

PUBLIC UTILITY DISTRICT NO. 1 *of* CHELAN COUNTY
P.O. Box 1231, Wenatchee, WA 98807-1231 • 327 N. Wenatchee Ave., Wenatchee, WA 98801
(509) 663-8121 • Toll free 1-888-663-8121 • www.chelanpud.org

May 4, 2007

VIA ELECTRONIC FILING

Honorable Kimberly D. Bose, Secretary
FEDERAL ENERGY REGULATORY COMMISSION
888 First Street, NE
Washington, DC 20426

Re: **Lake Chelan Hydroelectric Project No. 637-022**
Article 405 – Operations Compliance and Monitoring Plan
Article 401 – Quality Assurance Project Plan

Dear Secretary Bose:

On November 6, 2006, the Federal Energy Regulatory Commission (Commission) issued the "Order on Offer of Settlement and Issuing New License"[1] (License) for the Lake Chelan Hydroelectric Project (Project). License Article 405 and Article 401 requested the Public Utility District No. 1 of Chelan County, Washington (Chelan PUD or Licensee), to file the following plans for Commission approval.

- Article 405: *Operations Compliance Monitoring Plan.*

  Within six months of the issuance date of the license, the Licensee shall file with the Commission, for approval, an Operations Compliance Monitoring Plan that describes how the licensee will comply with the instream flows, ramping rates, and tailrace flows as set forth in Article 7 of the Lake Chelan Settlement Agreement and Chapter 7 of the Comprehensive Plan attached to the settlement agreement; and the lake levels as set forth in Article 8 of the Settlement Agreement and Chapter 8 of the Comprehensive Plan.

  (a) a description of the exact location of any gages and/or measuring devices that would be used to monitor compliance, the method of calibration for each gage and/or measuring device, the frequency of recording for each gage and/or measuring device, and a monitoring schedule; a provision to electronically post recorded flows; provisions to notify the Commission no later than 48 hours after the licensee becomes aware of any deviation from the minimum flow requirements; and a provision for filing an annual report, beginning in the year in which the new release structure is installed that

[1] 117 FERC ¶ 62,129

documents compliance with the instream flows, ramping rates, and tailrace security flows, including hourly and daily inflow records, as appropriate, to document compliance with the relevant project operating constraints;

(b) a provision to file with the Commission within one year of the issuance date of the license, and annually thereafter, a report comparing monthly actual and target lake levels; and runoff volume forecasts and other factors influencing achievement of targeted lake levels; and

(c) an implementation schedule.

- Article 401(a): Requirement to File Plans for Commission Approval and Requirement to Consult *(paraphrased)*

  Appendix D, Condition V.B requires Chelan PUD to prepare the Quality Assurance Project Plan for water quality monitoring and temperature modeling for approval by some or all of the signatories of the Lake Chelan Settlement Agreement. This plan shall also be submitted to the Commission for approval and include an implementation schedule within one year of the date of issuance of the license and any proposed revisions to the plan by April 30 of year 6 of the license.

In accordance with the above License requirements, Chelan PUD hereby files the Operations Compliance Monitoring Plan and the Quality Assurance Project Plan. Please note that the Quality Assurance Project Plan was coupled with the Operations Compliance Monitoring Plan due to their complementary nature and to alleviate a duplicative consultation process since both plans involved the same entities. Appendix B provides a record of consultation with federal, state and tribal resource agency members during the development of the OCMP and QAPP.

Please do not hesitate to contact Steve Hays (509-661-4181) of my office regarding any questions or comments regarding these plans.

Sincerely,

Michelle Smith
Licensing and Compliance Manager
michelle.smith@chelanpud.org
(509) 661-4180

OPERATIONS COMPLIANCE MONITORING PLAN

Final

LAKE CHELAN HYDROELECTRIC PROJECT
FERC Project No. 637

May 4, 2007

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

TABLE OF CONTENTS

LIST OF TABLES

EXECUTIVE SUMMARY

The Federal Energy Regulatory Commission (Commission) Order on Offer of Settlement and Issuing New License (License) for the Lake Chelan Hydroelectric Project No. 637 (Project) was issued November 6, 2006 to the Public Utility District No. 1 of Chelan County (Chelan PUD). Article 405 of the new Project License requires Chelan PUD to submit an Operations Compliance Monitoring Plan by May 6, 2007. This plan describes the monitoring methods and monitoring gauges that will be used to demonstrate compliance with minimum instream flows, ramping rates, tailrace flows and lake level management required by the new Project License, as specified in Article 405 of the new license, the State of Washington Department of Ecology's 401 Water Quality Certification which is incorporated in the new license. These measures are to be implemented as described in the Lake Chelan Comprehensive Settlement Agreement, October 8, 2003, for the relicensing of the Project, which is Appendix A of the Project License. Included in this plan are provisions for electronic posting of flow information in a public domain, a schedule for implementation of minimum flows, ramping rates and tailrace flows, and annual reporting of lake level management and compliance with instream flow requirements.

SECTION 1: INTRODUCTION

The Federal Energy Regulatory Commission (Commission) Order on Offer of Settlement and Issuing New License (License) for the Lake Chelan Hydroelectric Project No. 637 (Project) was issued November 6, 2006 to the Public Utility District No. 1 of Chelan County (Chelan PUD). The Project License requires a number of measures related to release of flows into the Chelan River (instream flow) and management of the forebay level at the Project dam (lake level), as specified in Articles 405 and 408 of the Project License and described in the Lake Chelan Comprehensive Settlement Agreement, October 8, 2003 (Settlement Agreement).

Project License Article 405 requires Chelan PUD, within six months of the license issuance date, to file with the Commission an Operations Compliance Monitoring Plan (OCMP). The components of the OCMP relate to implementing, measuring and reporting Chelan PUD's compliance with the instream flow, lake level, ramping rates and powerhouse tailrace flows that are specified in the Settlement Agreement, as stated below.

> Article 405. *Operations Compliance Monitoring Plan*. Within six months of the issuance date of the license, the licensee shall file with the Commission, for approval, an Operations Compliance Monitoring Plan that describes how the licensee will comply with the instream flows, ramping rates, and tailrace flows as set forth in Article 7 of the Lake Chelan Settlement Agreement and Chapter 7 of the Comprehensive Plan attached to the Settlement Agreement; and the lake levels as set forth in Article 8 of the Settlement Agreement and Chapter 8 of the Comprehensive Plan.

This OCMP reflects the present status of flow measurement and reporting for existing installations and the most current knowledge regarding flow measurement methods and instrumentation for new structures that will be constructed in order to meet the requirements of the Project License and Settlement Agreement. The organization of this OCMP is in sections that relate to specific clauses in Article 405. Each section begins with the relevant requirements of the Project License, followed by a description of the methods that will be used to monitor and report compliance.

Many of Article 405's specific requirements regarding methods, quality control and reporting of monitoring techniques and equipment are also required in the State of Washington Department of Ecology's (Ecology) 401 Water Quality Certification (401 Certification), which is incorporated as Appendix D of the Project License. The 401 Certification requires that Chelan PUD submit a Quality Assurance Project Plan (QAPP), which is adopted into the Project License as a requirement of Article 401, Requirement to File Plans for Commission Approval and Requirement to Consult. The 401 Certification requires that the QAPP be submitted within one year of the Project License issuance date, and the Project License Article 401 requires that Chelan PUD submit the QAPP to the Commission for approval and include both an implementation schedule and documentation of its consultation with other parties in connection with the QAPP. Since the requirements of Article 405 and the QAPP are either duplicative or complementary, the QAPP is incorporated into this OCMP as Appendix A. Since the Project

License requires consultation on both documents, Chelan PUD intends to conduct those consultations concurrently.

SECTION 2: INSTREAM FLOW REQUIREMENTS AND COMPLIANCE MONITORING

2.1 Instream Flow Requirements for the Chelan River

The Project License requires that a minimum flow of 80 cfs be released throughout the year to the Chelan River at the Project dam, with additional flows provided for a two month period during average and high water runoff years to simulate the effects of an annual runoff hydrograph (Table 1). These requirements are described in described in the Settlement Agreement, Attachment B, Lake Chelan Comprehensive Plan, Chapter 7, Section 2.6.5. The spring/early summer flow increase is variable, depending on the level of winter snow deposition and runoff forecast prepared by Chelan PUD using information from four snow monitoring sites operated by Chelan PUD and other information including predicted weather patterns. In dry years, when the runoff is predicted to be less than normal (within the 80% exceedance range of historical runoff volumes or 20% of the years based on historical records), then only the 80 cfs minimum flow would be released. In average water years, when the runoff is predicted to be normal (within the 21% - 79% exceedance range or 60% of the years based on historical records), then a 200 cfs minimum flow would be released from May 15 through July 15. The exact timing of the flow increases could change depending on climatic conditions (spring temperatures or rain) and biological evaluations. In wet years, when runoff is predicted to be greater than normal (within the 20% exceedance level or 20% of the years based on historical records), then a 320 cfs minimum flow would be released from mid-May through mid-July.

Additional flow of 240 cfs is also to be provided to fish habitat to be constructed in the lowermost reach of the Chelan River (Reach 4) during the salmon and steelhead spawning periods, with such flow to either be pumped from the powerhouse tailrace or released from the Lake Chelan Dam. Depending on the location of salmon and steelhead spawning activity, sufficient flow must be provided after completion of spawning to protect the eggs and alevins from desiccation during the incubation period and through emergence of the fry from the spawning gravel. The amount and timing of additional flows required by the Project License are described in the Settlement Agreement, Attachment B, Lake Chelan Comprehensive Plan, Chapter 7, Section 2.6.5 (pg. 7-18) and in Table 7-3, which is duplicated below. Please note that the measurement methods cited in the footnotes to Table 1 have been updated as described in Section 2.4 in this OCMP.

Table 1. Flow Requirements for the Chelan River

Reach	Dry year (cfs)	Average year (cfs)	Wet year (cfs)
1, 2 & 3[1]	80 all months	80 July 16-May 14	80 July 16-May 14
		May 14 ramp up to 200	May 14 Ramp up to 320
		200 May 15-July 15	320 May 15-July 15
		July 16- ramp down to 80	July 16- Ramp down to 80
4[2] Spawning flow	80 + 240 pumped March 15 to May 15 and Oct. 15 to Nov. 30	320 by combination of spill & pumping March 15 to May 15 and Oct. 15 to Nov. 30 Incubation flow, as needed	320 by combination of spill & pumping March 15 to May 15 and Oct. 15 to Nov. 30 Incubation flow, as needed

[1] Flows measured at the dam by ultrasonic flow meter.
[2] Flows measured at the dam and at the pump station by ultrasonic flow meter.
Source: Settlement Agreement, Attachement B, Chapter 7, Table 7-3; footnotes have been updated.

2.2 New Construction to Provide Minimum Flows

2.2.1 Low Level Outlet

In order to provide minimum flows throughout the year, as required in the Project License, (Appendix A, Settlement Agreement License Article 7(b)(1) Minimum flows and ramping rates), a new structure is needed at the Project dam. The spillway crest at the dam is at elevation 1,087[1] feet, whereas the minimum lake level (headwater elevation) allowed by the Project License is 1,079 feet, thus a new outlet structure is needed in order to provide minimum flows when the lake level is below the spillway crest. This new structure, which has been named the Low Level Outlet (LLO), is currently in the early stages of design. The LLO will withdraw water from the Project dam forebay by tapping into an existing power tunnel intake structure that was part of the original construction of the Lake Chelan Project, but was never developed for additional power production. This intake structure draws water from approximately the same elevation as the river bed at the face of the dam, thus insuring compliance with the 401 Certification's requirement that Chelan PUD "design the new outlet structure to maximize the potential for cold water withdrawal at the base of the dam" (Ibid, X. D.; Project License pg. 127). The current design of the LLO includes tapping into the power tunnel stub-out of the existing intake with a pipe (84- to 96-inch diameter), which bifurcates into two pipes of equal size upstream from the control gates. Discharge from each of these pipes will be controlled with a sluice gate positioned at the outlet to the pipe, from which water will flow into the Chelan River below the spillway apron.

2.2.2 Tailrace Pump Station

The Project License (Article 408) requires that Chelan PUD develop and operate a system to release water at the Project dam or pump water from the Project powerhouse tailrace to the Chelan River at rates sufficient to continuously maintain flows equal to or greater than the flows

1 Elevations on Project drawings and water level elevations reported by Chelan PUD for lake levels and tailwater are based on the National Geodetic Survey (NGS) vertical datum 1914 Fourth General Adjustment. This vertical datum is 1.78 ft higher than NGVD 29, which is used to report water level elevations in the Columbia River. NGS currently publishes only NAVD 88 vertical datum, which is 3.82 feet higher than NGVD 29. Thus, to convert elevations from Lake Chelan Project prints and water level gauges to NGVD 29, subtract 1.78 from the elevation. To convert Lake Chelan Project elevations to NAVD 88, add 2.04 feet.

required for Reach 4 of the Chelan River. The Project License (401 Certification and Settlement Agreement, Attachment B) defines those flows (Table 1) as 80 cfs measured at the Project dam and 240 cfs measured at the dam or through calibrated pump discharge curves. The intent of the Settlement Agreement is that Chelan PUD would have the option of pumping 240 cfs of water from the powerhouse tailrace as a cost-saving measure, rather than releasing that additional water from the Project dam. The use of pumped water would require that the water be released at the beginning of the constructed fish habitat in Reach 4 of the Chelan River.

The design of a powerhouse tailrace pump station is in progress, with 60 percent design scheduled for completion in December of 2007. At the current stage of design, the pump station will include: a pump station intake structure equipped with fish screens; mechanical and electrical equipment including pumps, motors, control valves, discharge manifold, distribution power line feed, and transformers; a conveyance structure (canal or pipeline) to carry the pump station flow; and an outlet structure to release the flow into Reach 4 of the Chelan River. Prior to procurement and construction, an updated cost-benefit analysis will be completed for pumping water from the powerhouse tailrace, rather than releasing the water from the LLO and/or spillways at the Project dam.

2.3 Gauges and Measuring Devices for Instream Flow

2.3.1 Gauge and Measurement Type and Exact Locations

Article 405 requires a description of any gauges and/or measuring devices that would be used to monitor compliance with these instream flow requirements. The flow into the Chelan River at the Project dam (Reach 1) will be monitored at the LLO and/or the spillway. Flows from the LLO will be measured with an ultrasonic flow meter or similar device, which will be installed during construction and located along the 84- to 96-inch diameter pipe. Flows from the pump station would also be measured with an ultrasonic flow meter or similar device, located within the conveyance structure.

The spillway flow is measured by calculating flow from lake level readings and gate settings, for which rating tables exist. The rating tables have been conformed to accuracy standards in cooperation with the United States Geological Survey (USGS) through river stage and flow measurements in the river channel at an existing USGS stream hydrology station located a short distance downstream from the spillway apron. This gauging site is known as USGS 12452500 Chelan River at Chelan, which combines powerhouse discharge flows reported by Chelan PUD with the spillway flows, as corroborated with the stream gauging site.

Flows discharged from the turbines into the Project powerhouse tailrace are measured using an ultrasonic flow meter. The device uses ultrasonic sound wave sensors to measure the velocity of the water in a cross section of the penstock. The sensors are located approximately 30-feet upstream of the turbine inlet valve (TIV), with one flow meter in each leg of the bifurcation from the main power tunnel. Combining the two measurements provides the total flow through the penstock, including turbine, irrigation and raw water flows.

Article 405 requires the exact location of any gages and/or measuring devices that would be used to monitor compliance. As mentioned above, the approximate location of flow measuring devices for the LLO and pump station are within the conveyance structures. The exact location

and manufacturer specifications for these flow meters will be supplied in a future update to this OCMP following completion of these new Project structures.

Determination of the spillway discharge requires measurement of the lake level elevation, which is measured at a gauging station located on the south shore of Lake Chelan at Lakeside. This gauge, known as the Lakeside Gauge (USGS 12452000), is located at Latitude 47°50'11", Longitude 120°03'37", near center of section 15, Township 27 North, Range 22 East, in Chelan County, Hydrologic Unit 17020009, on south shore of Lake Chelan at Lakeside, 2.1 miles west of Chelan. (http://waterdata.usgs.gov/nwis/dv/?site_no=12452000). Gate positions are also used to determine flow from the spillway. Automatic spillway gates 5, 6, and 8 are equipped with sensors that monitor gate position and relay this information. Gate positions are displayed on a control panel in the powerhouse and at the Chelan PUD central control center. The other gates are manually operated, with gate settings reported by the personnel when dogging the gate in an open position. During maintenance of the LLO and at other times when the spillway is operating, the spillway discharge will be included in the monitoring of compliance with the instream flow requirements for the Chelan River.

2.3.2 Gauge Calibration Methods and Frequencies of Calibration

The new ultrasonic flow meters that will be installed in the LLO and pump station will be installed and calibrated using a dye dilution method or other method. The LLO calibration will inject a dye at a known concentration into the intake and then measure the diluted concentration at the outlet structure. The objective will be to calibrate the meter to be accurate to approximately 1 percent of discharge. Thus, the flow meter will be calibrated to provide average flow measurements within 0.8 cfs of the actual flow passing though the LLO when the desired flow is 80 cfs. The accuracy of the calibration will be verified, which may include comparison with other flow measurement procedures, such as open channel flow measurements at outlet structures or stream flow estimation in the river channel. The precision of the ultrasonic flow meters is expected to be within two to five percent of the maximum discharge of each conveyance pipe or channel. In other words, any single instantaneous reading at the pump station will be within 4.8 cfs – 7.0 cfs at flows of 240 cfs or greater, while the average readings for a day would be accurate to within 2.4 cfs of the desired 240 cfs flow release. The accuracy and precision of open-channel flow measurement and/or stream flow estimation in the river channel will be lower, but comparison with these methods following installation will ascertain if there are any installation errors or equipment malfunctions that have grossly affected the accuracy of the flow meters.

Spillway rating curves for low volume discharge (80 cfs – 500 cfs) were compared for accuracy with USGS estimates of stream flow at the hydrology station during temperature modeling studies conducted in 2002. Spillway rating curves for higher discharges had been compared with USGS measurements in earlier years. Spillway flow calculations have a precision of about 5 – 10 percent of the measured flow. The USGS stream flow estimates likely are less precise, but provide a basis for comparison to assure that spillway rating tables are within the norms of accuracy for stream flow calculations. The location of the USGS gauging site (USGS 12452500 Chelan River at Chelan) is described by USGS as: Latitude 47°50'05", Longitude 120°00'43", in SE 1/4 NE 1/4 Section 30, Township 27 North, Range 23 East, in Chelan County, Hydrologic Unit 17020009, at Chelan River power plant tailrace, 4.3 miles downstream from control dam at

outlet of Lake Chelan, 3.0 miles southeast of Chelan, and at river mile undetermined. Datum of gage is 1,074.66 feet above NGVD of 1912.
(http://waterdata.usgs.gov/nwis/dv/?site_no=12452500).

The powerhouse penstock flow meters are highly accurate. The measurement system is an eight path Accusonic 7500 panel. Each bifurcation has an eight path setup to measure flows. Overall accuracy of the system is +/- 1% of maximum scale (+/-26 cfs total in this installation). The accuracy (calibration) is defined by having precise as-built values of the distance between sensors on each path, functioning sensors and electronics. Typically these flow meters lose accuracy by having the surface of the sensor scoured by debris in the water. This occurs very slowly over time, particularly since the water from Lake Chelan contains very little suspended material. To calibrate these meters, a technician from Accusonic measures the reads on each individual channel to verify the integrity of the sensors and performs diagnostics on the computer boards in the panel. It is not necessary to calibrate frequently. The last calibration was performed in September 2005.

The frequency of maintenance and re-calibration of the above flow measurement devices and methods will follow manufacturer's recommendations for the new flow meters and will be on an as-needed basis for the lake level gauge following maintenance or any observed malfunction. Comparison of spillway discharge, LLO flows and powerhouse discharge with USGS streamflow estimations will be pursuant to USGS standards, which have been developed over the history of the Lake Chelan Project. The USGS relies on the spillway and powerhouse discharge calculations for their reporting of Chelan River flows and Chelan PUD has and will continue to coordinate with USGS in maintaining the accuracy of these flow measurements, as well as new flow measurements from the LLO.

2.4 Instream Flow Monitoring and Reporting

The flows measured or calculated from the LLO, pumping station, spillway and powerhouse discharge are or will be equipped for both local and remote readability and control. The powerhouse and spillway flows, as well as lake level and tailwater elevations, are currently monitored and recorded with the Chelan PUD's Supervisory Control and Data Acquisition (SCADA) system. The SCADA system provides data in real-time, with readings every second, as well as data recording. The flows and lake level elevation are recorded as the previous hour's average of the one-second readings. The tailwater elevation point value is recorded at the end of the hour.

2.4.1 Instream Flow Periodic and Electronic Reporting

Chelan PUD will report hourly average and daily average instream flows as recorded from the LLO, pumping station, spillway and powerhouse. In addition, hourly and daily lake level and tailwater elevation readings will be reported. This information will be provided in written form to the Chelan River Fish Forum (CRFF) and posted electronically to the Lake Chelan Implementation web page (http://www.chelanpud.org/lake-chelan-implementation.html) on a quarterly basis. Real-time flows, lake levels and tailwater levels will also be provided at this site.

Chelan PUD will, within 48 hours, notify the Commission and Ecology's Central Regional Office via email of any deviation from the minimum flow requirements.

2.4.2 Annual Reports of Compliance with Instream Flows, Ramping Rates and Tailrace Security Flows

Chelan PUD will file an annual report with the Commission and Ecology by February 28 of the year following collection of the data, as specified in the 401 Certification and QAPP, beginning in the year in which the new release structure (LLO) is installed (Article 405(a)). This report will be coordinated with the reporting of water quality data and biological evaluations that are also required in the 401 Certification, as specified in the QAPP. The reporting of minimum instream flow compliance will be concurrent with the initiation of minimum flows into the Chelan River, which is to occur no later than two years after the effective date of the new license (401 Certification, Settlement Agreement). However, the initiation of minimum flows cannot proceed until the design of the LLO and habitat improvements in Reach 4 of the Chelan River have been approved by Commission (Article 408) and construction has been completed. The approval process and long lead times for permitting and procurement of some components of the LLO may delay initiation of minimum flows beyond the two-year anniversary (November 1, 2008) of the Project License.

2.5 Instream Flow Compliance

The instream flow compliance data will include hourly and daily flow records for Project flow releases from the LLO, spillway, pump station and powerhouse. This information may be summarized and correlated with relevant water quality and biological data collected for compliance with the 401 Certification. A summary of any deviations from the minimum flow requirements will be provided, including a description of the cause and corrective actions taken to prevent future deviations from the minimum flow requirements.

2.6 Ramping Rate Compliance

The 401 Certification and Settlement Agreement require that ramping rates be established for the Chelan River to protect aquatic organisms from rapid fluctuations in water levels. The ramping rates are initially set at approximately two inches per hour during the period when fry (very small juvenile salmon and trout) may be present (Settlement Agreement, Attachment B, Lake Chelan Comprehensive Plan, Chapter 7, pages 7-35, 7-36). The ramping rate limitation of two inches per hour does not apply when the hydraulic capacity of the Project has been exceeded by natural inflows and the lake is within one foot of being full (elevation 1,099 feet) or during other operations to satisfy requirements for flood control.

The two inches per hour ramping rates will remain in effect until biological evaluations have determined the actual ramping rates necessary to prevent stranding of fish in the Chelan River. The locations in the Chelan River where water level changes will be measured to determine operating criteria for compliance with ramping rates will be determined in consultation with the Chelan River Fishery Forum (CRFF). A study will be conducted to determine the operating criteria for changes in flow from the LLO, spillway and pump station. The results of this study will establish ramping procedures in terms of allowable flow reductions per hour for these sources of flow releases. Biological evaluations will determine the periods of time during the year when ramping rates will be applied to protect fry from stranding.

Compliance with ramping rates will be reported in terms of meeting the operating criteria developed in consultation with the CRFF for flow reductions into the Chelan River. These criteria will establish the allowable rates of decrease in hourly average flow releases from the LLO, spillway and pump station. These rates may vary, depending on the overall flow level and the time of year. The compliance reporting will consist of a summary of any deviations from the ramping criteria, including a description of the cause and corrective actions taken to prevent future deviations.

2.7 Tailrace Security Flow Compliance

The Project License (Article 405) requires protection from dewatering and low intragravel dissolved oxygen for salmon and steelhead eggs and alevins incubating within the constructed spawning habitat in the powerhouse tailrace, as described in the Settlement Agreement, Attachment B, Lake Chelan Comprehensive Plan, Chapter 7, pages 7-59-60). During years 1-5 of the 10-year evaluation period for meeting biological objectives, the Settlement Agreement, Attachment B, Lake Chelan Comprehensive Plan, Chapter 7, (pages 7-53 and 7-54) requires monitoring of dissolved oxygen levels in representative salmon and steelhead redds in the powerhouse tailrace during scheduled powerhouse shutdowns. The purpose of this monitoring is to determine if powerhouse shutdowns for extended periods of time can lead to low levels of dissolved oxygen and potential mortality of eggs or alevins. If adverse intragravel dissolved oxygen (<6.0 mg/l) conditions are detected, then Chelan PUD will develop powerhouse operating criteria for either periodic flow releases or other methods to maintain adequate intragravel dissolved oxygen levels. These operations would only be implemented when necessary to protect salmon and steelhead eggs and alevins during the periods of the year when they are present in the powerhouse tailrace. These powerhouse operating criteria or other methods, described as flow security criteria in the 401 Certification (III, C), will be developed in consultation with the CRFF.

Compliance with powerhouse tailrace security flows will be reported in terms of meeting the operating criteria, if any are needed, for periodic operation of the powerhouse to maintain favorable intragravel dissolved oxygen levels in the powerhouse tailrace. These criteria will establish the times of year, volume, duration and frequency of powerhouse operations necessary to protect salmon and steelhead eggs and alevins. The compliance reporting will consist of a summary of powerhouse operations during the incubation period for these species of fish, with the duration of any powerhouse shutdowns and any periodic flow releases provided for protection of eggs and alevins (security flows). During years 1-5 following the completion of fish spawning habitat construction in the powerhouse tailrace, the results of intragravel dissolved oxygen monitoring and incubation period determined from biological monitoring will also be provided in the compliance report.

SECTION 3: LAKE LEVEL MANAGEMENT AND COMPLIANCE REPORTING

Chelan PUD manages the operating levels of Lake Chelan to meet Commission required minimum (1,079 feet) and maximum (1,100 feet) water level elevations and a number of objectives, as specified in the Settlement Agreement, Attachment B, Lake Chelan Comprehensive Plan, Chapter 8). The new lake level management objectives in the Project License include target lake levels for certain dates, which are intended to balance the needs of recreation and fish protection. Lake Chelan water levels are managed by Chelan PUD with the following objectives in mind:

- Maintaining minimum flows in the Chelan River (this objective has priority over lake levels);
- Reducing high flows in the Chelan River (this objective has priority over lake levels);
- Satisfying regulatory requirements for flood control (adjusting lake level);
- Providing usable lake levels for recreation (which varies between elevation 1,090 feet and 1,098 feet, depending on the slope of the shoreline and boat dock configurations);
- Reduce shoreline erosion;
- Preventing fish passage blockages (due to tributary barriers); and
- Minimizing the effect of refill on attainment of flow objectives for salmon in the mainstem Columbia River.

In the Settlement Agreement, Chelan PUD committed to make every reasonable effort to operate the Project, to the extent practicable, to obtain the minimum lake elevations by the dates specified below in Table 2.

Table 2. Target Minimum Lake Level Elevations

Date	Minimum Elevation
May 1	1,087.6
June 1	1,094.0
July 1	1,098.0
August 1	1,099.0
September 7	1,098.7
October 1	1,097.2

The Project License contains a new reporting requirement pertaining to lake level management. Article 405(b) requires Chelan PUD to file with the Commission, within one year of the issuance date of the license, and annually thereafter, a report comparing monthly actual and target lake levels. The annual Lake Level Report is to include runoff volume forecasts and other factors influencing achievement of targeted lake levels.

Chelan PUD will file the first Lake Level Report by November 1, 2007, which is one year from the issuance date of the Project License. Additionally, Chelan PUD will submit the first annual Flow Report, as required under the 401 Certification and QAPP, to the Commission by February

28, 2008. Subsequent annual Lake Level Reports are proposed to be filed with the Commission by February 28 annually, beginning 2009, to coincide with the submittal of the annual Flow Report.

The annual report will include a graph of daily average lake levels, with the elevation at the target dates in Table 2 highlighted. Tabulated data will include Lake Chelan snow survey and runoff forecasts for April through July, which are made each month from January – April, and calculated daily average inflows and discharges (powerhouse, LLO, spillway) for the year. A narrative will be provided that summarizes the lake level management decisions, particularly in relation to the management objectives above, that occurred as precipitation forecasts, runoff forecasts and inflows changed significantly during the lake drawdown and refill period. Principal factors influencing lake level management decisions during the drawdown and refill cycle are predictions of runoff volume, timing of runoff and protection of fish habitat in Reach 4 of the Chelan River from high flow damage.

SECTION 4: IMPLEMENTATION SCHEDULE

Schedules for all Lake Chelan implementation are being managed using Primavera® Enterprise scheduling software. The various projects are interrelated and managed real-time by various project managers. The anticipated OCMP implementation and reporting schedule is presented below. Please note that completion dates for the Low Level Outlet, Pump Station, and Reach 4 Fish Habitat are current estimates and will need to be further refined following completion of the design phase (during 2007). If following design, construction schedules necessitate a request for additional time, Chelan PUD, through consultation with the Chelan River Fishery Forum, will prepare an extension request for Commission approval.

4.1 Compliance Plan Implementation Schedule

5/4/07 – OCMP Submitted to Commission

5/4/07 – QAPP Submitted to Commission

11/1/07 – Electronic Posting of Flows begins

11/1/08 – Completion of Reach 4 Fish Habitat*

11/1/08 – Completion Low Level Outlet at Dam*

11/1/08 – Initiation of Minimum Flow Requirements*

11/1/08 – Initiation of Ramping Rate Requirements

11/1/08 – Initiation of Powerhouse Tailrace Security Flow Requirements

2/5/09 – Completion of Pump Station*

* Chelan PUD will notify the Commission and seek an extension of time for the completion of these projects if necessary

4.2 Annual Report and Review Schedule

11/1/07 – First Annual Lake Level Report Submitted to Commission

2/28/08 – Annual Flow Report Submitted to Commission (Absent Minimum Flows)

2/28/09 + Annually Thereafter – Proposed Annual Lake Level Report to Commission to coincide with annual flow report submittal

2/28/09 + Annually Thereafter – Annual Flow Report to Ecology and Commission

APPENDIX A: QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN
Lake Chelan Water Quality Monitoring and Reporting

Final

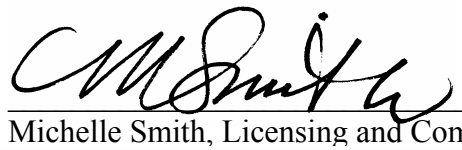
LAKE CHELAN HYDROELECTRIC PROJECT
FERC Project No. 637

May 4, 2007

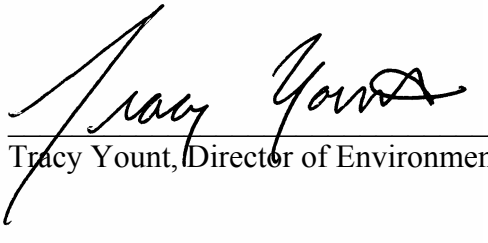
Public Utility District No. 1 of Chelan County
Wenatchee, Washington

In accordance with the State of Washington Order Number: 1233
(Amended Order Number. DE 03WQCR-5420)
Licensing of the Lake Chelan, Hydroelectric Project (FERC No. 637),
Chelan County, Washington

Approved by:



Michelle Smith, Licensing and Compliance Manager, Chelan PUD — May 4, 2007 Date



Tracy Yount, Director of Environmental Affairs, Chelan PUD — May 4, 2007 Date

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

DISTRIBUTION LIST

Chelan PUD
- Janet Jaspers
- Bill Christman
- Todd West
- Scott Buehn
- Waikele Hampton
- Rob Campbell
- Steve Hays
- Darrell Gouldin
- Jeff Osborn
- Michelle Smith

Ecology
- Denise Mills
- John Merz
- Pat Irle

Chelan River Fisheries Forum (persons to be named)
- WDFW
- USFWS
- USFS
- NOAA Fisheries, National Marine Fisheries Service

Other (FERC Article 405 Consultation List)
- U.S. Geological Survey
- U.S. Park Service (National Park Service)
- Washington State Parks and Recreation Commission
- Washington Interagency Committee for Outdoor Recreation
- Confederated Tribes of the Colville Reservation
- City of Chelan
- Lake Chelan Sportsman's Association
- Manson Parks and Recreation Department
- Lake Chelan Recreation Association
- American Whitewater

ACRONYMS AND ABBREVIATIONS LIST

ASTM	American Society for Testing and Materials
BHC	butylated hydroxyanisole
cfs	cubic feet per second
Chelan PUD	Public Utility District Number 1 of Chelan County
CRBEIP	Chelan River Biological Evaluation and Implementation Plan
DDD	4,4'-dichlorodiphenyldichloroethane
DDE	4,4'-dichlorodiphenyldichloroethylene
DDT	4,4'-dichlorodiphenyltrichloroethane
DO	dissolved oxygen
DQO	data quality objectives
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
ft/mi	feet per mile
GPS	Global Positioning System
kcfs	thousands of cubic feet per second
mg/L	milligrams per liter
mmHg	millimeters of mercury
MQO	measurement quality objective
msl	mean sea level
N/A	not applicable
NIST	National Institute of Standards and Technology
NTU	nephelometric turbidity unit
PCB	polychlorinated biphenyls
P.I.	Plant Information
Project	Lake Chelan Hydroelectric Project
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control

RPD relative percent difference

SM standard method
SOP standard operating procedure
SPCC Spill Prevention Control and Countermeasure

TDG total dissolved gas
TMDL Total Maximum Daily Load

WAC Washington Administrative Code
WAS Watershed Assessment Section
WQA Water Quality Assessment

SECTION 1: BACKGROUND

The Lake Chelan Hydroelectric Project (Project) is located approximately 32 miles north of the city of Wenatchee in Chelan County, near the geographic center of Washington State (Figure 1-1). Lake Chelan is a natural body of water that developed within a broad glacial trough. The 15.8 million acre-foot lake averages 1.03 miles in width, and has depths up to 1,486 feet. It is bordered by more than two million acres of National Forest Lands, more than half of which are designated wilderness. The Project generates 48 megawatts of hydropower.

Figure 1-1: Project Location

This Federal Energy Regulatory Commission (FERC) licensed Project includes a diversion dam at the head of the Chelan River, which is located at the southeasterly end of 50.4-mile-long Lake Chelan, adjacent to the city of Chelan. The dam is 40 feet high and approximately 490 feet long and controls the elevation of Lake Chelan and the flow to the Chelan River. The Chelan River is 3.91 miles long and empties into the Columbia River. Historically, most of the annual flow out of Lake Chelan has been diverted to the power tunnel, except during high inflows when the lake is full, leaving the Chelan River dry during much of the past 79 years. The Project's Powerhouse is located near the Columbia River and the community of Chelan Falls (Figure 1-2). Except during spring and summer in years with above average snowfall or rain, nearly the entire Lake Chelan outflow, averaging approximately 2,041 cubic feet per second (cfs), is diverted through the intake at the face of the dam into a 14-foot diameter, 2.2-mile long power tunnel which transitions to a 12-foot diameter pipe prior to bifurcating to form two 9-foot diameter penstocks, each 90 feet in length. The penstocks convey the water to the powerhouse for power production. From the powerhouse, the water empties into the powerhouse tailrace, about 1,700 feet from the Columbia River, just south of the mouth of the Chelan River (Figure 1-2).

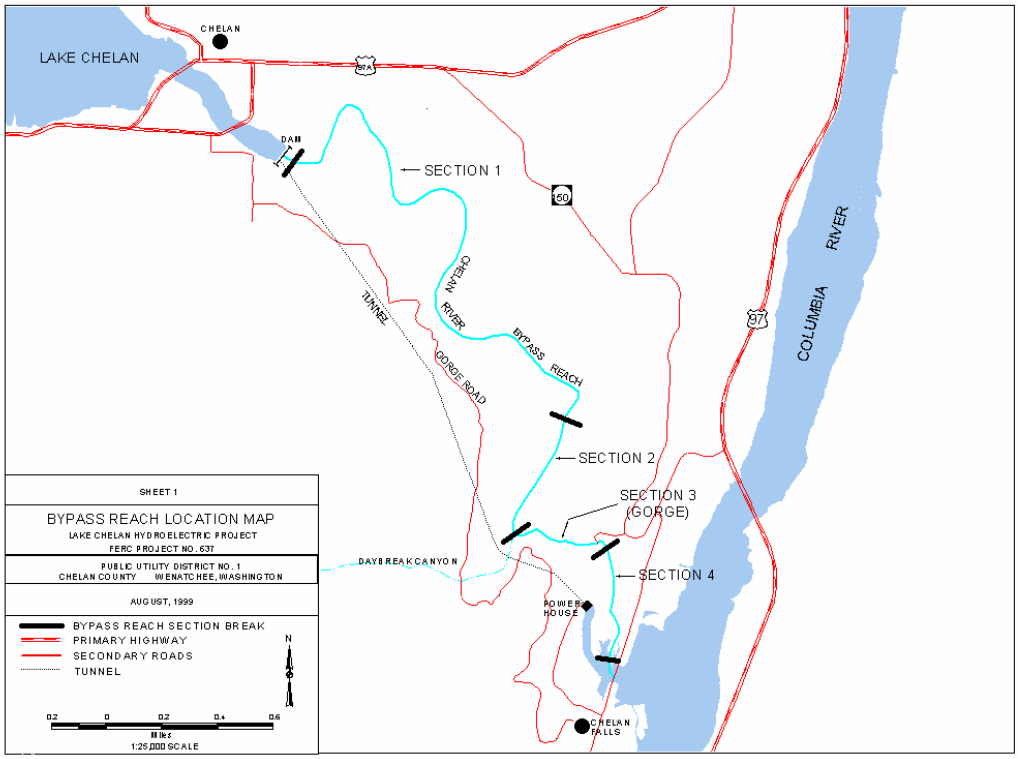


Figure 1-2: Detail of the Project

During peak spring and summer runoff conditions, water not diverted to the tunnel and penstock system for power generation flows down the Chelan River bypassed reach, which is comprised of four distinct reaches or sections (Chelan PUD, 1999; Figure 1-2). The upper two sections, Reaches 1 and 2, are relatively low gradient areas (approximately 55 and 57 feet per mile (ft/mi), respectively) extending a length of 2.29 and 0.75 miles, respectively. Reach 3, referred to as the gorge, is 0.38 miles long with steep and narrow canyon walls. The gradient in this part of the channel is very steep, approximately 480 ft/mi, or approximately 9%. Waterfalls, from five to 20 feet high, numerous cascades, bedrock chutes, and large deep pools characterize the stream channel in the gorge reach. Finally, Reach 4 is 0.49 miles long and is characterized by a wide flood plain. This section of the bypass reach has a low gradient (22 ft/mi) and substrate comprised of gravel, cobble, and boulders. Reach 4 extends from the bottom of the gorge section to the confluence with the powerhouse tailrace and Columbia River.

The water quality monitoring program described in this Quality Assurance Project Plan (QAPP) is necessary to fulfill the requirements set forth by the Washington State Department of Ecology (Ecology) in the Section 401 water quality certification, Order No. DE 03WQCR-5420 issued on March 24, 2003, initially amended by Ecology on April 21, 2003, and finally amended on June 1, 2004 (Order 1233), as required by the Pollution Control Hearings Board (PCHB) Order No. 03-075. The Section 401 certification incorporates by reference the Chelan River Biological Evaluation and Implementation Plan (CRBEIP), which is Chapter 7 of the Comprehensive Plan incorporated into the October 8, 2003 Lake Chelan Settlement Agreement entered into by Chelan

PUD, Ecology, and other parties. This QAPP was prepared in accordance with the Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology, 2004), and Field Sampling and Measurement Protocols for the Watershed Assessments Section (Ecology, 1993)

Because the Chelan River bypassed reach has been generally dewatered for the last 79 years, little is known about what level of fish production and attainment of water quality criteria for temperature can reasonably be expected. Therefore, the 401 certification requires a monitoring plan, as part of a 10-year adaptive management plan, to gather and assess the data necessary to identify all known, reasonable, and feasible measures to achieve biological objectives, and to determine whether implementing these measures will meet the numeric water quality criteria as specified in Washington Administrative Code (WAC) 173-201A.

To accomplish these measures in accordance with the 401 certification, the Public Utility District Number 1 of Chelan County (Chelan PUD) will monitor and evaluate water temperature, dissolved oxygen (DO) concentrations, flows, pH, turbidity, and total dissolved gas (TDG) at various locations in the Chelan River and the powerhouse tailrace. This QAPP is designed to describe the proposed sampling, monitoring and assessment methods, and subsequent reporting requirements. **It is anticipated that temperature modeling will be a substantial component of the assessment plan after the data collected under this effort have been evaluated. This QAPP will not address the modeling effort.** Due to the complexity of the water temperature modeling that will be necessary to determine whether the Chelan River can meet temperature criteria for its current use designation, Chelan PUD intends to develop a separate QAPP for that modeling study. The study may require modeling of temperatures that would flow into the Chelan River from Lake Chelan in the absence of the Project. The modeling study may require three to five years of additional temperature monitoring in the lower portion of Lake Chelan, as well as the same number of years after the Chelan River flows have been established. The QAPP for this study will be developed for implementation by the summer of 2010.

It is necessary to note that some of the monitoring described in this QAPP may not be conducted if unsafe conditions exist. At this time it is not possible to know if unsafe conditions exist, and if so, whether they are temporary or permanent. If permanently unsafe conditions exist, Chelan PUD will consult with Ecology to determine an appropriate alternative.

1.1 Historical Water Quality Information

This water body has a 401 certification designed to address any impacts to the Chelan River from ongoing Project operations. The development of this QAPP is meant to initiate the data collection and analysis phase of 401 certification requirements.

Because the Chelan River bypassed reach has been historically dry most the time during the year, except during high flow spill conditions, previous water quality data are only available for the associated reaches during studies conducted for relicensing of the Project. These studies found little change in water quality between the lake outlet and the confluence of the Chelan River with the Columbia River, except for water temperature, because of limited residence time of water discharged through the bypass reach. The assessments of DO, pH, TDG and turbidity defined later in this QAPP are intended to confirm this finding.

1.2 Implementation Studies and New Construction to Provide Minimum Flows

1.2.1 Low Level Outlet

Chelan PUD is proceeding with the planning and design of a flow release outlet structure to provide managed minimum flows to the Chelan River bypassed reach, consistent with the Section 401 certification. This outlet structure has been named the Low Level Outlet (LLO), which will be capable of withdrawing water from Lake Chelan under the full range of headwater elevations (1079 feet – 1100 feet) allowed by the Project License. Feasibility analyses identified two possible locations for the construction of the outlet structure. These locations are on opposite sides of the Chelan Dam and have different approaches for withdrawing water from the base of the dam.

A forebay water temperature study was conducted to determine whether there were any differences between the two proposed design options that would influence the potential for cold water withdrawal from the forebay. The 401 Certification requires Chelan PUD to "design the new outlet structure to maximize the potential for cold water withdrawal at the base of the dam". The results of this study indicated that there is no lateral temperature variation in the forebay, thus the lateral position of the structure along the dam would not affect the temperature of the water withdrawn. However, due to the observation of temporary vertical thermal gradients at the face of the dam, the depth of the withdrawal would influence the temperature discharged when such thermal gradients are present. The LLO is being designed to withdraw water from the Lake Chelan Dam forebay by tapping into an existing power tunnel intake structure that was part of the original construction of the Lake Chelan Project, but was never developed for additional power production. This intake structure draws water from approximately the same elevation as the river bed at the face of the dam, which is where the coldest water layers were observed in the forebay. Selection of this design option for the LLO insures compliance with the 401 Certification's requirement that Chelan PUD maximize the potential for cold water withdrawal at the base of the dam.

1.2.2 Tailrace Pump Station

The Project License (Article 408) requires that Chelan PUD develop and operate a system to release water at the Lake Chelan Dam or pump water from the project powerhouse tailrace to the Chelan River at rates sufficient to continuously maintain flows equal to or greater than the flows required for Reach 4 of the Chelan River. The Settlement Agreement defines those flows (OCMP, Table 1) as 80 cfs measured at the Lake Chelan Dam and 240 cfs measured at the dam or through calibrated pump discharge curves. The intent of the Settlement Agreement is that Chelan PUD would have the option of pumping 240 cfs of water from the powerhouse tailrace as a cost-saving measure, rather than releasing that additional water from the Lake Chelan Dam. The use of pumped water would require that the water be released at the beginning of the constructed fish habitat in Reach 4 of the Chelan River.

The design of a powerhouse tailrace pump station is in progress, with 60% design scheduled for completion during the summer of 2007. At the current stage of design, the pump station will

include: a pump station intake structure equipped with fish screens; mechanical and electrical equipment including pumps, motors, control valves, discharge manifold, distribution power line feed, and transformers; a conveyance structure (canal or pipeline) to carry the pump station flow; and an outlet structure to release the flow into Reach 4 of the Chelan River. Prior to procurement and construction, an updated cost-benefit analysis will be completed for pumping water from the powerhouse tailrace, rather than releasing the water from the LLO and/or spillways at the Lake Chelan Dam.

SECTION 2: PROJECT DESCRIPTION

According to the Section 401 certification, monitoring, assessment, and reporting are required. Each will be discussed in this QAPP. Additionally, in accordance with the Table 7-10 of the CRBEIP, additional DO monitoring will be conducted.

The goal of the QAPP is to determine compliance with Washington's water quality criteria (WAC 173-201a). This QAPP was prepared to guide the Chelan PUD in this effort. If criteria are not being met, subsequent goals may include identifying any impacts due to ongoing Project operations on the regulated parameters; and determining and implementing any reasonable and feasible solutions to exceedances.

The following are the monitoring requirements of the Lake Chelan Section 401 water quality certification:

- Conducting hourly monitoring of the temperature of the water in the Lake Chelan Dam forebay, at the end of Reaches 1, 3 and 4 of Chelan River, and in the powerhouse tailrace;
- Collecting and recording hourly flow data through the Chelan River bypassed reach and in the penstock;
- Assessing the DO, turbidity, and pH levels in the water in Reach 4 and the TDG in the spillway during the third and fifth years after the effective date of the new Lake Chelan FERC license (unless otherwise noted, all years referenced in this document will be the number of years after the effective date of the new License); and
- Weekly visually monitoring of the powerhouse tailrace for a visible sheen indicating petroleum products.

The reporting of these data includes submitting:

- Flow and temperature data on the Chelan PUD website on a monthly basis (no later than the 30th day of the month following the reporting period) during July through September annually, and quarterly the remainder of the year;
- An annual report to Ecology in an approved format that includes a data assessment of compliance with state water quality criteria, summaries of the data, and a list of any water quality exceedances;
- DO, TDG, turbidity, and pH data in the annual reports in the fourth and sixth years; and
- A report of observed dying fish or violations of Class A water quality criteria in the Chelan River bypassed reach for pH, temperature, DO, TDG, turbidity, or sheen within 48 hours with an explanation of cause and notification for the course of action.

The following are the additional monitoring requirements for intragravel DO, during years one through five, as described in Table 7-10 of Chapter 7 of the Lake Chelan Comprehensive Plan:

- In the powerhouse tailrace hourly during all scheduled (non-emergency) powerhouse shutdowns; and
- Weekly in the powerhouse tailrace and Reach 4 hourly for at least one 24-hour period during incubation (estimated to be from November to February).

This monitoring will be conducted in accordance with previous studies conducted as a basis for the CRBEIP (BioAnalysts, 2003).

SECTION 3: ORGANIZATION AND SCHEDULE

This section includes key personnel assigned to the project and an associated organizational chart, and time schedules for field operations, project deliverables, budgeting, and funding information.

3.1 Key Personnel

This project is to be conducted primarily by Chelan PUD personnel, with assistance as needed, to expedite the process, reduce costs, or improve quality (if needed). All personnel conducting work will have sufficient skills and experience to complete the necessary tasks at a high level of quality. This plan has been designed by Chelan PUD, and is anticipated to be conducted by the personnel outlined in Table 3-1.

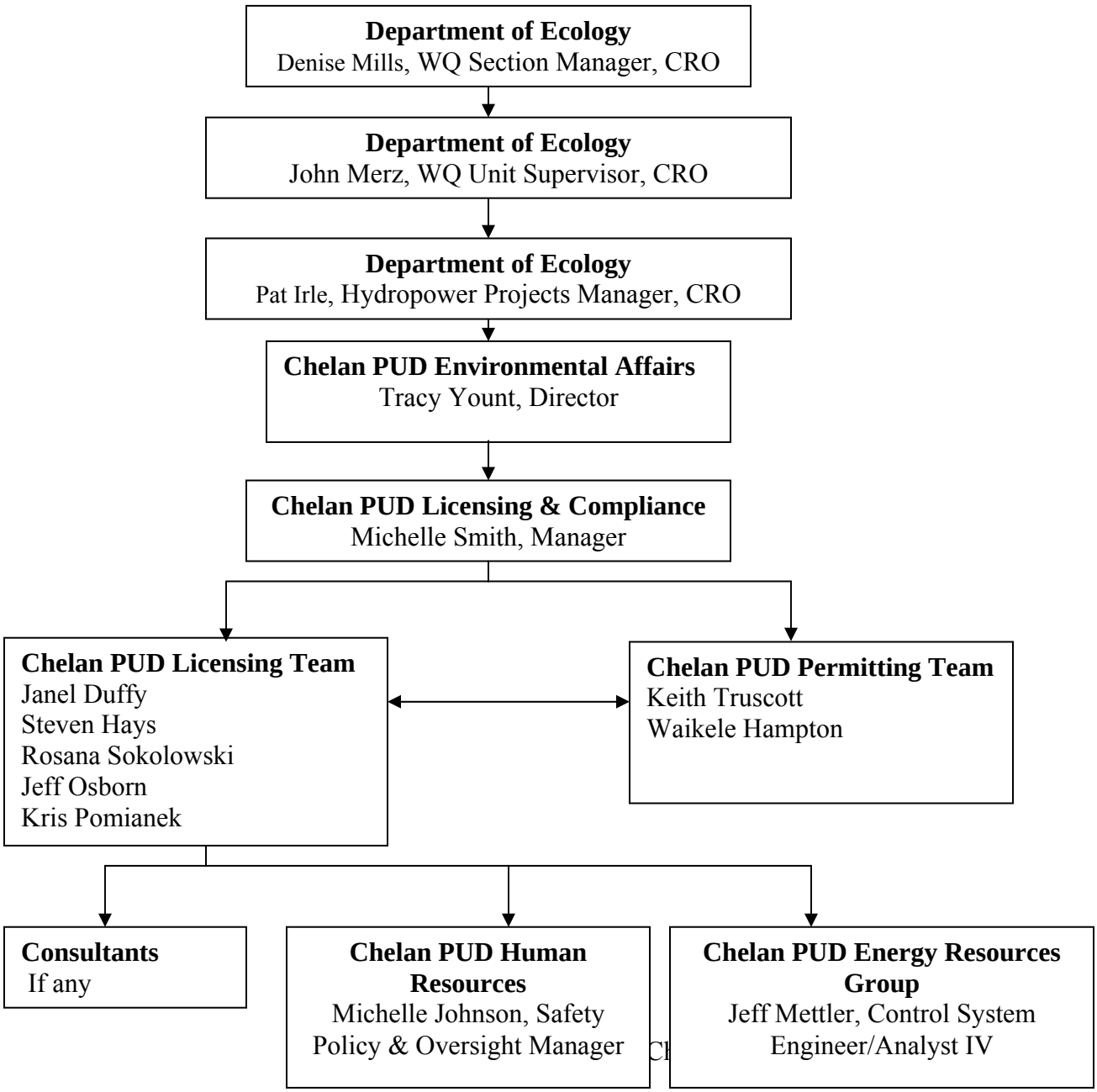
Table 3-1: List of Key Personnel

Personnel	Responsibility
Janel Duffy	*Chelan PUD Environmental Engineer / Program Manager.* Lead responsible for project management, jointly responsible for report generation, data interpretation, field sampling methodology development, and sampling and monitoring.
Waikele Hampton.....	*Chelan PUD Environmental Specialist*. Jointly responsible for report generation, sampling and monitoring.
Steven Hays.....	*Chelan PUD Fish and Wildlife Senior Advisor.* Jointly responsible for report generation and/or review, data interpretation, and field sampling methodology development. Senior technical review for all reports.
Jeff Osborn	*Chelan PUD Fish and Wildlife Specialist.* Jointly responsible for implementation of intergravel DO measurement, and fish-related issues.
Michelle Smith	*Chelan PUD Licensing and Compliance Manager*. Responsible for QAPP and report review and approval, and funding approval.
Rosana Sokolowski ..	*Chelan PUD Licensing & Compliance Coordinator*. Responsible for administrative support of QAPP, sampling, data entry, and reporting.
Keith Truscott.....	*Chelan PUD Environmental and Permitting Manager*. Responsible for QAPP and report review.
Denise Mills..... John Merz	*Ecology, Section Manager – Water Quality Program, Central Regional Office (CRO).* Oversight of Ecology participation in implementation of the 401 certification. *Ecology, Unit Supervisor - Water Quality Program, Central Regional Office (CRO).* Oversight of Ecology participation in implementation of the 401 certification.
Patricia Irle	*Hydropower Projects Manager, CRO*. Contact for review of reports and the QAPP and assistance in meeting requirements as defined in the 401 certification.
To be determined (may be contracted out)	*Field sampler*. Responsible for field activities (including equipment maintenance), documentation and health and safety during field operations. Jointly responsible for report generation as needed.
Kris Pomianek	*Community Outreach Advisor*. Responsible for website creation and maintenance.
Bruce Barsness	*Power Management, P.I. Interface person.* Responsible for providing assistance with data management and recovery.

Michelle Johnson.....	*Health and Safety Officer*. Responsible for overall aspects of health and safety for the QAPP project work.

3.2 Organizational Chart

The organization relationship between the personnel is depicted in Figure 3-1.



3.3 Schedule

3.3.1 Monitoring Schedule

The schedule that will be followed has been developed from the requirements stated in the Section 401 certification. Monitoring will begin immediately upon initiation of the minimum

flows provided by the implementation of the LLO (the continuous 80 cfs released from the dam) and will be conducted as described in Table 3-2.

Table 3-2: Monitoring Schedule

Parameter	Monitoring Schedule	Comments
Flow	Hourly upon initiation of minimum flow	
Temperature	Hourly upon initiation of minimum flow	
DO	Yrs 3 & 5 2 samples/month	Samples will be taken during the most biologically productive months of the year (July – September). DO will also be sampled more frequently during the heat of the summer for an equivalent of 2 samples per month, or 24 samples per year.
	During scheduled Powerhouse shutdowns	Powerhouse tailrace intragravel DO will be monitored hourly, during low water years. It is estimated powerhouse shutdowns, necessitating this monitoring, will occur up to three times from year one to five after initiation of minimum flow.
	During incubation of salmonid eggs and alevins	Powerhouse tailrace and Reach 4 intragravel DO will be monitored hourly, one day per week, during incubation. This is expected to occur each of years one through five after initiation of minimum flow in the months of November through February.
pH	Yrs 3 & 5 2 samples/month	Samples will be taken during the most biologically productive months of the year (July – September).
Turbidity	Yrs 3 & 5 2 samples/month	Samples will be taken during the most biologically productive months of the year (July – September). Samples will be obtained during as many different flows as possible, with an emphasis on high flow when turbidity is likely to be higher.
TDG	Yrs 3 & 5 2 samples/month	Samples will be obtained during as many different flows as possible and only during times of spill.
Petroleum Products	Weekly upon initiation of minimum flow.	A visual inspection for sheen will be made and any sheen observed reported.

3.3.2 Reporting Schedule

Chelan PUD will report hourly average and daily average instream flows as recorded from the LLO, pumping station, spillway and powerhouse. In addition, hourly and daily lake level and tailwater elevation readings will be reported. This information will be provided in written form to the Chelan River Fish Forum (CRFF) and posted electronically to the Lake Chelan Implementation web page (http://www.chelanpud.org/lake-chelan-implementation.html) on a quarterly basis. Real-time flows, lake levels and tailwater levels will also be provided at this site.

Temperature data will be made available on a monthly basis from July to September and quarterly the rest of the year. The information will include hourly, daily maximum, minimum and average temperatures, and also present any observable water quality exceedances and measures taken by the Chelan PUD in conformance with the CRBEIP. The data will be available no later than the 30th of the month following the reporting period and will be posted on the Chelan PUD's website.

An annual summary report will be submitted to Ecology by February 28 of each year, providing the data assessment described herein to determine compliance with state water quality criteria (WAC 173-201A).

The Chelan PUD will report exceedances of the water quality criteria within 48 hours to Ecology's Central Regional Office. Note that it may not be possible to provide temperature exceedances that are based on shifts in the temperature from natural because modeling is required to determine this type of exceedance.

Results of the DO, turbidity, pH, and TDG monitoring will be reported to Ecology in the annual reports no later than February 28th of years four and six.

The results of petroleum product monitoring will be reported annually, unless sheen is observed. If sheen is observed, it will be reported to Ecology within 48 hours of observation. The occurrence of any detection will be sent in a notification describing the likely cause of the sheen and the proposed course of action to be taken. Additionally, in the case of a spill, the conditions of the Chelan PUD Spill Prevention Control and Countermeasure (SPCC) plan will apply. These provisions include the immediate report of any spills to Ecology's 24-hour phone number (509) 575-2490 and a submittal of a detailed written report to Ecology within five days of such observation.

3.3.3 Overall Schedule

The overall anticipated schedule is presented as Figure 3-2. The schedule began with drafts submitted to Ecology prior to the new license issuance date of November 6th, 2006. This schedule will be closely managed to ensure that no deadlines are missed, or parameter reporting requirements overlooked, unless a Force Majeure event arises, as provided in the Lake Chelan Settlement Agreement.

It is not necessary to seek external permission to access the property because Chelan PUD owns all of the property where monitoring will be conducted. Additionally, no permits are required to conduct this work.

Figure 3-2: Anticipated Chelan River Water Quality Monitoring and Reporting Schedule

ID	Task Name	Start	Finish
1	**QAPP**	**Fri 5/19/06**	**Fri 5/4/07**
2	Final Draft QAPP Submitted	Fri 5/19/06	Fri 5/19/06
3	Final Draft QAPP Review	Fri 5/19/06	Thu 6/8/06
4	New Lake Chelan License Issued	Mon 11/6/06	Mon 11/6/06
5	Final QAPP Prepared w/ OCMP	Mon 11/6/06	Fri 5/4/07
6	QAPP & OCMP Complete	Fri 5/4/07	Fri 5/4/07
7	Dam Modification - min. flows	Mon 11/6/06	Thu 11/6/08
8	Hourly Temp/Flow Monitoring	Fri 11/7/08	Thu 11/6/14
9	Weekly Petroleum Product Inspection	Fri 11/7/08	Thu 11/6/14
10	**Comprehensive Plan DO Monitoring**	**Fri 11/7/08**	**Thu 3/7/13**
13	**Hourly Data Due**	**Tue 1/6/09**	**Fri 12/5/14**
50	**Third Year Monitoring**	**Mon 7/6/09**	**Mon 9/21/09**
58	**Fifth Year Monitoring**	**Mon 7/4/11**	**Mon 9/19/11**
59	1st July Year 3	Mon 7/4/11	Mon 7/4/11
60	2nd July Year 3	Tue 7/19/11	Tue 7/19/11
61	1st August Year 3	Wed 8/3/11	Wed 8/3/11
62	2nd August Year 3	Thu 8/18/11	Thu 8/18/11
63	1st September Year 3	Fri 9/2/11	Fri 9/2/11
64	2nd September Year 3	Mon 9/19/11	Mon 9/19/11
65	Fifth Year Monitoring Complete	Mon 9/19/11	Mon 9/19/11
66	**Annual Data Reports**	**Fri 2/26/10**	**Fri 2/27/15**
67	Year 1 due	Fri 2/26/10	Fri 2/26/10
68	Year 2 due (w. 3rd year monitoring)	Mon 2/28/11	Mon 2/28/11
69	Year 3 due	Tue 2/28/12	Tue 2/28/12
70	Year 4 due (w. 5th year monitoring)	Thu 2/28/13	Thu 2/28/13
71	Year 5 due	Fri 2/28/14	Fri 2/28/14
72	Year 6 due	Fri 2/27/15	Fri 2/27/15
73	Final Data Due	Fri 2/27/15	Fri 2/27/15
74	End of Phase I Monitoring, start study	Fri 2/27/15	Fri 2/27/15

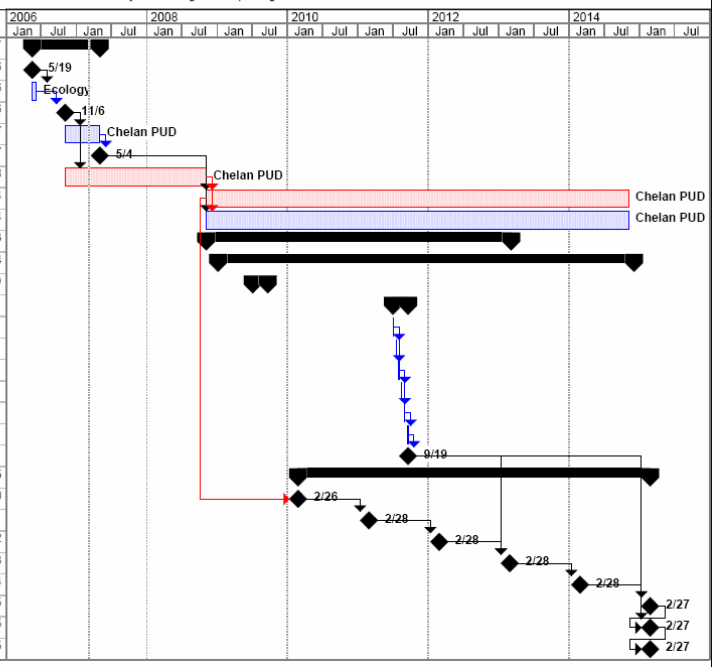


Figure 3-2: Proposed Monitoring and Reporting Schedule

3.4 Budget

A preliminary budget has been developed to aid in planning for this work. How the monitoring is conducted (i.e. real-time temperature data collection versus logged data collection) and who may conduct the work (i.e. Chelan PUD personnel or a consultant) has not yet been decided. For the sake of the initial budget, it is assumed that the forebay and powerhouse tailrace temperature data will be collected real-time and the remainder will be logged and downloaded monthly or quarterly. It is anticipated that temperatures in between measuring points on the Chelan River can be interpolated from the real-time data, after enough data has been collected and evaluated. Additionally, at this juncture it will be assumed that all of the monitoring will be conducted by Chelan PUD personnel. An estimate of the costs based on these assumptions is presented in **Table 3-3**.

Table 3-3: Summary of Estimated Budget for Monitoring and Reporting

Year	Materials/Equipment	Labor	Total
Year 1 - 2007	$ 54,423	$ 13,292	$ 67,715
Year 2 - 2008	$ 4,950	$ 13,292	$ 18,242
Year 3 - 2009	$ 4,950	$ 13,292	$ 18,242
Year 4 - 2010	$ 4,950	$ 13,292	$ 18,242
Year 5 - 2011	$ 4,950	$ 13,292	$ 18,242
Year 6 - 2012	$ 5,325	$ 21,472	$ 26,797
Grand Total			**$ 167,480**

3.5 Funding

Chelan PUD will fund the monitoring and reporting described herein. These funds will be made available internally earmarked well in advance of the initiation of the monitoring (likely a minimum of two years prior) to ensure sufficient funding is provided.

SECTION 4: DATA QUALITY OBJECTIVES (DQO)

The primary objective for collecting data is to track compliance with water quality standards. The purpose of the QAPP is to identify the methods and standards used to make that determination/decision. Data quality objectives (DQOs) are statistical statements of the level of uncertainty that a decision-maker is willing to accept in results derived from environmental data. They describe what data are needed, and how the data will be used to address the concerns being investigated. The DQOs also establish numeric limits that ensure the data collected are of sufficient quality and quantity for data user applications.

The overall DQO is to ensure that data of known and acceptable quality are provided. Proper execution of each task will yield consistent results that are representative of the media and conditions measured. All data will be calculated and reported in conventional units to allow comparability of the data. There are two types of DQOs, including decision quality objectives and measurement quality objectives (MQOs).

The acquired data will be used to characterize the water quality of the Chelan River bypassed reach. Decision quality objectives to obtain this information are to:

- Generate scientific data of sufficient quality to withstand scientific and legal scrutiny.
- Gather and develop data in accordance with procedures appropriate for its intended use.
- Conduct all methods/procedures specified for this project in compliance with Ecology requirements for environmental investigations.

To ensure that the MQOs of the monitoring effort are within the limits of the work, specific criteria for data parameters have been established as appropriate.

4.1 Decision Quality Objectives

For this effort, the data collection must be designed in such a manner that the results can be used to determine if the water quality criteria have been met; therefore, quality objectives at the level of the decision are required. These objectives will be met by carefully determining the number of measurements taken to represent a given condition. The Sampling Process Design (Section 5.0) addresses the requirements of the decision quality objectives.

The success of obtaining these objectives can be measured by ensuring that the representativeness, completeness and comparability are controlled. Each is described below.

4.1.1 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. For this investigation, representativeness is a qualitative parameter that is primarily

concerned with proper design of the sampling program, and can be best satisfied by ensuring that the monitoring locations are properly located with a sufficient number of data collected.

4.1.2 Comparability

The comparability criterion is a qualitative characteristic that expresses the confidence with which one data set can be compared to another. Principal comparability issues are field sampling techniques, and standardized concentration units and reporting formats. Data comparability is achieved using standard field sampling techniques and measuring methods; however, comparability is limited by the other MQOs because only when precision and bias (accuracy) are known can data sets be compared with confidence.

4.1.3 Completeness

Completeness is defined as the percentage of valid analytical determinations compared to the total number of determinations. A reasonable completeness goal is 90 percent. Typical field or electronics problems may result in completeness of less than 100 percent. Completeness will be evaluated and documented throughout all monitoring, and corrective actions taken as warranted on a case-by-case basis.

4.2 Measurement Quality Objectives (MQOs)

The term "data quality" refers to the level of uncertainty associated with a particular data set. Data quality associated with environmental measurement is a function of the sampling plan rationale and procedures used to collect the samples, as well as the monitoring methods and instrumentation used in making the measurements. Uncertainty cannot be eliminated entirely from environmental data. However, quality assurance (QA) programs effective in measuring uncertainty in data are employed to monitor and control deviation from the desired DQOs. Sources of uncertainty that can be traced to the sampling component are poor sampling plan design, incorrect sample handling, faulty sample transportation (if applicable), and inconsistent use of standard operating procedures (SOPs). The most common sources of uncertainty that can be traced to the analytical component of the total measurement system are calibration and contamination (i.e. equipment not "resetting" or fully equilibrating in a new sampling location).

One of the primary goals of this QAPP is to ensure that the data collected are of known and documented quality and useful for the purposes for which they are intended. The procedures described are designed to obtain data quality indicators for each field procedure and analytical method. To ensure that quality data continues to be produced, systematic checks must show that test results and field procedures remain reproducible, and that the methodology employed is actually measuring the parameters in an acceptable manner.

For the field measurements to be conducted under this QAPP (including pH, visual petroleum observations, DO, turbidity, temperature, flow, and TDG) many MQOs can be specified. Each of the MQOs that pertain to this QAPP is further discussed below. The goals for this effort are outlined in Table 4-1**.** Note that it is not possible to develop MQOs for visual petroleum observations because it is a human test that is a "pass/fail" based on whether it is observable.

Table 4-1: MQOs

Parameter	Smallest Reference Level for Decision Making	Range of Instrument	Precision (Duplicate Samples)	Bias/Accuracy	Sensitivity/ Resolution
Temperature	0.3°C	-5 to 50°C	20% RPD or ±0.05 units, whichever is least	± 0.1°C	0.01°C
Flow	10-25/200* cfs	0-500/0-2,200 * cfs	N/A	5% of flow / 200*cfs	1% / 100*cfs
Turbidity	5 NTU	0 to 3,000 NTU	N/A	1% up to 100 NTU 3% for 100 – 400 NTU 5% for 400-3000 NTU	0.1 NTU up to 400 NTU 1.0 NTU for 400-3000 NTU
pH	0.2 units	0 to 14 units	20% RPD or ±0.05 units, whichever is least	±0.2 units	0.01 units
TDG	1% saturation	400 – 1,300 mmHg	N/A	±0.1 % of span	1 mmHg
DO	0.2 mg/L	0 to 50 mg/L	20% RPD or ±0.05 mg/L, whichever is least	±0.2 mg/L at ≤20 mg/L ±0.6 mg/L at >20 mg/L	0.01 mg/L

RPD = relative percent difference
cfs = cubic feet per second
NTU = nephelometric turbidity unity
TDG = total dissolved gas
mmHg = millimeters of mercury
DO = dissolved oxygen
mg/L = milligrams per liter
* The first value is for the low level outlet; the second is for the penstock flow. If a range is given, it is flow dependent. The smaller value is for a lower flow and the larger for a higher flow.

4.2.1 Precision

Precision is a measure of the reproducibility of an analysis or set of analyses under a given set of conditions, and generally refers to the distribution of a set of reported values about the mean. The overall precision of a sampling event has both a sampling and an analytical component. The precision provides transparency into presence of random error such as field sampling procedures, handling, and data collection/analysis method. A reduction of precision could be introduced to this work in several ways including using equipment that is not sensitive enough (see Sensitivity below), collecting measurements over a large spatial or temporal regime, using a wide range of types of equipment, etc. A means of determining the precision of a measurement is to conduct duplicate sampling (e.g. making the same measurement in the same location at approximately the same time with the same type of equipment) and looking at the variability in results.

4.2.2 Bias

Bias (otherwise known as accuracy) is the difference between the population mean and the true value of the parameter being measured. Bias in measurements obtained under this QAPP may be introduced by faults in the sampling design (e.g. all of the temperature measurements collected in one location that is not indicative of the mixed flow or strata of interest), inability to measure all forms of the parameter of interest (e.g. inability of a thermometer to reach a temperature regime needed due to physical obstacles), improper or insufficient calibration of instrumentation and/or equipment. Bias will be minimized by following standard protocols for calibration and maintenance, and by following field protocols for stabilization of meter readings.

4.2.3 Sensitivity

Sensitivity denotes the rate at which the analytical response varies with the concentration of the parameter being measured, or the lowest concentration of a parameter that can be detected (often referred to as "resolution" for water quality equipment). For this work, equipment must be selected that provides tight enough tolerances to ensure that the data collected are described to the necessary precision. For example, if water criterion for temperature is concerned with a temperature shift of greater than 0.3 degrees Celsius, then the equipment should be able to measure the water temperature with sensitivity less than 0.3 degrees Celsius, preferably by an order of magnitude. Often, the accuracy is much larger than the resolution. If this is the case, the accuracy is the smallest verifiable value reported by the instrument.

SECTION 5: SAMPLING PROCESS DESIGN

The sampling process design includes the parameters of interest, the measurement location and the frequency of monitoring. The goal of the sampling process design is to ensure that the quality objectives for this effort can be met. The Section 401 certification has outlined the requirements for the parameters, frequency, basic location, and schedule of sampling (see Table 5-1).

Table 5-1: Monitoring Parameters, Locations, Frequency, and Criteria

Parameter	Location(s)	Frequency	Metric	Standards
Temperature	Forebay, Powerhouse Tailrace,End Reaches 1, 3 and 4	Hourly	degrees Celsius	Natural ≤18.0, <2.8 increase Natural > 18.0, <0.3 increase
Flow	Penstock, Low Level Outlet	Hourly	cfs	Minimum flow in Chelan River of 80 – 320 cfs (location and time dependent – see 401; Penstock measured to calculate total flow, no criteria apply)
DO	Reach 4 (Years 3 & 5)	Hourly, one day/week in years 3 & 5	mg/L	DO in mixed flow ≥8.0
Turbidity	Reach 4	2/month in years 3 & 5	NTU	Background ≤ 50: ≤ 5 increase Background >50: < 10% increase
pH	Reach 4	Hourly, one day/week in years 3 & 5	pH units	6.5 – 8.5
TDG	Below spillway	Hourly, 2/month in years 3 & 5 when spilling	% Saturation	110%
Petroleum products	Powerhouse Tailrace	Weekly	N/A	No spills or visual sheen
Intergravel DO	Reach 4 Powerhouse shutoff	Hourly during shutoff	mg/L	Biological Objective DO in intergravel averages >6.0 mg/L
	Reach 4 / Powernouse Tailrace incubation	Hourly for 24-hours per week during incubation	mg/L	Biological Objective DO in intergravel averages >6.0 mg/L

cfs = cubic feet per second
mg/L = milligrams per liter
NTU = nephelometric turbidity unit
N/A = not applicable

The decision making process to develop the requirements is described in the Section 401 certification as follows:

> *Ecology has worked collaboratively for a number years with a relicensing team that includes the Chelan PUD, federal and state fishery resource agencies, and other stakeholders to develop biological objectives to be achieved in the Chelan River. Those objectives identify three key species of fish (westslope cutthroat trout, steelhead trout, and fall Chinook salmon), for restoration or enhancement. The biological objectives and the initial measures that shall be implemented to attain those objectives are described in the Chelan River Biological Evaluation and Implementation Plan (CRBEIP revised April 8, 2003). Once those initial measures are implemented, regular monitoring and evaluation, as prescribed below, will be undertaken to identify any new measures or modification of the initial measures that may be necessary to achieve the objectives or effectively monitor and evaluate conditions. Changes to the implementation measures will be made in coordination with the Chelan River Fishery Forum (CRFF); however, Ecology retains authority to order additional changes or modifications to the extent necessary.*

No modification to the Certification's sampling plan is needed; however, further clarification is presented here. Chelan PUD has outlined the specific proposed locations for monitoring in this section in an attempt to provide as clear and robust a design as possible. The design has been in an attempt to fulfill the sampling process parameters.

5.1 Monitoring Location

As stated in the 401 certification, the general locations for measurements have been identified. These locations are included in Table 5-1. It is necessary, however, to more specifically define the location and number of proposed measurements to be collected.

The locations for hourly monitoring will be placed such that the equipment can function properly, be easily placed and removed, is protected from vandals and natural forces (e.g. being swept away in current, beat against rocks, etc.) to the extent possible. The locations for parameters to be evaluated in years three and five years can be more flexible, but must further consider personnel safety due to the increased numbers of visits of personnel to the monitoring locations. Because the non-hourly sampling is conducted with a portable unit, as opposed to the fixed measurement stations, the description of the location must be made using a fixed coordinate system. Each monitoring location will be described by coordinates obtained using a Global Positioning System (GPS) instrument on the first sampling event. On subsequent sampling events the coordinates will be used to locate the initial sampling location within 30 feet. The coordinates will be reported in the annual reports and used to generate figures of the sampling locations.

The proposed monitoring locations for each area of concern (the forebay, end of Reaches 1, 3, and 4, and powerhouse tailrace) are depicted in Figure 5-1 through Figure 5-7. Figure 5-1 contains temperature monitoring locations for the two options originally considered for location of the LLO. Both sampling locations in the forebay were monitored during the forebay water

temperature monitoring study conducted to determine the site for the LLO. Only the monitoring locations on the south side of the forebay and downstream of the LLO will be used when the LLO is completed.

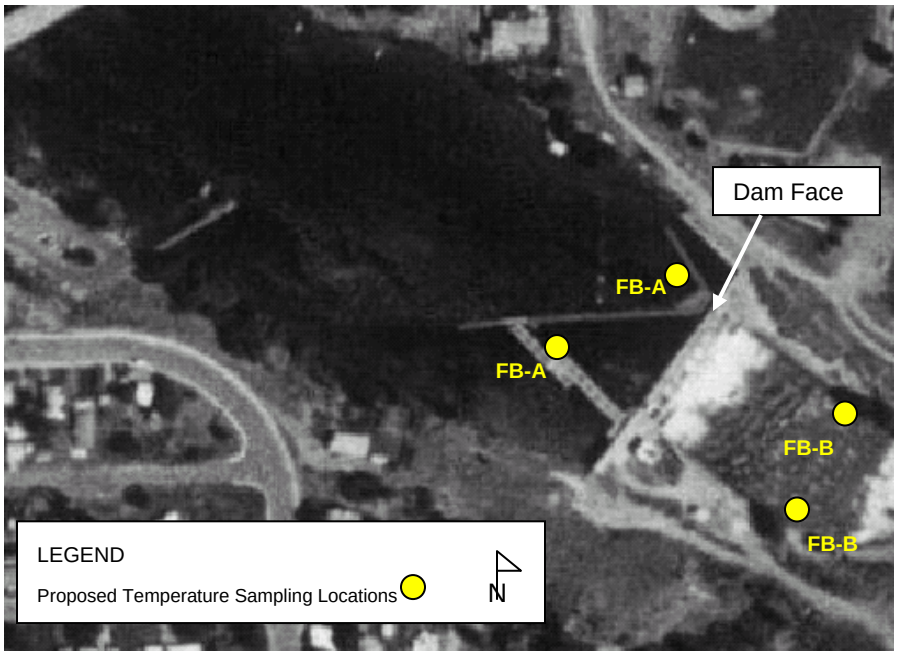


Figure 5-1: Proposed Temperature Sampling Location, Forebay of the Lake Chelan Dam

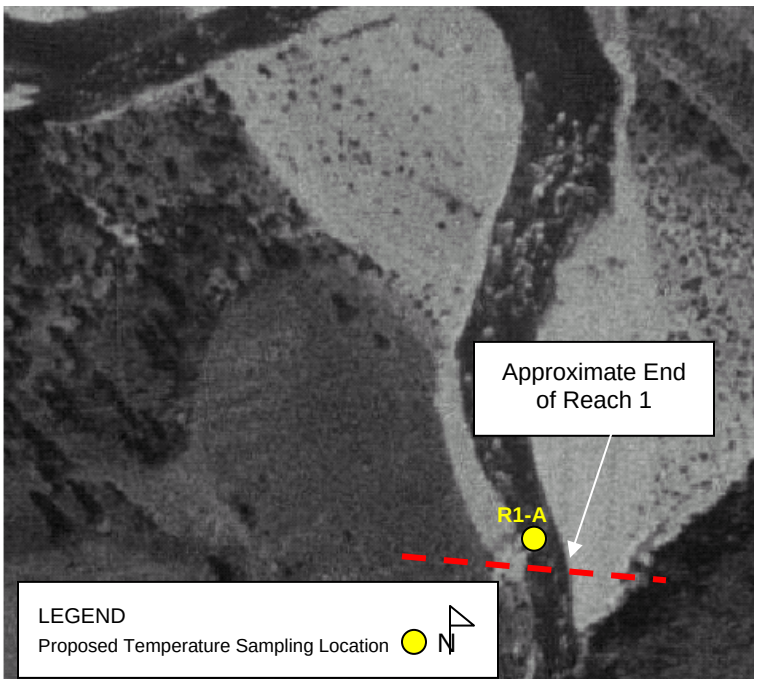


Figure 5-2: Proposed Temperature Sampling Location, End of Reach 1 of the Chelan River

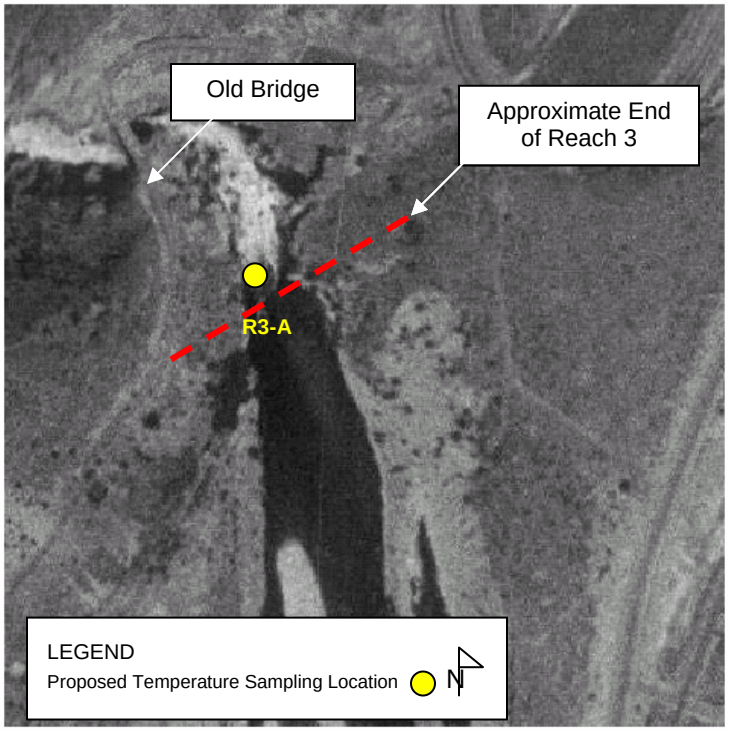


Figure 5-3: Proposed Temperature Sampling Location, End of Reach 3 of the Chelan River

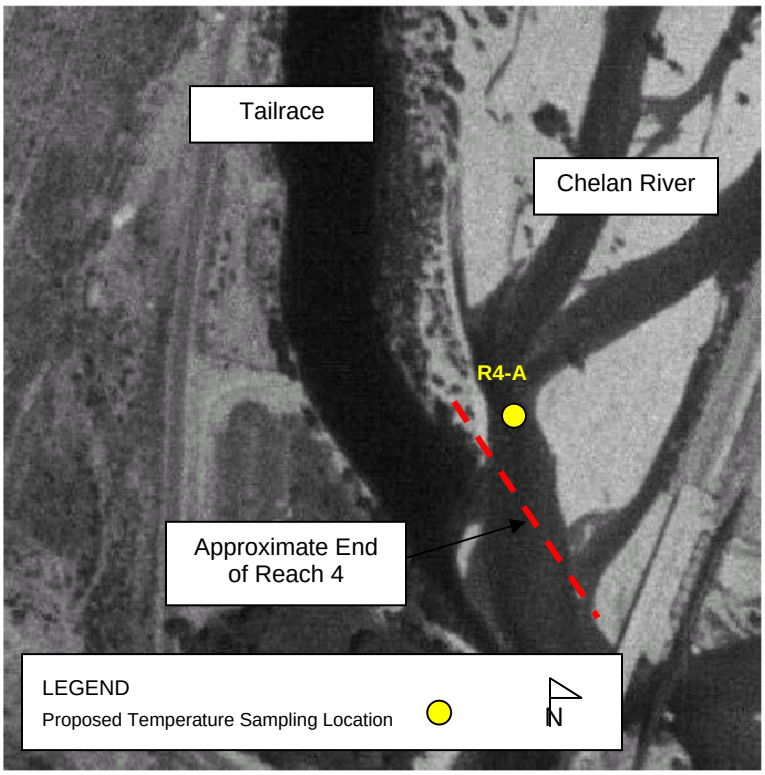


Figure 5-4: Proposed Temperature Sampling Location, End of Reach 4 of the Chelan River

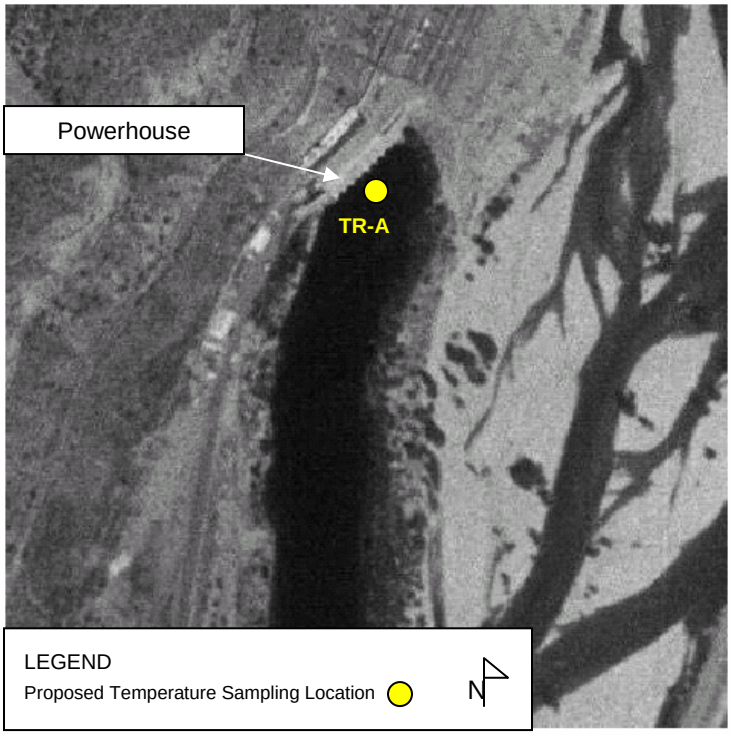


Figure 5-5: Proposed Temperature Sampling Location, Tailrace of the Powerhouse

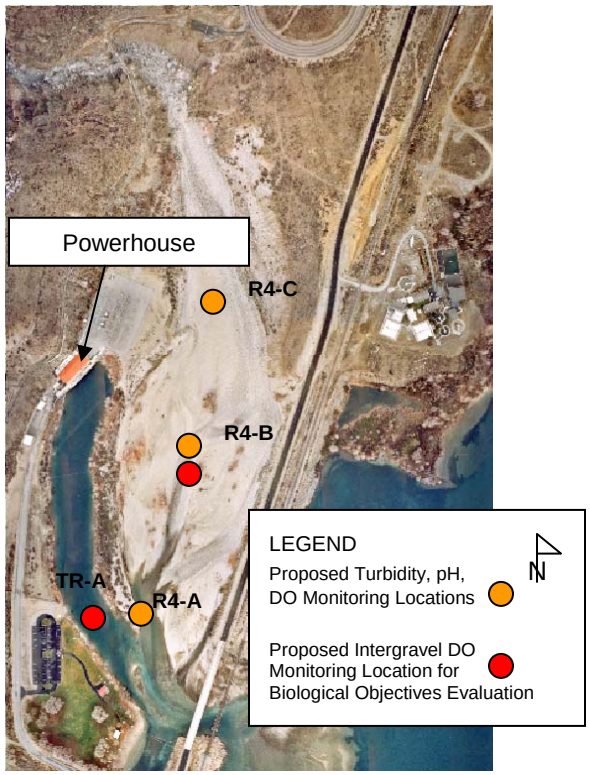


Figure 5-6: Proposed Turbidity, DO, pH Sampling Locations, Reach 4

Figure 5-7: Proposed TDG Sampling Location in the Spillway

5.1.1 Monitoring Depth

The TDG, DO, pH, and turbidity should be measured as consistently as possible at the same depths during each monitoring event, while prioritizing the goal of capturing the condition of the mixed flow. The depth of measurement is anticipated to be four feet from the surface of the river and six inches from the bottom of the river. If the river is less than five feet deep, the depth that is shallower will be monitored.

For the DO monitoring conducted for the biological objectives evaluation, the goal is to determine the intragravel DO. For this monitoring, equipment will be imbedded in the gravels by divers as was conducted in previous studies of this nature (BioAnalysts, Inc., 2003).

The desired location of the temperature monitoring is the depth that is indicative of the mixed flow of the river. The appropriate depth for monitoring then will be different for monitoring conducted in the Chelan River than it will in the forebay, where water is not moving as rapidly.

5.1.1.1 Chelan River and tailrace monitoring depth

To obtain data that are representative of mixed flow in the Chelan River, it is proposed that temperature equipment be located somewhere between the bottom and two feet from the bottom of the river in sampling locations where there is a strong flow. The tether holding the equipment will be short enough to keep the equipment near the bottom of the river even if the current is strong enough to pull the equipment into the flow.

5.1.1.2 Chelan Dam forebay monitoring depth

A temperature study was conducted in the Chelan Dam forebay to determine if any thermal stratification or temperature dependence on the distance from the dam or the midline of the inflowing water is present. No relationship between temperature and location (distance from dam or midline) was observed. On some days a thermal gradient was observed, on other days no gradient was present. On the days when a gradient was observed, the start of the depth of the gradient varied from 5 to 31 feet below the surface.

To attempt to determine the cause and frequency of temporary variation, and to ensure that the necessary data are collected that represent the temperature entering the Chelan River through the low level outlet, temperature will be collected to at three depths in the forebay including within five feet of the surface, within five feet of the bottom, and near the middle of the column, approximately 15 feet, depending on depth of the lake. The low level water withdrawal is anticipated to span from 1070.5 to 1072.5 feet above mean sea level (msl). The lake level will dictate the relative depth of withdrawal. The lake level can vary from 1100 to 1079 feet above msl, but typically remains between 1099 and 1083 feet above msl. The hot summer months are when thermal gradients have been observed, and are when data are most critical. During these months, the lake is anticipated to be around 1099 feet above msl. At this lake level the withdrawal will be at a depth of approximately of 26.5 to 28.5 feet.

The probes will be connected to a stationary fixture in an array so that the depths measured will be represented by elevations, not depths. Although during high water years this may result in the upper probe being out of the water during spring run off when the lake level is low, it provides a standard means of evaluating any thermal gradient when one may be present. There are trash booms that float, moving with the lake level. These will not be used as fixed measuring point attachment sites.

Additionally, the intent of the monitoring is to determine the temperature in the Chelan River; therefore, a probe will be located near the discharge of the new outlet structure, on the down river side of the dam. It will be located in accordance with the description presented in Section 5.1.1.1.

SECTION 6: SAMPLING AND MEASUREMENT PROCEDURES

6.1 Temperature Monitoring

Water temperature must be measured hourly for water entering the Chelan River at the Chelan Dam, at the end of Reaches 1, 3 and 4 of the Chelan River, and in the powerhouse tailrace leaving the Lake Chelan Project Powerhouse. Chelan PUD proposes the use of one of two technologies, from which a selection will be made based on a budget and risk evaluation and reevaluated when new equipment is made available. The first option is to deploy equipment that allows data collected underwater to be immediately transmitted to a data logger located within a controlled proximity, and then transmitted in real-time to Chelan PUD headquarters via radio telemetry or other remote communication device. The second option is to deploy a technology that logs data for monthly or quarterly manual retrieval (in compliance with the reporting requirements).

Further, to improve Chelan PUD's ability to determine factors that influence water temperature, Chelan PUD proposes the use of a weather station at one or two locations. Ideally, the weather stations selected for use will be capable of providing ambient air temperature, relative humidity, solar radiation, and, possibly, wind speed and direction. The weather stations will have to be placed in a secure location on shore, so it is understood that comparisons to over water conditions will take some investigative work.

Examples of potential monitoring equipment and their associated requirements will be presented, as will specific data collection methodologies.

6.1.1 Temperature Monitoring Equipment

All temperature monitoring equipment will be of sufficient quality to meet the MQOs (Table 4-1). The monitoring equipment that will be used for data collected on monthly or quarterly basis collection will be Onset Tidbits, HydroLab's DataSondes or MiniSondes, or Hobo Water Temperature Pro Data Logger, or equivalent. The monitoring equipment to be used for remote, real-time monitoring is anticipated to be YSI 600 Sondes, or equivalent, connected by cable to a newly installed receiver/transmitting unit at each the forebay and the powerhouse tailrace. Specifications for all types of equipment described herein are provided in Appendix A. Any of these types of monitoring equipment are referred to as merely equipment in the following discussion.

To help correlate water temperature to the climatic conditions, the Chelan PUD may use a weather station sited at the forebay and/or the powerhouse. If used, the weather station to be used is anticipated to be Hobo Weather Station, or equivalent. This QAPP does not cover how the climatic conditions may be correlated to water temperature; that will be covered in a subsequent document. Mention of the collection of data is made herein because the longer the period of record, the easier any subsequent analysis.

6.1.2 Temperature Monitoring Methodology

The water temperature equipment will be installed in the water in areas which are representative of the surrounding environment and are shaded from direct sunlight. The goal is to obtain the temperature of the mixed flow of water. To do so, the depth of the equipment must be secured. To safeguard against data loss, the loggers will be placed in a location that is difficult to see and safe from natural weather conditions.

The Chelan PUD will install a three-point array of temperature equipment in the forebay (FB-A1, FB-A2, and FB-A3), equipment in the discharge of the outlet structure (FB-B), and a single piece of equipment at the end of Reach 1 (R1-A), 3 (R3-A), and 4 (R4-A), and in the powerhouse tailrace (TR-A), as indicated on Figure 5-1 through Figure 5-7. If logging equipment is used instead of real-time equipment, a duplicate piece of equipment will be placed adjacent to the primary piece of equipment (except in the forebay) to serve as a back up should one piece of equipment fail, be swept away, or removed by a vandal. The real-time equipment will not be duplicated because it will come to the attention of the Chelan PUD very quickly if it is missing or has failed. Sample locations for all parameters were chosen to collect representative data, as well as to ensure staff safety.

It is anticipated that concrete tubing with a slotted end will be fashioned as a jacket for the equipment. The weight of the concrete intended to keep the equipment from being swept away during high flows. The bulk and strength of the concrete is intended to deter vandals and protect the equipment from projectiles (such as rocks carried by strong current).

6.2 DO, pH, Turbidity, TDG Monitoring

MQOs have also been established for pH, DO, and TDG (Table 4-1). The data will be collected with equipment and in such a manner to ensure that the MQOs are met. The equipment and methodologies will be discussed in this section.

6.2.1 DO, pH, Turbidity, TDG Monitoring Equipment

The Chelan PUD will use Hydrolab DataSondes or MiniSondes, or equivalent, with a handheld communications display for the collection of DO, pH, turbidity, and TDG data (See Appendix A for Equipment Specifications). To the extent possible, sampling methods will follow protocol established by Hydrolab (or alternative manufacturer), the most current version of the Ecology Field Sampling and Measurements Protocols for the Watershed Assessment Section (Ecology, 1993), and this QAPP. In the currently manufactured versions of the proposed equipment, one unit can be equipped with the four necessary probes to collect all of the pertinent data.

6.2.2 DO, pH, Turbidity, TDG Monitoring Methodology

As per the 401 certification, data will be collected during years three and five, at a frequency sufficient to demonstrate compliance with water quality criteria. The Chelan PUD has generally defined this to be weekly during the most productive months of the year (July – September). The DO will be sampled more frequently during the heat of the summer, and as required to ensure that DO is sufficient to meet biological requirements. Turbidity and TDG will be sampled during

as many different flow conditions as possible in order to better understand what effect each condition has on these parameters; however, TDG will be sampled only during those years when it is necessary to spill water through the bypassed reach. Since TDG is a function of spill levels, sampling will be done only as necessary to determine the TDG effects of different spill levels.

The field technician will ensure the calibration of each of the pieces of equipment prior to going to the field. The measurement unit and associated hand-held readout device (the Hydrolab Journeyman 4, Surveyor 4a or equivalent), will be utilized manually to collect the necessary data. The field personnel will wade or take a boat to the designated sampling coordinates determined in the first monitoring event and located using a GPS unit to deploy the equipment, encased in a slotted protective tube of polyvinyl chloride (PVC) piping, to the specified depth. The equipment will be held in place until the parameters stabilize (as dictated by the user's manual and a visual indication of stability that will be confirmed by a lack of fluctuation in readout data). Once the stabilization is complete, a complete data set will be collected (the value for each parameter will be recorded either manually or within the handheld unit's memory). After data are collected, the equipment will be retrieved and the field personnel will travel to the next sampling location to repeat the sampling process. For each sample location, information associated with the monitoring will be collected in the field notebook (see Section 9.1 for further information) and on a monitoring form (see Section 9.2 and Appendix B for further information).

The data that must be collected hourly to monitor the intragravel DO to ensure that redds are receiving enough oxygen will be collected on a data logger. During all scheduled (non-emergency) powerhouse shutdowns during egg incubation, powerhouse tailrace and Reach 4 intragravel DO will be monitored hourly each week for at least one 24-hour period.. It is anticipated that these data will be collected from equipment placed by divers and left in the powerhouse tailrace and Reach 4 substrate.

Monitoring of DO will detect if serious oxygen depletion is occurring in the redds in the powerhouse tailrace, which provides for proactive triggering of decisions to protect redds before survival is seriously effected. The objective is to maintain oxygen levels in the redds at or above 6.0 mg/l. Additional monitoring to determine survival, the result of all potential causative factors, including those beyond the Project's influence, will be done to establish a complete basis for evaluating the achievement. This additional monitoring includes ratios of dead/live eggs and dead/live alevins, and snorkel surveys for fry presence during the emergence period.

6.2.3 DO, pH, Turbidity, TDG Monitoring Quality Assurance and Control Monitoring

At a frequency of one in ten monitoring locations, a duplicate set of monitoring data will be collected from a given location to serve as a quality control (QC) monitoring sample. These data will be obtained by removing the equipment from the water, and then returning to the same location (defined by the tolerance of the GPS unit that is being used to locate the monitoring locations) and allowing stabilization and recording the new data readout. Care should be taken to avoid changing the conditions (i.e. allowing the position of deployment to change substantially, deploying once when a deleterious matter is passing and again when it is not, etc.). Also, for one in ten sampling events, a second unit should be taken into the field and deployed adjacent to the first for one in ten samples to obtain a QA monitoring sample.

The QC and QA monitoring samples will be used to determine if the measurements are representative of the desired conditions. If the QC sample has a large relative percent difference (RPD) from the primary sample, then the variation of the conditions present may be larger than anticipated and require that a systemic increase in sampling frequency be implemented to obtain the true mean value of the system. The RPD value will be compared to the MQOs listed in Table 4-1. Additionally, these samples will help to ensure that there is not a systematic flaw with the measuring equipment that becomes present over time.

6.3 Flow Monitoring

The flow will be monitored at the penstock and flow into the Chelan River at the LLO, spillway and pump station. Flow through the penstock is currently being monitored as a part of normal Lake Chelan Hydroelectric operations. These measurements are reported directly as the powerhouse flow. It is not anticipated that additional measuring equipment will be needed to monitor penstock flow. Currently, the penstock flow is reported in the thousands of cubic feet per second (kcfs) of water passing through it. Flows discharged from the turbines into the project powerhouse tailrace are measured using an ultrasonic flow meter. The device uses ultrasonic sound wave sensors to measure the velocity of the water in a cross section of the penstock. The sensors are located approximately 30-feet upstream of the turbine inlet valve (TIV), with one flow meter in each leg of the bifurcation from the main power tunnel. Combining the two measurements provides the total flow through the penstock, including turbine, irrigation and raw water flows. The data are already electronically transmitted to a central server which can easily be accessed using the readily-available Plant Information (P.I.) system from any of several computers within the Chelan PUD.

The spillway flow is measured by calculating flow from lake level readings and gate settings, for which rating tables exist. The rating tables have been conformed to accuracy standards in cooperation with the United States Geological Survey (USGS) through river stage and flow measurements in the river channel at an existing USGS stream hydrology station located a short distance downstream from the spillway apron. This gauging site is known as USGS 12452500 Chelan River at Chelan, which combines powerhouse discharge flows reported by Chelan PUD with the spillway flows, as corroborated with the stream gauging site.

Flows from the LLO will be measured with an ultrasonic flow meter or similar device, which will be installed during construction and located along the pipe that routes flow to the Chelan River below the spillway apron. Flows from the pump station into Reach 4 of the Chelan River would also be measured with an ultrasonic flow meter or similar device, located within the conveyance structure. The data collected will then be transmitted electronically to the P.I. system. Using existing software called P.I. ProcessBook a simple interface can be established that allows real-time observance of all of the flow data and hourly averages for reporting.

6.4 Petroleum Product Monitoring

Petroleum monitoring is to be conducted in two ways: the first is a weekly visual inspection of the powerhouse tailrace for sheen; the second is the report of any spills in compliance with the

SPCC plan. The petroleum monitoring will be conducted by the dam operators. They will be required to fill out a form indicating that they have completed the inspection, whether any sheen was observed, and if sheen was observed who they notified.

The SPCC plan is an independent document that describes the process to be followed if a spill occurs. A copy can be made available upon request.

SECTION 7: QUALITY CONTROL

Field sampling and measurement protocols will follow those described in the Watershed Assessment Section (WAS) protocol manual (Ecology, 1993). Prior to deployment, instruments will be calibrated in a lab and the calibration verified by side-by-side readings. Specific quality control for each parameter measurement is described as follows.

7.1 Temperature Quality Control

For all field-deployed equipment, a pre-and post-calibrated protocol will be conducted in accordance with the manufacturer's recommendations to document instrument bias and performance at representative temperatures. The accuracy of the field thermometers (data loggers and real-time equipment) will be maintained by a two-point comparison between the field equipment and a certified reference thermometer. This comparison will be made prior to and after logger deployment, and at a minimum of annually for real-time equipment. The certified reference thermometer to be used will have an American Standard Test Method (ASTM) etched-stem, and a National Institute of Standards and Technology (NIST) Traceable certification. If the mean difference between the NIST-certified thermometer and the field equipment differs by more than the manufacturer's reported specifications during the pre-study calibration, then the thermometer of interest (Sonde or logger) will not be used during field work.

Additionally, each month or quarter when the data are downloaded from the loggers the Chelan PUD staff will inspect the equipment to ensure it has not been damaged, has sufficient battery power (with the exception of equipment that does not show battery life, which will be replaced prior to expected battery failure), shows no signs of biofouling, and is generally in good condition. It will be cleaned as needed and replaced if damaged. The real-time equipment will be inspected and maintained in accordance with the manufacturer's recommendations.

7.2 DO, TDG, Turbidity, pH Quality Control

Pre- and post-calibration for pH will consist of comparisons to two reference standards immediately before and after each sampling event. The two standards will be composted of pH values just outside the range of 6.5 to 8.5 units; such as 6.0 ph unites and 9.0 pH units. Pre- and post-calibration for DO will consist of air-calibration immediately before and after each sampling event. Pre- and post-calibration for TDG will follow Standard Method (SM) 2810B (APHA *et al*, 1995), manufacturer's instructions, and United State Geological Survey protocols for TDG (Tanner and Johnston, 2001). Pre- and post-calibration for turbidity will consist of comparisons to reference standards provided with the equipment immediately before and after each sampling event.

Meters will be checked for proper performance at the deployment site at the beginning and end of each deployment. After calibration and prior to each deployment, meters will be placed side by side and readings reviewed to ensure the data are acceptable for reporting. A significant discrepancy between readings will result in a review of meter performance.

7.3 Flow Quality Control

The powerhouse penstock flow meters are highly accurate. The measurement system is an eight path Accusonic 7500 panel. Each bifurcation has an eight path setup to measure flows. Overall accuracy of the system is +/- 1% of maximum scale (+/-26 cfs total in this installation). The accuracy (calibration) is defined by having precise as-built values of the distance between sensors on each path, functioning sensors and electronics. Typically these flow meters loose accuracy by having the surface of the sensor scoured by debris in the water. This occurs very slowly over time, particularly since the water from Lake Chelan contains very little suspended material. To calibrate these meters, a technician from Accusonic measures the reads on each individual channel to verify the integrity of the sensors and performs diagnostics on the computer boards in the panel. It is not necessary to calibrate frequently. The last calibration was performed in September 2005.

Spillway rating curves for low volume discharge (80 cfs – 500 cfs) were compared for accuracy with USGS estimates of streamflow at the hydrology station during temperature modeling studies conducted in 2002. Spillway rating curves for higher discharges had been compared with USGS measurements in earlier years. Spillway flow calculations have a precision of about 5 – 10 percent of the measured flow. The USGS streamflow estimates likely are less precise, but provide a basis for comparison to assure that spillway rating tables are within the norms of accuracy for streamflow calculations. The location of the USGS gauging site (USGS 12452500 Chelan River at Chelan) is described by USGS as: Latitude 47°50'05", Longitude 120°00'43", in SE 1/4 NE 1/4 Section 30, Township 27 North, Range 23 East, in Chelan County, Hydrologic Unit 17020009, at Chelan River powerplant tailrace, 4.3 miles downstream from control dam at outlet of Lake Chelan, 3.0 miles southeast of Chelan, and at river mile undetermined. Datum of gage is 1,074.66 feet above NGVD of 1912. (http://waterdata.usgs.gov/nwis/dv/?site_no=12452500).

The new ultrasonic flow meters that will be installed in the LLO and pump station will be factory calibrated and installed following the manufacturer's instructions for calibration testing. The accuracy of these flow meters will be determined using field verification techniques, which may include comparison with other flow measurement procedures, such as open channel flow measurements at outlet structures or streamflow estimation in the river channel. The precision of the ultrasonic flow meters is expected to be within two to five percent of the maximum discharge of each conveyance pipe or channel. The precision of open-channel flow measurement and/or streamflow estimation in the river channel will be lower, but comparison with these methods following installation will ascertain if there are any installation errors or equipment malfunctions that have grossly affected the accuracy of the flow meters.

The frequency of maintenance and re-calibration of the above flow measurement devices and methods will follow manufacturer's recommendations for the new flow meters and will be on an as-needed basis for the lake level gauge following maintenance or any observed malfunction. Comparison of spillway discharge, LLO flows and powerhouse discharge with USGS streamflow estimations will be pursuant to USGS standards, which have been developed over the history of the Lake Chelan Project. The USGS relies on the spillway and powerhouse discharge calculations for their reporting of Chelan River flows and Chelan PUD has and will continue to

coordinate with USGS in maintaining the accuracy of these flow measurements, as well as new flow measurements from the LLO.

SECTION 8: DATA MANAGEMENT PROCEDURES

The data collected from this effort will vary depending on whether it is collected occasionally (TDG, DO, turbidity and pH), weekly (petroleum visual inspections), or hourly (temperature and flow). The data management for each will be discussed in this section.

8.1 Data Management for Hourly Data

Data management will vary depending on whether it is transmitted in real-time or logged and downloaded periodically. The data that are collected in real-time will be automated to be transmitted directly into Chelan PUD's P.I. system as they are collected. This data management system is used on a regular basis across the Chelan PUD to manage power, flows, temperatures and many other parameters. Data that are logged and downloaded monthly or quarterly (including the DO monitoring conducted in accordance with the Comprehensive Plan), will be manually added to the P.I. system for consistent ease of availability and safe, archived keeping.

The reported data are anticipated to include the location of collection, the time of collection (by the interval determined if real-time), hourly data (averaged over the hour if more than one reading is collected per hour), and the date of collection.

8.2 Data Management for Weekly Data

The weekly data consists only of the reported visual inspections for petroleum. For the sake of reliability and simplicity, an online form will be used by the project operators to report that they have conducted the inspections and what the outcome is. The form will be stored on the Chelan PUD intranet, filled out and downloaded monthly. The data that are downloaded will be stored on the Chelan PUD server in a secure folder. The server is backed up regularly to protect the data.

8.3 Data Management for Years Three and Five Data

The data collected during the years three and five will be collected using portable equipment and data loggers. The data loggers will be downloaded monthly or quarterly, as required by the 401 certification, using a hand-held readout device. The device will be taken back to Chelan PUD headquarters and the downloaded data imported to a desktop personal computer. The downloaded files will be arranged in a spreadsheet with necessary qualifying information (e.g. dates and time sampled, locations sampled, parameters evaluated, units of interest, etc.), reviewed and verified (See Section 11), and saved to the Chelan PUD server, which is backed up regularly. Data will not be deleted from the hand-held device until it is confirmed that the spreadsheet of corresponding data are securely stored on the server.

SECTION 9: DOCUMENTATION AND REPORTS

Reporting will be conducted in a variety of ways, which will vary primarily on the frequency of monitoring. Additionally, there will be multiple levels of documentation that will occur during the project. Each is described in this section.

9.1 Field Notebook

Detailed notes on field activities will be maintained in a bound field notebook specific for this project. For each day in the field, as applicable, information recorded in the notebook will include:

- Name of project and description;
- Date;
- Location;
- Weather;
- Field personnel conducting the work;
- Sequence of events;
- Changes to the plan;
- Identification of monitoring device(s);
- Calibration of equipment, including the equipment calibrated, personnel involved, and procedure utilized;
- A description of the monitoring conducted and whether QA or QC monitoring was conducted;
- Identification of conditions that might affect the representativeness of a sample (e.g., inability to stay in one location, unusual water conditions, safety concerns that alter the SOP, etc.).
- All photographs taken listed by number, including a description of the subject and the sample identification number, if relevant;
- Equipment failures or breakdown, and subsequent repairs or replacements;
- Changes in procedures or sample locations and the rationale for the changes;
- Unusual circumstances;
- Comments; and
- The field personnel's signature.

The field notebook will be a chronological record of all work conducted in the field. It is meant to serve as a permanent detailed field activities record sufficient to recreate all mobilization, demobilization, data downloading and monitoring activities conducted in the field. The information will be recorded in a permanently bound notebook with sequentially numbered pages. No pages will be removed from the field logbook for any reason. Blank pages will be marked "Page Intentionally Left Blank". Corrections to erroneous data will be made by crossing a line through the entry and entering the correct information. The correction will be initialed and dated by the person making the entry. Unused portions of logbook pages will be crossed out,

signed, and dated at the end of each workday. Logbook entries must be dated, legible, in ink, and contain accurate documentation. Language used will be objective, factual, and free of personal opinions.

This log will be maintained for all forms of field work with the exception of petroleum visual observations and real-time data collection.

9.2 Monitoring Logs

Monitoring logs will be maintained for all monitoring that occur in the field except the real-time data collection. All logged data, visual inspections, and hand reading activities will have logs associated with them. A standardized form has been generated for each logged temperature download, weekly petroleum visual observation, and years three and five data collection. A proposed version of each monitoring form is presented as Appendix B.

9.3 Periodic Updates

Data collected will be evaluated and flagged to indicate any water quality exceedances and measures taken by the Chelan PUD in conformance with the CRBEIP (Chelan PUD, 2003). The data will be available no later than the 30th of the month following the reporting period and will be posted on the Chelan PUD's website. The Chelan PUD will report exceedances of the water quality criteria within 48 hours to the Central Regional Office. If sheen is observed, it will be considered a violation of the Class A water quality criteria and will be reported to Ecology within 48 hours of observation. The occurrence of any detection will be sent in a notification describing the likely cause of the sheen and the proposed course of action to be taken. Additionally, in the case of a spill, the conditions of the Chelan PUD SPCC plan will apply. These provisions include the immediate report of any spills to Ecology's 24-hour phone number (509) 575-2490 and a submittal of a detailed written report to Ecology within five days of the event.

9.4 Annual Reports

As required by the Section 401 certification, formal reports must be generated throughout the monitoring period. A summary data report will be submitted to Ecology by February 28 of each year, providing the data assessment described herein to determine compliance with state water quality criteria (WAC 173-201A). Each year these reports will include temperature and flow data on a monthly basis, from July to September, and quarterly the rest of the year, the results of petroleum product monitoring will be reported annually, unless sheen is observed (in which case the steps outlined in Section 9.3 will be followed). In years four and six, results of the DO, turbidity, pH, and TDG monitoring will be reported as a part of the annual report.

The annual report generally will include the results of all field activities, sampling and measurement procedures, conclusions, and recommendations for further action, if necessary. Additionally, the report will include a location map, a site map illustrating the location of the sampling positions and the values observed for each parameter. Chelan PUD will prepare project results reports that will include a discussion of the work and recommendations for further

investigation, or actions based on the monitoring results. Each report will contain all monitoring data, data review and verification write ups, non conformance with this plan, and completed monitoring logs reports.

A scale drawing approximating sampling locations and sample identification numbers will be included. On-site obstacles will also be noted. Color photographs will be used to document sampling as needed.

SECTION 10: AUDITS

Two forms of audits will be conducted in this effort: field audits and reporting audits. Each will be discussed in this section.

10.1 Field Audits

Once per year the Chelan PUD will send an additional person into the field to monitor and audit all field activities including equipment set up, data downloads, hand-held monitoring (if any), and safety. The auditor will focus on ensuring that all SOPs are followed, calibrations are conducted in compliance with manufacturers' specifications when applicable, and this QAPP is followed. The auditor will provide a brief write up of their observations including any deviations from plan and whether the plan should be changed or the process in the field needs to be addressed.

The project manager will be responsible for ensuring that if needed, any corrective actions meet Ecology's approval, and that each corrective action is implemented. A subsequent audit may be required to ensure that the change has been successfully implemented.

10.2 Reporting Audits

It is the responsibility of the Chelan PUD to ensure that all of the reporting requirements of the Section 401 certification have been met. The project manager will be responsible for keeping track of the mandated reporting and confirming that it has been met. Specifically, the project manager will access the website monthly or quarterly, as appropriate, to check that the necessary data are present, legible and correct. Additionally, the project manager will review the annual reports to make sure that the data presented are accurate, and verifiable (see Section 11). Any deviations from requirements will be rectified and Ecology will be notified of the deviation and corrective action.

SECTION 11: DATA REVIEW, VERIFICATION, AND QUALITY ASSESSMENT

Data will be downloaded from the meters or the P.I. system to a spreadsheet and reviewed for outliers and values not conforming to the MQOs. Outliers and data not within the MQO tolerances will be evaluated for the cause of the problem. Slight non-conformances will be tolerated, with the data qualified and the poorer precision taken into account in data analysis. Non-conformances that can be traced to membrane or other equipment failure will result in rejection of the data.

Data completeness will be adequate if monitoring is completed with data meeting the MQOs at least 85 percent of the time. A lower rate of data completeness may be acceptable, which will be determined in an overall review of data. All data meeting MQOs will be used.

The results analyses will be evaluated for compliance with acceptance criteria. This evaluation will include collection of temperature data for subsequent modeling, and a statistical evaluation of other data to the numeric criteria. It is anticipated that the average and variance of all data will be assessed to determine the frequency that any numeric water quality criteria have been exceeded, if any. Once the data have been reviewed, verified, and validated, the project manager will determine if the data are of usable quality to make decisions for which the study was designed.

SECTION 12: REFERENCES

APHA, AWWA, and WEF, 1995. Standard Methods for the Examination of Water and Wastewater, Nineteenth Edition. American Public Health Association, American Water Works Association, and Water Environment Federation. Washington, D.C.

BioAnalysts, Inc., 2003. Effects of Powerhouse Operations on Intragravel Flows and Water Quality within Chinook Redds, First Draft. Lake Chelan Hydroelectric Project FERC Project No. 637. June 30, 2003.

Chelan PUD, 2003. Lake Chelan Comprehensive Settlement Agreement, Final. Lake Chelan Hydroelectric Project FERC Project No. 637. October 8, 2003.

Chelan PUD, 1999. Lake Chelan Water Quality Study Plan, Final. Lake Chelan Hydroelectric Project FERC Project No. 637. July 16, 1999.

Ecology, 2004. Guidelines for Preparing Quality Assurance Project plans for Environmental Studies. Publication No. 04-03-030, Revision of Publication No. 01-03-003. July 2004.

Ecology, 1993. Field Sampling and Measurement Protocols for the Watershed Assessments Section. Publication No. 93-e04. November 1993. Washington State Department of Ecology, Olympia, Washington.

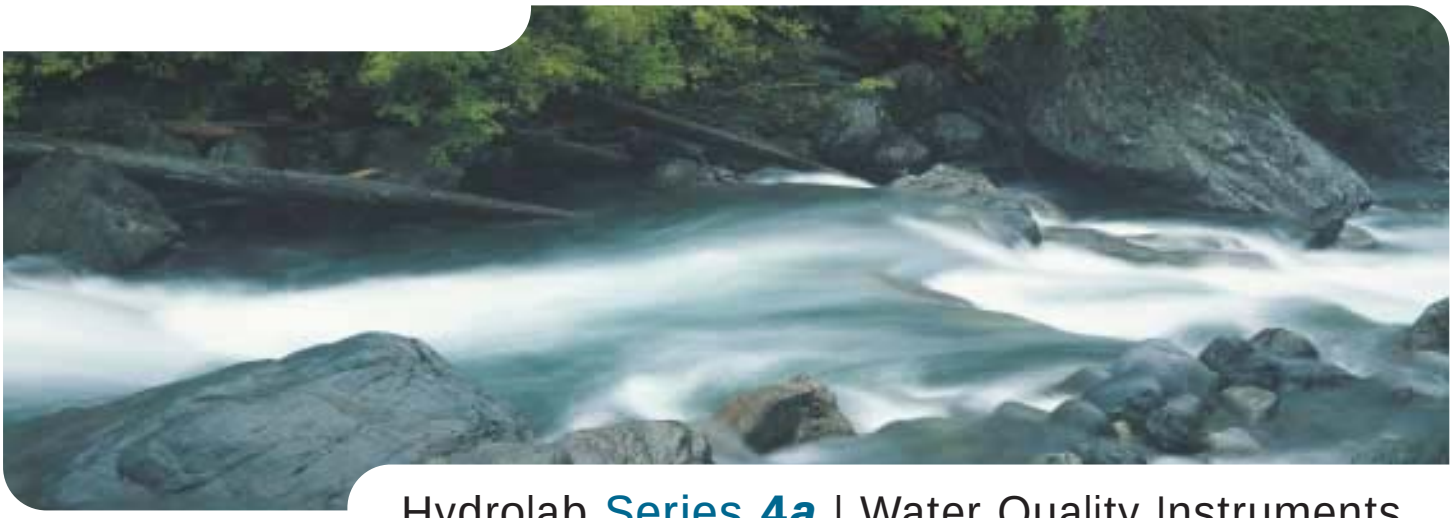
Tanner, D. Q. and Johnston, M. W., 2001. Data-Collection Methods, Quality-Assurance Data, and Site Considerations for Total Dissolved Gas Monitoring, Lower Columbia River, Oregon and Washington, 2000. Water-Resources Investigations Report 01–4005, U.S. Geological Survey, Portland, Oregon.

APPENDIX A: SPECIFICATIONS FOR PROPOSED EQUIPMENT

HYDROLAB®
A HACH COMPANY BRAND

THE WORLD LEADER IN MULTI-PARAMETER WATER QUALITY MONITORING INSTRUMENTATION

> Superior sensor technology > Unsurpassed reliability > Best warranty in the industry

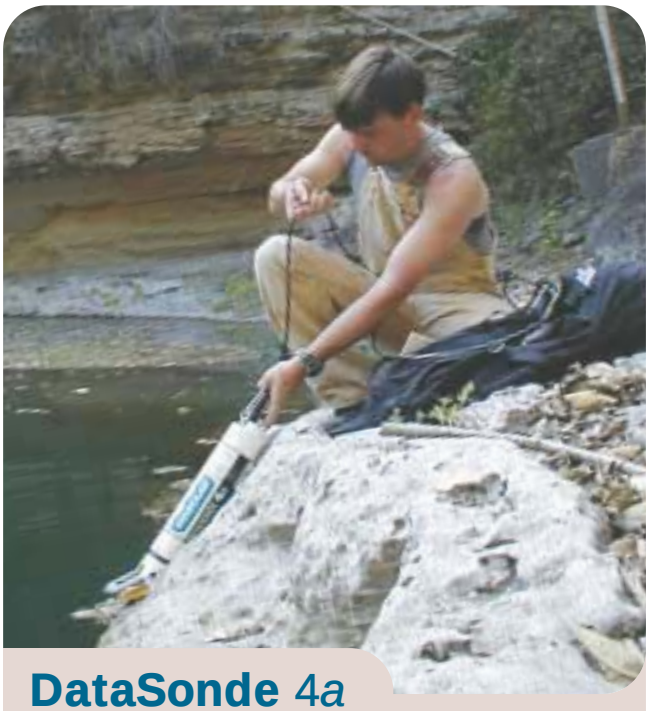


Hydrolab Series ***4a*** | Water Quality Instruments

Helping you preserve the world's water

Hydrolab Series **4a** | Water Quality Instruments

> *For over 40 years Hydrolab has been known for manufacturing reliable water quality instruments.*
> *The Series 4a continues that tradition with several enhancements that provide you with even greater value.*
> *Now, as part of Hach Company, you can expect continuous innovation from Hydrolab, now and into the future!*



DataSonde 4a

- Seven built-in expansion ports
- Designed for in-situ and flow-through applications
- Measures up to 15 parameters
- Excellent long-term deployment capability

*Both the **DataSonde 4a** and the **MiniSonde 4a** are well suited for profiling and spot-checking applications, and are available with battery packs and memory to use for long-term monitoring. Data can be downloaded to the **Surveyor 4a** or a PC.*

MiniSonde 4a

- Four built-in expansion ports
- 1.75" diameter housing – ideal for ground water monitoring, portability, and limited space environments
- Measures up to 10 parameters

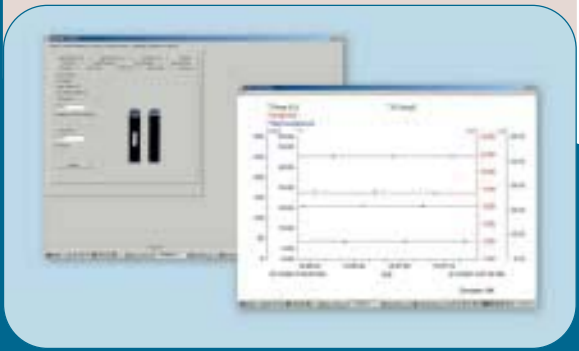
Series **4a** water quality instruments provide the best long-term value: > Easy to use and maintain

Surveyor 4a

- Rugged, waterproof (NEMA 6) case with hand strap
- Displays parameters in real-time or stores data automatically (up to 375,000 measurements)
- Data presented in real-time graphical form or tabular format
- Optional GPS and barometric pressure

Hydras3 LT

- Easy-to-use GUI
- Real-time multiparameter time series graphs *and* vertical profiling
- Simple calibration of any parameter
- Set-up data logging runs in a snap
- One click download for field data collection
- Simultaneous, multiple probe download capability
- Available for free download at www.hydrolab.com



*Superior **Sensor** Technology*

At the heart of the Series 4a instruments is Hydrolab's superior sensor technology. Advanced design and sensor technology make these instruments the most reliable in the field. The Series 4a features watertight sensors based on superior technology to produce instruments that are longer lasting, more reliable, less expensive, and easier to maintain. This means lower operating costs in the long run, and better value for you.

*The **DataSonde 4a** and **MiniSonde 4a** system, proven during years of field testing, provides the following advantages:*

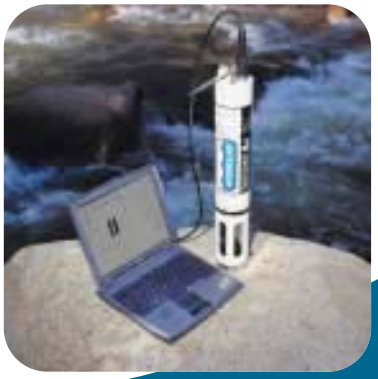
- *Sensor connection is protected from the environment*
- *Fewer components for smoother, glitch-free operation*
- *Sensors cannot become loose or trap water or debris*

> Superior sensor technology > Unsurpassed reliability > Guaranteed after-sale support

Hydrolab Series **4*a***

Engineered for dependable performance and durability in the field, Series 4*a* water quality instruments by Hydrolab can measure up to 15 parameters at once. These rugged instruments offer the highest long-term value, providing you years of reliable water quality data.

The three components of Hydrolab's Series 4*a* product line are the DataSonde 4*a*, MiniSonde 4*a* and Surveyor 4*a*. These instruments come with a two-year warranty – the best you'll find in the industry.



- > Configured to fit your specific need
- > Profiling or long-term deployment
- > Surface or ground water
- > Remote or attended monitoring

Hydrolab Series 4*a*: DataSonde 4*a* | MiniSonde 4*a* | Surveyor 4*a*

- Temperature
- Conductivity
- Dissolved Oxygen
- Rebuildable pH
- ORP
- 4-Beam Turbidity
- Self-Cleaning Turbidity
- Level & Depth
- Chlorophyll a
- Blue-Green Algae
- Rhodamine WT
- Li-Cor® Ambient Light
- Ammonium/Ammonia
- Nitrate
- Chloride
- GPS
- Barometric Pressure
- Transmissivity
- Total Dissolved Gas

HYDROLAB®
A HACH COMPANY BRAND

HACH®
Be Right™

OTT

Hydrolab
5600 Lindbergh Drive
Loveland, CO 80539
(800) 949-3766
(970) 669-3050
fax (970) 461-3921
hydrolab.com

Lit. No. HY04 Rev. 5
G42 Printed in U.S.A.

TYPICAL PERFORMANCE SPECIFICATIONS

	RANGE	ACCURACY	RESOLUTION	AVAILABLE INSTRUMENT *
Temperature	-5 to 50° C	±0.10° C	0.01° C	D, M
Specific Conductance	0 to 100 mS/cm	±1% of reading; ±0.001 mS/cm	4 digits	D, M
pH	0 to 14 units	±0.2 units	0.01 units	D, M
Dissolved Oxygen	0 to 50 mg/L	±0.2 mg/L at ≤ 20 mg/L ±0.6 mg/L at > 20 mg/L	0.01 mg/L	D, M
ORP	-999 to 999 mV	±20 mV	1 mV	D, M
Depth Vented Level	0 to 10 m	±0.003 m	0.001 m	D, M
0-25 m	0 to 25 m	±0.05 m	0.01 m	D, M
0-100 m	0 to 100 m	±0.05 m	0.01 m	D, M
0-200 m	0 to 200 m	±0.1 m	0.1 m	D, M
Salinity	0 to 70 ppt	±0.2 ppt	0.01 ppt	D, M
4-Beam Turbidity	0 to 1000 NTU	±5% of reading; ±1 NTU	0.1 NTU (<100 NTU) 1 NTU (≥100 NTU)	D
Self-Cleaning Turbidity	0 to 3000 NTU	±1%, up to 100 NTU ±3%, 100-400 NTU ±5%, 400-3000 NTU	0.1, up to 400 NTU 1.0, 400-3000 NTU	D, M
Ammonium/Ammonia	0 to 100 mg/L-N	Greater of ±5% of reading or ±2 mg/L-N (typical)	0.01 mg/L-N	D, M
Nitrate	0 to 100 mg/L-N	Greater of ±5% of reading or ±2 mg/L-N (typical)	0.01 mg/L-N	D, M
Chloride	0.5 to 18,000 mg/L	Greater of ±5% of reading or ±2 mg/L (typical)	4 digits	D, M
Total Dissolved Gas	400 to 1300 mmHg	±0.1% of span	1.0 mmHg	D, M
Ambient Light	0 to 10,000 µmol $s^{-1}m^{-2}$	±5% of reading or ±1 µmol $s^{-1}m^{-2}$	1 µmol $s^{-1}m^{-2}$	D
Chlorophyll *a*	0 to 500 µg/L 0 to 50 µg/L 0 to 5 µg/L	±3% for signal level equivalents of 1ppb Rhodamine WT dye	0.01 µg/L	D, M
Rhodamine WT	0 to 1000 ppb 0 to 100 ppb 0 to 10 ppb	±3% for signal level equivalents of 1ppb Rhodamine WT dye	0.01 ppb	D, M
Blue-Green Algae	100 to 2,000,000 cells/mL 100 to 200,000 100 to 20,000	±3% for signal level equivalents of 1ppb Rhodamine WT dye	0.01 cells/mL	D, M
Barometric Pressure	500 to 850 mmHg	±10 mmHg	0.1 mmHg	S
Global Positioning System	-90 to 90° Latitude -18 to 180° Longitude	25 m CEP (50%) without SA and DGPS 2 m CEP (50%) with DGPS	0.1”	S

* D = DataSonde 4*a* M = MiniSonde 4*a* S = Surveyor 4*a*

INSTRUMENT SPECIFICATIONS

Computer Interface	RS-232, SDI-12
Memory	DataSonde 4*a* – 120,000 measurements MiniSonde 4*a* – 120,000 measurements Surveyor 4*a* – 375,000 measurements
Battery Supply	DataSonde 4*a* – 8 C batteries MiniSonde 4*a* – 8 AA batteries Surveyor 4*a* – rechargeable nickel metal hydride
Typical Battery Life (1-hour intervals)	DataSonde 4*a* – 313 days MiniSonde 4*a* – 114 days Surveyor 4*a* – 12-16 hours
Operating Temperature	-5 to 50° C
Maximum Depth	DataSonde 4*a* & MiniSonde 4*a* – 225 m
Size	DataSonde 4*a*: Outer diameter – 3.5”/8.9 cm; Length – 23”/58.4 cm; Weight – 7.4 lbs/3.35 kg MiniSonde 4*a*: Outer diameter – 1.75”/4.4 cm; Length – 21”/53.3 cm; Weight – 2.2 lbs/1.0 kg with extended battery pack: 29.5”/74.9 cm, Weight – 2.9 lbs/1.3 kg Surveyor 4*a*: 11x4x5”/27.9x10.2x3.8 cm, Weight – 2 lbs/0.9 kg

Hydrolab

5600 Lindbergh Drive
Loveland, CO 80539
(800) 949-3766
(970) 669-3050
fax (970) 461-3921
hydrolab.com

HYDROLAB®
A HACH COMPANY BRAND

BENEFITS & SPECIFICATIONS

- Uses a pH glass sensor
- Both feature a single refillable, flowing junction reference electrode OR optional low ionic strength electrode
- Standard reference electrode is more reliable, lasts longer, is easily maintained, and refills in seconds
- Reference electrode is maintained and refilled independently of pH and/or ORP
- Two-year warranty

pH SENSOR

Range	0 to 14 pH units
Accuracy	±0.2 units
Resolution	0.01 units

ORP SENSOR

Range	-999 to 999 mV
Accuracy	±20 mV
Resolution	1 mV

Hydrolab

5600 Lindbergh Drive
Loveland, CO 80539
(800) 949-3766
(970) 669-3050
fax (970) 461-3921
hydrolab.com

HYDROLAB®
A HACH COMPANY BRAND

BENEFITS & SPECIFICATIONS

DISSOLVED OXYGEN SENSOR

- Uses field-proven Clark Cell technology
- Provides a continuous steady-state reading
- Low maintenance – no need to recondition the sensor
- Two-year warranty

Range	0 to 50 mg/L
Accuracy	±0.2 mg/L for 20 mg/L or less ±0.6 mg/L for over 20 mg/L
Resolution	0.01 mg/L

SPECIFIC CONDUCTANCE SENSOR

- Hydrolab uses the four graphite electrode cell methodology:
  - Increases sample exchange
  - Open cell design provides more reliable data
  - Reduces measurement error due to fouling and air bubbles (bubbles rise above the electrodes out of the way and debris and sediment fall below)
  - Easily maintained without damaging electrodes
  - Resists corrosion
- Also measures salinity, resistivity, and TDS
- Two-year warranty

Range	0 to 100 mS/cm
Accuracy	±1% of reading, ±0.001 mS/cm
Resolution	4 digits

SAMPLE CIRCULATOR

Only Hydrolab offers a sample circulator for more reliable readings. The DataSonde 4*a* and MiniSonde 4*a* integrated sample circulator facilitates fast, accurate, steady-state dissolved oxygen measurements. Other sensors receive similar benefits.

- Creates a flow of water past the sensors
- Provides “sufficient sample flow across membrane surface” in accordance with Standard Methods Article 4500-OG
- Reduces response time – important to detect moving contaminant plumes or movement within water column
- Reduces sensor fouling – sweeps away inert debris and biological growth
- Allows deployment in any environment, even in poorly mixed areas

Hydrolab

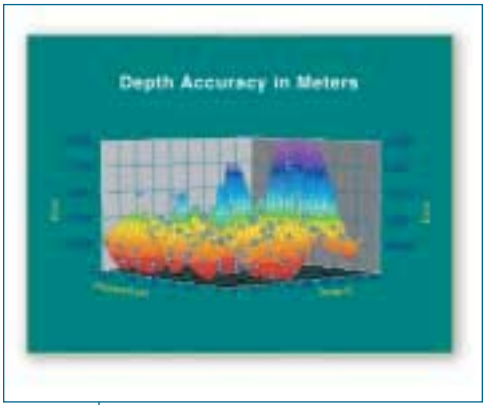
5600 Lindbergh Drive
Loveland, CO 80539
(800) 949-3766
(970) 669-3050
fax (970) 461-3921
hydrolab.com

HYDROLAB®
A HACH COMPANY BRAND

BENEFITS & SPECIFICATIONS

Hydrolab offers high-stability, custom made pressures sensors with four range options, available on both the DataSonde 4*a* and MiniSonde 4*a*.

- Exceptional accuracy for 10m, 25m, 100m, and 200m
- Two-year warranty



0 to 10 meters	Vented Level
Range	0 to 10 meters
Accuracy	±0.003 meters
Resolution	0.001 meters
0 to 25 meters	
Range	0 to 25 meters
Accuracy	±0.05 meters
Resolution	0.01 meters
0 to 100 meters	
Range	0 to 100 meters
Accuracy	±0.05 meters
Resolution	0.01 meters
0 to 200 meters	
Range	0 to 200 meters
Accuracy	±0.1 meters
Resolution	0.1 meters

Hydrolab

5600 Lindbergh Drive
Loveland, CO 80539
(800) 949-3766
(970) 669-3050
fax (970) 461-3921
hydrolab.com

HYDROLAB®
A HACH COMPANY BRAND

BENEFITS & SPECIFICATIONS

Hydrolab's self-cleaning turbidity offers several benefits for operators:

- ISO 7027 compliant
- Extended range with exceptional resolution
- Utilizes small aperture technique to reduce false readings from particulates and other debris
- Fixed parking position to ensure consistent data collection after each cleaning cycle
- Excellent performance in low NTU environments due to enhanced noise cancelling technique
- Two-year warranty

Range	0 to 3000 NTU
Accuracy	±1% up to 100 NTU; ±3% from 100-400 NTU; ±5% from 400-3000 NTU using StablCal®
Resolution	0.1 NTU from 0-400 NTU; 1 NTU for >400 NTU
Linearity	±1% from 0-100 NTU; ±3% from 100-400 NTU; ±5% from 400-3000 NTU
Temperature Coefficient	±0.05%/ºC

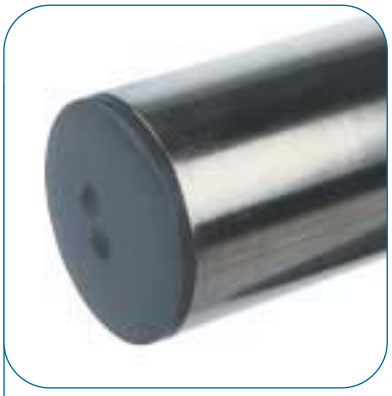
Hydrolab

5600 Lindbergh Drive
Loveland, CO 80539
(800) 949-3766
(970) 669-3050
fax (970) 461-3921
hydrolab.com

HYDROLAB®
A HACH COMPANY BRAND

BENEFITS & SPECIFICATIONS

- Ultra-compact size designed by Turner Designs specifically for integration into the DataSonde and MiniSonde
- Turner's industry leading measurement capabilities have not been compromised – this is the highest performance submersible fluorometer available!
- Excellent turbidity rejection ensures superior detection limits in a wide range of environmental conditions
- Three auto-selected gain ranges provide a wide measurement range of 0.03 to 500 µg/L for Chlorophyll *a*, 100 to 2,000,000 cells/mL for Blue-Green Algae, and 0.04 to 1000 ppb for Rhodamine WT
- Turner's unique Secondary Standards to provide a quick and simple method to verify the sensor's stability over time
- The Secondary Standard can also be adjusted to correlate to a known chlorophyll or dye concentration
- Cost optimized for affordable price and excellent value!



OPTICAL CHARACTERISTICS:

Light Source	Light Emitting Diode
Detector	Photodiode
Excitation Wavelength	Chl 460 nm BGA (FR) 590 nm BGA (MAR) 525 nm RWT 550 nm
Emission Wavelength	Chl 685 nm BGA (FR) 650 nm BGA (MAR) 570 nm RWT 600 nm

SPECIFICATIONS:

Minimum Detection Limit

Chlorophyll *a*:	0.03 µg/L
Blue-Green Algae:	100 cells/mL
Rhodamine WT:	0.04 ppb

Dynamic Range

Chlorophyll *a*:

• Low sensitivity:	0-500 µg/L
• Medium sensitivity:	0-50 µg/L
• High sensitivity:	0-5 µg/L

Blue-Green Algae:

• Low sensitivity:	100-2,000,000 cells/mL
• Medium sensitivity:	100-200,000 cells/mL
• High sensitivity:	100-20,000 cells/mL

Rhodamine WT:

• Low sensitivity:	0-1000 ppb
• Medium sensitivity:	0-100 ppb
• High sensitivity:	0-10 ppb

Hydrolab

5600 Lindbergh Drive
Loveland, CO 80539
(800) 949-3766
(970) 669-3050
fax (970) 461-3921
hydrolab.com

HYDROLAB®
A HACH COMPANY BRAND

HOBO® Water Temp Pro

AWARD-WINNING TECHNOLOGY AE50 HOBO® WEATHER STATION HOBO® WATER TEMP PRO

Size/Weight: 11.4 x 3.0 cm (4.5" X 1.19") with 6.4 mm (0.25") hole in mounting bail
42 grams (1.5 oz)

$110

The durable HOBO Water Temp Pro has 12-bit resolution and a precision sensor for ±0.2°C accuracy over a wide temperature range. A temperature-compensated real time clock provides better than ± 1 minute per month time accuracy. Designed with a durable streamlined case for extended deployment in fresh or salt water up to 50°C, the Water Temp Pro is equipped with an infrared (IR) interface for data offload in the field, even when the logger is wet.

Key Specifications

Measurement Range: 0° to 50°C (32°F to 122°F) in water (nonfreezing); –20°C to 70°C (-4°F to 158°F) in air

Waterproof: To 120 m (400 ft)

Accuracy: ±0.2°C at 0 to 50°C (± 0.36°F at 32° to 122°F)

Resolution: 0.02°C at 25°C (0.04°F at 77°F)

Time accuracy: Better than ±1 minute per month

Capacity: 21,580 12-bit measurements

CE Compliant with all relevant directives in the European Union (EU)

Bp BoxCar®Pro-compatible

Features

Accurate:

12-bit resolution and precision sensor for ±0.2°C accuracy at 0° to 50°C (±0.36°F accuracy at 32°F to 122°F)
Includes a NIST-traceable accuracy certificate at room temperature
Real-time clock for better than ±1 minute per month time accuracy

Easy to Use:

High-speed infrared (IR) interface offloads full logger <30 seconds
Programmable start time/date
User-selectable sampling interval: 1 second to 9 hours
Uses popular BoxCar® Pro 4.3+ for system launch and data retrieval

Reliable:

Factory-replaceable battery lasts 6 years (typical); temperature extremes will reduce battery life
Battery level indication at launch
Offload data, check logger and battery status while logging using BoxCar Pro
Non-volatile EEPROM memory retains measurements even if battery fails
Blinking LED confirms operation with option to suppress signal during logging
UV-stable plastic for long-term immersion in fresh or salt water*
Rugged, streamlined case design withstands years of use in stream conditions
Rated for use up to 50°C in water, 70°C in air
The dark gray case blends in, minimizing chances of tampering
Optional protective boot for high water flow, flooding, or conditions with debris *(see pg. 38)*

Detailed Specifications

Response Time: 5 minutes in water, 12 minutes in air moving 2 m/sec, typical to 90%
Memory modes: Stop when full or Wrap-around when full
Data offload: Readout full logger in < 30 seconds while logging or when stopped
Buoyancy: +13 grams (0.5 oz) (fresh water at 25°C); +17 grams (0.6 oz) with optional boot
Battery : One 3.6 V Lithium, factory replaceable ONLY
Battery Life: 6 years typical, temperature extremes reduce battery life
Drop proof to 1.5 m (5')
Note: NIST-traceable certification at additional temperature points is also available through Onset at additional cost.

The HOBO Water Temp Pro received an AE50 award for product innovation from the American Society of Agricultural Engineer's Resource *magazine.*

** Not for prolonged exposure to chlorinated water.*

IR Basestation for HOBO® Water Temp Pro

Operating Range: 0° to 40°C (32° to 104°F) 0 to 95% RH
Size/Weight: 3.2 x 6.4 x 1.5 cm (1.3 x 2.5 x 0.6 in.); 54 g (2.0 oz)

$60

The Infrared (IR) Basestation is required for communications between the HOBO Water Temp Pro and the PC. Simply place the logger 4 to 5 inches away from an IR Basestation (connected to a PC) within the 30° angle of view to read out the Water Temp Pro. The IR Basestation requires a 9-pin serial port in the PC. For use with USB port, see USB-to-Serial Adapter (pg 43). The Water Temp Pro is not compatible with IR ports on PCs or laptops.

Note: The IR Basestation is not waterproof.

HOBO Water Temp Pro Ordering

Description	Part No.	Qty. 1-9	10-99	100+
HOBO Water Temp Pro	H20-001	$110	$102	$94
IR Basestation	BST-IR	$60	$56	$51
Protective boot—black	BOOT-BLK	$15	$14	$13
Protective boot—white	BOOT-WHT	$15	$14	$13
Factory replacement battery service		$35		
Replacement caps				
Cap for Water Temp Pro (without Boot)	85-CAPLUG-H20	$2		
Cap for Boot-BLK	85-CAPLUG-H20-B	$2		
Cap for Boot-WHT	85-CAPLUG-H20-W	$2		
Software				
BoxCar Pro 4.3 Starter Kit (Windows®)	BCP4.3-ON	$95	$88	$81

Note: A BoxCar Pro Starter Kit and IR Base Station are required to operate the HOBO Water Temp Pro. Each starter kit includes software, computer interface cable and software manual. See page 42 for software information. Use with USB port requires USB-Serial Adapter (pg 43) and BoxCar Pro 4.3+.

underwater

StowAway® TidbiT®

$119

Small size: approx.
3.0 x 4.1 x 1.7 cm thick
(1.2 x 1.6 x 0.65"); 23 gm (0.8 oz)

The StowAway TidbiT is Onset's smallest data logger and is widely used for monitoring temperatures in streams, lakes, oceans, and soils. Small size, rugged case and alarm indication also make this a popular choice for monitoring conditions in shipping applications.

Key Specifications

Ideal for underwater applications up to 30° C

StowAway TidbiT: Model TBI32-05+37

Range†: -4° to 37°C (24° to 99°F)
Accuracy: ±0.2° at 20°C (±0.4° at 70°F)
Resolution: 0.16° at 20°C (0.29° at 70°F)

StowAway TidbiT: Model TBI32-20+50

Range†: -20° to 50°C (-4° to 122°F)
Accuracy: ±0.4°at 20°C (±0.8° at 70°F)
Resolution: 0.3°C at 20°C (0.6° at 70°F)

Capacity: 32,520 measurements

† *Specified range is narrower than nominal range due to precision calibration process. Using TidbiT Temp loggers in wet environments (>90% RH) over 86°F (30°C) for extended periods of more than 8 weeks cumulative may lead to premature failure. For applications over 30°C, use the HOBO Water Temp Pro (pg 35).*
Note: For Onset's lowest cost underwater temperature monitoring solutions, see HOBO Pendant Temp (pg 17). For depths greater than 300m see HOBO Stainless Temp (pg 18).

Features and Specifications

Waterproof to 300 m (1000 feet)
IR communications and Optic Shuttle for readout when wet—even underwater!
Programmable start time/date or triggered start on location with Optic Coupler or magnet
Small Size and Alarm Indication
5-year, non-replaceable battery (typical use*)
NIST-traceable temperature accuracy certificate available
Multiple sampling with minimum, maximum or averaging
Mounting tab
Time accuracy: ±1 minute per week at 20°C (68°F)
Memory modes: Stop when full, Wrap-around when full
Response time in water: 5 minutes (typical to 90%)
Response time in air moving 1m/second: 20 minutes

** 16 three-month deployments in water (35° to 80°F) with 4 minute or longer intervals (no multiple sampling)*

Optic Shuttle™

$199

Size/Weight: 132 x 20 x 25 mm
(5.25 long x 0.8 tall x 1.0" thick)
without coupler; 28.35 g (1 oz)

The pocket-sized Optic Shuttle provides a convenient way to readout and relaunch TidbiT data loggers and bring the data back to your host PC.

Features and Specifications

Waterproof to 15 psi (30 feet)
128K capacity enough for 4 full 32K loggers
Data offload time from logger: 6 minutes typical from 32K logger
Data readout time to PC: 3 minutes typical for complete offload
TidbiT Coupler and Optic Coupler included
Uploads the same data to a PC as if the data were read out directly from the logger
6 year factory-replaceable battery (typical)

Optic Base Station™

$80

Size/Weight: 132 x 20 x 25 mm
(5.25 long x 0.8 tall x .95" thick)
without coupler; 56.7 g (2 oz)

The Optic Base Station is used to communicate between the host computer and either a StowAway TidbiT data logger or an Optic Shuttle. An Optic Coupler and TidbiT Coupler for connecting the base station to loggers are also included.

StowAway TidbiT Ordering

Description	Part No.	Qty. 1-9	10-99	100+
32K StowAway TidbiT				
(-4° to 37°C)	TBI32-05+37	$119	$110	$101
(-20° to 50°C)	TBI32-20+50	$119	$110	$101
Optic Base Station for TidbiT	DSA	$80	$74	$68
Optic Shuttle for TidbiT	DTA128B	$199	$183	$169
Software				
BoxCar Pro 4.3 Starter Kit (Windows)	BCP4.3-ON	$95	$88	$81
BoxCar 3.7 Starter Kit (Windows)	BC3.7-ON	$20	$19	$17

Note: A BoxCar Pro 4.3 or BoxCar 3.7 starter kit and an Optic Base Station are required to operate the TidbiT loggers. Each starter kit includes software, computer interface cable and software manual. The Optic Base Station includes an Optic Base Station, Optic Coupler and TidbiT Coupler. See pages 42-43 for software information. Use with USB port requires USB-Serial Adapter (pg 43) and BoxCar Pro 4.3+.

B BoxCar®-compatible

Bp BoxCar®Pro-compatible

CE Compliant with all relevant directives in the European Union (EU)

YSI Environmental

YSI 600XL and 600XLM Sondes

The YSI 600XL and 600XLM.

Measure multiple parameters simultaneously

The YSI 600XL and YSI 600XLM compact sondes measure eleven parameters simultaneously:

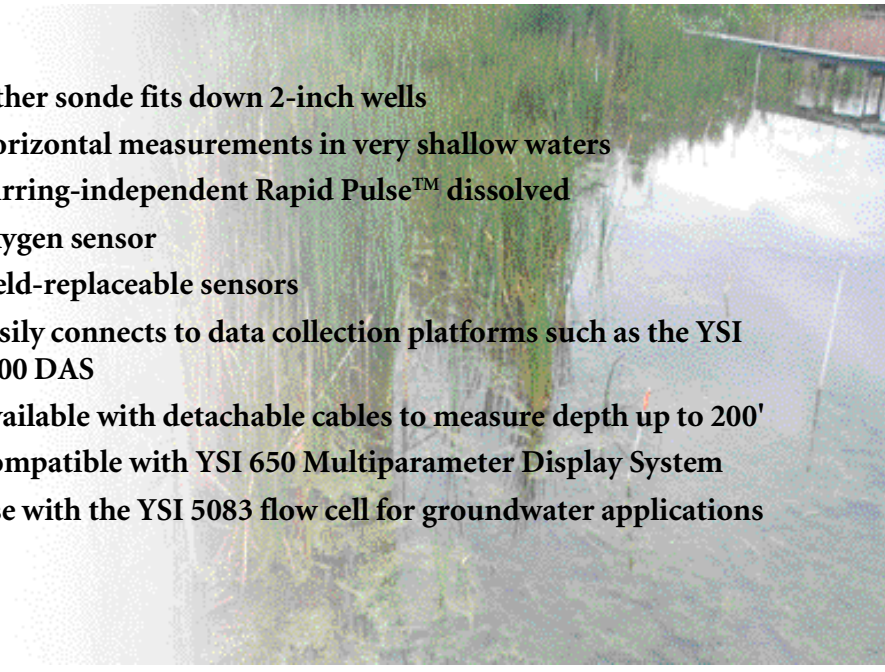
DO (% and mg/L)	ORP
Temperature	Depth or Level
Conductivity	Total Dissolved Solids*
Specific Conductance*	Resistivity*
Salinity*	pH

Connect with Data Collection Platform

Either sonde can easily connect to the YSI 6200 DAS (Data Acquisition System), or your own data collection platform, via SDI-12 for remote and real-time data acquisition applications.

In addition

The YSI 600XLM is an economical logging system for long-term, *in situ* monitoring and profiling. It will log all parameters at programmable intervals and store 150,000 readings. At one-hour intervals, the instrument will log data for about 75 days utilizing its own power source. The 600XL can also be utilized in the same manner with user-supplied external power.



- **Either sonde fits down 2-inch wells**
- **Horizontal measurements in very shallow waters**
- **Stirring-independent Rapid Pulse™ dissolved oxygen sensor**
- **Field-replaceable sensors**
- **Easily connects to data collection platforms such as the YSI 6200 DAS**
- **Available with detachable cables to measure depth up to 200'**
- **Compatible with YSI 650 Multiparameter Display System**
- **Use with the YSI 5083 flow cell for groundwater applications**

Pure Data for a Healthy Planet.™

Compatible with EcoWatch® for Windows® software for data analysis and more!

* Calculated parameters.

www.YSI.com

Pure Data for a Healthy Planet.™

To order or for more information, contact YSI Environmental.

800 897-4151

www.YSI.com

YSI Environmental
937 767 7241
Fax 937 767 9353
environmental@YSI.com

Endeco/YSI
508 748 0366
Fax 508 748 2543
environmental@YSI.com

YSI Environmental
European Support Centre
44 1730 710 615
Fax 44 1730 710 614
europe@YSI.com

YSI (Hong Kong) Limited
852 2891 8154
Fax 852 2834 0034
hongkong@YSI.com

YSI/Nanotech (Japan)
81 44 222 0009
Fax 81 44 222 1102
nanotech@YSI.com

YSI (Qingdao) Limited
86 532 389 6648
Fax 86 532 389 6647
china@YSI.com

ISO **9001**
ISO **14001**

YSI *incorporated*
Who's Minding the Planet?™

600XL & 600XLM Sensor Specifications

Dissolved oxygen % saturation	Range Resolution Accuracy	0 to 500% 0.1% 0 to 200%: ±2% air sat; 200 to 500%: ±6% air sat
Dissolved oxygen mg/L	Range Resolution Accuracy	0 to 50 mg/L 0.01 mg/L 0 to 20 mg/L: ±0.2 mg/L; 20 to 50 mg/L: ±0.6 mg/L
Conductivity †	Range Resolution Accuracy	0 to 100 mS/cm 0.001 to 0.1 mS/cm (range-dependent) ±0.5% of reading + 0.001 mS/cm
Temperature	Range Resolution Accuracy	-5 to +45°C 0.01°C ±0.15°C
pH, includes most low-ionic-strength measurements	Range Resolution Accuracy	0 to 14 units 0.01 unit ±0.2 unit
Non-vented depth, shallow	Range Resolution Accuracy	0 to 30 feet (0 to 9 m) 0.001 foot (0.001 m) ±0.06 foot (±0.02 m)
Non-vented depth, medium	Range Resolution Accuracy	0 to 200 feet (0 to 61 m) 0.001 foot (0.001 m) ±0.4 foot (±0.12 m)
Vented level	Range Resolution Accuracy	0 to 30 feet (0 to 9 m) 0.001 feet (0.0003 m) 0 to 10 feet (0 to 3 m): ±0.01 feet (0.003 m) 10 to 30 feet (3 to 9 m): ±0.06 feet (0.01 m)
ORP	Range Resolution Accuracy	-999 to +999 mV 0.1 mV ±20 mV
Salinity	Range Resolution Accuracy	0 to 70 ppt 0.01 ppt ±1% of reading or 0.1 ppt, whichever is greater

YSI Model 5083 flow cell and 600XL. This is an ideal combination for groundwater applications.

YSI 600XLM sonde

Sampling Medium: Fresh, sea or polluted water
Temperature: -5 to +45°C
Computer interface: RS-232, SDI-12
Logging memory: 384K flash ROM logs ~150,000 readings
Software: PC-compatible, Windows® 95 or higher; 256K RAM minimum. Graphics card recommended.
Size: 1.65" dia., 21.3" long (4.32 x 54.1 cm)
Weight with batteries: 1.5 lbs (0.7 kg)
External power supply: 12 VDC
Internal power supply: 4 AA-alkaline cells capable of logging for 75 days at one-hour intervals at 25°C

YSI 600XL sonde

Sampling Medium: Fresh, sea or polluted water
Temperature: -5 to +45°C
Computer interface: RS-232, SDI-12
Software: PC-compatible, Windows® 95 or higher; 256K RAM minimum. Graphics card recommended.
Size: 1.65″ dia., 16″ long, 1.3 lbs. (4.19 x 35.6 cm, 0.49 kg)
External power supply: 12 VDC

† Report outputs of specific conductance (conductivity corrected to 25° C), resistivity, and total dissolved solids are also provided. These values are automatically calculated from conductivity according to algorithms found in *Standard Methods for the Examination of Water and Wastewater* (ed 1989).

GeoXM

The essential GPS platform for mobile GIS

The GeoXM™ handheld, from the GeoExplorer® series, turns the concept of mobile GIS into a productive reality. It's the rugged, all-in-one solution you've been waiting for—the perfect tool for taking your GIS data into the field.

The unique GeoExplorer series combines a Trimble® GPS receiver with a rugged field-ready handheld computer running the Microsoft® Windows Mobile™ 2003 software for Pocket PCs. Plus there's an internal battery that easily lasts for a whole day of GPS operation. The result is tightly integrated, tough, and incredibly powerful.

Integrated GPS

The GeoXM integrates reliable, 2–5 meter accuracy GPS into your mobile GIS application, so you can relocate assets with confidence and fulfill work orders efficiently. You can differentially correct in real-time, using corrections from a satellite-based augmentation system (SBAS) such as WAAS[1] or EGNOS[2]. For extra precision, collect data using Trimble's TerraSync™ or GPScorrect™ extension for ESRI ArcPad software, then postprocess it back in the office.

Because the GPS receiver and antenna are built into the handheld computer, it's never been easier to use GPS in your application. The system is more than just cable-free: it's a totally integrated solution.

Optimized productivity

Take advantage of the power and flexibility of Windows Mobile software for Pocket PCs by choosing from the most comprehensive range of field software available—whether off-the-shelf or purpose-built. Whatever your needs, Windows Mobile lets you choose a software solution to match your workflow.

Windows Mobile includes familiar Microsoft productivity tools, including Pocket Word, Pocket Excel, and Pocket Outlook®. Pocket Outlook lets you synchronize e-mails, contacts, appointments, and data with your office computer, so whether you're in the office or in the field, you're always up to date.

Go wireless with integrated Bluetooth®* for connection to other Bluetooth-enabled devices, including cell phones and PCs. You also have the option to use the USB support module to connect to a desktop computer, or use the optional serial clip for cabled connections in the field.

Receive a free copy of Microsoft Streets & Trips** 2005 software with your GeoXM handheld, and take advantage of comprehensive map and travel information for easy navigation and route planning.

All the memory you need

There's plenty of storage space in the GeoXM for all your GIS data. The fast processor and large memory mean even big graphics files load quickly—and they're crisp and crystal-clear on the advanced TFT outdoor color screen.

Light, easy to use, and adaptable, the GeoXM handheld is built with mobile GIS in mind. So get your hands on a GeoXM, and get mobile.

Key Features

- Reliable GPS with integrated WAAS/EGNOS
- Windows Mobile 2003 software for Pocket PCs, allowing maximum flexibility in software choice
- Rugged handheld with all-day battery
- Advanced color TFT display with backlight
- Integrated Bluetooth for wireless connectivity

* *Bluetooth type approvals are country specific. GeoExplorer series handhelds are approved for use with Bluetooth in the USA. For a complete list of other countries with Bluetooth approval please refer to: www.trimble.com/geo_bluetooth.html.*

** *Microsoft Streets & Trips 2005 software available in US/Canada; Microsoft AutoRoute® 2005 in Europe.*

Trimble®

GeoXM

The essential GPS platform for mobile GIS

Standard features

System

- Microsoft Windows Mobile 2003 software for Pocket PCs
- 206 MHz Intel StrongARM processor
- 512 MB non-volatile Flash data storage
- Outdoor color display
- Ergonomic cable-free handheld
- Rugged and water-resistant design
- All-day internally rechargeable battery
- Bluetooth wireless

GPS

- 2–5 meter accuracy
- Integrated WAAS[1]/EGNOS[2]
- RTCM real-time correction support
- NMEA and TSIP protocol support

Software

- GPS Controller for control of integrated GPS and in-field mission planning
- GPS Connector for connecting integrated GPS to external ports
- File Explorer, Internet Explorer, Pocket Outlook (Inbox, Calendar, Contacts, Tasks, Notes), Pocket Backup, Transcriber, Pocket Word, Pocket Excel, Pictures, Windows® Media Player, Bluetooth File Transfer, Calculator, ActiveSync®
- Microsoft Streets & Trips/AutoRoute 2005 software

Accessories

- Support module with power supply and USB data cable
- Getting Started Guide
- Companion CD includes Outlook 2002 and ActiveSync 3.7.1
- Hand strap
- Pouch
- Stylus

Optional features

Software

- Trimble GPScorrect extension for ESRI ArcPad software
- TerraSync
- GPS Pathfinder® Tools Software Development Kit (SDK)
- GPS Pathfinder Office
- Trimble GPS Analyst™ extension for ESRI ArcGIS software

Accessories

- Serial clip for field data and power input
- Vehicle power adaptor[3]
- Portable power kit[3]
- Hurricane antenna
- External patch antenna
- Pole-mountable ground plane
- Baseball cap with antenna sleeve
- Beacon-on-a-Belt (BoB™) differential correction receiver[3]
- Hard carry case
- Null modem cable[3]
- Backpack kit

Specifications subject to change without notice.

Technical specifications

Physical

Size	21.5 cm × 9.9 cm × 7.7 cm (8.5 in × 3.9 in × 3.0 in)
Weight	0.72 kg (1.59 lb) with battery
Processor	206 MHz Intel StrongARM SA-1110
Memory	64 MB RAM and 512 MB internal Flash disk
Power	
Low (no GPS)	0.6 Watts
Normal (with GPS)	1.4 Watts
High (with GPS, backlight, and Bluetooth)	2.5 Watts
Battery	Internal lithium-ion, rapidly rechargeable in unit, 21 Watt-hours

Environmental

Temperature	
Operating	–10 °C to +50 °C (14 °F to 122 °F)
Storage	–20 °C to +70 °C (–4 °F to 158 °F)
Humidity	99% non-condensing
Casing	Wind-driven rain and dust-resistant per IP 54 standard Slip-resistant grip, shock- and vibration-resistant

Input/output

Communications	Bluetooth for wireless connectivity USB v1.1 compatible via support module, serial via optional DE9 serial clip adaptor
Bluetooth	
Certification	Bluetooth type approvals are country specific. GeoExplorer series handhelds are approved for use with Bluetooth in the USA. For a complete list of other countries with Bluetooth approval please refer to www.trimble.com/geoxm_ts.asp.
Profiles	
Both client and host support	Serial Port, File Transfer (using OBEX)
Client support only	Dial-Up Networking, Lan Access
Host support only	Basic Imaging, Object Push
Display	Advanced outdoor TFT, 240 × 320 pixel, 65,536 colors, with backlight
Audio	Microphone and half duplex speaker, record and playback utilities
Interface	Touch screen, 2 hardware control keys plus 4 programmable permanent touch buttons Soft Input Panel (SIP) virtual keyboard, Handwriting recognition software Audio system events, warnings, and notifications

GPS

Channels	8
Integrated real-time	WAAS[1] or EGNOS[2]
Update rate	1 Hz
Time to first fix	30 sec (typical)
Protocols	NMEA (GGA, VTG, GLL, GSA, ZDA, GSV, RMC) TSIP (Trimble Standard Interface Protocol)

Accuracy (RMS)[4] after differential correction

Postprocessed[5]	2–5 m
Real-time	2–5 m

1 *WAAS (Wide Area Augmentation System). Available in North America only. For more information, see http://gps.faa.gov/programs/index.htm.*
2 *EGNOS (European Geostationary Navigation Overlay System). Available in Europe only. For more information, see http://www.esa.int/export/esaNA/egnos.html.*
3 *Serial clip also required.*
4 *Horizontal accuracy. Requires data to be collected with minimum of 4 satellites, maximum PDOP of 6, minimum SNR of 4, minimum elevation of 15 degrees, and reasonable multipath conditions. Ionospheric conditions, multipath signals or obstruction of the sky by buildings or heavy tree canopy may degrade precision by interfering with signal reception. Accuracy varies with proximity to base station by +1 ppm for postprocessing and real-time.*
5 *Postprocessing with GPS Pathfinder Office software or GPS Analyst extension for ArcGIS.*

YOUR LOCAL TRIMBLE OFFICE OR REPRESENTATIVE

www.trimble.com

NORTH & SOUTH AMERICA
Trimble Navigation Limited
7401 Church Ranch Blvd
Westminster, CO 80021 • USA
+1-720-887-4374 Phone • +1-720-887-8019 Fax

EUROPE, AFRICA & MIDDLE EAST
Trimble GmbH
Am Prime Parc 11 • 65479 Raunheim • GERMANY
+49-6142-2100-0 Phone • +49-6142-2100-550 Fax

ASIA-PACIFIC
Trimble Navigation Australia Pty. Ltd
Level 1 • 123 Gotha St • Fortitude Valley
Queensland 4006 • AUSTRALIA
+61-7-3216-0044 Phone • +61-7-3216-0088 Fax

APPENDIX B: MONITORING LOGS

PETROLEUM PRODUCT VISUAL OBSERVATION

Date*	Time	Personnel	Location	Sheen observed?	If yes, reported?
5/2/2005	12:05	Bob Smith	Chelan Powerhouse Tailrace	No	NA
5/9/2005	14:22	Carol Jones	Chelan Powerhouse Tailrace	Yes	Yes
5/16/2005					
5/23/2005					
5/30/2005					
6/6/2005					
6/13/2005					
6/20/2005					
6/27/2005					
7/4/2005					
7/11/2005					
7/18/2005					
7/25/2005					
8/1/2005					
8/8/2005					
8/15/2005					
8/22/2005					
8/29/2005					
9/5/2005					
9/12/2005					
9/19/2005					
9/26/2005					
10/3/2005					
10/10/2005					
10/17/2005					
10/24/2005					
5/2/2005					
5/9/2005					
5/16/2005					
5/23/2005					
5/30/2005					

* Note: These are example dates. When monitoring begins actual weekly dates will be substituted. The dates will be provided to ensure that no weekly inspections are missed.

TDG, DO, Turbidity and pH Monitoring Sheet

Date:		**Personnel:**		
Monitoring Equipment:				
Location	**Start Time**	**End Time**	**Parameters**	**QA/QC samples**

Temperature Data Download Form

Personnel	Equipment used	Sampling Location	Download Date	Previous Download Date	Comments

APPENDIX B: CONSULTATION WITH STAKEHOLDERS

B.1 Overview of Consultation

Article 405 of the Project License requires that Chelan PUD prepare the Operations Compliance Monitoring Plan:
"…after consultation with Washington Department of Ecology, NOAA National Marine Fisheries Service (NMFS), U.S. Geological Survey (USGS), U.S. Park Service, U.S. Forest Service, U.S. Fish and Wildlife Service, Washington State Parks and Recreation Commission, Washington Interagency Committee for Outdoor Recreation, Confederated Tribes of the Colville Reservation, the Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation, City of Chelan, Lake Chelan Sportsman's Association, Manson Parks and Recreation Department, Lake Chelan Recreation Association, and American Whitewater. 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 comments of the above entities are accommodated by the plan. The licensee shall allow a minimum of 30 days for the above entities to comment and to make recommendations prior to filing the plan with the Commission."

Chelan PUD has completed the consultation requirements, beginning on 1/17/07 by consulting with the Chelan River Fisheries Forum (CRFF) on the outline for the OCMP. The draft plan was provided to the members of the CRFF, LCRF and USGS, listed below, on March 15, 2007 and comments were received through April 26, 2007. All comments received were incorporated into the plan. A summary of comments received and Chelan PUD's response is below in Section B.2. Records of Chelan PUD's communications soliciting comments and responses received are compiled in Section B.3.

Distribution and request for review and comments on the draft OCMP was solicited from the CRFF and LCRF memberships and USGS:

Washington State Department of Ecology
Washington State Department of Fish and Wildlife
United States Forest Service
National Park Service
United States Fish and Wildlife Service
National Marine Fisheries Service
Confederated Tribes of the Colville Reservation (CCT)
Yakama Indian Nation (YIN)
Confederated Tribes of the Umatilla Indian Reservation (CTUIR)
City of Chelan
Lake Chelan Sportsman Association
Washington State Parks and Recreation Commission
Washington Interagency Committee for Outdoor Recreation
Manson Parks and Recreation Department
Lake Chelan Recreation Association
American Whitewater
United States Geological Survey

B.2 Summary of Response to Comments

Entity	Date Received	Comment	Licensee's response to comment
Washington Department of Fish and Wildlife: Bruce Heiner	3/22/07	Section 2.1. There is discussion of runoff forecasts to be used to determine flow releases at the dam. Where do those forecasts come from; USGS, Chelan PUD, others?	The OCMP was revised to state that Chelan PUD makes the forecasts and the sources of information used.
		Section 2.1. The description of dry years and wet years is slightly confusing (within 80% or 20% exceedance ranges, respectively). If the term "within" is used, then a range should be identified, such as "within the 80% to 100% exceedance range" or "within the 20% to 1% exceedance range." Another way of describing it could be "flows less than or equal to the 80% exceedance value", or "flows greater than or equal to the 20% exceedance value." The latter approach would be easier to understand for those not used to working with flow exceedance values.	Subsequent comments by WDFW (Tony Eldred) had a different proposal for clarity, which preserved the language that was originally a direct quote from the Settlement Agreement. The language has been modified to reflect the suggestions made by Tony Eldred (see below).
		Section 2.2.2. The description of flows measured at the dam confused me (80 cfs measured at the Project dam and 240 cfs measured at the dam or through	The LLO or spillway releases are the backup for the pump station, thus 320 cfs or some lesser amount could be released from the dam to supplement pump station flows during the spawning period. The intent of

		calibrated pump discharge curves). It is not clear when 240 cfs would be measured at the dam. The obvious flows to be measured at the dam are 80 cfs, 200 cfs (avg runoff years), and 320 cfs (wet years or if the lift pumps were not used).	the discussion is to show that flows in Reach 4 can be provided from either the dam or pump station, while flows for Reaches 1-3 are fixed at the dam as shown in Table 1.
		Section 2.6. Do the ramping rates apply to the tailrace?	No, but biological effectiveness, i.e. protection of redds, is required.
		Section 3. There seems to be a typo on the date of the first annual Flow Report. Section 3 lists the date as 2/28/07 and Section 4.2 gives the date as 2/28/08. I assume 2/28/08 is the correct date.	Correct. The error in Section 3 has been corrected.
		Ramping Rates. My last comment is of a more substantive nature. One of the goals or objectives for the Chelan River is to manage it as a functional ecosystem. The proposed ramping rate, particularly for lowering the flow, does not seem to fit that concept. Typical hydrographs for rivers in this area have a very gradual recession limb. I realize it is not reasonable to expect to match the natural hydrograph, but I think it makes sense to try to imitate it more than the proposed 1-day ramp-down period. I would suggest ramping down over a week	As discussed in the CRFF meeting and as stated in the second paragraph of the OCMP, Section 2.6, the ramping rates necessary to protect fish will be set for specific flows and seasons based on empirical measurement of stranding risk during the monitoring and evaluation studies. The two inches per hour is the starting requirement until the site-specific information can be obtained.

		rather than a day. Although future studies are intended to determine if the 2"/hr rate protects salmonids, an ecosystem includes more aquatic organisms than salmonids. Other fish, as well as the some of the insects they prey on, may be affected by relatively rapid lowering of the flows in the river. I think there are ramping rate options that would satisfy the resource agencies and preserve the power production levels currently in the license agreement. Perhaps we can discuss this issue at the Fisheries Forum meeting next week.	
Washington Department of Ecology, Pat Irle	4/3/07	Corrections to names on table and figure in Section 3 of the QAPP	The corrections were made to the QAPP
US Fish and Wildlife Service, Stephen Lewis	4/23/07	Plan Reviewed and OK – no comments	
Manson Parks, Lanny Armbruster	4/23/07	No comments	
USGS, Raymond Smith	4/23/07	Gauging adequate for OCMP compliance	
IAC, Jim Eychaner	4/23/07	No comments	
Lake Chelan Sportsman Association, Gary Denniston	4/23/07	Telephone Conversation Plan reviewed – no comments	
US Forest Service, Phil Archibald	4/24/07	Plan Reviewed – no comments	
Washington Department of Fish and Wildlife: Tony Eldred	4/24/07	2.1 Instream Flow Requirements for the Chelan River Provide citations to specific sections of the Settlement Agreement, Attachment B, Lake	These citations have been added to appropriate areas in the TESPP

		Chelan Comprehensive Plan, where necessary In the first paragraph you state "… In average water years, … (within the 21%-79% exceedance range **or 60% of the years** based on historical records), …." It aids the reader to better understand event frequency by including the percentage of years occurrence. I suggest you also do this for dry years and wet years. 2.3.1 Tailrace pump station. On page 5, first complete paragraph at the top of the page, it is stated that a cost-benefit analysis will be performed of pumping water from the tailrace vs. releasing water from the LLO or spilling. The begs the question, what is the fallback for maintaining flow in the Reach 4 Habitat Channel if the pumps fail? Releases from the LLO (or spilling, if possible)? Is this the only fallback option? How long will be required for LLO flow release to reach the upper end of the Habitat Channel? 2.3.2 Gauge Calibration Methods. It would be most helpful to many readers if, early-on in your discussion, you clearly explain the distinct	The change recommended by WDFW was incorporated into the TESPP This comment applies to section 2.2.3 of the TESPP. The pump station will have multiple redundancy in the pumps (five pumps) and two separate power feeds. Thus, the risk of a total loss of pumped flow is small. A field test was conducted on 4/24/07 to determine the amount of time it would take an increase in spill from 80 cfs to 320 cfs to arrive at Reach 4. The water stabilized at 320 cfs within two hours of the change in spill volume. This is sufficiently rapid to prevent egg mortality during incubation. To clarify for the reader, the following sentences have been added to show with examples the distinction between

		difference in meaning of these two terms (accuracy and precision). … It is not clear whether this expected 2-5 percent precision error is constant or proportional at lesser discharges. Please elaborate as to what to expect in seasonal (varying) "real flow" situations.	accuracy and precision and the magnitude of these calibration levels for low (80 cfs) and higher (240 cfs) flow levels. The objective will be to calibrate the meter to be accurate to approximately 1 percent of discharge. Thus, the flow meter will be calibrated to provide average flow measurements within 0.8 cfs of the actual flow passing though the LLO when the desired flow is 80 cfs.…. The precision of the ultrasonic flow meters is expected to be within two to five percent of the maximum discharge of each conveyance pipe or channel. In other words, any single instantaneous reading at the pump station will be within 4.8 cfs – 7.0 cfs at flows of 240 cfs or greater, while the average readings for a day would be accurate to within 2.4 cfs of the desired 240 cfs flow release.
		QAPP Section 2: Project Description. ….monitoring requirements specifies hourly monitoring of water temperature in the dam forebay and at the end of Reaches 1, 3 and 4 of the Chelan River. Why was Reach 2 omitted. It will make it easier for the reader if, when you use "tailrace", you identify which one. (powerhouse or spillway)	The end of Reach 2 will not be monitored because of inaccessibility and safety concerns, coupled with a determination that there will be little temperature difference between that location and the end of Reach 3. For these reasons, the 401 Certification does not require monitoring at the end of Reach 2. All references to tailrace in the QAPP are for the powerhouse tailrace. All tailrace monitoring, except for total dissolved gas monitoring downstream from the Project dam's spillway, is

			also in the powerhouse tailrace. The term tailrace in the OCMP also always refers to the powerhouse tailrace. Except in titles and quotes from Article 405, the term "powerhouse tailrace" has been added for clarity.
		Page 5, first bullet. Flow and temperature data will be reported on the CPUD website on a monthly basis….This seems to indicate that monthly data will be going on two months old when it becomes available. Is it possible that such data could be available significantly earlier?	The reporting requirements are from the 401 Certification and are <u>minimum</u> reporting requirements. It is Chelan PUD's intent to provide some temperatures in real-time, along with the flow data, where feasible to connect temperature probes to the PUD's SCADA system. This could occur at the dam forebay site and at the powerhouse tailrace. Other sites will be monitored with data logging devices that must be manually retrieved and downloaded. Based on biological evaluations, this may be done more frequently than monthly during sensitive life stages of fish in Reach 4 during the 10-year monitoring and evaluation period defined in the Settlement Agreement.
		Page 9, Table 3-2. Monitoring Schedule. Under monitoring for Dissolved Oxygen (DO), the table shows two samples/month in Years 3 & 5 during the most biologically productive	The DO level during winter will be greater than necessary to meet water quality standards due to the high solubility of oxygen in cold water. Ice buildup could affect intragravel oxygen in salmon redds, but the powerhouse tailrace never freezes. It is unlikely that there will be significant anchor ice in Reach 4 spawning habitat also, due to the deep pool that will be at the head of Reach 4

		months of the year (July – September). What of really adverse winter conditions (ice buildup) as they occur?	providing a thermal buffer, preventing formation of anchor and frazzle ice. If anchor ice is observed in Reach 4 during the 10 year monitoring and evaluation period, studies to determine if intragravel DO falls below 6.0 mg/l could be initiated. Due to the brevity required in a Table, the exact nature of this monitoring was misunderstood. The "up to three times" refers to the frequency of water supply conditions or maintenance requirements that lead to scheduled powerhouse shutdowns during the salmon and steelhead incubation periods. When powerhouse shutdowns occur, then hourly monitoring will be continuous until scheduled shutdowns are discontinued, thus monitoring could last for weeks. The incubation periods for salmon and steelhead occur during fall and spring, not during the "warmest months". The language in the table has been clarified.
		Table 3-2. Scheduled powerhouse shutdowns. Tailrace gravel DO will be monitored hourly, during low water years. It is estimated this monitoring will occur up to three times form year one to five after initiation of minimum flow. Three monitorings over a period of five years under minimum flow conditions (80 cfs) during the year's warmest months seems remarkably minimal.	The monitoring schedule will be developed in consultation with the CRFF. Probably, for logistical reasons, the scheduled days will be systematically determined. Reporting of hourly and daily maximum , minimum and average temperatures has been added to the paragraph.
		Table 3-2, during egg incubation. How will the one day per week be selected: randomly,	

		systematically, or..?	
		Page 10, first complete paragraph. We prefer that daily water temperature data be reported as daily minimum, daily maximum, and daily average.	This paragraph refers to determination of what is an "exceedance", where the water temperature criterion is based on "natural" temperatures. The "natural" temperature is unknown, thus this type of exceedance can't be reported on a 48 hour basis.
		Page 10, third complete paragraph. Please elaborate on how unnatural temperature shifts might occur.	This schedule is intended to show general timeframes and will be revised after final completion of the Chelan River projects. A more detailed schedule will be developed in consultation with the CRFF at that time. The specific dates in the project schedule are just approximations at this time.
		Page 11, Figure 3-2, Anticipated Chelan River Water Quality Monitoring and Reporting Schedule. Several minor edits are suggested.	The preceding paragraph explains that the figure shows monitoring sites proposed before the LLO location had been decided. Only the monitoring sites on the south side of the dam will be implemented since that is where the LLO will be constructed.
		Page 18, Figure 5-1. Proposed temperature sampling location. Suggested changes to labeling.	Reach 4 intragravel DO monitoring is expected to be specific to redd locations, thus there is no point to establishing a monitoring site for that parameter. Monitoring of a representative number of redds will be established yearly in consultation with the CRFF after redd surveys have established where redds occur.
		Page 20, Figure 5-6.	Fall Chinook has been changed

		Proposed turbidity, DO, pH sampling locations, Reach 4. Recommendation to establish intragravel DO monitoring stations in Reach 4. "Fall" Chinook in the upper mid-Columbia are more properly termed "summer" Chinook	to summer Chinook throughout the TESPP. This term is not used in the OCMP
Washington Department of Ecology, Pat Irle	4/25/07	I wanted to make sure that we capture in a prominent place the fact that the QAPP will need to include, at some time in the not-too-distant future, a description of the temperature modeling and the data to be collected to support that modeling, in accordance with Ecology's QAPP guidelines. There is a small reference made to the modeling on page 3 of the"draft final" (April 3, 2007) version of the QAPP. …Put the statement on page 3 in bold, and include a discussion about the probable contents and timeframe. Also, perhaps a statement whether the QAPP for modeling will be a separate, supplemental, stand-along document or included as an appendix.	The statement on page 3 has been changed to boldface, and the following information was added: "Due to the complexity of the water temperature modeling that will be necessary to determine whether the Chelan River can meet temperature criteria for its current use designation, Chelan PUD intends to develop a separate QAPP for that modeling study. The study may require modeling of temperatures that would flow into the Chelan River from Lake Chelan in the absence of the Project. The modeling study may require three to five years of additional temperature monitoring in the lower portion of Lake Chelan, as well as the same number of years after the Chelan River flows have been established. The QAPP for this study will be developed for implementation by the summer of 2010."
National Park Service, Stanley	4/25/07	Plan Reviewed – no comments	

Zyskowski			
Colville Confederated Tribes, Jerry Marco	4/26/07	Plan Reviewed – no comments	
NMFS, Rich Domingue		No comments	
CTUIR, Carl Merkle		No response	
YIN, Bob Rose		No response	
City of Chelan		No response	
Washington State Parks		No response	
American Whitewater		No response	

B.3 Record of Communications Soliciting Comments and Responses

OCMP and QAPP Consultation Record Summary

1/17/07 - Submittal of OCMP Outline to CRFF, RRFF and USGS for review and comment

3/15/07 - Submittal of 1st Draft OCMP to CRFF, RRFF and USGS for review and comment.

3/22/07 – WDFW, Bruce Heiner, email providing comments on OCMP.

3/30/07 - Email to RFF, RRFF and USGS advising of limited changes to OCMP 1st Draft, requesting they continue review of that draft, advising that final draft will be issued week of 4/2/07, and setting deadline for comments of April 26, 2007.

4/03/07 - Emails to RFF, RRFF and USGS providing final draft of OCMP for review, requesting comment letters, deadline for comments of April 26, 2007, stating Chelan PUD intent to file final OCMP, comment letters appended to plan, with FERC on 5/4/07.

4/03/07 –Ecology, Pat Irle, email with corrections to the contact list in the QAPP, Appendix A of the OCMP.

4/20/07 – Chelan PUD email reminder to CRFF, RRFF and USGS of comments due 4/26/07 on OCMP.

4/18 - – Chelan PUD log of telephone reminders to CRFF, RRFF and USGS of 4/24/07 comments due 4/26/07 on OCMP.

4/23/07 – USFWS, Stephen Lewis, email approving OCMP and stating he will have no comments.

4/23/07 – Manson Parks, Lanny Armbruster, email stating he will have no comments.

4/23/07 – USGS, Raymond Smith, email stating that gauging is adequate for OCMP compliance monitoring.

4/23/07 – IAC, Jim Eychaner, email stating he will have no comments.

4/24/07 – USFS, Philip Archibald, email approving OCMP and stating he will have no comments.

4/24/07 – WDFW, Tony Eldred, email approving OCMP and providing comments on OCMP and QAPP, Appendix A of the OCMP.

4/25/07 –Ecology, Pat Irle, email with an addition to the QAPP, Appendix A of the OCMP.
4/25/07 – NPS, Stanley Zyskowski, email stating NPS will have no comments.
4/26/07 – Lake Chelan Recreation Association, Richard Uhlhorn, email approving OCMP and stating he will have no comments.
4/26/07 – Colville Tribe, Jerry Marco, email that has reviewed OCMP and stating he will have no comments.

Minutes of Chelan River Fishery Forum meeting 1/17/2007 documenting distribution of OCMP outline and requesting comments by 2/1/2007 (note error in minutes – wrong year 2/1/06).

Chelan River Fishery Forum (CRFF) Meeting

Date: January 17, 2007
Time: 10:00 am – 3:30 pm
Location: Chelan PUD Headquarters, Wenatchee, WA
Second Floor Conference Room

Call in number: (509)661-4844, Password is 4000.

Attendees are noted in bold below.

Meeting called by:	Jeff Osborn, Chelan PUD	Type of meeting:	CRFF Meeting
		Note taker:	Tracy Dunning

CRFF Members

Name	Agency	Phone	Email
Art Viola	WDFW	509-665-3337	violaaev@dfw.wa.gov
Bruce Heiner	WDFW	509-332-0892	heinebah@dfw.wa.gov
Carmen Andonaegui	WDFW	509-754-6066 x25	andonca@dfw.wa.gov
Alex Martinez	USDA-FS	509-662-4335	ramartinez@fs.fed.us
Phil Archibald	USDA-FS	509-784-1151	parchibald@fs.fed.us
Joe Kastenholz	USDA-FS	509-682-2576	jkastenholz@fs.fed.us
Rich Domingue	NOAA	503-231-6858	Richard.Domingue@noaa.gov
Steve Lewis	USFWS (by phone)	509-665-3508 x14	Stephen_Lewis@.fws.gov
Steve Zyskowski	NPS (by phone)	360-856-5700 x229	Stan_Zyskowski@nps.gov
Bob Rose	YN	509-865-5121	brose@yakama.gov
Jerry Marco	CCT	509-634-2114	jerry.marco@colvilletribes.com
Pat Irle	Ecology	509-454-7864	Pirle461@ecy.wa.gov
Brad Caldwell	Ecology	360-407-6639	brca461@ecy.wa.gov
Gary Denniston	LCSA	509-687-4078	geedee@cablespeed.com
Jay Witherbee	City of Chelan	509-682-8018	mayor@cityofchelan.com
Jeff Osborn	Chelan PUD	509-661-4176	jeffa@chelanpud.org
Steve Hays	Chelan PUD	509-661-4179	steveh@chelanpud.org
Vern Chamberlain	Chelan PUD	509-661-4680	vern@chelanpud.org
Courtney Hill	Chelan PUD	509-661-4143	courtney.hill@chelanpud.org
Gene Yow	Chelan PUD	509-661-4305	gene@chelanpud.org
Also Attending:			
Gary Rice	Chelan PUD	509-661-4441	garyr@chelanpud.org
Rosana Sokolowski	Chelan PUD	509-661-4175	Rosana@chelanpud.org
Tom Schadt	Anchor Environmental	206-287-9130	tshadt@anchorenv.com
Jay Kidder	Anchor Environmental	360-678-4747	jay@chinook-engineering.com
Pat Powers	Anchor Environmental	360-754-2133	ppowers@anchorenv.com
Janel Duffy	Chelan PUD	509-661-4400	Janel.duffy@chelanpud.org
Gregg Carrington	Chelan PUD	509-661-4178	Gregg@chelanpud.o

			rg
Michelle Smith	Chelan PUD	509-661-4180	Michelle.smith@chelanpud.org

Meeting Purpose: First meeting of the Chelan River Fishery Forum to initiate Lake Chelan license implementation

Agenda	Discussion Summary Notes	Action Items
Introductions	Attendees listed in bold above	
Review Chelan River Fishery Forum goals and objectives	Ground rules for participation and Lake Chelan Project goals and objectives were reviewed.	1. Agenda and handouts will be posted to Chelan PUD website two weeks prior to a meeting. 2. Agenda will include "desired outcome" items. 3. Meeting notes will be posted to Chelan PUD website within two days following a meeting. There will be a two week comment period on these meeting notes.
Review License Order conditions	Article 404 – Lake Chelan Fishery Plan (due in one year) Article 405 – Operations Compliance Monitoring Plan (due in six months) Article 406 - Wildlife Plan (due in one year) Article 408 - Threatened & Endangered Species Plan (due in six months)	1. 2/1/06 is deadline to return comments to Steve Hays regarding Threatened and Endangered Species Protection Plan Outline and Operations Compliance Monitoring Plan Outline. 2. Jeff Osborn will have Comprehensive Plan documents printed up for Forum members.
Discuss and provide input on Reach 4 and tailrace habitat design criteria	Presentation by Anchor Environmental and forum discussion	1. Anchor to continue with 30% design; incorporate with group input on moving the stream closer to the bank.
Review Chelan River Project schedules	Janel reviewed. Next meetings were scheduled.	1. Chelan Dam Water Temperature Study report will be posted to Chelan PUD website. 2. Janel will generate report that shows chronological list of tasks and will include this with minutes. 3. Future meeting dates:

	30% of Reach 4 Project	3/28/07
	60% of Reach 4 Project	6/28/07
	90% of Reach 4 Project	10/4/07

Additional Information

Handouts: forum goals and objectives; project schedules; License document (FERC License Order; Settlement Agreement; License articles); implementation plan outlines.

==========

From: Sokolowski, Rosana on behalf of Smith, Michelle
Sent: Thursday, March 15, 2007 5:09 PM
To: 'heinebah@dfw.wa.gov'; 'ramartinez@fs.fed.us'; 'violaaev@dfw.wa.gov'; 'parchibald@fs.fed.us'; 'jkastenholz@fs.fed.us'; 'Stan_Zyskowski@nps.gov'; 'Richard.Domingue@noaa.gov'; 'Stephen_Lewis@fws.gov'; 'jerry.marco@colvilletribes.com'; 'brose@yakama.com'; 'pirl461@ecy.wa.gov'; 'brca461@ecy.wa.gov'; 'geedee@cablespeed.com'; 'mayor@cityofchelan.com'; 'carlmerkle@ctuir.com'; Osborn, Jeff; Hays, Steve; Chamberlain, Vern; Hill, Courtney; Yow, Gene; 'bill.fraser@parks.wa.gov'; 'jim.harris@parks.wa.gov'; 'jime@iac.wa.gov'; 'mansonparks@flymail.net'; 'richard@richarduhlhorn.com'; 'okeefe@amwhitewater.org'; 'rrsmith@usgs.gov'
Cc: Smith, Michelle; Duffy, Janel; Smith, Michelle
Subject: Lake Chelan 637: Chelan PUD Request to Review the Draft Operations Compliance Monitoring Plan (March 15, 2007)

Follow Up Flag: Follow up
Due By: Monday, March 26, 2007 5:00 PM
Flag Status: Flagged

P U B L I C U T I L I T Y D I S T R I C T N O . 1 o f C H E L A N C O U N T Y
P.O. Box 1231, Wenatchee, WA 98807-1231 • 327 N. Wenatchee Ave., Wenatchee, WA 98801
(509) 663-8121 • Toll free 1-888-663-8121 • www.chelanpud.org

To: Chelan River Fishery Forum:
- Washington Department of Ecology
- Washington Department of Fish and Wildlife
- United States Forest Service
- National Park Service
- United States Fish and Wildlife Service
- National Marine Fisheries Service
- CCT (Colville)
- YN (Yakama)
- CTUIR (Umatilla tribe)
- City of Chelan
- Lake Chelan Sportsman Association

United States Geological Survey
Washington State Parks and Recreation Commission
Washington Interagency Committee for Outdoor Recreation
Manson Parks and Recreation Department
Lake Chelan Recreation Association
American Whitewater

From: Michelle Smith, Licensing & Compliance Manager
Public Utility District No. 1 of Chelan County (Chelan PUD)

michelle.smith@chelanpud.org

Re: Lake Chelan Hydroelectric Project No. 637 (Project)
License Article 405 Operations Compliance Monitoring Plan (OCMP)

Dear Chelan River Fishery Forum and Other Parties:

Article 405 of the Federal Energy Regulatory Commission's (Commission) Order on Offer of Settlement and Issuing New License on November 6, 2006, requires Chelan PUD to file for Commission approval the OCMP by May 6, 2007. Pursuant to Article 405, Chelan PUD is required to prepare the plan in consultation with the entities listed above.

This email is to inform you that the first draft OCMP is now available for your review, comment, and recommendation. Comments and recommendations on the "first" draft OCMP must be received by Monday, 5:00 pm, **March 26**.

Comments will be incorporated into a "final" draft document and provided to the entities above on March 28. Chelan PUD will provide a 30-day review and comment period on the "final" draft OCMP.

The OCMP describes how Chelan PUD will comply with the instream flows, ramping rates, and tailrace flows as set forth in Article 7 of the Lake Chelan Settlement Agreement and Chapter 7 of the Comprehensive Plan attached to the Settlement Agreement; and the lake levels as set forth in Article 8 of the Settlement Agreement and Chapter 8 of the Comprehensive Plan. The draft OCMP also contains, in Appendix A, a draft Quality Assurance Project Plan for water quality monitoring and reporting in the Chelan River, which is a requirement of the Washington Department of Ecology's 401 Water Quality Certification issued for the Project.

To view and print the draft OCMP, click the direct link, http://www.chelanpud.org/documents/9102_3(1).pdf. Refer to the Lake Chelan Implementation Website, http://www.chelanpud.org/lake-chelan-implementation.html, under the License Documents heading to view the New License and Lake Chelan Settlement Agreement. Hard copies are available upon request.

Please provide comments by **March 26** to Steven Hays, Fish and Wildlife Senior Advisor, at (509)661-4181 or steveh@chelanpud.org.

Thank you for your assistance and attention to this matter.

==========

From: Bruce Heiner [mailto:heinebah@DFW.WA.GOV]
Sent: Thursday, March 22, 2007 11:07 AM
To: Hays, Steve
Cc: Tony Eldred
Subject: OCMP comments

Steve - I looked through the OCMP for the Chelan River and had a few comments, most of which are relatively minor.

Section 2.1

There is discussion of runoff forecasts to be used to determine flow releases at the dam. Where do those forecasts come from; USGS, Chelan PUD, others?

The description of dry years and wet years is slightly confusing (within 80% or 20% exceedance ranges, respectively). If the term "within" is used, then a range should be identified, such as "within the 80% to 100% exceedance range" or "within the 20% to 1% exceedance range." Another way of describing it could be "flows less than or equal to the 80% exceedance value", or "flows greater than or equal to the 20% exceedance value." The latter approach would be easier to understand for those not used to working with flow exceedance values.

Section 2.2.2

The description of flows measured at the dam confused me (80 cfs measured at the Project dam and 240 cfs measured at the dam or through calibrated pump discharge curves). It is not clear when 240 cfs would be measured at the dam. The obvious flows to be measured at the dam are 80 cfs, 200 cfs (avg runoff years), and 320 cfs (wet years or if the lift pumps were not used).

Section 2.6

Do the ramping rates apply to the tailrace?

Section 3

There seems to be a typo on the date of the first annual Flow Report. Section 3 lists the date as 2/28/07 and Section 4.2 gives the date as 2/28/08. I assume 2/28/08 is the correct date.

Ramping Rates

My last comment is of a more substantive nature. One of the goals or objectives for the Chelan River is to manage it as a functional ecosystem. The proposed ramping rate, particularly for lowering the flow, does not seem to fit that concept. Typical hydrographs for rivers in this area have a very gradual recession limb. I realize it is not reasonable to expect to match the natural hydrograph, but I think it makes sense to try to imitate it more than the proposed 1-day ramp-down period. I would suggest ramping down over a week rather than a day. Although future studies are intended to determine if the 2"/hr rate protects salmonids, an ecosystem includes more aquatic organisms than salmonids. Other fish, as well as the some of the insects they prey on, may be affected by relatively rapid lowering of the flows in the river. I think there are ramping rate options that would satisfy the resource agencies and preserve the power production levels currently in the license agreement. Perhaps we can discuss this issue at the Fisheries Forum meeting next week.

Bruce Heiner, P.E.
WDFW
509-332-0892
heinebah@dfw.wa.gov

==========

From: Hays, Steve
Sent: Friday, March 30, 2007 2:39 PM
To: 'heinebah@dfw.wa.gov'; 'ramartinez@fs.fed.us'; 'violaaev@dfw.wa.gov'; 'parchibald@fs.fed.us'; 'jkastenholz@fs.fed.us'; 'Stan_Zyskowski@nps.gov'; 'Richard.Domingue@noaa.gov'; 'Stephen_Lewis@fws.gov'; 'jerry.marco@colvilletribes.com'; 'brose@yakama.com'; 'pirl461@ecy.wa.gov'; 'brca461@ecy.wa.gov'; 'geedee@cablespeed.com'; 'mayor@cityofchelan.com'; 'carlmerkle@ctuir.com'; Osborn, Jeff; Chamberlain, Vern; Hill, Courtney; Yow, Gene; 'bill.fraser@parks.wa.gov'; 'jim.harris@parks.wa.gov'; 'jime@iac.wa.gov'; 'mansonparks@flymail.net'; 'richard@richarduhlhorn.com'; 'okeefe@amwhitewater.org'; 'rrsmith@usgs.gov'
Cc: Duffy, Janel
Subject: RE: Lake Chelan 637: Chelan PUD Request to Review the Draft Operations Compliance Monitoring Plan (March 15, 2007)

Dear OCMP Reviewers,

As of today, I have received only very minor comments on the first draft Operations Compliance Monitoring Plan, which did not change the substantive content of the plan. Please continue to review the current draft OCMP. We will issue a final draft early next week, but the only differences between the two drafts will consist of a few editorial changes for clarity and some changes to the Key Personnel and Organizational Chart in the QAPP (Appendix A). You will received an email next week with the updated link to the final draft.

Please provide final comments on the OCMP to Steven Hays, Fish and Wildlife Senior Advisor, at (509)661-4181 or steveh@chelanpud.org by Thursday, April 26, 2007.

Thank you for your assistance and attention to this matter.

Steven Hays
Fish and Wildlife Senior Advisor
Chelan County Public Utility District
PO Box 1231
Wenatchee, Washington 98807
(509) 661-4181

-----Original Message-----
From: Sokolowski, Rosana **On Behalf Of** Smith, Michelle
Sent: Thursday, March 15, 2007 5:09 PM
To: 'heinebah@dfw.wa.gov'; 'ramartinez@fs.fed.us'; 'violaaev@dfw.wa.gov'; 'parchibald@fs.fed.us'; 'jkastenholz@fs.fed.us'; 'Stan_Zyskowski@nps.gov'; 'Richard.Domingue@noaa.gov'; 'Stephen_Lewis@fws.gov'; 'jerry.marco@colvilletribes.com'; 'brose@yakama.com'; 'pirl461@ecy.wa.gov'; 'brca461@ecy.wa.gov'; 'geedee@cablespeed.com'; 'mayor@cityofchelan.com'; 'carlmerkle@ctuir.com'; Osborn, Jeff; Hays, Steve; Chamberlain, Vern; Hill, Courtney; Yow, Gene; 'bill.fraser@parks.wa.gov'; 'jim.harris@parks.wa.gov'; 'jime@iac.wa.gov'; 'mansonparks@flymail.net'; 'richard@richarduhlhorn.com'; 'okeefe@amwhitewater.org'; 'rrsmith@usgs.gov'
Cc: Smith, Michelle; Duffy, Janel; Smith, Michelle
Subject: Lake Chelan 637: Chelan PUD Request to Review the Draft Operations Compliance Monitoring Plan (March 15, 2007)

P U B L I C U T I L I T Y D I S T R I C T N O . 1 o f C H E L A N C O U N T Y
P.O. Box 1231, Wenatchee, WA 98807-1231 • 327 N. Wenatchee Ave., Wenatchee, WA 98801
(509) 663-8121 • Toll free 1-888-663-8121 • www.chelanpud.org

To: Chelan River Fishery Forum:
- Washington Department of Ecology
- Washington Department of Fish and Wildlife
- United States Forest Service
- National Park Service
- United States Fish and Wildlife Service
- National Marine Fisheries Service
- CCT (Colville)
- YN (Yakama)
- CTUIR (Umatilla tribe)
- City of Chelan
- Lake Chelan Sportsman Association

United States Geological Survey
Washington State Parks and Recreation Commission
Washington Interagency Committee for Outdoor Recreation
Manson Parks and Recreation Department
Lake Chelan Recreation Association
American Whitewater

From: Michelle Smith, Licensing & Compliance Manager

Public Utility District No. 1 of Chelan County (Chelan PUD)
michelle.smith@chelanpud.org

Re: Lake Chelan Hydroelectric Project No. 637 (Project)
License Article 405 Operations Compliance Monitoring Plan (OCMP)

Dear Chelan River Fishery Forum and Other Parties:

Article 405 of the Federal Energy Regulatory Commission's (Commission) Order on Offer of Settlement and Issuing New License on November 6, 2006, requires Chelan PUD to file for Commission approval the OCMP by May 6, 2007. Pursuant to Article 405, Chelan PUD is required to prepare the plan in consultation with the entities listed above.

This email is to inform you that the first draft OCMP is now available for your review, comment, and recommendation. Comments and recommendations on the "first" draft OCMP must be received by Monday, 5:00 pm, **March 26**.

Comments will be incorporated into a "final" draft document and provided to the entities above on March 28. Chelan PUD will provide a 30-day review and comment period on the "final" draft OCMP.

The OCMP describes how Chelan PUD will comply with the instream flows, ramping rates, and tailrace flows as set forth in Article 7 of the Lake Chelan Settlement Agreement and Chapter 7 of the Comprehensive Plan attached to the Settlement Agreement; and the lake levels as set forth in Article 8 of the Settlement Agreement and Chapter 8 of the Comprehensive Plan. The draft OCMP also contains, in Appendix A, a draft Quality Assurance Project Plan for water quality monitoring and reporting in the Chelan River, which is a requirement of the Washington Department of Ecology's 401 Water Quality Certification issued for the Project.

To view and print the draft OCMP, click the direct link, http://www.chelanpud.org/documents/9102_3(1).pdf. Refer to the Lake Chelan Implementation Website, http://www.chelanpud.org/lake-chelan-implementation.html, under the License Documents heading to view the New License and Lake Chelan Settlement Agreement. Hard copies are available upon request.

Please provide comments by **March 26** to Steven Hays, Fish and Wildlife Senior Advisor, at (509)661-4181 or steveh@chelanpud.org.

Thank you for your assistance and attention to this matter.

From: Dunning, Tracy **On Behalf Of** Hays, Steve
Sent: Tuesday, April 03, 2007 11:12 AM
To: 'violaaev@dfw.wa.gov'; 'heinebah@dfw.wa.gov'; 'ramartinez@fs.fed.us'; 'parchibald@fs.fed.us'; 'jkastenholz@fs.fed.us'; 'Stan_Zyskowski@nps.gov'; 'Richard.Domingue@noaa.gov'; 'Stephen_Lewis@fws.gov'; 'jerry.marco@colvilletribes.com'; 'brose@yakama.com'; 'pirl461@ecy.wa.gov'; 'brca461@ecy.wa.gov'; 'geedee@cablespeed.com'; 'mayor@cityofchelan.com'; 'carlmerkle@ctuir.com'
Cc: Smith, Michelle; Duffy, Janel; Osborn, Jeff; Chamberlain, Vern; Hill, Courtney; Yow, Gene
Subject: Chelan PUD's request for comments on the final draft Operations Compliance Monitoring Plan, pursuant to License Article 405 for the Lake Chelan Project, No. 637

PUBLIC UTILITY DISTRICT NO. 1 of CHELAN COUNTY
P.O. Box 1231, Wenatchee, WA 98807-1231 • 327 N. Wenatchee Ave., Wenatchee, WA 98801

(509) 663-8121 • Toll free 1-888-663-8121 • www.chelanpud.org

To: Chelan River Fishery Forum:
Washington Department of Ecology
Washington Department of Fish and Wildlife
United States Forest Service
National Park Service
United States Fish and Wildlife Service
National Marine Fisheries Service
CCT (Colville)
YN (Yakama)
CTUIR (Umatilla tribe)
City of Chelan
Lake Chelan Sportsman Association

From: Steve Hays, Fish & Wildlife Senior Advisor
Public Utility District No. 1 of Chelan County (Chelan PUD)

Re: Lake Chelan Hydroelectric Project No. 637 (Project)
License Article 405 - Operations Compliance Monitoring Plan

Chelan River Fishery Forum and Other Parties:

In accordance with Article 405, Chelan PUD invites comment letters on the attached final draft Operations Compliance Monitoring Plan (OCMP). To open the document, click on the following link: http://www.chelanpud.org/documents/9102_4(2).pdf

Please submit your comment letters on or before 5:00 p.m., April 26, 2007 to me via email at steveh@chelanpud.org or via fax to (509) 661-8155.

Pursuant to License Article 405, Chelan PUD will file the OCMP with FERC (Commission) by May 4, 2007. All received comment letters will be appended to the 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 Commission 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.

From: Dunning, Tracy **On Behalf Of** Hays, Steve
Sent: Tuesday, April 03, 2007 11:26 AM
To: 'bill.fraser@parks.wa.gov'; 'jim.harris@parks.wa.gov'; 'jime@iac.wa.gov'; 'mansonparks@flymail.net'; 'richard@richarduhlhorn.com'; 'okeefe@amwhitewater.org'; 'rrsmith@usgs.gov'
Cc: Smith, Michelle; Duffy, Janel; Osborn, Jeff; Chamberlain, Vern; Yow, Gene; Hill, Courtney
Subject: Chelan PUD's request for comments on the final draft Operations Compliance Monitoring Plan, pursuant to License Article 405 for the Lake Chelan Project, No. 637
P U B L I C U T I L I T Y D I S T R I C T N O . 1 o f C H E L A N C O U N T Y
P.O. Box 1231, Wenatchee, WA 98807-1231 • 327 N. Wenatchee Ave., Wenatchee, WA 98801
(509) 663-8121 • Toll free 1-888-663-8121 • www.chelanpud.org
To: United States Geological Survey
Washington State Parks and Recreation Commission
Washington Interagency Committee for Outdoor Recreation
Manson Parks and Recreation Department
Lake Chelan Recreation Association
American Whitewater
From: Steve Hays, Fish & Wildlife Senior Advisor
Public Utility District No. 1 of Chelan County (Chelan PUD)

Re: Lake Chelan Hydroelectric Project No. 637 (Project)
License Article 405 - Operations Compliance Monitoring Plan
Dear Agency Parties:
In accordance with Article 405, Chelan PUD invites comment letters on the attached final draft Operations Compliance Monitoring Plan (OCMP). To open the document, click on the following link: http://www.chelanpud.org/documents/9102_4(2).pdf
Please submit your comment letters on or before 5:00 p.m., April 26, 2007 to me via email at steveh@chelanpud.org or via fax to (509) 661-8155.
Pursuant to License Article 405, Chelan PUD will file the OCMP with FERC (Commission) by May 4, 2007. All received comment letters will be appended to the 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 Commission 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.
==========

From: Hays, Steve [mailto:steveh@chelanpud.org]
Sent: Friday, April 20, 2007 3:40 PM
To: violaaev@dfw.wa.gov; heinebah@dfw.wa.gov; ramartinez@fs.fed.us; parchibald@fs.fed.us; jkastenholz@fs.fed.us; Stan_Zyskowski@nps.gov; Richard.Domingue@noaa.gov; Stephen_Lewis@fws.gov; jerry.marco@colvilletribes.com; brose@yakama.com; Irle, Pat (ECY); Caldwell, Brad (ECY); geedee@cablespeed.com; mayor@cityofchelan.com; carlmerkle@ctuir.com
Cc: Smith, Michelle; Duffy, Janel; Osborn, Jeff; Chamberlain, Vern; Hill, Courtney; Yow, Gene
Subject: Reminder: Comments due April 26 on Threatened & Endangered Species Protection Plan

PUBLIC UTILITY DISTRICT NO. 1 of CHELAN COUNTY

P.O. Box 1231, Wenatchee, WA 98807-1231 • 327 N. Wenatchee Ave., Wenatchee, WA 98801

(509) 663-8121 • Toll free 1-888-663-8121 • www.chelanpud.org

To: Chelan River Fishery Forum:
Washington Department of Ecology
Washington Department of Fish and Wildlife
United States Forest Service
National Park Service
United States Fish and Wildlife Service
National Marine Fisheries Service
CCT (Colville)
YN (Yakama)
CTUIR (Umatilla tribe)
City of Chelan
Lake Chelan Sportsman Association

From: Steven Hays, Fish and Wildlife Senior Advisor
Public Utility District No. 1 of Chelan County (Chelan PUD)
steveh@chelanpud.org

Re: Lake Chelan Hydroelectric Project No. 637 (Project)

License Article 408 - Threatened & Endangered Species Protection Plan (TESPP)

Reminder: Comments Due before 5:00 p.m., April 26, 2007

Chelan River Fishery Forum:

This email is to remind you that comments are due on the draft Threatened & Endangered Species Protection Plan on next Thursday, April 26.

To open the document, click on the following link: http://www.chelanpud.org/documents/9140_2.pdf

Please submit your comment letters on or before 5:00 p.m., April 26, 2007 to me via email at steveh@chelanpud.org or via fax to (509) 661-8155.

Pursuant to License Article 405, Chelan PUD will file the OCMP with FERC (Commission) by May 4, 2007. All received comment letters will be appended to the 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 Commission 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.

==========

CONSULTATION TELEPHONE LOG – OCMP AND TESPP

DATE	TIME	FROM	TO WHO	SUBJECT	OUTCOME
4/18/07	1600	Steve Hays	Rich Domingue, NMFS	Reminder to Call Dale Bambrick on Article 14, Review Comments on OCMP and TESPP due 4/26	Rich had forgotten to contact Dale, knew Dale would like to be the NMFS rep on Article 14, said he would do it now. Said he would review OCMP and TESPP
4/20/07	1551	Steve Hays	Steve Lewis, USFWS	Reminder that Review Comments on OCMP and TESPP due 4/26. Discussed Reach 4 spill – bedload movement tests scheduled for next	Steve said that he had partially reviewed the documents. Would finish next week by deadline.

				week	
4/20/07	1615	Steve Hays	Phil Archibald, USFS	Reminder that Review Comments on OCMP and TESPP due 4/26. Discussed Reach 4 spill – bedload movement tests scheduled for next week	Phil had reviewed the documents, will send an email stating such and that he has no comments. I will send him a copy of the spill test schedule.
4/20/07	1640	Steve Hays	Art Viola, WDFW	Reminder that Review Comments on OCMP and TESPP due 4/26.	Voicemail said Art would be out of office until April 24. Left message reminding of comment deadline.
4/20/07	1640	Steve Hays	Bruce Heiner, WDFW	Reminder that Review Comments on OCMP and TESPP due 4/26.	Left voice message reminding of comment deadline.
4/20/07	Voice mess.	Dale Bambrick, NMFS	Steve Hays	Confirming that he will represent NMFS on Article 14	He left contact information
4/23/07	1203	Steve Hays	Joe Kastenholtz, USFS	Reminder that Review Comments on OCMP and TESPP due 4/26.	Left voice message reminding of comment deadline. Received email response later that will not have any comments.
4/23/07	1515	Steve Hays	Stan Zyskowski, NPS	Reminder that Review Comments on OCMP and TESPP due 4/26.	He hadn't reviewed the plans yet, but would do so. He said probably will not have any comments
4/23/07	1542	Steve Hays	Ray Smith, USGS	Reminder that Review Comments on OCMP due 4/26.	He has reviewed the plans and does not have any comments
4/23/07	1545	Steve Hays	Lanny Armbruster, Manson Parks	Reminder that Review Comments on OCMP due 4/26.	Left voice message that comments due 4/26, please respond even if no comments
4/23/07	1552	Steve Hays	Jim Harris and Bill	Reminder that Review Comments	Left message with receptionist that

			Fraser, Wash. State Parks	on OCMP due 4/26.	comments due 4/26, please respond even if no comments
4/23/07	1600	Steve Hays	Thomas O'Keefe, American Whitewater	Reminder that Review Comments on OCMP due 4/26.	He has been gone for three weeks, but will review tomorrow.
4/23/07	1610	Steve Hays	Richard Uhlhorn, Lake Chelan Recreation Association	Reminder that Review Comments on OCMP due 4/26.	Left voice message that comments due 4/26, please respond even if no comments
4/23/07	1623	Steve Hays	Jay Witherbee, City of Chelan	Reminder that Review Comments on OCMP and TESPP due 4/26.	Left message with receptionist that comments due 4/26, please respond even if no comments
4/23/07	1630	Steve Hays	Jerry Marco, Colville Confederated Tribes	Reminder that Review Comments on OCMP and TESPP due 4/26.	Left voice messages (office and cell phones) reminding of comment deadline and asking for response if no comments.
4/23/07	1635	Steve Hays	Carl Merkle, Confederated Tribes of the Umatilla Indian Reservation	Reminder that Review Comments on OCMP and TESPP due 4/26.	Left voice message reminding of comment deadline and asking for response if no comments.
4/23/07	1203	Steve Hays	Bob Rose, Yakama Indian Reservation	Reminder that Review Comments on OCMP and TESPP due 4/26.	Left voice message reminding of comment deadline and asking for response if no comments.
4/23/07	1650	Steve Hays	Jim Eychaner, Washington Interagency Committee for Outdoor Recreation	Reminder that Review Comments on OCMP due 4/26.	He had reviewed and had no comments. Will send email to that effect.
4/23/07	1655	Steve Hays	Gary Denniston, Lake Chelan	Reminder that Review Comments on OCMP due	He had reviewed and had no comments. Will send email to

			Sportsman Association	4/26.	that effect.
4/24/07	0938	Steve Hays	Art Viola, WDFW	Reminder that Review Comments on OCMP and TESPP due 4/26.	Left voice message reminding of comment deadline and asking for email response if no comments.
4/24/07	0938	Steve Hays	Dale Bambrick, NMFS	Called to discuss Article 14 work	Left voice message stating the nature of the project, what we need to do and dates I will be in the office.
4/24/07	1010	Steve Hays	Bruce Heiner, WDFW	Asked if any additional comments on OCMP or TESPP	Bruce indicated that he had no additional comments

==========
From: Irle, Pat (ECY) [mailto:PIRL461@ECY.WA.GOV]
Sent: Tuesday, April 03, 2007 12:10 PM
To: Hays, Steve
Cc: Merz, Jonathan (ECY)
Subject: RE: Chelan PUD's request for comments on the final draft Operations Compliance Monitoring Plan, pursuant to License Article 405 for the Lake Chelan Project, No. 637

Hi, Steve -

Couple quick comments in the QAPP:

In Table 3-1 and Figure in Section 3-2:
Jon Merz is spelled with a “z” not an “s”.

In Table 3-1, Denise, like Jon, will be responsible for oversight.

On page iv, Brian Faller (our attorney) probably doesn’t need to be on the distribution list for the QAPP!

We may be sending something more technical later….

Thanks!

Pat ==========
From: Stephen_Lewis@fws.gov [mailto:Stephen_Lewis@fws.gov]
Sent: Monday, April 23, 2007 3:34 PM
To: Hays, Steve
Subject: Re: Reminder: Comments due April 26 on Operations Compliance Monitoring Plan

Hi Steve-

This respective plan looks good. I have no further comments to add to this document.

S-
****
Stephen T. Lewis
Mid-Columbia Relicensing Coordinator
U.S. Fish and Wildlife Service
Central Washington Field Office
215 Melody Lane, Suite 119
Wenatchee, WA 98801
phone: (509) 665-3508 Ext. 14
fax: (509) 665-3523
e-mail: Stephen_Lewis@fws.gov
==========
From: Manson Parks [mailto:mansonparks@flymail.net]
Sent: Monday, April 23, 2007 4:24 PM
To: Hays, Steve
Subject: Re: Reminder: Comments due April 26 on Operations Compliance Monitoring Plan

Steve
In reply to your message, I would love to see the dam gone, lots if beach that no one could buy, must stay public. I don't thind anyone would go for that so I really have no better ideas. thanks for the chance. Lanny Armbruster

==========
From: Raymond R Smith [mailto:rrsmith@usgs.gov]
Sent: Monday, April 23, 2007 4:28 PM
To: Hays, Steve
Subject: Lake Chelan Hydroelectric Project

To Whom It May Concern:

The USGS has operated two gaging stations to monitor lake level and discharge from Lake Chelan in an effort to aid Public Utility District No. 1 of Chelan County's operation of the Lake Chelan Hydroelectric Project in compliance with orders stipulated in FERC Project No. 637, Article 13, and to serve as a public record of the effects of the Project operation on the lake level and outflow. The gaging stations are 12452000 Lake Chelan at Celan, WA and 12452500 Chelan River at Chelan, WA, both of which have provided continuous record since 1911.

It is the USGS opinion that the gaging is adequate at this time and for the foreseeable future to ensure compliance with the FERC Article of operation.

Sincerely,

Ray Smith
==========
From: Eychaner, Jim [mailto:JimE@IAC.WA.GOV]
Sent: Monday, April 23, 2007 4:56 PM
To: Hays, Steve
Subject: Lake Chelan operations document

Steve - I will have no comments on the document
==========
From: Philip R Archibald [mailto:parchibald@fs.fed.us]
Sent: Tuesday, April 24, 2007 3:13 PM
To: Hays, Steve
Cc: Robert A Martinez
Subject: Re: Reminder: Comments due April 26 on Operations Compliance Monitoring Plan

Steve: I have reviewed the OCMP/QAPP and it appears to be more than satisfactory.

Philip Archibald
Fishery Biologist
Entiat/Chelan Ranger Districts
Wenatchee National Forest
parchibald@fs.fed.us
509-784-1511
==========
From: Tony Eldred [mailto:eldredte@DFW.WA.GOV]
Sent: Tuesday, April 24, 2007 5:28 PM
To: Hays, Steve
Subject: Stateof Washington

STEVE-O: My (and some Art's) comments for OCMP, QAPP, and ETSPP. Please see attachment. Questions? call me. 662-0452/679-0655. Will be in & out tomorrow. Lv. mess., will get back to you. If these are late for you, I'm sorry. Time crunch my end. TE

State of Washington
DEPARTMENT OF FISH AND WILDLIFE
Habitat Program
Major Projects Division
3860 Chelan Highway, Wenatchee, WA 98801-9607
(509) 662-0452

April 24, 2007

Lake Chelan Hydroelectric Project, FERC No. 637:
Review Comments for Draft Operations Compliance and Monitoring Plan, Appendix A Quality Assurance Project Plan, and Threatened and Endangered Species Protection Plan

Mr. Steve Hays
Chelan PUD Fish and Wildlife
Senior Advisor
Chelan County Public Utility District No. 1
Wenatchee, WA 98807

I have reviewed your above drafts. The following comments are mine only. My comments for each draft are presented in the order shown above.

First, for the OCMP, beginning on page 2 and following thereafter, it would be easier for the reader if the printing on the reverse side of each page is rotated 180 degrees, as is the case in the Draft Threatened and Endangered Species Protection Plan.

Your drafts of technical subjects are generally readily comprehended. But some questions were begged. I will refer to the bold printed section nos. and titles where I have questions.

2.1 Instream Flow Requirements for the Chelan River

In the first sentence you state "The Settlement Agreement requires that a minimum flow of 80 cfs be released throughout the year to the Chelan River at the Project Dam, with additional flows provided for a two month period …." Upon revisiting Article 7 of the Settlement Agreement, the reader is referred to Chapter 7 of the Comprehensive Plan. I realize the Comp. Plan is Attachment B to the Settlement Agreement, is intended to be the "detail" part of the Settlement Agreement, and technically is a part of the Settlement Agreement. At different places in the Draft OCMP you refer the reader to the "Settlement Agreement" as sort of short-hand. But it would be most helpful to the unfamiliar reader if instead you refer to the appropriate place in Chapter Y, section x.x.x of the Comprehensive Plan. This really is where the details are presented.

Steve Hays/Draft OCMP, QAPP & TESPP
Page 2

2.2.1 ***Instream Flow Requirements for the Chelan River***. In the first paragraph you state "… In average water years, … (within the 21%-79% exceedance range or **60% of the years based on historical records), ….**" It aids the reader to better understand
event frequency by including the percentage of years occurrence. I suggest you also do this for dry years and wet years.

2.3.1 Tailrace pump station. On page 5, first complete paragraph at the top of the page, it is stated that a cost-benefit analysis will be performed of pumping water from the tailrace vs. releasing water from the LLO or spilling. The begs the question, what is the fallback for maintaining flow in the Reach 4 Habitat Channel if the pumps fail? Releases from the LLO (or spilling, if possible)? Is this the only fallback option? How long will be required for LLO flow release to reach the upper end of the Habitat Channel?

2.3.2 Gauge Calibration Methods and Frequencies of Calibration. Your discussion of measuring flow involves two very important quantification components, Accuracy and Precision. Many uninitiated readers may not grasp the distinctly different technical meanings of these two terms. Some may assume they are synonymous. For example, in
the first paragraph, third sentence, you stated "The objective will be to calibrate the meter to be *accurate* to approximately 1 percent of discharge". The fifth sentence states "The *precision* of the ultrasonic flow meters is expected to be within two to five percent of the maximum discharge of each conveyance pipe or channel". It would be most helpful to many readers if, early-on in your discussion, you clearly explain the distinct difference in meaning of these two terms. A discussion of these two terms with fellow workers resulted in finding a good explanation in the on-line resource

Wikipedia. Without a prefacing explanation, the result is confusion if the reader is not aware of the distinction between *accuracy* and *precision.*

In reference to the "fifth sentence" cited above, the precision of the ultrasonic flow meters is expected to be within **two to five percent** of the maximum discharge of each conveyance pipe or channel. (Emphasis added). It is not clear whether this expected 2-5 percent precision error is constant or proportional at lesser discharges? Please elaborate as to what to expect in seasonal (varying) "real flow" situations.

These conclude my comments on the Draft OCMP. I turn now to comments regarding the Draft Appendix A Quality Assurance Project Plan.

SECTION 2: PROJECT DESCRIPTION

The first bullet under the "monitoring requirements" (upper half of Page 5) specifies hourly monitoring of water temperature in the dam forebay and at the end of Reaches 1, 3 and 4 of the Chelan River. Why was Reach 2 omitted? Did your water temperature

---

study indicate little difference in water temperature between the ends of Reaches 1 and 2, or 2 and 3, and therefore Reach 3 water temperature would be superfluous? Or what?

The fourth bullet under the "monitoring requirements" lists weekly visual monitoring of the *tailrace* …. At a number of places in the QAPP "tailrace" is referred to. Technically, I would say there are two tailraces: immediately downstream from the dam and downstream from the powerhouse. Here it seems self-evident the powerhouse tailrace is being referred to. But at other places it was necessary to deduce which was
intended. It will make it easier for the reader if, when you use "tailrace", you identify which one.

Page 5, first bullet, lower half of page. Flow and temperature data will be reported on the CPUD website on a monthly basis (no later than the 30th day of the month following the reporting period). This timeline may or may not be directed by a specification in the 401 Water Quality Certification. Unfortunately, this seems to indicate that monthly data will be going on two months old when it becomes available. Is it possible that such data could be available significantly earlier?

Page 9, Table 3-2: Monitoring Schedule. Under monitoring for Dissolved Oxygen (DO), the table shows two samples/month in Years 3 & 5 during the most biologically productive months of the year (July-September). What of really adverse winter conditions (ice buildup) as they occur?

Table 3-2, scheduled powerhouse shutdowns. "Tailrace gravel DO will be monitored hourly, during low water years. It is estimated this monitoring will occur up to three times from year one to five after initiation of minimum flow". Three monitorings over a period of five years under minimum

flow conditions (80 cfs) during the years' warmest months seems remarkably minimal. If achieving Biological Objectives is the criterion of success for the Chelan River (and survival looms large in achieving success), it seems logical that significantly greater effort would be devoted to monitoring such a critical environmental component.

Table 3-2, during egg incubation. "Tailrace and Reach 4 intragravel DO will be monitored hourly, one day per week, during incubation. This is expected to occur years one through five during minimum flow (80 cfs) in November through February". How will the one day per week be selected: randomly, systematically, or ….?

Page 10, first complete paragraph. We prefer that daily water temperature data be reported as daily minimum, daily maximum, and daily average.

Steve Hays/OCMP, QAPP & TESPP
Page 4

Page 10, third complete paragraph. Please elaborate how unnatural temperature shifts might occur.

Page 11, Figure 3-2, Anticipated Chelan River Water Quality Monitoring and Reporting Schedule. Box no. 50 lists third year start and finish dates as 07/06/09 through 09/21/09,
but no subsequent individual sampling dates within months. Box no. 58 lists fifth year start and finish dates. Boxes nos. 59 through 64 show six individual dates over July, August, and September. Individual dates within each of July, August, and September in Year 3 is desirable. Finally, boxes showing individual sampling dates in Year 5 are labeled Year 3 in the Task Name column, but by the year (2011) shown in the "Start" and "Finish" columns should be labeled Year 5.

Page 18, Figure 5-1, Proposed Temperature Sampling Location, Forebay of the Lake Chelan Dam. I suggest different labeling for the sampling locations shown. For the two forebay sites shown (both FB-A), I suggest FB-L and FB-R (for Forebay-Leftbank and Forebay-Rightbank). For the dam tailrace, I suggest the non-specific FB-B and FB-B be changed to TR-L (Tailrace Left) and TR-R (Tailrace Right).

Page 20, Figure 5-6. Proposed Turbidity, DO, pH Sampling Locations, Reach 4. I recommend establishing additional intragravel monitoring stations close by R4-C and R4-A. The Habitat Channel will be approximately one-half mile in length. It would be prudent to monitor at the upper end, middle, and lower end what is occurring, especially DO levels, over this critical half mile.

This completes my comments on the Draft QAPP. In conclusion I offer a brief comment about the TESPP.

Steve Hays/OCMP, QAPP & TESPP
Page 5

Beginning about page 8 and into page 10, several times "fall" chinook are mentioned. We believe this is misidentification. Art, Andrew Murdoch, and

myself are convinced the great majority of mid-summer-fall chinook in the upper mid-Columbia are correctly termed summer chinook. My personal experience indicates that the raising of Wells Reservoir saw the inundation of the last remaining significant mainstem fall chinook spawning upstream of Wanapum Dam. Figures showing adult chinook 10 year average run size (1997-2006) indicates that, based on passage timing at Rocky Reach, falls in the upper mid-Columbia are an artifact (Col. Bas. Research , School of Aquatic & Fishery Sciences, Univ. of WA). In fact, examination of the RR 10 year average suggests springs may outnumber the falls. This concludes my comments on the three draft plans.

Thank you for the opportunity to review these drafts. We hope our comments are constructive and helpful for completion of these plans.

Your truly,

Tony Eldred

cc Art Viola, WDFW-Wenatchee
Joe Miller, WDFW-Ephrata
Curt Leigh, WDFW-Olympia
Gary Sprague, WDFW-Olympia
Bruce Heiner, WDFW-Pullman
Carmen Andonaegui, WDFW-Ephrata
Pat Irle, Ecology-Yakima
Brad Caldwell, Ecology-Olympia
Steve Lewis, USFWS-Olympia
Phil Archibald, USDA-FS, Entiat
Rich Domingue, NOAA-Fish,

==========

From: Irle, Pat (ECY) [mailto:PIRL461@ECY.WA.GOV]
Sent: Wednesday, April 25, 2007 11:18 AM
To: Hays, Steve
Cc: Merz, Jonathan (ECY)
Subject: Lake Chelan Project No. 637-022 QAPP

Hi, Steve -
As usual, you do a great job on these things.
Beyond the changes to staff that we already discussed, I wanted to make sure that we capture in a prominent place the fact that the QAPP will need to include, at some time in the not-too-distant future, a description of the temperature modeling and the data to be collected to support that modeling, in accordance with Ecology's QAPP guidelines. There is a small reference made to the modeling on page 3 of the"draft final" (April 3, 2007) version of the QAPP. ("It is anticipated that temperature modeling will be a substantial component of the assessment plan after the data collected under this effort has been completed.") However, FERC License Article 401(a) specifically includes in their table, the condition of "Appendix D, Condition V.B.: Quality Assurance Project Plan for water quality monitoring and temperature modeling." (My italics.) It appears the condition allows for future changes.
Some suggestions (I think it might be the simplest, but I am sure there are other ways) :
1) Put the statement on page 3 in bold, and include a discussion about the probable contents and timeframe. Also, perhaps a statement whether the QAPP for modeling will be a separate, supplemental, stand-along document or included as an appendix. 2) If to be included as an appendix (ces), you

might need to include placeholders in the QAPP for the data collection for the temperature modeling and for the modeling itself - in the table of contents, in the appendices, with some discussion in Section 4 regarding Data Quality Objectives.
I know something like this is fully your intention, but I would hate to have it get lost in the shuffle or if there is some change in personnel at some time.
Thanks a lot,
Pat Irle
Hydropower Projects Manager
Department of Ecology
Central Regional Office
(509) 454-7864
==========
From: Stan_Zyskowski@nps.gov [mailto:Stan_Zyskowski@nps.gov]
Sent: Wednesday, April 25, 2007 4:20 PM
To: Hays, Steve
Subject: Re: Review of Chelan Hydro Operations Compliance Monitoring Plan and Threatened and Endangered Species Protection Plan

Steve, the NPS has no comments on the "Chelan Hydro Operations Compliance Monitoring Plan and Threatened and Endangered Species Protection Plan". Stan

Stanley Zyskowski
Biological Technician / Fisheries
North Cascades National Park Service Complex
810 State Route 20
Sedro Woolley, WA 98284
360-854-7316
fax 360-856-1934
==========
From: Richard Uhlhorn [mailto:richarduhlhorn@hotmail.com]
Sent: Thursday, April 26, 2007 2:23 PM
To: Hays, Steve
Subject: RE: Reminder: Comments due April 26 on Operations Compliance Monitoring Plan

Dear Steve Hays:

I hope this is in time to be included in your report to FERC. I have quickly reviewed the License Article 405 Operations Compliance Monitoring Plan (OCMP) and am in concurrence with the monitoring plan as written.

I want to take a minute to thank the PUD staff and stakeholders who spent hours, days, weeks, months and years coming to consensus on these important issues. The fact that the Lake Chelan Community will end up with an actual free flowing river year-round instead of a dry and rarely used bypass reach is a tribute to all the hard work that was accomplished. Economical and as an ecosystem, this river will, over the next 50 years be a place to see, use and enjoy.

Thanks again for the opportunity to be a stakeholder in this process.

Sincerely yours,

Richard Uhlhorn
Lake Chelan Recreation Association.
==========
From: Jerry Marco [mailto:jerry.marco@colvilletribes.com]
Sent: Thursday, April 26, 2007 3:54 PM
To: Hays, Steve
Subject: RE: Reminder: Comments due April 26 on Operations Compliance Monitoring Plan

Steve,

I have reviewed this plan as well as the T&E Species Protection Plan and do not have any comments.

Jerry
==========