

FINAL

**TOTAL DISSOLVED GAS ABATEMENT PLAN
ROCKY REACH HYDROELECTRIC PROJECT**

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EXECUTIVE SUMMARY

This total dissolved gas abatement plan (GAP) provides details on operational and structural measures that Public Utility District No. 1 of Chelan County (Chelan PUD) plans to implement as part of its fish-spill program. These measures are intended to result in compliance with Washington State water quality standards for total dissolved gas at the Rocky Reach Hydroelectric Project. The Washington State Department of Ecology (WDOE) establishes Washington state water quality standards for total dissolved gas (TDG) during the non-fish and fish-spill seasons.

Proposed operational abatement measures include minimizing involuntary spill by scheduling maintenance operations based on predicted flows and continuing to participate in the Hourly Coordination Agreement, which uses automatic control logic to maintain preset reservoir levels at the mid-Columbia River dams in order to meet load requirements and prevent involuntary spill. In addition, Chelan PUD plans to consult with WDOE on non-routine operational changes that may affect TDG, as well as manage fish-spill programs to meet TDG water quality standards through coordination Habitat Conservation Plan (HCP) Coordinating Committee.

No structural TDG abatement measures are included in this GAP, as Chelan PUD continues to conduct Rocky Reach HCP survival studies. For the studies to be considered valid, the studies need to take place during average flow conditions and normal project operating conditions consistent with the approved study design. This means project operations; including spill levels and configurations, as well as the overall project structure (such as spillway structures), need to remain constant during the survival studies.

Compliance monitoring for TDG will continue at Chelan PUD's fixed-site monitoring stations. TDG data will be collected on an hourly basis throughout the year and will be reported to U.S. Army Corps of Engineers Reservoir Control Center's website. An annual report to WDOE will summarize Chelan PUD's TDG monitoring and fish-spill season results.

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1. INTRODUCTION AND BACKGROUND

Public Utility District No. 1 of Chelan County (Chelan PUD) owns and operates the Rocky Reach Hydroelectric Project (Project), located on the Columbia River downstream of Wells Dam (Figure 1). The Project is licensed as Project No. 2141 by the Federal Energy Regulatory Commission (FERC). A 401 Water Quality Certification (401) for the operation of the Project was issued by the Washington State Department of Ecology (WDOE) on March 17, 2006. The 401 terms and conditions are incorporated in the new FERC license to operate the Project which was issued on February 19, 2009. Section 5.4.3 of the 401 requires Chelan PUD to submit an annual total dissolved gas abatement plan (GAP) in accordance with WDOE's water quality standards for total dissolved gas (TDG).

This GAP is being submitted to Washington State Department of Ecology (WDOE) as a condition of the 2006 Special Fish Passage Exemption (WAC 173-201A-200(1)(f)). Chelan PUD respectfully submits this plan with the goal of receiving a waiver commencing with the 2010 fish spill season. Chelan PUD will revise the GAP annually, to reflect any changes, and new or improved information and technologies.

1.1 Project Description

Rocky Reach Dam is owned and operated by Chelan PUD and is located on the Columbia River at river mile 474, about 7 miles upstream of the city of Wenatchee. Construction of the dam and powerhouse began in 1956 and the project was completed and put into production in 1961. The impounding structures are a mass of reinforced concrete consisting of a forebay wall section about 460 feet long, a combined intake and powerhouse section 1,088 feet long, a non-overflow center dam spillway that is 740 feet long consisting of 12 bays, each controlled by a 50 foot wide, 58 foot high radial gate. A 2,000-foot sub-surface cutoff consisting of a grout curtain and a compacted impervious barrier limits seepage through a terrace forming the east bank.

The forebay wall consists of mass concrete gravity blocks of various heights, with a maximum height of 118 feet. The service bay connects the forebay wall to the powerhouse. The powerhouse consists of 11 units, each 86 feet wide and approximately 200 feet long. The 11 turbines provide the total nameplate generating capacity of 1,213 MW and a total hydraulic capacity of 217.5 thousand cubic feet per second (kcfs).

A permanent bypass system was installed at the Project from September 2002 to March 2003, and has been in operation since then. The system consists of a surface collection system and a bypass conduit to provide downstream passage to juvenile salmon and steelhead.



Figure 1. Location of Rocky Reach Hydroelectric Project on the Columbia River.

1.2 Regulatory Framework

The Washington State water quality numeric criterion for TDG (WAC 173-201A-200(1)(f)) is set at 110% of saturation. The TDG criteria may be adjusted to aid fish passage over hydroelectric dams when consistent with a department approved gas abatement plan (GAP). This plan must be accompanied by fisheries management and physical and biological monitoring plans. The elevated TDG levels are intended to allow increased fish passage without causing more harm to fish populations than caused by turbine fish passage. This fish passage exemption states that TDG must not exceed an average of 120% saturation in the tailrace and 115% saturation in the forebay of the next downstream projects. These average TDG saturation levels are based on the average of the 12 highest consecutive hourly measurements in a 24-hour day. The TDG levels shall not exceed an average 125% for more than one hour in a 24-hour day.

This GAP is being submitted to Washington State Department of Ecology (WDOE) as a condition of the above mentioned special fish passage exemption.

It is important to note that the TDG water quality standards identified above are intended to help protect aquatic life designated uses within the Project. This includes WDOE's allowance of higher TDG levels during the fish-spill season which allows dams to spill water to help meet passage performance standards. Specific passage performance standards for the Rocky Reach Project are outlined in the Rocky Reach Habitat Conservation Plan (HCP) (see Section 2.4.1 below and Appendix A for more detail).

1.2.1 Fish-Spill Season

The fish-spill season is defined by WDOE to occur from April 1 through August 31 of each year (Section 5.4.2 of the 401). Actual spill for fish at Rocky Reach Dam typically occurs from mid-April through mid-August, depending on the timing of the fish migrations as documented at the Rocky Reach juvenile collection facility.

1.2.2 Incoming Total Dissolved Gas Levels

One challenge in meeting the TDG criteria is that for any given dam, if TDG levels in the forebay exceed 115%, the forebay of the next dam downstream may also not meet 115%, no matter how the dam manages spill. For this reason, the mid-Columbia TDG TMDL specifies a goal to continue spill for fish passage, but spill at a level that does not worsen TDG levels and hopefully improves them somewhat. Incoming TDG levels and their impact on compliance on downstream projects and overall TDG levels in the mid-Columbia is definitely a topic for future consideration.

1.2.3 7Q10 Flows

WAC 173-201A-200(f)(i) provide that the TDG water quality standard shall be waived if flows exceed the “7Q10 flood flow,” which is the highest seven consecutive day average flow with a 10-year recurrence frequency. The 7Q10 flood flow was calculated to be 252 thousand cubic feet per second (kcfs) for Rocky Reach Dam.

Additionally, Section 5.4.1(b) of the 401 Water Quality Certification states:

“Manage spill toward meeting water quality criteria for TDG during all flows below 7Q10 levels.....”

1.2.4 Total Dissolved Gas Total Maximum Daily Load

In 2004, WDOE established a TDG Total Maximum Daily Load (TMDL) for the mid-Columbia River which set TDG allocations for each dam (WDOE 2004). As per Section 5.4.7 of the 401, “This certification, along with the WQMF and the updated GAP, is intended to serve as the Rocky Reach Project’s portion of the Detailed Implementation Plan (DIP) for the Mid-Columbia River and Lake Roosevelt TDG TMDL”.

1.3 Historical Conditions

The following sections provide a brief historical overview of river flows, fish-spill operations, and TDG levels and provides references to previous TDG/Fish-Spill season reports.

1.3.1 Rocky Reach Project Operations (Runoff and Coordination)

The climate of the Columbia Basin in eastern Oregon, Washington and British Columbia is best described as desert. The major portion of the precipitation experienced within the basin falls in the form of snow during the period of November through March of each year. Runoff usually occurs from mid-April through July, with the historical peak occurring during the month of June. Storage dams in the U.S. and Canada capture spring and summer high flows to hold for release in the winter months.

In general, the hydropower system and reservoir operations in the Columbia River are coordinated through a set of complex agreements and policies to optimize the benefits and minimize the adverse effects of project operations. The Project operates within the constraints of its FERC regulatory and license requirements, Rocky Reach HCP (and associated Anadromous Fish Agreement), Hourly Coordination Agreement, Pacific Northwest Coordination Agreement, and Hanford Reach Agreement.

Under the Hourly Coordination Agreement, power operations are coordinated to meet daily load requirements through the assignment of "coordinated generation" through Central Control at Grant PUD, which establishes coordinated generation for all mid-Columbia projects. Automatic Control Logic is used to maintain preset reservoir levels in order to meet load requirements and prevent involuntary spill. These preset reservoir levels are maintained at each project through management of a positive or negative "bias" which assigns a project more or less generation depending on whether the reservoir elevation should be increased or decreased in order to maximize system benefits and minimize involuntary spill.

1.3.2 River Flows

Table 1 illustrates a 10-year average of mean daily discharge values from 1999 to 2008, as measured at the Project. During the fish-spill season streamflows typically peak in late May/early June and begin to recede in July.

Table 1. 2009 river flows compared to 10-yr average flows (in kcfs).

	10-yr ave flows (1999-2008)	2009 flows	% of 10-yr average
Spring			
Rocky Reach	126.48	118.57	93.75
Summer			
Rocky Reach	124.72	100.21	80.35

Water is passed through Rocky Reach Dam either through the 11 vertical-axis turbines, 12 tainter gates, or the juvenile fish bypass system.

1.3.3 Spill Scenarios

The six main scenarios that could result in spill at Rocky Reach Dam are, but are not limited to:

- fish bypass spill
- flow in excess of hydraulic capacity
- powerplant load rejection spill
- immediate replacement spill
- maintenance spill
- error in communication with Corps reservoir

It is recognized that achieving regulatory TDG levels may not be possible during spill associated with large flood (7Q10) events. However, at Rocky Reach Dam it may be possible to achieve current regulatory TDG levels during releases for fish bypass and up to the 7Q10 flows (252 kcfs) by selective operation of spillway bays.

1.3.3.1 Fish Spill

Spill is an ineffective method of bypassing fish away from the turbines at Rocky Reach Dam (Steig et. al., 1997) and, consequently, is not considered as the solution for the long-term fish bypass program. As an alternative to spill, Chelan PUD is focusing its efforts on increasing the fish passage efficiency and survival through the fish bypass system. Spill is utilized as a supplemental method for fish bypass for downstream migrating juvenile salmonids. Fish spill at Rocky Reach falls into two categories, Spring Spill and Summer Spill. For more information regarding spill during the spring and summer spill seasons, please refer to Section 4.1 above.

1.3.3.2 Flow in Excess of Hydraulic Capacity

The minimal storage and limited hydraulic capacity of the project occasionally force Chelan PUD to spill water past the project. This spill is required to maintain headwater elevations within the limits set by the project's Federal Energy Regulatory Commission license, to prevent overtopping of the project, and to maintain optimum operational conditions. With this type of release, flows up to, and in excess of the 7Q10 flood flows (252 kcfs) can be accommodated.

To reduce negative impacts of flow in excess of hydraulic capacity Chelan PUD has completed and implemented a TDG Operational Plan (Appendix B). Chelan PUD anticipates that this will be an operational function, which will require no structural modifications.

1.3.3.3 Plant Load Rejection Spill

This type of spill occurs when the plant is forced off line by an electrical fault, which trips breakers, or any activity forcing the units off line. This is an emergency situation and generally requires emergency spill. When the units cannot process flow, the flow must be passed by other means to avoid overtopping the dam.

Chelan PUD has completed and will implement a TDG Operational Plan (Appendix B) to address this emergency situation. This will be an operational function, which will require no structural modifications.

1.3.3.4 Immediate Replacement Spill

Immediate replacement spill is used to manage TDG levels throughout the Columbia River basin. The Technical Management Team (including National Marine Fisheries Services (NMFS), US Army Corps of Engineers, and Bonneville Power Administration) manages this spill. Immediate

replacement spill occurs when TDG levels are significantly higher in one river reach than they are in another reach. To balance the TDG levels throughout the basin, spill is reduced and generation increased in the reach with high TDG levels and the energy is transferred to reaches with lower TDG levels where spill is increased. The result is higher generation in the reaches with high TDG levels, increased spill in reaches with lower TDG levels, and equal distribution of TDG levels throughout the basin.

To control TDG levels that may result from immediate replacement spill, Chelan PUD has completed and will implement the TDG Operational Plan (Appendix B). We expect that this will be an operational function, which will require no structural modifications.

1.3.3.5 Maintenance Spill

Maintenance spill is utilized for any maintenance activity that requires spill to assess the routine operation of individual spillways and turbine units. These activities include forebay debris flushing, checking gate operation, gate maintenance, and all other maintenance that would require spill. The Federal Energy Regulatory Commission requires that all spillway gates be operated once per year. This operation requires a minimal amount of spill for a short duration annually and is generally accomplished in conjunction with fish passage spill operations.

To control TDG levels that may result from maintenance spill, Chelan PUD has completed and will implement the TDG Operational Plan (Appendix B). We expect that this will be an operational function, which will require no structural modifications.

1.3.3.6 Error in Communication Spill

Error in communication with the U.S. Army Corps Reservoir Control Center, including computer malfunctions or human error in transmitting proper data, can contribute to spill. Hourly coordination between hydroelectric projects on the river minimizes this type of spill, but it does occur occasionally.

To control TDG levels that may result from error in communication spill, Chelan PUD has completed and will implement the TDG Operational Plan (Appendix B). We expect that this will be an operational function, which will require no structural modifications.

1.3.4 Compliance Activities and Results of the Previous Year

In 2009, TDG standards were met 100% of the time in the Rocky Reach tailrace and Rock Island forebay (Table 2).

Preliminary survival study numbers are summarized in Table 3 below.

Table 2. Summary of Spill and TDG Compliance in 2009

“Season”	% Spill	Average Daily Spill Volume (kcfs)	Tailrace TDG Standard (%)	2009 Tailrace TDG Compliance (%)	Forebay TDG Standard (%)	2009 Forebay TDG Compliance (%)
Spring	0	0	120	100	115	100
Summer	9.06	9.3	120	100	115	100

Table 3. Preliminary 2009 Survival Study Results.

Species	% Project Survival
Yearling spring Chinook	No study conducted in 2009
Steelhead	No study conducted in 2009
Sockeye	95.45 (SE = 0.0118)
Subyearling summer/fall Chinook	No study conducted in 2009
Coho	No study conducted in 2009

1.3.4.1 Operational

Operational gas abatement measures at Rocky Reach were limited to the operational spill programs in concert with the operation of the juvenile fish bypass system (JFB) as required by Chelan PUD’s Rocky Reach Habitat Conservation Plan and Anadromous Fish Agreement (HCP).

Studies conducted in accordance with the HCP have shown that the JFB provides a most effective means for outmigrating salmon and steelhead to utilize a non-turbine route of passage at Rocky Reach Dam. The success of the JFB as a fish survival tool at Rocky Reach Dam has allowed Chelan PUD per HCP implementation language to reduce spill at Rocky Reach. Historically, fish passage plans have relied on the use of voluntary spill as a means to provide fish a non-turbine route for dam passage. Spring spill levels have ranged from 15-24% of the daily average flow. Recent results of JFB efficiency tests have allowed Chelan PUD to operate the juvenile fish bypass exclusively (no spill) for yearling Chinook and steelhead. For sockeye, Chelan PUD has conducted a number of powerhouse operations tests with a no spill condition to evaluate differences in route-specific survival and Project survival with all available river flow passing via a combination of JFB and turbine operation. During the summer outmigration of

subyearling Chinook, Chelan PUD spilled 9% of the day’s forecasted average river flow for a duration covering 95% of their outmigration.

Testing survival of juvenile outmigrants will continue at Rocky Reach Dam through 2013. Final results of those studies may suggest the use of additional passage tools including the use of voluntary spill if necessary to reach survival goals of the HCP. The current phase designation (status of salmon and steelhead species reaching final survival determination) for the Rocky Reach HCP are summarized in Table 3. Specific details regarding survival study design, implementation, analysis, and reporting is available in annual summary reports drafted by the HCP Coordinating Committee.

Table 4. Current Phase Designations for Rocky Reach HCP.
(Please refer to Appendix A for more detail regarding the HCPs and Phase Designation.)

Plan Species	Phase Designation	Date designation accepted by HCP CC
Upper Columbia River (UCR) steelhead	Phase III (Standards Achieved)	October 24, 2006
UCR yearling spring Chinook	Phase III (Provisional Review)	June 24, 2008
UCR subyearling summer/fall Chinook	Phase III (Additional Juvenile Studies)	June 24, 2008
Okanogan River sockeye	Phase II (Additional Tools)	November 30, 2005
Coho	Phase III (Standards Achieved –Interim Value)	June 20, 2007

1.3.4.2 Structural

No structural gas abatement measures were implemented at Rocky Reach in 2009, as Chelan PUD continues to conduct Rocky Reach HCP survival studies. For the studies to be considered valid, the studies need to take place during average flow conditions and normal project operating conditions consistent with the approved study design. This means project operations; including spill levels and configurations, as well as the overall project structure (such as spillway structures), need to remain constant during the survival studies.

2.0 PROPOSED OPERATIONS AND ACTIVITIES

The following sections describe TDG abatement measures proposed for implementation to achieve compliance with TDG water quality standards.

2.1 Operational Spill

The Rocky Reach Gas Abatement Plan outlines the intended project operations, the physical and biological monitoring plans, and the fisheries management plans that will be implemented to support WAC 173-201; and more specifically, to be consistent with the regulatory requirements enabling a seasonal adjustment to the total dissolved gas criteria to aid fish passage at hydroelectric dams. The operational spill program at Rocky Reach is managed via defined parameters of the HCP and the Hourly Coordination Agreement. Spill (9% daily average river flow) for fish passage at Rock Reach will commence with the seasonal timing of the subyearling Chinook outmigration (approximately 1st week of June) and will continue until it has been determined that 95% of the outmigration has passed the project (approximately mid August). Active participation and involvement in the Hourly Coordination Agreement is intended to effectively minimize the need for involuntary spill.

2.1.1 Minimizing Involuntary Spill

Section 5.4.1(b) of the 401 requires Chelan PUD to minimize involuntary spill at Rocky Reach Dam in order to meet TDG water quality standards. This includes:

- During fish passage, manage voluntary spill levels in real time in an effort to continue meeting TDG numeric criteria, using the TDG Operational Plan (Appendix B).
- Minimize spill, to the extent practicable, by scheduling maintenance based on predicted flows.
- Avoid spill by continuing to participate in the Hourly Coordination Agreement, or any successor agreement to which Chelan PUD is a party, to the extent it reduces TDG.
- Maximize powerhouse discharge as appropriate up to 212 kcfs.
- Implement alternative spillway operations, using any of gates 2 to 12, to determine, in consultation with the Rocky Reach Fish Forum (RRFF) and HCP Coordinating Committee, whether TDG levels can be reduced without adverse effects on fish passage. If effective, implement to reduce TDG.

2.2 Operational Changes

Potential operational changes that have been identified to date that are available at the project to meet state water quality standards and the required HCP spill to meet fish survival standards are:

- 1) changes to spill configurations
- 2) powerhouse operations
- 3) revise the operations protocol to be used when conditions of non-compliance may occur
- 4) some combination of the above

Per Section 5.4.5 of the 401, operational and structural changes that may affect TDG must be subject to review and approval by Ecology during the design and development phase to assure that such changes incorporate consideration of TDG abatement, when appropriate.

2.3 Fish Spill

Fish spill operations in 2010 at Rocky Reach will be implemented by Chelan PUD according to certain juvenile survival standards that have been achieved by Chelan PUD and some that have yet to be achieved.

During the juvenile fish migration season, 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.

Rocky Reach 2010 Spring Spill

In the spring of 2010 for yearling Chinook and steelhead, Chelan PUD plans to operate the juvenile fish bypass (JFB) at Rocky Reach exclusively with no spill, and conduct a Project survival study for yearling Chinook. This study will repeat the day-night release survival study that the District conducted for juvenile sockeye in 2009. The 2009 study evaluated the differences in Project survival for day time and night time releases of tagged sockeye smolts, and the differences in passage and survival rates for tagged smolts passing the dam itself during the day and night. This test included running turbine units in best efficiency mode to evaluate differences in route-specific survival (powerhouse and juvenile fish bypass system), with all available river flow passing through turbines and bypass system. Results showed that survival for sockeye smolts passing Rocky Reach Dam (powerhouse and bypass system) was 98.04% during night time hours, and 96.99% during the day time hours. Survival of tagged smolts passing through powerhouse was significantly higher during night time hours, even though units operated at the same efficiency settings day and night, and river flow did not vary significantly between day and night periods; predation in the immediate tailrace is believed to have caused the survival difference. The Project operated with no spill during the entire study; total study-wide Project survival for juvenile sockeye was estimated to be 95.45%.

Based on data collected in 2009 during 0% spill conditions when 100% compliance with the TDG standard was achieved, Chelan PUD is confident that maintaining a spring fish-spill program of zero spill will result in 100% compliance with the TDG standard at Rocky Reach in 2010.

Rocky Reach 2010 Summer Spill

Summer spill at Rocky Reach for subyearling Chinook will be 9% of day average river flow following completion of the yearling Chinook survival test, sometime in the first week of June. Spill will continue through the 95 percentile passage point for the subyearling migrants. The no-spill condition for the 2010 yearling Chinook test will not be shortened by the potential early arrival of subyearling Chinook at Rocky Reach. Spill for subyearling Chinook may commence only after study requirements are met (all test fish are released upstream and all tags verified at downstream detection points) for the tagged Chinook. The guidelines for starting summer spill at Rocky Reach are as follows:

1. Summer spill will start upon verification that the spring sockeye study is complete by and all tagged sockeye have passed necessary detection points at the dam and downstream (likely sometime in the first week of June). *Subyearling* Chinook will be defined as any Chinook having a fork length from 75 mm to 150 mm.
2. Summer spill season will generally end no later than August 15, or when subyearling index counts from the juvenile collector are 0.3% or less of the cumulative run for three out of any five consecutive days (same protocol used in 2009) and Program RealTime shows the 95% passage percentile has been reached.

Spill not provided for juvenile passage will be shaped to avoid delay of upstream migrants according to agreements made within the HCP Coordinating Committee and will be shaped to follow the diel distribution of the fish present.

Based on data collected in 2009 during 9% spill conditions when 100% compliance with the TDG standard was achieved, Chelan PUD is confident the summer fish-spill program in 2010 will result in 100% compliance with the TDG standard at Rocky Reach.

2.4 Fisheries Management Plan – Habitat Conservation Plan (HCP)

More than fifteen years ago, Chelan PUD began to assess how it should respond to a changing regulatory environment that was increasingly affecting operation of Rocky Reach and Rock Island Hydroelectric Projects on the Columbia River. Chelan PUD has since developed a Habitat Conservation Plans (HCP) for each project for anadromous fish in cooperation with federal and state regulatory agencies and Tribes. The HCPs were developed to conserve and protect all anadromous fish species over the long term, and to support ongoing compliance with the ESA while allowing continued operation of the Project. The Rocky Reach HCP serves as the foundation for the fisheries management plan at Rocky Reach Dam. It fundamentally describes a 100% No Net Impact (NNI) concept with necessary outcomes required for mainstem passage, habitat improvement and protection, and hatchery programming. The implementation

of the HCP is recognized by the FERC as a license article and implementation is managed via committees comprised of signatory parties (Federal, State, and Tribal) to the HCP. All measures proposed in the HCP are intended to minimize and mitigate impacts to the Plan species, to the “maximum extent practicable” as required by the Endangered Species Act. Measures that promote fish passage survivability include spills and modified spills that generate TDG during the outmigration of juvenile fish.

The HCPs began by implementing the “Phase I Plan to Achieve the Performance Standards”. Phased survival studies have been conducted since 2004 to determine the survival rates of plan species. For the studies to be considered valid, the studies needed to take place during average flow conditions and normal project operating conditions consistent with the approved study design. This means project operations; including spill levels and configurations, as well as the overall project structure (such as spillway structures), need to remain constant during the survival studies. If Chelan PUD finds feasible gas abatement methods during these studies, implementation of those methods will be considered following achievement of survival standards.

Both the Rocky Reach and Rock Island HCPs include an overall project survival goal for adult and juvenile fish of 91%. However, biologists agree that at this time adult fish survival cannot be conclusively measured for each species covered by the plan. To compensate for the scientific unknowns, the HCPs set even higher standards for juvenile survival at each project– 95% juvenile dam passage survival and 93% juvenile project survival throughout the Project (i.e., 1,000 feet below the tailrace of the upstream dam to 1,000 feet below the tailrace of the project dam). Juvenile passage survival is the major component of the HCPs, but since the Projects are so distinct, different methods have been and will continue to be used at each dam to meet the survival goals set forth in the HCPs.

2.5 Rocky Reach Operations Plan

Chelan PUD’s Operations Plan (FERC License Requirement – Article 402) is included in Appendix C of this GAP. This plan includes:

(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.

Additionally, the Operations Plan includes the **DRAFT** 2010 Fish Spill Plan for Rocky Reach.

2.6 Biological Monitoring Plan

Annual biological monitoring is not conducted at Rocky Reach; however, the 401 requires Chelan PUD to prepare and implement a study of Gas Bubble Trauma (GBT) at an undefined time. Because additional time is needed to prepare a plan of study, Chelan PUD does not plan to conduct this study in 2010. Upon completion of the plan, which is anticipated to be commenced in the summer of 2010, Chelan PUD will request a peer-review of the plan by recognized experts and submit the plan to Ecology for their review and approval.

2.7 Participation in Water Quality Forms

As part of this GAP, Chelan PUD will continue its participation in regional water quality related forums, including the Transboundary Gas Group, the Corps' end-of-year TDG monitoring summary meetings, and other forms as applicable to TDG abatement issues. Chelan PUD staff will also attend applicable trainings and workshops related to TDG abatement and/or monitoring methods.

3.0 PROPOSED STRUCTURAL TDG ABATEMENT MEASURES

No structural gas abatement measures are planned at Rocky Reach in 2010, as Chelan PUD continues to conduct Rocky Reach HCP survival studies at the Project. For the studies to be considered valid, the studies need to take place during average flow conditions and normal project operating conditions consistent with the approved study design. This means project operations; including spill levels and configurations, as well as the overall project structure (such as spillway structures), need to remain constant during the survival studies. Upon achievement of standards, Chelan PUD will be able to consider structural TDG abatement measures, if necessary.

4.0 COMPLIANCE/PHYSICAL MONITORING

The following sections describe Chelan PUD's TDG compliance monitoring program, and includes information about its fixed-site monitoring program and quality assurance protection plan.

4.1 Fixed-Site Monitoring Stations

Chelan PUD currently maintains two fixed monitoring stations (FMS) at Rocky Reach to monitor hourly TDG levels annually from April through August. The fixed monitoring stations are installed to a depth of approximately 15 feet. This depth varies as the forebay and tailrace river elevations fluctuate with river flows. This depth variation is not expected to affect the accuracy of the TDG readings because the instruments are located below the depth where gas bubbles form on the membrane and are deep enough in the water column to not be affected by near surface temperature gradients.

The forebay fixed monitoring station (Figure 2) is located on the upstream side of the dam, affixed to the corner between the powerhouse and spillway, approximately mid-channel. The tailrace fixed monitoring station (Figure 2) is located approximately 0.38 mile downstream of the dam. The standpipe is affixed to the downstream side of a pier nose supporting the juvenile bypass system outfall pipe. This location is east of mid-channel, and is minimally impacted by powerhouse flows when the project is passing water over the spillway (Schneider and Wilhelms, 2005).

TDG measurements will be recorded throughout the monitoring season at 15-minute intervals, enabling plant operators to adjust spill volumes to maintain gas levels to prevent exceedances of the TDG criteria. These 15-minute intervals will be averaged into hourly readings for use in compiling daily and 12-hour averages. All hourly data will be forwarded to Chelan PUD headquarters building and then onto the US Army Corps of Engineers Reservoir Control Center and posted at their site on the World Wide Web.

Chelan PUD will enter into a Professional Services Agreement with Columbia Basin Environmental (CBE) to perform monthly calibrations and equipment maintenance during the 2008 monitoring season. It is anticipated at this time that Chelan PUD will continue to contract with CBE into the future. QA/QC measures will be accomplished through training in instrument maintenance, operation, and factory prescribed calibration methods. A detailed log will be maintained for all work done on the monitoring equipment, including monthly maintenance, calibration, exchange of instruments, and any other pertinent information. Redundant measurements with a mobile instrument to verify the accuracy of the in-situ instruments will be conducted during the monthly calibrations.



Figure 2. Location of forebay and tailrace fixed monitoring stations at Rocky Reach Project.

4.2 QA/QC

Section 5.7.3 of the 401 requires Chelan PUD to maintain a TDG monitoring program that is at least as stringent as the QA/QC calibration and monitoring procedures and protocols developed by the USGS monitoring methodology for the Columbia River.

Chelan PUD has developed its QA/QC protocols following established protocols by other resource agencies conducting similar monitoring programs, such as the USGS, U.S. Army Corps of Engineers, and other mid-Columbia River Dam operators, as well as HydroLab Corporation's recommendations. These QA/QC protocols are included in Chelan PUD's QAPP (Appendix D) per Section 5.7.2 of the 401.

4.3 Compliance Reporting

The following sections discuss Chelan PUD's TDG reporting requirements, including reporting TDG data to its water quality web-site, notification of the start of the fish-spill season, and content of the TDG annual report.

4.3.1 Water Quality Web-Site

Section 5.7.6 of the 401 requires hourly TDG information be made available to the public via Chelan PUD's website, as close to the time of occurrence as technologically feasible. To meet this requirement, Chelan PUD will add a link to the website to direct the public to the U. S Army Corps of Engineers Reservoir Control Center (<http://www.nwd-wc.usace.army.mil/report/tdg.htm>) where the data is currently posted on a nearly hourly basis.

4.3.2 Notifications

Chelan PUD shall notify WDOE, Central Regional Office, Water Quality Program within 48 hours (either before or after) of any TDG spill; this includes the start of spill for fish, as defined in Section 1.2.1 above, and any deviation from the TDG Operational Plan or the fish spill plan that adversely affects TDG levels. This notification may be either electronic or written.

4.3.3 Annual Report

Per Section 5.4.4 of the 401, Chelan PUD will provide WDOE with a DRAFT Gas Abatement Annual Report (aka TDG monitoring report) by October 31 of each year. The Gas Abatement Annual Report will include:

- flow over the preceding year (cfs over time);
- spill over the preceding year (cfs and duration);

- reasons for spill (e.g. for fish, turbine down time);
- TDG levels during spill (hourly);
- summary of exceedances and what was done to correct the exceedances;
- results of the fish passage efficiency (FPE) studies and survival per the HCP;
- analysis of monitoring data for confirmation or refinement of the regression equations in the WQMP¹ used to predict compliance with TDG numeric criteria.

The analysis of monitoring data for confirmation or refinement of the regression equations in the WQMP used to predict compliance with TDG numeric criteria will include the following steps:

- input relevant 2008 (post relocation of tailrace fixed monitoring site), 2009, and 2010 data,
- analyze to see if the relationship between quantity of spill and TDG yields a similar or different regression than that predicted for site FOP1 in Schneider and Wilhelm (2005),
- if regression is different, look for patterns that may explain the difference,
- determine if any differences in the regression affect the predictions in Schneider and Wilhelm (2005) to meet TDG standards up to 7Q10 flows.

The report will be in the format of, and include analyses similar to those in, the 2009 Gas Abatement Annual Report, which is included in Appendix E of this GAP.

¹The WQMP is a response to Ecology's request that the PUD provided the scientific and biological basis for Ecology's Section 401 certification. It is the principal supporting document for the 401. As stated in Chapter 2 of the Comprehensive Plan (Attachment B to the Rocky Reach Settlement Agreement):

“Ecology is a participant in the Settlement Group negotiating conditions for relicensing of the Project, and has requested that Public Utility District No. 1 of Chelan County (Chelan PUD) help provide the scientific and biological basis for Ecology's Section 401 Certification. The Settlement Group has developed a Comprehensive Plan that provides the rationale and details behind proposed license articles that the Settlement Group will recommend for inclusion in the New License to be issued by FERC. The Rocky Reach Water Quality Management Plan is in response to Ecology's request and is contained in this chapter of the Comprehensive Plan.

The WQMP includes project background; background water quality; management considerations and options investigated; and protection, mitigation, and enhancement measures.

5.0 CONCLUSIONS

Based on the information presented in this GAP, it is anticipated that TDG water quality standards will be met at the Rocky Reach Project according to the implementation schedule provided in the 401 for the Project. This GAP will be updated annually to reflect any changes in implementation schedules, new or improved technologies, or TDG abatement measures.

LITERATURE CITED

Federal Energy Regulatory Commission (FERC). 2009. Order on Offer of Settlement and Issuing New License, Project No. 2145-060.

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Washington State Department of Ecology (WDOE). 2004. Total Maximum Daily Load for Total Dissolved Gas in the Mid-Columbia River and Lake Roosevelt. Submittal Report. Prepared jointly by the U.S. Environmental Protection Agency and the Washington State Department of Ecology in cooperation with the Spokane Tribe of Indians. Ecology Publication Number 04-03-002. June 2004.

Washington State Department of Ecology (WDOE). 2006. Section 401 Water Quality Certification for the Rocky Reach Hydroelectric Project. Order# 3155 dated March 17, 2006.

APPENDIX A
Rocky Reach Habitat Conservation Plan

The Rocky Reach Habitat Conservation Plan can be found at:
http://www.midcolumbiahcp.org/RR_HCP.pdf

APPENDIX B
2010 Rocky Reach TDG Operational Plan

2010 Rocky Reach TDG Operational Plan
During Fish Spill Season
April 1 – August 31

(All spill between these dates is subject to the actions contained in this plan.)

Protocol

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 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 visa versa for the opening process.

APPENDIX C
2010 Operations Plan
FERC License Requirement (Article 402)

The 2010 Rocky Reach Operations Plan can be found at the following link:

http://www.chelanpud.org/departments/licensingCompliance/rr_implementation/ResourceDocuments/33940.pdf

APPENDIX D
Quality Assurance Project Plan
Rocky Reach Water Quality Monitoring and Reporting

The Quality Assurance Project Plan can be found at:

http://www.chelanpud.org/departments/licensingCompliance/rr_implementation/ResourceDocuments/33937.pdf

APPENDIX E
2009 Gas Abatement Annual Report

The 2009 Gas Abatement Annual Report can be found at:

http://www.chelanpud.org/departments/licensingCompliance/rr_implementation/ResourceDocuments/33792.pdf