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Subject: Draft 2017 Rocky Reach Operations Plan
Date: Friday, February 24, 2017 7:36:28 AM
Attachments: [2017 DRAFT Operations Compliance Monitoring Plan 2-23-17.docx](#)

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

Re: Rocky Reach Hydroelectric Project No. 2145
License Article 402 – Draft 2017 Operations Plan

In accordance with Article 402 of the Rocky Reach License, Chelan PUD requests your review and comments on the attached Draft 2017 Rocky Reach Operations Plan.

Please submit your comments on or before 5:00 p.m., **March 24, 2017** via email at marcie.clement@chelanpud.org.

Pursuant to a FERC-approved revised submittal date, Chelan PUD will file the Operations Plan with FERC by March 30, 2017. 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 Clement | **Water Resources Specialist**

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2017 OPERATIONS PLAN
LICENSE ARTICLE 402

DRAFT

ROCKY REACH HYDROELECTRIC PROJECT
FERC Project No. 2145

February 2017



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

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APPENDIX D: 2017 ROCKY REACH OPERATIONAL PLAN FOR TOTAL DISSOLVED GAS DURING FISH SPILL SEASON

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TERMS AND ABBREVIATIONS

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
kcf	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
WQC	401 Water Quality Certification
YN	Confederated Tribes and Bands of the Yakama Nation

EXECUTIVE SUMMARY

On February 19, 2009, the Federal Energy Regulatory Commission (FERC or Commission) issued its Order on Offer of Settlement and Issuing New License (License) for the Rocky Reach Hydroelectric Project for a term of 43 years to the Public Utility District No. 1 of Chelan County (Chelan PUD). As required in Article 402 of the License order, 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 in accordance with the terms of the Mid-Columbia Hourly Coordination Agreement (HCA),¹ which seeks to coordinate operations for all of the mid-Columbia projects for the best use of flows for generation and to meet fishery and other environmental resource needs. During the juvenile fish migration season (April 1 through August 31), 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 Juvenile Fish Bypass System (JBS) will operate continuously from April 1 to August 31 (fish spill season) 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. Chelan PUD conducts annual maintenance activities as listed in Appendix E from January to February during the annual overhaul fishway period. If more time is required to complete critical fishway maintenance, the fishway outage may begin in December and be extended into March with the agreement of the HCP CC.

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

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 Habitat Conservation Plan Coordinating Committee (HCP CC) approval of the annual Fish Spill Plan.

¹ The HCA was originally signed for a one-year experimental period from July 1, 1972, to June 30, 1973. The agreement was extended numerous times, and the most recent renewal extends the term of the HCA to November 1, 2017. See EIS, section 2.1.2.

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 ninth Operations Plan, and is substantially the same as the 2016 Operations Plan. Changes made to the 2017 Operations Plan are limited to Section 2.3: *2017 Unit Outages*, Section 4.2: *Spill Outside of Juvenile Fish Passage*, and specifics associated with the Juvenile Fish Bypass Operations Plan and Fish Spill Plan (Appendices A and C).

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 or Commission) 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 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 JBS 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.

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 Habitat Conservation Plan Coordinating Committee (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 ninth Operations Plan, and is substantially the same as the 2016 Operations Plan. Changes made to the 2017 Operations Plan are limited to; Section 2.3: *2017 Unit Outages*, Section 4.2: *Spill Outside of Juvenile Fish Passage*, and specifics associated with the Juvenile Fish Bypass Operations Plan and Fish Spill Plan (Appendices A and C).

The License requires the continued implementation of the Habitat Conservation Plan (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 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 (WQC), 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 RRF.

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 RRF 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 RRF 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 RRF 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) nine 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 JBS 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 JBS; 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 2017 Unit Outages

Specific Unit outages and repairs are discussed briefly in this Section and will continue to be updated annually.

Unit C-10 became unavailable due to coil failures in April of 2016. Rewind was completed and the unit was returned to service in November of 2016. Unit C10 is running in an interim repaired status. Unit C-8 has been off line since January 21st of 2015, with completion of repairs scheduled for May of 2017. Unit C-9 became unavailable due to coil failures in September of 2016. Repairs are estimated to be completed by May of 2017. Unit C-11 became unavailable due to coil failure in November of 2016. Rewind will be performed during the turbine repair outage is scheduled to be back in service by November of 2018.

The remaining large units repair will follow as listed below.

- Expected final repair schedule:
 - ~ Unit C-9 January, 2020 through February, 2021
 - ~ Unit C-10 November, 2018 through January, 2020
 - ~ Unit C-11 September, 2017 through November, 2018

No other routine unit overhaul outages are scheduled for 2017.

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 Juvenile Fish Bypass System (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 JBS 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: 2017 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 JBS 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 JBS 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 gateway 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 JBS 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.

3.3.3 Unscheduled Maintenance

If unscheduled maintenance will cause an outage of the JBS 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.

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 programmed spill pattern. Currently, two spill configurations are programmed for use, fish spill (standard spill pattern) and non-fish spill (flattened spill pattern).

The fish spill pattern was designed to open gates to create a tailrace pattern of turbulent water, the edges of which lead toward the adult fishway entrances or a V shape. Typically, this spill pattern is used from April 1 through August 31 for juvenile fish passage and adult fish attraction. The spill schedule for gate opening order to implement the fish spill configuration (standard spill configuration) is displayed in Table 4-1.

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 p.m., 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.

The non-fish spill gate configuration or flattened spill, attempts to spread the spillway flows between more gates evenly with the goal of reducing TDG. This spill pattern is being implemented as a pilot or test spill outside of the primary fish passage season during the non-fish spill season (January through March and September through December) and is further discussed in Section 4.4 of this report.

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 WQC, 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 the fish spill period (April 1 through August 31) and non-fish spill period (September 1 through March 31), 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.

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/. Website locations are subject to change. Please contact USACE at (206) 761-0011 for general questions.

4.4 Implementation of Alternative Spillway Operations

Under Section 5.4.1(b)(6) of the WQC, Ordering Paragraph D, Appendix A of the FERC License, Chelan PUD is required to implement alternative spillway operations, using any of gates 2 through 12, to determine, in consultation with the RRFF and HCP CC, whether TDG levels can be reduced without adverse effects on fish passage. If effective in reducing TDG and not adversely affecting fish passage, Chelan PUD will implement the alternative in coordination and consultation with Ecology, the RRFF and HCP CC.

Chelan PUD identified four steps or phases necessary to complete condition 5.4.1(b)(6) of the WQC. Phases 1 through 3 have been completed and Chelan PUD is currently implementing Phase 4. The identified phases are listed and discussed further below.

- Phase 1. Develop and run test scenarios for spill gate configurations, collect data
- Phase 2. Analyze the data collected during the test scenarios for TDG reduction
- Phase 3. Further analyze the TDG reductions and potential effects on fish passage
- Phase 4. If effective in TDG reduction without potentially affecting fish passage, develop an implementation plan in coordination and consultation internally with Chelan PUD operations and externally with the RRFF and the HCP CC

Phase 1. Develop and run test scenarios for spill gate configurations, collect data

Alternative spillway flow distribution patterns were studied in 2011 and 2012 in order to evaluate the potential to reduce TDG levels, particularly during high spill levels (above 50 kcfs). Studies of TDG levels at other Columbia River basin hydroelectric projects have shown that TDG levels are typically reduced when spillway flows are spread between more gates, thus reducing the flow per gate. The studies in 2011 and 2012 were conducted to test three alternative spill patterns during normal operations to see if TDG levels would be reduced by any of these alternate patterns.

Phase 2. Analyze the data collected during the test scenarios for TDG reduction

In 2013, Chelan PUD contracted with Parametrix to analyze the results of the 2011 and 2012 test spill patterns. The results of the 2011 and 2012 studies (Chelan PUD, 2013a) were analyzed from the perspective of absolute TDG levels under different spillway flow volumes and the percentage of increase or decrease in TDG levels in the tailrace below the spillway, compared to the ambient TDG arriving at the Rocky Reach Project's forebay. Generally, all of the three alternative spill patterns resulted in lower TDG levels than the standard spill (fish spill pattern). Of the three alternative patterns, the flattened spill pattern flow is distributed evenly between spillway gates, had a slightly better TDG performance than the other two alternative patterns, which attempted to maintain some semblance of the V-shaped turbulence zone desired for adult salmon guidance. The Parametrix (Chelan PUD, 2013b) analysis did not explore whether there was any disruption of fish passage associated with the use of the alternative spill patterns. Additionally, since both 2011 and 2012 were high flow years, spillway flows were usually greater than 50 kcfs during these tests. Thus, any effects on fish passage might have been masked due to the overall effects of high spill, regardless of the spill pattern in use.

The standard spill pattern (fish-spill pattern) is a required operating procedure for upstream salmon passage, thus prior to changing that pattern for the purpose of reducing TDG an analysis of effects on fish passage is needed. Any decision to permanently change the spill pattern requires approval by the RRFF and HCP CC.

Phase 3. Further analyze the TDG reductions and their potential affect on fish passage

Chelan PUD conducted further analysis of the 2011 and 2012 test spill patterns and TDG data to determine if there is sufficient potential benefit regarding TDG levels to warrant changing the spill pattern for spill volumes of 50 kcfs or less. Chelan PUD began by looking only at the 2011 data set in 2015, as this year was more consistent in the duration and frequency of the test of the flattened spill configuration. In addition, the adult salmon passage data for Chinook and sockeye was examined to determine if there were any apparent adverse effects on daily passage rates during the 2011 study. This analysis indicated that there may be a significant reduction in TDG levels for spillway volumes of 40 kcfs or greater if the flat spill pattern were used rather than the standard spill pattern. There were not sufficient data to determine if the flat spill pattern would significantly reduce TDG for spill levels of less than 40 kcfs. This was, for the most part, consistent with the findings of a previous study (Schneider and Wilhelms, 2005) which found little difference in TDG levels generated with either the standard spill pattern (fish spill pattern) or with spill spread evenly between spillway gates 2 through 12 (roughly equivalent to the flat spill pattern tested in 2011). However, the Schneider and Wilhelms study had very limited data for spill levels above 40 kcfs and no data for spill volumes greater than 60 kcfs. Thus, the ability to detect a reduction in TDG levels using the flat spill pattern was limited during this study.

In order to determine whether the flattened spill pattern (non-fish spill pattern) indeed reduced TDG, it was concluded that the pattern would need to be monitored over a longer time period than what was conducted during the 2011 and 2012 test spill studies. The use of different spill patterns did not appear to have any adverse effect on adult salmon passage at the Rocky Reach Project (Chelan PUD, 2015).

Phase 4. If effective in TDG reduction without potentially affecting fish passage, develop an implementation plan in coordination with various parties

Chelan PUD's findings were presented to Ecology, the RRF and HCP CC. Through the consultation process with Ecology, the RRF and HCP CC, Chelan PUD developed a schedule to make the necessary changes to perform the flattened spill configuration during the non-fish spill period (January through March and September through December). Computer automation and programming of spill gates occurred in 2016 for implementation to begin in late 2016.

Chelan PUD is currently operating the flattened spill configuration as a pilot or test spill during the non-fish spill only, evaluating the TDG data annually. If during operation of the flattened spill configuration, data show that optimal results are not occurring as previously evaluated, Chelan PUD will implement adaptive management practices in coordination with the RRF and HCP CC re-evaluate the continued implementation of the flattened spill configuration.

Overall project operations during the non-fish spill season under the flattened spill configuration have not changed from the overall project operations of the previous standard spill pattern. Chelan PUD continues to operate generating resources to minimize spill, of achieving 110 percent TDG saturation as were operated under the previous spill pattern. 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.

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>Submerged²Weir 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.

²During 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 programs, which are required pursuant to the HCP. Ongoing hatchery mitigation activities at these facilities are required by the License as mandated by USFWS' incidental take statement, and as such, 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 for structure protection. WDFW (under contract with the PUD) and the Yakama Nation 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). Depending on the time of year, the following trapping operations are in effect: from approximately mid-February to 15 July and from 1

September until mid-December the trap is collecting fish 24 hours per day, seven days per week. 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 some-time in 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 are continually processed, with WDFW personnel on site from dawn to dusk (1 June to 15 July). If the median passage time for spring Chinook through both PIT tag antennas in the upper 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: 2017 Rocky Reach Juvenile Fish Bypass System
Operations Plan***

The 2017 Rocky Reach Juvenile Fish Bypass System Operations Plan will be provided in the final document.

***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:
LOCATION:
ITEM NO.

REFERENCE DRAWINGS:

REVISION
1

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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: 2017 Fish Spill Plan

The 2017 Fish Spill Plan will be provided in the final document.

***APPENDIX D: 2017 ROCKY REACH OPERATIONAL PLAN FOR
TOTAL DISSOLVED GAS DURING FISH SPILL SEASON***

2017 Rocky Reach Operational Plan
for Total Dissolved Gas (TDG) 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 headwater control)

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%

RI TDG Compliance: 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

2017 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 24, 2017, for a 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
Breean Zimmerman	Washington Department of Ecology
Steve Lewis	U.S. Fish and Wildlife Service