natural Resources completed a *Reintroduction and Conservation Plan for Anadromous Fish in the Upper Deschutes River Sub-basin, Oregon* (ODFW and CTWS 2008). Each spring since that plan was completed, both steelhead and Chinook salmon fry have been released into the Crooked River system above the OSHP. More than 50,000 Chinook and steelhead smolts have been captured in the SWW at Round Butte and released into the lower Deschutes River.

OSHP has been a near-complete to complete barrier to upstream migrations of game fish, including redband and bull trout, and mountain whitefish, since the renovation and retrofit of the dam was completed in 1984. Since the reintroduction plan is in the process of being implemented, passage at OSHP is a high priority.

6.6.1.5 OTHER THREATENED OR SENSITIVE SPECIES

The USFWS list of species under its jurisdiction in Jefferson County (USFWS 2015) includes the threatened bull trout, which is known to be present in the OSHP area; NMFS ESA listed steelhead are also present. Aside from these species, no USFWS or NMFS ESA listed species are currently known to be present in the OSHP area. Redband trout (*Oncorhynchus mykiss ssp.)* is known to occur in the Crooked River. Other USFWS listed species in Jefferson County include the threatened Northern spotted owl (*Strix occidentalis caurina*), proposed species including Fisher (*Martes pennant*) and candidate species including North American wolverine (*Gulo* *luscus*), Greater sage grouse (*Centrocercus urophasianus*), and whitebark pine (*Pinus albicaulis*).

The DVWD has worked with USFWS and NMFS to evaluate what species may be present in the OSHP area, and how the Proposed Action could affect them. A final determination regarding the proposed OSHP's effects on listed species or their habitats will be made at the conclusion of formal ESA consultation.

6.6.1.6 Operations and Run Timing

Timing of potential wild steelhead smolt emigration past the Opal Springs site can be approximated as a composite of that observed at the Pelton skimmer in 1959–1963 (Lewis 2005) and more recently at multiple other sites still accessible to the species in the lower Deschutes Subbasin (Figure 6-1). These data suggests that most emigration will occur between March 1 and July 30. Accumulated data on the timing of smolt outmigration will affect the pattern of use of the BFAA, as well as how water is physically managed at the OSHP through proposed gates, weirs, and any AWS associated with the diversion structure. This will be an adaptive management opportunity as described in the Settlement Agreement and its associated appendices.

For planning purposes, the timing of smolt outmigration corresponds to periods of high flow at the OSHP, when flow is often expected to spill. Under existing conditions, outmigrants that bypass the intake pass the OSHP primarily via the roughened spillway. According to the Proposed Action, most spilled water (and the fish attracted to it) will bypass the powerhouse and travel downstream via routes that are more fish-friendly.

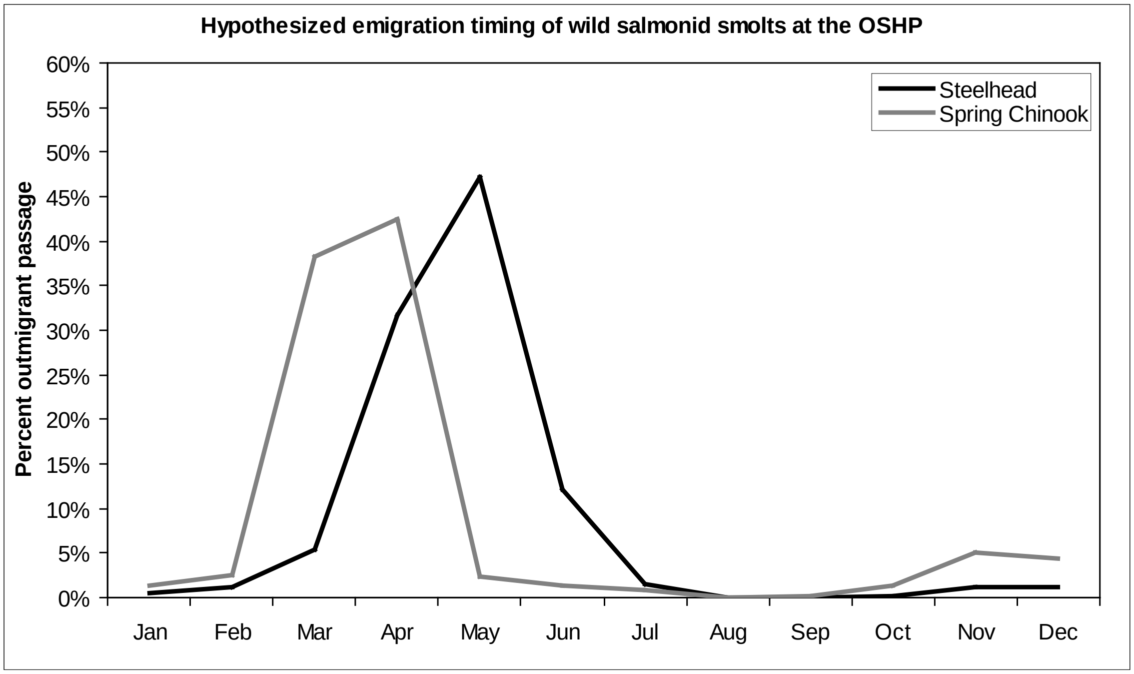
Huntington (2015) developed a preliminary model of down-migrant mortality (DMM) for the OSHP. The model relies upon available information on the sizes and migration timing of salmon and steelhead smolts, variations in river flows, characteristics of the OSHP, and likely passage route selections by smolts given variable daily flow conditions, to estimate annual mortality rates for specific types of downstream migrants. It has been used to develop estimates for steelhead and spring Chinook smolt losses that might occur under existing and proposed conditions. Modeled estimates of these losses are being refined but suggest improved survival rates at the OSHP given the proposed (new) conditions relative to those that occur under existing conditions.

Figure 6-3 provides a graphic summary of some of the quantitative information on fish migration timing and sizes on which the DMM model is based. With regard to migration timing, the model is based on species-specific data from the Crooked River itself (M. Hill, PGE, pers comm.), the Pelton Round Butte hydro-complex (Newton 1973; Lewis 2005), and from other Deschutes River tributaries (Montgomery 1955; Burck 1981; Nelson 2008). As for the size of migrants anticipated at the OSHP, the model relies upon information from Ratliff (2001), Lewis (2006), and others. Ratliff (2001) summarized information on sizes of anadromous outmigrants captured in the Deschutes River Basin upstream of the PRB Project. He reported that steelhead smolts captured in the 1960s averaged 200 millimeters (mm) in length. He also cited 1999 and 2000 data from Trout Creek that showed emigrating smolts ranged from 100 mm to 260 mm, and averaged 175 mm. In 1960, wild steelhead smolts were trapped in the Deschutes River downstream of the Crooked River confluence. Their length–frequency distribution provides an estimate of the sizes of wild steelhead smolts that might be expected to be entrained at the OSHP. These fish ranged from 140 to 270 mm fork length with a mean of 190 mm (Lewis 2006).

As described in Section 5.5, mortality and injury of entrained fish appear to be functions of size, such that salmonids less than 250 mm long tend to have higher survival rates.

Estimates of smolt emigration timing that are applied in the DMM model (Figure 6-3) were based on species-specific data from the Crooked River itself (M. Hill, PGE, pers comm.), the PRB Project (Newton 1973; Lewis 2005), and from other Deschutes River tributaries (Montgomery 1955; Burck 1981; Nelson 2008).

(Montgomery 1955; Burck 1981; Nelson 2008).



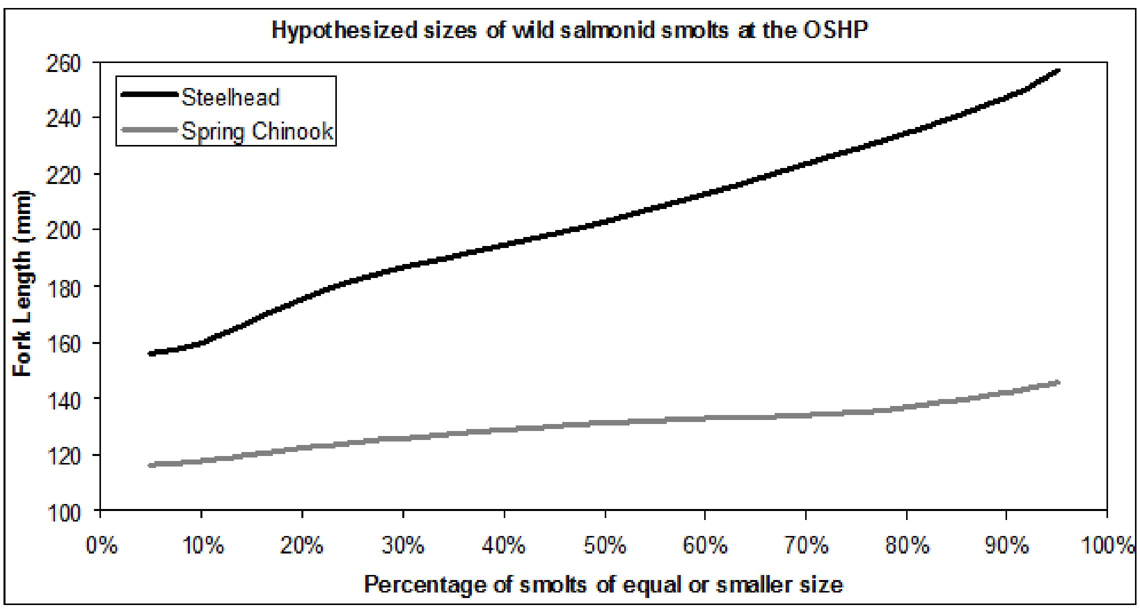


FIGURE 6-3 ESTIMATED FUTURE EMIGRATION TIMING (TOP) AND SIZE (BOTTOM) FOR SUMMER STEELHEAD AND SPRING CHINOOK SALMON SMOLTS AT THE OSHP

4.3.2 ENVIRONMENTAL EFFECTS

6.6.2.1 PROPOSED ACTION

Direct and Indirect Effects. The purpose of the Proposed Action is to mitigate the OSHP's effects on threatened fish species; therefore, the environmental effects of this action are seen to be positive in terms of connecting fish habitat and facilitating fish passage. The Proposed Action does not include screening of the powerhouse intakes; therefore, the downstream migrants that do not pass through the alternative routes provided will travel through the turbine. Turbine passage survival is discussed in Section 6.4.2. For larger sub-adult and adult bull trout that use the ladder to explore foraging areas above the OSHP, this presents a potential source of injury and mortality. Other sources of direct and indirect injury and mortality are also discussed in Section 6.4.2.

Cumulative Effects. Cumulative effects for fish and aquatic resources were assessed at the basin and sub-basin scale. Because an effort to improve habitat conditions and provide passage in the Lower Crooked River is underway, the proposed action will significantly enhance those efforts above the OSHP and improve the chances of success of the reintroduction effort overall.

6.6.2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any effects of the OSHP on threatened, endangered, and special status species would continue, as would existing environmental measures.

Under the No Action Alternative, there would be:

- injury and mortality of fish, including foraging bull trout and migrating steelhead that must be trapped and hauled around the OSHP; and
- delay or holding in the powerhouse tailrace with no mechanism for cueing behavior, since the BFAA would not be available.

4.3.3 PROPOSED MITIGATION MEASURES

Section 4.3.5 describes agreed-to performance metrics for upstream and downstream passage, and these metrics are thought to be both realistic and sustainable. Section 4.3.6 describes the adaptive management opportunities that are available if performance objectives are not reached. Additional detail is found in Appendices A and B of the Settlement Agreement.

4.5 BOTANICAL AND RIPARIAN RESOURCES

4.3.3 AFFECTED ENVIRONMENT

BLM assessed riparian and spring/seep vegetation associations in the Crooked River Gorge immediately upstream of the OSHP area in 2005 (Hardin-Davis 2006). A total of 103 plant species were found in the BLM's study area, of which 30 species were introduced. The most common introduced species in the riparian zone was reed canarygrass (*Phalaris arundinacea*), an invasive species that appeared to be competitively excluding other species (Hardin-Davis 2006). Estes wormwood (*Artemesia ludoviciana* spp. *estesii*), a rare perennial forb, was encountered during the surveys (Hardin-Davis 2006).

Hardin-Davis (2006) concluded that the riparian zone in the lower Crooked River was dominated by mockorange (*Philadelphus lewisii*) and red-osier dogwood (*Cornus sericea* ssp. sericea), and that riparian vegetation appeared homogenous throughout much of the survey area. Plant diversity was highest where shrubs and trees were not dominant. The more common native species found in the riparian area are common in riparian settings throughout the region. Dominant riparian plant species in the OSHP area include white alder (*Alnus rhombifolia*), red osier dogwood, mockorange, blue elderberry (*Sambucus mexicana*), reed canarygrass, torrent sedge (*Carex nudata*), chokecherry (*Prunus virginiana*), and Mexican elder (*Sambucus mexicana*) (Huntington 2009).

During a fall 2010 reconnaissance trip to the area, BLM personnel reported what looked like an invasive species, *Phragmites australis*, on the east bank in the area that would be inundated by the higher pool. Staff noted that care should be taken not to disturb this species for fear of spreading it. In an email dated April 2, 2015, the BLM has indicated that if the species in question is confirmed, then the BLM would not require its removal. Further, information gathering relative to the presence/absence of this plant should not be pursued.

As required for removal fill permitting for DSL and USACE, DVWD had a wetland survey completed in 2014. The purpose was to determine and establish the presence and location of Jurisdictional Wetlands along the shorelines of the OSHP. It was found that the area of wetlands that would be inundated as a result of the survey would be 0.018 acres.

4.3.2 ENVIRONMENTAL EFFECTS

6.7.2.1 PROPOSED ACTION

Direct and Indirect Effects. Implementing the Proposed Action would have limited direct effects on botanical resources as a result of inundation. The primary substrate inundated is composed of basalt cliffs. Some areas on the west bank composed of fill from the original construction will be inundated; however, as this is a run-of-river project, reservoir fluctuation will be minimal.

During an April 16, 2009, reconnaissance, Huntington (2009) determined that the proposed increase in the elevation of the pool will inundate some existing riparian vegetation. In addition, a small near-channel spring will become backwatered.

Vegetation bordering the existing water surface will be inundated (Huntington 2009), including 0.018 acres of jurisdictional wetlands (Sage West 2014). Riparian vegetation not inundated but near the edge of the newly inundated area will respond to the change in water surface, which could include mortality of a few mature white alder trees. Regeneration patterns along the existing diversion pool suggest that natural replacement of these white alder and other vegetation affected by the raised pool could be slow because growing conditions within the predominantly boulder-covered surfaces near the river channel provide limited locations for trees and shrubs to become established. The plant surveys conducted by Hardin-Davis (2006) along the river segment that will be inundated did not identify any designated sensitive, threatened, or endangered species as being present.

Cumulative Effects. Cumulative effects for botanical and riparian resources were assessed at the watershed scale. Because no other projects have been identified within the watershed, no cumulative effects will occur as a result of the Proposed Action.

6.7.2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any ongoing effects of the OSHP on botanical and riparian resources would continue, as would existing environmental measures.

4.3.3 PROPOSED MITIGATION MEASURES

No mitigation measures for the potential effects on riparian and botanical resources are proposed.

4.5 RECREATION, LAND USE, AND AESTHETICS

4.3.3 AFFECTED ENVIRONMENT

6.8.1.1 RECREATION

The segment of the lower Crooked River from RM 17.8 downstream to RM 8 is a federally designated Wild and Scenic River, with identified Outstandingly Resource Values that include recreation (USDI 1992). The Crooked River Wild and Scenic area is readily accessible and provides a variety of year-round recreation opportunities, including fishing, hiking, camping, hunting, photography, wildlife viewing, and boating (USDIBLM 1992). A survey conducted by the BLM indicated that the area received 29,750 visits annually in the early 1990s (BLM and BOR 1992), a level that probably has increased as the human population has expanded in the region. Angling is the primary recreational activity, particularly for redband trout and mountain whitefish. Camping at group campgrounds as well as at dispersed sites is a popular activity. The area's recreational opportunities are well advertised through the State Scenic Highway and National Back Country Byway publications (USDIBLM 1992).

The OSHP lies within an approximately 27-mile segment of the Crooked River used for whitewater kayaking, and recreational fishing takes place within the OSHP vicinity. A boat ramp exists in the reservoir to allow safe transit past the dam.

FIGURE 6-4 WARNING SIGN TO AID BOATERS IN SAFE TRANSIT PAST THE FACILITIES AT THE OPAL SPRINGS HYDROELECTRIC PROJECT

6.8.1.2 LAND USE

General Land Use Characteristics. The OSHP vicinity is part of a vast, high desert prairie interspersed with mountain ranges and isolated peaks. The region is a non-metropolitan region in Oregon's Jefferson County with a population of approximately 28,000 people (U.S. Census Bureau 2010). All or parts of seven Oregon counties are included in the Crooked River Basin, including Crook, Deschutes, Grant, Jefferson, Harney, Lake, and Wheeler. Land use within the basin is focused primarily on livestock, including beef cattle, large numbers of sheep, dairy herds, horses, and swine as well as significant acres of irrigated land. Agriculture and forestry dominate more than 90% of the basin, and rural residential is the third largest category (CRWC 2002). The CRWC (2002) concluded that lumber and wood products form the basis of the region's economic structure. Since the late 1970s, the proportion of irrigated lands has increased relative to grazed lands, while forest lands have remained stable.

Federal agencies manage nearly 57% of the land in the basin. The BLM manages 35.2% of the basin (1,023,215-acres), and 22.8% is managed by the United States Forest Service. Private ownership (41%) makes up most of the remaining land, and a small percentage is owned by the state of Oregon.

***Lower Crooked Wild and Scenic River*.** Because of its proximity to the easternmost boundary of the Lower Crooked Wild and Scenic River, the potential upstream hydrologic effects are of special significance. Section 7(a) of the Wild and Scenic Rivers Act bars FERC from licensing the construction of any dam, water conduit, or other project works on or directly affecting any river that is designated a component of the national Wild and Scenic Rivers System. This does not, however, preclude licensing of developments below or above a wild, scenic, or recreational river or any stream tributary that would not invade or unreasonably diminish the scenic, recreational, and fish and wildlife values present when the river was designated a component of the Wild and Scenic Rivers System. Under Section 7(d) of the Wild and Scenic Rivers Act, the administering Secretary makes determinations regarding consistency of a project with the provisions of the Wild and Scenic Rivers Act.

The Lower Crooked Wild and Scenic River boundary is described in the *Middle Deschutes/Lower Crooked Wild and Scenic Rivers' Management Plan,* dated December 1992. The boundary is described as "River Mile 8, south of Opal Springs," and further described as "the North 1/16th line of Section 4, in the Metes and Bounds description under T. 13 S., R. 12 E., W.M." Because of the importance of establishing the boundary elevation with precision and confidence, DVWD contracted with CH2M Hill and a local surveyor (CH2M Hill 2010) to perform survey work to tie the metes and bounds description of the boundary to existing surveys of key OSHP elevations. The key findings from the survey efforts are described below:

- The metes and bounds description of the Wild and Scenic River boundary appears to be inconsistent with the designation of the RM 8 marker. T. 13 S., R. 12 E., WM is the more conservative description, downstream of where DVWD believes RM 8 to be.
- The surveyed elevation of the metes and bounds description where the boundary crosses the stream had a surface elevation of just above 2,010.66 feet. This elevation was measured in October 2009 during a period of low flows and, therefore, should be considered conservative. The top of the riffle below the assumed boundary was surveyed at 2,010.56 feet.

- Given that the maximum extent of the proposed increase in the pool would be to 2,010.21 feet, and below the visible riffle that is downstream of the Wild and Scenic boundary, it appears that the upstream end of the impoundment under the Proposed Action will be downstream of the Wild and Scenic boundary, with a discernible visible break provided by the cascade at the downstream end of the riffle under most flow conditions.

Note that under the 2017 revised proposal, the separation between the proposed head of pool at 2007.21 feet and the lower end of the boundary is more distinct.

6.8.1.3 AESTHETIC/VISUAL RESOURCES

The segment of the lower Crooked River from RM 17.8 downstream to RM 8 is a federally designated Wild and Scenic River with identified Outstanding Resource Values ORVs that include scenic and recreation resources (USDIBLM 1992). The river canyon is unique in that its geologic characteristics represent a smaller, more accessible example of the Lower Deschutes and John Day basin formations (USDIBLM 1992). Scenic features within the canyon include massive walls and escarpments of deeply eroded rust-brown basalt, upland vegetation, and the Crooked River and its associated riparian vegetation. State Scenic Highway 27 provides views of the geologic formations and eroded lava flows throughout the canyon. Highway 27 has received awards from the Federal Highway Administration for its natural looking construction and its compatibility with the surrounding environment (BLM and BOR 1992). The lower Crooked River adjacent to the highway led to the designation of the route as a National Back Country Byway.

Because of its proximity to the Wild and Scenic River boundary, the BLM requested that a Visual Resources Survey be completed to understand potential impacts of the project on the ORV's. Three Visual Resource Management (VRM) objectives were identified for the OSHP area. These include:

- <u>VRM II- Upland and upper riparian zone:</u> The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color and texture found in the predominant natural features of the characteristic landscape.
- <u>VRM III- Lower riparian zone and reservoir pool:</u> The objective of this class is to partially retain the existing character of the landscape. The level of change to the

characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

- VRM IV – Dam, Fish ladder and power generating facilities: The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

4.3.2 Environmental Effects

6.8.2.1 Proposed Action

Implementing the Proposed Action will have direct effects on recreation, land use, and aesthetic resources. DVWD's survey efforts have identified the upstream extent of the higher pool. Figure 6-4 illustrates the position of the Lower Crooked Wild and Scenic River boundary in relation to the head of the OSHP diversion pool (top). A boulder rapid-cascade located below the boundary drops approximately 4.7 feet and provides a clear separation between the head of the proposed OSHP pool and the boundary.

FIGURE 6-5 WILD AND SCENIC RIVER BOUNDARY

Recreation. The proposed increase in the pool will inundate a pool-and-riffle habitat downstream of the cascade that will act as a hydraulic barrier to pool encroachment into the Wild and Scenic River reach. Two recreational opportunities that will be minimally affected by the proposed increase in the pool are boating and sport fishing (Huntington 2009). A segment of river popular with some boating enthusiasts extends from Lone Pine Bridge above Smith Rocks State Park down to Lake Billy Chinook and has two distinct whitewater runs separated by a boater take-out at China Dam. The lower run is 9 miles long and includes a short portage around the OSHP diversion dam and bypass reach. The ability of boaters to transit past the project will not be impacted. The upper 18-mile run includes some Class 3 and 4 whitewater. ODFW habitat survey data suggest that raising the pool will inundate about 1.6% of the total length of whitewater now being boated within the lower run from China Dam to Lake Billy Chinook and will be well below 1% of the whitewater within the full 27-mile river segment between Lone Pine Bridge and Lake Billy Chinook. None of the affected whitewater is in the Wild and Scenic River segment, which ends immediately upstream.

Trout fishing in the canyon upstream of the OSHP diversion pool is excellent (USDIBLM 1992), although difficult access limits anglers' use of the area. To the extent that the higher pool modifies habitat and changes the use of this area by trout species, localized angling opportunities may be reduced minimally.

Land Use. As stated above, the Proposed Action envisions that the increase in the size of the impoundment will approach, but will neither invade nor unreasonably diminish the scenic, recreational, and fish and wildlife values present when the river was designated a component of the Wild and Scenic Rivers System. The BLM will make that determination during the amendment proceeding.

Aesthetics. Effects on visual resources associated with the Proposed Action will be negligible. The proposed increase in the pool will inundate approximately 700 linear feet of riverine habitat upstream of the current head of the Opal Springs impoundment, but given that the OSHP facilities and reservoir already exist, the basic visual character of the OSHP area, including views from the upstream Wild and Scenic River area, will be very similar to existing conditions.

The most dramatic change will be elimination of a rapid immediately downstream of the Wild and Scenic boundary. This rapid will serve as a hydraulic control, and the upstream end of the rapid will be discernible under most hydraulic conditions.

The VRM analysis (Sage West, 2015) evaluated visual impacts at key observation points (KOPs). Two viewpoints were selected and represent sites on public land and water that is accessible by walking the Otter Bench Trail or floating upstream of the dam. Analysis of potential impacts were determined by superimposing potential characteristics under the Proposed Action. KOP#1 is the publicly accessible and frequently visited Otter Bench Trail System. As described in the analysis, the Proposed Action will meet the VRM objectives when viewed from KOP#1:

1. VRM II: Uplands are retained. The upland/riparian fringe will reestablish naturally in a short time period (3-7 years).
2. VRM III: The pool will be raised 6 feet and the shoreline will be flooded near the dam and grading to 0 feet to the end of the pool where there will be no impact. The river rapid at the upper end of the pool will be partially flooded during high water levels. The reservoir pool will be +/- 25% larger and once flooded will not be noticeable.
3. VRM III: The existing character of the landscape will be retained. The lower 6 ft. of the cliff and talus slopes will be inundated, but the landscape above is the same and will remain intact.

KOP #2 is from the river and viewable from a floating device near the take out point and above the dam/fish ladder. The Project also meets the VRM objectives when viewed from this KOP:

1. VRM II: Uplands are retained. The shoreline is cliff and talus slopes.
2. VRM III: The pool will be raised 6 feet and the shoreline will be flooded near the dam. The water will cover existing basalt cliffs and talus slopes. The remaining cliffs and talus will be visually identical for several hundred feet upward.
3. VRM III: The existing character of the landscape will be retained. The lower 6 ft. of the cliff and talus slopes will be inundated, but the landscape above is the same and will remain intact. After flooding, the upland/riparian fringe will reestablish naturally in a short time period (3-7 years).

Additional indirect or short-term effects include visual impacts from construction. For approximately two years, there will be construction equipment and materials in the immediate area of the diversion.

6.8.2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any effects of the OSHP on recreation, land use, and aesthetic resources would continue, as would existing environmental measures.

4.3.3 PROPOSED MITIGATION MEASURES

Land Use. To ensure that the higher pool will not invade or unreasonably diminish the scenic, recreational, and fish and wildlife values present when the river was designated a component of the Wild and Scenic Rivers System, the proposed facilities include an ability to control pool elevation, such that it will not exceed 2,010.21 feet NGVD 29 (2012 feet LPD). The weirs that span the crest of the diversion will be capable of being lowered as flows increase in the Crooked River; CH2M Hill (2010) estimated that the weirs, when lowered to 2,003.41 NGVD 29, will pass the IDF of 8,000 cfs without exceeding 2,010.21 feet. When fully deflated, it is anticipated that the facility will pass 12,700 cfs.

Recreation and Aesthetics: In order to address potential visual impacts of raising an existing control tower on the dam, the licensee proposes to utilize a dark brown color paint or other natural materials to blend in with the environment. Prior to selecting a color for mitigation, the BLM will conduct a site-specific color matching on site using BLM Standard Environmental Colors to select appropriate colors for facilities. This includes potential mitigation for roof material.

4.5 CULTURAL RESOURCES

4.3.3 AFFECTED ENVIRONMENT

The Lower Crooked River, in general, has been a significant contributor to the lifestyles and cultural history of the early inhabitants. Early settlers used the area for travel, lodging, and fishing. Native Americans inhabited the region for at least 13,000 years before Europeans arrived and used the area for hunting and gathering. The OSHP impoundment and Prineville Reservoir are within the ceded lands of the CTWS (BLM 2004).

The Warm Springs Reservation, created by the Treaty of 1855, covers an area of approximately 641,000 acres. The Tribes ceded 10 million acres of lands to the Oregon Territory, reserving the Reservation for their exclusive use and retaining their rights to harvest fish, game, and other foods from their usual and accustomed places. Although lands of the Warm Springs Tribal Reservation extend over approximately 7% of the Deschutes Subbasin, the OSHP is located within the Warm Springs Tribes ceded area and does not encroach on any Reservation lands or known lands of ceremonial or religious significance (BLM 2007; PNHO n.d.; BLM 2004).

On August 10, 2009, BLM conducted a cultural resources survey of the OSHP area (Griffin 2009). The area of potential effects (APE) was determined to be a 0.7-mile reach of the Crooked River beginning at Opal Springs Dam and ending upstream at the NAD83 Universal Transverse Mercator (UTM) coordinates 635250E, 4926099N (Figure 6-5). Talus slopes range from approximately 35 to 45 degrees and are concentrated at the southern half of the APE. Sheer rock faces dominate the northern half of the OSHP area. The survey results indicate that there are no cultural resources sites or isolates in the OSHP area, and as a result, Griffin (2009) made no eligibility or protection recommendations.

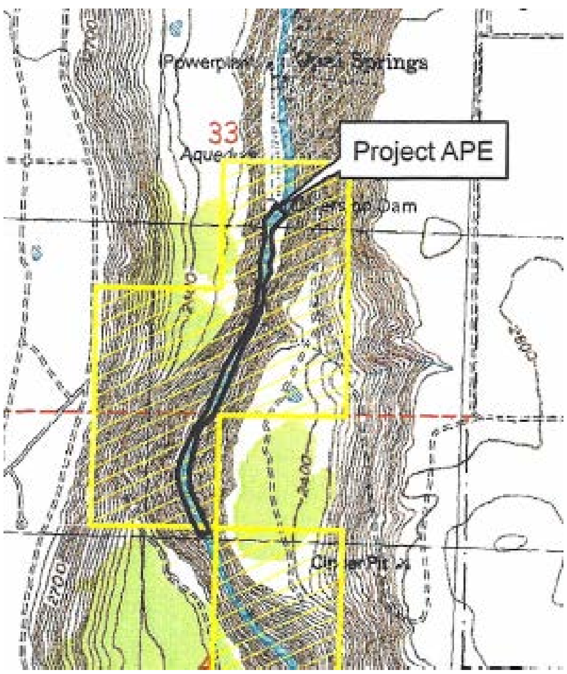


FIGURE 6-6 PROJECT APE AS DETERMINED BY THE BLM
Yellow hatching indicates BLM land (Griffin 2009).

4.3.2 ENVIRONMENTAL EFFECTS

6.9.2.1 PROPOSED ACTION

Direct and Indirect Effects. The SHPO concurred with BLM's determination (Griffin 2009) that no historic properties will be affected by raising pool, or any other elements of the Proposed Action (Exhibit E).

Cumulative Effects. Cumulative effects for cultural resources were assessed at the watershed scale. Because no other projects have been identified within the watershed, no cumulative effects will occur as a result of the Proposed Action.

6.9.2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any effects of the OSHP on cultural resources would continue, as would existing environmental measures.

4.3.3 PROPOSED MITIGATION MEASURES

No mitigation measures are proposed for this resource.

6.10 SOCIOECONOMIC RESOURCES

6.10.3 AFFECTED ENVIRONMENT

The following is a summary of CRWC’s (2008) characterization of socioeconomic conditions in the Crooked River vicinity.

Primary industries in the vicinity include livestock, secondary wood products, agriculture, and recreation and tourism. The recreation and tourism sector of the economy is growing. The Crooked River, Smith Rocks State Park, Crooked River National Grasslands, and Ochoco National Forest provide a variety of activities that bring people to the area. Although the primary wood products industry was the major employer for most of the twentieth century, reductions in locally harvested timber have shifted the industry to secondary manufacturing. Crop production includes hay, mint, potatoes, wheat, and alfalfa.

Data from the United States Census Bureau (2010) indicate that Jefferson County is economically distressed relative to the rest of the state and the country (Table 6-7). As of 2015, unemployment in Jefferson County was 14.4%. This compares to 9.3% statewide and 8.3% nationally ((U.S. Census Bureau 2015).

TABLE 6-7 COMPARATIVE ECONOMIC STATISTICS FOR JEFFERSON COUNTY AS COMPARED TO THE UNITED STATES AND THE STATE OF OREGON

	UNITED STATES	OREGON	JEFFERSON COUNTY
Persons in Poverty (percent)	15.5%	16.5%	20.5%
Persons without Health Insurance	13%	12.3%	17.6%
Median household income (2013 Dollars)	$53,889	$51,243	$46,366
Per capita income	$28,930	$27,684	$21,341
	UNITED STATES	**OREGON**	**JEFFERSON COUNTY**
Persons in Poverty (percent)	14.5%	16.7%	21.8%
Persons without Health Insurance	15.3%	17.2%	24.3%
Median household income (2013 Dollars)	$53,046	$50,229	$43,373
Per capita income	$28,155	$26,809	$32,678

6.10.2 Environmental Effects.

6.10.2.1 Proposed Action

Direct and Indirect Effects. Investments in watershed restoration have substantial economic effects, generating both equipment-intensive and labor-intensive work opportunities that, in turn, create jobs and stimulate economic activity in several ways (Nielsen-Pincus and Moseley 2009). First, direct jobs are created by hiring equipment and labor contractors to implement restoration projects. Second, jobs are created indirectly through the sourcing of materials and services needed to implement the project (e.g., equipment rentals, materials vendors, fuel purchases). Last, employees and contractors spend wages on goods and services to support their livelihoods, which creates additional economic activity and supports additional jobs (called induced jobs).

Restoration efforts in the Upper Deschutes Basin (upstream of the Pelton Round Butte Dams) are large-scale collaborations among non-profit groups, private individuals, state, federal, and local governments, and the Confederated Tribes of Warms Springs Reservation of Oregon (CRWC 2008). The jobs that are supported from the Opal Springs Fish Passage Project will influence the local economy by increasing demand for design and planning services, construction services, and goods needed to fabricate and construct the passage structure and weir.

Max Nielsen-Pincus (personal communication, 2009) estimated that design and construction of the passage structure and supporting infrastructure will create an estimated 43 direct jobs ranging from principal engineers to equipment operators and laborers. It is unclear how many of these jobs will be supported locally through various phases of the project, but Neilson-Pincus stated that employment multipliers could enhance the effect in the Jefferson County area (Nielsen-Pincus and Moseley 2009).

DVWD plans to use existing staff to help maintain the fish ladder and monitor fish use of the OSHP area and facilities once they are constructed.

Cumulative Effects. Cumulative effects for socioeconomic resources were assessed at the watershed scale. Because no other projects have been identified within the watershed, no cumulative effects will occur as a result of the Proposed Action.

6.10.2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the OSHP would continue to operate under the terms and conditions of the existing license, without new facilities or environmental measures. Any ongoing effects of the OSHP on socioeconomic resources would continue, as would existing environmental measures.

6.10.2 PROPOSED MITIGATION MEASURES

No mitigation measures are proposed for this resource.

7.0 DEVELOPMENTAL ANALYSIS

5.3 POWER AND ECONOMIC BENEFITS OF THE PROPOSED ACTION

The dependable capacity of OSHP will increase because the applied head of the OSHP will increase as a result of raising the pool. This capacity increase will have little effect on the actual ability to displace future diesel generation; therefore, capacity considerations were discarded in the economic analysis. The present-day OSHP plant, with a nameplate capacity of 4.3 MVA, operates with a capacity factor of 85%. The increase in storage does not require a capacity increase to realize a gain in energy output.

The long-term benefit of the OSHP is that it provides additional hydropower resources for sale into the interconnected Pacific Power and Light (PP&L) transmission and distribution system. These increased sales will help offset annual costs of operating the fish passage facilities and implementing the monitoring and evaluation program.

DVWD plans on seeking certification from the Low Impact Hydropower Institute (LIHI), and this certification will make the OSHP eligible to sell its power as renewable resource, pursuant to PP&L's published avoided cost schedule of August 11, 2014.

The total cost to the DVWD, including all costs for license amendment, permitting, engineering, and construction, is forecasted to be $4,000,000 in 2017 dollars. The DVWD is seeking outside support to offset the balance of the construction costs (including construction management), thought to be about $10,700,000. The future incremental operating costs for operating the fish passage facilities, conducting monitoring and evaluation studies, and implementing agreed to adaptive management measures is estimated to be $30,000 annually. As DVWD intends to self-finance, annual payments are excluded from the analysis.

DVWD developed a generation inflow model to evaluate the effect of the raising the pool on the energy generation capabilities of the OSHP (CH2M Hill 2010). The model accounts for an assumed accrual reduction by 50% of the potential incremental generation as a result of the

BFAA. The model used a 30-year period-of-record based on available hydrology. Results of this model indicate that that hydro generation at the OSHP will increase as shown in Table 7-1.

TABLE 7-1 MODEL OUTPUT FOR ANNUAL ENERGY AT PROPOSED OPERATING ELEVATION 2007.21 (MINIMUM). BFAA IS REFLECTED AS AN ADJUSTMENT TO THE INCREMENTAL GENERATION.

Flows	Turbine Flow	EL 2004.21	EL 2007.21	
		Base Case (KWH)	Incremental KWH	w/ BFA
20-year minimum	856	24,941,590	1,688,572	844,286
20-year average	1,177	29,509,406	2,021,347	1,010,673
20-year maximum	1,700	34,880,782	2,435,859	1,217,929

4.5 COMPARISON OF ALTERNATIVES

OSHP was licensed as a Qualifying Faculty pursuant to the Public Utility Regulatory Policies Act (PURPA; 18 CFR § 292.203) and is compensated pursuant to an existing power sales agreement (PSA). In establishing the price for power, the PSA uses avoided cost rates. The term of the PSA will expire in 2021, and the new power sales rate has not been established. The principal economic distinction between the Proposed Action and the No Action Alternative is the potential power sales and costs associated with the capital project.

4.3.3 PROPOSED ACTION

According to the Proposed Action, the OSHP will generate an average of 1,010,673 kilowatt-hours (KWh) of power above its base generation of 29,509,406 KWh. Using the most recently available avoided cost rates raising the pool will generate additional revenue as shown in Table 7-2, through the balance of the license term. The OSHP's PSA provides for an additional capacity payment as a result of a "Demonstrated Capacity" calculation. This is the actual demonstrated ability of the facility to generate and deliver electric power to meet the buyer's capacity requirements.

TABLE 7-2 ASSUMED PRICE OF POWER THROUGH LICENSE TERM

Capacity Payment of $36,000 represents premium paid for demonstrated capacity. Price of Power may increase if the output can be classified as "renewable" under Oregon's Integrated Resources Portfolio.

YEAR	PRICE OF POWER	INCREMENTAL O&M	INCREMENTAL CAPACITY PAYMENT	NET REVENUE (INCREMENTAL)
2018	0.043	$ 30,000	$ 16,000	$51,500
2019	0.046	$ 30,000	$ 16,000	$89,526
2020	0.048	$ 30,000	$ 16,000	$36,213
2021	0.049	$ 30,000	$ 16,000	$36,820
2022	0.056	$ 30,000	$ 16,000	$37,444
2023	0.048	$ 30,000	$ 16,000	$63,603
2024	0.070	$ 30,000	$ 16,000	$64,487
2025	0.071	$ 30,000	$ 16,000	$65,397
2026	0.073	$ 30,000	$ 16,000	$66,332
2027	0.075	$ 30,000	$ 16,000	$67,292
2028	0.077	$ 30,000	$ 16,000	$68,277
2029	0.080	$ 30,000	$ 16,000	$69,288
2030	0.083	$ 30,000	$ 16,000	$70,349
2031	0.084	$ 30,000	$ 16,000	$71,461
2032	0.086	$ 30,000	$ 16,000	$71,461
			Total	**$929,450**

Over the term of the new license, raising the pool raise does not pay for the cost of the new facilities. However, it is expected that the benefits of the Proposed Action will carry over into any new license term, and the cost of doing nothing would generate additional regulatory, legal, and operational costs for DVWD without the ability to offset these costs with new revenue. Moreover, the public interest considerations of providing fish passage to these introduced species are considerable.

4.3.2 NO ACTION ALTERNATIVE

A status quo approach would not provide additional head to increase generation, and this course of action would not provide operational flexibility to firm the output from future, planned renewable sources in the region, and would not provide operational flexibility to address potential needs for mitigation related to fish passage. The No Action Alternative would increase the future carbon footprint of the Pacific Northwest, compared to the Proposed Action.

Additional costs at the OSHP would be expected from continuing to mitigate for the lack of fish passage via trap-and-haul or other efforts sought by the regional Fish Managers.

However, the capital cost of the Propose Action would be avoided and the OSHP would continue to generate revenue through the current license term at the avoided cost rate of a PURPA Qualifying Facility.

4.5 Cost of Environmental Measures

Throughout consultation with stakeholders, no environmental measures have been requested and DVWD proposes none to mitigate for the Proposed Action, which is itself an environmental measure costing the DVWD approximately $4,000,000 in capital construction. As a result, the cost of environmental measures is not included in the economic analysis.

8.0 CONCLUSIONS AND RECOMMENDATIONS

“Developmental” benefits of a hydropower project include power generation, water supply, flood control, irrigation, and river navigation. “Non-developmental” values of a waterway include fish and wildlife resources, recreational opportunities, and other aspects of environmental quality.

Table 8-1 summarizes the relative effects on developmental and non-developmental resources of each alternative analyzed as described in this APEA (i.e., the Proposed Action and the No Action Alternative).

TABLE 8-1 DEVELOPMENTAL AND NON-DEVELOPMENTAL EFFECTS

	PROPOSED ACTION	NO ACTION
DEVELOPMENTAL		
Power generation	Annual increase of 1,010,673MWh in power generation.	No change in power generation
Water supply	N/A	N/A
Flood control	N/A	N/A
Irrigation	N/A	N/A
River navigation	N/A	N/A
Socioeconomic resources	Would ensure continued delivery of cost effective potable water to service area and provide for continued operation of bottling plants. Construction activity would provide direct and indirect economic benefit to the area.	N/A
NON-DEVELOPMENTAL		
Fish and aquatic resources	Would result in significant gains in access to upstream habitat for anadromous fish and migratory bull trout.	No change from existing conditions.
Recreation	Public use facilities would continue to be used as they are today.	No change from existing conditions.
Geology and soils	Would subject approximately 3.9 acres of soils to inundation, but with limited reservoir fluctuation. This would be similar to existing conditions.	No change from existing conditions.
Water resources	Would not affect stream flow or beneficial use of water, and would not cause any significant change in water quality.	No change from existing conditions.
Wildlife	No long-term adverse effects anticipated to threatened, endangered, and candidate species and sensitive species.	No change from existing conditions.
Botanical and riparian resources	No change from existing conditions	No change from existing conditions.

	PROPOSED ACTION	NO ACTION
Wetlands	Anticipated loss of approximately 0.018 acres of wetlands due to inundation on BLM property.	No change from existing conditions.
Cultural and tribal resources	No changes anticipated from existing conditions.	No change from existing conditions.

5.3 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require FERC to consider all uses of the waterway on which an action is proposed. When FERC reviews a hydropower project, the recreational, fish and wildlife, and other non-developmental values of the involved waterway are considered equally with its electric energy and other developmental values. In determining whether, and under what conditions, to approve the Proposed Action, FERC weighs the various economic and environmental tradeoffs involved in the decision.

This section contains the basis for, and a summary of, DVWD's recommendations to FERC for the approval of the Proposed Action. DVWD weighs the costs and benefits of the recommended alternative against other proposed measures.

Based on DVWD's review of and evaluation of the Proposed Action and the No Action Alternative, DVWD has selected the Proposed Action as the preferred and recommended alternative.

DVWD recommends this alternative because (1) authorization for increasing the maximum surface elevation of the operating pool to 2,007.21 feet will facilitate the engineering and construction associated with the fish ladder on the east bank and will result in additional power output and sales, (2) the increase in pool height coupled with the controllable weirs will provide for adaptive management capabilities to influence upstream and downstream passage, (3) the environmental and social benefits of connecting 108 miles of upstream habitat to the lower Deschutes Basin will maximize the investment that has been made in the basin to implement salmon and steelhead reintroduction, and (4) the Proposed Action will meet all relevant statutory and regulatory requirements. Overall, the public benefits of the Proposed Action exceed those of the No Action Alternative because DVWD has addressed issues through early and extensive consultation with stakeholders.

4.5 UNAVOIDABLE ADVERSE EFFECTS

The Proposed Action would inundate 0.018 acre of wetland surrounding the OSHP impoundment as a result of raising the pool.

4.5 SUMMARY OF SECTION 10(J) RECOMMENDATIONS AND 4(E) CONDITIONS

Under the provisions of Section 10(j) of the FPA, each hydroelectric license issued by FERC shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project. Section 10(j) of the FPA states that, whenever FERC believes that any fish and wildlife agency's recommendation is inconsistent with the purpose and requirements of the FPA or other applicable law, FERC and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency. Provisions of Section 4(e) of the FPA require FERC to include mandatory conditions from federal land managers in a FERC license for hydropower projects located on federal lands.

The project was developed with the consensus of the agencies that have the statutory and regulatory responsibility to submit 10(j) recommendations and 4(e) conditions. No 10(j) recommendations have been proposed, but nothing precludes the agencies from filing 10(j) recommendations pursuant to FERC notice. DVWD anticipates that 4(e) BLM will provide conditions that pertain to management of federal land within the existing FERC boundary.

This section will be completed by FERC in its NEPA document following Public Notice of Agency Final Terms, Conditions, and Recommendations.

4.5 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a) (2) of the FPA requires FERC to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, and conserving waterways affected by the project. Under Section 10(a) (2), federal and state agencies filed a total of 72 plans that address various resources in Oregon. Of these, DVWD identified and reviewed 14 plans potentially relevant to the proposed action at the OSHP:

1. Bureau of Land Management. 1990. Issues and alternatives for management of the lower Deschutes River. Department of the Interior, Prineville, Oregon. January 1990.
2. Bureau of Land Management. Bureau of Reclamation. 1992. Lower Crooked Wild and Scenic River (Chimney Rock segment) management plan. Department of the Interior, Prineville, Oregon. October 1992.
3. Bureau of Land Management. Forest Service. Oregon State Parks and Recreation Department. 1992. Middle Deschutes/Lower Crooked Wild and Scenic Rivers management plan. Department of the Interior, Prineville, Oregon. Department of Agriculture, Ochoco National Forest. December 1992.
4. Department of the Army, Corps of Engineers. Portland District. 1993. Water resources development in Oregon. Portland, Oregon.
5. Forest Service. 1989. Ochoco National Forest and Crooked River National Grassland Plan. Department of Agriculture, Bend, Oregon. October 1989.
6. Oregon Department of Environmental Quality. 1978. Statewide water quality management plan. Salem, Oregon. November 1978.
7. National Park Service. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. 1993.
8. Oregon Department of Fish and Wildlife. 1996. Crooked River Fish Management Plan. Prineville, Oregon. April 24, 1996.
9. Oregon Department of Fish and Wildlife. 1997. Oregon plan for salmon and watersheds. Salem, Oregon. December 1997.
10. Oregon State Parks and Recreation Department. Oregon Outdoor Recreation Plan (SCORP): 2003-2007. Salem, Oregon. January 2003.
11. Oregon State Parks and Recreation Division. n.d. The Oregon scenic waterways program. Salem, Oregon.
12. Oregon Water Resources Commission. 1987. State of Oregon water use programs. Salem, Oregon.
13. Oregon Water Resources Department. 1988. Oregon water laws. Salem, Oregon.
14. U.S. Fish and Wildlife Service. n.d. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C.

No inconsistencies were found in any approved plans listed above.

9.0 FINDING OF NO SIGNIFICANT IMPACT

This APEA was developed pursuant to NEPA requirements, which direct all federal agencies to consider and report the potential environmental effects of proposed federal actions. As outlined in the Initial Consultation Document this APEA examines the potential effects of the Proposed Action on the following areas: geology and soils; water resources; fish and aquatic resources; wildlife; threatened, endangered, and special status species; botanical and riparian resources; recreation, land use, and aesthetics; socioeconomic resources; and cultural resources.

After consulting with stakeholders, DVWD gathered additional information to determine the optimal configuration of the fish ladder and the potential effects of raising the pool, to identify wetland and visual resources, and to address specific questions relative to upstream and downstream fish passage success. The final results of these additional information gathering efforts are described herein and incorporated into this APEA and as technical appendices.

In developing and conducting environmental studies and throughout Second Stage consultation, DVWD consulted with stakeholders, including state, local, and federal agencies; Tribal groups; local municipalities; and non-governmental entities. Communication included public and agency meetings, site visits, presentations, phone calls, e-mails, and online postings. The consultation record is provided in Exhibit C.

On the basis that the Proposed Action (a) involves proactive measures intended to benefit reintroduced salmon and steelhead and (b) will have no direct, indirect, or cumulative negative effects as documented in this APEA, the Proposed Action will not affect the human or natural environment significantly. DVWD believes, therefore, that FERC can find that issuing an amended license for the OSHP will not constitute a major federal action significantly affecting the human or natural environment.

10.0 LITERATURE CITED

Beauchamp, D. A. and M. F. Shepard. 2008. Evaluation of factors affecting kokanee production in Lake Billy Chinook Final Report to the Pelton Round Butte Committee.

Bureau of Land Management (BLM). 2004. Deschutes Subbasin Plan. [Online] URL: http://www.nwcouncil.org/fw/subbasinplanning/deschutes/plan/ Accessed October 15, 2011.

Bureau of Land Management (BLM). 2007. Draft Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management Districts. [Online] URL: http://www.blm.gov/or/plans/wopr/deis/ Accessed October 15, 2011.

Bureau of Reclamation (BOR). June 2003. Prineville Reservoir Management Plan and Master Plan: Final Environmental Assessment. Prepared by U.S. Department of Interior, Bureau of Reclamation (Pacific Northwest Region.) [Online] URL: http://www.usbr.gov/pn/programs/rmp/prineville/rmp-prineville2003.pdf Accessed September 18, 2015.

CH2MHill. 2003. Literature based characterization of resident fish entrainment and turbine-induced mortality, Klamath Hydroelectric Project, (FERC No. 2082), Draft Technical Memorandum.

CH2MHill. 2010. Diversion Structure Elevation 2012 Pool Raise Feasibility Report; Opal Springs Hydroelectric Project. Prepared for the Deschutes Valley Water District.

Concannon, G. 1998. 1988-1998 Wildlife studies summary report, Pelton Round Butte Hydroelectric Project, FERC No. 2030. Prepared for Portland General Electric Company.

CRWC. 2002. Crooked River watershed assessment. Edited by Max Nielsen-Pincus, Ph.D., Executive Director, Crooked River Watershed Council (CRWC).

CRWC. 2008. Lower Crooked River watershed assessment. Prepared by Tina Whitman, Crooked River Watershed Council.

Ecological Services, Inc. 2006. Review of Literature to Estimate Potential Turbine Mortality of Bull Trout and Steelhead/Rainbow Trout at the Opal Springs Hydroelectric Facility. Prepared for Jefferson Soil and Water Conservation Services.

Electric Power Research Institute (EPRI). 1987. Turbine-related fish mortality: review and evaluation of studies. Prepared by Eicher Associates, Inc., Portland, OR. EPRI AP-5480.

FERC (Federal Energy Regulatory Commission). 2008. Preparing environmental documents, guidelines for applicants, contractors, and staff. Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing. September 2008.

Griffin, R. M. 2009. Oregon cultural resources survey report, Opal Springs Hydroelectric fish passage improvements. BLM Report No.: 05050600486P.

Hardin-Davis, Inc. 2006. Crooked River gorge riparian vegetation survey. Consultant report to the U.S. Bureau of Land Management, Prineville District, Prineville, Oregon. Hardin-Davis, Inc., Albany, Oregon.

Huntington, C. 2009. Environmental "Fatal Flaws" Analysis for an Opal Springs Pool-Raise of about 4 Feet. Prepared for the Opal Springs Fish Passage Settlement Working Group.

Huntington, C. 2015. Memorandum Regarding Smolt Mortality at the Opal Springs Hydroelectric Project. Prepared for Gary Lytle, DVWD.

Lewis, S. D. 2005. Graph of historic smolt emigration for wild spring chinook and summer steelhead at the Pelton skimmer from 1959-1963, and sizes of summer steelhead smolts captured from the Deschutes River downstream of the confluence with Crooked River, 1960. Portland General Electric, Madras, Oregon.

Lewis, S. D. 2006. Graph of sizes of summer steelhead smolts captured from the Deschutes River downstream of the confluence with Crooked River, 1960. Portland General Electric, Madras, Oregon.

Montgomery, M. 1955. Deschutes River Investigations, Central Region. River Basin Investigations, Oregon State Game Commission.

Nehlsen, W. 1995. Historic Salmon Steelhead Runs of the Upper Deschutes River Basin and Their Environments. Prepared for Portland General Electric, Hydro Licensing Department. Portland, Oregon.

Nelson. 2008. Trout Creek 1998-2007 summer steelhead outmigrant trapping results. Oregon Department of Fish and Wildlife, Madras, OR. 25 p.

Newton, J. 1973. Deschutes River spring Chinook salmon (*Oncorhynchus tshawytscha*) Walbaum. A literature review. Oregon Wildlife Commission. Central Region Administrative Report No. 74-1. December.

Nielsen-Pincus, M, and C. Moseley. 2009. A Preliminary Estimate of Economic Impact and Job Creation from the Oregon Watershed Enhancement Board's Restoration Investments. Ecosystem Workforce Program Briefing Paper #13. University of Oregon.

NMFS 2012. Endangered and Threatened Species: Designation of a Nonessential Experimental Population for Middle Columbia River Steelhead above the Pelton Round Butte Hydroelectric Project in the Deschutes River Basin, OR. [Federal Register Vol. 78, No. 10, January 15, 2013].

NMFS. 1999. Endangered and Threatened Species: Threatened Status for Two ESUs of Steelhead in Washington and Oregon (Final Rule). [Federal Register Vol. 64, No. 57, March 25, 1999].

NMFS. 2009. Middle Columbia River Steelhead Distinct Population Segment: ESA Recover Plan. Prepared by National Marine Fisheries Service Northwest Region.

NMFS. 2011. Draft Environmental Assessment for Non-essential Experimental Population Designation for Middle Columbia River Steelhead Reintroduced above the Pelton Round Butte Hydroelectric Project. Prepared by National Marine Fisheries Service, Northwest Region. May 18, 2011. RIN Number: 0648-BB04.

Northwest Power and Conservation Council (NPCC). 2004. Deschutes Subbasin Plan. [Online] URL: http://www.nwcouncil.org/fw/subbasinplanning/deschutes/plan/ Accessed April 15, 2010.

ODEQ. 2010. Oregon Water Quality Index Report for Deschutes and Hood Basins. [Online] URL: http://www.deq.state.or.us/lab/wqm/wqindex/deshood3.htm. Accessed October, 2011.

ODEQ. 2011a. Water quality standards applicable to the lower Crooked River and (thus) Opal Springs Hydroelectric Project. Available at: http://www.deq.state.or.us/wq/standards/standards.htm.

ODEQ. 2011b. Oregon's integrated 2010 water quality assessment database. [Online] URL: http://www.deq.state.or.us/wq/assessment/rpt2010/results303d10.asp.

ODEQ. 2011c. Assorted water quality data for the lower Crooked River, Oregon, acquired from the web-accessible LASAR database at: http://deq12.deq.state.or.us/lasar2/.

ODFW and CTWS. 2008. Reintroduction and Conservation Plan for Anadromous Fish in the Upper Deschutes River Sub-basin, Oregon. Edition 1: Spring Chinook Salmon and Summer Steelhead.

ODFW. 1996. Crooked River Fish Management Plan. Prineville, Oregon. May 1996.

ODFW. 2009. Aquatic inventory data from a 1997 survey of the lower Crooked River, Oregon. Available at: http://oregonstate.edu/dept/ODFW/freshwater/inventory/nworgis.html.

OEDD 2015. Workforce and Economic Research Division, https://www.qualityinfo.org/ed. Accessed May 19, 2015.

OWEB. 2007. Oregon Watersheds. [Online] URL: http://www.oregonwatersheds.org/councils/oregon-watershed-councils Accessed September 18, 2015.

PGE and CTWSRO. 2004. Fish Passage Plan: Exhibit D to Settlement Agreement Concerning the Relicensing of the Pelton Round Butte Project No. 2030.

Portland General Electric Company. 2010. Crooked River Hydroelectric Project (FERC No 13527): Preliminary Application Document.

Ratliff, D. E., S. L. Thiesfeld, M. D. Riehle and D. V. Buchanan. 1996. Distribution, Life History, Abundance, Harvest, Habitat, and Limiting Factors of Bull Trout in the Metolius River and Lake Billy Chinook, Oregon, 1983-94. Oregon Department of Fish and Wildlife Information Report No. 96-7.

Ratliff, D. E., and E. Schulz. 1999. Fisheries program at the Pelton Round Butte Hydroelectric Project (Oregon) 1956-1995. Portland General Electric Company. Portland, Oregon

Sage West. 2014. Wetland Delineation Report to Oregon State Division of State Lands.

Sanders, G. 2015. A Progress Report of the CRWC Connecting Waters Program. Poster session presented at the Pelton Round Butte Fisheries Workshop, Madras, OR.

SHPO. 2009. Letter to Molly Brown, BLM, Prineville District Office re: Opal Springs hydro fish passage improvement project. State Historic Preservation Office (SHPO) Case No. 09-2332.

Silvernale, C.E., G.H. Simonson, and M.E. Harward. 1976. Soil and watershed characteristics in relation to turbidity of the Prineville Reservoir. Special Report 453, Agricultural Experiment Station, Oregon State University, Corvallis.

Torgerson, C.E., D.P. Hockman-Wert, D.S. Bateman, D.W. Leer, and R.E. Gresswell. 2007. Longitudinal patterns of fish assemblages, aquatic habitat, and water temperature in the lower Crooked River, Oregon. USGS, OF 2007-1125, 37 p.

U.S. Census Bureau. 2010. Guide to State and Local Census Geography, accessed online October 2011. [Online] URL: http://www.census.gov/geo/www/guidestloc/guide_main.html.

U.S. Department of Agriculture (USDA). 1966. Soil survey Prineville area, Oregon. Soil Conservation Service, in cooperation with Oregon Agricultural Experiment Station. Series 1955, No. 12.

U.S. Department of Interior (USDI). 1992. Lower Crooked Wild and Scenic River (Chimney Rock Segment) Management Plan. Prepared by U.S. Department of Interior, Bureau of Land Management (Prineville District), and Bureau of Reclamation (Pacific Northwest Region). Report No. BLM-OR-FT-93-02-1792.44 pp. plus appendices. BLM and USFS (US Forest Service). 1992. Middle Deschutes/Lower Crooked Wild and Scenic Rivers' management plan. BLM-OR-PT-93-11-1792.

U.S. Fish and Wildlife Service (USFWS). 2002. Chapter 7, Deschutes Recovery Unit, Oregon. 62 p. In: U.S. Fish and Wildlife Service. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland. Oregon.

U.S. Forest Service (USFS). 1989. Land and resource management plan for the Ochoco National Forest/Crooked River National Grassland, Final Environmental Impact Statement. SDIBLM. 1992. Middle Deschutes/Lower Crooked Wild and Scenic Rivers' Management Plan. BLM-OR-PT-11-1792. Prineville District Office: Prineville, Oregon.

USFWS. 2010. Bull Trout Final Critical Habitat Justification: Justification: Rationale for Why Habitat is Essential, and Documentation of Occupancy. U.S. Fish & Wildlife Service Idaho Fish and Wildlife Office, Boise, Idaho. Pacific Region, Portland, Oregon

USFWS. 2015. US Fish & Wildlife Service, Information for Planning and Conservation (IPAC) Accessed on September 18, 2015.

USFWS. 2015. Official Species List, generated from Information for Planning and Conservation (IPaC) website [http://ecos.fws.gov/ipac/], Accessed May 21, 2015.

EXHIBIT A

BIOLOGICAL ASSESSMENT

In 2016 NMFS and USFWS issued a Conference Opinion and a Biological Opinion, respectively.

As part of the modification proposed in 2017 these opinions will be supplemented.

NOTE: This 2015 BA has been supplemented by memo dated April 17, 2017.
This memo has been attached to this Exhibit A of the APEA (as filed, October 2017)

BIOLOGICAL ASSESSMENT FOR IMPLEMENTATION OF THE OPAL SPRINGS FISH PASSAGE AND PROTECTION PLAN

Prepared by

Charles W. Huntington
Sr. Aquatic Biologist
Clearwater BioStudies, Inc.
1160 Old Ferry Road
Shady Cove, Oregon 97539

Prepared for

Deschutes Valley Water District
881 SW Culver Hwy
Madras, Oregon 97741

28 August 2015

NOTE: This 2015 BA has been supplemented by memo dated April 17, 2017. This memo has been attached to this Exhibit A of the APEA (as filed, October 2017)

1. INTRODUCTION

The purpose of this Biological Assessment (BA) is to evaluate whether structural and operational changes to the Opal Springs Hydroelectric Project ("Project"; FERC No. 5891), as proposed in the District's application to the Federal Energy Regulatory Commission (FERC) for a non-capacity amendment to its Project license, might affect the federally protected species listed in Table 1.0-1. Changes associated with the amendment are essentially those outlined in the Opal Springs Fish Passage and Protection Plan (DVWD 2011), and include fish ladder construction and some other modifications to Project facilities described in greater detail by CH2M Hill (2014). The BA has been prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (ESA) (16 U.S.C. 1536 [c]) and follows the standards established in FERC's National Environmental Policy Act (NEPA) guidance (FERC 2009).

Table 1.0-1. Threatened and Endangered species in the Opal Springs Action Area addressed in this BA.

Species common name	Scientific name	Status
Columbia River Bull Trout	*Salvelinus confluentus*	Threatened
Middle Columbia Steelhead	*Oncorhynchus mykiss*	Threatened – Non-essential Experimental Population

1.1. BACKGROUND

The existing Opal Springs Hydroelectric Project was completed in early 1985 on the lower Crooked River, Oregon, without provisions for fish passage. Since then, both bull trout and steelhead have become frequent visitors to the Project. Bull trout are arriving at the Project as a consequence of increased dispersal of foraging fish, primarily sub-adults, from bull trout populations that spawn in the Metolius River system and whose abundance has increased dramatically after harvest regulations became more restrictive in the 1980s and 1990s (Ratliff et al. 1996; Hodgson 2015). Anadromous fish reintroduction to the Deschutes basin above Round Butte Dam, including the Crooked River watershed, began in 2009 per a Settlement Agreement for the Pelton-Round Butte Hydroelectric Project (FERC No. 2030). As part of that reintroduction effort, young hatchery-origin Chinook salmon and steelhead have been released into the watershed upstream of the Project, naturally reared smolts have been emigrating downstream through the Project since 2010, and anadromous adult salmonids have been returning to the Crooked River basin from the ocean since 2012.

The District has been working in good faith before its FERC license comes up for renewal (in 2032), to develop a passage program at the Project that will contribute to a successful anadromous fish reintroduction effort in the basin. Upstream passage of Chinook salmon and steelhead has already been reestablished on a temporary basis using interim measures not requiring major changes to the Project and FERC approval. These measures have involved using a trap to collect fish that are migrating upstream at the Project, releasing the adult salmon and steelhead captured into the small reservoir above the District's diversion dam, and recycling other species of fish that enter the migrant trap (including bull trout) back downriver. The interim measures have not been nearly as effective as a permanent passage facility would be at providing fish a well-functioning migratory route to upstream areas (Huntington 2015a).

Based on an assumption that it can garner some level of financial assistance for installing a fish ladder at the Project now rather than after the existing FERC license expires, the District is applying for a non-capacity license amendment allowing for ladder installation and specific other passage improvements. These improvements would be implemented in adaptive fashion as described in the Opal Springs Fish Passage and Protection Plan (DVWD 2011). This Plan was incorporated by reference in the Non-essential Experimental Population designation for the steelhead being reintroduced to areas above the Project (78 FR 2893).

1.2. PURPOSE OF THE PROPOSED ACTION

The purpose of installing a fish ladder at the Project and implementing the other elements of the Opal Springs Fish Passage and Protection Plan is to restore effective migratory fish passage through the lower Crooked River, Oregon.

2. EXISTING CONDITIONS

2.1. SITE DESCRIPTION

The Opal Springs Hydroelectric Project lies within a strongly groundwater influenced section of the lower Crooked River, in a deep gorge approximately 5 miles southwest of Culver, Oregon (Figure 2.1-1). The Project extends from Mile 6.9 on Crooked River, less than a mile above Lake Billy Chinook, up to Mile 7.8, 0.2 miles downstream of a federally designated Wild-and-Scenic section of the river. The Project will extend nearly (but not quite) to Mile 8.0, the lower boundary of the Wild-and-Scenic section, if the license is amended as proposed.

The Project itself is a small run-of-river operation whose rock-fill dam diverts water from a narrow 10.9-acre reservoir, around a 1,570-foot reach of the river, and through a powerhouse containing a 10-foot (3 meter) diameter horizontal-axis Kaplan turbine (CH2M Hill 2014). Crooked River flows not diverted toward the powerhouse pass down an otherwise bypassed reach, and include a continuous 50 cubic foot per second (cfs) conservation release plus any additional water that exceeds powerhouse capacity (1772.5 cfs). Flows passing down the bypass reach are augmented by several natural springs (23 cfs total) before joining powerhouse discharge in the Project tailrace. Opal Springs, the Project's namesake, delivers another 240 cfs of groundwater to the river less than 0.1 mile below the powerhouse. In the years since Project completion, Crooked River flows at the Opal Springs diversion dam have averaged 1,224 cfs and exceeded 1,846 cfs (the level at which powerhouse capacity was exceeded) about 8 percent of the time (adapted from USGS 2015).

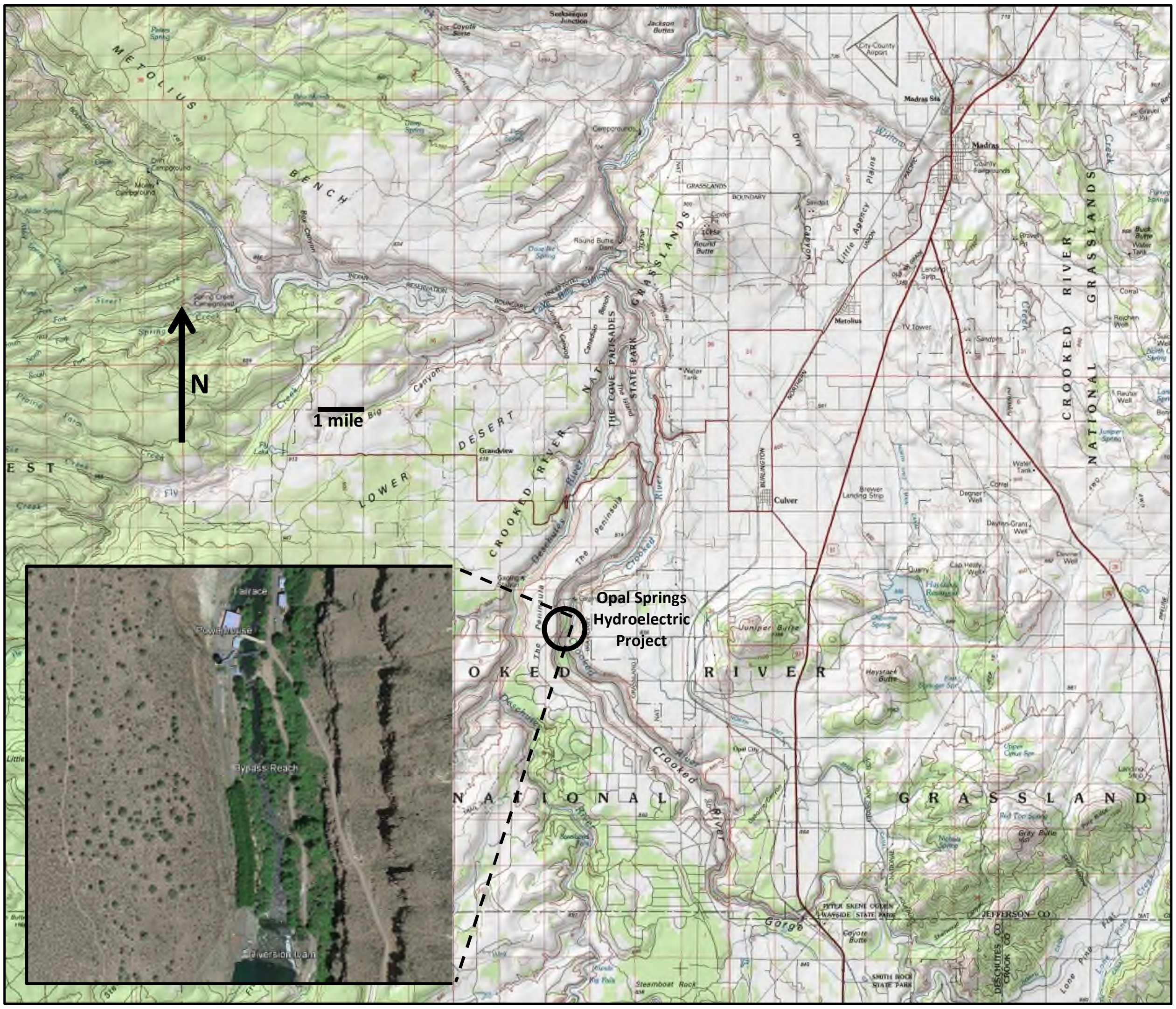


Figure 2.1-1. Location map for the Opal Springs Hydroelectric Project (identified by an open circle) on the lower Crooked River, Oregon.

2.2. ACTION AREA

The Action Area defines the geographic space over which the potential effects of a Proposed Action on a federally protected species or its habitat are evaluated. For this BA, the Action Area includes the Crooked River and its tributaries upstream of Lake Billy Chinook but excluding streams above Bowman Dam (at Mile 74.4 on mainstem Crooked River) or above Ochoco Dam (at Mile 12.9 on Ochoco Creek). Specific actions associated with the proposed license amendment will occur at the Project, where their environmental effects will be most concentrated. However, the potential benefits to ESA-listed bull trout or steelhead of providing fish passage (or more effective passage) at the Project extend to aquatic habitat throughout those portions of the watershed made accessible (or more accessible) to these fish.

2.3. THE PROTECTED SPECIES IN THE ACTION AREA

Bull trout from populations that spawn in the nearby Metolius watershed and summer steelhead that are being actively reintroduced to the Crooked River and its tributaries are known to occupy aquatic habitat within the Action Area. The following section of the BA describes the species and their use of this habitat.

Columbia River Bull Trout. There is no historical record of bull trout spawning in the Crooked River watershed (Lickwar 2015). Bull trout are the region's most cold-water dependent species of salmonid and locations where thermal conditions are suitable for both spawning (<9^{o}C; McPhail and Murray 1979, plus multiple field researchers) and the early life-stages of the species (also cold) are apparently absent. However, Oregon's most resilient populations of these fish spawn nearby in the Metolius watershed (Ratliff and Howell 1992; Hodgson 2015). These populations spawn, incubate, and rear as small juveniles in spring-fed streams notably colder than the lower Crooked River. Many young bull trout migrate from natal streams in the Metolius watershed during their second or third year of life toward other accessible waters, including those within the Crooked River watershed (Ratliff 1992). Migratory fish from these Metolius populations become piscivorous, grow rapidly (up to 1.4 cm/month), and become large adults that return home to spawn during August through October (Ratliff 1992). Bull trout 290-625 mm long have been observed in the Project bypass reach in recent years (unpublished data), and multiple dozens of them up to 420 mm long (presumed 3 and predominantly 4 year-olds) have been returned to the reach after capture in a trap used to pass adult salmon and steelhead. Migratory bull trout like those that forage in the lower Crooked River first return to spawn in the Metolius watershed as 5 year-olds, and some exhibit repeat cycles of migratory foraging followed by spawning (Ratliff et al. 1996). Alternate year spawning may occur after the fish reach maturity (Shepard et al. 1984).

Dispersed, interconnected waterways with cool water temperatures, pool habitat, hiding cover, and an adequate prey base are important to migratory bull trout while foraging. A life history schedule for these fish within the Action Area is given in Figure 2.3-1.

Lifestage/activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sub-adult migration												
Sub-adult foraging												
Adult migration												
Adult foraging												

Figure 2.3-1. Life history schedule for migratory bull trout in the lower Crooked River below the Opal Springs Hydroelectric Project, Oregon, based on limited observations of fish in the Project bypass reach. Light gray cells indicate that a particular bull trout lifestage is or may be present, and solid black cells identify periods of greatest use of the stream.

Habitat in the 0.8 miles of Crooked River below the Project's diversion dam is suited to year-round use by foraging bull trout, as is habitat found in other groundwater-dominated segments of the lower Crooked River that remain relatively cool during summer. These segments extend as far as perhaps 6 miles upriver from the diversion dam, to about Mile 13 (Torgerson et al. 2007). However, the species foraged at least as far upriver as Prineville (near Mile 48) before construction of the existing dam at Opal Springs (Ratliff et al. 1996), and habitat above Mile 13 contains abundant small fishes that might serve as prey for predatory bull trout during the cooler months of the year.

Only the short section of Crooked River below the diversion dam is generally accessible to bull trout at present. Other than during infrequent events that temporarily overtop flashboards at the diversion dam, the habitat upstream is blocked to bull trout and will remain so until DVWD's operating license is amended or expires.

Middle Columbia River Steelhead. Middle Columbia River (MCR) steelhead that occur in the Deschutes Basin are summer-run fish that spawn in their natal streams from late winter through spring (Olsen et al. 1991; Nehlsen 1995). MCR steelhead fry emerge in spring or early summer depending on time of spawning and water temperature during egg incubation in streambed gravels (Zimmerman and Reeves 1999). Juvenile steelhead in the basin typically rear for 2 years in freshwater (may range 1–4 years) before migrating to the Pacific Ocean as smolts during spring (Olsen et al. 1991). About half of the adults return after 1 year in the ocean and the other half after 2 years. Adult steelhead enter the Deschutes River during summer or fall, and migrate up the Crooked River at or near the Project from September through April. Both the upstream migration of sea-run adults and downstream (seaward) migration of smolts are critical to successful completion of the steelhead cycle. A life history schedule for these fish within the Action Area is given in Figure 2.3-2.

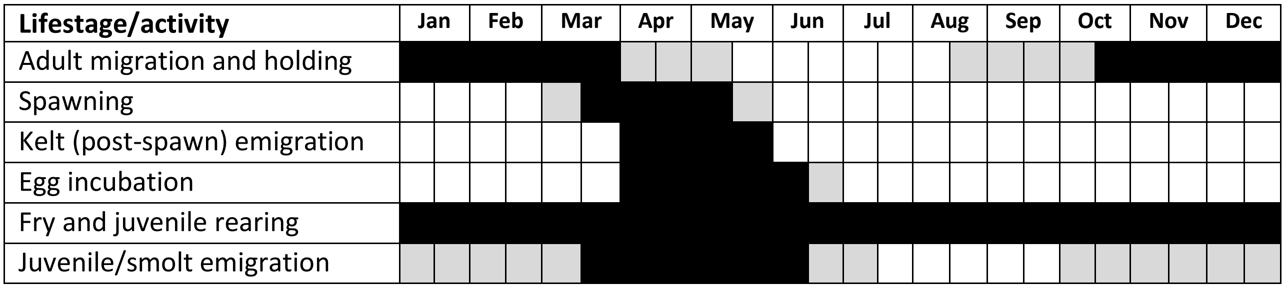


Figure 2.3-2. Life history schedule for steelhead in the lower Crooked River, Oregon. Light gray cells indicate that a particular steelhead lifestage is or may be present, and solid black cells identify periods of heaviest use of the stream.

Productive steelhead habitat consists of cool water and the sort of complex structure associated with the presence of large and small wood or boulders (NMFS 2009; Carmichael and Taylor 2010), though the fish sometimes rear in warmer streams by exploiting thermal refugia (Ebersole et al. 2003). Steelhead require cover in the form of overhanging vegetation, undercut banks, submerged vegetation, submerged objects, deep water or surface turbulence (Giger 1973). Spawning occurs where streambed gravels, water depths, stream velocities, and temperatures are found suitable by adult fish. Summer rearing occurs primarily in the faster parts of pools or in areas of modest water velocity with high adjacent velocities, though young-of-the-year steelhead are often found along channel margins or in glides and riffles. Winter rearing by steelhead occurs at lower numerical densities across a broader range of fast and slow habitat types (Bambrick et al. 2004).

Recent habitat evaluations suggest that there are about 120 miles of stream channel available for use by migratory salmonids above the Project diversion dam and nearly another mile of riverine habitat for them in Crooked River below the dam (Spateholtz 2015). Much of the aquatic habitat above the Project has been degraded or fragmented by past land use and water management practices (Nehlsen 1995; Stuart et al. 2007; NMFS 2012), but there remains significant production potential for steelhead within the Wild and Scenic section of Crooked River below the Highway 97 Bridge as well as in more distant areas nearer the Ochoco Mountains (Cramer and Beamesderfer 2006; Ackerman et al. 2007). Spateholtz (2015) has estimated that habitat available above the Project could produce approximately 49,500 steelhead smolts, though existing production is well below this level and dependent on outplants of hatchery-origin steelhead. Habitat conditions and production potential above the Project are likely to improve as a consequence of ongoing habitat rehabilitation and efforts to augment streamflows (NMFS 2012).

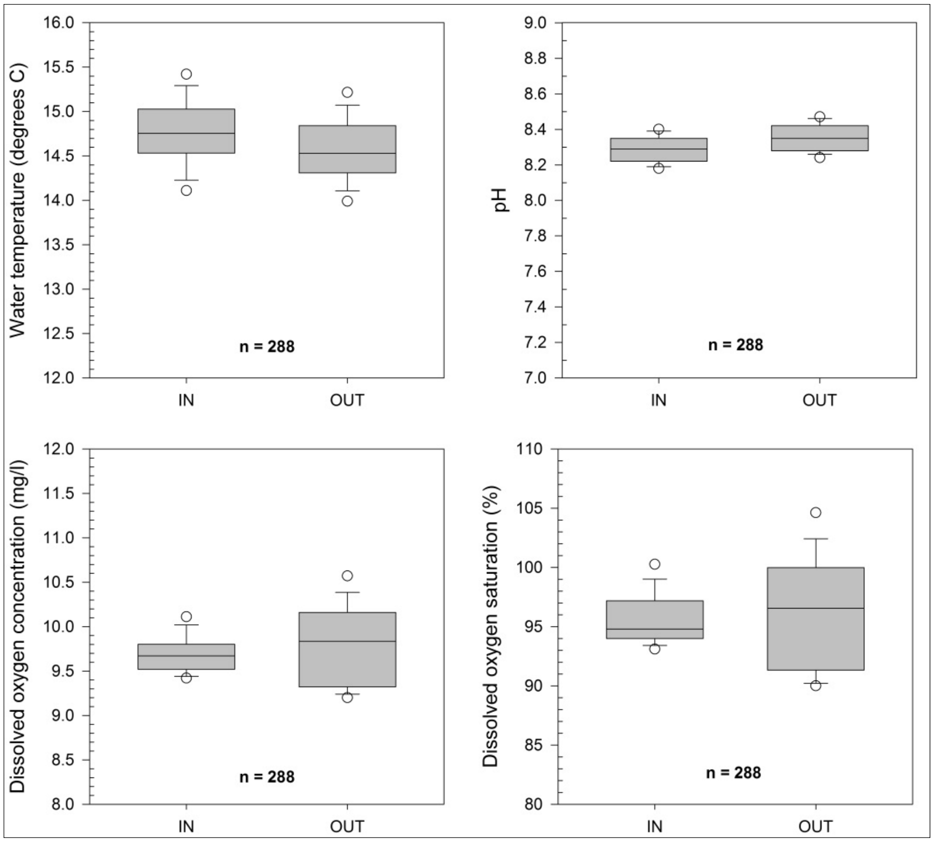
Considerable effort has gone into planning for the restoration of a MCR steelhead run into the Crooked River watershed (Carmichael and Taylor 2010; NMFS 2009, 2012; and multiple others). Provision of permanent fish passage at the Opal Springs Hydroelectric Project would be central to such an effort. Re-establishment of a viable Crooked River population of MCR steelhead is not essential to recovery of the species but would certainly contribute to its recovery (NMFS 2012).

2.4. HABITAT CONDITIONS AT THE PROJECT SITE

2.4.1. Habitat Quantity and Quality

Available habitat is suitable for use by the species addressed in this BA from the lower end of the Project at Mile 6.9 on the Crooked River to the upriver end of the Project (now Mile 7.8 but nearly Mile 8.0 if the Proposed Action occurs). This habitat is strongly affected by profuse contributions to flow from cool groundwater springs, as described by Huntington (2009), and is heavily utilized by the resident redband form of native rainbow trout above and below the Opal Springs diversion pool. The 0.55-mile long pool itself is not heavily used by these fish during summer (direct personal observation), apparently due to their preference for physical habitat with the greater structural diversity and stronger velocity gradients found immediately upstream, in the bypass reach, and in the Project tailrace. Modeling by Cramer and Beamesderfer (2006), Ackerman et al. (2007), and by Spateholtz (2015), has ascribed little rearing potential for MCR steelhead to habitat at the Project due to a thermal regime that apparently favors the resident form of rainbow trout. Assuming this is correct, steelhead will use the area primarily as a migratory corridor for sea-run adults returning to, and smolts migrating seaward from, the Crooked River watershed. Moderate thermal conditions in Crooked River at the Project, with temperatures that rarely dip below 10^{o}C and never reach 16^{o}C, may also be well suited to temporary holding by adult MCR steelhead during their migration toward areas upstream.

In contrast to many areas farther upstream in the watershed, water quality is generally good at the Project (Huntington 2009). This, combined with an abundance of prey-sized fishes, make it suitable for use as bull trout foraging habitat. Water quality conditions vary at the project, depending on location, as indicated in Figure 2.4.1-1. Solar heating of the existing diversion pool causes minor and difficult to measure increases in maximum summer water temperatures (Huntington 2009). The biological activity of aquatic macrophytes growing in some portions of the pool influence both pH and dissolved oxygen concentrations within the waterbody, but the magnitude of this influence is also small and difficult to discern with precision. Large volumes of groundwater enter the diversion pool at depth and their water quality characteristics have proven hard to measure. Reduced flows in the Project bypass reach increase the influence of cool groundwater there, decreasing river temperatures and strengthening the positive effect local groundwater has on water quality.



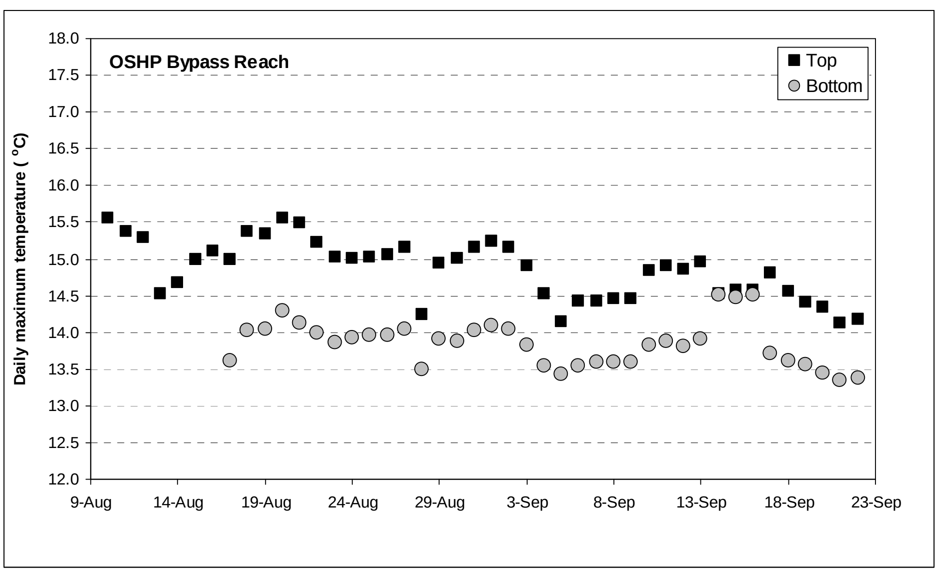


Figure 2.4.1-1. Results of synchronous monitoring of the quality of water entering (IN) and leaving the Opal Springs Hydroelectric Project's diversion pool (OUT) during August 2012 (upper panel), and at the top and bottom ends of the Project's bypass reach during August 2009.

2.4.2. Habitat Connectivity

Fish migrations up the Crooked River are currently blocked at Mile 7.2 by the Opal Springs diversion dam, less than a mile above Lake Billy Chinook, but anadromous adults captured using a temporary trap deployed below the dam in the Project bypass reach are being moved upstream by DVWD staff. This experimental arrangement is contributing to an improved understanding of how reintroduced salmon and steelhead will respond to the Project and to habitat within the watershed upstream (as per NMFS 2012). However, it requires human handling of each fish trapped and does not meet modern expectations for fish passage performance. It may stress the fish captured, whether they are passed upstream or recycled to the bypass, and has proven less effective than hoped at converting anadromous fish apparently intending to pass upstream into fish actually passed upstream (Huntington 2015a). Of 68 adult summer steelhead known to have arrived at the project tailrace during the most recent (2014-15) migration season, 64 (94%) moved into the bypass reach, suggesting migratory intent, but only 40 (63% of 64 adults) were actually trapped and passed over the dam (Huntington 2015a). A total of 42 bull trout were captured in the trap during its most recent full year of operation and recycled downstream (Huntington 2015a).

In addition to the lack of permanent upstream fish passage at the Project, fish agencies, tribes, and others, have expressed concerns that upstream migrant fish, downstream migrant fish, or both, may experience difficulties passing the Project even when upstream passage is provided at the diversion dam, whether the passage involves a temporary trap or a fish ladder. These concerns relate to multiple Project features, as outlined below, and have been taken into account in the Opal Springs Fish Passage and Protection Plan:

- *Potential for false attraction of upstream migrants to the powerhouse and the possibility that fish will suffer turbine-strike injuries or mortality.* This concern has lessened over the last couple of years because the anadromous fish reintroduced to the area do not appear strongly attracted to the powerhouse. A quantitative analysis suggests the risk that bull trout or other non-anadromous salmonids could enter the powerhouse from below and reach the turbine is extremely low (Huntington 2015a).

- *Possible upstream migrant rejection of the bypass as a migration route or failure to move through the bypass and into the trap or ladder in a timely manner.* Most anadromous fish that have migrated up into the Project tailrace over the last several years have also moved into the bypass reach, but some have not done so and many of the fish that have entered the bypass have not been trapped (Huntington 2015a). The rates at which fish will migrate upstream through the Project after ladder installation remain uncertain.

- *Potential for losses of migrant fish to predators in the bypass reach.* Conditions in the Project bypass may increase the vulnerability of upstream migrant adult fish or juvenile emigrants to large predators. Concern that the risk of predation on adults could be consequential if there are migratory delays within the reach has been validated during the last few years by river otter predation on some adult steelhead that did not enter the fish trap.

- *Potential for losses of upstream migrants to injuries or mortality as a consequence of fallback, either through the powerhouse or over the Project spillway.* The levels of such losses are uncertain at present. Huntington (2015b) provides a desktop analysis of this situation that will be verified or revised after the ladder has been installed and fish passage performance monitored.

- *Absent improvements at the Project such as are included in the Plan, there is a potential for high aggregate losses of downstream migrants to injuries or mortality as they pass the Project via surface spills of water into the bypass reach or become entrained at the diversion dam and pass via the powerhouse.* The levels of such losses are uncertain at present. Huntington (2015b; 2015c) provides desktop analyses of the potential for such losses that will be verified or revised after the ladder has been installed and fish passage performance monitored. Those analyses suggest that absent improvements such as are included in the Plan, existing downstream passage conditions may cause the mortality of an average of ~9-10 percent of the annual emigration of naturally produced steelhead smolts that reach the Project.

2.5. DESIGNATED CRITICAL HABITAT

Federal agencies have identified Critical Habitat for both Columbia River bull trout (75 FR 63898) and for Middle Columbia River steelhead (70 FR 52630). The Analysis Area contains designated Critical Habitat for the bull trout but not for the steelhead. The section of Crooked River extending 12.2 miles from the Highway 97 Bridge down to Lake Billy Chinook, which includes the Project, has been so designated for Columbia River bull trout.

Primary Constituent Elements (PCEs) of bull trout habitat include (1) space, (2) food, (3) cover or shelter, (4) sites for breeding, reproduction or rearing, and (5) connectivity among spatially dispersed elements. Bull trout are provided most of these five habitat elements in the section of Crooked River below the Project's diversion dam, and use the habitat available there as foraging sub-adults and adults. However, temperature regimes suitable for reproduction by the species are apparently absent. Potential habitat for foraging bull trout is extensive above the diversion dam but its quality declines in the upriver direction during summer, including within the section designated as Critical Habitat, due to reduced groundwater influence (Torgerson et al. 2007; see Figure 2.5-1).

NOTE: This 2015 BA has been supplemented by memo dated April 17, 2017. This memo has been attached to this Exhibit A of the APEA (as filed, October 2017)

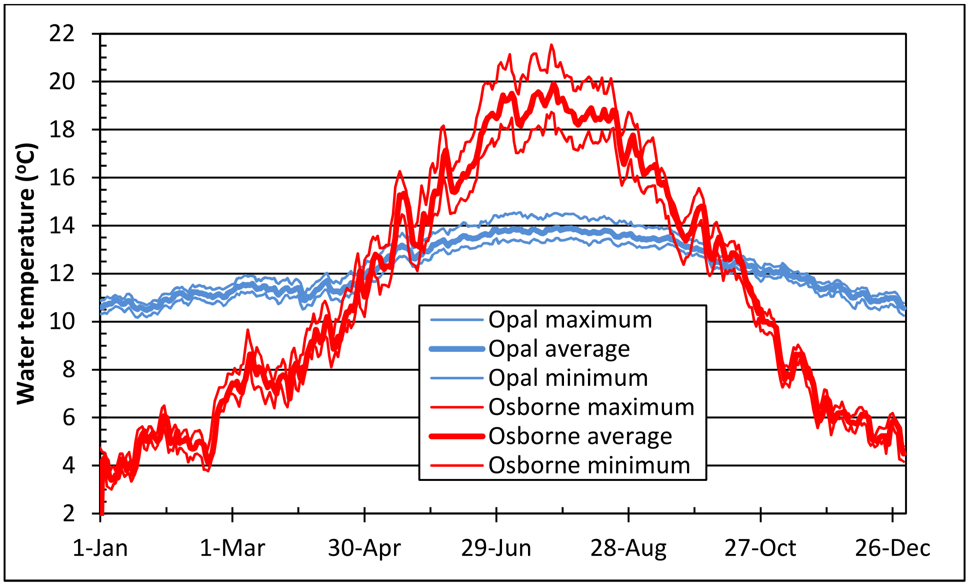


Figure 2.5-1. Annual thermal regimes expressed as average daily maximum, average, and minimum water temperatures in the lower Crooked River above Opal Springs ("Opal" at Mile 6.9; water years 2006-2014) and below Osborne Canyon ("Osborne" at Mile 13.5; water years 2003-2006). Adapted from source data for U.S. Geological Survey monitoring at gauges 14087400 (USGS 2015a) and 14087380 (USGS 2015b).

3. DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action involves DVWD applying to the FERC for a non-capacity amendment to its license for the Opal Springs Hydroelectric Project and, upon approval, installing a fish ladder at the Project as well as meeting other responsibilities it has accepted under the Opal Springs Fish Passage and Protection Plan ("the Plan"; DVWD 2011). The intent of this action will be to restore permanent fish passage through the lower Crooked River, Oregon, sooner than might otherwise occur while gaining reasonable regulatory assurance that DVWD will not be surprised by unanticipated Endangered Species Act constraints on project operations during the remainder of a license term already set to expire in 2032. This assurance would apply to issues related to Columbia River bull trout that might arise from the time the Plan is initiated through 2032. It would apply also to any issues that might arise in relation to MCR steelhead after the Non-essential Experimental Population designation of the fish being reintroduced to the area expires (if it expires) in January 2025.

The Plan calls for DVWD, with assistance from fish agencies, tribes, and other signatories, to first make an initial set of fish passage improvements at the Project (including construction of the ladder) and then to step through a series of three 5-year adaptive management (AM) periods in which fish passage performance would be evaluated against agreed-upon performance targets. At the end of each period, monitoring data accumulated over the period will be used to identify possible fish passage problems and to identify remedies from a specified suite of potential actions. Remedies will be selected and applied, where appropriate, prior to the initiation of each new period. The passage performance targets that have been agreed upon for the species covered by this BA are given in tables 3-1 and 3-2. The Plan is structured with an intent to assure that performance "standards" will be met and that that DVWD will strive to meet aspirational performance "goals".

Table 3-1. Upstream fish passage performance targets that will be used to drive adaptive management of fish passage improvements at the Opal Springs Hydroelectric Project (DVWD 2011).

Species	**Standard (to be met)**	**Goal (to be strived for)**
Steelhead and Chinook Salmon adults	≥90% successful upstream passage of migratory adults, with ≥90% of those adults that do successfully pass the Project doing so by a specified date each year[1]. Fish that perish when falling-back after dam passage will be considered unsuccessful migrants.	≥97% successful upstream passage of migratory adults destined for areas above the Project. Fish that perish when falling-back after dam passage will be considered unsuccessful migrants.
Bull trout adults and subadults	≥90% successful upstream passage, with the standard assumed to be met if that for steelhead adults is met at the Project.	≥97% successful upstream passage, with the goal assumed to be met if that for steelhead adults is met at the Project.

Table 3-2. Downstream fish passage performance targets that will be used to drive adaptive management of fish passage improvements at the Opal Springs Hydroelectric Project (DVWD 2011).

Species	**Standard**	**Goal**
Steelhead and Chinook Salmon smolts	≥90% passage survival	≥97% passage survival
Bull trout adults and subadults	Assumed to be met if the ≥90% passage survival standard for steelhead smolts is met and levels of upstream passage by bull trout >12" at the Project do not exceed 1,000 fish on an annual basis.	Assumed to be met if the ≥97% goal for steelhead smolts is met.

[1] This objective implies that there is a target date each year by which the specified proportion of adult spawners should have passed the project in order for the run to reach the spawning grounds above the project at an appropriate time of year. The target date is unknown, and will be the subject of ongoing research as part of the reintroduction plan. There will be a multi-party effort to establish this date as soon as is practical.

3.1. PROPOSED CONSTRUCTION AND OPERATIONAL CHANGES

The Plan includes multiple fish passage measures outlined in DVWD (2011) and described in detail by CH2M Hill (2014). Construction that is certain to occur prior to the first 5-year adaptive management period described in the previous section will include the installation of a 30 cfs fish ladder at the Project diversion dam, raising the dam and diversion pool by an estimated 6 feet so that modest increases in generation potential can offset modest reductions in water diversions that will occur so as to increase bypass flows, and making fish-friendly improvements to the dam's spillway. Multiple additional structural or operational project mitigation or enhancement measures (PMEs) relevant to CR bull trout and MCR steelhead will be implemented or considered in an adaptive management fashion. The PME's identified in the Plan include:

- establishment and use a Banked Flow Accrual Account (BFAA),
- adjustments or minor modifications to the ladder to optimize its performance,
- enhancements to the bypass channel,
- removal of a peninsula situated between the powerhouse and the bypass channel,
- behavioral deterrents to fish entrainment through the Project intake,
- refinements of spillway operations and consideration of further improvements
- trash rack modifications, and
- remote monitoring.

3.2. MEASURES AFFECTING AQUATIC SPECIES

The following section describes measures included in the Plan that will affect the ESA-listed species being addressed by this BA.

Fish Ladder. A 30 cfs pool-and-weir fish ladder having 9-inch vertical steps has been designed for the Project in consultation with the fish agencies and tribes, and will be installed on the east bank of the river at the site of the diversion dam. The ladder's site-specific design is given by CH2M Hill (2014), and includes accommodations for potential fish trapping operations within the ladder itself and remote video monitoring of ladder passage by fish 12 inches or more in length. In-water work on the ladder will occur during a construction season established to minimize potential effects on fish or water quality (01 July to 31 October; ODFW 2008) or otherwise approved by the fish agencies. All work done on the ladder will follow construction best management practices.

Dam raise and spillway improvements. Modifications to the crest and spillway of the Project diversion dam will accompany ladder construction and will also follow construction best management practices. Specific designs for these modifications are given by CH2M Hill (2014) and include reconstructing the concrete pad atop the dam crest and installing four automated Obermeyer weir gates that can be individually inflated (or deflated) to (or from) levels up to 9 feet above the new pad. Three of the gates will control up to 1,805 cfs of discharges into the bypass reach through sections of spillway whose formerly roughened surfaces will be transformed into smooth, fish-friendly surfaces bordered by concrete walls or baffles parallel to flow. Bypass discharges above 1,805 cfs will travel via the fourth gate down an unmodified section of the existing roughened spillway. All work done to modify the dam crest and improve the spillway(s) will follow construction best management practices, and during the same season as fish ladder construction where appropriate.

Bathymetric and topographic survey results from CH2M Hill (2014) suggest that after the dam raise, increasing the surface elevation of the diversion pool by a maximum of 6 feet will increase the length of the pool upstream by 25 percent (from 2,925 to 3,650 feet), its surface area by 43 percent (from 10.9 to 15.5 acres) and its volume by 97 percent (from 83.6 to 164.8 acre-feet). Under average flow conditions, the increase in volume will be accompanied by a 49 percent reduction in mean diversion pool velocities (to an average of about 0.6 feet per second overall) and by a 97 percent increase in water retention time (to 1.63 hours). The changes in water volume, velocity, and retention are likely to decline to some unknown degree over time as a consequence of sediment deposition within the pool.

Expansion of the reservoir as per the Proposed Action is expected to cause increases in maximum water temperatures at the Project tailrace that may be on the order of 0.1°C, increases in maximum pH levels of perhaps 0.1 standard unit, and decreases in minimum dissolved oxygen levels of about 0.1 mg/l. All of these minor shifts in water quality constituents will be partly ameliorated by profuse groundwater inputs into the Project bypass reach and immediately below the tailrace.

Banked Flow Accrual Account (BFAA). This certain-to-occur measure will involve "banking" water equivalent to 25 percent of the added revenue derived from the pool raise (during the first and potentially subsequent AM periods), 35 percent (during the second and potentially third AM period, if passage performance targets have not been met), and 45 percent (during the third AM period if performance targets were not met during the second period). In addition to the availability of these flow accruals, the increased head at the Project will lower the magnitude of flow diversion necessary to maximize hydroelectric generation from the existing powerplant from 1,772.5 cfs to an estimated 1,600 cfs. This reduction is anticipated to significantly increase the number of days water volumes greater than the existing 50 cfs conservation minimum will be spilled into the bypass even without drawing upon water banked in the BFAA.

Flows in the bypass reach will increase as a consequence of the BFAA. Adaptive management of water banked in the account will be at the discretion of the fish agencies and tribes, and its seasonal or daily patterns of use will be varied over time to improve fish passage performance at the Project.

Adjustments to optimize fish ladder performance. Adjustments or minor ("fit and finish") modifications will be made to the ladder soon after its installation, to optimize performance. This will be a certain-to-occur measure.

Remote monitoring. Another certain-to-occur measure, monitoring of radio-tagged fish and those passing through the fish ladder will accumulate information on fish passage, timing, and behavior at the Project during each AM period. Evaluation of the resultant data will inform decisions on the need for additional (optional) PMEs as well as the selection and implementation of such measures.

Enhancements to the bypass channel. A dense boulder field in the upper portion of the bypass reach has caused passage difficulties for some of the anadromous fish that have arrived at the Project during the last few years. This optional but likely-to-occur measure would involve movement of rocks and boulders in the bypass reach downstream of the fish ladder entrance to provide better adult fish passage conditions. All such in-water work would occur during a construction season established to minimize potential effects on fish or water quality and would follow construction best management practices.

Removal of a small peninsula between the powerhouse and the bypass channel. If there are consequential adult delays at the Project powerhouse following ladder installation and possible bypass improvements, removal of a peninsula of land that currently separates the tailrace from the bypass channel will be considered as an option. If selected, this measure will occur during a construction season established to minimize potential effects on fish or water quality and would follow construction best management practices.

Install and operate behavioral deterrents to fish movement into the Project intake. Experimental measures for preventing fish entrainment and losses to powerhouse mortality are an explicit option for DVWD under the Plan. Any such measures would be subject to standard environmental permitting.

Spillway operations. Management of the new spillway gates at the Project diversion dam will be adjusted through adaptive management, to improve fish passage effectiveness. Adjustments to spillway operations are likely to occur whenever spillway-related fish passage problems or ways to improve fish passage through adjustments in spillway gate management are identified.

Trash rack modifications. At present the Project takes Crooked River water from the southwest corner of the diversion dam through a large trash rack with vertical bar spacing of 5.5 inches. The rack extends from the top to bottom of the diversion pool, and the water flowing through it moves at an average velocity of about 1.4 to 2.7 feet per second, depending upon discharge, as opposed to an average water velocity in the forebay of approximately 0.2 feet per second.

Multiple studies of adult salmon on the Columbia and Snake rivers have shown that adult anadromous salmonids prefer to pass downstream via surface spill rather than following deeper passage routes into hydroelectric turbines. In fact, a quick reanalysis of data provided by

Wertheimer and Evans (2005) and by Colotello et al. (2013) suggests that surface spills of water at such dams can be up to 15 times or more effective at attracting steelhead kelts for downstream passage than is deeper water pulled toward turbines. Also, juvenile Chinook salmon have been shown under experimental conditions to begin resisting entrainment through trash racks whose gaps were equivalent in width to about one fish body length (Hanson and Li. 1983), and to respond more strongly as the gaps were narrowed. Although these sorts of responses may not be universal among salmonids of differing species or ages, they suggest that many of the larger salmonids that will enter the Project forebay in the future will prefer surface routes of downstream passage and may resist entrainment into the Project intake. Sub-adult and adult CR bull trout and adult MCR steelhead may resist entrainment partly because of their size, given that they are likely to be 2 to >5 times longer than the 5.5-inch gaps in the rack. However, the fish will be physically able to pass through the racks and enter the powerhouse, and some of them may do so.

There will certainly be good reason to want to avoid having fish pass downstream via the Project turbine if and when passage routes are available along which higher rates of survival could be expected. At Opal Springs such routes will, in the future, consist of surface spills from the forebay that will pass into the bypass reach via fish-friendly routes. The importance of having fish find these more fish-friendly routes increases with fish size, because rates of turbine mortality increase with size. Although there have been no on-site studies, an application by Huntington (2015c) of a standard turbine strike model to site-specific conditions suggests that entrained sub-adult bull trout, adult bull trout, and adult steelhead having the size distributions observed or expected at the Project might experience mortality rates averaging about 15 percent, 25 percent, and nearly 30 percent, respectively. This would compare to rates of mortality when passing via improved spillway routes of less than perhaps 1 or 2 percent.

If monitoring data suggest consequential losses of fish entrained through the Project intake and passing through the Opal Springs turbine, DVWD may choose to narrow the gaps, change the orientation, or otherwise modify the Project trash rack. If so, it would automatically initiate a restart of an adaptive management cycle per the Plan.

4. EFFECTS OF THE PROPOSED ACTION

4.1. DIRECT EFFECTS

Direct effects of the Proposed Action seem likely to be both beneficial and adverse to the species covered by this BA. The beneficial effects of the Project on CR bull trout would include an expansion of geographic range and increased forage availability for those members of the Metolius populations that disperse through Lake Billy Chinook and into the lower Crooked River during periods when forage is limiting in the reservoir. Recent observations suggest that forage may become limiting for larger migratory bull trout from those populations when kokanee abundance in the reservoir reaches cyclical lows (Ratliff 2015). Beneficial effects for MCR steelhead have been clearly implied by NMFS (2012). Without effective fish passage at the Opal Springs Hydroelectric Project, ongoing efforts to ready the basin for a re-established run of these fish would have an uncertain or differing purpose, and attempts to learn from experimental reintroduction efforts would be hampered both by a lack of returning adults and by uncertainty over whether any of the fish being produced in the system were truly indicating which parts of the watershed were actually functioning well enough to sustain natural-origin fish. Provision of fish passage at the Project would benefit the watershed-wide reintroduction effort, and thus the MCR steelhead themselves.

However, the Proposed Action is also likely to have direct effects potentially adverse to individual CR bull trout and MCR steelhead. Potentially adverse effects on the bull trout will be reduced by thoughtful implementation of the adaptive management component of the Opal Springs Fish Passage and Enhancement Plan (DVWD 2011), but include:

- *Injury or mortality of individual sub-adult or adult fish that are passed upstream if or when they are entrained by the Opal Springs powerhouse intake while passing back downstream.* Absent detailed, site-specific information, the level of such losses that might occur has been evaluated through a desktop analysis by Huntington (2015b).
- *Injury or mortality of individual sub-adult or adult fish that are passed upstream when passing back downstream via the Project spillway.* Absent detailed, site-specific information, the level of such losses that might occur has been evaluated through a desktop analysis by Huntington (2015b).

Modeling results from Huntington (2015b) that rely upon multiple reasonable but yet-to-be confirmed assumptions suggest that if all bull trout passed upstream at the Project immediately reverse course and head back downstream, as many as about 14 per 100 might perish on their way back to the lower-most Crooked River. This outcome seems unlikely, but would probably cause the maximum level of Project-induced mortality for bull trout passed upstream. If, as expected, most bull trout that are passed spend an extended period of time foraging upstream of the Project, they will be larger and experience higher per-capita rates of mortality when passing back downstream, but cumulative mortality during their foraging period is likely to reduce their numbers such that the total number that perish at the Project will be lower than if they had all reversed course immediately after first passing upstream (Huntington 2015b). Lower rates of immediate fallback are expected to be associated with lower aggregate bull trout mortality at the Project. If there is no such fallback and down-migrant passage route selection at the Project is in direct proportion to the volumes of water passing via each accessible route, Huntington (2015b) has estimated about 13 of every 100 bull trout passed upstream at the Project might perish when passing back downstream. If emigrant bull trout are more strongly attracted to passage routes associated with the Project bypass or less attracted to the powerhouse intake, lower levels of bull trout mortality would be expected.

Potentially adverse effects of the Proposed Action on MCR steelhead, which will also be reduced by thoughtful implementation of the adaptive management component of the Opal Springs Fish Passage and Enhancement Plan (DVWD 2011), include:

- *Injury or mortality of individual smolts, adults prior to spawning, or kelts, if or when they are entrained by the Opal Springs powerhouse intake while passing downstream.* Absent detailed, site-specific information, the level of such losses that might occur has been evaluated through a desktop analysis by Huntington (2015b, c).
- *Injury or mortality of individual smolts, adults prior to spawning, or kelts, when they pass downstream via the Project spillway.* Absent detailed, site-specific information, the level of such losses that might occur has been evaluated through a desktop analysis by Huntington (2015b, c).
- *Increased predation potential for MCR steelhead smolts emigrating through the expanded diversion pool whether due to increased abundances of predators (including CR bull trout), greater vulnerability in a somewhat slower-flowing pool, or both.* The risk that this will be a consequential problem is uncertain but seems low (Huntington 2009)
- *Mortality from turbine strike if adult MCR steelhead move up into the draft tubes.* Quantitative analyses suggest this is a physical possibility but direct observations and telemetry of these fish at the Project suggest that if it does occur it will be at a low frequency of occurrence (Huntington 2015a).
- *Migratory delays or outright fish mortality as a result of adult failure to pass the project.* Experience with the temporary passage system now in place at the Project suggests that this type of problem is certainly a risk but multiple elements of the Plan should minimize the problem.

The Proposed Action will without question lower the injury and mortality rates of MCR steelhead at the Project if compared to a prolonged application of the existing temporary trapping system installed to address adult returns from ongoing experimental reintroduction efforts.

4.2. INDIRECT, INTERDEPENDENT, AND INTERRELATED EFFECTS

This section of the BA provides a very brief analysis of whether the bull trout and steelhead populations to be affected by the Proposed Action can be expected to survive with an adequate potential for recovery under the effects of the proposed or continuing action, the environmental baseline, and any interrelated, interdependent and indirect effects. The baseline includes existing Project operations as licensed by the FERC. Interrelated actions are activities that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those which have no independent utility apart from the action being considered. Indirect effects are themselves caused by the action but are removed in space and/or time.

The interrelated, interdependent, and indirect effects of the Proposed Action include:

- Implementing the Plan will improve the prognosis for a successful MCR steelhead reintroduction effort within the geographic area covered by the recent Non-essential Experimental Population designation by NMFS (78 FR 2893). The migratory success of reintroduced anadromous salmonid smolts emigrating through Lake Billy Chinook has thus far been higher for fish from the Crooked River watershed than it has been for those from the reservoir's other tributaries (Hill 2015). This, combined with the watershed's estimated smolt production potential, makes experimental steelhead in the Crooked River watershed those most likely to become self-sustaining contributors to the species if existing sources of mortality can be reduced. Within the area of experimental reintroduction, the opportunity to reduce current rates of MCR steelhead mortality at the Opal Springs Hydroelectric Project may rank second only to opportunities that others have to reduce losses of migratory individuals in Lake Billy Chinook as a way to improve the survival and productivity of fish produced across a multitude of locations in the Crooked River watershed. Taking advantage of the opportunity available at Opal Springs is the specific purpose of implementing the Plan.

- Implementing the Plan may further benefit MCR steelhead by encouraging greater participation and support from local, regional, and other potential partners in ongoing recovery efforts, both within the Analysis Area and beyond.

4.3. CRITICAL HABITAT

Per section 2.5 of this BA, the mainstem of Crooked River extending 12.2 miles from Lake Billy Chinook upstream to the Highway 97 Bridge has been designated as Critical Habitat for CR bull trout. The habitat is suited to foraging, migration, and overwintering by these fish, although this use would be expected to be seasonal in the upper reaches of this segment of river (see section 2.5).

The Proposed Action will have minor, short-term effects on the turbidity of habitat below the Project due to construction activities, but these will be minimized by best management practices and potential effects on the habitat available to CR bull trout below the Project will be further limited by the construction season chosen. The Action will also have several durable effects on the designated Critical Habitat in Crooked River. First, it will provide CR bull trout access to most of this habitat. Second, it will expand the existing diversion pool at the Project, increasing the extent of slow-flowing areas and decreasing the extent of more rapidly flowing areas. The slower flowing areas could be advantageous to foraging bull trout due to increased prey vulnerability to predation but might (or might not) affect the local abundance of prey. Huntington (2009) found that the pool expansion would inundate about 1 percent of the riverine habitat within the designated section of river and have a small, incremental effect on water quality in the diversion pool. The small shifts in water quality within the pool would be diminished downstream by profuse inputs of high-quality groundwater, including within the Project bypass reach. Within that reach, thermal conditions would be returned to something closer to their natural state by increased flows associated with the BFAA.

4.4. CUMULATIVE EFFECTS

The Proposed Action will contribute to broader and more diverse efforts to recover MCR steelhead, as noted in the previous section. Efforts to improve conditions for these fish being made by Portland General Electric Company both downstream at the Pelton-Round Butte Hydroelectric Project and upstream in the Crooked River watershed, as well as helpful actions by local irrigation districts, private and public landowners, and others, should cumulatively improve chances that a self-sustaining population can be reestablished in the watershed.

5. CONCLUSIONS

On balance, the Proposed Action appears potentially beneficial to the recovery of MCR steelhead but of lesser consequence for CR bull trout, with the caveat that predicting biological responses to environmental change can be difficult. There may be benefits to the bull trout that are more significant than recognized. Regardless, the anticipated effects of the Action have been discussed earlier in this BA, and are summarized briefly in Table 5-1.

The Action may affect, and seems likely to adversely affect, individual MCR steelhead and CR bull trout.

Table 5-1. Summary of the Proposed Action's probable effects on Columbia River bull trout and Middle Columbia River steelhead.

	Effects of the Action			
Diagnostics	Restore	Improve	Maintain	Degrade
Spawning and Incubation			There will be no consequential effect on either species, as naturally spawned individuals are not anticipated to reproduce in the area to a significant degree.	
Rearing/foraging		Foraging conditions will be improved for bull trout, due to expanded access to prey.	There will be little effect on juvenile steelhead rearing in the area for the reason given above.	
Upstream passage facilities		Migration conditions will be improved for both species.		
Overwintering		Access to thermally moderate overwintering habitat will be expanded for bull trout and improved for steelhead.		
Downstream passage facilities		Migration conditions will be improved for steelhead.	Migration conditions will be improved but will cause mortality for bull trout that would otherwise be blocked from the watershed upstream. The consequences of this mortality, given the numbers of fish likely to be involved, would be quite small if measurable.	
Water quality conditions			There will be a small, incremental decrease in water quality caused by expansion of the diversion pool. The effects on the listed species would be unmeasurable.	There will be a small, incremental decrease in water quality caused by expansion of the diversion pool. The effects on the listed species would be unmeasurable.
Critical Habitat			There is no Critical Habitat (CH) for MCR steelhead in the Analysis Area. CH for CR bull trout will be better utilized above the Project and will not be degraded from its natural condition below the Project. Changes to habitat suitability for the foraging and overwintering of bull trout within the diversion pool expansion zone is unclear.	

6. REFERENCES

Bambrick, D., T. Cooney, B. Farman, K. Gullett, L. Hatcher, S. Hoefer, E. Murray, R. Tweten, R. Gritz, P. Howell, K. McDonald, D. Rife, C. Rossel, A. Scott, J. Eisner, J. Morris and D. Hand. 2004. Critical Habitat Analytical Review Team (CHART) Assessment for the Middle Columbia River Steelhead ESU.

Carmichael, R. W. and B. J. Taylor. 2010. Conservation and recovery plan for Oregon steelhead populations in the middle Columbia River steelhead distinct population segment. ODFW, Portland, Oregon.

CH2M Hill. 2014. Opal Springs Hydroelectric Project pool raise and fish passage improvements: 99% supporting design report. Consultant report prepared for the Deschutes Valley Water District by CH2M Hill. July 2014.

Colotelo, A., B. Jones, R. Harnish, G. McMichael, K. Ham, Z. Deng, G. Squeochs, R. Brown, M. Weiland, G. Ploskey, X. Li, and T. Fu. 2013. Passage Distribution and Federal Columbia River Power System survival for steelhead kelts tagged above and at Lower Granite Dam. Report PNNL-22101, prepared for the U.S. Army Corps of Engineers under contract no. W912EF-08-D-0004. Batelle, Pacific Northwest Division, Richland, Washington. March 2013.

Cramer, S., and R. Beamesderfer. 2006. Population dynamics, habitat capacity, and a life history simulation model for steelhead in the Deschutes River, Oregon. S. P. Cramer and Associates, Inc. Gresham, Oregon. Prepared for Portland General Electric, Portland, Oregon.

Deschutes Valley Water District (DVWD). 2011. Appendix B to the 2011 Settlement Agreement for fish passage at the Opal Springs Hydroelectric Project (FERC No. 5891). Deschutes Valley Water District, Madras, Oregon. 44 p.

Ebersole, J., W. Liss, and C. Frissell. 2003, Thermal heterogeneity, stream channel morphology, and salmonid abundance in northeastern Oregon streams. Canadian Journal of Fisheries and Aquatic Sciences 60:1266-1280.

Federal Energy Regulatory Commission (FERC). 2009. Preparing environmental documents, guidelines for applicants, contractors, and staff. Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing. September 2008.

Giger, R. 1973. Streamfiow requirements of salmonids. Oregon Wildlife Commission, Project AFS-62-1, Job Final Report, Portland, Oregon.

Hanson, C., and H. Li. 1983. Behavioral response of juvenile Chinook salmon, Oncorhynchus tschawytscha, to trash rack bar spacing. Calif. Fish and Game 69(1):18-23.

Hill, M. 2015. Personal communication from Megan Hill, Portland General Electric Company, Madras, Oregon, to Charles Huntington, Clearwater BioStudies, Inc., Shady Cove, Oregon. ADD DATE.

Hodgson, B. 2015. Email communication plus attachments sent on 17 June 2015 from B. Hodgson, Oregon Department of Fish and Wildlife, Bend, Oregon, to C. Huntington, Clearwater BioStudies, Inc., Shady Cove, Oregon.

Huntington, C. 2009. Environmental "fatal flaws" analysis for an Opal Springs pool-raise of about 4 feet*. Technical memorandum to the Settlement Working Group, with later recognition that the raise might be greater than 4 feet. Clearwater BioStudies, Inc., Canby, Oregon. 07 May 2009.

Huntington, C. 2015a. Upstream passage of adult salmonids and other fish at the Opal Spring Hydroelectric Project. Technical memorandum to Finlay Anderson, McMillen-Jacobs Associates, Portand, Oregon. Clearwater BioStudies, Inc., Shady Cove, Oregon. 16 June 2015.

Huntington, C. 2015b. Analysis of potential entrainment or spillway mortality of large salmonids at the Opal Springs Hydroelectric Project. Technical memorandum to Gary Lytle, Deschutes Valley Water District, Culver, Oregon. Clearwater BioStudies, Inc., Shady Cove, Oregon. 20 August 2015.

Huntington, C. 2015c. Analysis of potential smolt mortality at the Opal Spring Hydroelectric Project. Technical memorandum to Finlay Anderson, McMillen-Jacobs Associates, Portand, Oregon. Clearwater BioStudies, Inc., Shady Cove, Oregon. 15 June 2015.

Lickwar, P. 2015. Personal communication from Peter Lickwar, U.S. Fish and Wildlife Service, Bend, Oregon, to C. Huntington, Clearwater BioStudies, Inc., Shady Cove, Oregon. 16 June 2015.

McPhail, J. A., and C. B. Murray. 1979. The early life-history and ecology of Dolly Varden (Salvelinus malma) in the upper Arrow Lakes. Department of Zoology and Institute of Animal Resources, University of British Columbia, Vancouver, British Columbia.

National Marine Fisheries Service (NMFS). 2009. Middle Columbia River steelhead distinct population segment ESA recovery plan. NMFS, Northwest Region, 30 September 2009.

NMFS. 2012. Final environmental assessment for Non-Essential Experimental Population Designation for Middle Columbia River Steelhead reintroduced above the Pelton Round Butte Hydroelectric Project. RIN no. 0648-BB04. National Marine Fisheries Service, Northwest Region, National Oceanic and Atmospheric Administration. 16 November 2012.

Nehlsen, W. 1995. Historical salmon and steelhead runs of the Upper Deschutes river and their environments. Report to Portland General Electric Company, Portland, Oregon.

Olsen, E., R. Lindsay, and W. Burck. 1991. Summer steelhead in the Deschutes River. Oregon. Oregon Department of Fish and Wildlife, Corvallis, Oregon.

Oregon Department of Fish and Wildlife (ODFW). 2008. Oregon guidelines for timing of in-water work to protect fish and wildlife resources. Available via the internet at http://www.dfw.state.or.us/lands/inwater/Oregon_Guidelines_for_Timing_of_%20InWater_Work2008.pdf. 12 p.

Ratliff, D. 1992. Bull trout investigations in the Metolius River-Lake Billy Chinook system. Pages 37¬44 in P. J. Howell and D. V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Ratliff, D., and P. Howell. 1992. The status of bull trout populations in Oregon. Pages 10-17 in Howell, P. J. and D. V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Ratliff, D., S. Thiesfeld, W. Weber, A. Stuart, M. Riehle, and D. Buchanan. 1996. Distribution, life history, abundance, harvest, habitat, and limiting factors of bull trout in the Metolius River and Lake Billy Chinook, Oregon, 1983-1994. Information report, Oregon Department of Fish and Wildlife, Portland.

Ratliff, D. 2015. Personal communication from Don Ratliff, Portland General Electric Company, Madras, Oregon, to Charles Huntington, Clearwater Biostudies, Inc., Shady Cove, Oregon. ADD DATE.

Shepard, B. B., K. L. Pratt, P.J. Graham. 1984. Life histories of westslope cutthroat and bull trout in the upper Flathead River Basin, Montana. Report to the Environmental Protection Agency. Contract R008224-01-5. Montana Department of Fish Wildlife and Parks, Helena.

Spateholtz, B. 2015. Pelton Round Butte Project (FERC 2030) native fish monitoring plan (habitat component): 2014 Annual Report and 2015 Work Plan. Report submitted to the Federal Energy Regulatory Commission, per License Article 421, by the Portland General Electric Company and the Confederated Tribes of the Warm Springs Reservation of Oregon.

Stuart, A. M., D. Grover, T. K. Nelson and S. L. Thiesfeld. 2007. Redband trout investigations in the Crooked River basin. In: Redband trout: resilience and challenge in a changing landscape. Oregon Chapter, American Fisheries Society. pp 76-91.

Torgerson, C., D. Hockman, D. Bateman, D. Leer, and R. Gresswell. 2007. Longitudinal patterns of fish assemblages, aquatic habitat, and water temperature in the lower Crooked River, Oregon. U.S. Geological Survey, OF 2007-1125. 37 p.

U.S. Geological Survey (USGS). 2015a. Daily streamflow data for U.S. Geological Survey streamflow gauge number 14087400. Internet access available at the address http://waterdata.usgs.gov/or/nwis/uv/?site_no=14087400&PARAmeter_cd=00065,00060

U.S. Geological Survey (USGS). 2015b. Daily streamflow data for U.S. Geological Survey streamflow gauge number 14087400. Internet access available at the address http://waterdata.usgs.gov/or/nwis/uv/?site_no=14087380&PARAmeter_cd=00065,00060

Wetheimer, R., and A. Evans. 2005. Downstream passage of steelhead kelts through hydroelectric dams on the lower Snake and Columbia rivers. Transactions of the American Fisheries Society 134:853-865.

Zimmerman, C. E. and G. H. Reeves. 1999. Steelhead and resident rainbow trout: early life history and habitat use in the Deschutes River, Oregon. Report prepared for Portland General Electric Company, Portland, Oregon. December, 1999.

NOTE: This 2015 BA has been supplemented by memo dated April 17, 2017.
This memo has been attached to this Exhibit A of the APEA (as filed, October 2017)

Clearwater BioStudies, Inc.

1160 Old Ferry Road Shady Cove, Oregon 97539 (503) 895-7498

TECHNICAL MEMORANDUM

To: Gary Lytle, Deschutes Valley Water District, Culver, Oregon
From: C.W. Huntington, CBI Sr. Aquatic Biologist
Subject: Analysis of potential down-migrant mortality for large salmonids at the OSHP
Date: 26 June 2015

The following memorandum describes the methods and results of a preliminary analysis of potential mortality for large salmonids passing downstream at the Opal Springs Hydroelectric Project (OSHP) on the lower Crooked River, Oregon, approximately 0.6 mile above Lake Billy Chinook. The analysis generated survival (or associated mortality) rate estimates for adult Chinook salmon fallback, steelhead fallback, bull trout fallback, emigrating steelhead kelts and emigrating bull trout. The analysis was based on a down-migrant mortality (DMM) model for the OSHP and yielded separate survival rate estimates for the fish just identified under two conditions:

(1) OSHP as currently configured; and

(2) a (proposed) new OSHP operating with a 30 cfs fish ladder, an Obermeyer weir maintaining a diversion pool elevation of 2012 feet, a bypass flow accrual account (BFAA) system with a 287 cfs capacity delivery chute, and two bypass gates intended to aid fish passage that will have a combined capacity of 1,498 cfs (see CH2M Hill 2014).

The DMM Model

The Opal Springs DMM model has seven basic elements. These include (1) Crooked River discharges for a 53-year historical time series, (2) user-defined patterns of fish emigration, (3) defined size distributions for the fish migrating past the OSHP, (4) a user-influenced relationship between daily discharge and the relative use of routes by which fish can pass the OSHP, (5) fish survival rates for each route of passage, (6) user-defined use of the BFAA system, and (7) automated integration of the other six elements. The model generates a sequence of 53 annual smolt survival estimates for hydrologic conditions matching the water year 1962-2014 series. The model allows one to explore the potential consequences of alternative Project configurations or operations (including uses of the BFAA) on fish survival under variable river conditions. Brief descriptions of DMM model elements are given below.

River discharges. The DMM model moves emigrating salmonids through the OSHP on a daily time step during a sequence of 53 distinct years, assigning daily fish route selections that are based on the relative volumes of flow passing the project via the powerhouse, the spillway, and whatever bypass routes are available given a specified project configuration. Daily flows at the project (and upstream) are based on the historical record of discharges in the Crooked River at the Opal Springs gauge (USGS no. 14087400; Figure 1). Daily volumes of flow passing the OSHP via non-powerhouse routes can be made more attractive (or less unattractive) to the fish per unit volume than discharges passing through the powerhouse by adjusting a "bypass effectiveness" setting within the model. This component quantifies the relative (proportional) per-volume effectiveness of surface water passed into the OSHP bypass reach at attracting and passing down-migrant fish when compared to water drawn through the project intake and through the powerhouse. The setting can be adjusted incrementally to test the hypothetical influence of changes in bypass discharges on fish survival rates. It also will allow the DMM model to be fitted to future data on the routes selected by fish passing the OSHP. Model runs for large salmonids have included incremental adjustments of "flow effectiveness" settings ranging from 1 to 20, to account for the strength of fish attraction to water discharged into the bypass or to the relative avoidance of fish to water drawn through the Project intake.

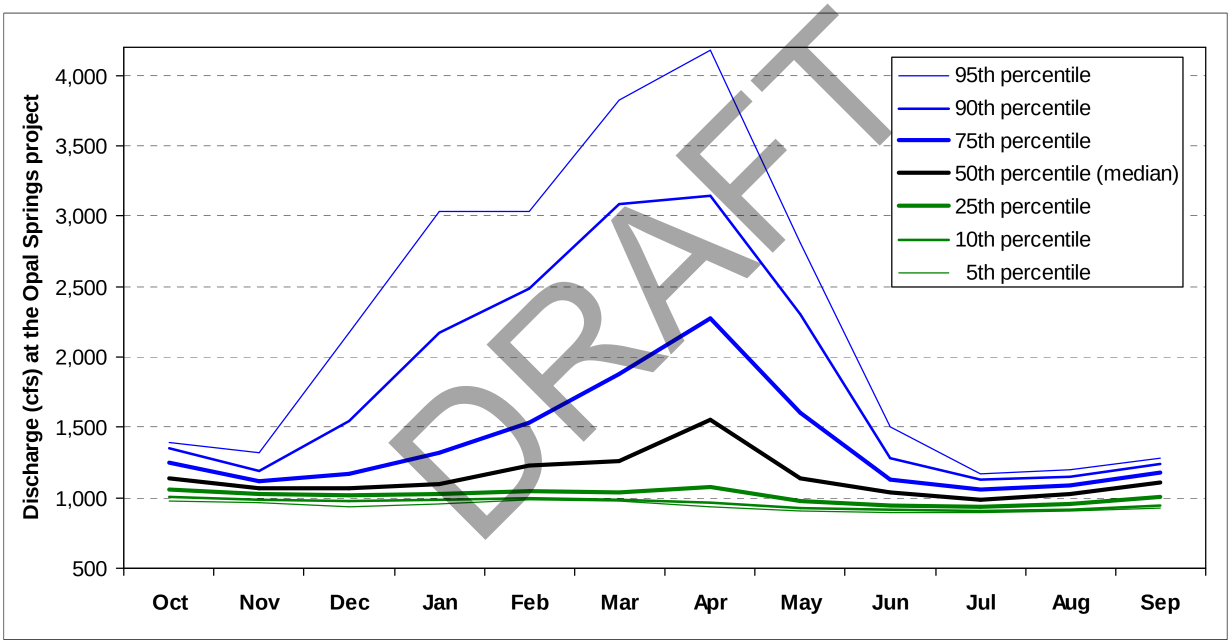


Figure 1. Seasonal (monthly) exceedances for daily discharges in the Crooked River at the OSHP during water years 1962-2014, based on data from the USGS gauge below Opal Springs (gauge no. 14087400).

Fish migration timing and size at the OSHP. Annual survival rates for migrant salmonids at the OSHP are influenced in the DMM model by migration timing and fish size at the project. The model assumes daily passage of a percentage of the total annual migration of a given type of fish, with the exact percentage based on user-defined seasonal (monthly) fractions of annual migration that the model adjusts to daily fish passage at OSHP on the basis of daily discharges estimated for Crooked River above the lower canyon (which begins near the Highway 97 bridge) and a sensitivity factor that makes the annual population of emigrants more or less sensitive to river flows as a migratory cue. Seasonal patterns of migration assumed in the current analysis are given in Figure 2. The flow sensitivity factor was set to "1", a value at the lower end of the range that would seem reasonable for the system.

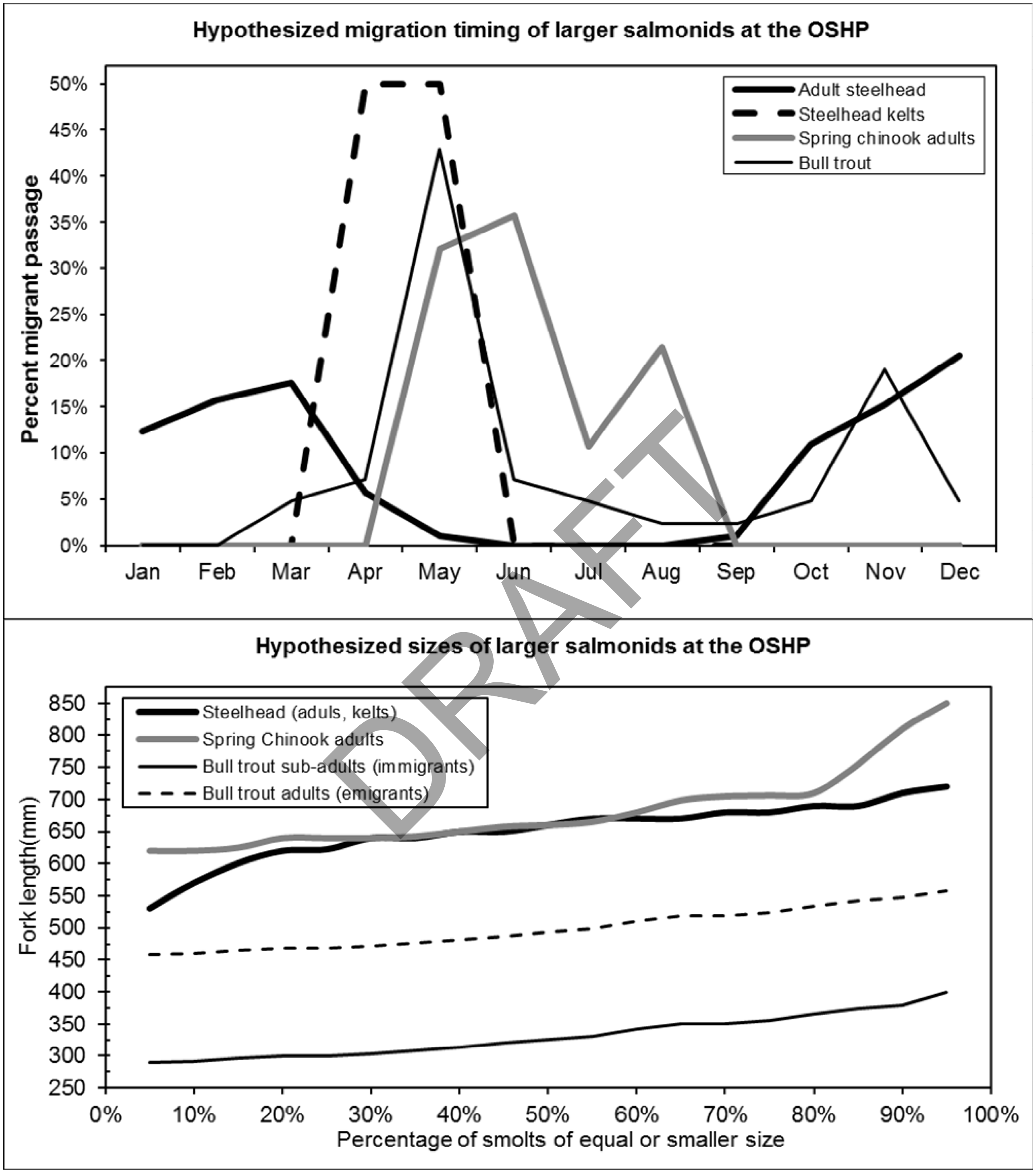


Figure 2. Estimated migration timing (top) and size (bottom) for adult summer steelhead and kelts, adult spring Chinook, and bull trout, at the OSHP. These estimates were based on recent but unpublished fish telemetry or trap data from the lower Crooked River, and two assumptions about migratory bull trout. The two assumptions were that future emigration timing for bull trout will match immigration timing, and that each emigrant bull trout will have grown for one year in the Crooked River watershed upstream of the OSHP at a rate similar to that recorded elsewhere for migrant bull trout from the Metolius watershed.

Size distributions the model assumes for each species of fish migrating through the OSHP are based on data available from the lower Crooked River (Figure 2). These distributions should be viewed as first-approximations that can be refined as additional monitoring data are collected at the project during the next decade or so. These distributions have no effect within the model on fish migration timing or passage route selection, but have a significant effect on the size-dependent survival rates of fish that pass the OSHP via the powerhouse.

Powerhouse survival. Survival rates the DMM model applies to steelhead adults (including kelts), adult spring Chinook, and bull trout sub-adults or adults, passing through the OSHP powerhouse are based on a published turbine-strike model for Kaplan turbines developed by Franke et al. (1997) and adjusted by R2 Resources (2008) to account for uncertainty in the Lambda parameter. A separate weighted average rate is used for each species and lifestage, with each average based on the adjusted Franke Model and length distributions for the fish (per Figure 2). Project-specific parameters used in the model are given below, followed by graphical and tabular summaries of model results for powerhouse survival rates given the old and (proposed) new configurations of the OSHP (Figure 3; Table 1).

Parameters used in the Franke Model

- N = number of turbine blades = 5
- L = fish length = species-specific distributions characterized in Figure 2
- D = turbine diameter (m) = 3.0
- Q_{wd} = discharge coefficient = 0.1203
- Q = turbine flow rate (m3/s) = 51.01, a mid-range flow
- W = rotational speed = 15.708
- a_a = 0.701015 (old), 0.77297 (new)
- E_{wd} = energy coefficient = 0.0606 (old), 0.07004 (new)
- H = net head (m) = 13.720 (old), 15.854 (new)
- N = turbine efficiency = 80%
- r/R = 0.75

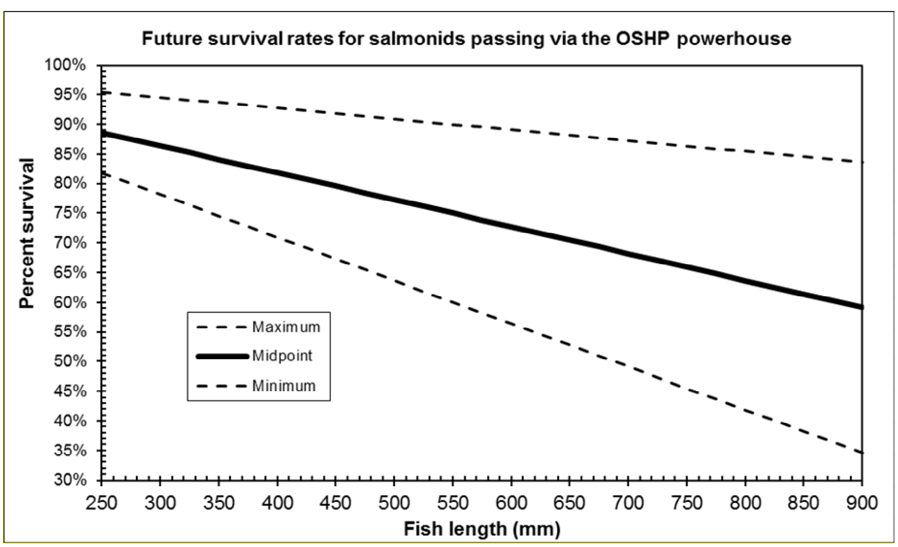


Figure 3. Estimated future survival rates for larger salmonids that pass the OSHP via the powerhouse.

Table 1. Mid-point, maximum, and minimum estimates of the future aggregate survival rates of larger salmonids passing through the OSHP powerhouse, estimated using the Franke et al. (1997) model as modified by R2 Resources (2008). The mid-point estimates are "best estimates". Actual powerhouse survival rates will decline with increasing fish length and fall within the given ranges (between maximum and minimum values).

Fish	Estimated aggregate survival rates		
	Mid-point	Maximum	Minimum
Steelhead (adults and kelts)	70.6%	88.2%	52.9%
Spring Chinook (adults)	68.7%	87.5%	49.9%
Bull trout (immigrants)	84.9%	94.0%	75.8%
Bull trout (emigrants)	77.3%	90.9%	63.6%

Spillway survival. Survival rates for larger fish passing over unimproved sections of the OSHP spillway are assigned by the DMM model on the basis of mean daily spillway discharge and a step-function that assumes a set percentage of direct fish mortality from physical injuries occurs whenever discharges through these sections are at levels likely to pass fish (approximately 300 cfs, a 20-24 cm veil of water spilling over the top). The function maintains a constant rate of survival at all higher discharges over unimproved sections of spillway.

A more complex function for the relationship between spillway discharge and smolt mortality was considered, but the simple step-function approach was adopted after considering probable causes of physical injury at this location. A fraction of the fish passing downstream via this route when spillway discharges are modest will likely suffer lethal injuries caused predominantly by high impact velocities near the base of the flashboards or new Obermeyer weir. However, as discharge rates over the spillway increase, the predominant source of physical injury and mortality will likely shift from high impact velocities near the boards or Obermeyer to high-velocity contact with the rough surface of the spillway. The specific range of discharges over which this spatial shift will occur is uncertain. However for the purpose of the DMM model it seemed reasonable to assume that the aggregate mortality rate remained constant.

Studies of physical injuries to salmonids passing other low-head (<50 ft) dams via non-turbine routes (spillways, fish chutes and bypasses) have found variable rates of passage mortality (RMC 1992; Karchesky et al. 2008; Heisey et al. 2008), with higher rates associated with routes having more natural or roughened surfaces, or exposed debris (Normandeau Associates 1995; Karchesky et al. 2009). Given the irregular and roughened surface of the unimproved OSHP spillway, I assumed a seven percent rate of injury-related mortality for salmonids passing via this route.

Bypass survival. Given the (proposed) new configuration, down-migrant fish bypassing the OSHP powerhouse will do so via a new fish ladder, the 257 cfs capacity BFAA fish chute, or one of two bypass gates that together will have a combined capacity of 1,498 cfs. As currently parameterized, the DMM model applies a 98 percent survival rate to steelhead adults or kelts and to adult spring Chinook passing the OSHP via these routes. Because of their generally smaller size, a 99 percent survival rate is applied to sub-adult and adult bull trout.

Project operations, including management of the BFAA system. The DMM model is structured to allow user-defined adjustments to how the OSHP is operated over the 53-year period of analysis. For the analysis reported here I assumed that the "old" Project was configured and operated much as it has been for the last few decades. I also assumed for a "new" Project that all weir gates on bypass routes would be operated to minimize spill over the central Obermeyer weir and that the BFAA would be managed under a strategy of constant and equal daily augmentation of bypass flows until or unless flows into the bypass were already 250 cfs. Bypass flows greater than 250 cfs occurred only when forced by river discharge. In order to account for changes in BFAA water availability that are likely to occur at 5-6 year invervals in the near future, I ran the DMM model three times assuming each of three levels of water availability as per DVWD (2011) and CH2M Hill (2014). The runs assumed annual use of the BFAA would average 32.95 cfs, 46.19 cfs, and 59.38 cfs. When the analytical results were summarized, outcomes for the first of the three levels of bypass flow augmentation was weighted by a factor of 3, those for the second by a factor of 2, and those for the third by a factor of 1. This accounted for the probability that the discharge levels would actually be experienced, and in how many of the 5-6 year periods they might be experienced.

Modeling Results

Results of the DMM model runs, based on the parameterization outlined in this memo, including an assumption of mid-range turbine survival per the adjusted Franke Model, are summarized in Tables 2 and 3, and Figure 4. These results should be viewed as structured hypotheses given that (1) there have not been site-specific fish passage studies at the OSHP and (2) the actual seasonal pattern of use of the BFAA, with augmentation of bypass flows potentially varying by month, week, or shorter intervals, has yet to be determined. Regardless, the model outputs indicate clearly that rates of downstream passage survival will be higher for any fish passed upstream under the Opal Springs Fish Passage and Protection Plan than would be the case if the fish were passed upstream absent the Plan.

Table 2. Results of DMM model simulations of survival rates per fish passed at the OSHP given the existing project configuration. Fallback percentages for adult migrants are as identified in table headings. <u>These results should be viewed as structured hypotheses</u>.

Bypass effective-ness	Adult MCR Steelhead				Adult Chinook Salmon			CR Bull Trout			
	Fallback @0 .05	Fallback @0.10	Fallback @0.15	Kelts	Fallback @0.05	Fallback @0.10	Fallback @0.15	Fallback @0.05	Fallback @0.10	Fallback @0.15	Emigrants
1	0.986	0.971	0.957	0.718	0.985	0.969	0.954	0.993	0.985	0.978	0.777
2	0.986	0.972	0.957	0.726	0.985	0.969	0.954	0.993	0.985	0.978	0.779
3	0.986	0.972	0.958	0.731	0.985	0.969	0.954	0.993	0.985	0.978	0.781
4	0.986	0.972	0.958	0.735	0.985	0.970	0.954	0.993	0.985	0.978	0.782
5	0.986	0.972	0.958	0.738	0.985	0.970	0.954	0.993	0.985	0.978	0.783
6	0.986	0.972	0.959	0.740	0.985	0.970	0.954	0.993	0.986	0.978	0.784
7	0.986	0.973	0.959	0.742	0.985	0.970	0.955	0.993	0.986	0.978	0.785
8	0.986	0.973	0.959	0.744	0.985	0.970	0.955	0.993	0.986	0.978	0.785
9	0.986	0.973	0.959	0.745	0.985	0.970	0.955	0.993	0.986	0.978	0.786
10	0.986	0.973	0.959	0.746	0.985	0.970	0.955	0.993	0.986	0.978	0.786
11	0.986	0.973	0.959	0.748	0.985	0.970	0.955	0.993	0.986	0.978	0.787
12	0.986	0.973	0.959	0.749	0.985	0.970	0.955	0.993	0.986	0.978	0.787
13	0.986	0.973	0.959	0.749	0.985	0.970	0.955	0.993	0.986	0.978	0.787
14	0.986	0.973	0.959	0.750	0.985	0.970	0.955	0.993	0.986	0.978	0.787
15	0.986	0.973	0.959	0.751	0.985	0.970	0.955	0.993	0.986	0.979	0.788
16	0.986	0.973	0.959	0.752	0.985	0.970	0.955	0.993	0.986	0.979	0.788
17	0.987	0.973	0.960	0.752	0.985	0.970	0.955	0.993	0.986	0.979	0.788
18	0.987	0.973	0.960	0.753	0.985	0.970	0.955	0.993	0.986	0.979	0.788
19	0.987	0.973	0.960	0.753	0.985	0.970	0.955	0.993	0.986	0.979	0.789
20	0.987	0.973	0.960	0.754	0.985	0.970	0.955	0.993	0.986	0.979	0.789

Table 3. Results of DMM model simulations of survival rates per fish passed at the OSHP under implementation of the Opal Springs Fish Passage and Enhancement Plan (DVWD 2011). Fallback percentages for adult migrants are as identified in table headings. <u>These results should be viewed as structured hypotheses</u>.

Bypass effective-ness	Adult MCR Steelhead				Adult Chinook Salmon			CR Bull Trout			
	Fallback @0 .05	Fallback @0.10	Fallback @0.15	Kelts	Fallback @0.05	Fallback @0.10	Fallback @0.15	Fallback @0.05	Fallback @0.10	Fallback @0.15	Emigrants
1	0.987	0.974	0.961	0.755	0.986	0.972	0.958	0.993	0.987	0.980	0.801
2	0.988	0.977	0.965	0.783	0.987	0.974	0.961	0.994	0.988	0.982	0.820
3	0.989	0.978	0.967	0.802	0.988	0.976	0.964	0.994	0.989	0.983	0.833
4	0.990	0.980	0.970	0.817	0.989	0.978	0.967	0.995	0.990	0.984	0.845
5	0.990	0.981	0.971	0.829	0.990	0.979	0.969	0.995	0.990	0.985	0.855
6	0.991	0.982	0.973	0.839	0.990	0.980	0.971	0.995	0.991	0.986	0.864
7	0.991	0.983	0.974	0.848	0.991	0.981	0.972	0.996	0.991	0.987	0.871
8	0.992	0.984	0.976	0.856	0.991	0.982	0.973	0.996	0.992	0.988	0.878
9	0.992	0.984	0.977	0.863	0.992	0.983	0.975	0.996	0.992	0.988	0.884
10	0.993	0.985	0.978	0.869	0.992	0.984	0.976	0.996	0.992	0.989	0.889
11	0.993	0.986	0.979	0.874	0.992	0.984	0.977	0.996	0.993	0.989	0.894
12	0.993	0.986	0.979	0.879	0.993	0.985	0.978	0.997	0.993	0.990	0.898
13	0.993	0.987	0.980	0.884	0.993	0.986	0.978	0.997	0.993	0.990	0.902
14	0.994	0.987	0.981	0.888	0.993	0.986	0.979	0.997	0.994	0.990	0.906
15	0.994	0.988	0.981	0.891	0.993	0.987	0.980	0.997	0.994	0.991	0.909
16	0.994	0.988	0.982	0.895	0.994	0.987	0.981	0.997	0.994	0.991	0.912
17	0.994	0.988	0.983	0.898	0.994	0.987	0.981	0.997	0.994	0.991	0.915
18	0.994	0.989	0.983	0.900	0.994	0.988	0.982	0.997	0.994	0.991	0.917
19	0.994	0.989	0.983	0.903	0.994	0.988	0.982	0.997	0.994	0.992	0.920
20	0.995	0.989	0.984	0.906	0.994	0.988	0.983	0.997	0.995	0.992	0.922

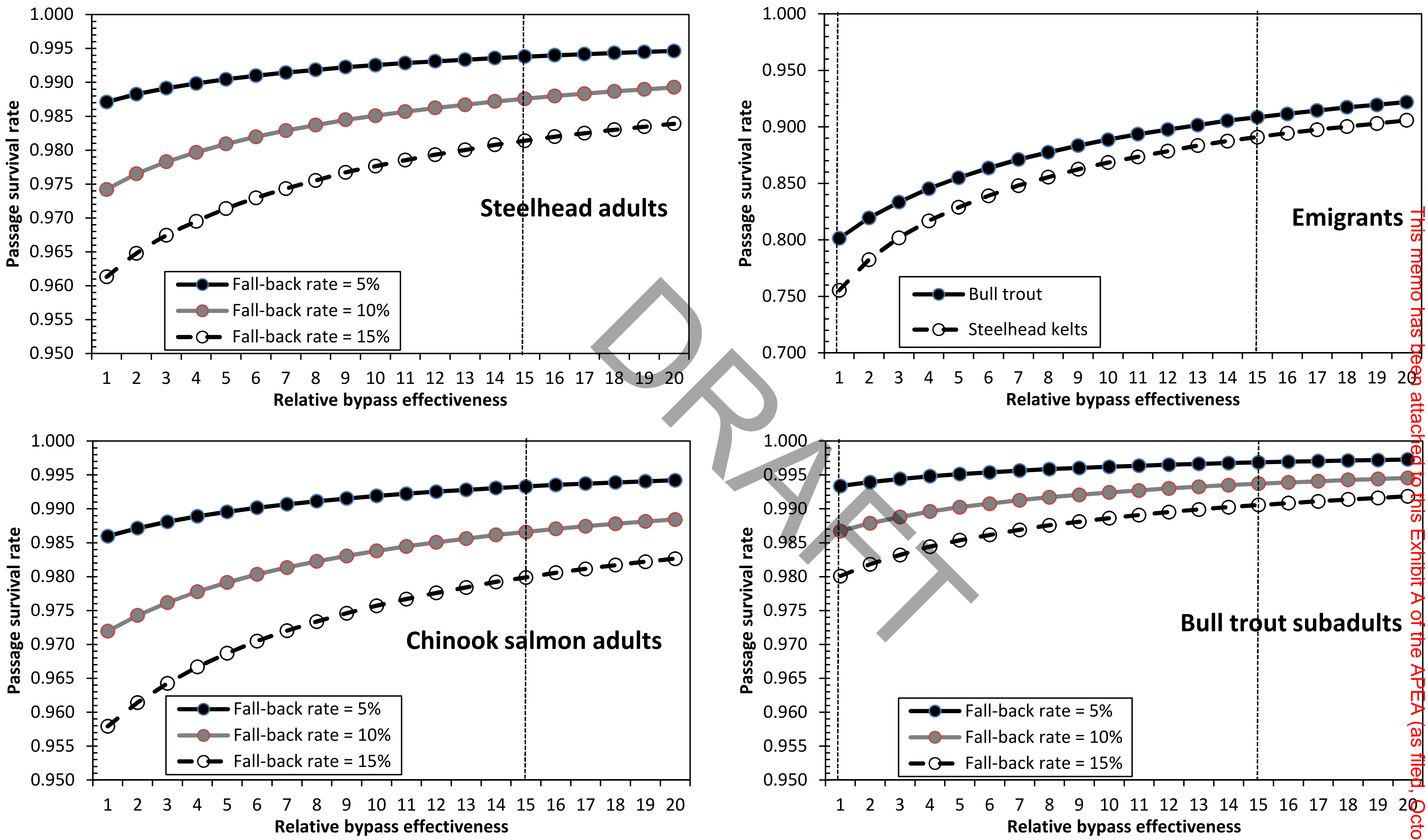


Figure 4. DMM estimates of passage survival rates for steelhead (adults and kelts), spring Chinook salmon (adults), and migratory bull trout (subadults and emigrant adults) at the OSHP.

Citations

CH2M Hill. 2014. Opal Springs Hydroelectric Project pool raise and fish passage improvements, 99% supporting design report. Consultant report to the Deschutes Valey Water District, Culver, Oregon. CH2M Hill, Portland, Oregon. July 2014.

Deschutes Valley Water District (DVWD). 2011. Settlement Agreement for the Opal Springs Hydroelectric Project.

Franke, G., D. Webb, R. Fisher, Jr., D. Mathur, P. Hopping, P. March, M. Headrick, I. Laczo, Y. Ventikos, and F. Sotiropoulos. 1997. Development of environmentally advanced hydropower turbine system design concepts. Idaho National Engineering and Environmental Laboratory. August.

Heisey, P.G., D. Mathur, J.R. Skalski, R.D. McDonald, and G. Velazquez. 2008. Effect of spillway structural modifications on fish condition and survival in Advances in Fisheries Bioengineering, Symposium 61. 239 pages.

Karchesky, C.M., R.D. McDonald, P.G. Heisey, S.W. Adams, and S.N. Graver. 2008. Estimating survival and condition of juvenile salmonids after passage through the fish bypass system at the T. W. Sullivan Hydroelectric Project, Willamette River, Oregon. Prepared for Portland General Electric (PGE), Portland, Oregon.

Karchesky, C.M., R.D. McDonald, P.G. Heisey, Joanne L. Fulmer, and S.N. Graver. 2009. FTC Review Draft: Estimating survival and condition of juvenile salmonids after passage through the flow control structure at the apex of Willamette Falls, Willamette River, Oregon, Fall 2008. Prepared for Portland General Electric (PGE), Portland, Oregon.

Normandeau Associates, Inc. 1995. The Vernon Bypass Fistube: Evaluation of survival and injuries of Atlantic salmon smolts. Report prepared for New England Power Co., Westborough, MA.

R2 Resource Consultants. 2008. Estimates of turbine mortality for salmonid and non-salmonid fish at proposed Enloe Hydroelectric Project. Consultant report prepared for the Okanogan Public Utility District. May 2008.

RMC Environmental Services (RMC). 1992. Survival of Atlantic salmon smolts passing the Log-Ice sluice at the Wilder Hydroelectric Station, Vermont/New Hampshire. Report prepared for New England Power Company, Westborough. MA.

NOTE: This 2015 BA has been supplemented by memo dated April 17, 2017.
This memo has been attached to this Exhibit A of the APEA (as filed, October 2017)

Clearwater BioStudies, Inc.

1160 Old Ferry Road Shady Cove, Oregon 97539 (503) 895-7498

TECHNICAL MEMORANDUM

To: Gary Lytle, Deschutes Valley Water District, Culver, Oregon
From: C.W. Huntington, CBI Sr. Aquatic Biologist
Subject: Analysis of potential entrainment or spillway mortality of large salmonids at the OSHP
Date: 20 August 2015

The following memorandum describes the methods and results of a preliminary analysis of potential mortality for large salmonids passing downstream at the Opal Springs Hydroelectric Project (OSHP) on the lower Crooked River, Oregon, approximately 0.6 mile above Lake Billy Chinook. The analysis generated survival (or associated mortality) rate estimates for adult Chinook salmon fallback, steelhead fallback, bull trout fallback, emigrating steelhead kelts and emigrating bull trout. The analysis was based on a down-migrant mortality (DMM) model for the OSHP and yielded separate survival rate estimates for the fish just identified under two conditions:

(1) OSHP as currently configured; and

(2) a (proposed) new OSHP operating with a 30 cfs fish ladder, an Obermeyer weir maintaining a diversion pool elevation of 2012 feet, a bypass flow accrual account (BFAA) system with a 287 cfs capacity delivery chute, and two bypass gates intended to aid fish passage that will have a combined capacity of 1,498 cfs (see CH2M Hill 2014).

The DMM Model

The Opal Springs DMM model has seven basic elements. These include (1) Crooked River discharges for a 53-year historical time series, (2) user-defined patterns of fish emigration, (3) defined size distributions for the fish migrating past the OSHP, (4) a user-influenced relationship between daily discharge and the relative use of routes by which fish can pass the OSHP, (5) fish survival rates for each route of passage, (6) user-defined use of the BFAA system, and (7) automated integration of the other six elements. The model generates a sequence of 53 annual fish survival estimates for hydrologic conditions matching the water year 1962-2014 series. The model allows one to explore the potential consequences of alternative Project configurations or operations (including uses of the BFAA) on fish survival under variable river conditions. Brief descriptions of DMM model elements are given below.

<u>River discharges</u>. The DMM model moves emigrating salmonids through the OSHP on a daily time step during a sequence of 53 distinct years, assigning daily fish route selections that are based on the relative volumes of flow passing the project via the powerhouse, the spillway, and whatever bypass routes are available given a specified project configuration. Daily flows at the project (and upstream) are based on the historical record of discharges in the Crooked River at the Opal Springs gauge (USGS no. 14087400; Figure 1). Daily volumes of flow passing the OSHP via non-powerhouse routes can be made more attractive (or less unattractive) to the fish per unit volume than discharges passing through the powerhouse by adjusting a "bypass effectiveness" setting within the model. This component quantifies the relative (proportional) per-volume effectiveness of surface water passed into the OSHP bypass reach at attracting and passing down-migrant fish when compared to water drawn through the project intake and through the powerhouse. The setting can be adjusted incrementally to test the hypothetical influence of changes in bypass discharges on fish survival rates. It also will allow the DMM model to be fitted to future data on the routes selected by fish passing the OSHP. Model runs for large salmonids have included incremental adjustments of "bypass effectiveness" settings ranging from 1 to 20, to account for the strength of fish attraction to water discharged into the bypass or to the relative avoidance of fish to water drawn through the Project intake. A setting of "2" for bypass effectiveness would mean that at any given time, each cubic foot of water passing into the bypass via an accessible route would be twice as likely to pass a fish downstream as would a cubic foot of water diverted to the powerhouse.

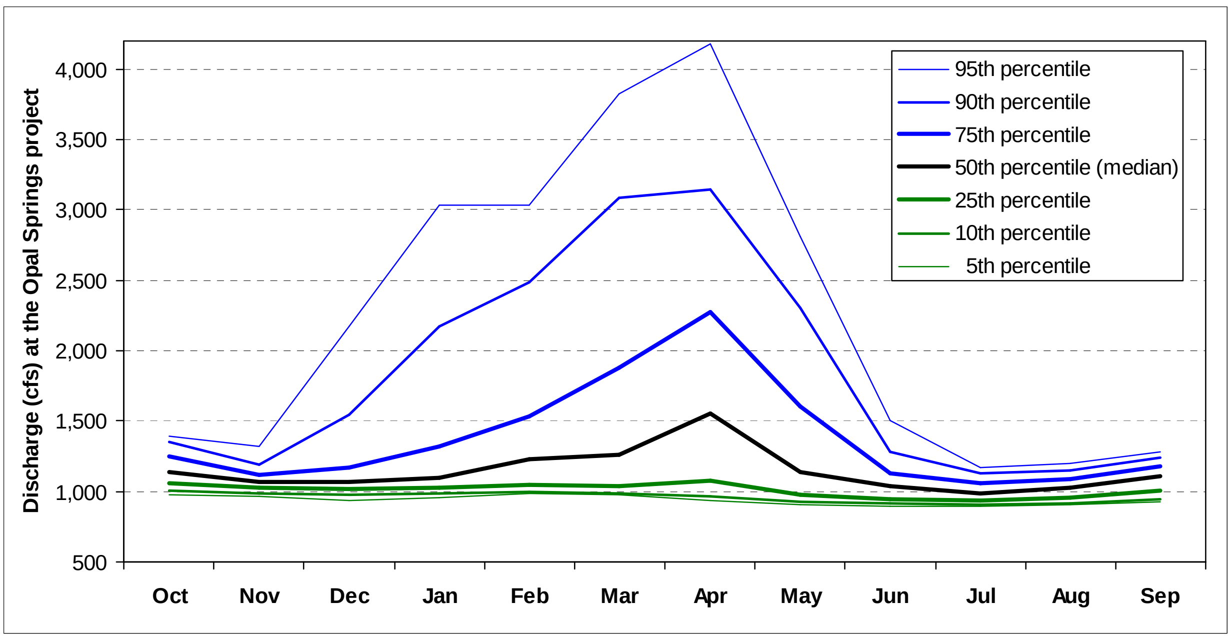


Figure 1. Seasonal (monthly) exceedances for daily discharges in the Crooked River at the OSHP during water years 1962-2014, based on data from the USGS gauge below Opal Springs (gauge no. 14087400).

Fish migration timing and size at the OSHP. Annual survival rates for migrant salmonids at the OSHP are influenced in the DMM model by migration timing and fish size at the project. The model assumes daily passage of a percentage of the total annual migration of a given type of fish, with the exact percentage based on user-defined seasonal (monthly) fractions of annual migration that the model adjusts to daily fish passage at OSHP on the basis of daily discharges estimated for Crooked River above the lower canyon (which begins near the Highway 97 bridge) and a sensitivity factor that makes the population of emigrants within a given month more or less sensitive to river flows from the upper watershed as a migratory cue. Seasonal patterns of migration assumed in the current analysis are given in Figure 2, with bull trout emigration hypothesized to occur from March through August. The flow sensitivity factor was set to "1", a value at the low end of the range and one that would seem reasonable for the analyses performed.

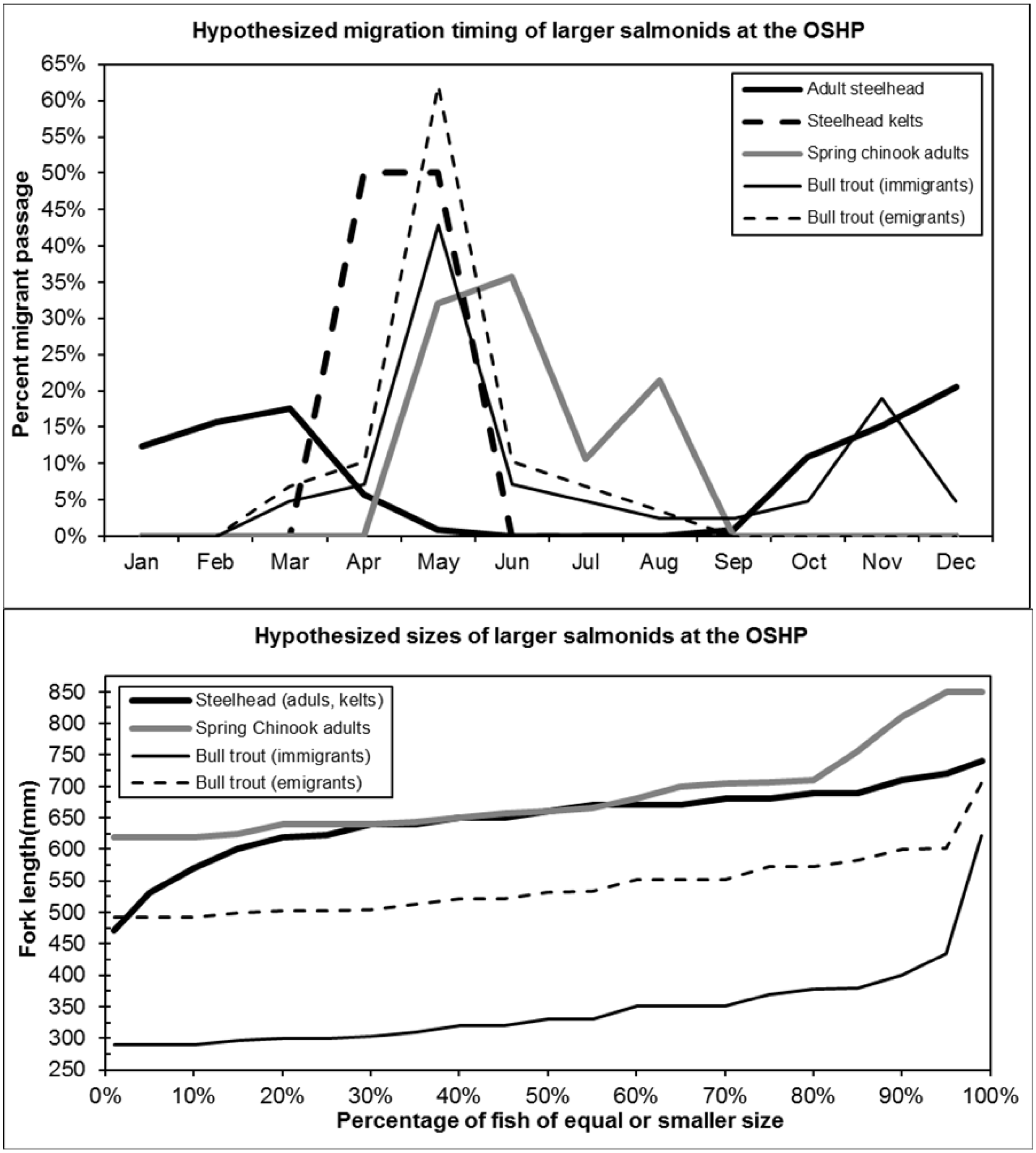


Figure 2. Estimated migration timing (top) and size (bottom) for adult summer steelhead and kelts, adult spring Chinook, and bull trout, at the OSHP. These estimates were based on recent data plus specific hypotheses about migratory bull trout that forage in the Crooked River watershed.

Size distributions the model assumes for each species of fish migrating through the OSHP are based on data available from the lower Crooked River (Figure 2). These distributions should be viewed as first-approximations that can be refined as additional monitoring data are collected at the project during the next decade or so. These distributions have no effect within the model on fish migration timing or passage route selection, but have a significant effect on the size-dependent survival rates of fish that pass the OSHP via the powerhouse. The size distributions assumed for bull trout account for large adult fish that have been seen in the OSHP bypass but that have not passed upstream, to account for the possibility that such fish may pass upstream in the future. I have hypothesized that bull trout will emigrate back toward their natal waters in the Metolius sytem during March-August after growing at 0.45 mm/d upstream of the OSHP (a rate documented elsewhere for migratory Metolius bull trout, per P. Lickwar, USFWS, Bend, OR) and that emigration will occur after an average 6 months (183 d) for adult fish that pass upstream during fall and after an average 15 months (449 d) for fish that pass upstream as smaller subadults. The duration of upstream residency assumed for bull trout that first pass the OSHP as subadults (mean length = 332 mm) was that required for them to grow to match observed sizes of 5 year-old adults returning toward the Metolius watershed from other productive waters having near-optimal temperatures for growth by the species (mean length = 534 mm).

Powerhouse survival. Survival rates the DMM model applies to steelhead adults (including kelts), adult spring Chinook, and bull trout sub-adults or adults, passing through the OSHP powerhouse are based on a published turbine-strike model for Kaplan turbines developed by Franke et al. (1997) and adjusted by R2 Resources (2008) to account for uncertainty in the Lambda parameter. A separate weighted average rate is used for each species and lifestage, with each average based on the adjusted Franke Model and length distributions for the fish (per Figure 2). Project-specific parameters used in the model are given below, followed by graphical and tabular summaries of model results for powerhouse survival rates given the old and (proposed) new configurations of the OSHP (Figure 3; Table 1).

Parameters used in the Franke Model

- N = number of turbine blades = 5
- L = fish length = species-specific distributions characterized in Figure 2
- D = turbine diameter (m) = 3.0
- Q_{wd} = discharge coefficient = 0.1203
- Q = turbine flow rate (m3/s) = 51.01, a mid-range flow
- W = rotational speed = 15.708
- a_a = 0.701015 (old), 0.77297 (new)
- E_{wd} = energy coefficient = 0.0606 (old), 0.07004 (new)
- H = net head (m) = 13.720 (old), 15.854 (new)
- N = turbine efficiency = 80%
- r/R = 0.75

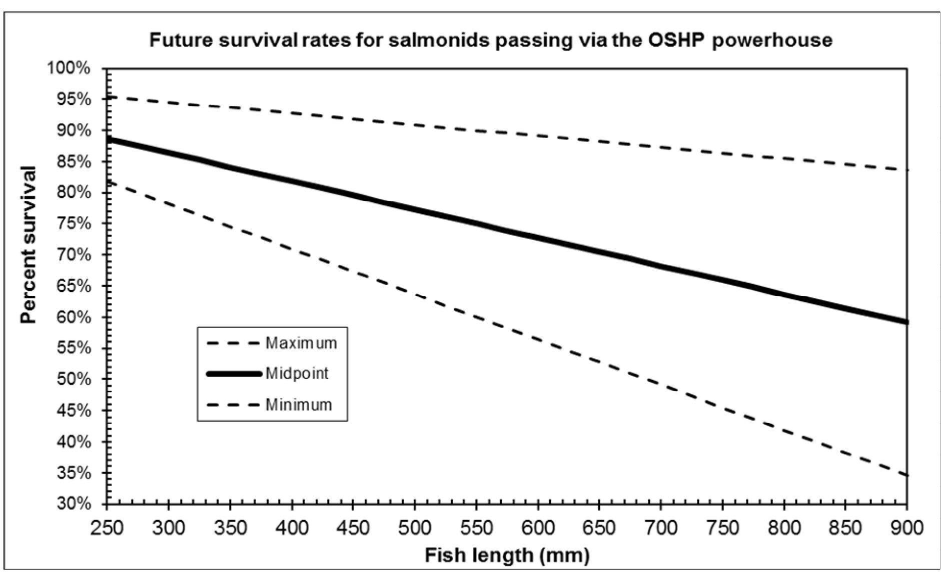


Figure 3. Estimated future survival rates for larger salmonids that pass the OSHP via the powerhouse.

Table 1. Mid-point, maximum, and minimum estimates of the future aggregate survival rates of larger salmonids passing through the OSHP powerhouse, estimated using the Franke et al. (1997) model as modified by R2 Resources (2008). The mid-point estimates are "best estimates". Actual powerhouse survival rates will decline with increasing fish length and fall within the given ranges (between maximum and minimum values).

Fish	Estimated aggregate survival rates		
	Mid-point	Maximum	Minimum
Steelhead (adults and kelts)	70.6%	88.2%	52.9%
Spring Chinook (adults)	68.7%	87.5%	49.9%
Bull trout (immigrants)	84.3%	93.7%	74.9%
Bull trout (emigrants)	75.2%	90.1%	60.4%

Spillway survival. Survival rates for larger fish passing over unimproved sections of the OSHP spillway are assigned by the DMM model on the basis of mean daily spillway discharge and a step-function that assumes a set percentage of direct fish mortality from physical injuries occurs whenever discharges through these sections are at levels likely to pass fish (approximately 300 cfs, a 20-24 cm veil of water spilling over the top). The function maintains a constant rate of survival at all higher discharges over unimproved sections of spillway.

A more complex function for the relationship between spillway discharge and smolt mortality was considered, but the simple step-function approach was adopted after considering probable causes of physical injury at this location. A fraction of the fish passing downstream via this route when spillway discharges are modest will likely suffer lethal injuries caused predominantly by high impact velocities near the base of the flashboards or new Obermeyer weir. However, as discharge rates over the spillway increase, the predominant source of physical injury and mortality will likely shift from high impact velocities near the boards or Obermeyer to high-velocity contact with the rough surface of the spillway. The specific range of discharges over which this spatial shift will occur is uncertain. However for the purpose of the DMM model it seemed reasonable to assume that the aggregate mortality rate remained constant.

Studies of physical injuries to salmonids passing other low-head (<50 ft) dams via non-turbine routes (spillways, fish chutes and bypasses) have found variable rates of passage mortality (RMC 1992; Karchesky et al. 2008; Heisey et al. 2008), with higher rates associated with routes having more natural or roughened surfaces, or exposed debris (Normandeau Associates 1995; Karchesky et al. 2009). Given the irregular and roughened surface of the unimproved OSHP spillway, I assumed a seven percent rate of injury-related mortality for salmonids passing via this route.

Bypass survival. Given the (proposed) new configuration, down-migrant fish bypassing the OSHP powerhouse will do so via a new fish ladder, the 257 cfs capacity BFAA fish chute, or one of two bypass gates that together will have a combined capacity of 1,498 cfs. As currently parameterized, the DMM model applies a 98% survival rate to steelhead adults or kelts and to adult spring Chinook passing the OSHP via these routes. Because of their generally smaller size, a 99% survival rate is applied to sub-adult and adult bull trout.

Project operations, including management of the BFAA system. The DMM model is structured to allow user-defined adjustments to how the OSHP is operated over the 53-year period of analysis. For the analysis reported here I assumed that the "old" Project was configured and operated much as it has been for the last few decades. I also assumed for a "new" Project that all weir gates on bypass routes would be operated to minimize spill over the central Obermeyer weir and that the BFAA would be managed under a strategy of constant and equal daily augmentation of bypass flows until or unless flows into the bypass were already 250 cfs. Bypass flows greater than 250 cfs occurred only when forced by river discharge. In order to account for changes in BFAA water availability that are likely to occur at 5-6 year intervals in the near future, I ran the DMM model three times assuming each of three levels of water availability for bypass flow augmentation, as per DVWD (2011) and CH2M Hill (2014). The runs assumed the BFAA would be used to augment bypass flows by 32.95 cfs, 46.19 cfs, or 59.38 cfs, every day of the year. Daily bypass flows included these levels of BFAA-based augmentation, OSHP's 50 cfs minimum conservation discharge (30 cfs of which will pass down the new fish ladder), and discharges beyond the Project's future operating capacity (estimated at 1,600 cfs). When the analytical results were summarized, outcomes for the first of the three levels of bypass flow augmentation were weighted by a factor of 3, those for the second by a factor of 2, and those for the third by a factor of 1. This accounted for the probability that the differing levels of BFAA-based flow augmentation would actually be experienced, and in how many of the 5-6 year periods they might be experienced.

Modeling Results

Results of the DMM model runs, based on the parameterization outlined in this memo, including an assumption of mid-range turbine survival per the adjusted Franke Model, are summarized in Tables 2 and 3, and Figure 4. These results should be viewed as structured hypotheses given that (1) there have not been site-specific fish passage studies at the OSHP and (2) the actual seasonal pattern of use of the BFAA, with augmentation of bypass flows potentially varying by month, week, or shorter intervals, has yet to be determined. Regardless, the model outputs indicate clearly that rates of downstream passage survival will be higher for any fish passed upstream under the Opal Springs Fish Passage and Protection Plan than would be the case if the fish were passed upstream absent the Plan.

Mortality of Adult Steelhead. Under the Plan, rates of mortality for adult steelhead that attempt to pass downstream at the OSHP will be reduced relative to the current situation. If "bypass effectiveness" is high, there may be a significant reduction in steelhead kelt mortality.

Mortality of Adult Spring Chinook Salmon. Under the Plan, rates of mortality for adult spring Chinook that fall back at the OSHP will be reduced relative to the current situation. If "bypass effectiveness" is high, there may be a significant reduction in the mortality rates of Chinook that fall back after passing upstream at the Project.

Bull Trout Mortality. Given the specific passage timing, size distributions, and rates of downstream passage survival simulated for bull trout, if one assumes passage route selection will be directly proportional to flow (i.e., bypass effectiveness = 1) and that once passed upstream the fish will experience a 65% annual survival rate (0.9988/d; midway between 0.50/yr in Lake Billy Chinook [Beachamp and Van Tassell 1999], and 0.80/yr under ideal unfished conditions [Post et al. 2003]), it becomes possible to estimate the proportion of foraging bull trout that might suffer downstream passage mortality at the OSHP.

NOTE: This 2015 BA has been supplemented by memo dated April 17, 2017. This memo has been attached to this Exhibit A of the APEA (as filed, October 2017)

Table 2. Results of DMM model simulations of survival rates per fish passed at the OSHP given the existing project configuration. Fallback percentages for adult migrants are as identified in table headings. These results should be viewed as structured hypotheses.

Bypass effective-ness	Adult MCR Steelhead				Adult Chinook Salmon			CR Bull Trout			
	Fallback @ 5%	Fallback @ 10%	Fallback @ 15%	Kelts	Fallback @ 5%	Fallback @ 10%	Fallback @ 15%	Fallback @ 5%	Fallback @ 10%	Fallback @ 100%	Emigrants
1	0.986	0.971	0.957	0.718	0.985	0.969	0.954	0.992	0.985	0.845	0.758
2	0.986	0.972	0.957	0.726	0.985	0.969	0.954	0.992	0.985	0.846	0.762
3	0.986	0.972	0.958	0.731	0.985	0.969	0.954	0.992	0.985	0.847	0.764
4	0.986	0.972	0.958	0.735	0.985	0.970	0.954	0.992	0.985	0.848	0.766
5	0.986	0.972	0.958	0.738	0.985	0.970	0.954	0.992	0.985	0.849	0.768
6	0.986	0.972	0.959	0.740	0.985	0.970	0.954	0.992	0.985	0.849	0.769
7	0.986	0.973	0.959	0.742	0.985	0.970	0.955	0.992	0.985	0.849	0.770
8	0.986	0.973	0.959	0.744	0.985	0.970	0.955	0.993	0.985	0.850	0.771
9	0.986	0.973	0.959	0.745	0.985	0.970	0.955	0.993	0.985	0.850	0.772
10	0.986	0.973	0.959	0.746	0.985	0.970	0.955	0.993	0.985	0.850	0.772
11	0.986	0.973	0.959	0.748	0.985	0.970	0.955	0.993	0.985	0.851	0.773
12	0.986	0.973	0.959	0.749	0.985	0.970	0.955	0.993	0.985	0.851	0.773
13	0.986	0.973	0.959	0.749	0.985	0.970	0.955	0.993	0.985	0.851	0.774
14	0.986	0.973	0.959	0.750	0.985	0.970	0.955	0.993	0.985	0.851	0.774
15	0.986	0.973	0.959	0.751	0.985	0.970	0.955	0.993	0.985	0.851	0.775
16	0.986	0.973	0.959	0.752	0.985	0.970	0.955	0.993	0.985	0.851	0.775
17	0.987	0.973	0.960	0.752	0.985	0.970	0.955	0.993	0.985	0.851	0.775
18	0.987	0.973	0.960	0.753	0.985	0.970	0.955	0.993	0.985	0.852	0.776
19	0.987	0.973	0.960	0.753	0.985	0.970	0.955	0.993	0.985	0.852	0.776
20	0.987	0.973	0.960	0.754	0.985	0.970	0.955	0.993	0.985	0.852	0.776

Table 3. Results of DMM model simulations of survival rates per fish passed at the OSHP under implementation of the Opal Springs Fish Passage and Enhancement Plan (DVWD 2011). Fallback percentages for adult migrants are as identified in table headings. These results should be viewed as structured hypotheses.

Bypass effective-ness	Adult MCR Steelhead				Adult Chinook Salmon			CR Bull Trout			
	Fallback @ 5%	Fallback @ 10%	Fallback @ 15%	Kelts	Fallback @ 5%	Fallback @ 10%	Fallback @ 15%	Fallback @ 5%	Fallback @ 10%	Fallback @ 100%	Emigrants
1	0.987	0.974	0.961	0.755	0.986	0.972	0.958	0.993	0.986	0.862	0.787
2	0.988	0.977	0.965	0.783	0.987	0.974	0.961	0.994	0.987	0.875	0.808
3	0.989	0.978	0.967	0.802	0.988	0.976	0.964	0.994	0.988	0.884	0.824
4	0.990	0.980	0.970	0.817	0.989	0.978	0.967	0.995	0.989	0.892	0.837
5	0.990	0.981	0.971	0.829	0.990	0.979	0.969	0.995	0.990	0.899	0.848
6	0.991	0.982	0.973	0.839	0.990	0.980	0.971	0.995	0.990	0.905	0.857
7	0.991	0.983	0.974	0.848	0.991	0.981	0.972	0.995	0.991	0.909	0.866
8	0.992	0.984	0.976	0.856	0.991	0.982	0.973	0.996	0.991	0.914	0.873
9	0.992	0.984	0.977	0.863	0.992	0.983	0.975	0.996	0.992	0.918	0.879
10	0.993	0.985	0.978	0.869	0.992	0.984	0.976	0.996	0.992	0.921	0.884
11	0.993	0.986	0.979	0.874	0.992	0.984	0.977	0.996	0.992	0.924	0.889
12	0.993	0.986	0.979	0.879	0.993	0.985	0.978	0.996	0.993	0.927	0.894
13	0.993	0.987	0.980	0.884	0.993	0.986	0.978	0.997	0.993	0.930	0.898
14	0.994	0.987	0.981	0.888	0.993	0.986	0.979	0.997	0.993	0.933	0.902
15	0.994	0.988	0.981	0.891	0.993	0.987	0.980	0.997	0.994	0.935	0.905
16	0.994	0.988	0.982	0.895	0.994	0.987	0.981	0.997	0.994	0.937	0.909
17	0.994	0.988	0.983	0.898	0.994	0.987	0.981	0.997	0.994	0.939	0.912
18	0.994	0.989	0.983	0.900	0.994	0.988	0.982	0.997	0.994	0.941	0.914
19	0.994	0.989	0.983	0.903	0.994	0.988	0.982	0.997	0.994	0.942	0.917
20	0.995	0.989	0.984	0.906	0.994	0.988	0.983	0.997	0.994	0.944	0.919

NOTE: This 2015 BA has been supplemented by memo dated April 17, 2017. This memo has been attached to this Exhibit A of the APEA (as filed, October 2017)

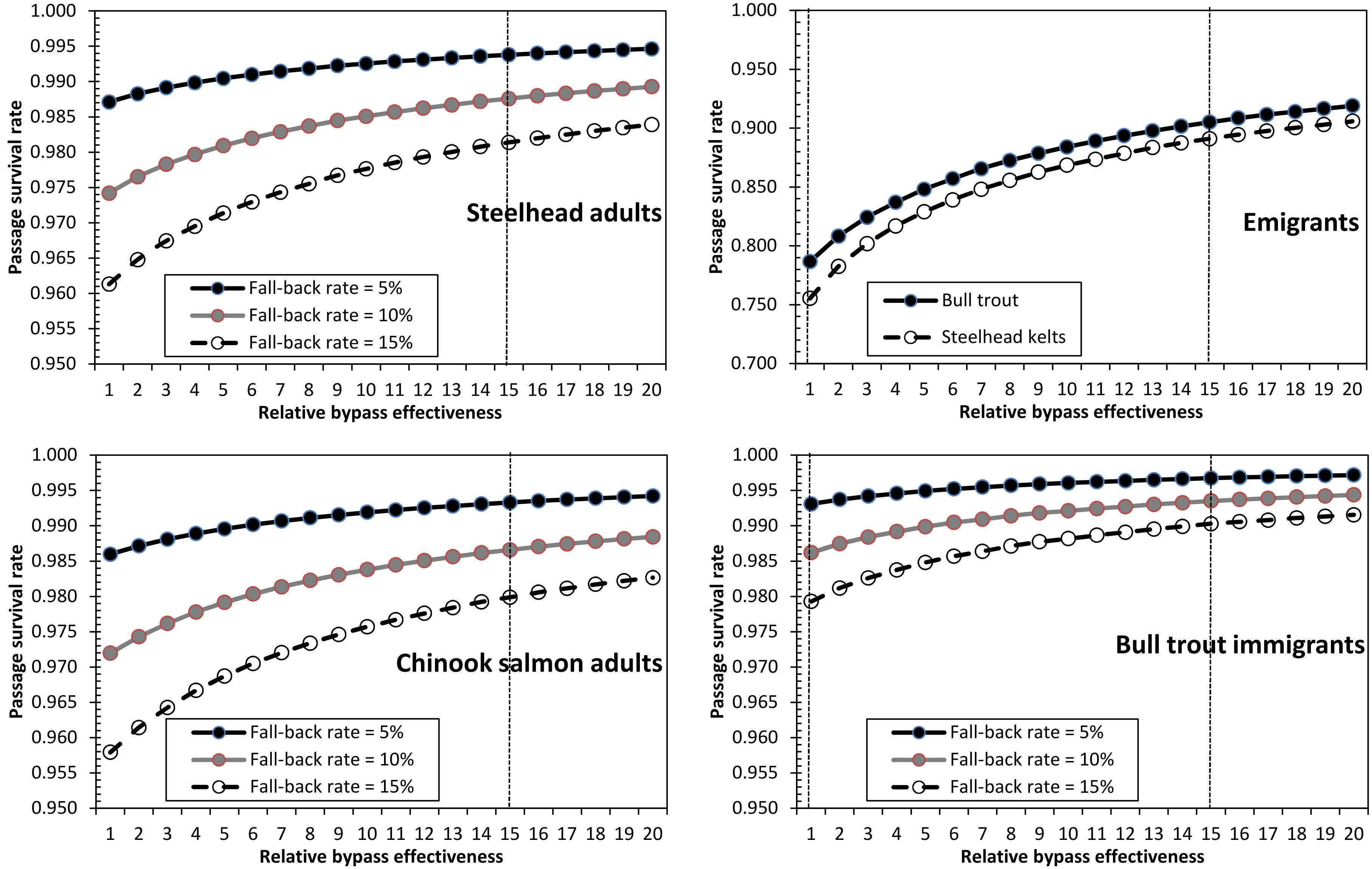


Figure 4. DMM estimates of passage survival rates for steelhead (adults and kelts), spring Chinook salmon (adults), and migratory bull trout (subadults and emigrant adults) at the OSHP.

Given the assumptions made above, if all bull trout passed upstream at the OSHP immediately reverse course and head downstream, an estimated 13.8% of them might perish on their way back to the lower-most Crooked River (Table 3). This unlikely scenario would probably cause bull trout the greatest level of Project-induced mortality, because increases in down-migrant mortality rates associated with the greater size of fish that forage upstream are likely to be more than offset by reductions in down-migrant abundance caused by natural mortality prior to emigration. At the other extreme, absent fallback at the OSHP, those bull trout passing upstream would survive at an average 60.2% rate prior to emigration at the sizes assumed in my DMM modeling. If there is no fallback, and since emigrant bull trout are estimated here as being likely to have an aggregate 21.3% mortality rate at the Project if bypass effectiveness is 1 (see Table 3), about 12.8% (0.602 x 0.213) of the fish passed upstream might perish passing back downstream.

If bypass effectiveness is 1, the 12.8% and 13.8% estimates just given for bull trout passage mortality at the OSHP are at the low and high ends of what my DMM modeling suggests are the range of most-probable outcomes. These mortality rates equate to about 13 to 14 fish per 100 bull trout that pass upstream.

Citations

Beauchamp, D. A., and J. J. Van Tassell. 1999. Modeling seasonal trophic interactions of adfluvial bull trout in Lake Billy Chinook, Oregon. Pelton Round Butte Hydroelectric Project, FERC No. 2030. Report prepared for Portland General Electric Company. Utah Cooperative Fisheries and Wildlife Research Unit, Department of Fisheries and Wildlife, and Ecology Center, Utah State University, Logan.

CH2M Hill. 2014. Opal Springs Hydroelectric Project pool raise and fish passage improvements, 99% supporting design report. Consultant report to the Deschutes Valey Water District, Culver, Oregon. CH2M Hill, Portland, Oregon. July 2014.

Deschutes Valley Water District (DVWD). 2011. Settlement Agreement for the Opal Springs Hydroelectric Project.

Franke, G., D. Webb, R. Fisher, Jr., D. Mathur, P. Hopping, P. March, M. Headrick, I. Laczo, Y. Ventikos, and F. Sotiropoulos. 1997. Development of environmentally advanced hydropower turbine system design concepts. Idaho National Engineering and Environmental Laboratory. August.

Heisey, P.G., D. Mathur, J.R. Skalski, R.D. McDonald, and G. Velazquez. 2008. Effect of spillway structural modifications on fish condition and survival in Advances in Fisheries Bioengineering, Symposium 61. 239 pages.

Karchesky, C.M., R.D. McDonald, P.G. Heisey, S.W. Adams, and S.N. Graver. 2008. Estimating survival and condition of juvenile salmonids after passage through the fish bypass system at the T. W. Sullivan Hydroelectric Project, Willamette River, Oregon. Prepared for Portland General Electric (PGE), Portland, Oregon.

Karchesky, C.M., R.D. McDonald, P.G. Heisey, Joanne L. Fulmer, and S.N. Graver. 2009. FTC Review Draft: Estimating survival and condition of juvenile salmonids after passage through the flow control structure at the apex of Willamette Falls, Willamette River, Oregon, Fall 2008. Prepared for Portland General Electric (PGE), Portland, Oregon.

Normandeau Associates, Inc. 1995. The Vernon Bypass Fistube: Evaluation of survival and injuries of Atlantic salmon smolts. Report prepared for New England Power Co., Westborough, MA.

Post, J. R., C. J. Mushens, A. Paul, and M. Sullivan. 2003. Assessment of alternative harvest regulations for sustaining recreational fisheries: model development and application to Bull Trout. North American Journal of Fisheries Management 23:22–34.

R2 Resource Consultants. 2008. Estimates of turbine mortality for salmonid and non-salmonid fish at proposed Enloe Hydroelectric Project. Consultant report prepared for the Okanogan Public Utility District. May 2008.

RMC Environmental Services (RMC). 1992. Survival of Atlantic salmon smolts passing the Log-Ice sluice at the Wilder Hydroelectric Station, Vermont/New Hampshire. Report prepared for New England Power Company, Westborough. MA.

Clearwater BioStudies, Inc.

1160 Old Ferry Road Shady Cove, Oregon 97539 (503) 895-7498

TECHNICAL MEMORANDUM

To: Finlay Anderson, McMillen Jacobs Associates
From: C.W. Huntington, CBI Sr. Aquatic Biologist
Subject: Analysis of potential smolt mortality at the Opal Springs Hydroelectric Project
Date: 15 June 2015

The following memorandum describes the methods and results of a preliminary analysis of potential smolt mortality at the Opal Springs Hydroelectric Project (OSHP) on the lower Crooked River, Oregon, approximately 0.6 mile above Lake Billy Chinook. The analysis was based on a down-migrant mortality (DMM) model for the OSHP and yielded separate estimates for steelhead and spring Chinook smolt losses that might occur under two conditions:

(1) OSHP as currently configured; and

(2) a (proposed) new OSHP operating with a 30 cfs fish ladder, an Obermeyer weir maintaining a diversion pool elevation of 2012 feet, a bypass flow accrual account (BFAA) system with a 287 cfs capacity delivery chute, and two bypass gates intended to aid fish passage that will have a combined capacity of 1,498 cfs (see CH2M Hill 2014).

The DMM Model

The Opal Springs DMM model has seven basic elements. These include (1) Crooked River discharges for a 53-year historical time series, (2) user-defined patterns of smolt emigration, (3) defined size distributions for the smolts migrating past the OSHP, (4) a user-influenced relationship between daily discharge and the relative use of routes by which smolts can pass the OSHP, (5) smolt survival rates for each route of passage, (6) user-defined use of the BFAA system, and (7) automated integration of the other six elements. The model generates a sequence of 53 annual smolt survival estimates for hydrologic conditions matching the water year 1962-2014 series. The model allows one to explore the potential consequences of alternative Project configurations or operations (including uses of the BFAA) on smolt survival under variable river conditions. Brief descriptions of DMM model elements are given below.

River discharges. The DMM model moves emigrating salmonids through the OSHP on a daily time step during a sequence of 53 distinct years, assigning daily fish route selections that are based on the relative volumes of flow passing the project via the powerhouse, the spillway, and whatever bypass routes are available given a specified project configuration. Daily flows at the project (and upstream) are based on the historical record of discharges in the Crooked River at the Opal Springs gauge (USGS no. 14087400; Figure 1). Daily volumes of flow passing the OSHP via non-powerhouse routes can be made more attractive (or less unattractive) to the fish per unit volume than discharges passing through the powerhouse by adjusting a "flow effectiveness" setting within the model. This component may allow the DMM model to be fitted to future data on the routes selected by fish passing the OSHP, but the few model runs preformed to date have relied on a neutral "flow effectiveness" setting (i.e., fish route selection equals the relative flow distribution among passage routes at the OSHP).

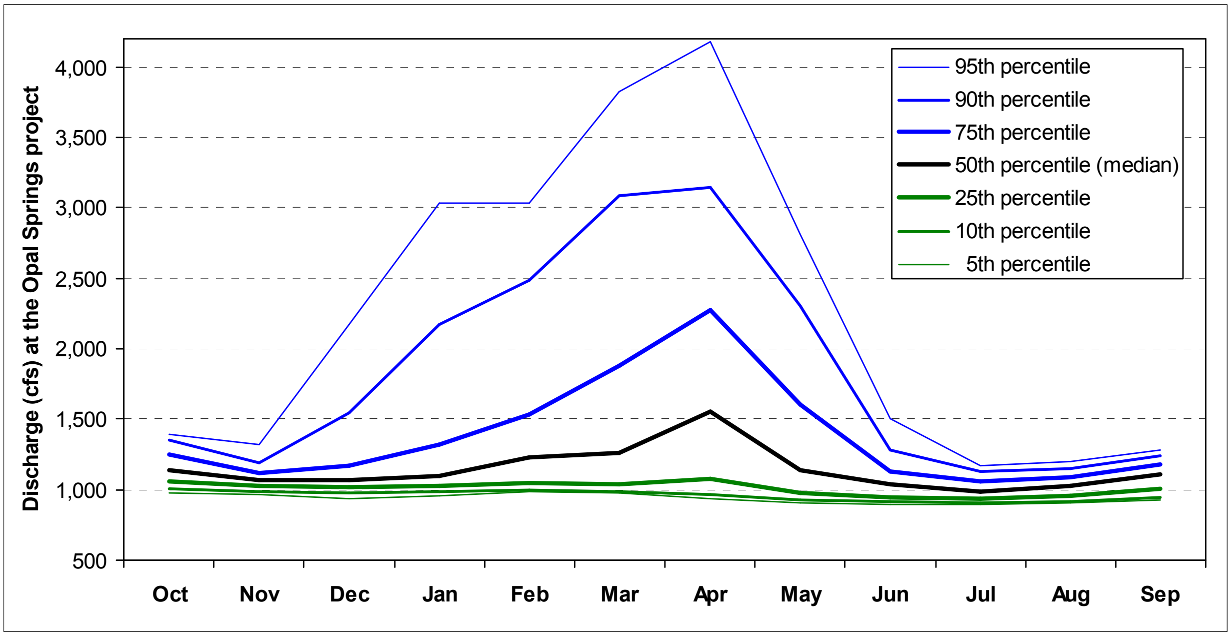


Figure 1. Seasonal (monthly) exceedances for daily discharges in the Crooked River at the OSHP during water years 1962-2014, based on data from the USGS gauge below Opal Springs (gauge no. 14087400).

Smolt emigration timing and size at the OSHP. Annual survival rates for summer steelhead and spring Chinook salmon smolts at the OSHP are influenced in the DMM model by emigration timing and smolt size, as they will be at the project. The model assumes daily passage of a percentage of the total annual emigration of smolts for each species, with the exact percentage based on user-defined seasonal (monthly) fractions of annual emigration that the model adjusts to daily fish passage at OSHP on the basis of daily discharges estimated for Crooked River above the lower canyon (which begins near the Highway 97 bridge) and a sensitivity factor that makes the smolt population emigrating from upstream areas more or less sensitive to river flows as a migratory cue. Seasonal patterns of emigration assumed in the current analysis are given in Figure 2. The flow sensitivity factor was set to "1", a value at the lower end of the range that would seem reasonable for the system.

Size distributions the model assumes for each species of anadromous salmonid emigrating through the OSHP are based on data available from the Crooked River and other relevant waterbodies in the Deschutes Basin (Figure 2). These distributions should be viewed as first-approximations that can be refined when monitoring data are collected at the project during the next decade or so. These distributions have no effect within the model on fish migration timing or passage route selection, but have a significant effect on the size-dependent survival rates of smolts that pass the OSHP via the powerhouse.

NOTE: This 2015 BA has been supplemented by memo dated April 17, 2017.
This memo has been attached to this Exhibit A of the APEA (as filed, October 2017)

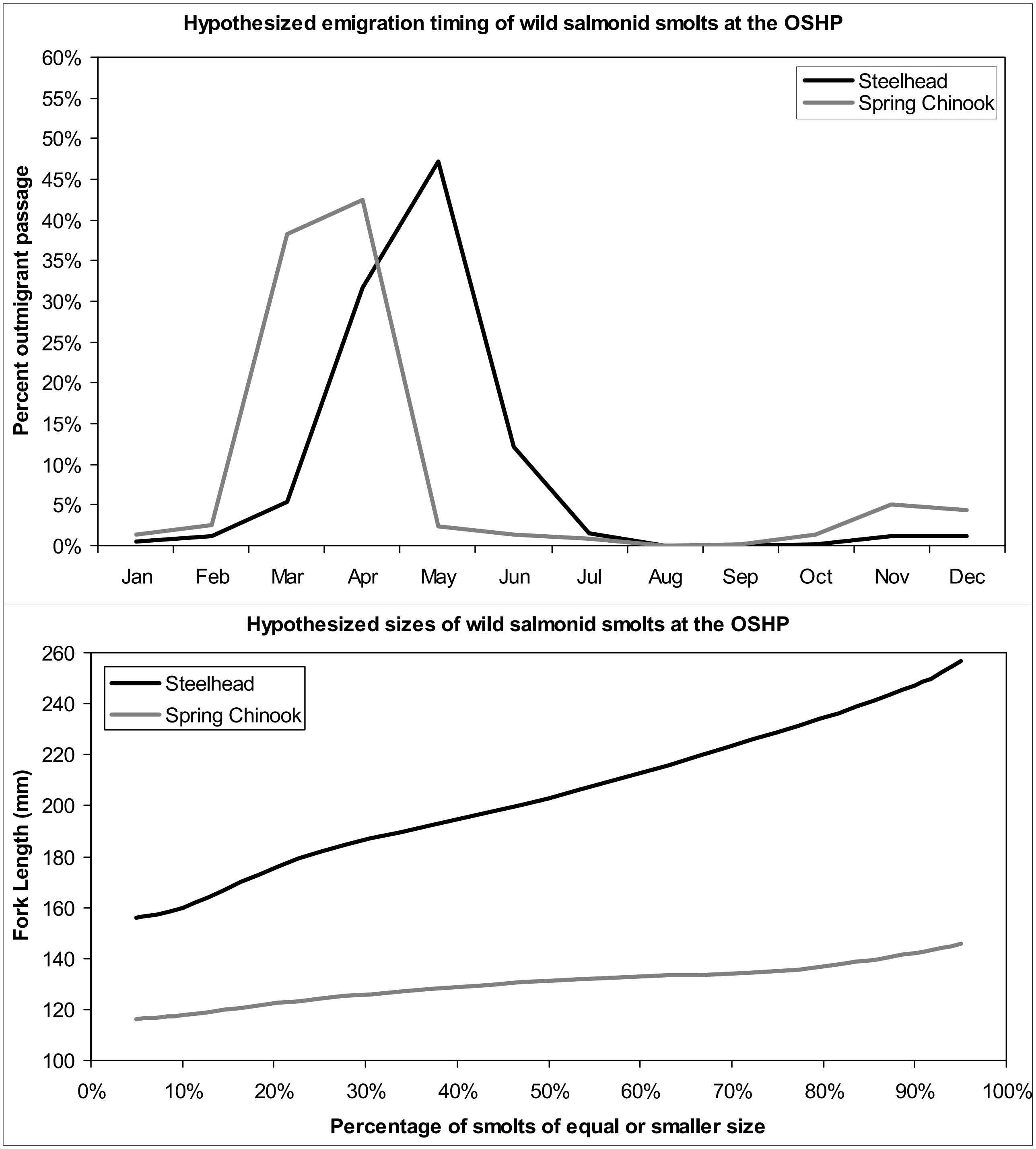


Figure 2. Estimated future emigration timing (top) and size (bottom) for summer steelhead and spring Chinook salmon smolts at the OSHP. Estimates of timing were based on species-specific data from the Crooked River itself (M. Hill, PGE, pers comm.), the Pelton-Round Butte hydro-complex (Newton 1973; Lewis 2005), and from other Deschutes River tributaries (Montgomery 1955; Burck 1981; Nelson 2008).

Powerhouse survival. Survival rates the DMM model applies to summer steelhead and spring Chinook salmon smolts passing through the OSHP powerhouse are based on a published turbine-strike model for Kaplan turbines developed by Franke et al. (1997) and recently adjusted by R2 Resources (2008) to account for uncertainty in the Lambda parameter. A separate weighted average rate is used for each species, with each average based on the adjusted Franke Model and hypothesized length distributions for smolts emigrating from the Crooked River (per Figure 2). Project-specific parameters used in the model are given below, followed by a summary of model results for the old and (proposed) new configuration of the OSHP (Table 1).

Parameters used in the Franke Model

- N = number of turbine blades = 5
- L = fish length = species-specific distributions characterized in Figure 2
- D = turbine diameter (m) = 3.0
- Q_{wd} = discharge coefficient = 0.1203
- Q = turbine flow rate (m3/s) = 51.01, a mid-range flow
- W = rotational speed = 15.708
- a_a = 0.701015 (old), 0.77297 (new)
- E_{wd} = energy coefficient = 0.0606 (old), 0.07004 (new)
- H = net head (m) = 13.720 (old), 15.854 (new)
- N = turbine efficiency = 80%
- r/R = 0.75

Table 1. Point estimates and potential ranges (in parentheses) for the survival rates of salmonid smolts passing through the OSHP powerhouse, estimated using the Franke et al. (1997) model as modified for uncertainty in the Lambda parameter by R2 Resources (2008). The mid-range point estimates given should be viewed as hypotheses, with true powerhouse survival rates almost certain to fall within the given ranges.

Project	Size percentile	Steelhead		Spring Chinook	
		Length (mm)	Percent survival	Length (mm)	Percent survival
Existing	5	156	91.8 (87.2-96.3)	116	93.0 (89.3-96.7)
	10	160	91.7 (87.0-96.3)	118	92.9 (89.2-96.7)
	25	182	91.3 (86.2-96.3)	124	92.7 (88.8-96.6)
	50	203	91.0 (85.6-96.4)	131	92.5 (88.4-96.5)
	75	229	89.8 (83.7-95.9)	135	92.3 (88.2-96.5)
	90	247	89.0 (82.4-95.6)	142	92.1 (87.8-96.4)
	95	257	88.6 (81.7-95.4)	146	92.0 (87.7-96.4)
	Wtd. avg.	---	*90.5 (85.0-96.1)*	---	*92.5 (88.5-96.5)*
New	5	156	92.0 (87.5-96.4)	116	93.2 (89.6-96.8)
	10	160	91.9 (87.3-96.4)	118	93.1 (89.5-96.7)
	25	182	91.5 (86.6-96.4)	124	92.9 (89.1-96.7)
	50	203	91.2 (85.9-96.4)	131	92.7 (88.8-96.6)
	75	229	90.1 (84.1-96.0)	135	92.5 (88.5-96.5)
	90	247	89.3 (82.9-95.7)	142	92.3 (88.1-96.5)
	95	257	88.2 (82.2-95.5)	146	92.2 (87.9-96.5)
	Wtd. avg.	---	*90.8 (85.4-96.2)*	---	*92.7 (88.8-96.6)*

Spillway survival. Survival rates for smolts passing over the general OSHP spillway are assigned by the DMM model on the basis of mean daily spillway discharge and a step-function that assumes a set percentage of direct fish mortality from physical injuries occurs whenever spillway discharges are at levels likely to pass fish (approximately 150 cfs, a 10-12 cm veil of water over flashboards). The function maintains a constant rate of survival at all higher spillway discharges.

A more complex function for the relationship between spillway discharge and smolt mortality was considered, but the simple step-function approach was adopted after considering probable causes of physical injury at this location. A fraction of the fish passing downstream via this route when spillway discharges are modest will likely suffer lethal injuries caused predominantly by high impact velocities near the base of the flashboards or new Obermeyer weir. However, as discharge rates over the spillway increase, the predominant source of physical injury and mortality will likely shift from high impact velocities near the boards or Obermeyer to high-velocity contact with the rough surface of the spillway. The specific range of discharges over which this spatial shift will occur is uncertain, however for the purpose of the DMM model it seemed reasonable to assume that the aggregate mortality rate remained constant.

Several studies of physical injuries to juvenile salmonids passing other low-head (<50 ft) dams via non-turbine routes (spillways, fish chutes and bypasses) have found rates of passage mortality that were typically less than 2 percent (RMC 1992; Karchesky et al. 2008; Heisey et al. 2008). However, slightly higher rates of passage mortality (3-7 percent) have been recorded for routes having more natural or roughened surfaces, or exposed debris (Normandeau Associates 1995; Karchesky et al. 2009). Given the irregular and roughened surface of the OSHP spillway, it seemed reasonable to assume a conservative seven percent rate of injury-related mortality for smolts passing via this route. This was the rate assumed in the modeling exercise described here.

Bypass survival. Given the (proposed) new configuration, smolts bypassing the OSHP will do so via a new fish ladder, the 257 cfs capacity BFAA fish chute, or one of two bypass gates that together will have a combined capacity of 1,498 cfs. As currently parameterized, the DMM model applies a 99.5 percent survival rate to smolts passing the OSHP via these routes.

Project operations, including management of the BFAA system. The DMM model is structured to allow user-defined adjustments to how the OSHP is operated over the 53-year period of analysis. For the analysis reported here I assumed that the "old" Project was configured and operated much as it has been for the last few decades. I also assumed for a "new" Project that all weir gates on bypass routes would be operated to minimize spill over the central Obermeyer weir and that the BFAA would be managed under a strategy of constant and equal daily augmentation of bypass flows until or unless flows into the bypass were already 250 cfs. Bypass flows greater than 250 cfs occurred only when forced by river discharge. In order to account for changes in BFAA water availability that are likely to occur at 5-6 year invervals in the near future, I ran the DMM model three times assuming each of three levels of water availability as per DVWD (2011) and CH2M Hill (2014). The runs assumed annual use of the BFAA would average 32.95 cfs, 46.19 cfs, and 59.38 cfs. When the analytical results were summarized, outcomes for the first of the three levels of bypass flow augmentation was weighted by a factor of 3, those for the second by a factor of 2, and those for the third by a factor of 1. This accounted for the probability that the discharge levels would actually be experienced, and in how many of the 5-6 year periods they might be experienced.

Modeling Results

Results of the DMM model runs, based on the parameterization outlined in this memo, including an assumption of mid-range turbine survival per the adjusted Franke Model, are summarized in Table 2 and Figure 3. These results should be viewed as structured hypotheses given that there have not been site-specific smolt passage studies at the OSHP and the actual seasonal pattern of use of the BFAA, with augmentation of bypass flows potentially varying by month, week, or shorter intervals, yet to be determined. Regardless, the results make clear it is reasonable to expect higher rates of smolt survival for steelhead and spring Chinook passing the new Project with BFAA operations than would occur under existing conditions.

Bypass capacity. After a bit of exploratory analysis my sense is that increases in smolt survival attributable to greater OSHP bypass capacity than is outlined in this memo would be nearly negligible in most years. Unless there are major changes in river hydrology, spills likely to pass fish over the central Obermeyer structure might not occur in even half the years of operation and that when such spills occur they often take place outside the periods of heaviest fish passage at the OSHP.

Table 2. Results of DMM model simulations of annual smolt survival rates at the OSHP under existing conditions and the proposed (new) Project configuration, assuming mid-range powerhouse survival rates and a hypothesized seven percent rate of spillway mortality. These results should be viewed as structured hypotheses.

Species	Condition	Annual OSHP smolt survival rate				
		10th-percentile	25th-percentile	50th-percentile	75th-percentile	90th-percentile
Steelhead	existing	90.5%	90.5%	90.6%	90.7%	90.8%
	new	91.6%	91.7%	91.9%	92.6%	93.4%
Spring Chinook	existing	92.5%	92.5%	92.5%	92.5%	92.6%
	new	93.3%	93.3%	93.8%	94.3%	94.9%

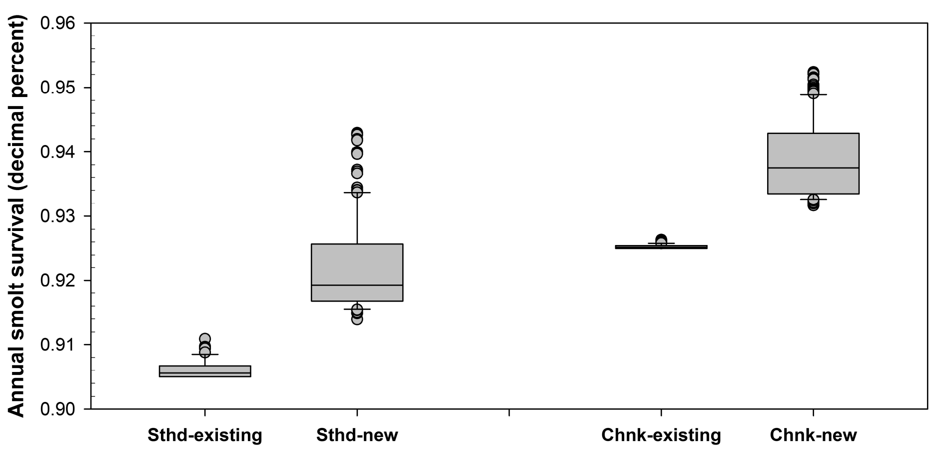


Figure 3. Box-plots of DMM model estimates of 53 annual survival rates for summer steelhead (Sthd) and spring Chinook (Chnk) smolts passing through the existing (old) and proposed (new) OSHP, assuming mid-range powerhouse mortality, a hypothesized 7 percent rate for spillway mortality, and the river discharge patterns seen during water years 1962 through 2014. These results should be viewed as structured hypotheses.

Citations

Burck, W. 1981. An ecological and fish cultural study of summer steelhead in the Deschutes River, Oregon. Unpublished manuscript. Oregon Department of Fish and Wildlife, Portland.

CH2M Hill. 2014. Opal Springs Hydroelectric Project pool raise and fish passage improvements, 99% supporting design report. Consultant report to the Deschutes Valey Water District, Culver, Oregon. CH2M Hill, Portland, Oregon. July 2014.

Deschutes Valley Water District (DVWD). 2011. Settlement Agreement for the Opal Springs Hydroelectric Project.

Franke, G., D. Webb, R. Fisher, Jr., D. Mathur, P. Hopping, P. March, M. Headrick, I. Laczo, Y. Ventikos, and F. Sotiropoulos. 1997. Development of environmentally advanced hydropower turbine system design concepts. Idaho National Engineering and Environmental Laboratory. August.

Heisey, P.G., D. Mathur, J.R. Skalski, R.D. McDonald, and G. Velazquez. 2008. Effect of spillway structural modifications on fish condition and survival in Advances in Fisheries Bioengineering, Symposium 61. 239 pages.

Hill, Megan. Fish Biologist, Portland General Electric Co., Madras, OR. Personal communication and sharing of unpublished Crooked River monitoring data during October 2011.

Karchesky, C.M., R.D. McDonald, P.G. Heisey, S.W. Adams, and S.N. Graver. 2008. Estimating survival and condition of juvenile salmonids after passage through the fish bypass system at the T. W. Sullivan Hydroelectric Project, Willamette River, Oregon. Prepared for Portland General Electric (PGE), Portland, Oregon.

Karchesky, C.M., R.D. McDonald, P.G. Heisey, Joanne L. Fulmer, and S.N. Graver. 2009. FTC Review Draft: Estimating survival and condition of juvenile salmonids after passage through the flow control structure at the apex of Willamette Falls, Willamette River, Oregon, Fall 2008. Prepared for Portland General Electric (PGE), Portland, Oregon.

Lewis, Scott. 2005. Fish Biologist, Portland General Electric Co., Madras, OR.

Montgomery, M. 1955. Deschutes River Ivestigations, Central Region. River Basin Investigations, Oregon State Game Commission.

Nelson. 2008. Trout Creek 1998-2007 summer steelhead outmigrant trapping results. Oregon Department of Fish and Wildlife, Madras, OR. 25 p.

Newton, J. 1973. Deschutes River spring Chinook salmon (Oncorhynchus tshawytscha) Walbaum. A literature review. Oregon Wildlife Commission. Central Region Administrative Report No. 74-1. December.

Normandeau Associates, Inc. 1995. The Vernon Bypass Fistube: Evaluation of survival and injuries of Atlantic salmon smolts. Report prepared for New England Power Co., Westborough, MA.

R2 Resource Consultants. 2008. Estimates of turbine mortality for salmonid and non-salmonid fish at proposed Enloe Hydroelectric Project. Consultant report prepared for the Okanogan Public Utility District. May 2008.

RMC Environmental Services (RMC). 1992. Survival of Atlantic salmon smolts passing the Log-Ice sluice at the Wilder Hydroelectric Station, Vermont/New Hampshire. Report prepared for New England Power Company, Westborough. MA.

SUPPLEMENTARY MEMO

Clearwater BioStudies, Inc.

1160 Old Ferry Road Shady Cove, Oregon 97539 (503) 895-7498

TECHNICAL MEMORANDUM

To: Finlay Anderson, Kleinschmidt
From: Charles W. Huntington, Sr. Aquatic Biologist
Subject: Fish passage survivals associated with a 3-foot dam raise at Opal Springs Dam
Date: 17 April 2017

Per your request, I re-ran all of the survival models for fish passage at the Opal Springs Hydroelectric Project (OSHP) assuming a 3-foot dam raise and compared the results to those of previous modeling by Huntington (2015a, 2015b, 2015c) that had assumed a 6-foot raise. Basic modeling assumptions that changed in addition to the magnitude of the dam raise were that only the spillway next to the fish ladder would be lined with smooth concrete, that the decrease in maximum powerhouse discharge would be cut in half since the estimated increase in Project head was being cut in half, and that there would be incremental calculated changes in turbine survival rates for down-migrants associated with the change in head. All other basic assumptions remained the same as outlined in previous memos, including, per your suggestion, flow allocations to the BFAA.

Results of my reanalysis are summarized briefly in Table 1. Basically, reducing the dam raise from 6 feet to 3 feet would cause incremental reductions in annual fish survivals at the OSHP. However, a 3-foot raise combined with implementation of the Opal Springs Fish Passage and Enhancement Plan would still improve annual survivals of migratory salmonids as compared to those that would occur if the fish were passed upstream at the OSHP via a new ladder but absent implementation of the Plan. This says nothing of the losses of up-migrant adult salmon and steelhead associated with the temporary passage operation occurring at the OSHP in anticipation of fish ladder construction.

Table 1. Projected median annual survival rates for migratory salmonids at the OSHP for three scenarios: (1) upstream passage provided via a ladder without the Opal Springs Fish Passage and Enhancement Plan (Passage with no Plan), (2) upstream passage provided via a ladder with a 6-foot dam raise and the Plan (Plan with 6-foot Raise), and (3) passage with the Plan given a 3-foot dam raise (Plan with 3-foot Raise).

	Median annual passage survival rates		
Species and lifestage	**Passage with no Plan**	**Plan with 6-foot Raise**	**Plan with 3-foot Raise**
Adult Chinook salmon[1]	96.9%	97.2%	97.2%
Adult steelhead[1]	97.1%	97.4%	97.4%
Steelhead kelts	71.8%	75.5%	74.7%
Bull trout immigrants[1]	98.5%	98.6%	98.6%
Bull trout emigrants[2]	75.8%	78.7%	78.4%
Chinook smolts	92.5%	93.8%	93.4%
Steelhead smolts	90.6%	91.9%	91.7%

[1] Estimated survival rates for upstream migrants assuming fall-back rates of 10%.

[2] Estimated survival rates for emigrants that first passed the OSHP in the upstream direction to forage in available habitat. Bull trout passed upstream will have experienced an approximately 65% per year survival rate while foraging above the OSHP prior to attempting to pass downstream.

References

Huntington, C. 2015a. Upstream passage of adult salmonids and other fish at the Opal Spring Hydroelectric Project. Technical memorandum to Finlay Anderson, McMillen-Jacobs Associates, Portand, Oregon. Clearwater BioStudies, Inc., Shady Cove, Oregon. 16 June 2015.

Huntington, C. 2015b. Analysis of potential entrainment or spillway mortality of large salmonids at the Opal Springs Hydroelectric Project. Technical memorandum to Gary Lytle, Deschutes Valley Water District, Culver, Oregon. Clearwater BioStudies, Inc., Shady Cove, Oregon. 20 August 2015.

Huntington, C. 2015c. Analysis of potential smolt mortality at the Opal Spring Hydroelectric Project. Technical memorandum to Finlay Anderson, McMillen-Jacobs Associates, Portand, Oregon. Clearwater BioStudies, Inc., Shady Cove, Oregon. 15 June 2015.

[This page intentionally left blank]

EXHIBIT B

CONSULTATION RECORD

OPAL SPRINGS HYDROELECTRIC PROJECT – AMENDMENT CONSULTATION SUMMARY

Notes: Items that were previously submitted with the original filing have been omitted for convenience and are available on the FERC elibrary or upon request from the DVWD. Items that are new and pertain to the redesign are included here. Items that have been "abridged" have been so in order to reduce the amount of redundant material. All can be made available upon request.

Item	Date	Name/Entity(s)	Consultation Event	Documentation
1	12/21/2011	DVWD	Filing Initial Consultation Document (ICD)	FERC E-library
2	12/21/2011	DVWD	Announcement of Site Visit and Joint Meeting to be held on February 7, 2012	Attached (see 10/8/2015 filing)
3	1/09/2013	DVWD	Communication to CTWS confirming information regarding site visit and public meeting	Attached (see 10/8/2015 filing)
4	01/11/2012	USFWS	Comments on suggested alternative facility design (R2 Resources)	Attached, abridged (see 10/8/2015 filing)
5	01/13/2012	NMFS	Comments on suggested alternative facility design (R2 Resources)	Attached, abridged (see 10/8/2015 filing)
6	01/20/2012	ODFW	Comments on suggested alternative facility design (R2 Resources)	Attached, abridged (see 10/8/2015 filing)
7	01/20/2012	DVWD	Notice to FERC of Joint Meeting to be held February 7, 2012	Attached (see 10/8/2015 filing)
8	01/23/2012	FERC	Designation of DVWD as non-federal representative for conducting informal consultation with NFMS and USFWS	Attached (see 10/8/2015 filing)
9	02/07/2012	DVWD, Parties, Public	Joint Meeting (see FERC E-Library (Accession Number 20120307-0002)	FERC E-library
10	04/03/2012	USFWS	Communication to FERC on ICD and proposed information development to be completed in Stage 2 Consultation	Attached (see 10/8/2015 filing)

Item	Date	Name/Entity(s)	Consultation Event	Documentation
11	04/03/2012	NMFS	Communication to FERC on ICD and proposed information development to be completed in Stage 2 Consultation	Attached (see 10/8/2015 filing)
12	04/04/2012	Public	Presentation public sponsored by Trout Unlimited in Bend, Oregon	Attached (see 10/8/2015 filing)
13	04/05/2012	ODFW	Communication to FERC on ICD and proposed information development to be completed in Stage 2 Consultation	Attached (see 10/8/2015 filing)
14	04/06/2012	BLM	Communication to FERC on ICD and proposed information development to be completed in Stage 2 Consultation	Attached (see 10/8/2015 filing)
15	4/23/2013	DVWD	Distribution of 60% Design and Supporting Design Report	Available upon request (see 10/8/2015 filing)
15	5/1/2013	DVWD, Parties	Meeting to discuss 60% design and provide updates on Project	Attached (see 10/8/2015 filing)
17	8/1/2013	DVWD	Distribution of 90% Design and Supporting Design Report	Available upon request (see 10/8/2015 filing)
18	8/29/2013	DVWD, Parties	Technical Work Group Meeting to review 90% design and discuss Settlement Agreement Extension	
19	9/29/2013	DVWD	Distribution of final meeting notes on 90% design meeting.	Attached (see 10/8/2015 filing)
20	5/3/2014	• Debra Henry/US Army Corps of Engineers • Heidi Hartman/Oregon Division of State Lands • Nancy Doran/Oregon Department of Fish and Wildlife	Site tour in advance of Joint state/federal removal and fill permit. Identification of wetland delineation needs	
21	10/14/2014	Settlement Parties	Amendment #1 to Settlement Agreement, Extending term of Agreement by one year	Attached (see 10/8/2015 filing)

Item	Date	Name/Entity(s)	Consultation Event	Documentation
22	04/025/2015	BLM	BLM advises DVWD to disregard request for Study B-1 (Invasive Species Investigation)	Attached (see 10/8/2015 filing)
23	11/21/2014	Parties	Update meeting at OSHP	Attached (see 10/8/2015 filing)
24	05/21/2015	USFWS	Updated Listed Species List for Opal Springs Project Area	Attached (see 10/8/2015 filing)
25	05/22/2015	DVWD to Settlement Parties	Discussion of timelines, distribution of Joint Explanatory Statement (JES) and proposed amendments to 2012 Settlement Agreement (modifications for consistency)	Attached, abridged (see 10/8/2015 filing)
26	06/24/2015	DVWD to Parties	Finlay Anderson discusses upcoming APEA/BA, requesting agency review within 30 days. Also seeking comments on conforming amendments to Settlement Agreement and Joint Explanatory Statement	Attached (see 10/8/2015 filing)
27	7/7/2015	USFWS	Commenting and denying request for 30 review period for APEA	Attached (see 10/8/2015 filing)
28	7/7/2015	NWPPC	Northwest Electric Power Planning and Conservation Act consistency	Attached (see 10/8/2015 filing)
29	7/8/2015	BLM	VRM requirements for NEPA analysis of right-of-way request	Attached (see 10/8/2015 filing)
30	7/13/2015	DVWD	Draft APEA and BA, request for comments within 60 days by 9/11/15	Attached, abridged (see 10/8/2015 filing)
31	7/20/2015	PGE	Comments on APEA	Attached (see 10/8/2015 filing)
32	7/29/2015	OWRD	APEA: Questions regarding water use and storage requirements under Proposed Action	Available upon request (see 10/8/2015 filing)
33	7/29/2015	OWRD	APEA: proposed edits statutory language governing permit amendments.	Attached (see 10/8/2015 filing)
34	8/24/2015	Sage West for DVWD	Transmittal of VRM study to BLM	Attached (see 10/8/2015

Item	Date	Name/Entity(s)	Consultation Event	Documentation
				filing) (see 10/8/2015 filing)
35	8/28/2015	NOAA	No Comments on BE	Attached (see 10/8/2015 filing)
36	9/9/2015	BLM	Comments on VRM study	Attached, Abridged (see 10/8/2015 filing)
37	9/10/2015	USFWS	Comments on Biological Evaluation	Attached (see 10/8/2015 filing)
38	9/10/2015	USFWS	Comments on JES, EA, SA	Attached, Abridged (see 10/8/2015 filing)
39	912/15/2016	ODEQ	Final 401 Certification from Oregon Department of Environmental Quality pursuant to Section 401 of the Federal Clean Water Act under P-5891.	FERC E-library
Consultation related to abeyance request and value engineering				
40	12/19/2016	DVWD	Request for Delay of License Amendment Issuance; Notice of Dispute Resolution Proceedings	FERC E-library
41	1/6/2017	DVWD to Parties	Meeting Summary – Value Engineering, Dispute Resolution	Attached
42	1/30/2017	DVWD	Request to continue abeyance until 3/31/2017, update and conclusion of Dispute Resolution-value engineering approach	FERC E-library
43	3/17/2017	DVWD	Update to value-engineering approach, proposal to continue abeyance pending completion of milestones	FERC E-library
44	5/30/2017	DVWD to Parties	Transmittal of Supplementary BA, crosswalk of changes to key documents; includes follow up on June 2, 2017	Attached, abridged
45	6/12/2017	DVWD to Oregon DEQ	Transmittal of Revised Project Description; request for conforming modifications to Water Quality Certificate	Attached, abridged
45	7/27/2017	DVWD to Parties	Meeting Summary – Design Update	Attached

Item	Date	Name/Entity(s)	Consultation Event	Documentation
46	10/11/2017	DVWD to Parties	Meeting Summary – Process Update, agreement to proceed	Attached
47	10/24/2017	Fish Agencies to DVWD	Agreement that modified project description and proposed modifications to the license articles would not constitute a material modification to the Settlement Agreement per Section 3.8.	Attached
Agency Approvals of Fish Passage Design, Pursuant to Proposed Article 2 of 2011 Settlement Agreement [Note: reaffirmation of approvals of 2017 design changes are pending]				
PLA2-1	01/27/2014	ODFW	Approval of 90 Design – Provided in fulfillment of Oregon Watershed Enhancement Board Grant Report.	Attached (see 10/8/2015 filing)
PLA2-2	04/03/2015	BIA	Approval of 90 Design	Attached (see 10/8/2015 filing)
PLA2-3	04/13/2015	USFWS	Approval of 90 Design	Attached (see 10/8/2015 filing)
PLA2-4	04/14/2015	NMFS	Approval of 90 Design	Attached (see 10/8/2015 filing)

PREVIOUS CONSULTATION FILING

THIS INFORMATION IS AVAILABLE IN THE PREVIOUSLY FILED VERSION

HTTPS://ELIBRARY-BACKUP.FERC.GOV/IDMWS/SEARCH/RESULTS.ASP

ACCESSION NUMBER 20151008-5251

[This page intentionally left blank]

EXHIBIT C

SUPPLEMENTAL INFORMATION

DVWD OPAL SPRINGS NEGOTIATION PROTOCOL

FEBRUARY 20, 2009

M E M O R A N D U M

DATE: **March 25, 2009**

TO: **File**

FROM: **Finlay Anderson**

SUBJECT: **Clarifications to Negotiations Protocol (version dated February 20, 2009) made at the March 9 Settlement Working Group meeting**

The Opal Springs Settlement Working Group (SWG) met on March 9 2009. A summary of decisions and action items is being prepared. However, one item discussed may impact how entities contemplating entering the negotiations may interpret the Negotiations Protocol (Protocol). The following summary of discussion and decisions on the interpretation of the Protocol is excerpted from the notes and is being provided here for the convenience of entities now contemplating executing the Protocol.

- Clarifications to the Protocol were reviewed, and the following **agreements** regarding interpretation of the Protocol were made:
  - Section H: clarified that if "the SWG reaches a Settlement Agreement in which all Parties have unanimously agreed on all issues and FERC approves the agreement without material modification, any subsequent filings by any Party during the balance of the current FERC license term related to issues addressed by the agreement with FERC by any Party to the Settlement Agreement shall be consistent with the Settlement Agreement."
  - Inconsistencies between review periods identified in Sections C.2(c) and C.2(g) are to be interpreted as 5 business days in each section.
  - Section C.4(c) is to be understood that Parties and Participants in the process will not make statements to the public or media about group consensus or agreements (tentative or otherwise) until the final package is complete. The third sentence (beginning with "All responses") will be interpreted to read "All responses ~~regarding group consensus or agreement~~ will be kept at a very general level and a low level of specificity and will be limited to the Principles and Goals described in this Protocol." If media make inquiries to members of the SWG, they can be referred to Finlay who will then work a response back through the entire SWG.

NEGOTIATIONS PROTOCOL
FOR FISH PASSAGE AGREEMENT FOR THE OPAL SPRINGS PROJECT

The Parties and Participants (as defined herein) to the negotiation regarding fish passage and protection at the Opal Springs Project, FERC No. 5891 ("Project"), hereby agree to the following Protocol:

PURPOSE: It is the purpose of this Protocol to guide and govern the process of deliberating and decision-making among the Parties and Participants to the Opal Springs fish passage negotiations. This Protocol memorializes the process and procedures that will be utilized by the Parties and Participants in discussions that could potentially lead to a negotiated settlement of the terms and conditions (the "Settlement Agreement") to be presented in a license amendment application ("Amendment Application") filed by the Deschutes Valley Water District (the "District") to the Federal Energy Regulatory Commission ("FERC"), as well as other non-license commitments among some or all of the Parties and Participants.

GOAL: It is the goal of this Protocol to encourage the creation of a negotiated Settlement Agreement among as many of the Parties and Participants as possible that resolves as many of the issues as possible related to fish passage and protection at the Project and the application of the Endangered Species Act ("ESA") to Project operations for the balance of the current FERC license term.

DEADLINES: The Parties and Participants recognize, based on the best available information, that adult salmonids from the anadromous fish reintroduction efforts in the Crooked River basin may begin returning to the Crooked River below the Project as early as July 2011. Parties and Participants will establish benchmarks and accompanying deadlines in the negotiations process and adhere to them to the greatest extent practicable with the goal of developing a Settlement Agreement for submittal to FERC concurrently with the amendment application. The target for execution of a Settlement Agreement is May 30, 2009; the target for submittal of the Amendment Application to FERC is November 30, 2009.

DATE: For identification purposes, this Protocol is dated February 20, 2009.

A. DEFINITIONS

1. **Consensus** means general concurrence of the Parties and Participants in the resolution of a procedural or substantive issue that arises in the negotiation process. It may be expressed as a result that the Parties and Participants can live with. It does not require or imply unanimity.

2. **Party** is an entity, including a corporation or other business organization, a unit of government, a social or environmental organization, or association, with stated interests in fish passage and protection at the Project whose agreement is desired for settlement or consensus, as defined in this Protocol. Any organized entity, by an Authorized Representative, may assert status as a Party to this proceeding by asserting Party status in the signature page to this Protocol. Any organized entity asserting the status of a Party must agree to be bound by the terms of this Protocol.

3. **Participant** is a person or entity who intends to contribute to the meetings and deliberations during the negotiations process, but who is not claiming Party status and will not be canvassed regarding settlement in the decisionmaking process. Each Participant must agree to abide by all provisions of this Protocol.

4. **Authorized Representative** means a person who is formally appointed by the governing body of a Party, or delegated by a person so appointed, to represent its interests in settlement discussions and negotiations. Upon the request of any Party, a person claiming to be an Authorized Representative may be required to demonstrate the fact and nature of his/her appointment. As an employee or agent of a Party, each Authorized Representative is bound by all provisions of this Protocol.

5. **Alternate Authorized Representative** means a person who is delegated by an Authorized Representative to act as an Authorized Representative for a Party in place of the designated Authorized Representative of such Party.

6. **Representative** is a person who may declare himself or herself a representative of a person or entity which is a declared Party to the proceeding and may participate in meetings on behalf of a Party, but his or her views are not official for the Party unless the person is also designated as an Authorized Representative or Alternate Authorized Representative. As an employee or agent of a Party, each Representative is bound by all provisions of this Protocol.

7. **Settlement Working Group (SWG)** is the policy level forum for efforts to develop the Settlement Agreement. The Authorized Representatives voluntarily work together in the SWG to achieve a mutually acceptable outcome that satisfies, to the greatest degree possible, the interests of all of the Parties. The SWG is the group responsible for all decisions and actions that are publicly identified as SWG products.

8. **Technical Work Groups (TWG)** may be formed at the direction of the SWG, which will designate TWG members for specific anticipated technical tasks. Individual TWG members need not be the same individuals as those who represent the Parties in the SWG. TWGs may develop draft products and make recommendations to the SWG as requested; however, TWGs will not make decisions on behalf of the SWG.

9. **Notice** means written notification provided at least 20 days in advance of a meeting and an agenda setting forth the topics to be discussed at such meeting, by U.S. mail, electronic mail, confirmed facsimile or personal delivery.

10. **Settlement Working Group meetings** are any meetings or conference calls of the SWG of which the District has provided Notice other than General Meetings of the Parties and Technical Work Group Meetings.

11. **Technical Work Group meetings** are any meetings or conference calls of one or more TWGs of which the District has provided Notice other than General Meetings of the Parties and Settlement Working Group meetings.

12. **General Meetings of the Parties** are meetings of all Parties and Participants, other than Settlement Working Group meetings and Technical Work Group meetings (e.g., informational meetings).

13. **Settlement Agreement** is a written agreement among declared Parties that resolves some or all issues among the agreeing Parties. If all Parties sign a Settlement Agreement that purports to resolve all issues among the Parties (a unanimous settlement), and pre-filing milestones identified as such in the Settlement Agreement are completed as described, the Licensee will submit the Settlement Agreement to FERC along with the Amendment Application and assert that all issues have been resolved. The Settlement Agreement will include the Settlement Agreement itself, an Explanatory Statement as required by FERC regulations, and any proposed license articles agreed to by the Parties. If all Parties are unable to reach a unanimous settlement agreement, the District, at its discretion, may submit to FERC a partial settlement reflecting all or some issues among all or some Parties. If a partial settlement is filed by the District, parties to the partial settlement agreement must support the partial settlement agreement, but reserve the right to disagree or file separate comments to FERC on the issue to which agreement has not been reached in the partial settlement agreement. Non-settling Parties will be free to submit comment to FERC representing their own positions and interests.

B. SETTLEMENT WORKING GROUP STRUCTURE

1. The Settlement Working Group (SWG) members will:

   (a) Ensure that all significant issues and concerns of their organizations and constituents are fully and clearly articulated during SWG meetings;

   (b) Work together to develop the components of a Settlement Agreement;

   (c) Agree on the desired level of specificity of Settlement Agreement components;

   (d) Ensure adequate integration of scientific, technical and economic information to support components of agreement;

   (e) Ensure that any eventual recommendations or agreements are acceptable to their constituents and/or organizations they were appointed to represent;

   (f) Concur in decisions about the SWG process, including overseeing the implementation of this Protocol; and

   (g) Identify both its Authorized Representative, and if different, official signatories for the Settlement Agreement.

2. The SWG may form TWGs and will designate work group members for specific anticipated technical or process tasks. TWGs may develop draft products and make recommendations to the SWG as requested; however, TWGs will not make decisions on behalf of the SWG.

C. GROUND RULES AND GENERAL PROTOCOL

1. Conduct of the Parties and Participants:

All persons at any meeting for discussion or negotiation of issues shall act in good faith and conduct themselves professionally and courteously. All Parties and Participants recognize that each Party and Participant has legitimate interests and the right to pursue satisfaction of those interests. Parties and Participants will focus on meeting their interests through an interest-based negotiations process, rather than utilizing a positional approach.

2. Attendance at Meetings:

(a) Each Party will endeavor to have its Authorized Representative (or Alternate Authorized Representative) attend each SWG Meeting and at least one Representative attend any TWG meeting (as defined herein) for which the Party has volunteered to participate. Parties commit to staying informed and to working diligently with all other Parties to try to resolve the identified issues. Parties are encouraged to provide staff with special expertise at meetings where that expertise is likely to be relevant.

(b) Parties and Participants are expected to bear their own expenses for participating in the discussions and negotiations related to the negotiations as anticipated under this Protocol.

(c) Attendance at meetings is expected and all Parties will strive to have an Authorized Representative present at each meeting in which they wish to participate. In the event that a Party or their Representative is not able to attend, that Party will strive to provide advance input in writing or by proxy through another attendee based on the available agenda. Following the meeting, all Parties will have a 7-day period in which to review the meeting summary in accordance with Section 3(g). During this review period, an absent Party may provide feedback on decisions made or actions taken at the meeting. Parties recognize that their failure to be represented at meetings to which they have committed will hamper the negotiations process and reduce the likelihood of successful settlement, may diminish the abilities of other Parties to understand and accommodate their interests, and is inconsistent with the spirit and intent of this Protocol.

(d) If an Authorized Representative cannot attend a SWG meeting he or she may designate an Alternate Authorized Representative to attend. It is the responsibility of the Authorized Representative to inform the alternate concerning the current status of the deliberations. All Alternate Authorized Representatives are also bound by this Protocol.

(e) Before an individual representing themselves or any organization or entity that is not already a Party or a Participant as of February 27, 2009 may attend a meeting of the SWG or a TWG meeting, with the intent of continued participation thereafter, the Authorized Representatives and Representatives in attendance at the meeting must approve that individual's attendance by consensus; provided that the individual, organization, or entity execute this Protocol as either a Party or a Participant, in accordance with the provisions of section I.4. of this Protocol, prior to any such participation.

3. **Conduct of Meetings:**

For all meetings anticipated under this Protocol the Parties and Participants agree:

(a) SWG and TWG meetings will be supported by a neutral facilitator provided by the District.The facilitator will serve as the unbiased assistant to the settlement negotiation process. The facilitator is responsible for ensuring that the meeting follows the agreed-upon agenda, ensuring that all Parties and Participants are heard, and working to resolve any impasses that may arise.

(b) Near the end of each meeting, the Parties and Participants in attendance will discuss the agenda for the next meeting and draw up a list of topics to be considered. The District shall then prepare a detailed agenda.

(c) The District will endeavor to distribute the agenda along with a meeting notice at least two weeks prior to the meeting.

(d) Between meetings, any Party or Participant may suggest agenda changes. The District will attempt to accommodate reasonable suggestions, and at a minimum will list any proposed changes on the revised agenda for consideration by the SWG/TWG at the beginning of the meeting. The agenda prepared by the District shall be announced at the beginning of a meeting, and Parties and Participants present shall decide based on consensus the merit of any agenda changes that have previously been proposed. In addition, any Party or Participant present may at that time suggest any further changes or additions to the agenda, which shall be accepted by consensus of the Parties present. Thereafter, the meeting shall follow the modified agenda as close as reasonably possible. Parties will strive to minimize modifications made at the meeting and should the modified agenda result in decisions that were not reasonably foreseen, Parties have the right to revisit these decisions in the subsequent SWG or TWG meeting.

(e) Action items will be prepared by the District to assist the SWG or TWG in documenting its progress and activities. These action items will be included in the meeting summary provided to Participants after each meeting and will be reviewed for progress at the start of each meeting.

(f) Meetings may be suspended at any time at the request of any Party to allow caucus among SWG/TWG members. Requests should be respectful of other attendees' time. If the use of caucuses becomes disruptive the SWG will revisit the process.

(g) Within 2 weeks after each SWG/TWG meeting, the District will prepare and circulate a draft written meeting summary, which shall include general topics discussed as well as any preliminary agreements reached and the supporting rationale, but will not include details regarding specific statements made or positions taken during the course of the meeting. Parties will have 5 days to review the draft summary and provide corrections, additions, clarifications or other comments. After the 5-day review period a final meeting summary will be prepared and circulated. This timeline will be modified with the agreement of the Parties, should such a modification be necessary to accommodate meeting schedules.

(h) In participating in the negotiations, Participants, Parties, Authorized Representatives and Representatives must behave according to the following commitments and ground rules and must take the following actions:

(i) Participate in a free, open and mutually respectful exchange of ideas, views and information.

(ii) Encourage imaginative thinking and sharing of ideas and solutions; however, endeavor to stick to the topics on the agenda, be concise, and do not repeat oneself. It is agreed that all Participants, Parties, Authorized Representatives and Representatives have the right to participate in discussions, but no one has a right to dominate.

(iii) Limit side conversations and other disruptive behavior (e.g., cell phone calls).

(iv) Follow through on promises and commitments.

(v) Bring concerns from their organizations up for discussion at the earliest point possible in the process.

(vi) Articulate to the best of their ability the interests that underlie issues and concerns in an effort to find common ground among the Parties.

(vii) Share relevant factual information that will assist the group in achieving its goals.

(viii) Ask questions if they do not understand one another.

(ix) Attack problems and issues, not each other.

(x) Be on time for meeting sessions and cooperate to keep all meetings on schedule so they can end on time. However, any meeting can be extended for a specific period of time upon a consensus of Parties present fifteen minutes before the scheduled conclusion of the meeting. In such cases, Parties and Participants who had to leave the meeting at or before its scheduled end time will endeavor to learn about the deliberations they had to miss so that those persons can register any input they may have.

(xi) By a consensus of those Parties present, ask any person using profane, disruptive or violent behavior to leave the meeting, or allow a previously excluded person to return to the meeting.

4. **Relationship of the Media and the Public to Meetings and Communications:**

The Parties and Participants agree that:

(a) All General Meetings of the Parties will be open to the media and the general public.

(b) All SWG meetings and TWG meetings will not be open to the media or the public without the unanimous consent of those Parties present at the meeting.

(c) Each Party and Participant will only speak for itself in response to any questions from the media. Any questions a Party or Participant may receive related to the positions or actions of another Party or Participant will be referred to that other Party or Participant. All responses regarding group consensus or agreements will be kept at a very general level and a low level of specificity. To the extent possible, only general information will be provided, so long as it is consistent with applicable law, such as the federal Freedom of Information Act (5 USC § 522). If additional follow up is needed, the SWG or TWG will provide a mutually acceptable written summary or statement. No other written or verbal information will be provided. In no case shall Parties, Authorized Representatives, Representatives, or Participants describe to the media the events and discussions of the SWG and TWG meetings.

(d) Requests received from the media may be addressed as consistent with the preceding paragraph (c). Any non-substantive questions from the media related to process aspects of the settlement negotiations will be referred to the District. The SWG will agree on any media releases on SWG/TWG activities and products.

D. STATEMENTS USED DURING THE PROCESS

Any statement made or position taken by a Party, Authorized Representative, Representative or Participant during negotiations in an attempt to reach settlement of any issue may not be used by any other Party or Participant in any way, such as evidence of the lack of necessity or factual support for the desired result if settlement is not reached. Any attempt by any Party or Participant to so use statements made or positions taken by any other Party or Participant is a violation of this Protocol. Violation of this Protocol will constitute grounds for withdrawal from negotiations.

E. AUTHORITY AND LIMITATIONS

1. Parties and Participants that are government agencies will be represented by Authorized Representative(s) or counsel empowered to participate in the negotiations on behalf of such agencies.

2. The Parties recognize that any agency charged with a statutory responsibility under the Federal Power Act, Endangered Species Act, or other applicable Federal or State law has the statutory right to exercise that authority regardless of whether the agency agrees with any position, consensus or settlement which may be taken by others in the negotiations, further recognizing that such agencies may lawfully agree to execute such authorities consistent with the Settlement Agreement. The Parties moreover recognize that agencies charged with statutory responsibilities under these or other applicable Federal or State laws cannot bind themselves to making any particular recommendations or take any particular action with respect to statutory compliance.

3. The Parties also recognize that agency representatives and representatives of other entities, including the District, may not bind their agencies or entities to positions or agreements without approval from appropriate levels of authority within their organizations, and that any position taken by such representatives (at a meeting or otherwise) is merely a recommendation until that appropriate level of authority has officially concurred.

4. All "agreements" reached during the course of the negotiations are by definition "preliminary" agreements subject to the Parties reaching a final settlement. The only documentation of the outcomes of the negotiating sessions on behalf of the Parties prior to reaching the Settlement Agreement will be the preliminary agreements and their supporting rationales; however, preliminary agreements will be considered confidential pursuant to Section F below and shall not be filed for the record before FERC or any other public record unless as allowed under Section F. Except for the written meeting summaries described above, no written summary of offers and counter offers will be prepared on behalf of the Parties. Each party, however, may retain whatever documentation is determined necessary for compliance with applicable law.

5. If all Parties, including all government agencies, reach a comprehensive Settlement Agreement resolving all issues among all of the Parties, including the Distrct, the agreement will be reduced to writing and filed with FERC as a full and comprehensive Settlement Agreement of the issues along with a license amendment application. If all Parties are unable to reach a unanimous Settlement Agreement, the District may at its discretion submit to FERC a partial settlement reflecting all or some issues among all or some Parties. Non-settling Parties will be free to submit comment to FERC representing their own positions and interests. To the extent a partial settlement is reached on only some issues, signing Parties are not precluded from submitting comment to FERC on omitted issues.

6. Nothing in this Protocol prevents or is intended to prevent the District from filing with FERC clearly documented partial settlement agreements reached with some Parties.

F. CONFIDENTIALITY

Except as required to be disclosed by applicable law as determined by the Party or Participant receiving the request for disclosure, which may include the federal Freedom of Information Act (5 USC § 522), the Oregon Public Records Law (ORS § 192.410 et. seq.), the Oregon Mediation Confidentiality Statute (ORS § 36.220 et. seq.), or other applicable law, regulation or executive order, each Party or Participant agrees that the content and work products of SWG and TWG negotiations shall not be disclosed to outside organizations, individuals or the media at any time during or after negotiations, unless otherwise unanimously agreed to by the Parties. With respect to written information provided within each Party's or Participant's organization for ultimate public dissemination (newsletters, reports before non-executive session public audiences, etc.), each Party and Participant will observe all of the restrictions set forth above and at Section C.4. with respect to providing information to the media.

G. RIGHT TO WITHDRAW

Any Party may temporarily or permanently withdraw from the SWG at any time after discussing the reasons for withdrawal with the other SWG members. Any entity that withdraws from the SWG shall remain bound by Sections C(3) (good faith), C(4) (media and communiciations), D (statements used during the process), and F (confidentiality) of this Protocol. Withdrawl from negotiations or settlement does not preclude a Party from participating, subject to Sections C(3) (good faith), C(4) (media and communiciations), D (statements used during the process), and F (confidentiality), in the FERC process as a member of the public. If a Party temporarily or permanently withdraws from the SWG and wishes to return to the SWG, that Party is subject to the same requirements as a new Party, as specified in section I. 4. of this document.

H. RELATIONSHIP TO THE FERC PROCESS

All Parties and Participants signatory to this Protocol retain the right to make filings as required by FERC during the pendency of the amendment application and to include in such filings such arguments, proposals, or evidence as each Party or Participant deems appropriate to maintain and preserve any legal rights it may have before FERC. No Party or Participant may purport to represent the views of the SWG or any other Party to FERC without the express approval of the SWG or such Party. The SWG may agree that certain filings or submittals may be made with FERC on behalf of the SWG or with the SWG's concurrence. If the SWG reaches a Settlement Agreement in which all Parties have unanimously agreed on all issues and FERC approves the agreement without material modification, any subsequent filings with FERC by any Party to the Settlement Agreement shall be be consistent with the Settlement Agreement.

I. EFFECTIVE DATE

1. The District shall, by February 6, 2009, email, mail (or personally deliver) to all potential Parties and Participants, a copy of this Protocol with a request that each Party execute the Protocol. Individual addressees may respond to the District's communication by signing:

   (a) as the Authorized Representative of a named Party, or,

   (b) as a Participant not seeking status as a Party.

2. This Protocol shall take operative effect on February 27, 2009 for signatories who, in accordance with this Protocol, choose to declare themselves Parties or Participants and who sign the form attached to the end of this Protocol (and, if a Party, designate an Authorized Representative Representative and Alternate Representative) and return it to the District by February 27, 2009

3. Any individual or organization that does not respond to the invitation to participate by February 27, 2009 shall not be counted as a Party for purpose of representation in the negotiations. A person or entity in this category by lack of response will be retained on the official mailing list of Participants for all other purposes.

4. Individuals and organizations not responding to this invitation by February 27, or which have withdrawn from the SWG, will be allowed to join in these negotiations if:

(a) The addition is approved by the unanimous consent of the Parties;

(b) The individual or organization executes this Protocol;

(c) A Settlement Agreement by some or all of the Parties has not yet been officially adopted; and,

(d) The individual or organization agrees to accept any and all preliminary agreements that may have been reached by the Parties prior to the time that the requirements of subsections (a) and (b) are met unless otherwise agreed to by the Parties.

5. The Parties may approve a revision of this Protocol by unanimous consent of the Parties who were previous signatories to this Protocol.

J. DURATION OF THE PROTOCOL

Except for the commitments in Sections C(4), D and F, which shall survive and be effective independently for an additional three (3) years, this Protocol will be operational until there is a final, non-appealable decision from FERC on the amendment application.

SIGNATURES OF PARTIES, PARTY REPRESENTATIVES, AND PARTICIPANTS:

By their signature, the undersigned agree to abide by the preceding Negotiations Protocol:

SIGNATURE:____________________________________

PRINTED NAME:________________________________

DECLARING AS: ( ) PARTY or ( ) PARTICIPANT

NAME OF ORGANIZATION, IF ANY: ____
ADDRESS:____
TELEPHONE NO:____
E-MAIL ADDRESS:____

IF PARTICIPATING AS A PARTY, please designate Authorized Representative:

NAME: ____
ADDRESS:____
TELEPHONE NO:____
E-MAIL ADDRESS:____

TRIBAL CONSULTATION LETTER

AUGUST 16, 2011

United States Department of the Interior

BUREAU OF INDIAN AFFAIRS
Northwest Regional Office
911 N.E. 11th Avenue
Portland, Oregon 97232-4169

IN REPLY REFER TO:

TAKE PRIDE IN AMERICA

AUG 16 2011

The Honorable Stanley Smith
Chairman
Confederated Tribes of the Warm Springs Reservation
Post Office Box C
Warm Springs, Oregon 97761-3001

RE: Intent to sign Opal Springs Hydroelectric Project Settlement Agreement, Request for Government to Government Consultation.

Dear Chairman Smith:

Over the past several years, the Bureau of Indian Affairs (BIA) has been working with other federal and state agencies, Trout Unlimited, and the Deschutes Valley Water District (DVWD) to negotiate fish passage measures at the Opal Springs Hydroelectric Project (Project). Although DVWD has over 20 years remaining on their existing operating license, they have voluntarily agreed to implement fish passage measures in support of salmon and steelhead reintroduction in the upper Deschutes River basin, pursuant to the terms of a proposed settlement agreement. The BIA as well as the U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), and National Marine Fisheries Service (NMFS) intend to sign the proposed settlement agreement by August 26, 2011, barring any objections from the Confederated Tribes of the Warm Springs Reservation (Tribes).

The negotiating group has been meeting under the auspices of a communications protocol that precluded detailed discussion of the settlement agreement with outside parties. Although the Tribes were invited on several occasions to sign the communications protocol and fully participate in the negotiations, they refrained – instead relying upon the federal trustees and the Oregon Department of Fish and Wildlife (ODFW) (as co-manager) to represent their interests. To ensure that input from the Tribes was timely received during the process, the protocols were modified to facilitate tribal coordination and consultation. Periodic updates, review materials (including draft copies of the settlement agreement), and briefings were provided to tribal staff under this coordination process - the most recent briefing occurred on August 9, 2011. Copies of the final settlement agreement proposed for signature have been provided to tribal staff and legal counsel, although we have not received any formal comments or indication of the Tribes' position on the documents.

At the August 9, 2011 meeting, the federal trustees briefed staff from the Tribes' Natural Resources Department, identifying the full suite of measures contained in the settlement agreement as well as its limitations. For example, although a volitional upstream fish passage facility (including monitoring, evaluation and adaptive management) and downstream fish passage measures are included in the agreement, installation may be delayed for up to three years as DVWD seeks to secure funding for approximately 50 percent of the estimated $7 million anticipated cost. During this delay, DVWD will work to complete facility design and to obtain all necessary permits. If funds are not acquired within three years, the settlement agreement terminates and the agencies are left to seek other avenues for gaining fish passage at the Project.

As stated previously, DVWD has a considerable period of time remaining in their existing license, complicating any regulatory actions the federal government may take to compel fish ladder construction under the Federal Power Act or Endangered Species Act. Such regulatory actions would also be subject to several lengthy appeal processes. Although such actions may eventually be considered, we feel participation in the settlement agreement and a voluntary approach to achieving fish passage at the Project is likely to result in more timely action by DVWD. As such, we believe our approval of the settlement agreement and participation in the implementation process it establishes is the most appropriate strategy for administering our trust obligations to the Tribes.

As explained to your staff, the settlement agreement has been designed to accommodate the Tribes' interest whether or not they sign the agreement. As a signatory, the Tribes would attain voting privileges and would have access to the dispute resolution provisions of the settlement agreement to resolve any concerns that may arise during implementation. Without signature, however, the Tribes may still participate in the committee designed to oversee implementation of the agreement. In such a case, your input would be acquired through the committee process and your interests would be considered by the federal trustees and by ODFW in any resulting votes. No Tribal rights or authorities would be compromised in either situation. If you choose not to participate in the committee, we will continue to engage the Tribes throughout implementation of the settlement agreement and to seek your input on all major decisions.

As discussed previously with tribal staff and counsel, the federal agencies would be happy to meet with you on a government to government basis to further discuss this matter. To insure timely implementation of the settlement agreement, the federal agencies are seeking to sign the agreement by August 26, 2011. If for any reason the Tribes would prefer that we not sign the agreement, or if you have any final recommendations for editing proposed language in the settlement agreement, please let us know by that date. Otherwise, we can meet in person to discuss your participation at a time more convenient to the Tribes. There is no time restriction on when the Tribes may sign the agreement and there are no additional requirements upon the Tribes if they seek to become a party to the agreement at any time in the future.

Please let us know by August 26, 2011 if you have any objections to the federal agencies signing the settlement agreement. We intend to sign the settlement agreement on that date if no additional communications are received from the Tribes.

To coordinate a government to government consultation on behalf of BIA, USFWS, BLM, and NMFS, please work with Bob Dach of my staff. He can be reached at (503) 231-6711 or at Robert.dach@bia.gov.

Thank you for your attention to this matter. We look forward to hearing from you.

Sincerely,

Scott L. Aikin

ACTING Northwest Regional Director

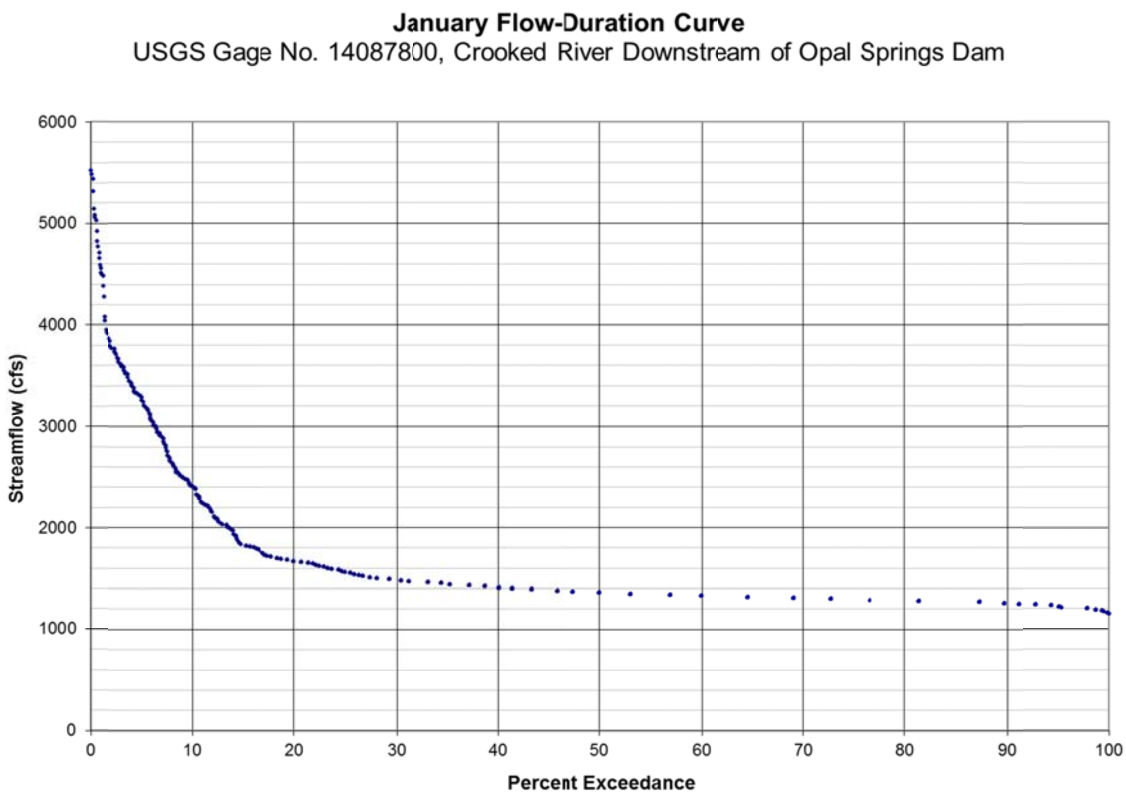
cc: U.S. Fish and Wildlife Service (electronic copy)
Bureau of Land Management (electronic copy)
National Marine Fisheries Service (electronic copy)
U.S. Department of the Interior, Office of the Solicitor (electronic copy)

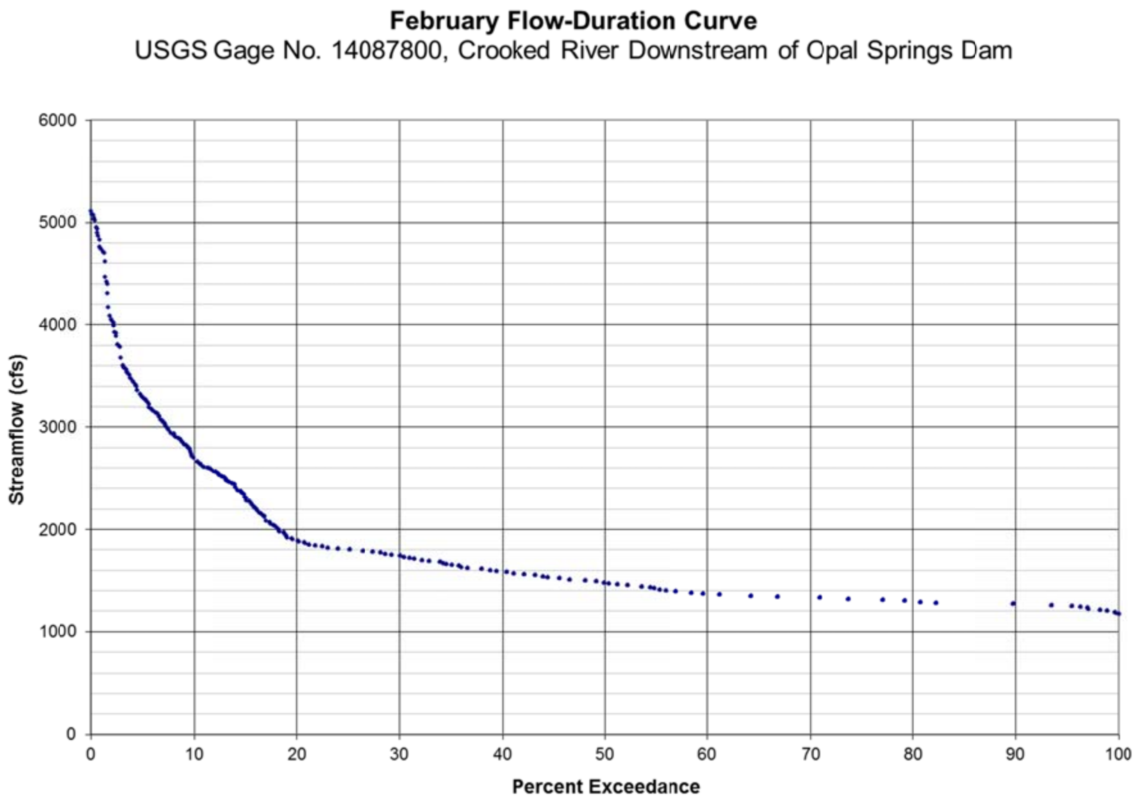
FLOW DURATION CURVES

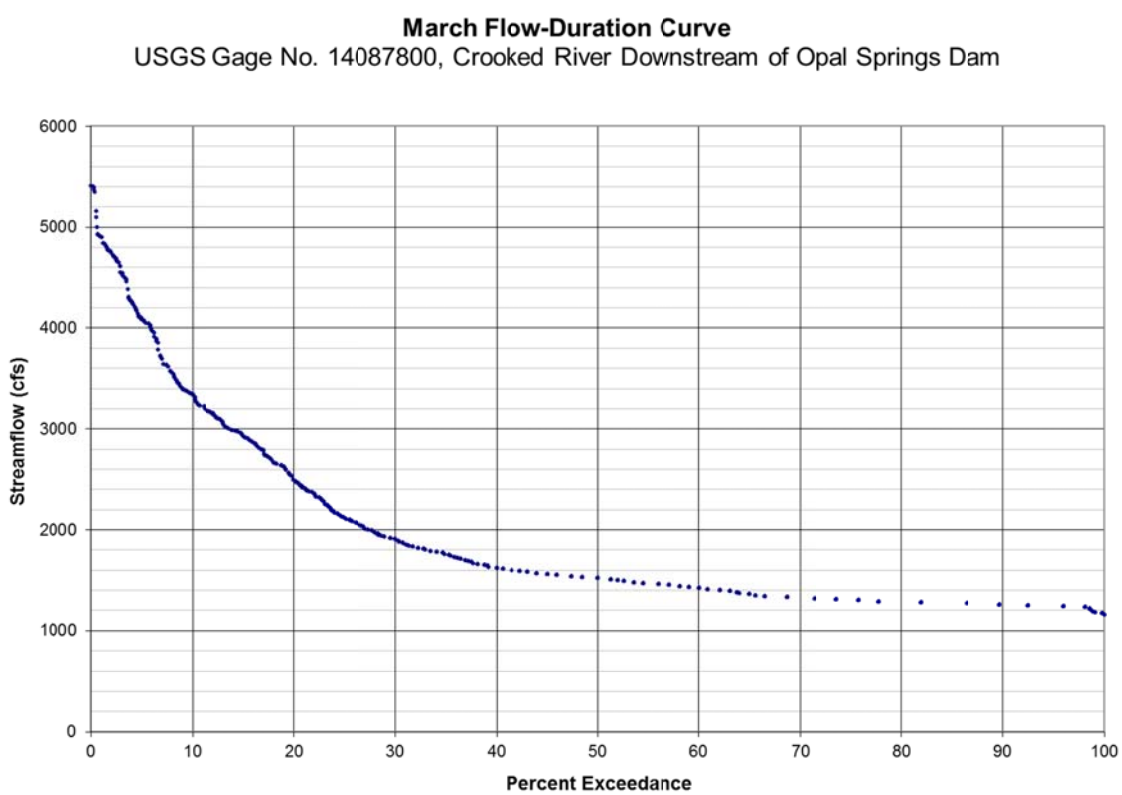
Attachment XX – Flow Duration Curves (CH2, 2010)

Data for the following site(s) are contained in this file
USGS 14087400 CROOKED RIVER BELOW OPAL SPRINGS, NEAR CULVER, OR

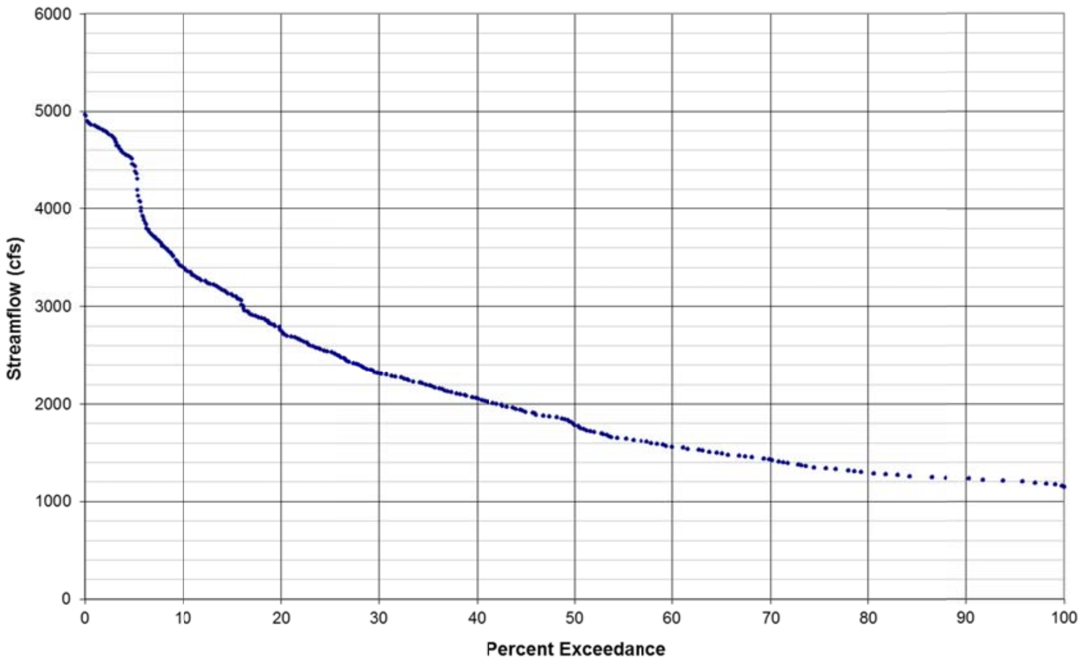
#
Data provided for site 14087400
DD parameter statistic Description
02 00060 00003 Discharge, cubic feet per second (Mean)
STATION.--14087400 CROOKED RIVER BELOW OPAL SPRINGS, NEAR CULVER, OR
LOCATION.--Lat 44° 29'33", long 121° 17'50", in NW 1/4 NE 1/4 sec.33, T.12 S., R.12 E.,
Jefferson County, Hydrologic Unit 17070305, on right bank 0.2 mi downstream from Opal
Springs, 4.8 mi southwest of Culver, and at mile 6.7.
DRAINAGE AREA.--4,300 mi^2, approximately, of which 500 mi^2 is probably noncontributing.
PERIOD OF RECORD.--October 1961 to 2010
GAGE.--Water-stage recorder. Datum of gage is 1,953.60 ft above NGVD of 1929 (Portland
General Electric Co. bench mark).
REMARKS.--Flow regulated since December 1960 by Prineville Reservoir, active capacity of
152,800 acre-ft and Ochoco Reservoir, active capacity, 46,500 acre-ft. Dam and powerplant
0.3 mi upstream, completed in 1985, causes brief fluctuations in flow. Many diversions
for irrigation upstream from station. Practically all of the summer flow comes from Opal
Springs and other springs within 15 mi upstream from station. Simultaneous records (1961-63)
at former gaging station 5.6 mi downstream indicated over 15 percent increase to summer flow
from springs downstream from this station. Continuous water-quality records for the period
October 1963 to September 1974 have been collected at this location.
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,660 ft^3/s Dec. 24, 1964, gage height,
9.36 ft; minimum daily discharge, 1,090 fts^3/s May 11, 1981, minimum instantaneous discharge
after October 1989, 656 ft^3/s many days in the 1990 water year, prior to that date minimum
instantaneous discharge was not determined.



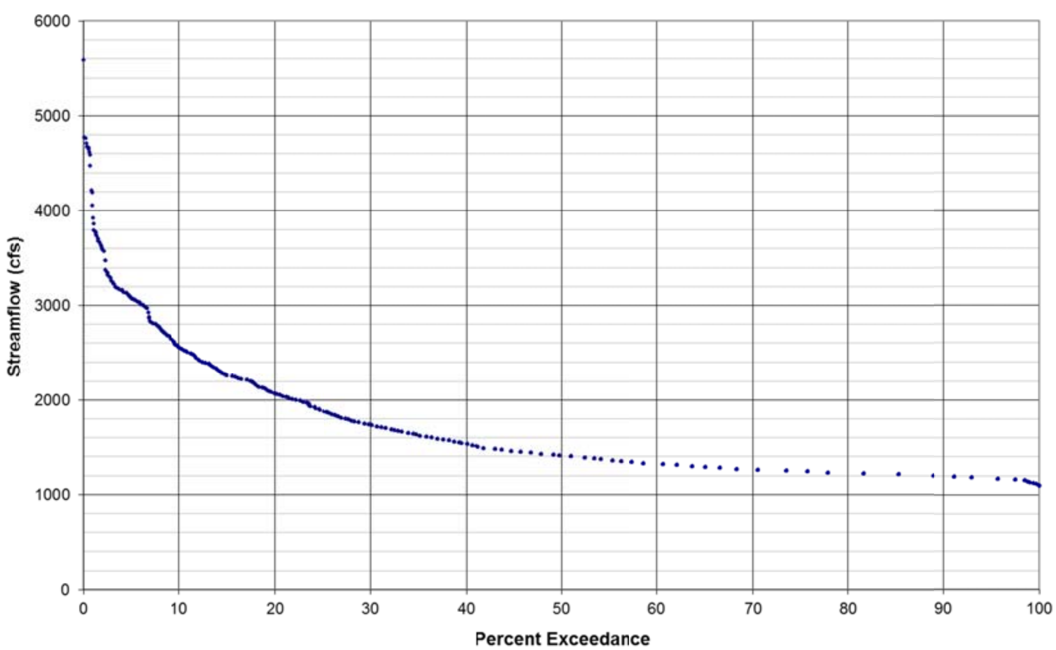

February Flow-Duration Curve
USGS Gage No. 14087800, Crooked River Downstream of Opal Springs Dam
Streamflow (cfs)
0
1000
2000
3000
4000
5000
6000
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedance


March Flow-Duration Curve
USGS Gage No. 14087800, Crooked River Downstream of Opal Springs Dam
Streamflow (cfs)
0
1000
2000
3000
4000
5000
6000
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedance

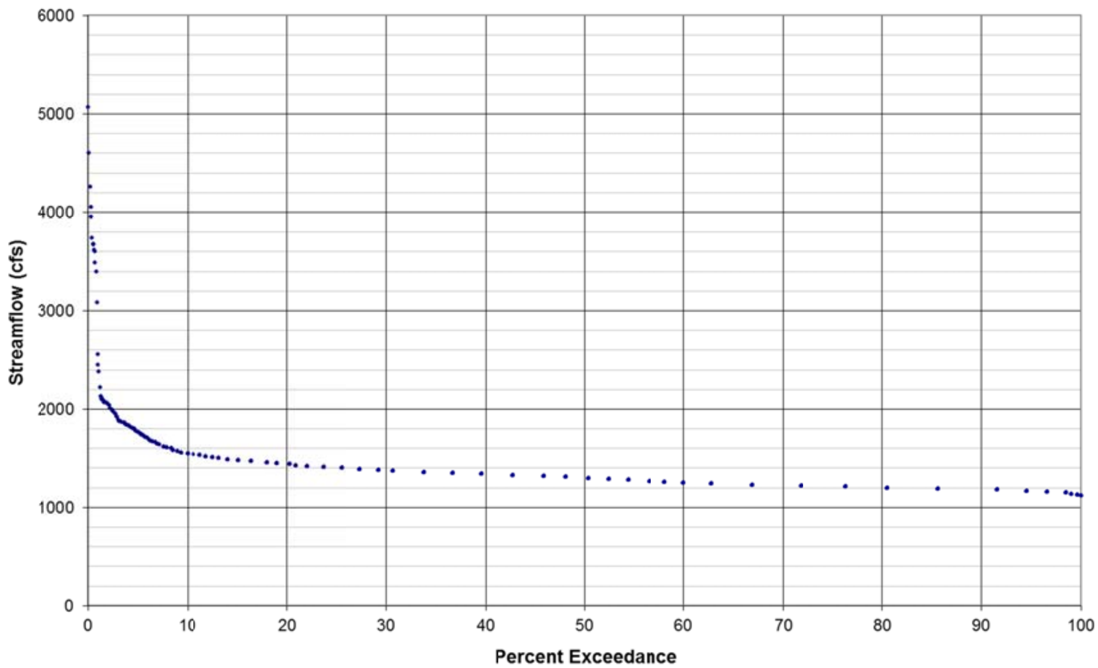
April Flow-Duration Curve
USGS Gage No. 14087800, Crooked River Downstream of Opal Springs Dam



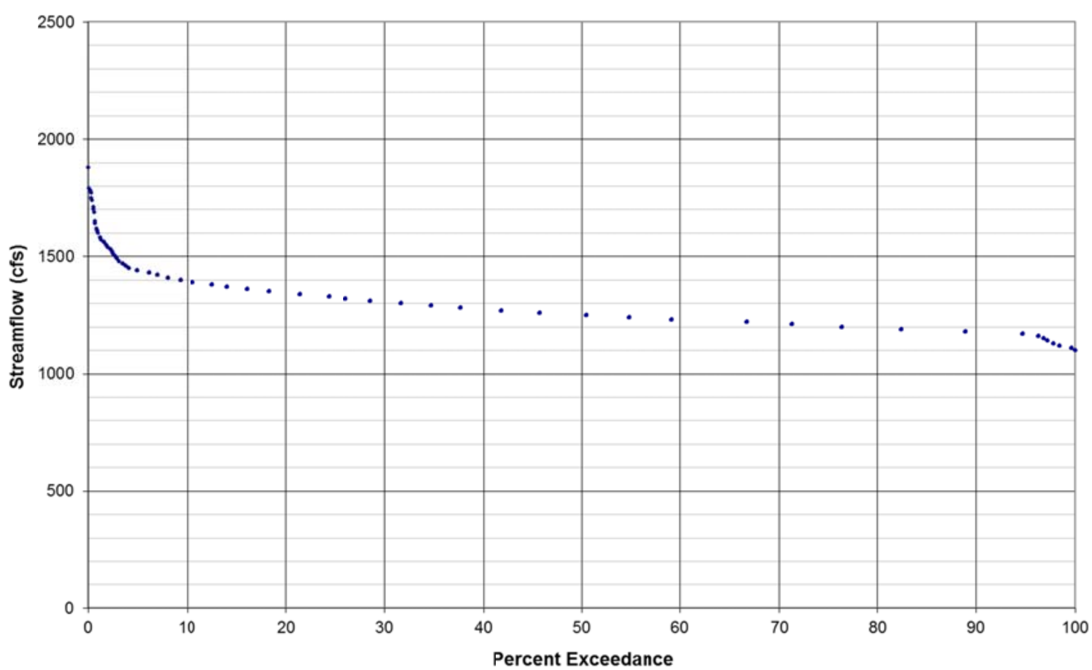
May Flow-Duration Curve
USGS Gage No. 14087800, Crooked River Downstream of Opal Springs Dam

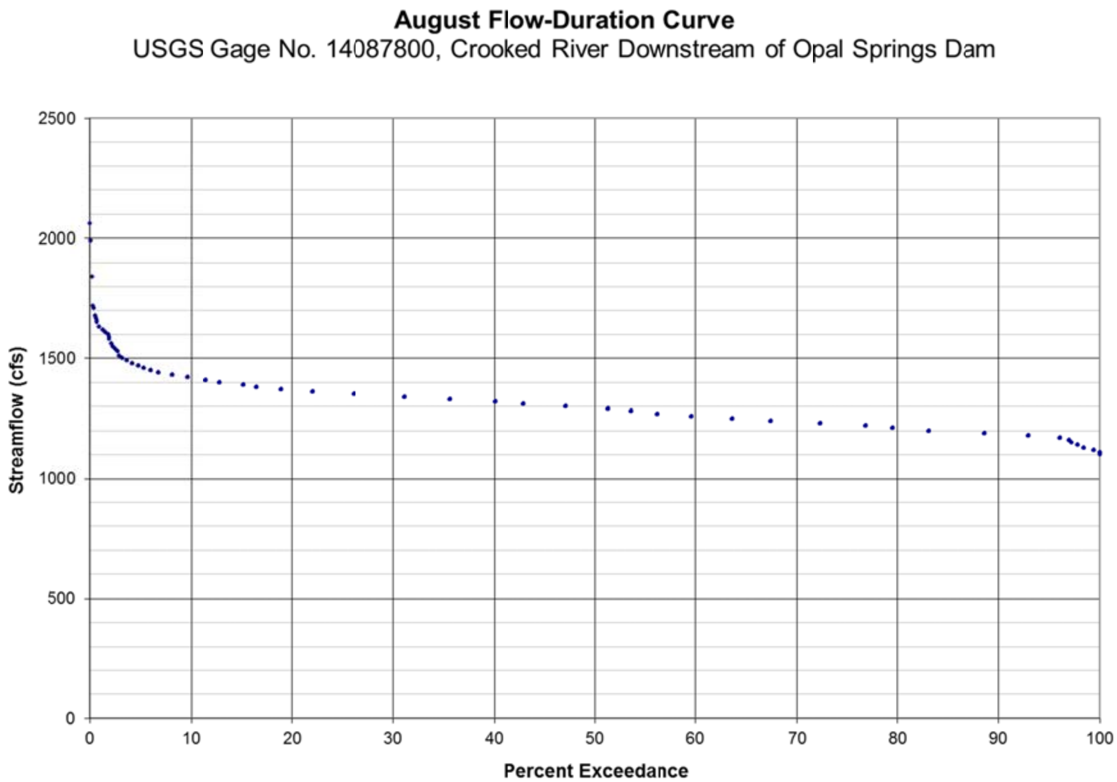


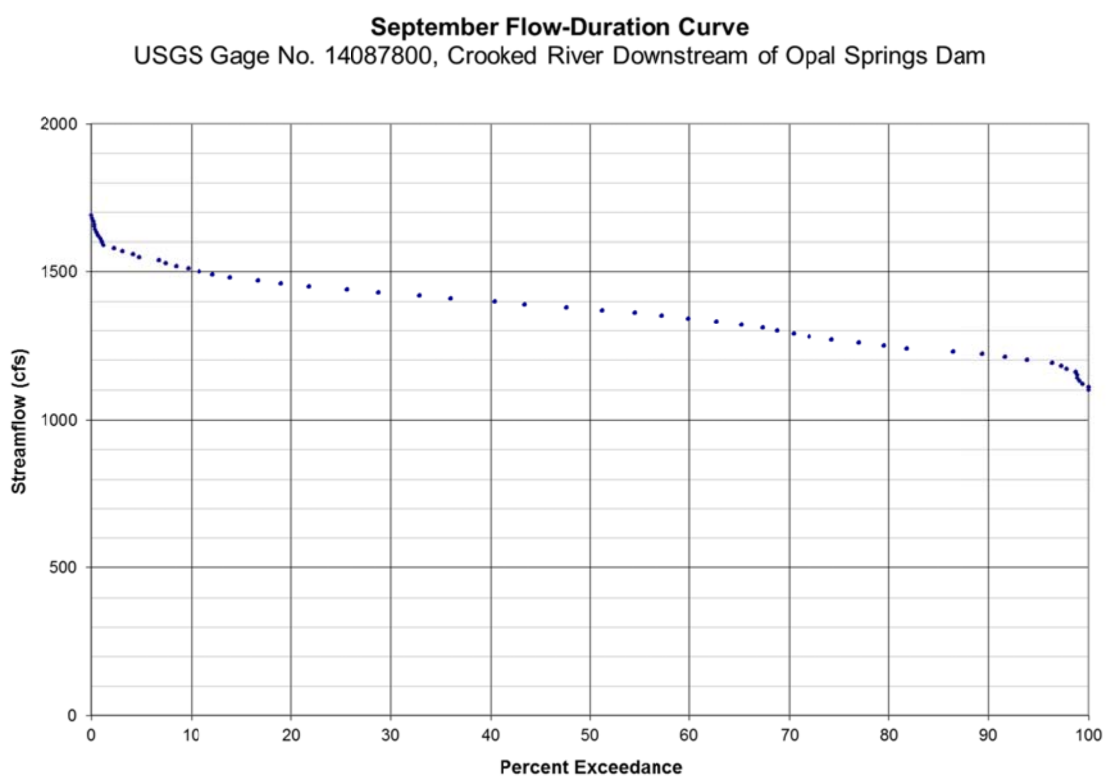
June Flow-Duration Curve
USGS Gage No. 14087800, Crooked River Downstream of Opal Springs Dam

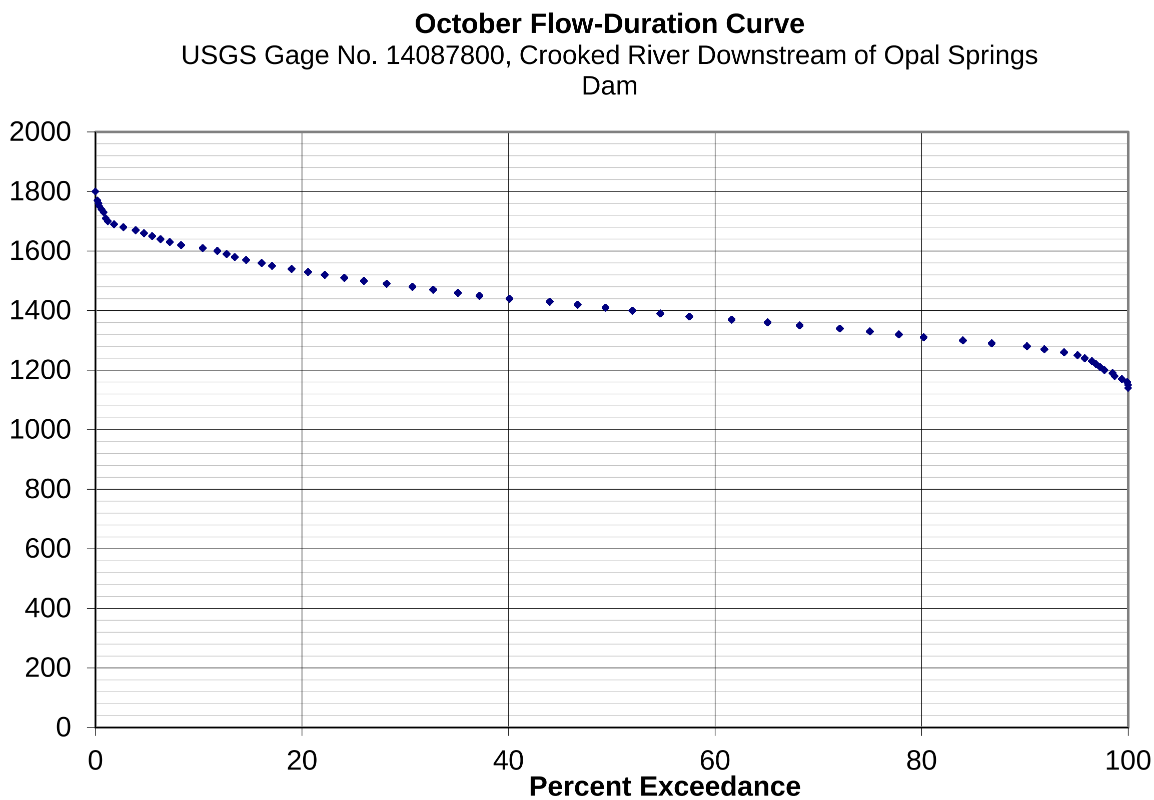


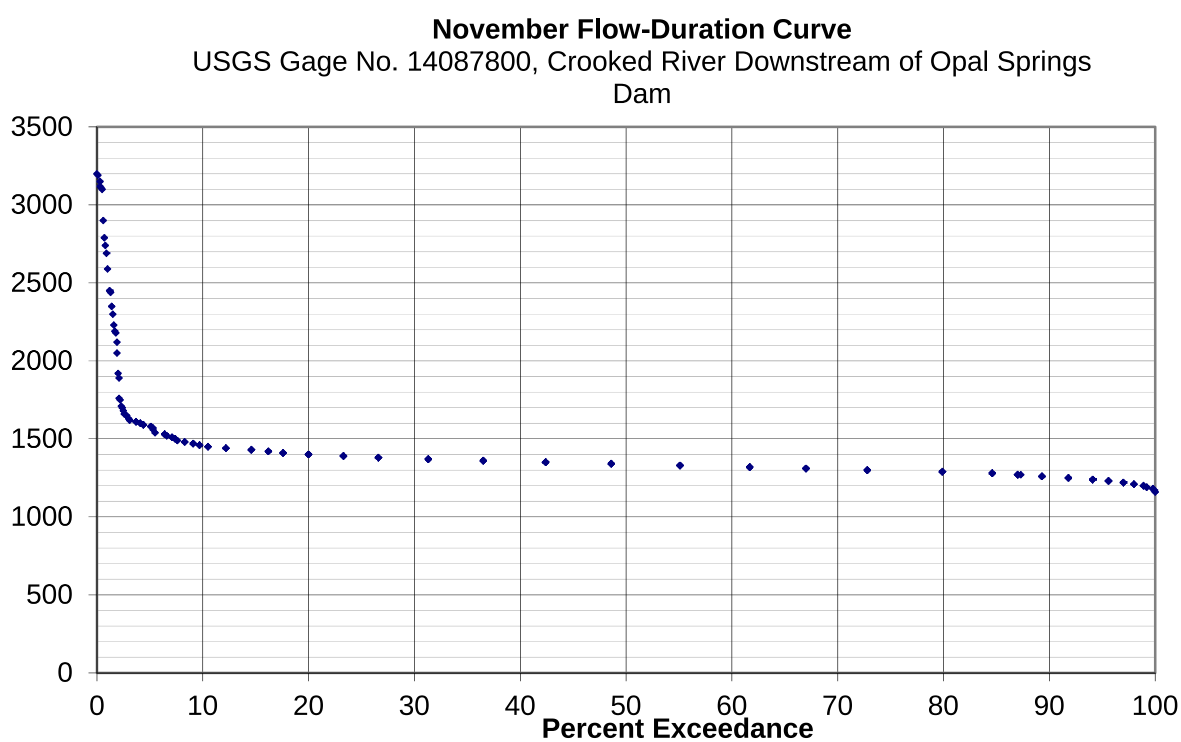
July Flow-Duration Curve
USGS Gage No. 14087800, Crooked River Downstream of Opal Springs Dam

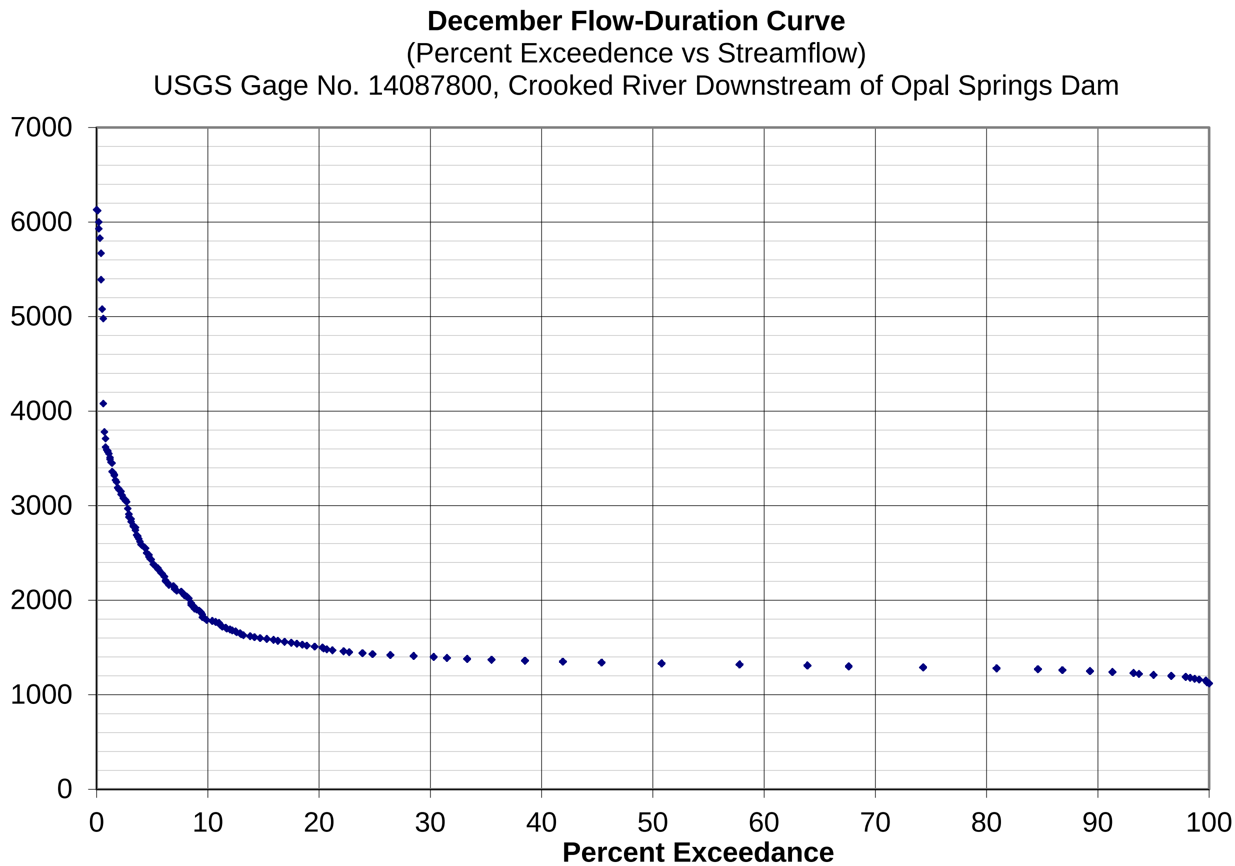



August Flow-Duration Curve
USGS Gage No. 14087800, Crooked River Downstream of Opal Springs Dam
Streamflow (cfs)
2500
2000
1500
1000
500
0
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedance


September Flow-Duration Curve
USGS Gage No. 14087800, Crooked River Downstream of Opal Springs Dam
Streamflow (cfs)
2000
1500
1000
500
0
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedance


October Flow-Duration Curve
USGS Gage No. 14087800, Crooked River Downstream of Opal Springs Dam
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
20
40
60
80
100
Percent Exceedance


November Flow-Duration Curve
USGS Gage No. 14087800, Crooked River Downstream of Opal Springs Dam
3500
3000
2500
2000
1500
1000
500
0
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedance


December Flow-Duration Curve
(Percent Exceedence vs Streamflow)
USGS Gage No. 14087800, Crooked River Downstream of Opal Springs Dam
7000
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
80
90
100
Percent Exceedance

BUREAU OF LAND MANAGEMENT LISTS

JANUARY 2008

PV = Prineville District   S= suspected   D= documented

STATE DIRECTOR'S SPECIAL STATUS SPECIES LIST - Federally Threatened, Endangered, and Proposed (TE&P)
USDI BUREAU OF LAND MANAGEMENT - OREGON and WASHINGTON
Date: January 2008

Taxon	Scientific Name	Common Name	ESU_DPS	Federal Status	Date Listed	Critical Habitat	Recovery Plan	PV
MA	LYNX CANADENSIS	CANADA LYNX		FT	2000	Designated 2006	None	S

STATE DIRECTOR'S SPECIAL STATUS SPECIES LIST - Sensitive Invertebrates
USDI BUREAU OF LAND MANAGEMENT - OREGON and WASHINGTON
Date: January 2008

Taxon	Scientific Name	Common Name	ISSSSP Status	PV
IG	JUGA HEMPHILLI DALLESENSIS	DALLES JUGA	OR-SEN	D
IG	JUGA HEMPHILLI HEMPHILLI	BARREN JUGA	SEN	S
IG	JUGA HEMPHILLI MAUPINENSIS	PURPLE-LIPPED JUGA	OR-SEN	D
IG	MONADENIA FIDELIS SSP. NOV.	DESCHUTES SIDEBAND	OR-SEN	D
IG	OREOHELIX VARIABILIS SP. NOV.	DESCHUTES MOUNTAINSNAIL	OR-SEN	D
IILE	BOLORIA BELLONA	MEADOW FRITILLARY	SEN	S
IILE	BOLORIA SELENE	SILVER-BORDERED FRITILLARY	OR-SEN	S

STATE DIRECTOR'S SPECIAL STATUS SPECIES LIST - Sensitive Vertebrates
USDI BUREAU OF LAND MANAGEMENT - OREGON and WASHINGTON
Date: January 2008

Taxon	Scientific Name	Common Name	ESU_DPS	ISSSSP Status	PV
BI	AGELAIUS TRICOLOR	TRICOLORED BLACKBIRD		OR-SEN	D
BI	AMMODRAMUS SAVANNARUM	GRASSHOPPER SPARROW		OR-SEN	S
BI	BARTRAMIA LONGICAUDA	UPLAND SANDPIPER		SEN	S
BI	BUCEPHALA ALBEOLA	BUFFLEHEAD		OR-SEN	D
BI	CENTROCERCUS UROPHASIANUS	GREATER SAGE-GROUSE		SEN	D
BI	COCCYZUS AMERICANUS	YELLOW-BILLED CUCKOO	WESTERN U.S. DPS	SEN	S
BI	COTURNICOPS NOVEBORACENSIS	YELLOW RAIL		OR-SEN	D
BI	CYGNUS BUCCINATOR	TRUMPETER SWAN		OR-SEN	D
BI	CYPSELOIDES NIGER	BLACK SWIFT		OR-SEN	S
BI	DOLICHONYX ORYZIVORUS	BOBOLINK		SEN	S
BI	FALCO PEREGRINUS ANATUM	AMERICAN PEREGRINE FALCON		SEN	D
BI	HALIAEETUS LEUCOCEPHALUS	BALD EAGLE		SEN	D
BI	MELANERPES LEWIS	LEWIS' WOODPECKER		OR-SEN	D
BI	PELECANUS ERYTHRORHYNCHOS	AMERICAN WHITE PELICAN		SEN	S
BI	PICOIDES ALBOLARVATUS	WHITE-HEADED WOODPECKER		SEN	D
BI	SEIURUS NOVEBORACENSIS	NORTHERN WATERTHRUSH		OR-SEN	S
HA	DICAMPTODON COPEI	COPE'S GIANT SALAMANDER		SEN	D

HA	RANA LUTEIVENTRIS	COLUMBIA SPOTTED FROG	GREAT BASIN DPS	OR-SEN	D
HA	RANA PRETIOSA	OREGON SPOTTED FROG		SEN	D
MA	ANTROZOUS PALLIDUS	PALLID BAT		SEN	D
MA	BRACHYLAGUS IDAHOENSIS	PYGMY RABBIT	COLUMBIA BASIN DPS	SEN	D
MA	CORYNORHINUS TOWNSENDII	TOWNSEND'S BIG-EARED BAT		SEN	D
MA	EUDERMA MACULATUM	SPOTTED BAT		SEN	D
MA	GULO GULO LUTEUS	CALIFORNIA WOLVERINE		SEN	S
MA	MARTES PENNANTI	FISHER	WEST COAST DPS	SEN	S
MA	MYOTIS THYSANODES	FRINGED MYOTIS		OR-SEN	D
MA	SPERMOPHILUS WASHINGTONI	WASHINGTON GROUND SQUIRREL		SEN	D

STATE DIRECTOR'S SPECIAL STATUS SPECIES LIST - Strategic Invertebrates
USDI BUREAU OF LAND MANAGEMENT - OREGON and WASHINGTON
Date: January 2008

Taxon	Scientific Name	Common Name	ISSSSP Status	PV
IBI	ANODONTA CALIFORNIENSIS	CALIFORNIA FLOATER	STR	D
IG	JUGA BULBOSA (1)	BULB JUGA	OR-STR	S
IG	JUGA SP. NOV.	OPAL SPRINGS (CROOKED RIVER) JUG/	OR-STR	D
IG	JUGA SP. NOV.	THREE-BAND JUGA	STR	D
IG	OREOHELIX VARIABILIS	DALLES MOUNTAINSNAIL	OR-STR	D
IG	PHYSELLA COLUMBIANA	ROTUND PHYSA	STR	S
IG	VESPERICOLA SP. NOV.	OAK SPRINGS HESPERIAN	OR-STR	D
IG	VORTICIFEX NERITOIDES	NERITE RAMSHORN	STR	S
IICO	CICINDELA COLUMBICA	COLUMBIA RIVER TIGER BEETLE	STR	D

STATE DIRECTOR'S SPECIAL STATUS SPECIES LIST - Strategic Vertebrates
USDI BUREAU OF LAND MANAGEMENT - OREGON and WASHINGTON
Date: January 2008

Taxon	Scientific Name	Common Name	ESU_DPS	ISSSSP Status	PV
BI	FALCO COLUMBARIUS	MERLIN		OR-STR	S
BI	PINICOLA ENUCLEATOR	PINE GROSBEAK		OR-STR	S
BI	SELASPHORUS PLATYCERCUS	BROAD-TAILED HUMMINGBIRD		OR-STR	S

GRIFFIN REPORT

OCTOBER 2009

AUTHOR INITIALS th DATE 10/26/09
SUPERVISOR INITIALS MB DATE 10/27/09

8100 (ORP060)

OCT 27 2009

CERTIFIED MAIL NO – 7008 3230 0001 0522 9031
Return Receipt Requested

rec'd SHPO 10/30/2009

Dr. Dennis Griffin
State Historic Preservation Office
725 Summer St., NE, Suite C
Salem, Oregon 97301

Dear Dr. Griffin:

Please find enclosed information for the Opal Springs Hydroelectric Fish Passage Improvement project. The proposed project would increase the height of the existing dam and construct a fish ladder. The construction area for the proposed project would occur within the footprint of the existing hydroelectric structure. Given the nature of the undertaking, potential impacts to cultural resources are expected to be minimal.

The structure is located in a steep canyon. The area of potential effect was based on the proposed dam height and the estimated rise in the water level. An estimated 3 acres were surveyed where terrain was feasible. No previous survey had occurred within this segment of the Crooked River. No new sites or isolates were discovered and the proposed project would not affect cultural resources. The enclosed packet includes the following:

- 1OHIMS BLM Project Technical Report with maps and photographs

These documents are being sent to you for information in accordance with the National Cultural Programmatic Agreement and the Protocol for Managing Cultural Resources on Lands Administered by the BLM in Oregon.

If you have any questions please feel free to contact Terry Holtzapple by phone at 541-416-6792 or email (theresa_holtzapple@blm.gov). Thank you for your attention to this report.

Sincerely,

Molly M. Brown

Molly M. Brown
Field Manager, Deschutes Resource Area

Enclosures
060:THoltzapple:6792:dja:10/23/09:S:\Front Desk Correspondence\2010 Corr\8100_opal_springs_rx_shpo.docx

Oregon

Theodore R. Kulongoski, Governor

Parks and Recreation Department
State Historic Preservation Office
725 Summer St NE, Ste C
Salem, OR 97301-1266
(503) 986-0671
Fax (503) 986-0793
www.oregonheritage.org

Nature HISTORY Discovery

November 13, 2009

Received
NOV 18 2009
Bureau of Land Mgmt
Prineville District

Ms. Molly Brown
BLM Prineville Dist Office
3050 NE 3rd
Prineville, OR 97754

RE: SHPO Case No. 09-2332
Opal Springs Hydro Fish Passage Improve Proj
12S 12E 33 and 12S 12E 4, , Jefferson

Dear Ms. Brown:

We have reviewed the materials submitted on the project referenced above, and we concur with a determination of No Historic Properties Affected for this undertaking.

Our response here is to assist you with your responsibilities under Section 106 of the National Historic Preservation Act (per 36 CFR Part 800). Please feel free to contact me if you have further questions, comments or need additional assistance.

Sincerely,

Stephen P. Poyser, Ph.D.
Review and Compliance Specialist
(503) 986-0686 or Stephen.Poyser@state.or.

As of August 2009, a redesigned form is available for Section 106 and ORS 358.653 projects. Find it on our updated and expanded Review and Compliance website: www.oregonheritage.org. Click on the "Review and Compliance" link.

Report Date: 08/24/2009
Report No.: 05050600486P
Authors: Ryan M. Griffin

OREGON CULTURAL RESOURCES SURVEY REPORT

Project Information

Project Name: Opal Springs Hydroelectric Fish Passage Improvements

Project Acres: 3

Project Description:

The project proposes to add fish passage to the Opal Springs Hydroelectric Project by increasing the height of the existing Opal Springs Dam and constructing a fish ladder within the Crooked River (Maps 1-3). An inflatable weir would be attached to the Opal Springs Dam, located at the NAD 83 utm coordinates 635309E, 4927249N (Photo 1-2). The weir would impound an additional four feet of water that would extend south upriver and terminate at the NAD83 utm coordinates 635250E, 4926099N. Furthermore, impounded river water would rise 4ft above riverside talus slopes and sheer rock faces located between these two points. An upstream fish ladder, consisting of approximately 39 ladder cells, would be constructed on the west bank of the Crooked River. Staging for construction of the proposed civil works would not require disturbance of new ground, but would be managed within the boundaries of the existing hydroelectric structural footprint. Other than the rise in water level, no additional ground disturbing activities would occur as a result of the proposed project. Given the nature of the undertaking, impacts to cultural resources are expected to be minimal to none.

Agency: BLM Prineville Deschutes Resource Area

Land Status: Bureau of Land Management

County	**USGS 7.5' Quad(s):**
Jefferson	STEELHEAD FALLS

Legals

T 12.0 S , R 12.0 E Willamette Meridian

Sections 33

T 13.0 S , R 12.0 E Willamette Meridian

Sections 4

Survey Area Environment

Project Setting :

The project area is located 28.7 air-miles north of Bend, Oregon upon the Crooked River and its talus slopes and sheer rock faces (Maps 1-2). Two units were surveyed at the only accessible portions of the project area (Map 3). Unit 1 is located at the project area's northern terminus, and Unit 2 is located at the project area's southern terminus. Locally, the project is located on the Crooked River Basin within the Blue Mountains physiographic province of Central Oregon.

Vegetation on talus slopes, just above this portion of the Crooked River, include willow, alder, mock orange, spireas, red osier dogwood, pentemon, and other riparian species.

Soils are non-existent within the project area, unless they are buried beneath bouldery talus slopes. These soils may include the Lickskillet-Rock outcrop complex and the Simas-Ruckles-Rock outcrop complex.

Lickskillet soil is a very stony sandy loam that reaches bedrock at 12-20in below the ground surface. It is found on slopes with a 45-80% gradient, and its parent material is colluvium derived from volcanic rock. Rock outcrops associated with this soil complex contain no soil at all and have slopes ranging from 45-80%.

Simas soil is a cobbly loam located on slopes with a 40-60% gradient. Its parent material is colluvium derived from tuff. Ruckles soil is an extremely cobbly loam that reaches bedrock at 11-21in below the ground surface. It is located on slopes with a 40-80% gradient and its parent material is colluvium over welded tuff. Rock outcrops associated with this soil complex contain no soil at all and have slopes ranging from 50-80%.

Contemporary Land Use:

The project area is currently used for dispersed recreation and water impoundment.

Survey Methods and Findings

Visibility: Good 30% visibility or better

Existing Data Review:

Review of the District/Forest Master Survey Maps, Historic Inventory Maps, Cultural Resource Overview, Township and Range files, Master Title Plats, Cadastral Survey Notes and the District/Forest Geology and Soil Inventory Maps indicate that there were no surveys previously conducted within the project area.

Survey Methods:

The Area of Potential Effects (APE) was determined to be a .7mi stretch of the Crooked River beginning at the Opal Springs Dam and ending upstream at the NAD83 utm coordinates 635250E, 4926099N (Map 2); the river will rise an additional 4ft within this area and inundate steep talus slopes and sheer rock faces along the riverside (Photos 1-3). Talus slopes range from approximately 35-45 degrees in steepness and are concentrated at the southern half of the APE. Sheer rock faces dominate the northern half of the project area.

Intensive survey above and within the accessible portions of the APE (units 1 and 2) just east of the Crooked River was conducted by three to four BLM archaeologists on meandering 5m interval transects (Map 3). Within Unit 1, three BLM archaeologists surveyed 4 meandering transects at a 5-meter interval just east of the Crooked River along talus slopes (Photo 4). Within Unit 2, four BLM archaeologists surveyed 4 meandering transects at a 5-meter interval just east of the Crooked River along talus slopes and narrow benches (Photo 5-6).

Please note: an approximate estimate of APE project acres is unknown, because the minute surface area of potentially inundated talus slopes could not be accurately measured at the time of survey or through the use of GIS applications and USGS topography maps at the district office.

Surveyor(s): Ryan Griffin, Megan O'Neill, Tom Thompson, and Kelly van Bronkhorst

Field Dates: 08/10/2009

Previous Acres Surveyed: 0 **New Acres Surveyed** 3 **Percent of Project Area Surveyed:** 100 %

Survey Results:

No sites or isolates were observed during survey.

Eligibility /Protection Recommendations:

None.

References Cited:

BLM Geology Database
2009
BLM Prineville District
Prineville, Oregon

National Register Bulletin 15
1997

National Resource Conservation Service (NRCS)
2009
Soils Database on file
BLM Prineville District
Prineville, Oregon

U.S. Department of Interior, BLM

Historic Index, T.12S R.12E and T.13S R.12E
Copy on file at BLM office, Prineville, OR

Field Hours: 35 **Office Hours:** 45 **Total:** 80

Location of Field Notes BLM Prineville Deschutes Resource Area

Name of Surveyor in Charge: Ryan Griffin

Terry Hallgappel, DRA Archaeogist — 30 Sept. 2009
Agency Specialist Signature — **Date**

Molly M. Brown — 9/30/09
Unit Manager Signature — **Date**

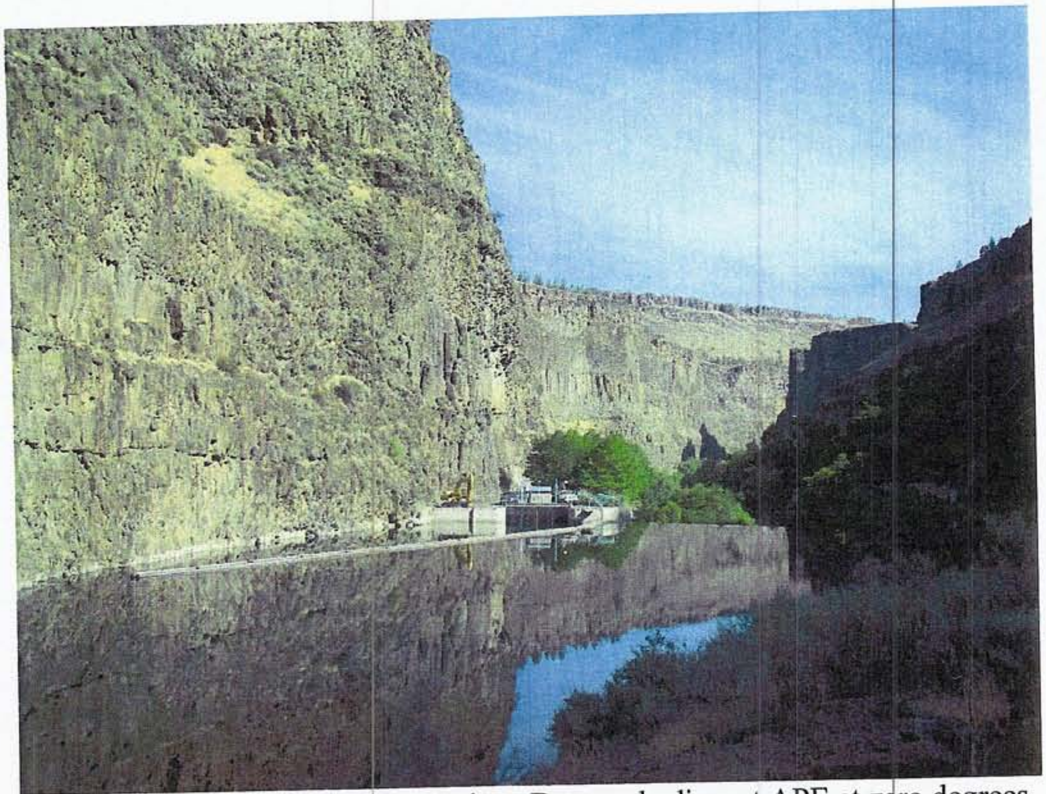


Photo 1: Overview of the Opal Springs Dam and adjacent APE at zero degrees.

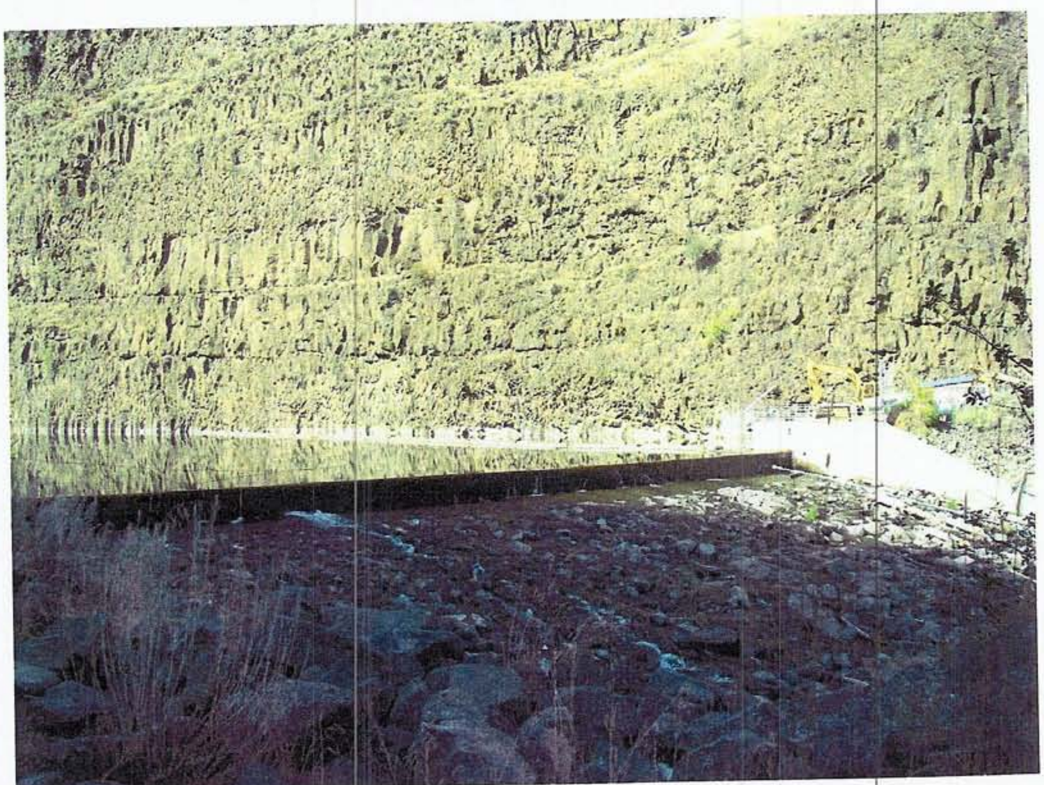


Photo 2: Overview of the Opal Springs Dam at 240 degrees.

Photo 3: Overview of the APE south of Opal Springs Dam at 208 degrees.

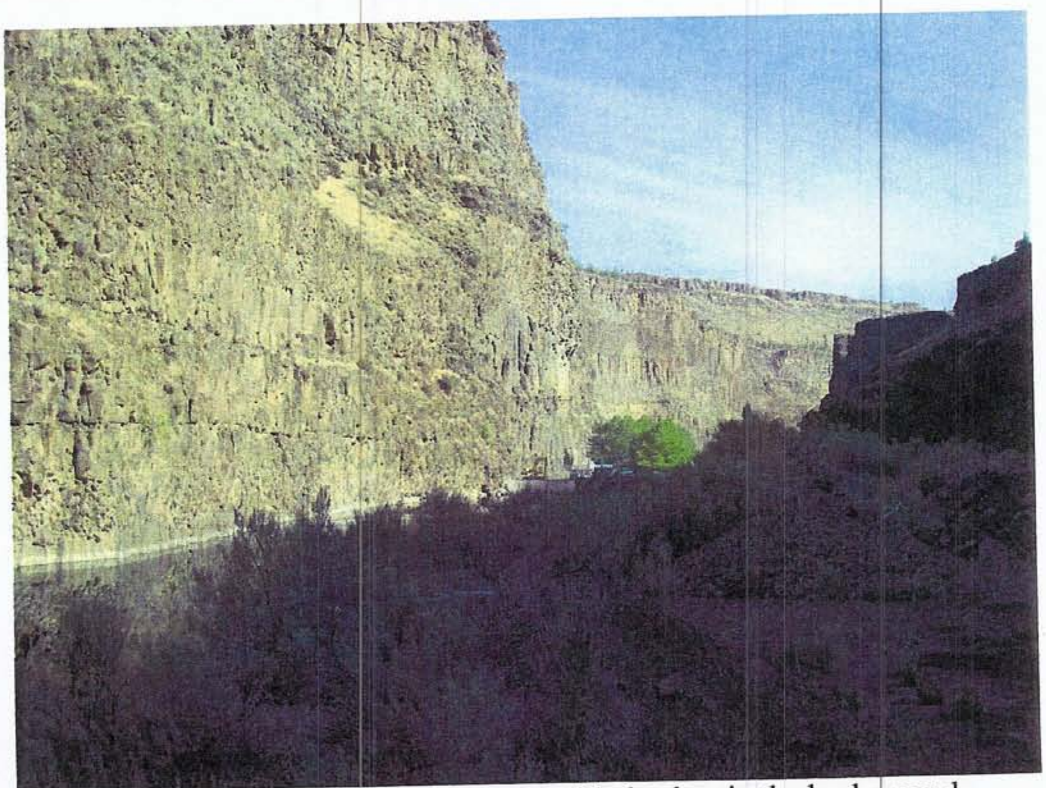


Photo 4: Unit 1 overview at zero degrees with the dam in the background.

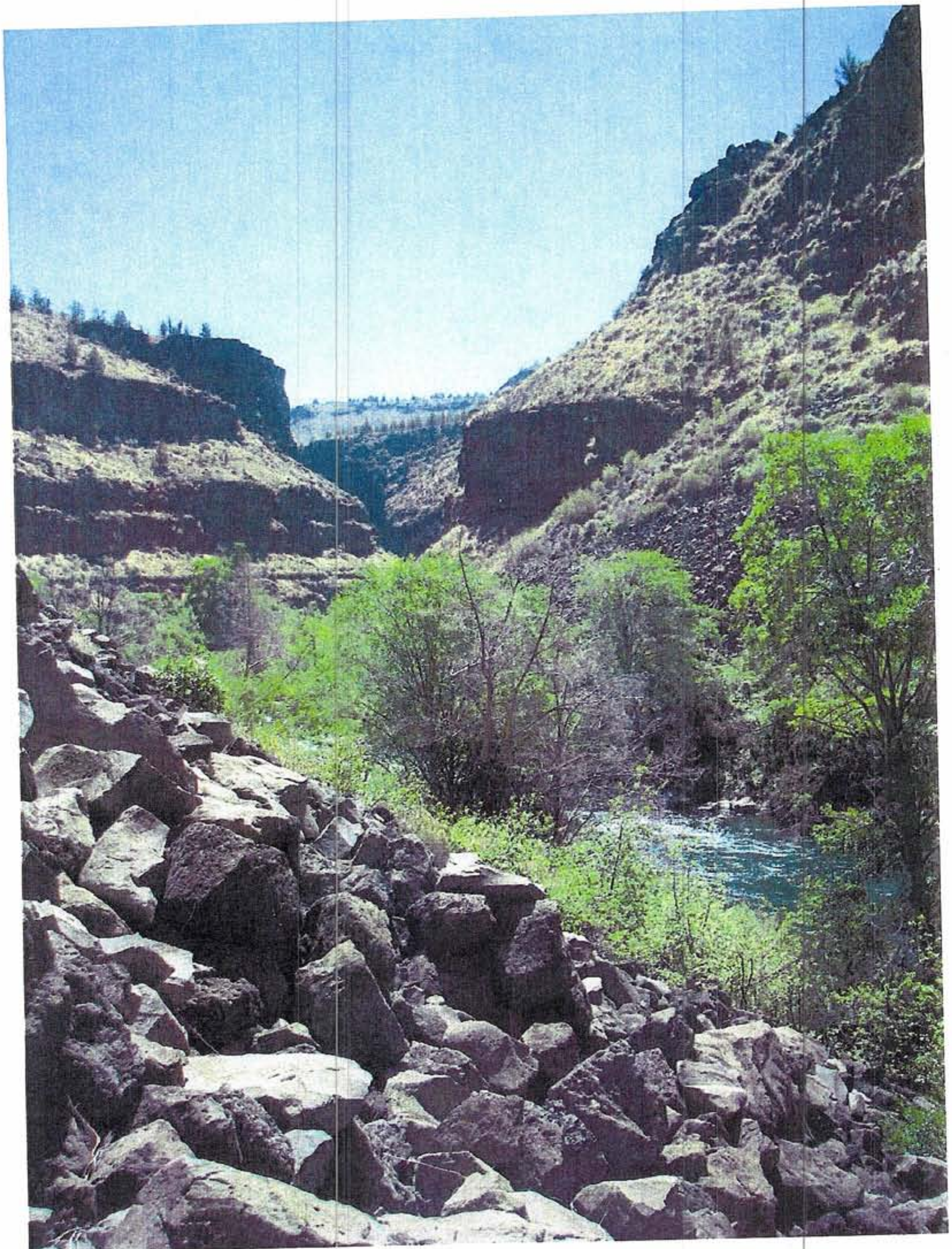


Photo 5: Unit 2 overview at 158 degrees.

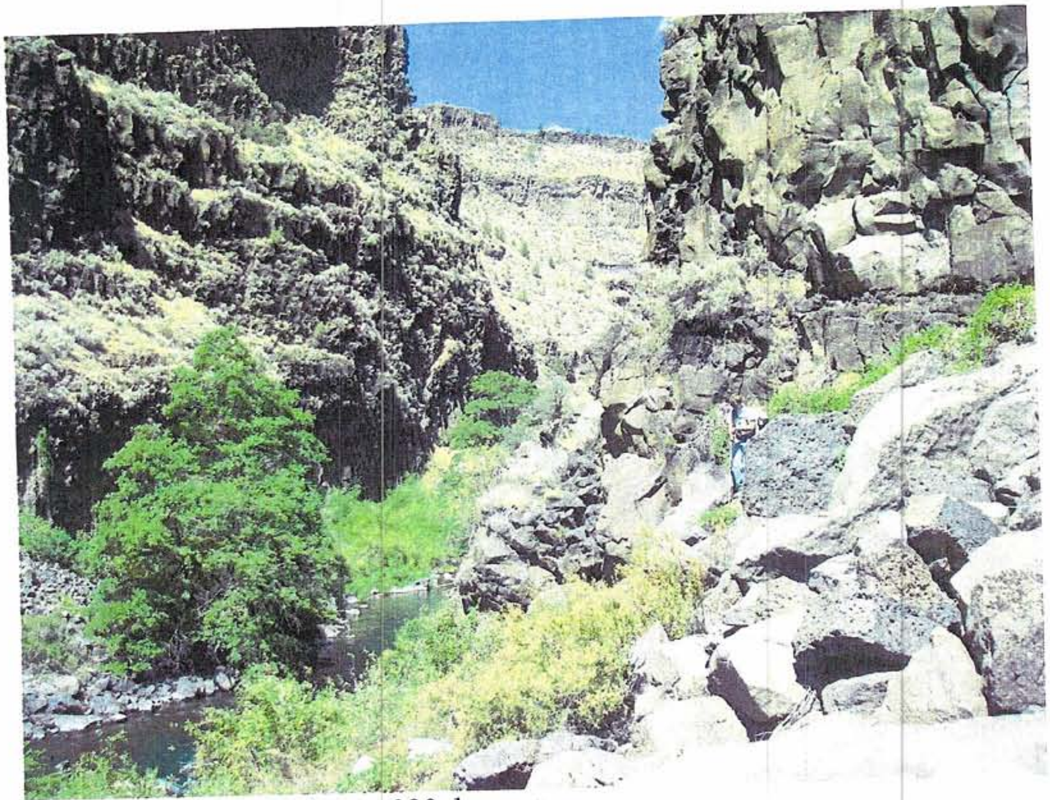
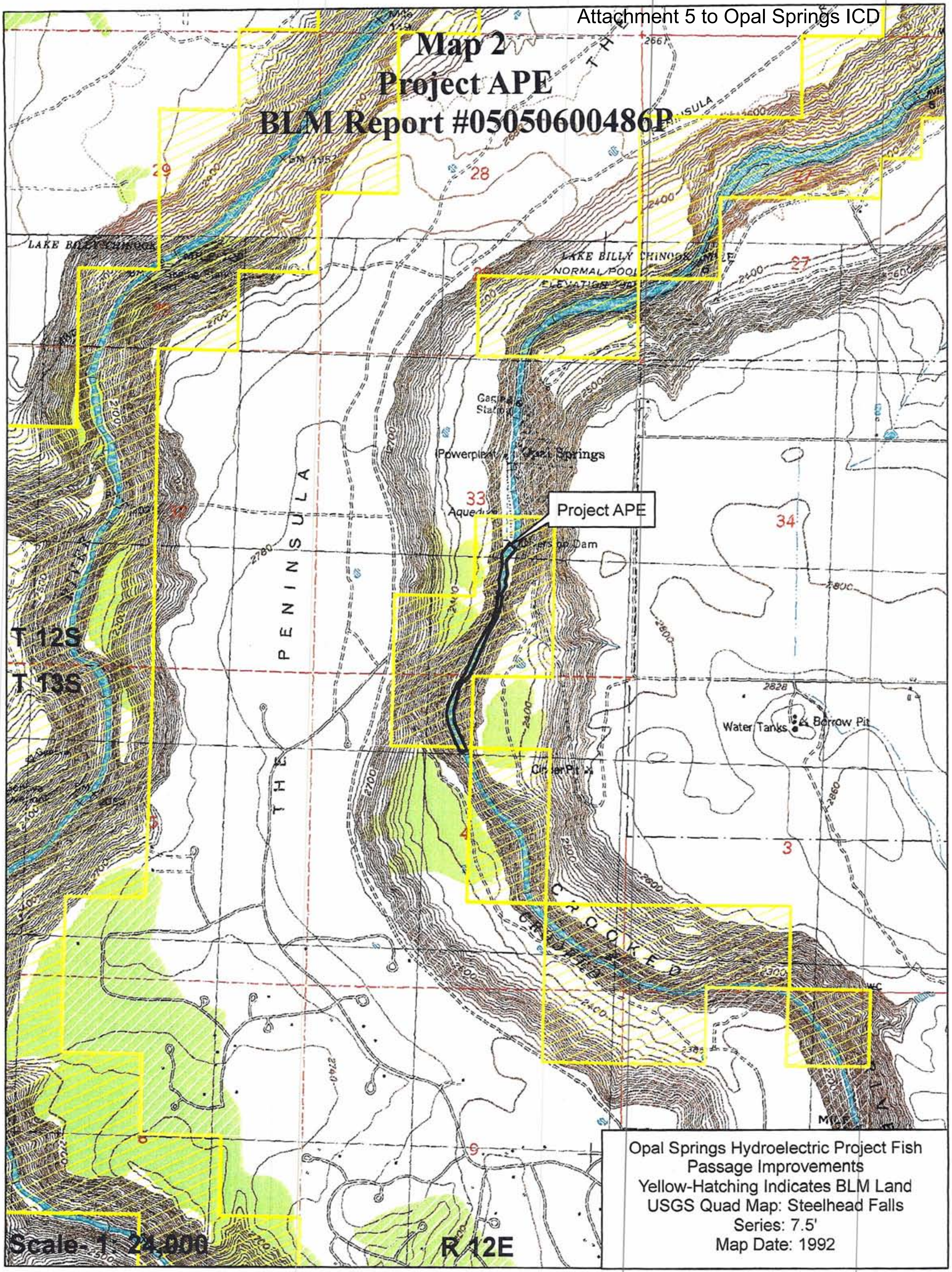
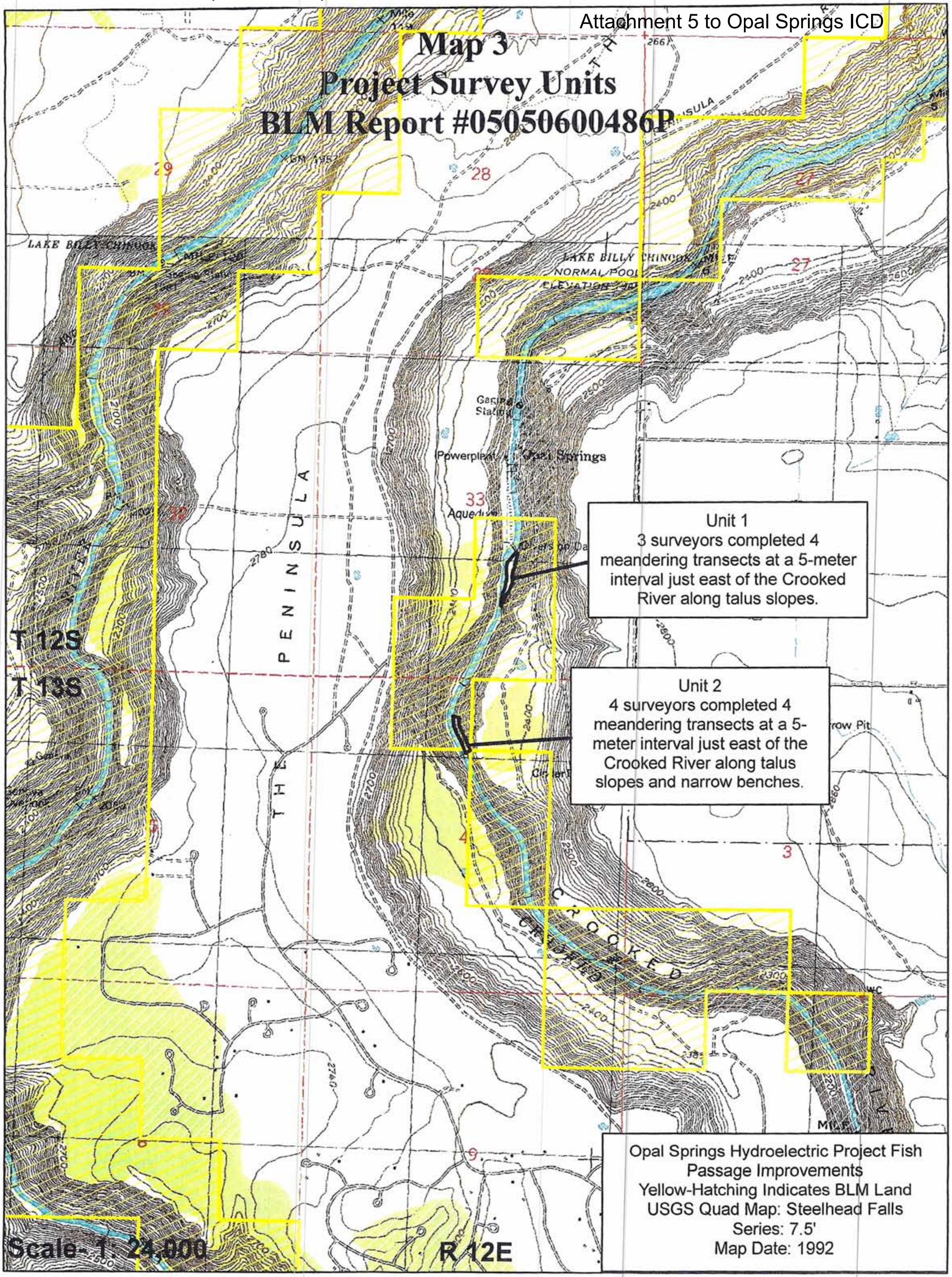


Photo 6: Unit 2 overview at 320 degrees.


Attachment 5 to Opal Springs ICD
Map 2
Project APE
BLM Report #05050600486P
Project APE
Gaging Station
Powerplant
Opal Springs
Aqueduct
Water Tanks
Borrow Pit
Cinder Pit
LAKE BILLY CHINOOK
NORMAL POOL
THE PENINSULA
CROOKED
T 12S
T 13S
R 12E
Scale- 1: 24,000
Opal Springs Hydroelectric Project Fish
Passage Improvements
Yellow-Hatching Indicates BLM Land
USGS Quad Map: Steelhead Falls
Series: 7.5'
Map Date: 1992


Attachment 5 to Opal Springs ICD
Map 3
Project Survey Units
BLM Report #05050600486P
LAKE BILLY CHINOOK
LAKE BILLY CHINOOK
NORMAL POOL
Powerplant
Opal Springs
Aqueduct
THE PENINSULA
CROOKED
T 12S
T 13S
Unit 1
3 surveyors completed 4 meandering transects at a 5-meter interval just east of the Crooked River along talus slopes.
Unit 2
4 surveyors completed 4 meandering transects at a 5-meter interval just east of the Crooked River along talus slopes and narrow benches.
Scale- 1: 24,000
R 12E
Opal Springs Hydroelectric Project Fish Passage Improvements
Yellow-Hatching Indicates BLM Land
USGS Quad Map: Steelhead Falls
Series: 7.5'
Map Date: 1992

Finlay Anderson

From: jeisner@blm.gov
Sent: Monday, January 10, 2011 8:25 AM
To: Finlay Anderson
Subject: Fw: Opal Springs Archaeology Report - Follow Up

----- Forwarded by Jimmy Eisner/PRFO/OR/BLM/DOI on 01/10/2011 08:24 AM

Theresa L
Holtzapple/PRFO/O
R/BLM/DOI To
Jimmy Eisner/PRFO/OR/BLM/DOI@BLM
01/07/2011 02:57 cc
PM Theresa L
Holtzapple/PRFO/OR/BLM/DOI@BLM
Subject
Re: Fw: Opal Springs Archaeology
Report - Follow Up(Document link:
Jimmy Eisner)

Jimmy,

Please forward to your Opal Springs team that in my professional opinion the Nov 13, 2009 SHPO concurrence for No Historic Properties Affected for the Opal Springs Fish Passage project still meets the amended project description and revised boundary elevation. I will incorporate the project description correction from Finley in the BLM report files along with my email.

The new information amending the project description does not change the determination for cultural resources. The initial survey accommodated a
larger area. The degree of change does not merit further consultation
with the SHPO office.

Thank you for the opportunity to address the recent changes in the project boundary description.

Terry

<<-->>
Theresa "Terry" Holtzapple
Cultural Resource and Paleontology Program Prineville BLM

3050 NE Third Street
Prineville, Oregon 97754

(541) 416-6792 theresa_holtzapple@blm.gov

Jimmy
Eisner/PRFO/OR/BL
M/DOI To
Theresa L
01/06/2011 09:48 Holtzapple/PRFO/OR/BLM/DOI@BLM
AM cc

Subject
Fw: Opal Springs Archaeology Report
- Follow Up

Terry,

Please let me know how this should be handled.

Thanks
Jimmy
----- Forwarded by Jimmy Eisner/PRFO/OR/BLM/DOI on 01/06/2011 09:47 AM

Finlay Anderson
<fanderson@longvi
ewassociates.com> To
Jimmy Eisner
01/06/2011 09:43 <Jimmy_Eisner@or.blm.gov>
AM cc
Steve Padula
<spadula@longviewassociates.com>,
Randall Filbert
<rfilbert@longviewassociates.com>
Subject
Opal Springs Archaeology Report -
Follow Up

Finlay Anderson

From: Finlay Anderson
Sent: Thursday, January 06, 2011 9:43 AM
To: Jimmy Eisner
Cc: Steve Padula; Randall Filbert
Subject: Opal Springs Archaeology Report - Follow Up
Attachments: Archeaology Report - BLM.pdf; Opal Springs Project Elevations Memo-11-22-2009.pdf

Hi Jimmy –

On November 13 2009 the State Historic Preservation Office concurred with the BLM's determination of No Historic Properties Affected for the Opal Springs Fish Passage Improvement Project (SHPO Case No. 09-2332). BLM's determination, and SHPOs concurrence with it, was based on field surveys conducted by the BLM and supervised by Ryan Griffin. The purpose of this note is to correct the Project Description in light of new survey information. For reasons described below, I believe this new information amends the description of the Proposed Action only, and would not change your determination. However, I would appreciate your office's view.

The surveys conducted by the BLM thoroughly covered the area that will be inundated by the proposed pool raise as part of the fish passage project, up to the location of the lower boundary of the Wild and Scenic Area described in the Deschutes/Lower Crooked Wild and Scenic Rivers' Management Plan, dated December 1992. The boundary is described as "River Mile 8, south of Opal Springs," and further described as "the North 1/16th line of Section 4, in the Metes and Bounds description under T. 13 S., R. 12 E., W.M." At the time the survey was conducted, it was believed that this elevation of the Metes and Bounds boundary was at approximately 2008.5 ft. (National Geodetic Vertical Datum of 1929 [NGVD 29]), 4 feet above the current pool.

Because of the importance of establishing the boundary elevation with precision and confidence, DVWD contracted with CH2M Hill and a local surveyor (CH2M Hill 2010) to perform survey work to tie the metes and bounds description of the boundary to existing surveys of key Project elevations. One of the findings was that the surveyed elevation of the metes and bounds description where the boundary crosses the stream had a surface elevation of just above 2,010.66 feet (NGVD 29). This elevation was measured in October 2009 during a period of low flows, so should be considered conservative. The top of the riffle below the assumed boundary was surveyed at 2,010.56 feet (see attached Project Elevations Memorandum).

The significance of this finding is that the proposed pool raise will inundate an additional 6 feet of the canyon, not 4 feet as described in the report. However, as a practical matter it is our understanding that the survey crew explored the contour up to the boundary which would include the full 6 feet of inundation. Given this new information, it might be helpful to document this correction to the Project Description in your files and with SHPO if you are in agreement. Please let me know if you have any questions or suggestions about how to proceed.

Sincerely,

Finlay Anderson
Long View Associates
4022 NE 8th Ave
Portland, Oregon 97212
p: (503) 335-5806
f: (503) 345-3418

OPAL SPRINGS HYDROELECTRIC PROJECT

VRM – ANALYSIS

AUGUST 21, 2015

August 21, 2015

Subject: VRM – Analysis
Opal Springs Hydroelectric Project
Deschutes Valley Water District
Madras, OR

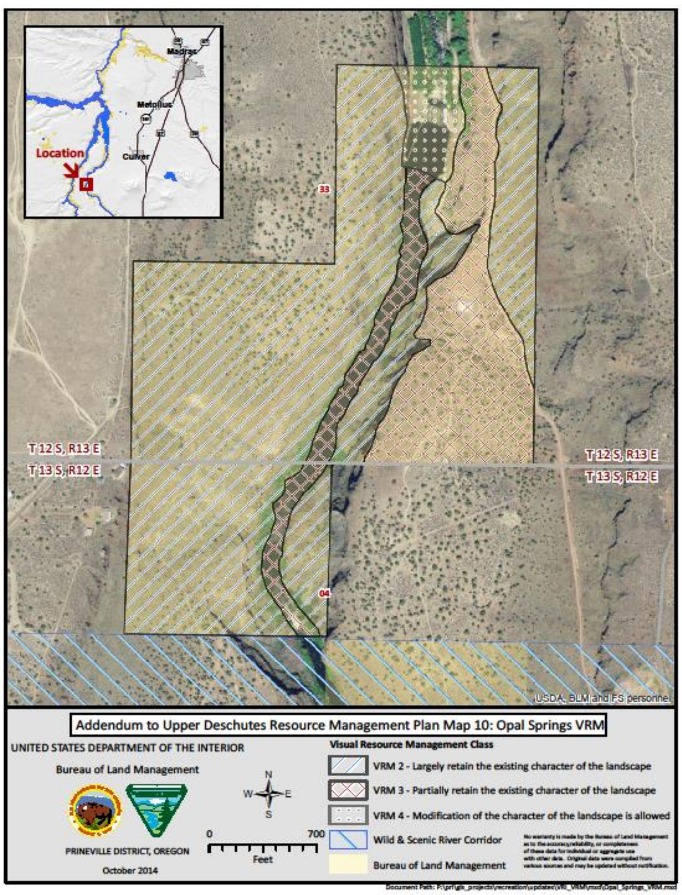
Project Description:

The proposed Project includes construction of a fish ladder to reconnect fish populations upstream and downstream of the Project. Modifications to an existing dam will raise the maximum operating elevation of the Project reservoir approximately six (6) feet. The action is needed to enhance efforts in the basin to reintroduce anadromous fish species into the Crooked River basin. The existing reservoirs riparian/wetland shoreline will be partially inundated.

VRM Objectives:

VRM classes for the Opal Springs Hydroelectric Project area:

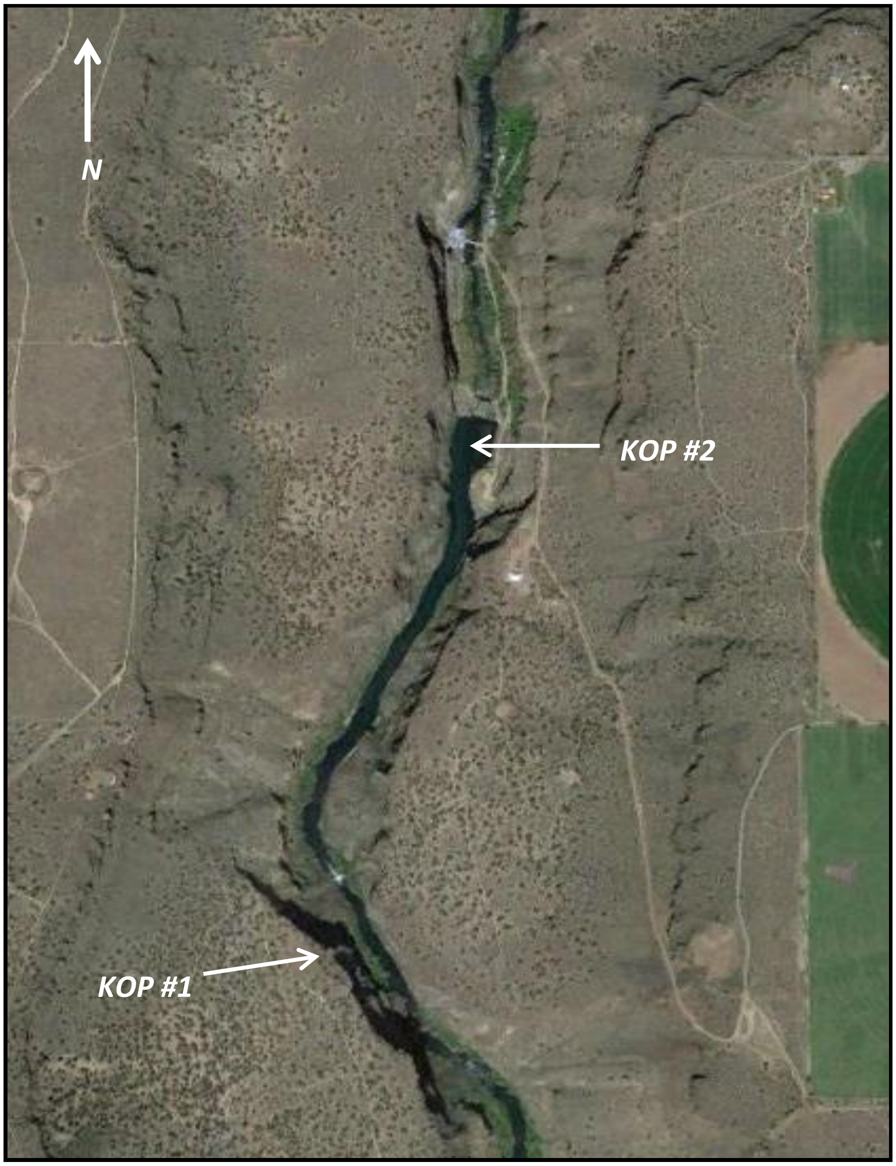
~ VRM II -Upland and upper riparian zone: largely retain the existing character of the landscape.
~ VRM III - Lower riparian zone and reservoir pool: Partially retain the existing character of the landscape.
~ VRM IV - Dam, fish ladder and power generating facilities: Modification of the character of the landscape is allowed.



Roger Borine
Sage West, LLC
Bend, OR

rborine@bendbroadband.com
541.610.2457

***Key Observations Points**:*
Two viewpoints were selected and represent sites on public land and water that is accessible by walking the Otter Bench Trail or floating upstream of the dam.



Roger Borine
Sage West, LLC
Bend, OR

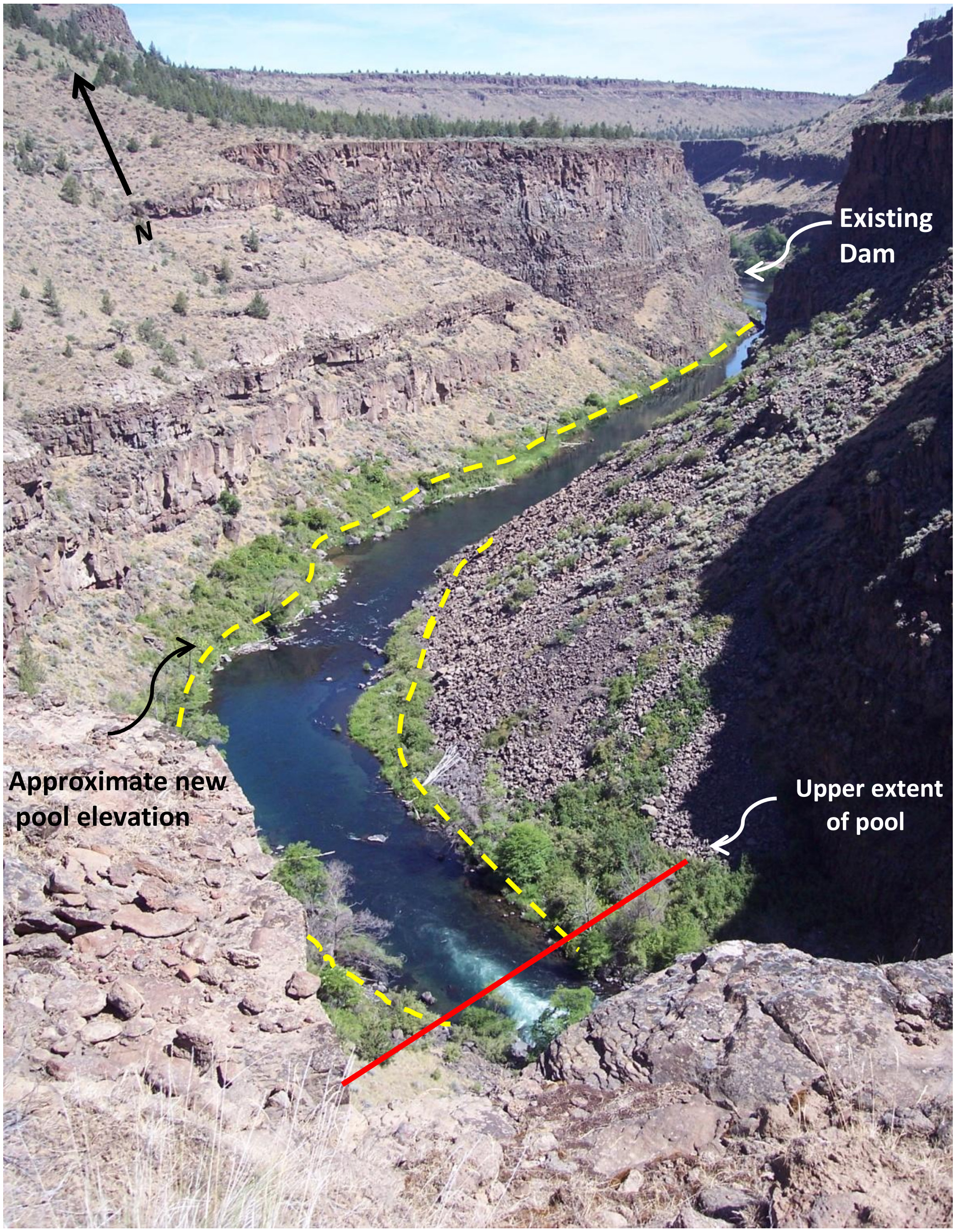
rborine@bendbroadband.com
541.610.2457

KOP #1 *– Is publicly accessible and frequently visited Otter Bench Trail system.*
Location: Latitude - 44 28 31.74 N, Longitude - 121 18 06.08 W.

KOP #2 *– is from the river and viewable from a floating device near the take out point and above the dam/fish ladder. Location: Latitude - 44 29 08.68 N, Longitude - 121 17 54.68 W.*

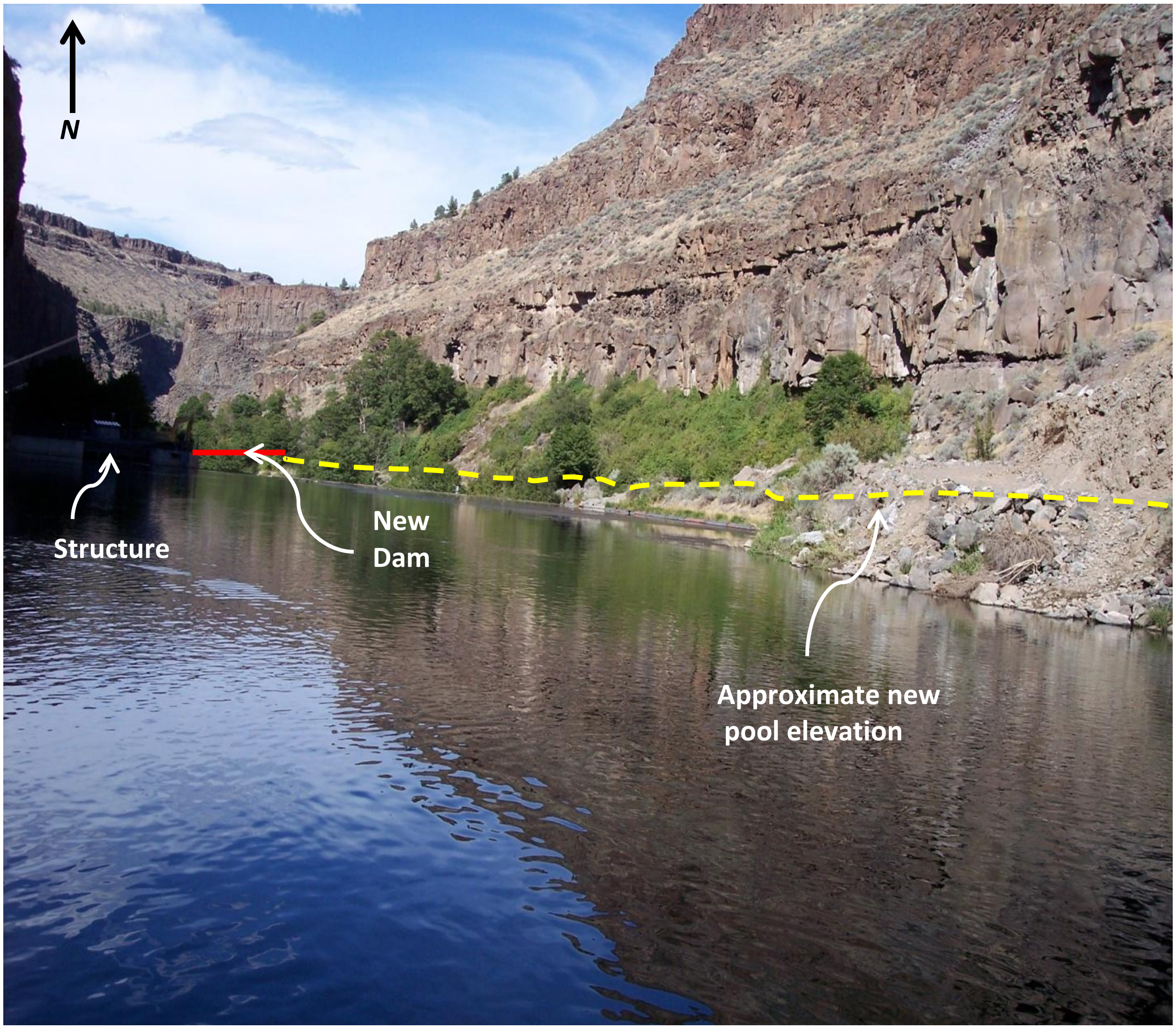
Visual Simulations:

KOP #1



Roger Borine
Sage West, LLC
Bend, OR
rborine@bendbroadband.com
541.610.2457

KOP #2



Roger Borine
Sage West, LLC
Bend, OR

rborine@bendbroadband.com
541.610.2457

Contrast Ratings:

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date August 4, 2015
District Prineville District
Resource Area
Activity (program)

SECTION A. PROJECT INFORMATION

1. Project Name: Opal Springs Hydroelectric Project
2. Key Observation Point: #1 – Otter Bench
3. VRM Class
4. Location: Township 13S; Range 12E; Section 4
5. Location Sketch

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Land: bold, steep, rugged, complex Water: narrow, linear, contrasting	narrow, linear, contrasting	N/A
LINE	Land: bold, rugged, complex Water: bold, simple	bold, simple	N/A
COLOR	Land: subtle/warm, light/dark, yellow/brown Water: brilliant, dark blue	brilliant, green	N/A
TEXTURE	Land: coarse/medium, rough, random Water: fine, smooth	medium, smooth, directional	N/A

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Land: bold, steep, rugged, complex Water: narrow, linear, contrasting	narrow, linear, contrasting	N/A
LINE	Land: bold, rugged, complex Water: bold, simple	bold, simple	N/A
COLOR	Land: subtle/warm, light/dark, yellow/brown Water: brilliant, dark blue	brilliant, green	N/A
TEXTURE	Land: coarse/medium, rough, random Water: fine, smooth	medium, smooth, directional	N/A

SECTION D. CONTRAST RATING ☐ SHORT TERM ☒ LONG TERM

1. DEGREE OF CONTRAST

ELEMENTS	Land/Water Body (1) Strong	Moderate	Weak	None	Vegetation (2) Strong	Moderate	Weak	None	Structures (3) Strong	Moderate	Weak	None
Form				X				X				X
Line				X				X				X
Color				X				X				X
Texture				X				X				X

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names	Date
Roger Borine	8/19/2015

~~Rel. 8-30~~
1/17/86

Roger Borine
Sage West, LLC
Bend, OR
rborine@bendbroadband.com
541.610.2457

SECTION D. (Continued)

Comments from item 2.

The project design meets the VRM objectives when viewed from KOP #1:

1. VRM II: Uplands are retained. The upland/riparian fringe will reestablish naturally in a short time period (3-7 years).
2. VRM III: The pool will be raised 6 feet and the shoreline will be flooded near the dam and grading to 0 feet to the end of the pool where there will be no impact. The river rapid at the upper end of the pool will be partially flooded during high water levels. The reservoir pool will be +/- 25% larger and once flooded will not be noticeable.
3. VRM III: The existing character of the landscape will be retained. The lower 6 ft of the cliff and talus slopes will be inundated, but the landscape above is the same and will remain intact.

Additional Mitigating Measures (See item 3)

The pool will be raised approximately 6 feet at the dam. The downstream shoreline is primarily cliffs and talus slopes where there will be no visual impact from KOP #1. Moving upstream to the end of the pool vegetation is flooded by 4 to 0 feet of water. Some vegetation will die and others will flourish. Sediment from the watershed will be deposited along the shoreline and colonizing species will establish. Note: the existing vegetation is a result of similar circumstances when the original dam was built and then again when it was lifted to a higher elevation. We can expect the same conditions to exist and riparian vegetation will naturally become established.

No mitigating measures are recommended.

*U.S. GOVERNMENT PRINTING OFFICE:

Roger Borine
Sage West, LLC
Bend, OR
rborine@bendbroadband.com
541.610.2457

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date	August 4, 2015
District	Prineville District
Resource Area	
Activity (program)	

SECTION A. PROJECT INFORMATION

1. Project Name: Opal Springs Hydroelectric Project
2. Key Observation Point: #2- Dam Site
3. VRM Class
4. Location: Township 12S; Range 12E; Section 33
5. Location Sketch

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Land: bold, steep, rugged, complex Water: wide, linear, contrasting	narrow, linear, contrasting	small, rectangular
LINE	Land: bold, rugged, complex Water: bold, simple	bold, simple	geometric
COLOR	Land: subtle/warm, light/dark, yellow/brown Water: brilliant, dark blue	brilliant, green	gray
TEXTURE	Land: coarse/medium, rough, random Water: fine, smooth	medium, smooth, directional	ordered

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Land: bold, steep, rugged, complex Water: wide, linear, contrasting	narrow, linear, contrasting	small, rectangular
LINE	Land: bold, rugged, complex Water: bold, simple	bold, simple	geometric
COLOR	Land: subtle/warm, light/dark, yellow/brown Water: brilliant, dark blue	brilliant, green	dark brown
TEXTURE	Land: coarse/medium, rough, random Water: fine, smooth	medium, smooth, directional	ordered

SECTION D. CONTRAST RATING ☐ SHORT TERM ☒ LONG TERM

1. DEGREE OF CONTRAST

ELEMENTS	Land/Water Body (1) Strong	Moderate	Weak	None	Vegetation (2) Strong	Moderate	Weak	None	Structures (3) Strong	Moderate	Weak	None
Form				X				X			X	
Line				X				X			X	
Color				X				X			X	
Texture				X				X			X	

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended ☒ Yes ☐ No (Explain on reverse side)

Evaluator's Names	Date
Roger Borine	8/19/2015

~~Rel. 8-30~~
1/17/86

SECTION D. (Continued)

Comments from item 2.

The project design meets the VRM objectives when viewed from KOP #2 while in a floating device from the middle of the pool above the dam:

1. VRM II: Uplands are retained. The shoreline is cliff and talus slopes.
2. VRM III: The pool will be raised 6 feet and the shoreline will be flooded near the dam. The water will cover existing basalt cliffs and talus slopes. The remaining cliffs and talus will be visually identical for several hundred feet upward.
3. VRM III: The existing character of the landscape will be retained. The lower 6 ft of the cliff and talus slopes will be inundated, but the landscape above is the same and will remain intact. After flooding, the upland/riparian fringe will reestablish naturally in a short time period (3-7 years).

Additional Mitigating Measures (See item 3)

The existing small control tower on the existing dam will be raised. View of this structure can be mitigated with a dark brown color paint.

No additional mitigating measures are recommended.

*U.S. GOVERNMENT PRINTING OFFICE

Roger Borine
Sage West, LLC
Bend, OR
rborine@bendbroadband.com
541.610.2457

Comments on VRM Analysis – Opal Springs Hydroelectric Project

Greg Currie, BLM Prineville District

September 3, 2015

I reviewed two documents: 1) Opal Springs Hydroelectric Project FERC No. 5891, Draft Environmental Assessment; and 2) VRM Analysis, August 21, 2015 document, by Roger Borine, Sage West, LLC. These will be referred to in my comments as Documents 1 and 2 respectively.

Document 1

Page 9, Section 4.1.1

1. It would help to clarify that what is described is the *EXISTING* project facilities. Applicant may want to identify if these are on private land or on BLM managed lands as well. I suspect most are on private land.

Page 23, Section 4.3.2

1. The EA needs to have a better description of the built structures associated with this project. Enough of a description needs to occur so an analysis of the visual impacts of the new facilities can be made, particularly the color and texture contrasts created by additional built features in the canyon. A description of the scale, materials used and colors are needed. What materials and color is the Obermeyer Weir? What material, color and height of the fish ladder? What will the material and height of the spillways be?

2. I recommend including photographs of representative type structures/materials at a minimum. A photo of the existing site setting where the new construction will take place would be useful as well.

6.8.1.3 Aesthetic/Visual Resources

1. Delete the last part of the first paragraph that describes State Scenic Hwy 27 and National Backcountry Byway. This is not pertinent to the project since this section of the river is 20 miles away from the project area.

2. Existing Setting section should include description of viewers, who accesses the area (hikers on rim, particularly to the west at Otter Bench Trail system, and paddlers who take out above the existing dam). I would characterize the Otter Bench Trail system as moderately popular, but access is somewhat limited by its location at the far north end of Crooked River Ranch. Some characterization of the levels of boating use on the river would be helpful. My understanding is it isn't used year round and is relatively low volumes of use. If people are travelling downstream to reach Lake Billy Chinook, they are near the end of the run, and have to pass through private land with many structures, including under at least one bridge? So the expectation for a wholly natural setting likely doesn't exist.

3. Some description of the existing setting should include the relative amount of built features seen from the project site, and how much of this occurs on private land vs. BLM managed lands. It's important to note the relative scale and depth of the canyon, and the dominance of the geology in relation to the scale of the existing project facilities. The existing environment section should capture what can be seen and how dominant the existing facilities are in this setting. Bottom line for me, there are considerable facilities on private land, and much less on BLM managed lands – these are noticeable as one travels through the canyon, yet the canyon itself and the water are such dominant features, the area still is quite scenic.

4. Incorporate some of the descriptions of form, line, color and texture from Section B, Contrast Rating worksheets contained in Document 2.

5. Include some description of how people use the area, particularly boaters who take out here (or reference this info from the recreation section). If boaters generally portage around the facility to continue downstream to Lake Billy Chinook, it would be useful to state the legal status of this travel (i.e., occurs under the permission of the facility operator?), and also to recognize that these visitors pass by facilities located wholly on private lands. In the later environmental assessment, it should be noted that to make this full journey, visitors must pass through a considerable amount of facilities on private land, and therefore their expectations might not be for a fully pristine, unaltered landscape.

<u>6.8.2.1.1 Direct and Indirect Effects</u>

Construction effects – additional equipment during construction operations for what amount of time (months?) and what season.

Are vegetation impacts as existing riparian veg gets flooded out identified as a short term (5 years or less) impact? Need to identify if this is short or long term effect.

There is no discussion of impacts of built features such as the weir, spillways and fish ladders. Need this, in order to determine, what, if any mitigation should be applied (colors and textures for the most part).

Draft states on Page 79 that results of BLM's proposed survey of aesthetic/visual resources will be used when available. Not sure what this means. Results have to be included in the EA.

<u>Document 2</u>

<u>Project area map (first page)</u>

Very difficult to read. Doesn't work well without being much larger, full page map.

<u>VRM Objectives (first page)</u>

I would use the complete text from the BLM Manual for these descriptions:

VRM Class II – The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color and texture found in the predominant natural features of the characteristic landscape.

VRM Class III – The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

VRM Class IV – The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

<u>Key Observation Point Map, page 2</u>

You may want to label existing reference points such as the existing dam and show BLM/Pvt boundaries.

<u>KOP 1, page 3</u> – good choice for KOP

<u>KOP 2, page 4</u>

Would fish ladder be visible from this location? Need to identify that in the analysis. This KOP represents the view for a paddler, who would then move slightly downstream and take out on the east shore and pass by the fish ladder (is this a correct assumption?). If correct, then there should be some discussion of the impacts from those structural elements and consideration of potential mitigation. Again, impacts should be discussed in light of the various other built features that will be seen as visitors move downstream.

<u>KOP #1, page 5, Contrast Rating worksheet</u>

1. Need to identify applicable VRM Class on the worksheet (box 3)

2. I would identify the short term impact of vegetation disturbance as pool elevations increase. There would be a short term decrease in bright green color and fine to moderate texture of riparian vegetation? The impact is not significant because it is short term. Otherwise, a good description of effects.

3. I also suspect the scale and dominance of the water in the landscape would be slightly higher under the proposed action (+/- 25%).

<u>KOP #2, page 7, Contrast Rating Worksheet</u>

1. Need to identify applicable VRM Class on the worksheet (box 3)

2. Characteristic Landscape Description – Land/Water (color): seems to me there is a significant amount of basalt cliffs/talus slopes that are various shades of gray to black depending on lighting/shadow on the canyon walls.

3. A little more description of effects/introduced contrast of structures is needed. What color is the fish ladder? Is the material reflective? Galvanized? The color of the weir bags has to be identified. I assume they are black, which is good in terms of less contrast. There's not enough info to really get at whether the impact of facilities is weak or moderate for color or texture. I would also identify the color of the roof for any structure and include the roof color as something we will select appropriate colros for.

4. Brown might work as a mitigating color, but certainly something with a significant amount of gray in it would help. I would add to the mitigation that BLM will conduct a site specific color matching on site using BLM Standard Environmental Colors to select appropriate colors for facilities. If the fish ladder is galvanized metal, we may want to discuss how dark it is, and if the side facing the river can be treated to minimize reflectivity or partially screen it.

<u>KOP #2, page 8, Contrast Rating Worksheet</u>

The view of the control tower structure cannot be mitigated by paint. The color contrast could be mitigated through appropriate paint color. A terminology issue mostly.

REVISED CROSS WALK

CROSSWALK OF 2015 PROPOSED ACTION AND 2017 MODIFICATIONS

Attachment 7: Crosswalk of 2015 Proposed Action and 2017 Modifications

Overview of Modified Project:

As noted in filings with FERC dated March 17, 2017, the Opal Springs Hydroelectric Project (OSHP) underwent value-engineering efforts regarding the proposed fish ladder and pool raise after it was determined that the lowest bid for construction was not economically feasible. The result of the value-engineering was a slight modification to the project description in which some of the project elements were removed entirely while others were modified to maintain the economic viability of the project (Figure 1). The crosswalk below describes the changes seen in Figure 1.

At the time DVWD initiated the value engineering effort, it was in the process of obtaining an amendment of its FERC license authorize include the fish ladder and pool raise, and implement certain operational measures achieve its fish passage objectives. By Order dated March 28, 2017 FERC granted DVWD an abeyance of the amendment proceedings, and directed that DVWD update the Commission by December 31, 2017.

In developing its revised project description, DVWD consulted extensively with the Settlement Parties (Parties), including Fish Agencies. Because the essential elements of the Project have not been modified, the Parties do not feel the need to amend the terms of the 2015 Settlement Agreement. The Parties have agreed that a FERC Amendment that is consistent with this filing will not be interpreted as being a “material modification” of the Agreement. Pursuant to Section 3.8.1 of the Agreement, “if FERC issues an Amended License that contains a modification that is not a Material Modification, this Agreement shall be interpreted in a manner that is consistent with such modifications”.

Summary of Changes

For convenience, the changes are summarized as follows:

1. Table 1 below is a crosswalk to provide an easy basis of comparison between the project, as described in the 2015 Amendment Application and the revised 2017 Project Description. The table summarizes the key physical and operational changes, as well as the necessary changes that should be reflected in license articles. The parties have been thoroughly engaged throughout the re-design process and believe a license amendment containing changes below is consistent with the intent of the original 2015 revised and restated settlement agreement.
2. Figure 1 is a marked-up layout of the original drawings from the 2015 application. Changes to the project layout are reflected here.
3. Attachment A is a track changes of the proposed Exhibit A for the project.
4. Updated Exhibit F drawings will be submitted as CEII documents, pursuant to commission guidance.
5. Exhibit G drawings are unchanged from what was previously submitted. As-built Exhibit G drawings would be provided following construction.

Attachment 7: Crosswalk of 2015 Proposed Action and 2017 Modifications

Table 1 Changes from 2015 Proposed Project to 2017 Value-Engineered Project

Element	Existing	2015 Proposed	2017 Modified
Maximum Pool Elevation	2004.21 feet[1]	2010.21 feet	2007.21 feet (LPD)
Minimum Pool Elevation	2004.21 feet	2007.21 feet	2007.21
Operating range of fish ladder	N/A	3 feet range of forebay elevation	Constant forebay elevation
Impoundment Storage	106 acre-feet	184.8 acre-feet	119 acre-feet
Surface Area	11 acres	15 acres	14.4 acres
Project Boundary (around reservoir)	Follows 2004.21-foot contour	Follows 2010.21-foot contour	Follows 2010.21-foot contour
Fish Ladder Exit Structure	N/A	Configurable (4 exit cells) for variable forebay elevation	Single exit cell, constant forebay elevation
Control of spillway	Fixed flashboard	Pneumatic Crest Weirs	Fixed flashboards with safety provisions for Inflow Design Flood.
Downstream passage past intake	Crest spill	3 gates for downstream passage (river right and left)	1 gate for fish passage (river right)
Monitoring and Evaluation Program	N/A	See Proposed License Articles 5,6	No Change
Performance Objectives	N/A	See Proposed License Article 7	No Change
Adaptive Management	N/A	See Proposed License Article 8	No Change
Proposed License Articles			
Article 2: Fish Passage Facilities		Authorizes facilities to increase in the normal maximum diversion pool elevation up to <u>2,010.21</u> feet NGVD 29	Authorizes facilities to increase in the normal maximum diversion pool elevation up to <u>2,007.21</u> feet NGVD 29

[1] All elevations are reported in National Geodetic Vertical Datum of 1929 (NGVD 29) except construction drawings that are in the local project datum (LPD), which is greater than NGVD 29 by 1.79 feet. For purposes of keeping the construction and engineering simple, this LPD is used in an engineering context.

The OSHP is authorized to operate at a maximum pool elevation of 2,005 feet NGVD 29; surveys conducted in 2009 by DVWD indicate that the current elevation of the impoundment is at 2004.21 feet. The proposal is to increase the impoundment elevation by 3 feet, making the new maximum operating elevation 2,07.21 feet NGVD 29 (2,009 feet LPD)

Attachment 7: Crosswalk of 2015 Proposed Action and 2017 Modifications

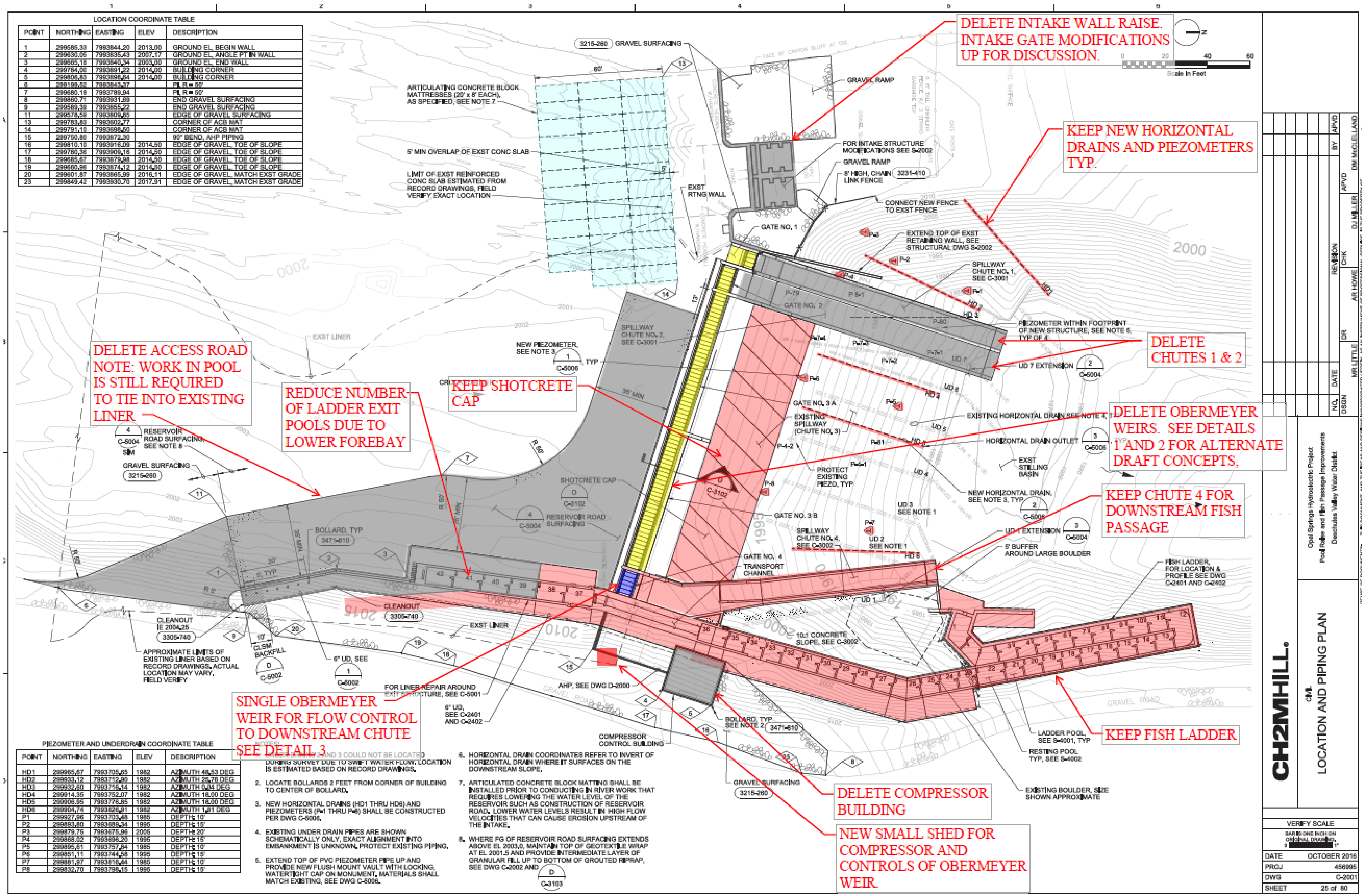
Element	Existing	2015 Proposed	2017 Modified
Article 4: Bypass Flow Accrual Account		Sets Accrual Rate[2] for calculating water credits for Bypass Flow Accrual Account as 2.89% of instantaneous turbine flow.	Change in formula such that the accrual rate (and hence the amount of water for the water bank) will remain unchanged.
Article 8: Adaptive Management (paragraph – 2.1)		Less than 90 percent passage effectiveness or survival. The Licensee shall implement applicable Tier 1 measures, as required by the FPWG, and shall increase the BFAA Allocation Percent to 35%.	Less than 90 percent passage effectiveness or survival. The Licensee shall implement applicable Tier 1 measures, as required by the FPWG, and shall increase the BFAA Allocation Percent to 60%.
Article 8: Adaptive Management (paragraph – 2.2)		Less than 90 percent passage effectiveness or survival. The Licensee shall implement all remaining and applicable Tier 1 measures, as required by the FPWG, and shall increase the fisheries BFAA Allocation Percent to 45%.	Less than 90 percent passage effectiveness or survival. The Licensee shall implement all remaining and applicable Tier 1 measures, as required by the FPWG, and shall increase the fisheries BFAA Allocation Percent to 70%.

Proposed Ordering Paragraph	
2015 Proposed	**2017 Modified**
Project works consisting of (1) a 21-foot-high, 200-foot-long, concrete-capped, rockfilled diversion dam, controlled with a single, fixedflashboard creating a pool with a storage capacity of 119 acre-feet and an area of 14.4 acres at normal maximum pool elevation of 2,007.21 feet NGVD 29; (2) a 30 cfs vertical slot ladder; (3) a 44-foot by 33-foot, rectangular, concrete intake structure 34 feet tall located on the left abutment of the diversion dam; (4) two 12.5-foot-diameter, 1,157-foot-long, buried, corrugated-metal conduits; (5) a 30-foot-diameter, steel bifurcator in the surge tank; (6) a 16-foot-diameter, 160-foot-long,	Project works consisting of (1) a 21-foot-high, 200-foot-long, concrete-capped, rockfilled diversion dam, controlled with a single, fixed flashboard creating a pool with a storage capacity of 119 acre-feet and an area of 14.4 acres at normal maximum pool elevation of 2,007.21 feet NGVD 29; (2) a 30 cfs vertical slot ladder; (3) a 44-foot by 33-foot, rectangular, concrete intake structure 34 feet tall located on the left abutment of the diversion dam; (4) two 12.5-foot-diameter, 1,157-foot-long, buried, corrugated-metal conduits; (5) a 30-foot-diameter, steel bifurcator in the surge tank; (6) a 16-foot-diameter, 160-foot-long, steel penstock; (7) two existing turbine-driven irrigation pumps, one rated at 175 horsepower and the other at 480 horsepower; (8) a powerhouse containing one 4.3 megawatt (MW) generating unit; (9) a 250-

[2] Accrual rate is the product of the Allocation Percent and the increase in power generation as a result of the pool raise: (25% x 11.54%); under the revised project description the formula will now be (50% x 5.77%)

steel penstock; (7) two existing turbine-driven irrigation pumps, one rated at 175 horsepower and the other at 480 horsepower; (8) a powerhouse containing one 4.3 megawatt (MW) generating unit; (9) a 250-foot-long, 69.5 kilovolt (kV), overhead transmission line interconnecting with the Pacific Power and Light transmission system; and (10) appurtenant facilities.	foot-long, 69.5 kilovolt (kV), overhead transmission line interconnecting with the Pacific Power and Light transmission system; and (10) appurtenant facilities.

Attachment 7: Crosswalk of 2015 Proposed Action and 2017 Modifications



LOCATION COORDINATE TABLE

POINT	NORTHING	EASTING	ELEV	DESCRIPTION
1	299586.33	7993844.20	2013.00	GROUND EL, BEGIN WALL
2	299630.05	7993835.43	2007.17	GROUND EL, ANGLE PT IN WALL
3	299665.18	7993840.34	2003.00	GROUND EL, END WALL
4	299784.00	7993891.22	2014.00	BUILDING CORNER
5	299806.83	7993898.64	2014.00	BUILDING CORNER
6	299199.52	7993843.37		PI, R = 50'
7	299680.18	7993789.94		PI, R = 50'
8	299880.71	7993931.89		END GRAVEL SURFACING
9	299589.39	7993855.22		END GRAVEL SURFACING
11	299578.59	7993809.85		EDGE OF GRAVEL SURFACING
13	299783.83	7993602.77		CORNER OF ACB MAT
14	299791.10	7993698.50		CORNER OF ACB MAT
15	299750.80	7993872.30		90° BEND, AHP PIPING
16	299810.10	7993916.09	2014.50	EDGE OF GRAVEL, TOE OF SLOPE
17	299780.36	7993909.16	2014.50	EDGE OF GRAVEL, TOE OF SLOPE
18	299685.67	7993879.98	2014.50	EDGE OF GRAVEL, TOE OF SLOPE
19	299660.86	7993874.12	2014.50	EDGE OF GRAVEL, TOE OF SLOPE
20	299601.87	7993865.99	2016.11	EDGE OF GRAVEL, MATCH EXST GRADE
23	299849.42	7993930.70	2017.91	EDGE OF GRAVEL, MATCH EXST GRADE

PIEZOMETER AND UNDERDRAIN COORDINATE TABLE

POINT	NORTHING	EASTING	ELEV	DESCRIPTION
HD1	299965.67	7993705.65	1982	AZIMUTH 48.53 DEG
HD2	299933.12	7993712.90	1982	AZIMUTH 25.76 DEG
HD3	299932.60	7993716.14	1982	AZIMUTH 0.04 DEG
HD4	299914.35	7993752.07	1982	AZIMUTH 18.00 DEG
HD5	299908.95	7993776.85	1982	AZIMUTH 18.00 DEG
HD6	299904.74	7993826.91	1982	AZIMUTH 1.81 DEG
P1	299927.96	7993703.48	1985	DEPTH: 10'
P2	299893.80	7993689.34	1995	DEPTH: 15'
P3	299879.75	7993675.96	2005	DEPTH: 20'
P4	299868.02	7993696.20	1995	DEPTH: 15'
P5	299895.61	7993757.84	1985	DEPTH: 10'
P6	299851.11	7993744.58	1995	DEPTH: 15'
P7	299861.97	7993816.44	1985	DEPTH: 10'
P8	299832.70	7993798.15	1995	DEPTH: 15'

NOTES:

1. UNDER DRAINS 2 AND 3 COULD NOT BE LOCATED DURING SURVEY DUE TO SWIFT WATER FLOW. LOCATION IS ESTIMATED BASED ON RECORD DRAWINGS.
2. LOCATE BOLLARDS 2 FEET FROM CORNER OF BUILDING TO CENTER OF BOLLARD.
3. NEW HORIZONTAL DRAINS (HD1 THRU HD6) AND PIEZOMETERS (P-1 THRU P-8) SHALL BE CONSTRUCTED PER DWG C-5006.
4. EXISTING UNDER DRAIN PIPES ARE SHOWN SCHEMATICALLY ONLY, EXACT ALIGNMENT INTO EMBANKMENT IS UNKNOWN, PROTECT EXISTING PIPING.
5. EXTEND TOP OF PVC PIEZOMETER PIPE UP AND PROVIDE NEW FLUSH MOUNT VAULT WITH LOCKING, WATERTIGHT CAP ON MONUMENT, MATERIALS SHALL MATCH EXISTING, SEE DWG C-5006.
6. HORIZONTAL DRAIN COORDINATES REFER TO INVERT OF HORIZONTAL DRAIN WHERE IT SURFACES ON THE DOWNSTREAM SLOPE.
7. ARTICULATED CONCRETE BLOCK MATTING SHALL BE INSTALLED PRIOR TO CONDUCTING IN RIVER WORK THAT REQUIRES LOWERING THE WATER LEVEL OF THE RESERVOIR SUCH AS CONSTRUCTION OF RESERVOIR ROAD. LOWER WATER LEVELS RESULT IN HIGH FLOW VELOCITIES THAT CAN CAUSE EROSION UPSTREAM OF THE INTAKE.
8. WHERE FG OF RESERVOIR ROAD SURFACING EXTENDS ABOVE EL 2003.0, MAINTAIN TOP OF GEOTEXTILE WRAP AT EL 2001.5 AND PROVIDE INTERMEDIATE LAYER OF GRANULAR FILL UP TO BOTTOM OF GROUTED RIPRAP, SEE DWG C-2002 AND D/C-3103

[This page intentionally left blank]

EXHIBIT F

GENERAL DESIGN DRAWINGS

OPAL SPRINGS HYDROELECTRIC PROJECT
FERC NO. 5891

UPDATED EXHIBIT F
GENERAL DESIGN DRAWINGS

The design drawings showing plan, elevations, and sections of the principal Project works have been filed with the Commission as follows:

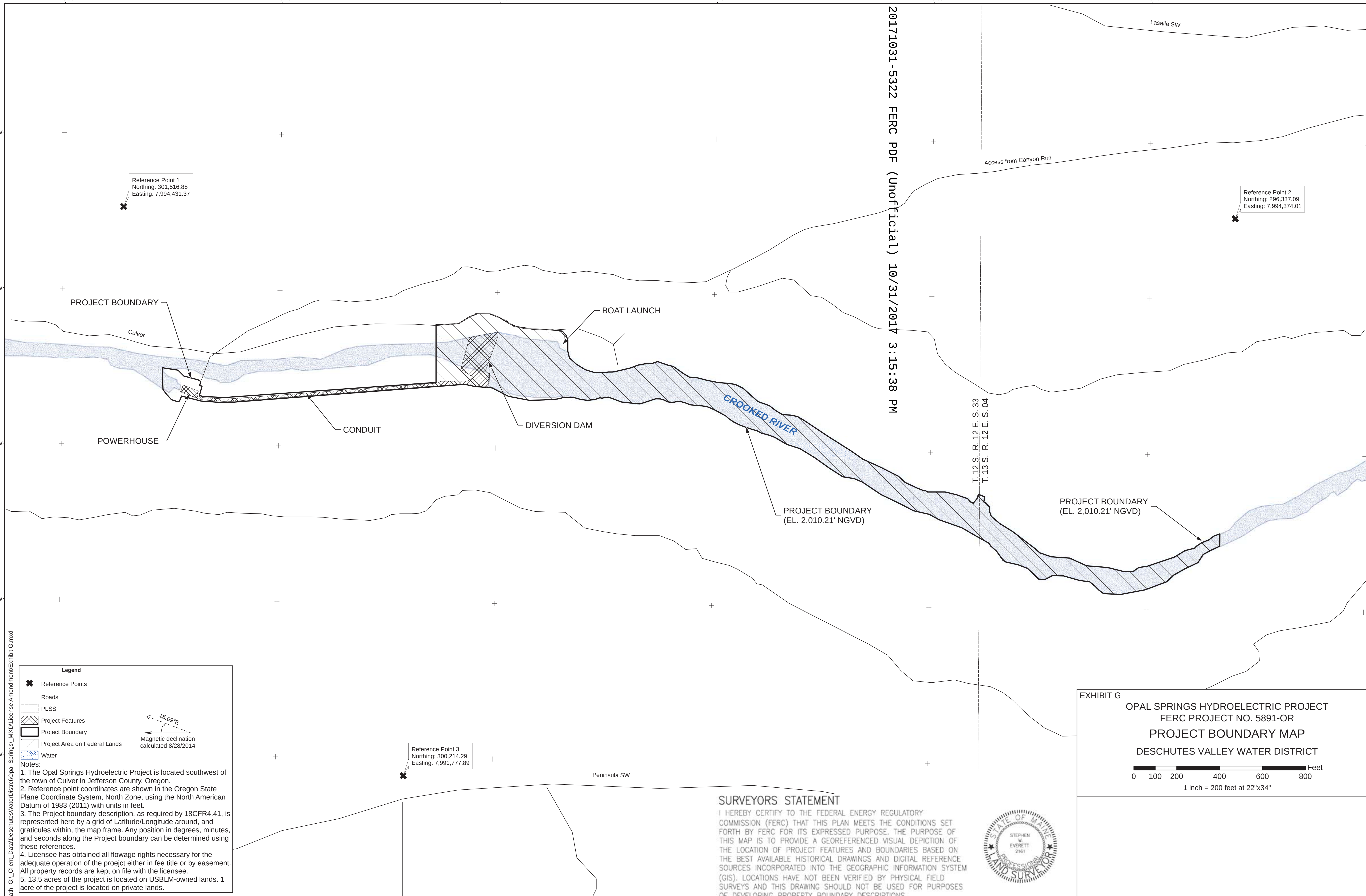
Sheet No.	Title
Sheet 5	Overall Site Plan
Sheet 14	Diversion Dam Site Plan
Sheet 15	Fish Ladder Plan and Profile (1)
Sheet 16	Fish Ladder Plan and Profile (2)
Sheet 17	Spillway Chute #2 Plan and Profile
Sheet 18	Spillway Chute No. 1 Plan and Profile
Sheet 19	Gate No. 1 Spillway Details
Sheet 20	Spillway Sections
Sheet 21	Gate No. 1 Sections

In accordance with Federal Energy Regulatory Commission (FERC or Commission) regulations, certain sensitive information related to this relicensing proceeding is being filed under separate cover with the Commission only. Special handling of this material is required to protect the security of critical energy infrastructure.

In order to protect critical energy infrastructure, the Commission has enacted regulations to govern public access to certain information. The Exhibit F drawings and Supporting Design Report referenced herein contain sensitive and detailed engineering information that, if used improperly, may compromise the safety of the Project and those responsible for its operation. Therefore, the Exhibit F drawings and Supporting Design Report have been labeled "Contains Critical Energy Infrastructure Information - Do Not Release." The drawings and Supporting Design Report have been submitted to FERC under separate cover. Agencies may file a CEII request under 18 CFR § 388.113 or a Freedom of Information Act (FOIA) request under 18 CFR § 388.108 to obtain the Exhibit F drawings.

EXHIBIT G

PROJECT BOUNDARY MAPS



Notes:
1. The Opal Springs Hydroelectric Project is located southwest of the town of Culver in Jefferson County, Oregon.
2. Reference point coordinates are shown in the Oregon State Plane Coordinate System, North Zone, using the North American Datum of 1983 (2011) with units in feet.
3. The Project boundary description, as required by 18CFR4.41, is represented here by a grid of Latitude/Longitude around, and graticules within, the map frame. Any position in degrees, minutes, and seconds along the Project boundary can be determined using these references.
4. Licensee has obtained all flowage rights necessary for the adequate operation of the proejct either in fee title or by easement. All property records are kept on file with the licensee.
5. 13.5 acres of the project is located on USBLM-owned lands. 1 acre of the project is located on private lands.

SURVEYORS STATEMENT

I HEREBY CERTIFY TO THE FEDERAL ENERGY REGULATORY COMMISSION (FERC) THAT THIS PLAN MEETS THE CONDITIONS SET FORTH BY FERC FOR ITS EXPRESSED PURPOSE. THE PURPOSE OF THIS MAP IS TO PROVIDE A GEOREFERENCED VISUAL DEPICTION OF THE LOCATION OF PROJECT FEATURES AND BOUNDARIES BASED ON THE BEST AVAILABLE HISTORICAL DRAWINGS AND DIGITAL REFERENCE SOURCES INCORPORATED INTO THE GEOGRAPHIC INFORMATION SYSTEM (GIS). LOCATIONS HAVE NOT BEEN VERIFIED BY PHYSICAL FIELD SURVEYS AND THIS DRAWING SHOULD NOT BE USED FOR PURPOSES OF DEVELOPING PROPERTY BOUNDARY DESCRIPTIONS.

STATE OF MAINE
STEPHEN W. EVERETT
2161
PROFESSIONAL LAND SURVEYOR

EXHIBIT G

OPAL SPRINGS HYDROELECTRIC PROJECT
FERC PROJECT NO. 5891-OR

PROJECT BOUNDARY MAP

DESCHUTES VALLEY WATER DISTRICT

0 100 200 400 600 800 Feet
1 inch = 200 feet at 22"x34"

20171031-5322 FERC PDF (Unofficial) 10/31/2017 3:15:38 PM

Path: G:_Client_Data\DeschutesWaterDistrict\Opal Springs_MXD\License Amendment\Exhibit G.mxd

Notes:
1. The Opal Springs Hydroelectric Project is located southwest of the town of Culver in Jefferson County, Oregon.
2. Reference point coordinates are shown in the Oregon State Plane Coordinate System, North Zone, using the North American Datum of 1983 (2011) with units in feet.
3. The Project boundary description, as required by 18CFR4.41, is represented here by a grid of Latitude/Longitude around, and graticules within, the map frame. Any position in degrees, minutes, and seconds along the Project boundary can be determined using these references.
4. Licensee has obtained all flowage rights necessary for the adequate operation of the proejct either in fee title or by easement. All property records are kept on file with the licensee.
5. 13.5 acres of the project is located on USBLM-owned lands. 1 acre of the project is located on private lands.

SURVEYORS STATEMENT

I HEREBY CERTIFY TO THE FEDERAL ENERGY REGULATORY COMMISSION (FERC) THAT THIS PLAN MEETS THE CONDITIONS SET FORTH BY FERC FOR ITS EXPRESSED PURPOSE. THE PURPOSE OF THIS MAP IS TO PROVIDE A GEOREFERENCED VISUAL DEPICTION OF THE LOCATION OF PROJECT FEATURES AND BOUNDARIES BASED ON THE BEST AVAILABLE HISTORICAL DRAWINCS AND DIGITAL REFERENCE SOURCES INCORPORATED INTO THE GEOGRAPHIC INFORMATION SYSTEM (GIS). LOCATIONS HAVE NOT BEEN VERIFIED BY PHYSICAL FIELD SURVEYS AND THIS DRAWING SHOULD NOT BE USED FOR PURPOSES OF DEVELOPING PROPERTY BOUNDARY DESCRIPTIONS.

STATE OF MAINE
STEPHEN W. EVERETT
2161
PROFESSIONAL LAND SURVEYOR

EXHIBIT G

OPAL SPRINGS HYDROELECTRIC PROJECT
FERC PROJECT NO. 5891-OR

PROJECT BOUNDARY MAP

DESCHUTES VALLEY WATER DISTRICT

APPENDIX A:
PROPOSED LICENSE ARTICLES
OPAL SPRINGS HYDROELECTRIC PROJECT (FERC NO. 5891)

Article 1: Opal Springs Fish Passage and Protection Plan

The Licensee shall implement the Opal Springs Fish Passage and Protection Plan (Attached).

Article 2: Fish Passage Facilities

The Licensee shall provide safe, timely, and effective fish passage at the Opal Springs Hydroelectric Project (Project) through implementation of the Amended License.

The Licensee shall design, construct, operate, maintain and monitor a volitional upstream fish ladder located at the Project dam structure to provide salmon and steelhead access to historic spawning and rearing habitats in the Crooked River basin and to provide native fish with foraging and migratory opportunities above the project. The fish ladder shall adhere to the National Marine Fisheries Service (NMFS) 2008 Anadromous Salmonid Passage Facility Design Manual.

The Licensee shall also design, construct, operate, maintain and monitor facilities at the Project to increase the normal maximum diversion pool elevation up to 2,07.31 feet National Geodetic Datum 1929. The increased diversion pool elevation will make water available for bypassing juvenile fish around the turbine penstock and for attracting adult fish up through the bypass reach to the fish ladder entrance.

The Licensee shall develop final design plans and specifications for the installation, operation, maintenance, and monitoring of the fish passage facilities in consultation with and for review by the Fish Passage Work Group (FPWG). Specifically, the detailed fish ladder design phases (50 percent and 90 percent completion stages) will be completed in consultation with the FPWG. Final design plans and specifications shall include: (1) final construction drawings; (2) construction schedule; and (3) a preliminary operation and maintenance (O&M) plan that includes daily, above water visual inspections of all areas within the fish ladder that are accessible to fish and annual dewatered fish ladder inspections. The Licensee shall file the final O&M Plan with the Commission within 120 days after construction is completed, following review and approval of the FPWG. The Licensee shall, within 60 days after issuance of the Amended License, provide the final design plans and specifications to the appropriate Fish Agencies for their approval pursuant to their statutory authority.

The Licensee shall, within 120 days after issuance of the Amended License, file the final design plans and specifications with the Commission for approval. When filing final plans and specifications with the Commission, the Licensee shall include documentation of consultation with the FPWG, copies of comments and recommendations, and specific descriptions of how comments and recommendations from FPWG members have been accommodated. If the Licensee does not adopt an FPWG recommendation, the filing shall include its reasons based on project specific information. If the Licensee files final plans and specifications without first obtaining approvals by the appropriate Fish Agencies pursuant to their statutory authorities, the Licensee shall include specific reasons for doing so.

The Commission reserves the right to require changes to the final fish facility design plans and specifications. Any such changes required by the Commission may also require additional approvals by the appropriate Fish Agencies pursuant to their statutory authorities.

The Licensee shall complete construction of the fish passage facilities within two years of Commission approval.

Article 3: **Fish Passage Work Group**

The Licensee shall, within 30 days after issuance of the Amended License, establish and convene a Fish Passage Work Group (FPWG) for the purpose of consulting on all aspects of the Settlement Agreement, associated license articles and the Fish Passage and Protection Plan. The Licensee shall convene the FPWG annually, or more frequently if a majority of the FPWG so desire, by no later than February 1 to review the Bypass Flow Accrual Account Allocation Plan and proposed actions for the coming year. The Licensee shall bear all costs associated with conducting FPWG meetings.

The Licensee shall arrange, administer, and chair all meetings. Upon request of a majority of the FPWG members, the Licensee shall provide a meeting facilitator. The facilitator shall be selected by consensus of the FPWG. The Licensee shall provide no fewer than 14 days prior notice of any meeting, unless otherwise agreed to by the FPWG or required to meet a license deadline or other emergency circumstance.

The Licensee shall, within 30 days of each meeting, provide draft meeting minutes for concurrence by the FPWG prior to final distribution. Meeting minutes will include FPWG action items, a summary of issues discussed, decisions reached, and member concerns.

For fish passage related purposes, consultation or consult means that the Licensee shall obtain the views of, and attempt to reach consensus among members of the FPWG. Consultation does not mean consultation under section 7 of the Endangered Species Act or other federal laws requiring consultation unless specifically provided.

Article 4: Bypass Flow Accrual Account

Upon completion of the fish passage facilities, the Licensee shall establish a Bypass Flow Accrual Account (BFAA). The BFAA will identify “water credits” (in acre-feet) which will be used to identify water available for aiding upstream and downstream fish passage. Water credits will be accrued in lieu of actual stored water, given that the Project has no storage capacity, and turbine discharge will be reduced when exchanging water credits for actual bypass flows. The Licensee shall administer the BFAA for the term of the amended license as follows:

1. <u>Accumulating Credits</u>

The Licensee shall accrue water credits in the BFAA beginning concurrently with the start of Project operations under the new diversion pool elevation and shall continue to accrue water credits in the BFAA for the License Term. Water credits will accrue as a percentage of instantaneous turbine flow (initially 1.53% and hereinafter referred to as the “Accrual Rate”) under all flow conditions up to the maximum controlled hydraulic capacity of the Project. The maximum controlled hydraulic capacity of the Project is initially 1,913 cfs [the sum of hydraulic capacity at new head (estimated at 1,600 cfs), the license required bypass flow (50 cfs), and spring water and ground water accreting into the bypass reach (263 cfs)]. Water credits will not accrue at total river discharge greater than the maximum controlled hydraulic capacity of the Project.

The Licensee shall, within one year of commencing operations at the new diversion pool elevation, verify all estimates used for determining the maximum controlled hydraulic capacity of the Project. The Licensee shall provide this information to the FPWG at least 45 days prior to filing any proposed modifications with the Commission. The Licensee shall not file with the Commission any proposed modifications of the information used to calculate water credits until any disputes raised by the FPWG have been addressed under the dispute resolution provisions of the Settlement Agreement. Upon Commission approval of any modifications to the information used for calculating water credits, the Licensee shall calculate all subsequent BFAA credits pursuant to the new information.

The Licensee shall periodically reassess spring water and ground water accretion estimates throughout the license term as requested by the FPWG. Any future changes recommended by the Licensee pursuant to periodic review of these parameters, will be further approved by the FPWG prior to the Licensee submitting the new information to the Commission. Upon Commission approval, the Licensee shall calculate all subsequent BFAA credits pursuant to the new information.

The Licensee shall calculate all BFAA credits based on: 1) direct measurements of the hourly turbine discharge data and 2) the gage data from USGS Gage No. 14087400, near Culver, Oregon, below Opal Springs.

The Licensee shall accrue water credits in the BFAA at a rate of between 50% and 70% ("Allocation Percent") of the increase in power generation attributable to the head increase at the Project. Adjustments to the Allocation Percent will only occur following each successive 5-year Performance Assessment Interval, and only if necessary, pursuant to the Adaptive Management program. The potential for asynchronous monitoring periods notwithstanding, the BFAA Allocation Percent will not be increased more than one time every five years. Allocation Percent increases above 70% may only occur with the approval of the Licensee.

The Licensee shall, until the turbine performance calculation is modified, accrue water credits at a rate of 2.89% of instantaneous turbine flow [(50% Allocation Percent) X (6.52% increase in power generation) = 2.89% Accrual Rate]. The Licensee shall convert real-time accruals into acre-feet for purposes of developing a BFAA Annual Allocation Plan. The Licensee shall develop the BFAA Annual Allocation Plan in consultation with and for approval by the FPWG. The BFAA Annual Allocation Plan will include a current accounting of BFAA water credits (less any water credits advanced the prior year for emergency purposes); a flow forecast for the upcoming year; and an estimate of the water credits that will be accrued over the coming year. The Licensee shall include the BFAA Annual Allocation Plan in its Annual Reports.

The Licensee shall maintain a record of withdrawal requests and actual discharged bypass flows, and shall provide a monthly status of available BFAA water credits to the FPWG within two business days of a request by Oregon Department of Fish and Wildlife and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWS) ("Fish Managers") (provided that the CTWS is a signatory to the Settlement Agreement). Water credits not used within a given year will be carried over from year to year until expended, but will not extend beyond the term of the Amended License. The Licensee shall include this information in its Annual Reports.

2. Bypass Flow Releases

The Licensee shall provide bypass flows from the BFAA within two business days of receiving a request from the liaison designated by the Fish Managers within the limitations of the approved BFAA Annual Water Plan. The Licensee shall make 10% of the forecasted annual accrual in the BFAA available for emergency use if insufficient water credits are available in the BFAA. Otherwise, only water credits accrued in the BFAA will be available for release. Any water credits advanced to the BFAA by the Licensee will be offset by a debit to the BFAA as soon as possible but by no later than one year from disbursement, unless otherwise agreed to by the Licensee.

The Licensee shall be exempted from providing BFAA flows that would result in a Critical Circumstance, which is potential damage or excess wear and tear to project equipment. The Licensee shall, within one year of initial operations at the new diversion pool elevation and periodically during the term of the amended license, in consultation with the FPWG and supported by engineering concerns, determine specific turbine unit loading that would result in a

Critical Circumstance. If the Licensee determines that a request for flow releases will cause a Critical Circumstance, the Fish Managers may request a lower BFAA flow release that will not cause a Critical Circumstance, or the Fish Managers may request and the Licensee shall shut down the powerhouse and direct all river flows into the bypass reach as long as sufficient water credits are available in the BFAA. The Licensee shall not be required to shut down the powerhouse in response to a BFAA flow request more than one time per week.

If the Project shuts down for other operational, safety, or maintenance reasons resulting in spill, water credits will not be removed from the BFAA.

Article 5: Upstream Fish Passage Monitoring, Data Collection, Fish Passage Performance, and Reporting

The Licensee shall use accepted scientific practices as approved by NMFS, USFWS, BIA, and ODFW for all data collection and monitoring, and shall ensure that data collection standards are being met. The Licensee shall provide raw monitoring data to the FPWG within two business days of a Fish Manager request. The Licensee shall include all data in its Annual Reports.

1. Fish Ladder Monitoring

The Licensee shall, upon completion of the fish passage facilities, continuously monitor the passage of adult fish >12” in length through the fish ladder for the term of the Amended License (Table 1). The Licensee shall identify and enumerate fish migrating through the fish ladder using video, electronic counter and/or adult trapping as determined by the FPWG, to identify species, passage date, and passage time. The Licensee shall provide this information to the FPWG within two business days of a Fish Manager request and shall include all fish passage information (for example, number by species, passage date, and passage time) in its Annual Reports.

2. Fish Migration Delay

The Licensee shall, for the initial five years after the release of adult steelhead or Chinook salmon upstream of the Pelton Round Butte Project, unless otherwise agreed to by the FPWG, implement observational techniques (in addition to radio-telemetry monitoring, as specified in this article) to identify any potential adult fish migration delays in the Project tailrace and bypass reach. The Licensee shall make direct observations on foot, by snorkel and/or through hydroacoustic spot-checks of the Project tailrace and bypass reach at least every two to three days, as determined by the FPWG, during the steelhead and Chinook salmon upstream passage seasons and shall provide this information to the FPWG within two business days of a Fish Manager request. The Licensee shall include all information from these observations in its Annual Reports. The Licensee shall report any indications of fish delay to the FPWG within 24 hours of the observation.

3. Fish Passage Performance

The Licensee shall, for the duration of the three 5-year Performance Assessment Intervals identified in the Adaptive Management program, or until any 5-year Performance Assessment Interval demonstrates that the 97% upstream fish passage Performance Goals have been met for adult steelhead and Chinook salmon, monitor adult steelhead and Chinook salmon passing through the lower Crooked River, Project tailrace, bypass reach, fish ladder, and diversion pool (either as upstream migrants or fish that fall back after passing upstream using the ladder). The Licensee shall calculate the percent passage success for adult steelhead and Chinook salmon as the number of fish that passed upstream through the fish ladder and diversion pool, minus any fish killed during fallback, divided by the number that entered the Project tailrace (after subtracting fish known to have exited the Crooked River or to have spawned successfully below the Project).

The Licensee shall monitor upstream fish passage performance during the initial 5-year Performance Assessment Interval using radio-telemetry. For radio-telemetry, the Licensee shall monitor at least 25 radio-tagged adult salmon (adult steelhead, adult Chinook salmon, or a combination of adult steelhead and Chinook salmon), annually. Should the FPWG make a determination that fewer than 25 radio-tagged adult steelhead and Chinook salmon are expected to enter the Crooked River from downstream radio-tagging studies during any annual monitoring period, the Licensee shall radio tag a sufficient number of adult steelhead and Chinook salmon, if available from a trap located within the Project fish ladder, to make up the anticipated short fall.

The Licensee shall release the radio-tagged fish downstream of the Project tailrace within the Crooked River. The Licensee shall monitor these radio-tagged adult steelhead and Chinook salmon, and any additional adult steelhead and Chinook salmon that are radio-tagged downstream of the Project by other parties, through an array of fixed-station antennae installed, operated, and maintained by the Licensee to record fish movements through the Project tailrace, bypass reach, fish ladder and diversion pool.

The Licensee shall assess the fish passage Performance Objectives during the second and third 5-year Performance Assessment Intervals using external tags and a mark and recapture protocol, or, by agreement of the FPWG, through some other appropriate method.

Once the Licensee has demonstrated, through the results of any of the 5-year Performance Assessment Intervals, that the 97% upstream fish passage Performance Goals for adult steelhead and Chinook salmon have been met, upstream fish passage performance assessment monitoring shall be limited to a one year fish passage performance monitoring assessment every five years to determine if the goals are continuing to be met. If the upstream fish passage Performance Goals for adult steelhead and Chinook salmon fall below the required fish passage Performance Goals, as determined by a one year fish passage performance monitoring assessment, the

Licensee shall resume annual monitoring assessments and Adaptive Management as described in this Amended License.

The Licensee is solely responsible for implementing the upstream fish passage performance monitoring requirements. Costs incurred by the Licensee above an annual amount of $50,000 solely for implementation of the monitoring required in section 3 of this license article to assess the fish passage performance standards may be off-set by a reduction in the BFAA annual Allocation Percent under the following conditions: 1) available monitoring information must demonstrate that the 90% upstream and downstream fish passage Performance Standards for steelhead and Chinook salmon are being met, and will continue to be met under the proposed BFAA reduction; 2) reductions in the BFAA annual Allocation Percent may be up to, and shall not exceed 5% in any one year; and 3) the Licensee shall provide the FPWG an accounting of the capital, expense, and labor costs incurred on an annual basis for upstream fish passage monitoring, and a determination of the value of the BFAA Allocation Percent reduction in then current dollars, to account for any reduction of the annual BFAA Allocation Percent.

At a minimum, the Licensee shall provide an assessment of the following adult steelhead and Chinook salmon metrics in the applicable Annual Reports: 1) total Project passage; 2) percent passage success, number of fallback fish, and cumulative passage timing of steelhead and Chinook salmon; and, 3) travel time through the bypass reach, fish accumulation (if any) within the bypass reach, variation in rates of ladder passage, and the time elapsed from first entering the Project tailrace until exiting the diversion pool.

For bull trout, the Licensee shall provide in its Annual Reports, an assessment of the number, size, and passage timing (diel and seasonal) of bull trout passing through the fish ladder.

Following each 5-year Performance Assessment Interval the Licensee shall, in that year's Annual Report, provide a 5-year assessment of its status in meeting the fish passage Performance Objectives.

TABLE 1 UPSTREAM MONITORING SCHEDULE

Monitoring Term	Monitoring Start Time	
	Upon Completion of Fish Passage Facilities	**Upon Release of Adult Fish at Pelton Round Butte**
Duration of Amended License	Continuous monitoring of fish >12" in length migrating through the fish ladder to identify species, passage date, and passage time.	
Five Years		Implement observational techniques to identify any potential adult fish migration delays in the Project tailrace and bypass reach every other day during the steelhead and Chinook salmon upstream passage seasons.
Duration of Adaptive Management Program		Monitor steelhead and Chinook salmon passing through the lower Crooked River, Project tailrace, bypass reach, fish ladder, and diversion pool, through radio-telemetry or other methods as necessary to assess fish passage Performance Objectives.

Article 6: Downstream Fish Passage Monitoring, Fish Passage Performance, Data Collection, and Reporting

The Licensee shall use accepted scientific practices as approved by NMFS, USFWS, BIA, and ODFW for all data collection and monitoring and shall ensure that data collection standards are being met. The Licensee shall provide raw monitoring data to the FPWG within two business days of a Fish Manager request. The Licensee shall include all data in its Annual Reports.

1. Diurnal, Seasonal, and Inter-Annual Variation

The Licensee shall, for the initial seven years following fish facility construction, or as otherwise agreed to by the FPWG, monitor by acoustic detection, or other appropriate method as agreed to by the FPWG, diurnal, seasonal and inter-annual variation in the relative abundance and timing of juvenile salmonids (particularly smolts) emigrating downstream through Project facilities.

This information is intended to provide the FPWG sufficient information to manage the BFAA for downstream fish passage and to establish migration trends over time. The Licensee shall include annual assessments of juvenile fish relative abundance and emigration timing in its Annual Reports, and shall provide this information to the FPWG within two business days of a Fish Manager request.

2. Fish Passage Performance

The Licensee shall, for the duration of the three 5-year Performance Assessment Intervals required by the Adaptive Management program, monitor at least 25 radio-tagged steelhead smolts annually. The Licensee's monitoring program may utilize radio-tagged juvenile steelhead that are radio-tagged upstream by other parties. Should the FPWG make a determination that less than 25 radio-tagged steelhead smolts will pass through the Project by May 1 of any given year, the Licensee shall tag a sufficient number of smolts to make up the shortfall. The Licensee shall monitor these juvenile steelhead as they enter the diversion pool, enter the turbine penstock or fish ladder, pass over each operable spillway gate, exit the bypass reach, exit the Project tailrace, and exit the lower Crooked River. The Licensee shall include this information in its Annual Reports.

The Licensee shall install, operate, and maintain fixed-station antennae positioned to record these fish movements. Antennae will be capable of differentiating between individual spillway gates, the turbine penstock, tailrace, and bypass reaches, and exit from the Crooked River into Lake Billy Chinook.

Following each 5-year Performance Assessment Interval the Licensee shall, in that year's Annual Report, provide a 5-year assessment of its status in meeting the fish passage Performance Objectives. The Licensee shall calculate percent survival estimates for downstream migrants from aggregated 5-year telemetry data as the number of radio-tagged fish that passed through the Project area to reach Lake Billy Chinook (minus any mortalities) divided by the number that originally entered the Project diversion pool, with possible adjustments to this algorithm dependent on agreement by the FPWG.

TABLE 2 DOWNSTREAM MONITORING SCHEDULE

Monitoring Term	Monitoring Requirements to Begin Upon Completion of Fish Passage Facilities
Seven Years	Monitor by acoustic detection, or other appropriate method, diurnal, seasonal and inter-annual variation in the relative abundance and timing of juvenile salmonids (particularly smolts) emigrating downstream through Project facilities.
Duration of Adaptive Management Program	Monitor at least 25 radio-tagged steelhead smolts annually.

Article 7: Fish Passage Performance Objectives

The Licensee shall strive to achieve the following fish passage Performance Objectives through the implementation of the Adaptive Management program. The License shall be considered in compliance with this license article so long as the fish passage Performance Objectives are met, or the Licensee is working towards meeting the fish passage Performance Objectives through implementation of the Adaptive Management program.

Upstream Fish Passage Performance Objectives:

Species	Standard	Goal
Steelhead and Chinook salmon adults	≥90% successful upstream passage of migratory adults, with ≥90% of those adults that do successfully pass the Project doing so by a specified date each year (date to be determined by FPWG through project evaluations). Fish that perish when falling-back after dam passage will be considered unsuccessful migrants.	≥97% successful upstream passage of migratory adults destined for areas above the Project. Fish that perish when falling-back after dam passage will be considered unsuccessful migrants.
Bull trout adults and sub-adults	≥90% successful upstream passage, with the standard assumed to be met if the standard for steelhead adults is met at the Project.	≥97% successful upstream passage, with the goal assumed to be met if the goal for steelhead adults is met at the Project.

Downstream Fish Passage Performance Objectives:

Species	Standard	Goal
Steelhead and Chinook salmon smolts	≥90% passage survival	≥97% passage survival
Bull trout adults and sub-adults	Assumed to be met if the ≥90% passage survival standard for steelhead smolts is met and levels of upstream passage by bull trout >12" at the Project do not exceed 1,000 fish on an annual basis.	Assumed to be met if the ≥97% passage survival goal for steelhead smolts is met.

Following each 5-year Performance Assessment Interval the Licensee shall, in that year's Annual Report, provide a 5-year assessment of its status in meeting the fish passage Performance Objectives.

Article 8: Adaptive Management

The Licensee shall implement this Adaptive Management program for the term of the Amended License to help it meet or exceed the fish passage Performance Objectives.

The Adaptive Management program includes: (1) increases to the BFAA at specified intervals if the fish passage Performance Objectives are not met; (2) two tiers of fish passage improvement measures (Tier 1 and Tier 2) that may be necessary to improve fish passage efficiency or to meet the fish passage Performance Objectives; (3) Monitoring, Data Collection, and Reporting as required in this amended license; and (4) modification of Project turbine intake trash racks if necessary to address adult steelhead turbine mortality.

The Licensee shall implement the Adaptive Management program in three 5-year Performance Assessment Intervals and shall provide an assessment of its status in meeting the fish passage Performance Objectives following each 5-year Performance Assessment Interval. The Licensee shall continue upstream and downstream fish passage monitoring for the duration of the three 5-year Performance Assessment Intervals regardless of whether it has met the fish passage Performance Objectives. If any of the fish passage Performance Goals have not been met by the end of the third 5-year Performance Assessment Interval, additional fish passage improvement measures and related monitoring activities will be determined by the FPWG, and implemented by the Licensee. The Licensee shall include annual monitoring information and 5-year assessments in its Annual Reports.

1. <u>Implementation</u>

The Licensee shall implement additional fish passage measures based on information collected during project monitoring and the status of achieving the fish passage Performance Objectives. Additional measures are organized into two tiers (Tier 1 and Tier 2 - see part 3 of this license article). The Licensee shall implement specific Tier 1 measures at any time as directed by the FPWG (or as required through Dispute Resolution as defined in the Settlement Agreement) in response to Obvious Fish Passage Problems (for example, indications that upstream or downstream fish migrants are not effectively bypassing the Project) or, in response to any 5-year performance assessment if needed to achieve the applicable fish passage Performance Objective.

If additional Tier 1 measures are directed by the FPWG in response to upstream or downstream Obvious Fish Passage Problems, the Licensee shall implement the measures within one year of FPWG approval, unless otherwise agreed to by the FPWG. With the exception of modifications to Project trash racks, implementation of Tier 1 measures will neither re-start nor increase the then current 5-year Performance Assessment Interval. However, any modifications to Project trash racks will automatically restart the then current 5-year Performance Assessment Interval.

If Tier 1 measures are required to meet an applicable fish passage Performance Objective following a complete 5-year Performance Assessment Interval, the Licensee shall implement the measures as soon as possible but in no case shall implementation take longer than one year unless otherwise agreed to by the FPWG. The next 5-year Performance Assessment Interval shall begin following implementation of the Tier 1 measures. The Licensee shall continue annual monitoring regardless of its status in implementing Tier 1 measures.

The Licensee shall implement Tier 2 measures following the third 5-year Performance Assessment Interval if the fish passage Performance Goals have not been met.

2. Required Actions

Following each 5-year Performance Assessment Interval the Licensee shall, in that year's Annual Report, provide a 5-year assessment of its status in meeting the fish passage Performance Objectives. The assessment will rely upon information collected annually from upstream and downstream fish passage monitoring.

2.1 1st 5-year Performance Assessment Interval: The Licensee shall, following the first 5-year Performance Assessment Interval, take actions in one of the following categories based on the point estimate of the aggregated annual data:

- 97 percent or greater passage effectiveness or survival. No additional Tier 1 measures and no increase to the BFAA Allocation Percent will occur at this time.

  The Licensee may, at its discretion, develop a study of BFAA effectiveness, for approval by the FPWG, to determine whether the BFAA has been over-allocated (less water is needed to meet fish passage Performance Goals or, for resident species, to ensure safe, timely, and effective passage). If it is determined by the FPWG that the BFAA is over-allocated, the Allocation Percent will be reduced consistent with the level of over allocation, upon agreement of the FPWG.

- 90 percent or greater, but less than 97 percent passage effectiveness or survival. The Licensee shall implement applicable Tier 1 measures, as required by the FPWG, in an effort to achieve the Fish Passage Performance Standards.

- Less than 90 percent passage effectiveness or survival. The Licensee shall implement applicable Tier 1 measures, as required by the FPWG, and shall increase the BFAA Allocation Percent to 60%.

- If more than 1,000 bull trout use the ladder annually, and measured performance of downstream steelhead smolt survival is less than 97%, the Licensees shall implement Tier 1 measures as required by the FPWG.

2.2 **2nd 5-year Performance Assessment Interval**: The Licensee shall, following the second 5-year Performance Assessment Interval, take actions in one of the following categories based on the point estimate of the aggregated annual data:

- 97 percent or greater passage effectiveness or survival. No additional Tier 1 measures and no increase to the BFAA Allocation Percent will occur at this time.

  The Licensee may, at its discretion, develop a study of BFAA effectiveness over a range of flow conditions, for approval by the FPWG, to determine whether the BFAA has been over-allocated (less water is needed to meet fish passage Performance Goals or, for resident species, to ensure safe, timely, and effective passage). If it is determined by the FPWG that the BFAA is over-allocated, the Allocation Percent will be reduced consistent with the level of over allocation, upon agreement of the FPWG.

- 90 percent or greater, but less than 97 percent passage effectiveness or survival. The Licensee shall implement all remaining and applicable Tier 1 measures, as required by the FPWG, in an effort to achieve the Fish Passage Performance Standards.

- Less than 90 percent passage effectiveness or survival. The Licensee shall implement all remaining and applicable Tier 1 measures, as required by the FPWG, and shall increase the fisheries BFAA Allocation Percent to 70%.

- If more than 1,000 bull trout use the ladder annually, and measured performance of downstream steelhead smolt survival is less than 97%, the Licensees shall implement Tier 1 measures as required by the FPWG.

2.3 **3rd 5-year Performance Assessment Interval**: The Licensee shall, following the third 5-year Performance Assessment Interval, take actions in one of the following categories based on the point estimate of the aggregated annual data:

- If all Fish Passage Performance Goals have been met: No additional Tier 1 measures and no increase to the BFAA Allocation Percent will occur at this time. The Licensee shall continue monitoring fish passage for the term of the Amended License and shall provide summaries of this monitoring information, and other salmonid data that may be available from other sources within the project area, annually.

The Licensee may, at its discretion, develop a study of BFAA effectiveness over a range of flow conditions, for approval by the FPWG, to determine whether the BFAA has been over-allocated (less water is needed to meet Fish Passage Performance Goals or, for resident species, to ensure safe, timely and effective passage). If it is determined by the FPWG that the BFAA is over-allocated, the Allocation Percent will be reduced consistent with the level of over allocation, upon agreement of the FPWG.

- <u>If one or more of the Fish Passage Performance Goals have not been met:</u> The Licensee shall meet with the FPWG as soon as possible, but by no later than February 1 of the next year, to determine: (1) whether implementation of any remaining Tier 1 measures is likely to meet the applicable Goal; or (2) whether major improvements are required (a "Tier 2 Determination").

    - If the FPWG determines that additional Tier 1 measures are warranted, the Licensee shall implement the relevant measures as soon as possible and shall resume monitoring as described for upstream and downstream fish passage for a period of 3 years. Following this 3-year monitoring cycle, the Licensee shall meet again with the FPWG to determine whether the applicable Goals have been met, or whether additional major improvements are required.

    - If the FPWG determines that Tier 2 major improvements are required, the Licensee shall, in consultation with and subject to the approval of the FPWG, identify specific Tier 2 measures and a necessary monitoring and evaluation plan for implementation. The Licensee shall, within 90 days of this determination, propose an action plan and schedule for implementing the Tier 2 measures. After review and approval by the FPWG, the Licensee shall file the action plan with the Commission for its approval.

    - The Commission reserves the right to require changes to any Tier 2 measure. Any such changes required by the Commission may also require additional approvals by the appropriate Fish Agencies pursuant to their statutory authorities. The Licensee shall implement the Tier 2 measures and the monitoring and evaluation plan upon Commission approval.

- If more than 1,000 bull trout use the ladder annually, and measured performance of downstream steelhead smolt survival is less than 97%, the Licensees shall implement additional measures as required by the FPWG.

3. Tier 1 Measures

Upstream Passage Measures:

- Remove peninsula that currently separates the tailrace from the bypass channel in order to reduce unacceptable adult delay at the powerhouse.
- Construct structures in the bypass channel to concentrate flows and provide necessary cues to help adult migrants reach and find the fish ladder entrance.
- Move rocks and boulders in the bypass reach downstream of the fish ladder entrance to provide for adult passage in most flow conditions.
- Other enhancements to the bypass channel.
- Adjustments or minor ("fit and finish") modifications to the ladder to optimize performance.
- Install and operate behavioral deterrents to fish movement toward and into the Project intake.
- Modify spill gate operations.
- Other measures proposed by the FPWG, and approved by the Licensee.

Downstream Passage Measures:

- Install or modify flow guidance devices on the downstream face of the dam to concentrate flow or otherwise improve smolt survival.
- Other enhancements to the bypass channel.
- Install and operate behavioral deterrents, which could include experimental technologies, to guide fish away from the Project intake.
- Other physical modifications that may be suggested by the FPWG, and agreed to the Licensee, in lieu of additional BFAA water.
- Predation control in the impoundment; the need for which will be determined by periodic assessments as agreed to by the FPWG.
- Modify spill gate operations.
- Other measures proposed by the FPWG, and approved by the Licensee.

4. Trash Rack Modifications

If the adult steelhead or the downstream bull trout fish passage Performance Standard is not likely to be met due to high turbine mortality in any two of three years of a 5-year assessment interval, the Licensee shall modify its trash racks in an effort to reduce adult turbine mortality, unless the FPWG decides otherwise or identifies an alternative solution. The following guidelines will govern trash rack modifications:

- New racks will be located in the existing stop-log slots and will be supplemental to the existing racks unless otherwise agreed to by the Licensee.
- New racks will only be deployed seasonally, during the applicable adult migrations, as determined by FPWG.
- The then current Performance Assessment Interval will restart once the new trash racks are installed.

5. Tier 2 Measures

- Increase water allocated to the BFAA.
- Modify powerhouse turbines to include a more fish friendly configuration.
- Extend the fish ladder upstream into the forebay.
- Install fish barriers or deterrents in the trailrace.
- Install experimental devices in the Project diversion pool to facilitate guidance of fish downstream past the project.
- Other measures proposed by the FPWG, and approved by the Licensee.

The Licensee may, at any time, propose to implement Tier 2 measures. After review and approval by the FPWG, the Licensee shall develop a plan and schedule in consultation with the FPWG and shall implement the proposed measure following all required approvals. Implementation of Tier 2 measures will be followed by a continuation of the Adaptive Management program described above.

Article 9: Annual Report

The Licensee shall file Annual Reports for the term of this Amended License. The Licensee shall, by December 15 annually, provide a draft Annual Report to the FPWG and provide at least 30-days for review and approval. The Annual Report will address all activities within that calendar year and will include: (1) Operations and Maintenance (O&M) relating to the fish passage facilities and planned O&M for the upcoming year; (2) annual BFAA Allocation Plan; (3) Monitoring and Evaluation (M&E) relating to the Adaptive Management program and the Fish Passage and Protection Plan; (4) description of planned monitoring activities for the upcoming year; (5) status of the Adaptive Management program and related measures; (6) the 5-year assessments required by the Adaptive Management program; and (7) any proposed changes to the Fish Passage and Protection Plan.

The Licensee shall file Annual Reports with the Commission by March 1. When filing Annual Reports with the Commission, the Licensee shall include documentation of consultation; copies of comments and recommendations; and specific descriptions of how comments and recommendations from FPWG members have been accommodated. If the Licensee does not adopt a recommendation, the filing shall include its reasons based on Project specific information. If the Licensee files an Annual Report without obtaining concurrence from the FPWG, the Licensee shall include specific reasons for doing so.

The Licensee shall implement planned O&M measures, requests for releases of BFAA accumulated water, M&E measures, and Tier 1 and Tier 2 measures as described in its Annual Reports.

Article 10: Inspection and Notice

The Licensee shall permit members of the Fish Passage Work Group, at any reasonable time, access to, through, and across Project lands and works for the purpose of inspecting fish passage facilities and related records pertaining to the operation of the Project and implementation of the Amended License. The Licensee shall require reasonable notice of such inspections and shall establish reasonable safety and security procedures for parties engaged in such inspections.

Article 11: Abandonment of Anadromous Fish Reintroduction

In the event that the NMFS, U.S. Fish and Wildlife Service, and ODFW, each notify the Commission that all efforts to re-introduce anadromous fish to the Upper Deschutes River Sub-basin have failed and have been discontinued, the Licensee's responsibilities to achieve steelhead and Chinook salmon performance standards shall cease and any associated monitoring and evaluation responsibilities shall terminate. The Licensee shall continue to operate the ladder for use by native resident fish, including bull trout, conduct associated monitoring for native resident fish, and provide water credits to the Bypass Flow Accrual Account for purposes of providing an ongoing benefit to native resident fish. The allocation shall be 25% of the increased hydroelectric potential resulting from the new diversion pool elevation.

The Licensee may, at its discretion, develop a study of BFAA effectiveness over a range of flow conditions, for approval by the FPWG, to determine whether the BFAA has been over-allocated (less water is needed) to meet fish passage needs of resident native fish. If it is determined by the FPWG that the BFAA is over-allocated, the allocation rate will be reduced consistent with the level of over allocation, upon agreement of the FPWG.

Article 12: Revised Exhibits

Within 90 days of the completion of any construction of facilities, modification of project boundaries, or any other action required by this license that results in changes to Exhibits A, F and G, the Licensee shall file for Commission approval revised Exhibits A, F, and G, as appropriate, to show those project facilities and lands as built or modified. The exhibits shall have sufficient detail to adequately delineate the relative location of project features. The Licensee shall submit six copies to the Commission, one copy to the Commission’s Portland Regional Engineer, and one to the Director, Division of Hydropower Administration and Compliance.

Article 13: Review and Approval of Final Plans and Specifications

At least 60 days before starting any license-related construction activities, the Licensee shall submit one copy to the Division of Dam Safety and Inspections, Portland Regional Engineer and two copies to the Commission (one of these shall be a courtesy copy to the Director, Division of Dam Safety and Inspections), of a supporting design report and final contract plans and specifications. Construction may not commence until authorized by the Regional Engineer.

Article 14: Quality Control and Inspection Program

At least 60 days before starting any license-related construction activities, the Licensee shall submit one copy to the Division of Dam Safety and Inspections, Portland Regional Engineer and two copies to the Commission (one of these shall be a courtesy copy to the Director, Division of Dam Safety and Inspections), of the Quality Control and Inspection Program (QCIP) for the Commission's review and approval. The QCIP shall include a sediment and erosion control plan.

Article 15: Cofferdam Construction Drawings

Before starting construction, the Licensee shall review and approve the design of contractor designed cofferdams and deep excavations. At least 30 days before starting construction of the cofferdams, the Licensee shall submit one copy to the Division of Dam Safety and Inspections, Portland Regional Engineer and two copies to the Commission (one of these copies shall be a courtesy copy to the Director, Division of Dam Safety and Inspections), of the approved cofferdam construction drawings and specifications and the letters of approval.

Article 16: Temporary Emergency Action Plan

At least 60 days before starting construction, the Licensee shall submit one copy to the Division of Dam Safety and Inspections, Portland Regional Engineer and two copies to the Commission (one of these shall be a courtesy copy to the Director, Division of Dam Safety and Inspections), of the Temporary Emergency Action Plan (TEAP) for the Commission's review and approval. The TEAP shall describe emergency procedures in case failure of a cofferdam, large sediment control structure, or any other water retaining structure could endanger construction workers or the public. The TEAP shall include a notification list of emergency response agencies, a plan drawing of the proposed cofferdam arrangement, the location of safety devices and escape routes, and a brief description of testing procedures.

Document Content(s)