QUALITY ASSURANCE PROJECT PLAN
Rocky Reach Water Quality Monitoring and Reporting

UPDATE FOR SHALLOW WATER/MACROPHYTE BED SAMPLING
Final

ROCKY REACH HYDROELECTRIC PROJECT
FERC Project No. 2145

July 10, 2012

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

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ACRONYMS AND ABBREVIATIONS LIST

cfs	cubic feet per second
Chelan PUD	Public Utility District Number 1 of Chelan County
CRO	Central Region Office of Ecology
CWA	Clean Water Act
DO	dissolved oxygen
DQO	data quality objectives
Ecology	Washington State Department of Ecology
FERC	Federal Energy Regulatory Commission
kcfs	thousands of cubic feet per second
mg/L	milligrams per liter
mmHg	millimeters of mercury
MQO	measurement quality objective
N/A	not applicable
NIST	National Institute of Standards and Technology
PI	PI System® from OSIsoft®
Project	Rocky Reach Hydroelectric Project
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RPD	relative percent difference
SM	standard method
SOP	standard operating procedure
TDG	total dissolved gas
TMDL	Total Maximum Daily Load
WAC	Washington Administrative Code
WAS	Watershed Assessment Section
WQA	Water Quality Assessment
WQMP	Water Quality Management Plan

SECTION 1: BACKGROUND

The Federal Energy Regulatory Commission (FERC) issued a new license for the Rocky Reach Hydroelectric Project (FERC Project No.2145) on February 19, 2009. The new license incorporated the terms of the Rocky Reach Settlement Agreement, which included a comprehensive Water Quality Management Plan (WQMP), and the terms of the Water Quality Certification issued by the Washington Department of Ecology (Ecology) as required by Section 401 of the Clean Water Act (Order 3155). One of the components of the WQMP was a one-time study to confirm that water quality standards for pH, dissolved oxygen (DO) and water temperature are being attained in shallow water areas of the Rocky Reach reservoir, including areas that contain dense growths of aquatic macrophytes. The Water Quality Certification incorporates this study requirement (Section 5.6.1) and requires that a Quality Assurance Project Plan (QAPP) be submitted for Ecology approval. A QAPP was submitted to Ecology and the final QAPP was filed with FERC on February 19, 2010. The QAPP provided the basic framework for all the water quality monitoring and reporting required in the Rocky Reach Water Quality Certification. The QAPP[1] (Chelan PUD, 2010) is incorporated herein by reference. This present document is an update to the 2/19/2010 QAPP and is intended to provide the specific details regarding sampling design, equipment updates, and other information specific to the assessment of water quality in shallow water areas of the Rocky Reach reservoir, including areas with macrophyte beds.

Several water quality studies were conducted prior to completion of the Settlement Agreement and issuance of the Water Quality Certification. These studies included a general assessment of water quality in the Rocky Reach reservoir[2] (Parametrix and Rensel Associates, 2001), aquatic habitat mapping, including aquatic macrophyte beds[3] (Duke Engineering Services, 2001), and a number of studies specific to water temperature[4] (WEST Consultants, 2006) and total dissolved gas[5] (Schneider and Wilhelms, 2005). Monitoring and reporting of water temperatures and total dissolved gas levels in the Rocky Reach Project's forebay and tailrace is ongoing and available at the Chelan PUD web site[6] (total dissolved gas abatement reports) and Columbia River DART web site[7] (data in river environment section). In addition to the water quality studies, there were a number of studies related to resident fish and other aquatic organisms, also available at the Chelan PUD Rocky Reach Relicensing web site.

The general assessment of water quality in the Rocky Reach Reservoir found that pH ranged from 7-7-8.1 (criteria 6.5-8.5) in the reservoir, with littoral areas having slightly higher pH than pelagic areas. Dissolved oxygen concentrations ranged from 8.26-13.56 mg/l (criteria >8.0), with the littoral areas having slightly higher dissolved oxygen concentrations than pelagic areas. Water temperatures during summer do exceed state criteria (7-DADMax 17.5°C) in both pelagic and littoral areas, which is due to water entering the reservoir at temperatures above criteria. However, temperature modeling studies

[1] http://www.chelanpud.org/departments/licensingCompliance/rr_implementation/ResourceDocuments/33937.pdf
[2] http://www.chelanpud.org/rr_relicense/study/reports/2697_2.pdf
[3] http://www.chelanpud.org/rr_relicense/study/reports/2904_2.pdf
[4] http://www.chelanpud.org/rr_relicense/study/reports/8302_1.pdf
[5] http://www.chelanpud.org/rr_relicense/study/reports/7773_1.pdf
[6] http://www.chelanpud.org/rr-Resource-Documents-WaterQuality.cfm
[7] http://www.cbr.washington.edu/dart/dart.html

determined that the localized effects of the Rocky Reach Project do not increase water temperatures more than allowable human action (0.3°C) (WEST Consultants, 2006).

The shallow water habitat water quality assessment is scheduled for August and September of 2012, which is concurrent with the schedule for resident fish habitat use studies that are also a component of the Rocky Reach Settlement Agreement and FERC License (Resident Fish Management Plan). The sampling is scheduled for August and September because this time of year is when water temperatures typically are highest and the aquatic plant beds are at seasonal maturity, when the effects of photosynthesis and decomposition of plant material are most likely to affect pH and dissolved oxygen levels. The resident fish habitat use studies will provide complementary data regarding the aquatic life uses that are present in the shallow water habitats at the time of year when temperature, pH and dissolved oxygen are near or outside the limits of numeric criteria for these parameters.

Figure 1-1: Project Location

1.1 REGULATORY FRAMEWORK

1.1.1 Water Temperature

WAC 173-201A-602 designates the section of the Columbia River within the Project as a "salmonid spawning, rearing, and migration" water body (formerly Class A) and therefore water temperature must remain below 17.5°C, as measured by the 7-day average of the daily maximum temperatures (7-DADMax). When a water body's temperature is warmer than the criteria (or within 0.3°C of the criteria) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the 7-DADMax temperature of that water body to increase more than 0.3°C.

1.1.2 Dissolved Oxygen and pH

The water quality criteria for DO within the Project require that DO be greater than 8.0 milligrams per liter (mg/L). When DO is lower than the criteria (or within 0.2 mg/L of the criteria) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the DO of that water body to decrease more than 0.2 mg/L (WAC 173-201A-200(1)(f)).

WAC 173-201A-200(1)(g) provides that pH shall be within the range of 6.5 to 8.5 units with a human-caused variation within the above range of less than 0.5 units.

1.1.3

The purpose of this study is to determine if the shallow areas and extensive macrophytes beds in the Rocky Reach reservoir meet water quality criteria, as has been shown in the previous general assessment of water quality in the reservoir (Parametrix and Rensel Associates, 2001). The determination of whether criteria are met or not includes the allowable deviation from criteria that is provided for in the water quality standards, which determines the smallest reference level for decision making under the WQMP. The water quality parameters, the criteria for meeting water quality standards, and the smallest reference level for decision making are summarized in Table 3-1.

Table 3-1: Water Quality Parameter Criteria and Decision Reference Levels

Parameter	Criterion – Salmonid Spawning, Rearing, Migration	Smallest Reference Level for Decision Making
Temperature	≤ 17.5°C DADMax	0.3°C
DO	≥ 8.0 mg/L	0.2 mg/l
pH	6.5-8.5 units	0.5 pH units

SECTION 2: PROJECT DESCRIPTION

The goals of this field assessment are to determine if shallow water habitats in the Rocky Reach reservoir, including macrophyte beds, meet water quality standards for temperature, pH and dissolved oxygen. Previous studies have demonstrated that the months of August and September are the times of year when water quality is most likely to fail to meet criteria; therefore, the sampling will be confined to these months. Previous studies have also shown that shallow water habitat with macrophytes is mostly confined to the lower and middle portions of the Rocky Reach reservoir (from Beebe Bridge – Rocky Reach Dam), therefore the sampling will be conducted in these areas.

Water quality data will be collected using Hydrolab® Minsonde equipped with temperature, pH and dissolved oxygen sensors. The sampling will include single samples at roving locations in macrophytes beds, collected by boat from dawn until mid-day and 24-hour sampling from sites within large, dense macrophytes beds with Minisondes tethered from anchor-buoy lines. The objective is to capture information on dissolved oxygen during the early morning time period expected to coincide with the daily minimum concentrations and to collect pH and temperature data around noon when overhead solar effects are expected to produce daily maximum temperatures and pH (due to photosynthesis in macrophyte beds reducing carbon dioxide, resulting in increased pH).

Surveys will be conducted during two weeks in August and two weeks in September, Monday – Friday. The deployment of 24-hour stations will be completed by Monday afternoons and the sondes will be retrieved on Fridays. Single sample data will be collected primarily on Tuesday – Thursday, although some sample data will be collected on Mondays and Fridays.

There is a serious threat of vandalism and equipment theft affecting the 24-hour sampling sites because the Rocky Reach reservoir is heavily used for recreational boating, water skiing/tubing, and by fishermen. If equipment is damaged or stolen early in the study, the 24-hour sampling will be discontinued. This study will use heavy anchors and tethering equipment and signage to discourage casual disturbance. However, there is no practical means to fully protect buoy tethered sampling equipment in shallow water areas from determined vandals and thieves.

The sampling schedule of two weeks in each month is expected to provide sufficient representative data to determine if the water quality meets standards for designated aquatic life uses in shallow water areas and dense macrophyte beds in the Rocky Reach reservoir. The previous water quality assessment consisted of single monthly samples from four locations in the Rocky Reach reservoir. This present study is expected to yield 50 or more single samples per week from a number of different shallow water areas and macrophyte beds with different plant species compositions. The four 24-hour sites are expected, if successful in avoiding vandalism, to provide four days of data per week. Inclement weather, equipment failure or vandalism, and other issues could reduce the number of samples taken in a week; however, this data-rich sampling schedule would still provide a robust assessment even if the number of samples were reduced by fifty percent.

SECTION 3: ORGANIZATION AND SCHEDULE

This section includes key personnel assigned to the project and time schedules for field operations and project deliverables.

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:. Project oversight and approval of the QAPP will be provided by Ecology. The Rocky Reach Fish Forum (RRFF) members are expected to provide peer review on the study design and reports.

Table 3-1: Key Personnel

Personnel	Responsibility
Waikele Frantz	*Chelan PUD Environmental Permit Coordinator / Project Manager.* Lead responsible for project management, jointly responsible for report generation, data interpretation, field sampling methodology development, and 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.
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.
Debby Bitterman	*Chelan PUD Administrative Assistant.* Responsible for administrative support of QAPP.
Charlie McKinney	*Ecology WQ Section Manager, Central Regional Office (CRO).* Oversees Ecology participation regarding 401 certification and Settlement Agreement.
Patricia Irle	*Ecology Hydropower Projects Manager, CRO.* Lead responsible for tracking compliance with terms of 401 Certification and Settlement Agreement. Includes review of reports and the QAPP and assistance in meeting other requirements as defined in the 401 certification and Settlement Agreement.

3.2 SCHEDULE

The schedules below will be managed to meet the sampling and reporting requirements of the WQMP and 401 Certification, unless a Force Majeure event arises, as provided in the Rocky Reach Settlement Agreement. The weekly sampling schedule may be shifted forward or backward as necessary to adapt to weather, equipment issues or other unforeseen circumstances.

3.2.1 QAPP Development and Monitoring Schedule

1/3/2012	First Draft QAPP to Pat Irle for review
2/10/2012	Pat Irle Initial Comments/Edits to Steve Hays
4/18/2012	Second Draft QAPP/Study Design to Ecology and RRFF for review
5/1/2012	Ecology and RRFF comments/edits to Steve Hays
6/1/2012	Final QAPP/Study Design to Ecology and RRFF
7/1/2012	Ecology Approval of QAPP
7/1-8/1/2012	Equipment preparation, calibration, data forms and maps
8/13-17/2012	First sample week
8/27-31/2012	Second sample week
9/10-14/2012	Third sample week
9/24-28/2012	Fourth sample week

3.2.2 Reporting Schedule

9/7/2012	August data to Ecology (Pat Irle)
10/5/2012	September data to Ecology (Pat Irle)
11/15/2012	Technical memo with results to Ecology and RRFF
2/1/2013	Draft report to Ecology and RRFF
3/15/2013	Ecology and RRFF comments to Chelan PUD
4/15/2013	Final Report to Ecology, RRFF and filed with FERC

SECTION 4: QUALITY OBJECTIVES

The purpose of the shallow water habitat/macrophyte water quality study is to assure that the water quality in these Rocky Reach reservoir habitats meet criteria for support of the designated use of salmonid spawning, rearing and migration. Quality objectives include both decision quality objectives (DQOs) and measurement quality objectives (MQOs). The DQOs are related to decisions that may be taken in the case that water quality does not meet the numeric criteria for salmonid spawning, rearing and migration. The MQOs are the specific goals for the sampling design and quality control of the measurements to address temporal and geographic representativeness of the samples and sufficient measurement precision, bias and sensitivity to assess whether criteria have been met.

4.1 DECISION QUALITY OBJECTIVES (DQOS)

Decisions that could be taken if measurements demonstrate that water quality numeric criteria are not met have been defined in the WQMP. These potential decisions include: further sampling to determine the impact of exceedances from criteria on aquatic habitat and associated biota, determination if the Rocky Reach Project creates conditions in which site-specific impacts to resident or anadromous fish are attributed to direct adverse water quality effects, and, if so, determination of what actions may be reasonable and feasible to protect aquatic life.

4.1.1 Representativeness

The sampling design is intended to assure that the monitoring locations are properly located and a sufficient number of data collected to provide a complement of water quality information that is representative of the various types of shallow water habitat and macrophytes beds that exist in the Rocky Reach reservoir. Due to the large geographical area of the Rocky Reach reservoir (43 miles in length with nearly 400 acres of macrophytes beds), a representative sampling design requires a large number of sample locations to adequately represent the diversity of shallow water habitats. For this reason, the study design set up four weeks of sampling.

Due to the diel nature of fluctuations in temperature, DO and pH associated with day-night changes in photosynthesis and solar radiation, this study design includes up to four continuous (hourly) monitoring locations per week. Leaving instruments unattended in open water areas accessible to the public is risky, but the value of continuous monitoring is the ability to use the hourly information to put in perspective the single site "grab" sampling that will cover a much greater geographical extent.

Samples will be taken in a consistent manner for all measurement locations. The single samples will be taken at two depths for each location, within 0.5 meters of the river bed and within 0.5 meters of the water surface. This will assure that samples include depth strata that may have the lowest DO (near bottom) and the highest temperature and pH (near surface). Samples will be taken from locations ranging in depth from 1 – 4 meters. The minimum sonde warm-up time and measurement time for each sample will be standardized for all sample locations.

4.1.2 Comparability

Data collection for DO, pH and water temperature using Hydrolab® sensors is a methodology comparable to previous water quality surveys in the Rocky Reach Reservoir. The resolution in this study

is intended to be comparable to data collected to support the Wenatchee River TMDL, as described by Bilhimer, et al, 2002[8]

4.1.3 Completeness

The sampling design is intended to provide 50 single location samples per week, based on the expectation that up to 20 samples can be accomplished in an average work day in the field. This is considerably more sampling than necessary to detect failure to meet water quality criteria if diminished water quality is a common event in the habitats being sampled, but redundant sampling in the design allows for lost sampling opportunities due to weather, equipment failure or other factors. The completeness goal for this study is to accomplish at least 25 single location samples per week.

4.2 MEASUREMENT QUALITY OBJECTIVES (MQOS)

Field measurements using electronic sampling equipment (Hydrolab® Minisondes) are limited to the sensitivity and accuracy of the equipment. However, proper calibration is necessary to assure that the accuracy is not biased due to improper or infrequent calibration. Sample blanks, spiked samples and other procedures typically used to test for bias in a laboratory setting are not available for field measurements. The procedures that can be taken to test and control for bias include instrument calibration before each week in the field and cross-checking between different instruments measuring the parameters in a common water environment.

Prior to each week of sampling in the field, all instruments will be calibrated for DO and pH following the recommended procedures from the manufacturer[9],[10]. The temperature is factory calibrated, so for this parameter the temperature values will be cross-checked against a NIST traceable calibration thermometer in a water bath. All Minisondes will be cross-checked against each other in the field at the beginning and end of each week of sampling in the field. Any Minisondes that deviate from the average of the collective measurements of the other Minisondes will either be recalibrated, not used or the data will be adjusted post-hock for measurement bias if such bias is consistent.

For the field measurements to be conducted under this QAPP (temperature, DO and pH), the MQOs can be specified based on the water quality criteria and the capability of the equipment. The bias (accuracy) and sensitivity of the equipment needs to be within the allowable deviations from water quality criteria in order to avoid reaching a false conclusion regarding whether or not criteria have been met. The precision (repeatability) of the measurements must be sufficient to assure that the measurements at different locations reflect actual water quality conditions rather than clustering of random measurement errors. The MQO for precision in this study is 10% relative standard deviation. The MQOs for these parameters are outlined in Table 4-1:.

[8] http://www.ecy.wa.gov/biblio/0203069.html

[9] http://www.hydrolab.com/web/ott_hach.nsf/gfx/EA8A56689807F8B6C125766900444419/$file/LDO_medium-001.pdf

[10] http://www.hydrolab.com/web/ott_hach.nsf/gfx/F0E5B689C58EB25DC125766900444449/$file/PH_Calibration_medium-001.pdf

Table 4-1: MQOs

Parameter	Range of Instrument	Sensitivity/ Resolution	Bias/ Accuracy	Precision
Temperature	-5 to 50°C	0.01°C	± 0.2°C	10% RSD
DO	0-60 mg/l	0.01 mg/l	±0.2 mg/l	10% RSD
pH	0 – 14 pH units	0.01 pH units	±0.2 pH units	10% RSD

SECTION 5: SAMPLING PROCEDURES

The goals of the sampling procedures are to obtain a broad array of samples from sites that are representative of the types of shallow water habitat that are prevalent in the Rocky Reach reservoir and to determine whether or not the water quality criteria for temperature, DO and pH are met in these habitats. The temporal regime selected for sampling is intended to cover the seasons and diel time periods when shallow water habitats and macrophyte beds are experiencing ambient conditions that may cause deviations from meeting water quality criteria.

5.1 SAMPLING LOCATIONS

The upper Rocky Reach reservoir, above Beebe Bridge, is more riverine in character than the middle and lower sections of the reservoir. Although shallow water habitat exists in the upper section, the acreage of macrophytes beds in this upper section is low compared to the lower and middle sections of the reservoir (29 acres of 386 acres mapped in 1999, Aquatic Habitat Mapping Study Report – see link in footnote 3). In order to meet the DQO for representativeness, sampling locations will be limited to reservoir areas below Beebe Bridge.

In order to focus on areas where water quality is likely to be affected by macrophyte respiration and decomposition of plant matter, 60% of sampling locations will be selected from macrophytes beds with dense growth. Two non-native species, Eurasian water milfoil (*M. spicatum*) and curled pondweed (*P. crispus*) often dominate large macrophytes beds. Because these are non-native plant species, sampling locations will often include macrophytes beds with a preponderance of these species. Although the boat and trailer for this study are typically only used in the Rocky Reach and Rock Island reservoirs, where these non-native plant species are ubiquitous, proper protocols for avoiding the spread of invasive species will be followed. These include cleaning off any plant material from the sampling equipment, boat, motor and trailer at the launch site prior to travelling to other launch sites or to overnight storage. In addition, the sampling equipment, boat, motor and trailer will be inspected for other invasive species, such as zebra or quagga mussels, even though these species have not been reported as present in the Rocky Reach reservoir. Prior to use in any other water body, the water quality meters, cables, lines, anchors, boat, motor and trailer will be allowed to thoroughly dry out or be hot-water washed.

Sampling locations will be recorded with GPS coordinates for data entry into GIS database. The GIS data will be used to assure that sample locations cover a representative selection of habitat locations within the reservoir. GIS layers currently exist from the 1999 aquatic habitat mapping study for depth, substrate type and macrophytes beds.

5.1.1 Typical Mid Reservoir Sample Locations

Sample locations from the middle reservoir (Entiat River – Beebe Bridge) will include data collected from some areas with extensive macrophytes beds and areas with narrower bands of macrophytes that parallel the shoreline, which is the habitat type most prevalent along the reservoir. Targeted areas include the Chelan Falls area and Daroga Park area (Figure 5-1: Figure 5-2:)

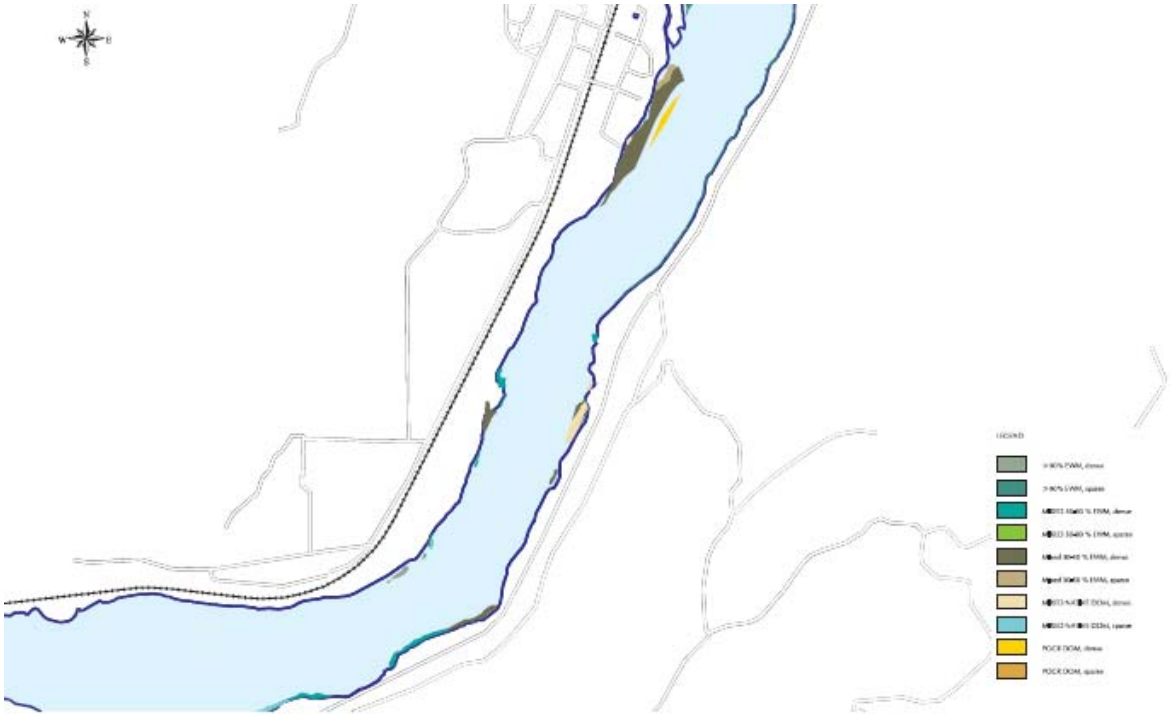

Figure 5-1: Chelan Falls Sampling Locations.

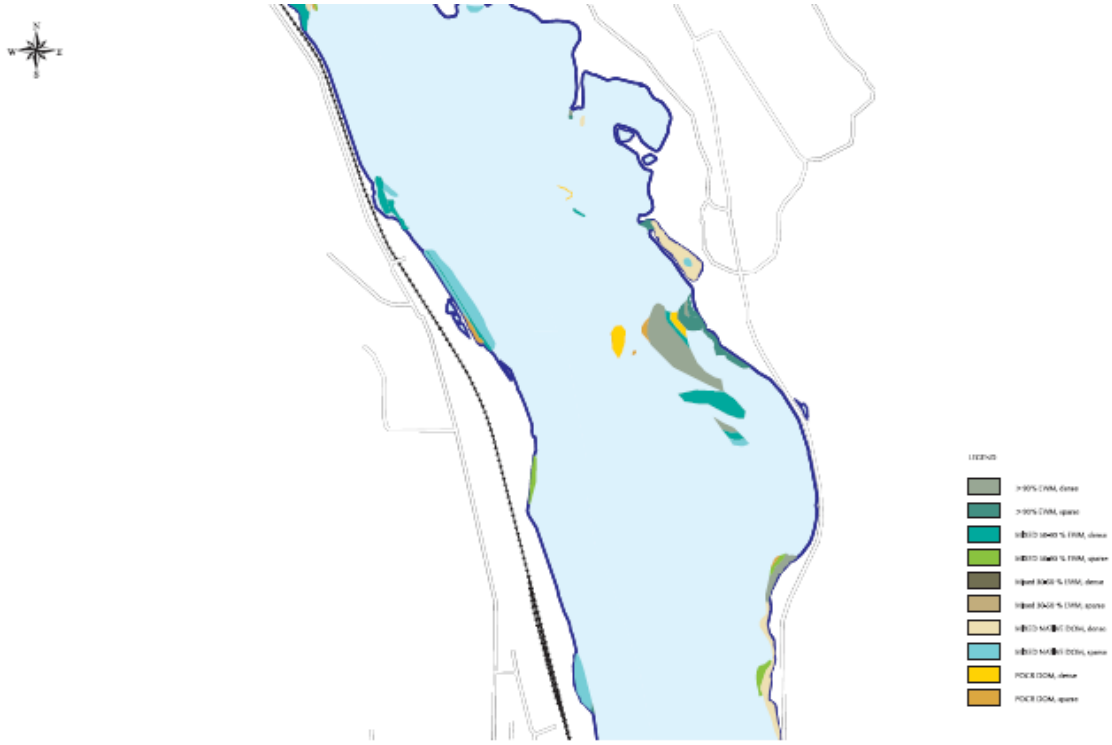

Figure 5-2: Daroga Park Sampling Locations.

5.1.2 Typical Lower Reservoir Sample Locations

Sample locations from the lower reservoir (Rocky Reach Dam – Entiat River) will include data collected from shallow water areas with sandy substrate, with and without macrophytes that are typical of the

Turtle Rock and Entiat River areas. Other sample sites will be similar to middle reservoir sample areas (Figure 5-3: Turtle Rock Sampling Locations.)

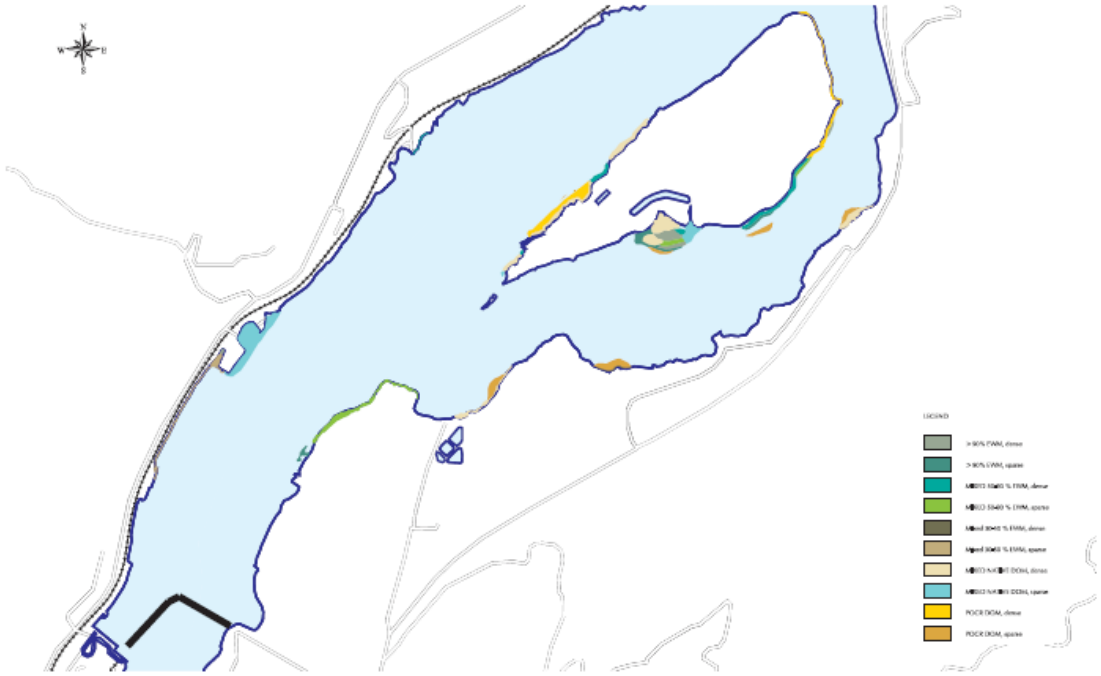

Figure 5-3: Turtle Rock Sampling Locations.

5.2 SAMPLING DEPTHS

Sample depths will be selected to bracket the depths typical of shallow water habitats that are typical rearing habitats for Chinook salmon and many resident fish species in the Rocky Reach reservoir. Samples will be taken from locations ranging in depth from 1 – 4 meters.

The single samples will be taken at two depths for each location, within 0.5 meters of the river bed and within 0.5 meters of the water surface. This will assure that samples include depth strata that may have the lowest DO (near bottom) and the highest temperature and pH (near surface).

Stations selected for tethering of sondes for continuous hourly sampling will be from 2 – 3 meters deep. The sonde will be located with 0.5 meters of the river bed.

SECTION 6: MEASUREMENT PROCEDURES

Water quality measurements will be taken in the field using Hydrolab® Minisondes (MS5 model) equipped with sensors for temperature, dissolved oxygen (LDO luminescence based measurement), and pH (electric potential based measurement). The MQOs for these sensors are outlined in Table 4-1: MQOs. For single site measurements the Minisonde will typically be connected to a Hydrolab Surveyor 4a, which has a digital readout of Minisonde readings and data logging functions. The hourly recording samples will use the Minisonde internal data logging functions, which will be programmed for hourly recording prior to deployment.

The following procedure will be used to record each sample:

1. Anchor the boat and record the GPS coordinates for the sample location on data sheet
2. Deploy the Minisonde and monitor the readings for 1 minute or until they stabilize
3. Record the data for 2 minutes (manual file) at the desired depth
4. Deploy the Minisonde to the other depth and monitor until readings stabilize
5. Record the data for 2 minutes (manual file)
6. Record Surveyor file number on data sheet
7. Record sample site descriptors on data sheet *(descriptors not yet defined)*

SECTION 7: QUALITY CONTROL

Prior to initiation of a week of sampling, instruments will be calibrated and the calibration verified by side-by-side readings. All calibration procedures and cross-check comparisons will be recorded with the values for each instrument and reference sample maintained on paper data forms and spreadsheet files. Specific quality control for each parameter measurement is described as follows.

7.1 TEMPERATURE QUALITY CONTROL

A pre-and post-deployment protocol will be conducted by a two-point comparison between the field equipment and a certified reference thermometer. This comparison will be made prior to and after each week of field sampling. The certified reference thermometer to be used will have a National Institute of Standards and Technology (NIST) Traceable certification. If the temperature readings for any Minisonde are not within ± 0.2°C of the reference thermometer the Minisonde will be retested over a range of temperatures. If the Minisonde is not within 10% RSD over repeated measurements, then it will not be used.

7.2 DISSOLVED OXYGEN QUALITY CONTROL

Individual Minisonde LDO sensors will be calibrated following the manufactures recommended procedures (see footnote 4), which is based on air saturated water in the procedure. All Minisondes will be cross-checked weekly against each other in the field at the beginning and end of each week of sampling in the field. Any Minisondes that deviate by more than +/-0.2 mg/L (Accuracy/Bias) with allowable 10% RSD (Precision) from the average of the collective measurements of the other Minisondes will either be recalibrated, not used or the data will be adjusted after collection for measurement bias if such bias is consistent (the difference between the average of other sensors and the biased sensor does not vary by more than 10% RSD over successive comparisons).

7.3 PH QUALITY CONTROL

Individual Minisonde pH sensors will be maintained and calibrated following the manufactures recommended procedures (see footnote 5), which is based on known pH buffer solutions. All Minisondes will be crosschecked weekly against each other in the field at the beginning and end of each week of sampling in the field. Any Minisondes that deviate from the average of the collective measurements of the other Minisondes will either be recalibrated, not used or the data will be adjusted after collection for measurement bias if such bias is consistent (+/-0.2 pH units (Accuracy/Bias) with allowable 10% RSD (Precision)).

SECTION 8: DATA MANAGEMENT PROCEDURES

The reported data are anticipated to include the location of collection, the time of collection, and the date of collection. Field data (measured values, site identification coordinates and anecdotal information) will be taken by a combination of electronic file logging and paper data forms, with cross-referencing procedures to assure that data stored on different media are properly paired.

Data will be regularly transferred to both Excel® spreadsheet and GIS database formats. Water quality measurements will be assessed for credibility both in the field and later after database/spreadsheet entry. Data that has impossible or otherwise extreme outlier values will be discarded from the database and spreadsheets, but recorded as non-credible data in the files.

Data will be periodically transmitted to Ecology in raw form for inspection (see 3.2.2 Reporting Schedule). Any questions regarding data validity arising from Ecology's review will be addressed prior to further data collection.

SECTION 9: REPORTS

Reporting will follow the schedule defined in Section 3.2.2. This schedule includes transmittal of compiled raw data in a timely manner and a more formal technical memorandum report of results prior to producing a draft report.

A draft report of the study methodology, findings and conclusions will be provided to Ecology and the RRFF for review and comment, to be followed by a final report that will be filed with FERC once approved by Ecology and the RRFF.

SECTION 10: REFERENCES

Bilhimer, D., J. Carroll, S. O'Neal, and G. Pelletier. 2002. Quality Assurance Project Plan:Wenatchee River Temperature, Dissolved Oxygen, pH, and Fecal Coliform Total Maximum Daily Load Year 1 Technical Study. Washington State Department of Ecology, Watershed Ecology Section. Olympia, Washington.

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Duke Engineering and Services, 2001. Aquatic Habitat Mapping Study Report, Final. Report prepared for Public Utility District No. 1 of Chelan County, June 1, 2001.

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. 2011. Water quality standards for surface waters of the State of Washington. Chapter 173-201A Washington Administrative Code. Updated May 9, 2011

Ecology. 2006. Section 401 Water Quality Certification for the Rocky Reach Hydroelectric Project, FERC Project No. 2145.

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Schneider, Michael L and Steven C. Wilhelms, 2005. Rocky Reach Dam: Operational and structural total dissolved gas management. Report prepared for Public Utility District No. 1 of Chelan County by U.S. Army Engineer Research and Development Center, Vicksburg, MS, June 30, 2005.

WEST Consultants, Inc, 2006. Technical report on the development of a CE-QUAL-W2 model for the Rocky Reach Hydroelectric Project. Report prepared for Public Utility District No. 1 of Chelan County, January 2006.

APPENDIX A: SPECIFICATIONS FOR PROPOSED EQUIPMENT

HYDROLAB MINISONDE

OVERVIEW

Engineered for dependable performance and durability in the field, the Hydrolab Minisonde 5 (MS5) offers a compact and lightweight multiprobe design for either profiling or unattended long term monitoring.

With a diameter of only 45mm (1.75”) the MS5 is perfect for the monitoring of 50mm (2”) environmental monitoring wells.

Technical Specifications

Product Specification	**Description**
Size	Outer diameter – 4.4cm (1.75”)Length – 53.3cm (21”) Length (with battery pack) – 74.9cm (29.5”)
Weight	1.0kg (2.2lbs)(with battery pack) – 1.3kg (2.9lbs)
Computer interface	RS-232, SDI-12, RS-485
Memory	120,000 measurements
Battery supply	8 AA batteries
Operating temperature	-5 to 50° C
Maximum depth	225m

Specifications

Sensors	Measurement Range	Accuracy	Resolution
Dissolved oxygen(Luminescence) LDO	0-60 mg/l *exceeds max. natural concentration	±0.1 mg/l for values ≤ 8 mg/l □±0.2 mg/l for values > 8 mg/l □nd ≤ 20 mg/l ± 10% reading for value□ >2□mg/l	0.01 mg/l
Conductivity sensor	0-100 mS/cm	± (0.5 % of reading +0.001 mS/cm)	
Salinity	0-70 ppt	±0.2 ppt	0.01 ppt
pH sensor	0-14 pH units	±0.2 units	0.01 units
Temperature	–5 ... +50 °C	±0.1 °C	0.01 °C

APPENDIX B: CONSULTATION RECORD

Chelan PUD submitted the first draft of the Shallow Water/Macrophyte Bed Update to the Quality Assurance Project Plan (QAPP) for Rocky Reach Water Quality Monitoring and Reporting to the Washington State Department of Ecology for review on January 3, 2012. Ecology provided technical review comments on February 1, with additional comments on February 6. Chelan PUD incorporated those comments into a second draft that was submitted to Ecology and the Rocky Reach Fish Forum (RRFF) on April 17. Ecology submitted final comments to Chelan PUD on April 24, 2012. No other comments from members were received. This final QAPP is being submitted to Ecology for approval on July 10, 2012. Field work for the water quality measurements is scheduled to begin in mid August.

Record of Correspondance Regarding Consultation with Ecology and RRFF on QAPP Drafts

From: Irle, Pat (ECY) [mailto:PIRL461@ECY.WA.GOV]
Sent: Tuesday, April 24, 2012 11:37 AM
To: Hays, Steve
Subject: FW: Macrophyte QAPP (RRFF Review Draft)

Our final comments.

From: Bitterman, Deborah On Behalf Of Hays, Steve
Sent: Tuesday, April 17, 2012 12:42 PM
To: 'Tracy Hillman'; Aaron Jackson; Andrew Gingerich; 'Bob Huber'; Bob Rose; 'Chad Jackson'; Jason McLellan; Osborn, Jeff; Miller, Joseph; Murauskas, Joshua; Truscott, Keith; Keller, Lance; 'Molly Hallock'; 'Patrick Verhey'; Hays, Steve; 'Steve Lewis'; Frantz, Waikele M.; Pat Irle; RD Nelle
Cc: Smith, Michelle; McKinney Charlie (cmck461@ECY.WA.GOV); Sokolowski, Rosana; Bitterman, Deborah
Subject: Macrophyte QAPP (RRFF Review Draft)

Hello RRFF,

Attached for your review is the draft QAPP-Update for Shallow Water/Macrophyte Bed Sampling (report incorporates all edits in response to Ecology's review).

Please send Steve Hays your comments/edits on the draft QAPP-Update for Shallow Water/Macrophyte Bed Sampling by Tuesday, 1 May.

From: Irle, Pat (ECY) [mailto:PIRL461@ECY.WA.GOV]
Sent: Monday, February 06, 2012 8:26 AM

To: Hays, Steve
Subject: FW: DRAFT Macrophyte QAPP Jan 31 2012 - DJD review.docx

Some more comments.

From: Irle, Pat (ECY) [mailto:PIRL461@ECY.WA.GOV]
Sent: Wednesday, February 01, 2012 4:40 PM
To: Hays, Steve
Subject: FW: QAPP

Our comments… I don't think they're very difficult, just filling in the blanks…

From: Irle, Pat (ECY) [mailto:PIRL461@ECY.WA.GOV]
Sent: Thursday, January 05, 2012 1:04 PM
To: Hays, Steve
Subject: RE: QAPP

It's looking good. I sent it to have our QA/QC experts look at it. Hopefully it won't take them too long...

Record of RRFF Meeting Minutes Regarding QAPP Drafts

Rocky Reach Fish Forum Meeting Minutes
Date: Wednesday, 2 May 2012
Time: 9:00 am – 12:00 pm
Conference Call

QAPP
Steve Hays received no comments from the RRFF on the QAPP. He will finish compiling comments from Ecology and meet the following due date:
• 1 June 2012: Final Report to Ecology
• 1 July 2012: Approval from Ecology
Steve indicated that they will conduct fieldwork during two weeks in August and two weeks in September. He said that anyone interested in participating or observing the sampling is welcome to join him in August and September.

Pat Irle and Patrick Verhey indicated that they would like to participate in the sampling and will check to see if others in their agencies are interested in participating in the sampling.
Action Items:
• Steve Hays will send an email reminder of fieldwork dates to the RRFF.
• Pat Irle and Patrick Verhey will provide additional names of people to Steve Hays that may be interested in participating in the fieldwork activities.

Rocky Reach Fish Forum Meeting Minutes
Date: Wednesday, 4 April 2012
Time: 1:00 – 4:00 pm
Conference Call

QAPP
Steve noted that he received good comments from Pat Irle on the draft QAPP. Steve said that he will address the comments and meet or beat the following schedule:
• 18 April 2012: Revised draft QAPP report to the RRFF and Department of Ecology.
• 1 May 2012: RRFF comments due to Steve Hays and Department of Ecology.

Rocky Reach Fish Forum Meeting Minutes
Date: Wednesday, 7 March 2012
Time: 1:00 – 4:00 pm
Conference Call

QAPP
Jeff Osborn reported that Steve Hays is in the process of addressing Ecology's comments on the QAPP.
Action Item:
• 18 April 2012: Draft QAPP report to the RRFF and Department of Ecology.
• 1 May 2012: RRFF comments due to Steve Hays and Department of Ecology.
• Jeff Osborn will share with Steve Hays the timeline discussed at the RRFF meeting.

Rocky Reach Fish Forum Meeting Minutes
Date: Wednesday, 4 January 2012
Time: 2:00 – 4:00 pm
Conference Call

Water Quality
Tracy noted that Pat Irle received the first draft of the QAPP from Steve Hays, Chelan PUD, for her review and comments.