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Subject: FINAL 2016 Rocky Reach Operations Plan
Date: Tuesday, April 05, 2016 7:14:09 AM
Attachments: [033016 2016 Final Operations Plan.pdf](#)

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Patrick Verhey, Washington Department of Fish and Wildlife
Jason McLellan, Confederated Tribe of the Colville Reservation
Mark Peterschmidt, Washington Department of Ecology
Steve Lewis, US Fish and Wildlife Service

From: Marcie Steinmetz, Water Resources Specialist
Public Utility District No. 1 of Chelan County (Chelan PUD)

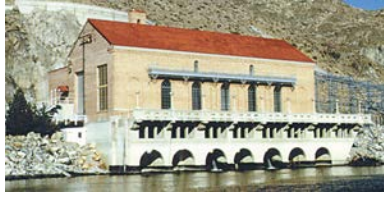
Re: Rocky Reach Hydroelectric Project No. 2145
License Article 402 – FINAL 2016 Operations Plan

In accordance with Article 402 of the Rocky Reach License, Chelan PUD has filed the attached 2016 Final Operations Plan with the FERC. Thank you for your review and comments.

If you have any questions, please do not hesitate to contact me.

Thank you,

Marcie Steinmetz | **Water Resource Specialist**
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March 30, 2016

Honorable Kimberly D. Bose, Secretary
ATTN: OEP/DHAC
FEDERAL ENERGY REGULATORY COMMISSION
888 First Street, NE
Washington, DC 20426

VIA ELECTRONIC FILING

Re: **Rocky Reach Hydroelectric Project No. 2145**
Article 402 – Operations Compliance Monitoring Plan

Dear Secretary Bose:

On February 19, 2009, the Federal Energy Regulatory Commission (Commission) issued the “*Order on Offer of Settlement and Issuing New License*”¹ (License) for the Rocky Reach Hydroelectric Project (Project). License Article 402 requires the Public Utility District No. 1 of Chelan County, Washington (Chelan PUD or Licensee), to file the Operations Plan by February 15 annually for Commission approval. On May 30, 2012, the Commission issued the “*Order Modifying Annual Operations Compliance Monitoring Plan Filing Date Pursuant to Article 402*”² amending the filing date to March 30 beginning 2013.

Therefore, in accordance with the above License requirement, Chelan PUD hereby files the Operations Plan for 2016. The plan includes the following: (a) descriptions of fisheries- and water quality-related operating criteria for the project turbines, the downstream fish passage facility, fishways, spillways, and sluiceways; (b) descriptions of fisheries- and water-quality-related protocols for startup, in-season operation, shutdown, and inspection of the project turbines, the downstream passage facility, fishways (including fish salvage), spillways, and sluiceways; and (c) an annual schedule for operation and inspection of these facilities. There are no operational changes from the previous year identified in this report. However, there are updates to *Section 2.3: Unit Outages* depicting the current repair schedule.

A final draft of this report was sent on February 8, 2016, to the federal, state and tribal resource agency members for 30-day review, which ended March 8, 2016. No comments were received. Appendix F provides the record of consultation during the development of the Operations Plan.

¹ 126 FERC ¶ 61,138

² 139 FERC ¶ 62,162

As this plan requires Commission approval prior to implementation, Chelan PUD respectfully requests a written acknowledgement from your office. Please do not hesitate to contact me regarding any questions or comments you may have.

Sincerely,



Jeffrey G. Osborn
License Compliance Supervisor
jeff.osborn@chelanpud.org
(509) 661-4176

Attached: 2016 Operations Plan

cc: Douglas Johnson (FERC-PRO)
David Lord (FERC-PRO)
Erich Gaedeke (FERC-PRO)

2016 OPERATIONS PLAN
LICENSE ARTICLE 402

FINAL

ROCKY REACH HYDROELECTRIC PROJECT
FERC Project No. 2145

March 30, 2016



Public Utility District No. 1 of Chelan County
Wenatchee, Washington

TABLE OF CONTENTS

TERMS AND ABBREVIATIONS	1
EXECUTIVE SUMMARY	2
SECTION 1: Introduction	3
1.1 Emergency Deviations from the Operations Plan	5
1.2 System Load Shaping.....	6
1.3 Adaptive Management Approach to Fishery Operations	6
SECTION 2: Description of Turbine Operating Criteria and Protocols.....	8
2.1 Turbine Operations	8
2.2 Turbine Operation and Inspection Schedule	8
2.3 Unit Outages	8
SECTION 3: Juvenile Fish Bypass System (JBS).....	9
3.1 Facilities Description	9
3.1.1 Surface Collection System	9
3.1.2 Intake Screen System	9
3.1.3 Bypass Conduit	9
3.1.4 Juvenile Fish Sampling Facility	10
3.2 Operating Criteria and Protocol	10
3.2.1 Operation Schedule	10
3.2.2 Operation Procedures	10
3.2.3 Service Interruptions	10
3.3 Inspection and Maintenance Schedule	10
3.3.1 Juvenile Fish Bypass Daily Inspection Check List (100 degrees).....	10
3.3.2 Scheduled Maintenance.....	11
3.3.3 Unscheduled Maintenance	11
SECTION 4: Description of Spillway Operating Criteria and Protocol.....	12
4.1 Fish Passage Spill Program	17
4.2 Operation and Inspection Schedule	17
4.3 TDG Monitoring and Control	18
SECTION 5: Adult Fishways.....	20
5.1 Facilities Description	20
5.2 Operations Schedule	20
5.3 Operation Criteria	21
5.4 Dewatering and Fish Handling.....	22
5.5 Inspection and Reporting	22
5.6 Maintenance	22
SECTION 6: Dryden and Tumwater Fishways and Traps.....	23
6.1 Dryden Fishway and Trap.....	23
6.1.1 Inspection and Maintenance	23
6.2 Tumwater Fishway and Trap	23
6.2.1 Inspection and Maintenance	24
SECTION 7: References	25

APPENDIX A: 2016 ROCKY REACH JUVENILE FISH BYPASS SYSTEM OPERATIONS PLAN

APPENDIX B: JUVENILE FISH BYPASS DAILY INSPECTION CHECKLIST (100 DEGREES)

APPENDIX C: 2016 FISH SPILL PLAN

APPENDIX D: 2016 ROCKY REACH OPERATIONAL PLAN FOR TOTAL DISSOLVED GAS DURING FISH SPILL SEASON

APPENDIX E: ANNUAL MAINTENANCE LIST FOR ROCKY REACH FISHWAY

APPENDIX F: CONSULTATION WITH STAKEHOLDERS

LIST OF TABLES

Table 1-1. Dates of Project Operations for Fisheries and Water Quality Purposes. 5
Table 4-1. Spilling Schedule for Rocky Reach Dam. (Openings are in feet) 13
Table 4-2. Mean Historical Juvenile Fish Run-timing at Rocky Reach Dam, (Columbia Basin Research website¹)..... 17
Table 5-1. Primary Adult Salmonid Passage Periods by Species at Rocky Reach Dam. 20

TERMS AND ABBREVIATIONS

401 Certification	water quality certification
7Q10	highest seven consecutive day average flow with a 10-year recurrence frequency
CCT	Confederated Tribes of the Colville Reservation
cfs	cubic feet per second
Chelan PUD	Public Utility District No. 1 of Chelan County
Ecology	Washington State Department of Ecology
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FPC	Fish Passage Center
fps	feet per second
GAP	Gas Abatement Plan
GBT	gas bubble trauma
HCP	Habitat Conservation Plan
HCP CC	Habitat Conservation Plan Coordinating Committee
HPU	hydraulic pumping unit
JBS	juvenile bypass system
kcfs	thousand cubic feet per second
LPEs	left powerhouse entrances
License	FERC license for Rocky Reach
MCHCA	Mid-Columbia Hourly Coordination Agreement
MSE	Main spillway entrance
NMFS	National Marine Fisheries Service
NNI	No Net Impact
Project	Rocky Reach Hydroelectric Project
RPE	right powerhouse entrance
RRFF	Rocky Reach Fish Forum
Settlement Agreement	2006 Rocky Reach Comprehensive Settlement Agreement
TDG	total dissolved gas
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
YN	Confederated Tribes and Bands of the Yakama Nation

EXECUTIVE SUMMARY

As required by the Federal Energy Regulatory Commission's (FERC's) License Order, Article 402, for the Rocky Reach Hydroelectric Project No. 2145 (Project), issued February 19, 2009, this Operations Plan describes: (1) fisheries- and water quality-related operating criteria for the project turbines, the downstream fish passage facility, fishways, spillways, and sluiceways; (2) fisheries- and water-quality-related protocols for startup, in-season operation, shutdown, and inspection of the project turbines, the downstream passage facility, fishways (including fish salvage), spillways, and sluiceways; and (3) provides an annual schedule for operation and inspection of these facilities.

The turbines at Rocky Reach are operated as needed to produce electricity and do not have an operation season or schedule. However, during the juvenile fish migration season (April 1 through August 31), Public Utility District No. 1 of Chelan County (Chelan PUD) will prioritize the dispatch of generating units to achieve peak plant operating efficiency as follows: 1, 2, 3, 5, 4, 6, 7, 8, 9, 10, 11 and turbine units 1 and 2 will operate at a soft-limit of 12 to 12.5 thousand feet per second (kcfs) each.

The Rocky Reach Juvenile Fish Bypass System (JBS) will operate continuously from April 1 to August 31 of each year. Operations outside these dates can occur if it is deemed necessary to encompass 95 percent of the juvenile salmon migration based on discussion with the Rocky Reach Habitat Conservation Plan Coordinating Committee (HCP CC).

The Project will provide spill for juvenile salmonid passage to cover 95 percent of the juvenile summer Chinook migration (see Table 4-2, specifically Chinook subyearling) in accordance with the criteria set forth by the HCP CC. Spill levels and durations are correlated with operations necessary for meeting the Habitat Conservation Plan (HCP) juvenile survival standards and the specific passage studies designed to measure attainment of Project survival standards.

Chelan PUD will continue to monitor total dissolved gas (TDG) to evaluate compliance with state water quality criteria.

Adult fishways will be operated from March 1 to December 31 each year. If more time is required to complete critical fishway maintenance during the annual fishway overhaul period (January and February), the fishway outage may begin in December and be extended into March with the agreement of the HCP CC.

SECTION 1: INTRODUCTION

The Rocky Reach Hydroelectric Project (Project) is owned and operated by the Public Utility District No. 1 of Chelan County (Chelan PUD). Chelan PUD received a new license (License) from the Federal Energy Regulatory Commission (FERC) on February 19, 2009, authorizing Chelan PUD to operate the Project dam and powerhouse for a period of 43 years.

The Project consists of a reservoir with a surface area of approximately 8,235 acres and a concrete-gravity dam approximately 130 feet high and about 2,847 feet long (including the powerhouse) that spans the river. The dam consists of:

- a forebay wall, which is integral with the dam and is formed by 10 blocks of various heights and widths between the powerhouse and west abutment;
- a powerhouse approximately 1,088 feet long, 206 feet wide and 218 feet high that includes 11 generating units and a service bay;
- a spillway that is integral with the dam and consists of twelve 50-foot-wide bays separated by 10-foot-wide piers, with flow through each bay controlled by a 58-foot-high radial gate;
- two non-overflow east abutment blocks that are integral with the dam, each 125 feet high by 60 feet wide;
- an east bank seepage cutoff, which is a buried structure that extends roughly 2,000 feet from the east end of the concrete portions of the dam and has a maximum depth of about 200 feet and;
- Dryden weir and Tumwater dams' fish ladders and trapping facilities. (These facilities are located some distance away from the Project on the Wenatchee River).

The Rocky Reach Project includes passage facilities for upstream and downstream migrating fish. The upstream migrant fishway has three main entrances. One entrance is located between spillway bays 8 and 9, a second entrance is at the center of the dam adjacent to powerhouse unit 11, and a third entrance is at the powerhouse service bay between turbine unit 1 and the west shoreline. There are also six submerged orifice entrances in operation; three at each end of the powerhouse. Fish pass from the entrances into fish collection and transportation channels, which converge to guide fish to a pool and weir fish ladder. There is a counting station at the fishway exit located near the west shoreline. Attraction water for the powerhouse fishway entrances is provided by three hydraulic turbine-driven pumps with a total capacity of 3,500 cubic feet per second (cfs). A gravity intake provides additional attraction water for the spillway entrance. The juvenile fish bypass system (bypass system) includes a surface collection system, turbine intake screens and collection system for turbines 1 and 2, a bypass conduit to the tailrace, and a fish sampling facility.

On February 19, 2009, FERC issued its Order on Offer of Settlement and Issuing New License for the Rocky Reach Hydroelectric Project for a term of 43 years to Chelan PUD (License ends February 1, 2052). Article 402 of the License order, *Operations Plan*, requires the following:

Within six months of the issuance date of the license and by February 15 each year thereafter, the licensee shall file for Commission approval an operations plan. The plan shall include, but not be limited to, the following: (a) descriptions of fisheries- and water quality-related operating criteria for the project turbines, the downstream fish passage facility, fishways, spillways, and sluiceways; (b) descriptions of fisheries- and water-quality-related protocols for startup, in-season operation, shutdown, and inspection of the project turbines, the downstream passage facility, fishways (including fish salvage), spillways, and sluiceways; and (c) an annual schedule for operation and inspection of these facilities.

The licensee shall prepare the plan after consultation with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, Washington Department of Fish and Wildlife, Washington Department of Environmental Quality (sic, Washington State Department of Ecology), the Confederated Tribes of the Umatilla Reservation, the Confederated Tribes of the Colville Indian Reservation, and the Confederated Tribes and Bands of the Yakama Nation. The licensee shall include with the plan, copies of comments and recommendations on the completed plan after it has been prepared and provided to the above entities, and specific descriptions of how the entities' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the entities to comment and to make recommendations before filing the plan with the Commission.

The Commission reserves the right to require changes to the plan. Implementation of the plan shall not begin until the plan is approved by the Commission. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

To comply with Article 402 of the License, Chelan PUD includes its annual Fish Spill Plan with the filing of the annual Operations Plan. The annual filing date of the Operations Plan was revised from February 15 to March 30, to better coincide with development and required HCP CC approval of the annual Fish Spill Plan.

On December 8, 2009, FERC approved and modified the 2009 (first) Operations Plan and on December 3, 2010 approved the 2010 Operations Plan. This document constitutes Chelan PUD's eighth Operations Plan, and is substantially the same as the 2015 Operations Plan. Changes made to the 2016 Operations Plan are limited to specifics associated with the Juvenile Fish Bypass Operations Plan and Fish Spill Plan.

The License requires the continued implementation of the HCP and associated Anadromous Fish Agreement, which was incorporated into the License by Ordering Paragraphs E and F. The License also includes several provisions of the 2006 Rocky Reach Comprehensive Settlement Agreement (Settlement Agreement). It is from this document that the Rocky Reach Fish Forum (RRFF) is established to work with Chelan PUD in implementation of Chapters 2, 3, 4, 5, and 6 of the Comprehensive Plan, relating to Water Quality, White Sturgeon (*Acipenser transmontanus*), Bull Trout (*Salvelinus confluentus*), Pacific Lamprey (*Entosphenus tridentatus*), and Resident Fish, respectively. The RRFF shall also assist Chelan PUD in coordinating Chelan PUD's work plans and efforts with the HCP CC through joint membership and/or other such arrangements as the RRFF and the HCP CC may mutually devise.

The operations of the Project with regards to upstream and downstream fish passage are guided by the terms and conditions of the HCP. The HCP is a 50 year agreement, ending in 2052, to protect four species (five stocks) of anadromous salmonids by implementing a combination of fish bypass systems, spill, off-site hatchery programs and evaluations, and habitat restoration work conducted in mid-Columbia tributary streams. This agreement was enacted by Chelan PUD with the United States Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the Washington Department of Fish and Wildlife (WDFW), the Confederated Tribes and Bands of the Yakama Nation (YN), and the Confederated Tribes of the Colville Reservation (CCT). The HCP describes the year round Project operations necessary to protect Endangered Species Act (ESA) listed Upper Columbia River steelhead (*Oncorhynchus mykiss*) and Upper Columbia spring Chinook (*O. tshawytscha*) as well as non-listed late-run (summer/fall) Chinook salmon (*O. tshawytscha*), sockeye salmon (*O. nerka*), and coho salmon (*O. kisutch*) (collectively referred to as "Plan Species"). A HCP CC, consisting of one member from each of the signing Parties, oversees the implementation of the HCP. The HCP CC will be used as the primary means of consultation between Chelan PUD and the other parties in connection with the conduct of studies and the implementation of measures set forth in the HCP.

The operation of the Project with respect to water quality is guided by the terms in the Washington State Department of Ecology’s (Ecology) 401 Certification, which has been included as Appendix A of the License.

This Operations Plan provides details of operations and procedures necessary to safely pass fish through the Project facilities to meet the standards agreed upon in the HCP. Additionally, this Operations Plan provides the details of operations and procedures that are taken to meet water quality standards, particularly with relation to operations of the spillway to meet both fish passage requirements and abatement of TDG resulting from spillway operations. Table 1-1 provides a schedule of Project operations for fisheries and water quality purposes at Rocky Reach.

The Operations Plan will be revised as necessary by Chelan PUD to incorporate changes to Project operations and maintenance as a result of new facilities, changes in operational procedures, or information gained from evaluations. Future revisions may incorporate changes adopted through ESA consultations or through agreement of the HCP CC and RRFF.

Table 1-1. Dates of Project Operations for Fisheries and Water Quality Purposes.

Project Name	Start Date	End Date
Juvenile Fish Bypass System Operation	April 1	August 31
Juvenile Fish Bypass Evaluation (Species composition, fish condition evaluation)	April 1	August 31
Juvenile Fish Bypass Maintenance	Sept. 1	March 31
Summer Fish Spill* (subyearling Chinook)	May/June	August*
Dissolved Gas Monitoring	Year round	
Adult Fishway Operation**	March 1	Dec. 31
Adult Fishway Maintenance**	Jan. 2	March 1
*Start and end * dates may vary according to in-season run-timing for each species. **Months of fishway operation and maintenance may vary according to scope of maintenance work for a given year.		

1.1 Emergency Deviations from the Operations Plan

Operational emergencies may occur that could require projects to deviate temporarily from the Operations Plan. To the extent possible, these deviations will be conducted to minimize impacts to fish and TDG and will be coordinated with the RRFF and HCP CC. Normally, coordination occurs prior to an action. However, if an emergency situation requires immediate attention, coordination will occur as soon as possible after the action.

Chelan PUD will file a report with FERC within 10 days of any emergency situation that requires a temporary deviation from this Operations Plan. The report will describe the emergency situation, the operational changes implemented as a result of the emergency, a schedule for resuming normal operation, and adverse environmental impacts associated with the emergency conditions, and any comments from the RRFF or the HCP CC.

Additionally, when emergency deviations from the Operations Plan occur, any adverse environmental effects including increased TDG levels, gas bubble trauma (GBT) or fish mortality; will be reported to Ecology's Central Regional Office, Water Quality Program.

1.2 System Load Shaping

The Project is a participant in the Mid-Columbia Hourly Coordination Agreement (MCHCA). The MCHCA operates the seven dams from Grand Coulee through the Priest Rapids Dam to meet system load requests while minimizing the reductions in head that could result if the projects were operated independently, using active storage in their reservoirs to meet individual loads. Efficient load following is accomplished by matching daily load requests to the movement of water released from Grand Coulee as it passes sequentially through the downstream projects, while maintaining the forebays of these projects as near full as possible. Limitations to operations flexibility at any of the projects with active storage result in greater fluctuations in discharge and forebay elevation at the remaining coordinated projects.

The MCHCA is also an important tool used to minimize spill (and resultant TDG levels) and headwater losses during special operations, including fish survival studies, spill gate testing, and repair and maintenance of turbine generating units at each of the projects.

To the extent it reduces TDG, Chelan PUD will avoid spill by continuing to participate in the MCHCA, or any successor agreement to which Chelan PUD is a party.

1.3 Adaptive Management Approach to Fishery Operations

The adaptive management approach that is used to direct Project fishery operations is clearly defined in the Rocky Reach Settlement Agreement, Page 4:

“Adaptive Management” is an iterative and rigorous process used to improve decision-making in the face of uncertainty. In the context of the Rocky Reach relicensing, it is intended to improve the management of natural resources affected by ongoing Project operations, in order to achieve desired goals and objectives as effectively and efficiently as possible, within the provisions of this Agreement. The process has seven steps:

- a) Develop initial hypotheses regarding any ongoing Project impacts and potential remedial measures;*
- b) Develop goals and objectives for addressing any such impacts;*
- c) Develop and implement appropriate and reasonable measures in accordance with an established schedule;*
- d) Develop or identify monitoring and evaluation methodologies for determining whether such goals and objectives have been achieved;*
- e) Monitor and evaluate the implementation of such measures and their effectiveness toward achieving such goals and objectives;*
- f) Review monitoring and evaluation efforts; and*
- g) Confirm that such goals and objectives have been achieved or, if not achieved, evaluate additional or revised measures, including those previously considered in the Comprehensive Plan, and implement any additional or revised appropriate and reasonable measures, or explain why such goals and objectives cannot be achieved. If such goals and objectives have not been achieved, the RRFF may reevaluate and revise such goals and objectives.*

The HCP is a programmatic approach developed by Chelan PUD and the fisheries agencies and tribes for reducing and eliminating the effects of the Project on salmon and steelhead. The objective of the HCP is to achieve No Net Impact (NNI) for each Plan Species (spring, summer and fall Chinook salmon, sockeye salmon, coho salmon, and steelhead) affected by the Project on the schedule set out in the HCP and to

maintain the same for the duration of the HCP. NNI consists of two components: 1) 91 percent combined adult and juvenile fish project survival achieved by Project improvement measures implemented within the geographic area of the Project, 2) 9 percent compensation for unavoidable project mortality provided through hatchery and tributary programs, with seven percent compensation provided through hatchery programs and two percent compensation provided through tributary programs. The Parties intend these actions to contribute to the rebuilding of tributary habitat production capacity and basic productivity and numerical abundance of Plan Species. Adaptive management, as detailed in the HCP, provides for on-going modification of management practices to respond to new information and scientific development. Adaptive management will yield prescriptions that may vary over time.

The Settlement Agreement includes management plans that include goals and a process for developing protection, mitigation, and enhancement measures for species not covered by the HCP (white sturgeon, Pacific lamprey, bull trout, and resident fish species).

SECTION 2: DESCRIPTION OF TURBINE OPERATING CRITERIA AND PROTOCOLS

2.1 Turbine Operations

The powerhouse contains 11 vertical-axis turbines. The turbines incorporate many fish-friendly design features, including minimal gaps between each blade's leading edge and the hub. At rated capacity and head, units 1 through 7 discharge 14,600 cfs each and units 8 through 11 discharge 17,200 cfs each.

Generally, the turbines are operated as needed for producing electricity and do not have an operation season or schedule. However, during the juvenile fish migration season, Chelan PUD will prioritize the dispatch of generating units to promote optimal fish guidance efficiency of the Bypass System, with unit priority for starts and stops, as 1, 2, 3, 5, 4, 6, 7, 8, 9, 10, and 11. During juvenile fish passage season (April 1 through August 31) turbine units 1 and 2 will operate at a soft-limit of 12 to 12.5 kcfs each to minimize high velocities at the vertical barrier screens in those two turbine units subsequent diversion into the JBS.

2.2 Turbine Operation and Inspection Schedule

Operation of the turbines at the Project is automated, including decisions to start, stop and adjust the output of the 11 generating units to achieve maximum efficiency. The Project's automated functions are backed up with around the clock on duty plant operators who monitor operations and can override computer control if needed.

Turbines are inspected as necessary based on hours operated and other associated stresses. To the extent possible, maintenance of priority units will be scheduled outside of fish passage periods. Because units 1 and 2 provide attraction water flows they are important components of the bypass system; long-term outages of the two units will be avoided during the juvenile fish passage season.

Additionally, to minimize TDG uptake in the tailrace, Chelan PUD will, to the extent practicable, avoid maintenance outages during the high flow periods. When possible, maintenance will be scheduled based on predicted flows.

2.3 Unit Outages

Units C-9 and C-11 are running in an interim repaired status. C-8 has been off line since January 21st of 2015, completion of repairs is scheduled for October of 2016. C-10 became unavailable due to coil failures on June 24th of 2015. Repairs are estimated to be completed by April of 2016.

The remaining large units will follow as listed below.

❖ Expected final repair schedule:

~ Unit C-9	January 9, 2017 through February 11, 2018
~ Unit C-11	February 12, 2018 through April 17, 2019
~ Unit C-10	April 18, 2019 through May 21, 2020

Additionally unit C-5 will be removed from service to perform routine overhaul maintenance as well as installation of a new exciter and governor control upgrades. It will be removed from service July 11, 2016 and return to service September, 2016.

SECTION 3: JUVENILE FISH BYPASS SYSTEM (JBS)

3.1 Facilities Description

Following more than 15 years of testing and prototype operation, Chelan PUD constructed the permanent JBS in 2002 and began operation of that system at Rocky Reach in 2003 to guide migrating fish before they enter the powerhouse and divert them downstream past the dam. The bypass system is a key component of the HCP signed by Chelan PUD, NMFS, USFWS, WDFW, CCT, and the YN to meet HCP juvenile fish survival standards.

The juvenile fish passage facilities at the Project consist of three parts: a surface collector, an intake screen system in units 1 and 2, and a bypass conduit, which includes a juvenile fish sampling facility.

For a more detailed discussion of bypass system operations, please see Appendix A: 2016 Rocky Reach Juvenile Fish Bypass Operations Plan.

3.1.1 Surface Collection System

The surface collector attracts the majority of the migrating juvenile fish into the bypass conduit. The surface collector is located in the forebay of the Rocky Reach powerhouse adjacent to the forebay wall, service bay, and turbine units 1, 2, and 3. The surface collector structure comprises three major sub-parts: the entrance, the de-watering structure, and the pump station. Trash racks, trash handling system and screen cleaners are provided to facilitate management of debris. The migrating fish pass over two surface collector control gates and are delivered to the bypass conduit by way of the surface collector weir box.

3.1.2 Intake Screen System

Studies indicate the second most likely path for migrating juvenile fish is through the turbine intakes for units C1 and C2. The intake screen system is designed to divert the majority of these fish and safely move them to the bypass conduit.

The intake screen system extends from the turbine intakes, up the gatewell slots, and into the gatewells of turbine units 1 and 2. The intake screen system consists of diversion and vertical barrier screens and 12 weir boxes (two boxes per intake slot, three slots per unit, and two units). The fish are guided by diversion screens in each intake, are routed up the gate well slot along the vertical barrier screens, and then pass over slide gates into the weir boxes. At normal forebay elevation (703 to 707 ft normal operating range), a total of 120 cfs flows through each weir box. Flow from each of these weir boxes is directed into the gatewell collection piping and routed to the bypass conduit which consists of a combination of flumes and large diameter pipes.

3.1.3 Bypass Conduit

The bypass conduit is a combination of flumes and large diameter pipes and is designed to collect 240 cfs from the surface collector and 120 cfs from the intake screen system. Transport pipes from the surface collector and intake screen system penetrate the forebay wall at two separate locations and merge at a junction just south of the intake screen system pipe's exit from the forebay wall. The bypass conduit is 4,600 feet long and ranges from 90 to 108 inches in diameter. The bypass conduit originates south of the forebay wall and service bay and proceeds north along the tailrace deck. The bypass conduit then curves to the east across the center dam area and continues along the spillway to the Eastbank area. As soon as the bypass conduit reaches the east bank, it curves to the south and runs along the top of the bank, until it finally swings to the southwest for its last 500 feet. The bypass conduit terminates with an outfall structure. The velocity at the outfall terminus is 26 feet per second (fps) with impact velocities ranging from 40 to 48 fps depending on the tailrace elevation.

3.1.4 Juvenile Fish Sampling Facility

The juvenile fish sampling facility is comprised of a sampling screen, sampling flume, adult fish separator and return pipe, juvenile fish flume, raceway, and support building. The sampling screen is designed to be deployed into and retracted from the bypass conduit by large hydraulic cylinders. When deployed, the sampling screen will divert 20 to 25 cfs from the bypass conduit flow; this flow is then reduced to four cfs. Adult fish are separated automatically from the juvenile fish. Adults are returned to the bypass conduit by means of the adult fish return pipe; juvenile fish fall between the bars of a separator and are delivered to the raceway by way of a flume. Juvenile fish are processed at the support building and returned to the bypass conduit or transported to other sites if needed for studies.

3.2 Operating Criteria and Protocol

3.2.1 Operation Schedule

The bypass system will operate continuously from April 1 to August 31, but may be extended as determined by the HCP CC beyond August 31. Operations outside these dates may occur if it is deemed necessary to encompass 95 percent of the juvenile salmon and steelhead run based on decisions by the HCP CC.

3.2.2 Operation Procedures

The bypass system has been designed to provide fish guidance and bypass at river flows ranging from 0 to 425 kcfs, forebay elevations ranging from 703 to 707 feet, and tailwater elevations ranging from 609 to 636 feet. The surface collector is operated to maintain a constant velocity of 2.85 feet per second at the entrance. At a normal forebay elevation of 703-707 feet, approximately 6,000 cfs is drawn into the entrance. After flowing through two dewatering channels, the 6,000 cfs is reduced to a bypass flow of 240 cfs at normal forebay elevation. A series of 36 screen cleaners sequentially remove debris from the surface collector dewatering screens. The diversion and vertical barrier screens in turbine units 1 and 2 will be cleaned routinely with a mobile intake screen cleaner. Cleaning will occur frequently enough to maintain the proper differential across the vertical barrier screens and to prevent descale/injury of migrating juvenile fish. Debris buildup will be monitored with a camera mounted to the screen cleaner; this monitoring will enable the cleaning schedule to be adjusted based on the debris load in the river. Slide gate settings (associated with weir boxes and the intake screen system) are controlled automatically to maintain a flow of 120 cfs from the gatewell depending on forebay elevation. Contingencies are in place to manually operate any of the automatic systems, if the need arises.

3.2.3 Service Interruptions

The JBS is taken out of operation at the end of the juvenile fish bypass season (i.e. after August 31) for fall/winter shutdown and annual maintenance. The JBS may also be removed from service due to unforeseen emergency repairs during the fish migration season. A fisheries biologist will be on-site for coordination and oversight of any maintenance activities during the April 1 to August 31 operating season.

3.3 Inspection and Maintenance Schedule

3.3.1 Juvenile Fish Bypass Daily Inspection Check List (100 degrees)

Chelan PUD has developed a Juvenile Fish Bypass Daily Inspection Check List (Check List) (Appendix B) for days when air temperatures exceed 100 degrees. Implementation of this Check List begins on April 1. The Check List must be performed by the end of each shift each day when temperatures are at or exceed 100 degrees. All hydraulic hoses and their associated cylinders and hydraulic pumping units (HPUs) will be inspected for leaks. Hoses will be inspected for signs of cracking or abrasions on the hose jackets, bulging, kinking, or any signs of imminent failure.

3.3.2 Scheduled Maintenance

Scheduled maintenance of the bypass system will occur in the off-season, which typically runs from September through March of each year. At this time, the various systems that comprise the JBS will be inspected; worn and/or broken parts will be repaired or replaced.

In 2015, Chelan PUD completed hydraulic hose replacements on the JBS at the bypass conduit and sampling facility. Additional hydraulic hose replacement in the headgate slot of C-2 will be replaced in the fall of 2016.

Additionally, Chelan PUD will begin a 7-year replacement cycle for the hoses remaining on the system that were not hard plumbed.

3.3.3 Unscheduled Maintenance

If unscheduled maintenance will cause an outage of the bypass system during the juvenile fish migration season, Chelan PUD's biologists will inform the HCP CC of the problem. If the problem is an emergency and immediate action must be taken, then the HCP CC will be informed as soon as possible. If the problem is not an emergency, but serious enough that action will need to be taken during the migration season, Chelan PUD will coordinate efforts with the HCP CC.

SECTION 4: DESCRIPTION OF SPILLWAY OPERATING CRITERIA AND PROTOCOL

The Project's gated spillway allows regulation of flows and headwater levels in the Project reservoir. The spillway structure is oriented roughly perpendicular to the flow of the river. The spillway section consists of twelve 50 foot wide bays separated by 10 foot wide piers. The crest of the ogee spillway section is at elevation 650 feet. Flow through each bay is controlled by a 58 foot high radial gate. Each gate is operated by a stationary hoist and is equipped for remote operation from the control room in the Project powerhouse.

Spillway releases to pass water in excess of turbine capability for load requirements, or for fish passage, are controlled by computer. The Project's automated functions are backed up with around the clock, on duty plant operators who monitor operations and can override computer control if needed. When the headwater level exceeds operator set maximum points, gates are automatically opened to pass the excess flow.

Spill gates are opened to create a tailrace pattern of turbulent water, the edges of which lead toward the adult fishway entrances. This spill pattern was designed to provide favorable guidance conditions for adult migrant salmon and steelhead. This spill pattern and alternate patterns were tested and it was determined this pattern was as good as, if not better than the alternate patterns (Schneider and Wilhelms, 2005). The same pattern (Table 4-1) is used for juvenile fish passage spill. During spill operations, whether for juvenile fish passage, TDG management, or for other purposes, the gates are operated via a computer automated system that follows the spill pattern.

During fish passage spill operations, the sequence and amounts of gate opening can also be adjusted to maximize the effectiveness of the water being spilled, both for juvenile fish passage and adult fish attraction. Based on the daily spill memo sent by the Chelan PUD Spill Coordinator by 5:00 PM., the plant operators input into the system the volume of spill, start time, and end time requested. On occasion the daily spill volumes are revised later in the day based on flows from Grand Coulee and Chief Joseph dams. The computer then determines, based on the program, which gates to open and how far.

For spill other than designated fish passage spill, the gates can be operated either automatically with the above mentioned program or manually.

Table 4-1. Spilling Schedule for Rocky Reach Dam. (Openings are in feet)

Total Feet of Gate Open	Gate 2	Gate 3	Gate 4	Gate 5	Gate 6	Gate 7	Gate 8	Estimated flow in cfs
2							2	4334
3							3	6501
4					2		2	8668
5					2		3	10835
6					3		3	13002
7			2		2		3	15169
8			2		3		3	17336
9			3		3		3	19476
10	2		2		3		3	21640
11	2		3		3		3	23804
12	2		3		3	2	2	25968
13	2		3		3	2	3	28132
14	2		3		3	3	3	30296
15	2		3	2	3	2	3	32460
16	2		3	2	3	3	3	34624
17	2		3	3	3	3	3	36788
18	2	2	3	3	2	3	3	38124
19	2	2	3	3	3	3	3	40242
20	2	2	3	4	3	3	3	42360
21	2	3	3	4	3	3	3	44478
22	2	3	3	4	4	3	3	46596
23	2	3	3	5	4	3	3	48714
24	2	3	4	5	4	3	3	50832
25	2	3	4	5	4	4	3	52950
26	2	3	4	5	4	4	4	55068
27	2	3	5	5	4	4	4	57186
28	2	3	5	5	5	4	4	59304
29	2	3	5	5	5	5	4	61422
30	2	3	5	6	5	5	4	63540
31	2	3	5	6	5	5	5	65658
32	2	3	5	6	6	5	5	67776
33	2	4	5	6	6	5	5	69894
34	2	4	5	6	7	5	5	72012
35	2	4	6	6	7	5	5	74130
36	2	4	6	6	7	6	5	76248
37	2	4	6	6	7	6	6	78366
38	2	4	6	6	8	6	6	80484
39	2	4	6	7	8	6	6	82602

Total Feet of Gate Open	Gate 2	Gate 3	Gate 4	Gate 5	Gate 6	Gate 7	Gate 8	Estimated flow in cfs
40	2	4	6	7	8	7	6	84720
41	2	5	6	7	8	7	6	86838
42	2	5	7	7	8	7	6	88956
43	2	5	7	7	9	7	6	91074
44	2	5	7	7	9	8	6	93192
45	2	5	7	8	9	8	6	95310
46	2	5	8	8	9	8	6	97428
47	2	5	8	9	9	8	6	99546
48	3	5	8	9	9	8	6	101664
49	3	6	8	9	9	8	6	103782
50	3	6	8	9	10	8	6	105900
51	3	6	8	10	10	8	6	108018
52	3	6	8	10	10	9	6	110136
53	3	6	9	10	10	9	6	112254
54	3	6	9	10	11	9	6	114372
55	3	6	9	11	11	9	6	116490
56	3	7	9	11	11	9	6	118608
57	3	7	10	11	11	9	6	120726
58	3	7	10	11	11	10	6	122844
59	3	7	11	11	11	10	6	124962
60	3	7	11	12	11	10	6	127080
61	4	7	11	12	11	10	6	129198
62	4	8	11	12	11	10	6	131316
63	5	8	11	12	11	10	6	133434
64	5	8	11	12	11	11	6	135552
65	6	9	11	12	11	11	6	137670
66	6	9	11	12	11	11	6	139788
67	7	9	11	12	11	11	6	141906
68	7	9	12	12	11	11	6	144024
69	8	9	12	12	11	11	6	146142
70	8	10	12	12	11	11	6	148260
71	9	10	12	12	11	11	6	150378
72	9	11	12	12	11	11	6	152496
73	9	11	12	12	12	11	6	154614
74	9	11	12	12	12	12	6	156732
75	9	12	12	12	12	12	6	158850
76	9	12	13	12	12	12	6	160968
77	9	12	13	13	12	12	6	163086
78	9	12	13	13	13	12	6	165204

Total Feet of Gate Open	Gate 2	Gate 3	Gate 4	Gate 5	Gate 6	Gate 7	Gate 8	Estimated flow in cfs
79	9	13	13	13	13	12	6	167322
80	9	13	13	13	13	13	6	169440
81	10	13	13	13	13	13	6	171558
82	10	13	14	13	13	13	6	173676
83	10	13	14	14	13	13	6	175794
84	10	13	14	14	14	13	6	177912
85	10	14	14	14	14	13	6	180030
86	10	14	14	14	14	14	6	182148
87	11	14	14	14	14	14	6	184266
88	11	14	15	14	14	14	6	186384
89	11	14	15	15	14	14	6	188502
90	11	14	15	15	15	14	6	190620
91	11	15	15	15	15	14	6	192738
92	11	15	15	15	15	15	6	194856
93	12	15	15	15	15	15	6	196974
94	12	15	16	15	15	15	6	199092
95	12	15	16	16	15	15	6	201210
96	12	15	16	16	16	15	6	203328
97	12	16	16	16	16	15	6	205446
98	12	16	16	16	16	16	6	207564
99	12	16	16	16	16	16	7	209682
100	12	16	16	16	16	16	8	211800
101	12	16	17	16	16	16	8	213918
102	12	16	17	17	16	16	8	216036
103	12	16	17	17	17	16	8	218154
104	12	17	17	17	17	16	8	220272
105	12	17	17	17	17	17	8	222390
106	13	17	17	17	17	17	8	224508
107	13	17	18	17	17	17	8	226626
108	13	17	18	18	17	17	8	228744
109	13	17	18	18	18	17	8	230862
110	13	18	18	18	18	17	8	232980
111	13	18	18	18	18	18	8	235098
112	14	18	18	18	18	18	8	237216
113	14	18	19	18	18	18	8	239334
114	14	18	19	19	18	18	8	241452
115	14	18	19	19	19	18	8	243570
116	14	19	19	19	19	18	8	245688
117	14	19	19	19	19	19	8	247806

Total Feet of Gate Open	Gate 2	Gate 3	Gate 4	Gate 5	Gate 6	Gate 7	Gate 8	Estimated flow in cfs
118	15	19	19	19	19	19	8	249924
119	15	19	20	19	19	19	8	252042
120	15	19	20	20	19	19	8	254160
121	15	19	20	20	20	19	8	256278
122	15	20	20	20	20	19	8	258396
123	15	20	20	20	20	20	8	260514
124	15	20	20	20	20	20	9	262632
125	15	20	20	20	20	20	10	264750
126	15	20	21	20	20	20	10	266868
127	15	20	21	21	20	20	10	268986
128	15	20	21	21	21	20	10	271104
129	15	21	21	21	21	20	10	273222
130	15	21	21	21	21	21	10	275340
131	16	21	21	21	21	21	10	277458
132	16	21	22	21	21	21	10	279576
133	16	21	22	22	21	21	10	281694
134	16	21	22	22	22	21	10	283812
135	16	22	22	22	22	21	10	285930
136	16	22	22	22	22	22	10	288048
137	17	22	22	22	22	22	10	290166
138	17	22	23	22	22	22	10	292284
139	17	22	23	23	22	22	10	294402
140	17	22	23	23	23	22	10	296520
141	17	23	23	23	23	22	10	298638
142	17	23	23	23	23	23	10	300756
143	18	23	23	23	23	23	10	302874
144	18	23	24	23	23	23	10	304992
145	18	23	24	24	23	23	10	307110
146	18	23	24	24	24	23	10	309228
147	18	24	24	24	24	23	10	311346

Notes:

- 1) The estimated flow values are only an estimate. Flow values are dependent on actual headwater (and possibly how far the gate is open).
- 2) The table only accounts for gates that are under SCADA control (2-8).
- 3) Other gates could be opened manually, which would change total flow.

4.1 Fish Passage Spill Program

Since 2003, the University of Washington has been contracted to provide Chelan PUD with run-timing predictions for spring and summer out migrating salmon and steelhead using the Program RealTime juvenile fish run-time forecasting model. Program RealTime provides daily forecasts and cumulative passage percentiles for steelhead, yearling Chinook, sockeye, and subyearling Chinook at both Rocky Reach and Rock Island dams. The program enables the Chelan PUD to better predict the date when a selected percentage of these species will pass each project and to determine when to initiate spring and summer fish spill. The program utilizes daily fish counts from the juvenile fish sampling facility at Rocky Reach and the bypass trap at Rock Island. Estimates of the program’s forecast error in daily run projections will be calculated and displayed with the daily predictions at the University of Washington’s Columbia Basin Research website page, “Inseason Forecasts Methods and Information”¹.

Spill will be provided for subyearling (summer) Chinook salmon passage to cover 95 percent of the run at each of the projects in accordance with the criteria set forth in the HCP. Spill levels and durations are correlated with operations necessary for meeting the HCP juvenile fish survival standards and the specific passage studies designed to measure attainment.

Table 4-2. Mean Historical Juvenile Fish Run-timing at Rocky Reach Dam, (Columbia Basin Research website¹).

Species	Passage Dates						
	<i>First</i>	<i>5%</i>	<i>10%</i>	<i>50%</i>	<i>90%</i>	<i>95%</i>	<i>Last</i>
Chinook Yearling	4/01	4/20	4/26	5/12	5/26	5/29	8/4
Steelhead	4/2	4/28	4/30	5/10	5/24	5/30	8/22
Sockeye	4/8	5/10	5/12	5/17	5/23	5/25	8/14
Chinook Subyearling	5/24	6/3	6/6	7/5	8/2	8/10	9/21

Appendix C provides information on annual operations related to the spillways, including annual juvenile fish spill program details.

4.2 Operation and Inspection Schedule

Spillways are operated on the schedule outlined above when spilling solely for juvenile fish passage. Spill required for other reasons, such as passing inflows in excess of powerhouse capacity or generation requirements may occur on an as-needed basis throughout the year, but rarely outside of the May to July snowmelt period. Inspections generally occur between May and October every year and are coordinated with spill requirements.

¹.The website for the University of Washington, School of Aquatic & Fishery Sciences, Columbia Basin Research, Inseason Forecasts for the Snake and Columbia Rivers is currently located at <http://www.cbr.washington.edu/inseason/>.

4.3 TDG Monitoring and Control

The state water quality criteria TDG is 110 percent of saturation at ambient temperature and pressure, except when inflows to the Project exceed the seven-day, 10-year average maximum flow level (7Q10). During the juvenile salmon passage season (April 1 through August 31), Ecology establishes a special fish passage water quality standards exemption for the Snake and Columbia rivers to aid in fish passage over hydroelectric dams when consistent with an Ecology approved Gas Abatement Plan (GAP). Per the exemption, TDG must not exceed an average of 115 percent as measured in the forebay of the next downstream dams and must not exceed an average of 120 percent as measured in the tailraces of each dam. These averages are measured as an average of the twelve highest consecutive hourly readings in any one day, relative to atmospheric pressure. Additionally, a maximum TDG one hour average of 125 percent must not be exceeded during spill for fish passage.

Chelan PUD operates the Project in a manner to avoid spill as much as possible, while meeting the juvenile fish passage and survival standards set forth in the HCP and Fish Management Plans. When spilling for fish or due to excess inflow or generation needs, the spillway is operated using gate settings that have been shown to limit TDG production and meet fish passage requirements (Schneider and Wilhelms, 2005). These gate settings are consistent with Section 5.4(1)(b) of the 401 Certification, which states “manage spill toward meeting state water quality criteria for TDG during all flows below 7Q10 levels, but only to the extent consistent with meeting the passage and survival standards set forth in the HCP and Fish Management Plans.....”

Under the Operational Plan for TDG (Appendix D), the Project’s operations personnel will monitor the TDG levels hourly. If the previous six-hour average TDG level in the tailrace at the bypass outfall is at or above 120 percent, or the instantaneous TDG level is at or above 125 percent, the voluntary spill volume will be reduced by three kcfs, or as necessary to achieve an instantaneous TDG level below 120 percent. The new spill volume will be monitored for an hour. If the next six-hour average TDG level is not less than 120 percent, the spill will be reduced by another two kcfs and monitored for an hour. The cycle continues, with the spill level reduced by two kcfs until the average TDG level of the previous six-hour period is less than 120 percent and remains at less than 120 percent through the next full hour. If the instantaneous TDG drops below 118 percent for one full hour, the spill will be increased by two kcfs and monitored. The objective is to maintain as much of the spill level scheduled for fish passage operations as possible, without exceeding the tailrace TDG numeric criteria.

If the TDG level in the forebay of Rock Island Dam exceeds 115 percent, the Rock Island operations personnel will notify Rocky Reach operations personnel immediately. If the TDG level in the Rock Island forebay is greater than 115 percent and the TDG level in the forebay of Rocky Reach is less than 115 percent, the voluntary spill volume at Rocky Reach will be reduced by three kcfs for two hours. If, after two hours of reduced spill, the Rock Island forebay TDG levels are still above 115 percent, the spill will be reduced another two kcfs. If, subsequently, the instantaneous TDG level in the forebay of Rock Island is less than 113 percent, spill will be increased to the level necessary to comply with the TDG level of 115 percent. Since the TDG level in the Rock Island forebay is affected by mixing of powerhouse flows with spillway flows at the Rocky Reach Project, Project operations personnel may develop additional protocols to adjust spill levels based on changes in powerhouse flow levels.

To track Project compliance during fish spill (April 1 through August 31) and non-fish (September 1 through March 31) seasons, Chelan PUD monitors TDG levels at three locations: one in the forebay of Rocky Reach Dam, one in the tailrace of the dam; and one in the forebay Rock Island Dam (the next downstream project). TDG levels are recorded at 15-minute intervals and are averaged into hourly readings for use in daily and 12-hour averages, as well as daily high values. The hourly average data is forwarded to the United States Army Corps of Engineers (USACE), Columbia River Basin Water Management Division on an hourly basis and posted on their site on their website. The data can be found

on their website by navigating from the USACE home page to the Columbia River Basin Water Management Division web page. From this location, select the Rocky Reach Project from the map and select TDG, Water Quality Data².

During the non-fish spill season Chelan PUD utilizes the standard spill pattern (gates 2 through 8) as necessary. Chelan PUD has no defined mechanism, other than operating generating resources to minimize spill, of achieving 110 percent during non-fish spill periods. Chelan PUD minimizes spill outside of juvenile fish passage times by participating in the MCHCA, and by careful planning of turbine unit outages and other activities to avoid reducing hydraulic capacity of the powerhouse during time periods when inflows to the Project are highest.

². The website for the United States Army Corps of Engineers, Columbia River Basin Water Management Division, Rocky Reach Dam, Water Quality Data, TDG is currently located at http://www.nwd-wc.usace.army.mil/ftppub/water_quality/tdg/#RRDW Website locations are subject to change. Please contact USACE at (206) 761-0011 for general questions.

SECTION 5: ADULT FISHWAYS

5.1 Facilities Description

Adult fish facilities provide upstream passage for both anadromous and native resident fish species at the Project. These facilities consist of a fishway with two right powerhouse entrances (RPEs) and two left powerhouse entrances (LPEs), powerhouse collection and transportation channels, a spillway tunnel, a middle spillway entrance (MSE), and a fish ladder. The LPEs are located at mid-dam between the powerhouse and spillway. The RPEs are located on the south end of the powerhouse. The fishway includes a counting station on the right bank of the river.

The adult fish passage facilities include three turbine-driven propeller-type pumps that supply attraction water from the tailwater of the Project for the powerhouse fishway entrances, the spillway entrance, and the six orifice gates that are operated along the powerhouse collection channel. Additional gravity-flow water can be supplied at the MSE to maintain the agreed upon criteria for that entrance. The collection, left powerhouse, and spillway channels merge in the junction pool area, which transitions into the transportation channel that guides fish to the lower end of the fish ladder. The fish ladder exit is located on the right bank of the river.

Construction activities and associated modification in operations have potential for impact on adult fish passage at the Project. Construction schedules and activities will be reviewed in advance to limit this potential. Activities that have a high probability of affecting passage will be scheduled during nighttime hours. However, activities will be scheduled to minimize potential effects to adult Pacific lamprey passage.

5.2 Operations Schedule

For operation and maintenance purposes, the primary fish passage season is considered to be April through November. Primary passage periods by species are included in Table 5-1. Adult fish facilities will be operated from March 1 to December 31 each year. If more time is required to complete critical fishway maintenance during the annual fishway overhaul period, the fishway outage may encompass the month of December in addition to January and February. Chelan PUD will notify the HCP CC as soon as possible in the process and request the additional time. Chelan PUD's annual goal is to have the fishway back in service by March 1. If unforeseen events or circumstances arise during the maintenance period which could extend the fishway outage beyond March 1, Chelan PUD will again notify the HCP CC and request an extension beyond March 1.

Table 5-1. Primary Adult Salmonid Passage Periods by Species at Rocky Reach Dam.

Species	Passage Period
Spring Chinook*	Mid-April to mid-late June
Summer Chinook*	Mid-late June to early September
Fall Chinook*	Early September to November
Steelhead	April to March
Coho	September to November
Sockeye	Late June to early September
* For accounting purposes and based on historical run timing, the spring Chinook run occurs from April 15 to June 23, summer Chinook from June 24 to September 1, and fall Chinook from September 2 to November 15.	

5.3 Operation Criteria

Below are the operation criteria for Rocky Reach Dam fish facilities.

- a. **Adult fishway:** Water depth over weirs will be maintained at 1.0 to 1.2 feet.
- b. **Transportation Channel (Between trifurcation pool and ladder):** A transportation velocity of 1.5 to 4.0 feet per second (fps) (preferably 2.0 fps) shall be maintained in the channel and the lower end of the fish ladder which is below tailwater elevation.
- c. **Entrances:**
 1. General: A 1.0-foot minimum head will be maintained.
 2. RPE: Rotary gates at RPE1 and RPE2 shall be fully open.
 3. LPE: LPE1 and LPE3 shall be continuously open.

Submerged weir crest elevation at the RPEs and LPEs for the following tailwater elevations shall be at or below:

<u>Tailwater Elevation (ft)</u>	<u>Submerged¹Weir Crest Elevation (ft)</u>
615.0	603.5
620.0	606.5

During periods of high tailwater (elev. 621.0 or above) the gates are set to maintain a depth of 10-12 feet.

4. Orifice Entrances: The following six orifice entrances shall be open: CC1, CC2, CC3, CC16, CC18, and CC20.
5. MSE: Open May 1 through October 31. One gate (MSE 1) is permanently closed. One gate (MSE 2) is permanently open.

Submerged weir crest elevations at MSE 2 for the following tailwater elevations shall be at or below:

<u>Tailwater Elevation (ft)</u>	<u>Submerged Weir Crest Elevation (ft)</u>
621.5	604.5
625.0	605.3

- d. **Trashracks:**
 1. Ladder Exit and Attraction Water Intake Trashracks: Visible buildup of debris shall be removed immediately.
 2. Picketed Leads at Counting Window: Visible buildup of debris shall be removed immediately.
- e. **Staff Gauges and Water Level Indicators:**
 1. Gauges and indicators shall be readable at all water levels encountered during passage periods.
 2. Staff gauges or water level indicators shall be located upstream and downstream from entrances, and at a convenient location for viewing along the fishway.
 3. Staff gauges and/or water level indicators shall be consistent with panel board water surface readings in the fishway control room.
 4. Water level indicators shall be maintained such that they are in continuous operation.

¹During periods of high tailwater (elev. 621.0 or above) it has been found that to keep a 1-foot differential at the LPEs and RPEs, gate depths cannot be set at the elevation listed. The depth that the gates are set at is generally between 10.0 and 12.0 feet. This has been coordinated with the Fish Passage Center.

5.4 Dewatering and Fish Handling

The Project's adult fish facilities are dewatered for annual maintenance during the maintenance season (approximately January 2 to March 1). On rare occasions, dewatering has been needed during the fish migration season to address emergency repairs. Although every effort is made to allow fish to leave the facilities volitionally, rescue and evacuation of some fish is typically required.

To facilitate volitional exiting by fish, the upper fishway section is dewatered three to four days ahead of the lower fishway. Orifice gates and ladder entrances in the lower fishway will remain open during this time, so that fish are able to leave the facility.

When fish evacuation is necessary, a Project biologist and a lead Fishway attendant will be on site to coordinate and oversee fish salvage and handling. They will ensure that proper procedures are followed, and the equipment needed to safely evacuate the fish is on hand. The Project biologist will determine where the rescued fish are to be returned to the river. The release location may be closest to the point of rescue, which is usually the tailrace. However, adult salmon, steelhead, and lamprey will be released in the forebay.

The evacuation of fish that are listed as threatened or endangered is a priority. However, the goal is to successfully relocate all fish to the river in good physical condition.

5.5 Inspection and Reporting

Chelan PUD's fishway attendants conduct two walk-throughs of the Rocky Reach fishway per day. A daily report is logged using information from the morning walk-through. The adult fish passage facilities are also inspected monthly by WDFW personnel. The Fish Passage Center (FPC) provides monthly reports covering inspections by WDFW as well as a year-end report.

5.6 Maintenance

Scheduled maintenance for the adult fishway will occur in the off-season from January 2 to March 1. The annual list of items that are checked is noted in Appendix E. Fishway attendants also record additional punch list items to address as they discover them throughout the fish passage season.

If unscheduled maintenance must occur during the fish passage season that results in the need for an outage of the attraction water system, the HCP CC will be consulted. Historically, nighttime outages have been preferred. However, potential effects of nighttime outages to adult Pacific lamprey passage will be considered, prior to initiating unscheduled maintenance activities, to the greatest extent practicable.

SECTION 6: DRYDEN AND TUMWATER FISHWAYS AND TRAPS

The Dryden and Tumwater dams are located at river miles 17.6 and 32, on the Wenatchee River, respectively. The Wenatchee River is a tributary of the Columbia River, with the confluence located approximately 5.3 miles downstream of Rocky Reach Dam. The Dryden and Tumwater facilities are owned and operated by Chelan PUD.

Chelan PUD uses the fish ladders and traps at these facilities to provide passage and to collect broodstock for its salmon and steelhead hatchery program, which is required pursuant to the HCP and used for the Rock Island project. This is the only connection between these fish ladders/trapping facilities and the Rocky Reach Project, and they serve no other purpose related to the Rocky Reach Project. However, because ongoing activities at these facilities are required by the License as mandated by USFWS' incidental take statement, the fish ladders and trapping facilities at Dryden and Tumwater have been made Project facilities through Ordering Paragraph (B)(2) and Article 204 of the License.

6.1 Dryden Fishway and Trap

At Dryden left and right bank fishways, the start of fishway operations and operations in general are based on river flows and the need for alternative fish passage routes. At Dryden left bank fishway, the fishway is opened for fish passage when river flow declines below six kcfs (headgates are removed). At Dryden right bank, the threshold is also six kcfs. The fishway attendants may open the fishways during slightly higher flows, if they observe that fish are beginning to have difficulty in migrating over the spillway (due to a declining hydrograph). The fishways remain in continuous operation throughout the year. When river flow reaches six kcfs or greater, head gates are deployed, at the discretion of the fishway attendants, to prevent the influx of sand and sediment.

The Dryden fish traps operate from July 1 through the end of November (or until the required number of coho and steelhead/Chinook are collected for the Yakama Nation and Eastbank Hatchery's broodstock programs, respectively). Both traps are operated continuously on a weekly basis, Sunday night through Friday afternoon. WDFW personnel operate the traps from July through August. Yakama Nation personnel operate the traps from September through November. Adult summer Chinook, steelhead and coho are collected at the Dryden fish traps.

6.1.1 Inspection and Maintenance

Site visits for operation vary throughout the operating year, from as few as three times per week to twice daily visits. Inspections of the ladder (including fishway hydraulics), attraction water intake screens, trashracks, and staff gauges are conducted during these site visits. Daily monitoring of weather and river flow conditions is necessary to determine when additional site visits are required to keep the facility operating within the established criteria.

Initial maintenance (prior to start-up) occurs before trapping operations commence in the summer. In addition, PUD mechanics normally conduct an annual structural inspection in the late spring. Winterization of the trapping facilities is conducted immediately following the conclusion of fish trapping operations for the year. The general purpose of winterization is to protect the facilities from freezing temperatures and damage due to ice formation.

6.2 Tumwater Fishway and Trap

The Tumwater fishway operates year round, with the exception of 1) the annual overhaul period (generally one week in February), and 2) river flow of 10 kcfs or greater at which point head gates are deployed. WDFW, the Yakama Nation, and USFWS trap adult steelhead, spring Chinook, summer Chinook, sockeye, and coho from mid to late-February through mid-December (or until weather

conditions prohibit trap operations). During this period, the trap is collecting fish 24 hours per day, seven days per week from approximately mid-February to 15 July and from 1 September until mid-December. From 16 July to 31 August, the trap is operated three days/week for up to 16 hours/day (not to exceed 48 hours per week). From mid-February until 31 May, the trap is passively operated, i.e. fish are removed from the trap hopper by WDFW personnel one to two times per day. As the numbers of spring Chinook increase (approximately late May), the trap is actively operated, and fish continually processed, with WDFW personnel on site from dawn to dusk (1 June to 15 July). If the median passage time through both PIT tag antennas in the middle fishway is greater than 48 hours, trapping will cease and fish will be allowed to exit via the upper fishway, bypassing the trap. As steelhead numbers decrease in the winter (late November/early December), the trap is passively operated until freezing temperatures bring an end to trap operations. From approximately mid-December to mid-February, no trapping operations occur. Fish move through the fishway and are captured on video.

6.2.1 Inspection and Maintenance

Site visits for operation vary throughout the operating year, from as few as three times per week to daily visits. Inspections of the ladder (including fishway hydraulics), attraction water intake screens, trashracks, staff gauges, fishway entrance gates, and pump intake and fish trap screens are conducted during these site visits. Daily monitoring of weather and river flow conditions is necessary to determine when additional site visits are required to keep the facility operating within the established criteria.

An annual inspection of the fish trapping facilities is performed during the fishway overhaul period in February.

SECTION 7: REFERENCES

- Adeniyi, R. and T. W. Steig. 1999. Hydroacoustic evaluation of the behavior of juvenile Salmon and steelhead approaching the two surface collectors and the powerhouse of Rocky Reach dam during spring of 1998. Report by Hydroacoustic Technology, Inc. to Chelan Co. PUD, Wenatchee, Wash.
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- Steig, T.W., R. Adeniyi, and V. Locke. 1997. Hydroacoustic evaluation of the fish passage through the powerhouse, the spillway, and the surface collector at Rocky Reach Dam in the spring and summer of 1997. Report by Hydroacoustic Technology, Inc. to Chelan Co. PUD, Wenatchee, Wash.

***APPENDIX A: 2016 Rocky Reach Juvenile Fish Bypass System
Operations Plan***

2016 Rocky Reach Juvenile Fish Bypass System Operations Plan

Final Plan

Prepared By:

Lance Keller

Public Utility District No. 1 of Chelan County
P.O. Box 1231
327 North Wenatchee Avenue
Wenatchee, Washington 98801

January 2016

Introduction

The Public Utility District of Chelan County (District) constructed and installed a permanent fish bypass system (FBS) in 2002/2003. The bypass system is designed to guide juvenile salmon and steelhead away from turbine intakes at Rocky Reach Dam. The system consists of one surface collector entrance (SC) and the intake screen (IS) system in turbine units 1 and 2. Please refer to Mosey (2004) for a detailed description of the bypass production system.

Studies and data collection at the Rocky Reach FBS fall under one of two general categories “Standard Operations” or “Special Operations” for bypass evaluations. Activities and data collection under standard operations include day to day sampling of run-of-river (ROR) fish to evaluate run timing, species composition, and fish condition after passage. Special operations may include additional sampling time to supply fish for marked fish releases.

2016 Evaluation Requirements

Run-of-river fish collected at the Juvenile Sampling Facility (JSF) to evaluate and provide fish for the following:

1. Run timing of target species:
 - a. Provide standardized juvenile capture rate data to supplement Program RealTime (UW) run-timing predictions
 - b. Guide decisions about initiating summer fish spill

2. Fish species composition:
 - a. Guide decisions about starting or stopping spill
 - i. Currently summer fish spill occurs at Rocky Reach (9% of the daily average river flow).

3. Origin of fish stocks and identification of marked individuals:
 - a. PIT tags
 - b. Fin clips

4. Fish condition:
 - a. Ensure that the bypass system remains safe for migrating juvenile salmon and steelhead by evaluating:
 - i. Descale: 20% or more scale loss on either side
 - ii. Injury: Scratches, bruises, or hemorrhages
 - iii. Mortality: Any fish dead on arrival to sampling facility

2016 Study Methods

For more information about the study methods please refer to Mosey (2004).

Standard Operations:

1. Sampling Periods (1 April to 31 August):
 - a. Monday through Sunday
 - b. Collections Times

- i. 30 minute maximum (**or**)
 - i. 0800-0830
 - ii. 0900-0930
 - iii. 1000-1030
 - iv. 1100-1130
 - ii. Target number of fish
 - i. 350 spring species
 - ii. 125 summer species
- 2. Fish Condition:
 - a. First 100 fish of each species are examined for condition:
 - i. Descale
 - ii. Injury
 - iii. Mortality
- 3. Species Composition:
 - a. ROR fish collected are enumerated by species
 - b. Collect data for Program RealTime to determine start and end of spill
 - c. Currently summer fish spill occurs at Rocky Reach.
- 4. Origin of fish stocks and identification of marked individuals:
 - a. PIT tags
 - b. Fin clips

Special Operations:

- 1. Marked Fish Releases (Prior 1 April):
 - a. Prior to the 1 April system start-up, hatchery yearling Chinook will be used for marked fish releases to determine if the JFBS is causing descale, injury, or mortality.
 - i. Releases will be conducted with hatchery summer chinook prior to the 1 April start date to determine if the JFBS is working properly and to help isolate potential sources of descale, injury, and mortality.
 - ii. Fish (n = 100/release) of varying sizes will be randomly selected from hatchery chinook. Only those with no scale loss or injury will be marked.
 - iii. Marked fish will be systematically released at locations upstream of the sampling screen in the bypass system and into both intake screens in units C1 and C2.
 - iv. If potential problems are identified, resolve problems by 1 April system start-up.
- 2. Marked Fish Releases (1 April to 31 August):
 - a. A phased approach will be used to evaluate the descaling rate, injury rate, and mortality rate of fish passing through the bypass system. We

- developed a sampling protocol and threshold percentages (Table 1) for descale, injury and mortality that will trigger study phases.
- b. Identify “ambient” rates of descale, injury and mortality.
 - c. Once the ambient rate is estimated and if further sampling shows descale problems continuing at 5%, (3% for injury, 2% for mortality) *above* ambient level for three consecutive samples.
 - i. If variable rates of descale, injury or mortality do occur between species, then collection of yearling chinook, sockeye, or steelhead may be necessary for marked releases.
 - ii. Fish (n = 100/release) of varying sizes will be randomly selected at the juvenile facility and only those migrants with no scale loss or injury will be marked.
 - iii. Marked fish will be systematically released at locations upstream of the sampling screen in the bypass system until the problem area is isolated.
 - d. Identify circumstances when we would refer to the HCP Coordinating Committee.
 - e. The District will consult with the Coordinating Committee if any abnormal fish conditions (within values outlined in Table 1) are observed in the sample population.

Table 1. Flow diagram of phased approach and threshold values for conducting marked-fish releases in the *juvenile bypass system at Rocky Reach Dam (Skalski and Townsend 2003)*

	Phase 1		Phase 2		Phase 3		Phase 4
<i>Threshold</i>		5% initl		A*+5%		A*+15%	
Descale	Index sampling for for descale rate	→	Mark-releases to est. ambient descale	→	In-system mark-releases to isolate descale problem	→	refer to HCP Coord. Comm.
<i>Threshold</i>		3% initl		A*+3%		A*+10%	
Injury	Index sampling for for injury rate	→	Mark-releases to est. ambient injury	→	In-system mark-releases to isolate injury problem	→	Temp. bypass shutdown refer to HCP Coord. Comm.
<i>Threshold</i>		2% initl		A*+2%		A*+4%	
Mortality	Index sampling for for mortality rate	→	Mark-releases to est ambient mortality	→	In-system mark-releases to isolate mortality problem	→	Temp. bypass shutdown refer to HCP Coord. Comm.

A* = Ambient percentage

3. Collection of Bull Trout:
 - a. Document:
 - i. Fork Length and weight measurements
 - ii. Condition (descale, injury, or mortality)

- b. Allow to recover, then release

Daily Protocol for Fish Collection

Standard Operations:

1. Deploy sampling screen at beginning of each hour (0800, 0900, 1000, 1100 hours).
2. Using direct enumeration to count fish entering the sampling facility
3. Collect for 30 minutes **or** until approximately 350 spring migrants/125 summer migrants have been collected, whichever comes first. **RETRACT SCREEN IF 200 TO 300 FISH ARE COLLECTED IN FIRST TWO MINUTES.**
4. Retract screen when time period or target number of fish has been reached.
5. Determine species composition of all collected fish in the hourly sample.
6. Scan/examine each fish for PIT tags, fin clips, and acoustic tags.
7. Evaluate fish condition (first 100 fish per species).
8. If needed, collect and hold fish for marked releases (Special Operations).
9. Return to step 1 for next sample period. After the 1100 hour sample, go to step 11.
10. See Special Operations
11. Allow anesthetized fish (examined for species composition and fish condition) to recover in the facility's holding tank for at least 1.5 hours.

Special Operations:

1. If fish are collected for marked fish releases, verify that the required number of target species has been set aside from the four sample periods.
2. If the required number of fish are not collected by the 1100 hour sample period, deploy the sampling screen and repeat steps 2 and 4 under standard operations.
3. Scan/check all anesthetized fish for PIT and acoustic tags.
4. Collect and hold the fish at the facility for transport and/or marking (marked fish releases).
5. Determine species composition for any remaining anesthetized fish and scan for PIT tags.
6. After fish have been collected to meet study needs, estimate the number of fish remaining in the raceway (by species to the extent practical), record the number, and immediately release the fish back into the bypass pipe.
7. Return to step 11 under Standard Operations.

Contingencies:

1. If, after start-up of the bypass system, we encounter any unforeseen problem(s) with fish collection, we will immediately consult with the HCP Coordinating Committee on how to correct the problem(s).
2. If we accumulate many fish during a collection period (e.g. just after a hatchery release), we will only handle/sample the number of fish needed to satisfy the study requirements and then immediately release the remaining fish back into the bypass pipe.

3. If we accumulate many fish during each “index” sample period, we will only evaluate species composition in the first three periods. In the final period, we will evaluate descale and injury, regardless of the number of fish. However, we will be attentive to any injury or descale that may be present among the fish in each of the first three periods. We need to allow enough time (between samples) to gather all species composition information, so that we have representative information on daily passage.

Diversion Screen and Trashrack Cleaning (Units 1 and 2):

During the last week of March, the trashracks in front of Units 1 and 2 (six intakes total) will be cleaned by divers and clammed to remove any dislodged debris. The trash rack cleaning will be repeated as differentials increase across the racks due to debris load. A mid-season cleaning will be scheduled in June. Starting 1 April, the vertical barrier and diversion screens (IS system) will be cleaned one to two times per week or as needed with an automated screen cleaner. Careful observation of trash build up will also be monitored and the screens will be cleaned on a more regular basis if warranted. Frequency of the cleanings may increase depending on debris load during spring run-off and aquatic plant load in the summer. The District will log each screen cleaning, and in the event of high descaling/injury in a single sample, the vertical barrier and diversion screens will be inspected prior to releasing marked fish.

Discussion

The 2016 biological studies at Rocky Reach will encompass the following: 1) a continuing evaluation of the juvenile bypass system, and 2) a daily sampling program to monitor fish passage for run timing. Representatives of various research agencies and the HCP Coordinating Committee will be consulted about the development of detailed study plans and protocols. A time line showing important activities and deadlines for these activities has been developed and is presented in Table 2.

Table 2. Tasks and deadlines for the Rocky Reach 2016 biological evaluations.

Task	Deadline
Present 2016 study plan to Committee	Winter 2015-2016
Committee discussion/comments on study plan	Jan. 27, 2016-Mar. 24, 2016
Pre-season JFB operations testing (marked fish releases prior to 1 April)	March 15, 2016-March 31, 2016
Begin biological evaluation of JFB	April 1, 2016
Complete 2016 biological evaluation	August 31, 2016
Present 2016 evaluation report to Committee	December 31, 2016
Committee comments on 2016 report	February 1, 2017
Present 2016 report to Committee	March 1, 2017

****Tasks printed in bold text require action by the HCP Coordinating Committee.**

References

Mosey, T. R., S. L. Hemstrom, and J. R. Skalski. 2004. Study Plan for the Biological Evaluation for the Rocky Reach Fish Bypass System-2004. Chelan County Public Utility District, Wenatchee, Washington.

***APPENDIX B: Juvenile Fish Bypass Daily Inspection Checklist
(100 Degrees)***



SITE RECORD SHEET
RR - JFBDICL - 001

PROJECT:
LOCATION:
ITEM NO.

REFERENCE DRAWINGS:

REVISION
1

PAGE
1 of 3

Juvenile Fish Bypass Daily Inspection Check List (100 degrees)

This daily inspection check list must be performed by the end of each shift each day when temperatures are at or exceed 100 degrees. Inspect ALL hydraulic hoses and their associated cylinders and HPUs for leaks and check off when completed. On the hoses, look for signs of cracking or abrasions on the hose jackets. Look for bulging, kinking or any signs of imminent failure. Make notes of any areas of concern.

The completed sheets need to be turned in to the Rocky Reach Operations Superintendent immediately for review. Complete SRS (Site Record Sheets) will be scanned and linked to the annual JFB operations admin work order.

Trash rakes and Trash racks

- 1.2.2. North trash rake cylinders and hoses _____ Note: _____
North trash rake HPU _____ Note: _____
- 1.2.4. South trash rake cylinders and hoses _____ Note: _____
South trash rake HPU _____ Note: _____

Trash Handling System

- 1.3.1. Local Control panel and Hydraulic Cabinet _____ Note: _____
- 1.3.2. Trash pusher cylinder and hoses _____ Note: _____
- 1.3.3. Trash hopper lift cylinder and hoses _____ Note: _____

Screen Cleaners

- 2.2.1. SC LCP 1, cylinders and hoses _____ Note: _____
- 2.2.2. SC LCP 2, cylinders and hoses _____ Note: _____
- 2.2.3. SC LCP 3, cylinders and hoses _____ Note: _____
- 2.2.4. SC LCP 4, cylinders and hoses _____ Note: _____
- 2.2.5. SC LCP 5, cylinders and hoses _____ Note: _____
- 2.2.6. SC LCP 6, cylinders and hoses _____ Note: _____
- 2.2.7. SC LCP 7, cylinders and hoses _____ Note: _____
- 2.2.8. SC LCP 8, cylinders and hoses _____ Note: _____
- 2.2.9. SC LCP 9, cylinders and hoses _____ Note: _____
- 2.2.10. SC LCP 10, cylinders and hoses _____ Note: _____
- 2.2.11. SC LCP 11, cylinders and hoses _____ Note: _____
- 2.2.12. SC LCP 12, cylinders and hoses _____ Note: _____
- 2.2.13. SC LCP 13, cylinders and hoses _____ Note: _____
- 2.2.14. SC LCP 14, cylinders and hoses _____ Note: _____
- 2.2.15. SC LCP 15, cylinders and hoses _____ Note: _____
- 2.2.16. SC LCP 16, cylinders and hoses _____ Note: _____



SITE RECORD SHEET
RR - JFBDICL - 001

PROJECT:	REFERENCE DRAWINGS:	REVISION
LOCATION:		1
ITEM NO.		PAGE 2 of 3

Juvenile Fish Bypass Daily Inspection Check List (100 degrees)

SC Hydraulic Pressure Units and Control Gates

- 2.3.1. SC HPU 1 _____ Note: _____
- 2.3.2. SC HPU 2 _____ Note: _____
- 2.4. SC Control Gates and Weirbox Flush Gate Hoses _____ Note: _____
- 2.4.1. GC LCP 1 _____ Note: _____
- 2.4.2. SC North Control Gate Cylinder and Hoses _____ Note: _____
- 2.4.3. SC South Control Gate Cylinder and Hoses _____ Note: _____
- 2.4.4. Weir Box Flushing Gate _____ Note: _____
- 2.7. SC Ring Follower Gates _____ Note: _____
- 2.7.1. GC LCP 2 (Also controls for the IS Ring Follower) _____ Note: _____
- 2.7.2. SC RFG guard gate _____ Note: _____
- 2.7.3. SC RFG service gate _____ Note: _____
- 2.8. SC Bypass Control Gate _____ Note: _____
- 2.8.1. GC LCP 3 _____ Note: _____
- 2.8.2. SC Bypass Control Gate _____ Note: _____
- 2.9. SC Fish Screen Gate _____ Note: _____
- 2.9.1. GC LCP 5 (Also controls for IS Fish Screen Gate) _____ Note: _____
- 2.9.2. SC Fish Screen Gate _____ Note: _____
- 2.9.3. IS Fish Screen Gate _____ Note: _____

IS Barrier Screens (C-1)

- 4.3.2. VBS Upper Panels and Hoists _____ Note: _____
- 4.4. C1 Weir Boxes and Weir Gates _____ Note: _____
- 4.5. C1 Knife Gates _____ Note: _____

IS Barrier Screens (C-2)

- 5.3.2. VBS Upper Panels and Hoists _____ Note: _____
- 5.4. C2 Weir Boxes and Weir Gates _____ Note: _____
- 5.5. C2 Knife Gates _____ Note: _____

Intake Screens - Joint Systems

- 6.1. IS Hydraulic Pressure Unit _____ Note: _____
- 6.5. IS Ring Follower Gate (Controls are in SC system) _____ Note: _____
- 6.6. IS Bypass Control Gate _____ Note: _____
- 6.6.1. GC LCP 4 _____ Note: _____
- 6.6.2. IS bypass control gate and operator _____ Note: _____

APPENDIX C: 2016 Fish Spill Plan

2016 Fish Spill Plan

Rock Island and Rocky Reach Dams

Public Utility District No. 1 of Chelan County

Prepared By:

Thad Mosey
Fisheries Biologist

Public Utility District No. 1 of Chelan County
Wenatchee, Washington

Final
January 29, 2016

Introduction and Summary

In 2016, Public Utility No. 1 of Chelan County (Chelan PUD) will implement spill operations for fish passage at the Rock Island and Rocky Reach and projects. Spill timing and spill percentages are specified by the anadromous Habitat Conservation Plans (HCP) for each respective project. Chelan PUD conducted juvenile project survival studies from 2002 through 2011 at Rocky Reach and Rock Island under varying spill levels in order to achieve HCP survival standards. The Rock Island Project completed multiple survival studies over a nine year period (17 total studies) for spring migrating Plan Species (yearling Chinook, steelhead, sockeye), first using a 20 percent spill level, then a 10 percent spill level. Rock Island will continue to spill 10 percent of day average flow during the spring outmigration period through at least year 2020. Rocky Reach completed its suite of HCP survival studies for spring migrating Plan Species in 2011 (14 studies), under spill and no-spill operation at the dam. HCP juvenile survival standards were achieved for species tested with a no spill operation (yearling Chinook, steelhead, sockeye). Project spill levels are summarized in Tables 2 and 4 of this plan. Chelan PUD holds valid Incidental Take Statements (ITS) from National Oceanic and Atmospheric Administration Fisheries (NOAA) and the United States Fish and Wildlife Service (USFWS) for HCP fish spill operations at Rocky Reach and Rock Island dams.

For the 2016 juvenile outmigration, Chelan PUD will operate the Rocky Reach juvenile fish bypass system (JFBS) starting 1 April for the spring juvenile outmigration of yearling Chinook, steelhead, and sockeye. Spring spill at Rocky Reach Dam will consist of hydraulic spill for reservoir control only. HCP Project survival standards were achieved with bypass-only operations. During the subyearling Chinook outmigration in 2016, Rocky Reach will spill 9 percent of day average river flow for a duration covering 95 percent of subyearling outmigration past the dam.

At Rock Island Dam in 2016, Chelan PUD will operate the Project with a 10 percent day-average spill level for the spring outmigration period. Rock Island has also completed HCP spring Plan Species survival testing for all Plan Species with a 10 percent spill level at the dam and has achieved juvenile survival standards for yearling Chinook, steelhead and sockeye and combined adult-juvenile survival for all three species.

During the summer period in 2016, Rock Island Dam will spill 20 percent of the day-average river flow for the outmigration of subyearling (summer) Chinook. Spill is the primary means of juvenile salmon and steelhead passage at Rock Island per Section 5.4.1(a) of the Rock Island HCP. Spring and summer spill will cover 95 percent of the juvenile fish outmigration for yearling/subyearling Chinook, steelhead, and sockeye in 2016.

Rocky Reach Spring Juvenile Fish Bypass Operations

Rocky Reach will operate its JFBS continuously through the spring outmigration period, beginning 1 April 2016. Daily index sampling (for steelhead, yearling Chinook, and sockeye) will be performed at the bypass sampling facility to estimate the outmigration percentiles for each species through the spring period. During “index sampling” each day, a total of four 30-minute samples (Table 1) will be taken beginning at the top of each hour, 0800 to 1100 hours. Spring spill for fish passage is not required at Rocky Reach in addition to the JFBS operation, but periods of forced spill may occur under high river flows. Some level of forced spill (river flow above 201 kcfs turbine capacity) normally occurs at Rocky Reach in the spring. Over the past 20 years, forced spill has occurred approximately 28 percent of all hours, April through June.

Sampling protocols at the Rocky Reach bypass system in 2016 will remain consistent with those used in 2004-2015. Daily sampling in spring and summer periods (Monday through Sunday) will use four 30-minute “index periods” at 0800, 0900, 1000, and 1100 hours (Table 1). The sample target for each 30-minute sample will be 350 smolts during the spring period (yearling Chinook, steelhead, and sockeye combined), and 125 smolts for summer period (subyearling Chinook). If the number of fish collected in the bypass sampling raceway is estimated to reach the maximum number prior to completion of the 30-minute sample, the sampling screen will be retracted from the bypass conduit, and the number of fish collected in the shortened sample period will be proportionately expanded to the entire 30-minute period.

Table 1. Index sampling times at the Rocky Reach juvenile fish bypass and the number of smolts per sample. Sample times and sample targets have remained consistent since 2004.

Time	Sample Duration	Number of Smolts	Day of Week
08:00-08:30	30 minutes*	350 (spring) 125 (summer)	Monday-Sunday
09:00-09:30	30 minutes*	350 (spring) 125 (summer)	Monday-Sunday
10:00-10:30	30 minutes*	350 (spring) 125 (summer)	Monday-Sunday
11:00-11:30	30 minutes*	350 (spring) 125 (summer)	Monday-Sunday

*Sample duration may be less than 30 minutes if smolt numbers are met prior to full 30 minute sample time

Rocky Reach 2016 Summer Spill Operations

Rocky Reach Dam will spill 9 percent of the estimated day average river flow for the subyearling Chinook outmigration (Table 2). Spill will commence in late May to early June upon arrival of subyearling Chinook smolts in the Rocky Reach bypass samples. Juvenile run-timing information at Rocky Reach will be used to estimate subyearling Chinook passage percentiles (from the University of Washington’s Program RealTime run forecaster) and guide spill operations to cover 95 percent of the summer outmigration. Actual subyearling counts in combination with juvenile passage estimates from the University of Washington’s Program RealTime run forecaster will determine start and stop dates for the summer spill program.

The HCP guidelines for starting and ending summer spill at Rocky Reach are as follows:

1. Summer spill will start at midnight no later than the day on which the estimated 1-percentile passage point is reached, as indicated by Program RealTime run-forecast model. Subyearling Chinook will be defined as any Chinook having a fork length from 76 to 150 mm.
2. Summer spill season will generally end no later than 15 August, but not until subyearling index counts from the juvenile bypass sampling facility are 0.3 percent or less of the cumulative run for three out of any five consecutive days (same protocol used 2004-2015) and Program RealTime is estimating that the 95th percentile passage point has been reached. In addition, spill operations must cover at least 95% of the subyearling outmigration

Diel Spill Shaping at Rocky Reach and Rock Island Dams

Daily spill volumes will be shaped within each 24-hour period at Rocky Reach Dam during the summer spill period, and at Rock Island Dam during both spring and summer spill periods (Tables 2 and 4).

Spill-shaping attempts to optimize spill water volume to maximize spill passage effectiveness for smolts. The diel spill shape functions to provide either higher or lower spill volume during periods of either higher or lower fish passage. Spill-shaping is based on the observed diel (24-hour) passage distributions of smolts at each project during spring and summer (Steig et al. 2009, Steig et al. 2010, Skalski et al. 2008, Skalski et al. 2010, Skalski et al. 2011, Skalski et al. 2012). The different spill percentages and time blocks are shaped such that the summation of water volume from all time blocks within the day equals the volume of water that would have been spilled under a constant, unshaped spill level (i.e. spill at 9 percent day-average river flow at Rocky Reach with no shaping). The hourly spill shape in 2016 will remain consistent with previous years, 2004-2015.

Table 2. Fish spill percentages and spill shape for the Rocky Reach spill program, 2016.

Project	Season	Daily Spill Average	Within-Day Spill Levels	Duration (# of hours each day)	Time of Day	Spill Shape %
Rocky Reach	Spring	none	--	--	--	--
Rocky Reach	Summer*	9%	Med	1	00:00-01:00	9.0%
			Low	6	01:00-07:00	6.0%
			Med	2	07:00-09:00	9.0%
			High	6	09:00-15:00	12.0%
			Med	9	15:00-00:00	9.0%

*Spill for subyearling Chinook

2016 Run-Timing Predictions

Chelan PUD contracts with the University of Washington (UW) to provide run-timing predictions and year-end observed values for spring and summer out-migrating percentiles for salmon and steelhead. UW's Program RealTime run-time forecasting model is used for this purpose. Program Real-Time provides daily forecasts and cumulative passage percentiles for steelhead, yearling/subyearling Chinook and sockeye at both Rocky Reach and Rock Island dams. This program enables Chelan PUD to better predict the time when a selected percentage of these species will arrive, and when a given percentage of any stock has passed. The program utilizes daily fish counts from the Rocky Reach bypass sampling facility and the juvenile fish bypass trap at Rock Island Dam. Estimates of passage percentiles are generated with the model's forecast error and are displayed with the daily predictions at:

<http://www.cbr.washington.edu/crisprt/>

Historic Run Timing

Estimated mean passage dates (first percentile to the 95th percentile) for each species at Rocky Reach and Rock Island dams are summarized in Table 3. Run-timing dates are estimated from daily index sample counts at the Rocky Reach JFBS (2004-2015), and from the Rock Island bypass trap, (2002-2015). At Rocky Reach Dam, the subyearling Chinook run generally begins the first week of June, with the one-percentile passage date on 31 May (mean date for years 2004-2015). Rocky Reach subyearling passage reaches the 95th percentile, on average, around 8 August (2004-2015, range: 21 July to 24 August).

Rock Island Dam juvenile salmon and steelhead sampling from the Smolt Monitoring Program (SMP; 2002-2015) indicates that the first percentile (one-percent passage) mean passage date for combined spring migrants (yearling Chinook, steelhead, and sockeye) occurs around 18 April (Table 3). The latest spring spill start date for Rock Island Dam per the HCP is 17 April. The summer outmigration of subyearling Chinook smolts at Rock Island Dam generally begins in early June (although fry are encountered earlier), and on average, reaches the 95th percentile passage point around 7 August (range: 22 July to 19 August, 2002-2015).

Table 3. Spill percentages, bypass operation dates, and mean passage percentile dates (2002-2015) for the 1st and 95th percentile passage points for HCP spring and summer outmigrants at Rocky Reach and Rock Island dams.

Rocky Reach	steelhead	yearling Chinook	sockeye	subyearling Chinook
Percent Spill	0% Spring	0% Spring	0% Spring	9% Summer
1 st , 95 th percentile Passage Dates	4/17, 5/30	4/16, 5/29	5/6, 5/25	5/31, 8/8
RR Bypass Operating?	Yes 4/1 – 8/31	Yes 4/1 – 8/31	Yes 4/1 – 8/31	Yes 4/1 – 8/31
Rock Island	steelhead	yearling Chinook	sockeye	subyearling Chinook
Percent Spill	10% Spring	10% Spring	10% Spring	20% Summer
1 st , 95 th percentile Passage Dates	4/22, 6/8	4/15, 6/4	4/17, 6/8	6/2, 8/7
RI Bypass Trap Operation	4/1 - 8/31	4/1 - 8/31	4/1 - 8/31	4/1 - 8/31

Source - Rock Island: http://www.cbr.washington.edu/crisprt/index_midcol2_pi.html

Source- Rocky Reach: http://www.cbr.washington.edu/crisprt/index_midcol2_che.html

Rock Island 2016 Spring Spill Operations

In 2016, Rock Island Dam will spill 10 percent of the estimated day average river flow starting no later than 17 April and will end spill after 95 percent of spring outmigrants have passed the dam (usually the first week of June), with spill being provided for at least 95% of the spring species outmigration. Spill volume will be shaped to maximize spill efficiency (Table 4). Chelan PUD personnel will operate the Rock Island bypass trap, an upper Columbia SMP site, continuously from 1 April through 31 August (seven days per week) to provide daily smolt counts. Index counts will provide the basis to determine the start and end of the spring and summer outmigration periods. The HCP guidelines to start and end the spring spill program at Rock Island Dam are as follows:

1. The Rock Island spring spill program will begin when the daily smolt passage index count exceeds 400 fish for more than 3 days (this corresponds to the approximately 5 percent passage date), or no later than 17-April, as outlined in Section 5.4.1. (a) of the Rock Island HCP.
2. Rock Island spring spill will end 1) following completion of the spring outmigration (95 percent passage point), and 2) when subyearling (summer) Chinook have arrived at the Project.

Rock Island 2016 Summer Spill Operations

Rock Island will spill 20 percent of the estimated daily average river flow for a duration covering 95 percent of the summer outmigration of subyearling Chinook. Daily smolt counts from the Rock Island bypass trap will inform decisions on when to start and stop spill. The HCP guidelines to start and stop summer spill at Rock Island Dam are outlined as follows:

1. Rock Island summer spill in 2016 will begin immediately after completion of the spring spill. The summer spill level will be 20 percent of day average flow, shaped to increase spill efficiency. Spill will continue for a duration covering 95 percent of the subyearling Chinook outmigration.
2. Summer spill will generally end no later than 15 August, or when subyearling Chinook counts from the Rock Island trap are 0.3 percent or less of the cumulative run total for three out of any five consecutive days, and UW's Program RealTime is estimating 95 percent run completion (same protocol used in 2004-2015).

Table 4. Spill percentages and hourly spill shape for the Rock Island spring and summer fish spill program, 2016.

Project/Season	Daily Spill Average	With-in Day Spill Levels	Duration (# of hours each day)	Time of Day	Spill Shape %
Rock Island Spring*	10%	High	4	0000-0400	12.5
		Med	3	0400-0700	10.0
		Low	5	0700-1200	6.0
		Med	8	1200-2000	10.0
		High	4	2000-2400	12.5
Rock Island Summer**	20%	High	1	0000-0100	23.0
		Med	1	0100-0200	19.0
		low	8	0200-1000	15.0
		Med	1	1000-1100	19.0
		High	13	1100-2400	23.0

*Spring spill for yearling Chinook, steelhead, and sockeye; **summer spill for subyearling Chinook.

Spill Program Communication

Chelan PUD’s fish spill coordinator will notify the HCPCC not less than once per week when fish passage numbers indicate that specific triggers for starting or stopping spill are likely to occur in the immediate future. Chelan PUD will notify the HCPCC regarding any unforeseen issues that pertain to the spill program as the season progresses. Communications with the HCPCC on spill information will generally be made by email, pre-scheduled conference calls, and HCPCC monthly meetings.

Literature Cited

- Skalski, J.R., R.L. Townsend, T.W. Steig, and P.A. Nealson. 2012. Survival, Diel Passage, and Migration Dynamics of Yearling Chinook Salmon Smolts at Rocky Reach Dam in 2011. Prepared for Public Utility District of Chelan County, Wenatchee, WA. Columbia Basin Research School of Aquatic and Fishery Sciences, University of Washington. Final Report, January 2012.
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- Skalski, J.R., R.L. Townsend, T.W. Steig, P.A. Nealson, and S. Hemstrom. 2008. Acoustic Tag Investigation of Sockeye Smolt Survival and Migration Dynamics at Rocky Reach Dam in 2008. Prepared for Public Utility District No. 1 of Chelan County, Wenatchee, WA. Columbia Basin Research School of Aquatic and Fishery Sciences, University of Washington. Final Report, 5 November, 2008.
- Steig, T.W., P.A. Nealson, K.K. Kumagai, B.J. Rowdon, J.R. Selleck and C. Tunnicliffe. 2009. Route specific passage of juvenile Chinook, sockeye and steelhead salmon using acoustic tag methodologies at Rocky Reach and Rock Island Dams in 2009. Draft report for Chelan County Public Utility District No. 1, Wenatchee, WA, by Hydroacoustic Technology, Inc. Seattle, WA.
- Steig, T.W., P.A. Nealson, K.K. Kumagai, B.J. Rowdon, J.R. Selleck and C. Tunnicliffe. 2010. Route specific passage of yearling Chinook and steelhead salmon using acoustic tag methodologies at Rocky Reach and Rock Island Dams in 2010. Draft report for Chelan County Public Utility District No. 1, Wenatchee, WA, by Hydroacoustic Technology, Inc. Seattle, WA.

***APPENDIX D: 2016 Rocky Reach Operational Plan for Total
Dissolved Gas During Fish Spill Season***

2016 Rocky Reach Operational Plan
for Total Dissolved Gas During Fish Spill Season
April 1 through August 31

(All spill between these dates is subject to the actions contained in this plan.)
(Applies only when not spilling for headwatercontrol)

1. If tailrace TDG average is greater than *120% for the 6-hour average*
 - reduce spill by 3 kcfs
 - monitor for 1 hour
 - if the 6-hr average TDG >120%, reduce spill by another 2 kcfs
 - monitor for 1 hour
 - continue reducing spill by 2 kcfs until 6-hr average TDG is less than 120% for one full hour
 - **if after reducing spill to control TDG levels, TDG drops below 118% for one full hour, increase spill by 2 kcfs and monitor****

2. If tailrace TDG is greater than *125% for 1 hr*
 - follow protocol outlined above, but instead, use **one-hour TDG levels of 125%** as the metric
 - continue until TDG is less than 125% for 1 hr and until the 6-hr average TDG <120%

If you receive a call from RI advising that the RI forebay is out of compliance (greater than 115%) and the RR forebay is 115% or less, reduce spill by 3 kcfs. Two hours after reducing spill, call RI to determine what the RI forebay gas levels are. If still above 115%, reduce spill another 2 kcfs. If after reducing spill for this reason, the Rock Island forebay drops to less than 113%, Rock Island will call again and advise. At this point, increase back to the hourly spill volume target by increasing spill in the reverse order it was decreased. For example, if to bring the RI forebay back into compliance, it was necessary to reduce spill by a total of 5 kcfs, begin by increasing spill by 2 kcfs, wait two hours, and call RI to determine what the forebay TDG levels are. If TDG is still below 115%, increase spill by 3 kcfs (back to the target volume in this case). This will allow for a ramping effect, rather than an open/shut effect which could bump the Rock Island forebay TDG levels back out of compliance (>115%).

**** Note:** It will not be necessary to monitor for one full hour after re-opening gates if it appears that TDG is approaching the upper threshold, rather, the procedure will repeat upon reaching the threshold. It is anticipated that in time, the operators will “get a feel” for how much change in TDG will occur as a result of opening or closing gates and it will be possible to hold the TDG around 118% or 119% or so. Once the operators have this down, instead of closing a gate entirely, it may only be necessary to close partially and vice versa for the opening process.

APPENDIX E: Annual Maintenance List for Rocky Reach Fishway

2016 ROCKY REACH ANNUAL FISH LADDER OVERHAUL

Annual Overhaul List:

- a. Perform maintenance on gate and hoist motors.
- b. Inspect and repair/replace any damaged or missing aluminum diffuser grating.
- c. Clean and test fishway annunciators.
- d. Replace burned-out tunnel lamps.
- e. Check and clean/repair attraction water intake screens.
- f. Check and clean traveling screens.
- g. Inspect fishway gates and repair as needed.
- h. Inspect fishway attraction water system which includes:
 1. Inspect turbine pumps A, B, and C.
 2. Check clearances on lower guide bearings.
 3. Check clearance runner crown and stay ring bore.
 4. Inspect carbon seals.
 5. Inspect each actuator for each butterfly valve on a yearly, rotational basis.
- i. Inspect fishway-traveling screens:
 1. Clean debris from traveling screen area.
 2. Inspect penstock intake chamber.
 3. Inspect and replace bearings as needed.
 4. Inspect sprockets and shaft bushings.
- j. Fishway flap and wing gates:
 1. Inspect and repair flap gates (if needed).
 2. Inspect seals and indicator rods.
 3. Inspect wing gates.
 4. Inspect the actuators for the gates.
- k. Fishway regulating gates and picket weir:
 1. Inspect control valves and hoses at the middle spillway entrance (MSE).
 2. Inspect and replace cables on MSE regulating gate.
 3. Inspect left powerhouse entrance (LPE) regulating gates.
 4. Clean, inspect and repair picket barrier regulating gate hoist.
 5. Drain, check operation, and clean CS-S1 (valve that controls make-up water in the upper fishway).
- l. Put attraction water system turbine pumps through dry runs and test alarms.
- m. Clean stilling wells and check operation of orifice valves.
- n. Clean and polish fish counting window.

APPENDIX F: Consultation with Stakeholders

Article 402 of the Project License requires that Chelan PUD prepare the Operations Plan:

“...after consultation with National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service, Washington Department of Fish Wildlife, Washington Department of Environmental Quality [Ecology], the Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Colville Indian Reservation, and the Confederated Tribes and Bands of the Yakama Nation. The licensee shall include with the plan, copies of comments and recommendations on the completed plan after it has been prepared and provided to the above entities, and specific descriptions of how the above entities’ comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the above entities to comment and to make recommendations before filing the plan with the Commission.”

The following individuals were sent draft copies for review on February 8, 2016, for a 30 day comment period. Chelan PUD did not receive any comments during the 30 day comment period.

<i>NAME</i>	<i>AGENCY</i>
Bob Rose	Confederated Tribes and Bands of the Yakama Indian Nation
Scott Carlon	National Marine Fisheries Service
Aaron Jackson	Confederated Tribes of the Umatilla Indian Reservation
Patrick Verhey	Washington Department of Fish and Wildlife
Kirk Truscott	Confederated Tribe of the Colville Reservation
Mark Peterschmidt	Washington Department of Ecology
Steve Lewis	U.S. Fish and Wildlife Service

From: [Steinmetz, Marcie](#)
To: ["rosb@yakamafish-nsn.gov"](#); ["scott.carlon@noaa.gov"](#); ["aaronjackson@ctuir.org"](#); ["Verhey, Patrick M \(DFW\)"](#); ["Lewis, Stephen"](#); ["Peterschmidt, Mark F. \(ECY\)"](#); ["Jason.McLellan@colvilletribes.com"](#)
Cc: [Sokolowski, Rosana](#); [Osborn, Jeff](#); [Smith, Michelle](#); [Bitterman, Deborah](#); [Keller, Lance](#)
Subject: Draft 2016 Rocky Reach Operations Plan
Date: Monday, February 08, 2016 10:27:00 AM
Attachments: [2016 DRAFT Operations Compliance Monitoring Plan.docx](#)

PUBLIC UTILITY DISTRICT NO. 1 of CHELAN COUNTY

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To: Bob Rose, Confederated Tribes and Bands of the Yakama Indian Nation
Scott Carlon, National Marine Fisheries Service
Aaron Jackson, Confederated Tribes of the Umatilla Indian Reservation
Patrick Verhey, Washington Department of Fish and Wildlife
Jason McLellan, Confederated Tribe of the Colville Reservation
Mark Peterschmidt, Washington Department of Ecology
Steve Lewis, US Fish and Wildlife Service

From: Marcie Steinmetz, Water Resources Specialist
Public Utility District No. 1 of Chelan County (Chelan PUD)

Re: Rocky Reach Hydroelectric Project No. 2145
License Article 402 – Draft 2016 Operations Plan

In accordance with Article 402 of the Rocky Reach License, Chelan PUD requests your review and comments on the attached Draft 2016 Rocky Reach Operations Plan.

Please submit your comments on or before 5:00 p.m., March 8, 2016 to me via email at Marcie.steinmetz@chelanpud.org.

Pursuant to a FERC-approved revised submittal date, Chelan PUD will file the Operations Plan with FERC by March 30, 2016.

All received comment letters will be appended to the final plan with a description of how each comment or recommendation was incorporated in the plan, or, if the licensee does not adopt a recommendation, the filing with the FERC will include the licensee's reasons, based on project-specific information for not adopting such recommendation.

If you have any questions, please do not hesitate to contact me.

Thank you,

Marcie Steinmetz | **Water Resource Specialist**
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