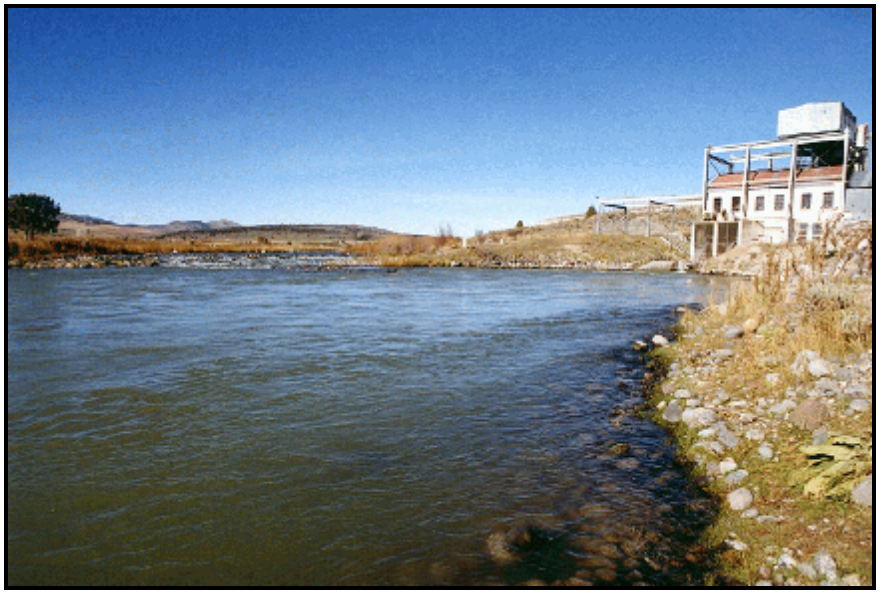
Bear River Hydroelectric Project
FERC No. 20

Grace/Cove Development
Water Quality Monitoring Plan



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1.0 INTRODUCTION

The major objective of this Water Quality Monitoring Plan (WQMP) is to develop and implement a quantitative water quality monitoring program which accurately defines the existing water quality conditions above, within and below the Grace/Cove hydroelectric complex (Project). Secondarily, the implemented plan will help determine the project's contribution to any violations of water quality criteria as set forth in the Idaho Water Quality Standards and Wastewater Treatment Requirements (IDAPA 58.01.02). The following sections will describe the location, frequency, water quality parameters, quality assurance/quality control requirements, and the reporting of the data and conclusions of the study.

2.0 MONITORING LOCATIONS

Four sampling locations will be included in the Grace WQMP. These sites will have continuously monitoring probes installed and also have water quality samples (grab) collected. These locations can be seen in Figures 1 and 2 and are described below.

GC01: Located below the outfall of the Last Chance Hydroelectric Plant and above the influence of the Grace forebay. This site represents the upstream control which will define water quality conditions entering the project.

GC02: Located below the Grace Diversion Dam at the head of Black Canyon. This site will define the water quality conditions at the head of the bypass reach and will also define water quality conditions of Grace Diversion Dam water releases.

GC03: Located at the exit of the Bear River from Black Canyon. This site will define the water quality conditions resulting from the combination of the Grace Diversion Dam flow releases and the inflowing springs or point sources accruing within Black Canyon.

GC04: Located below the outfall of the Cove Hydroelectric Plant. This site represents the water quality conditions leaving the Grace/Cove Hydroelectric complex and represents the cumulative effects of the project and land uses between the upper forebay of the Grace Diversion Dam and the outfall of the Cove plant.

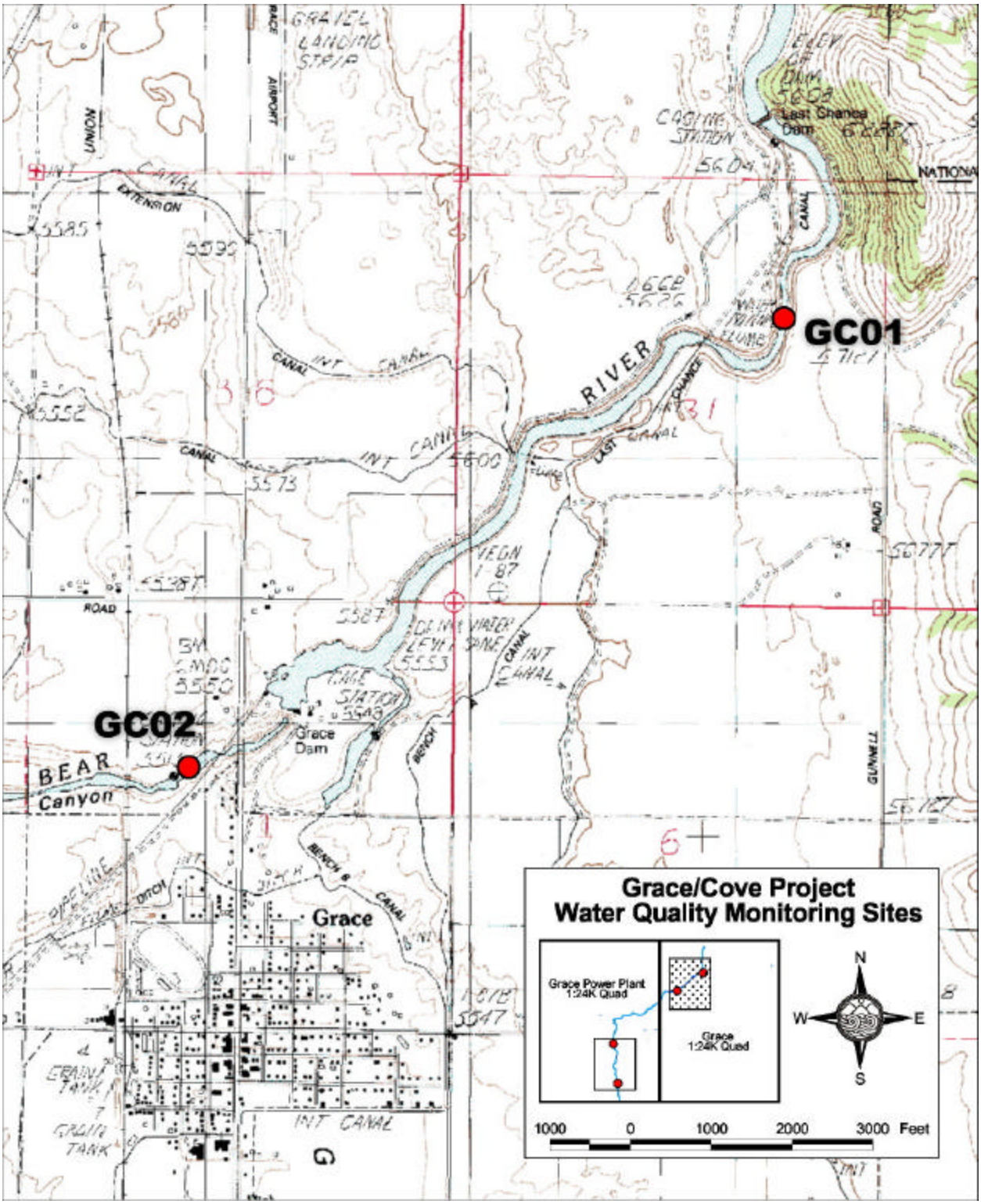

Figure 1. The location of the uppermost monitoring sites for the Grace/Cove WQMP.

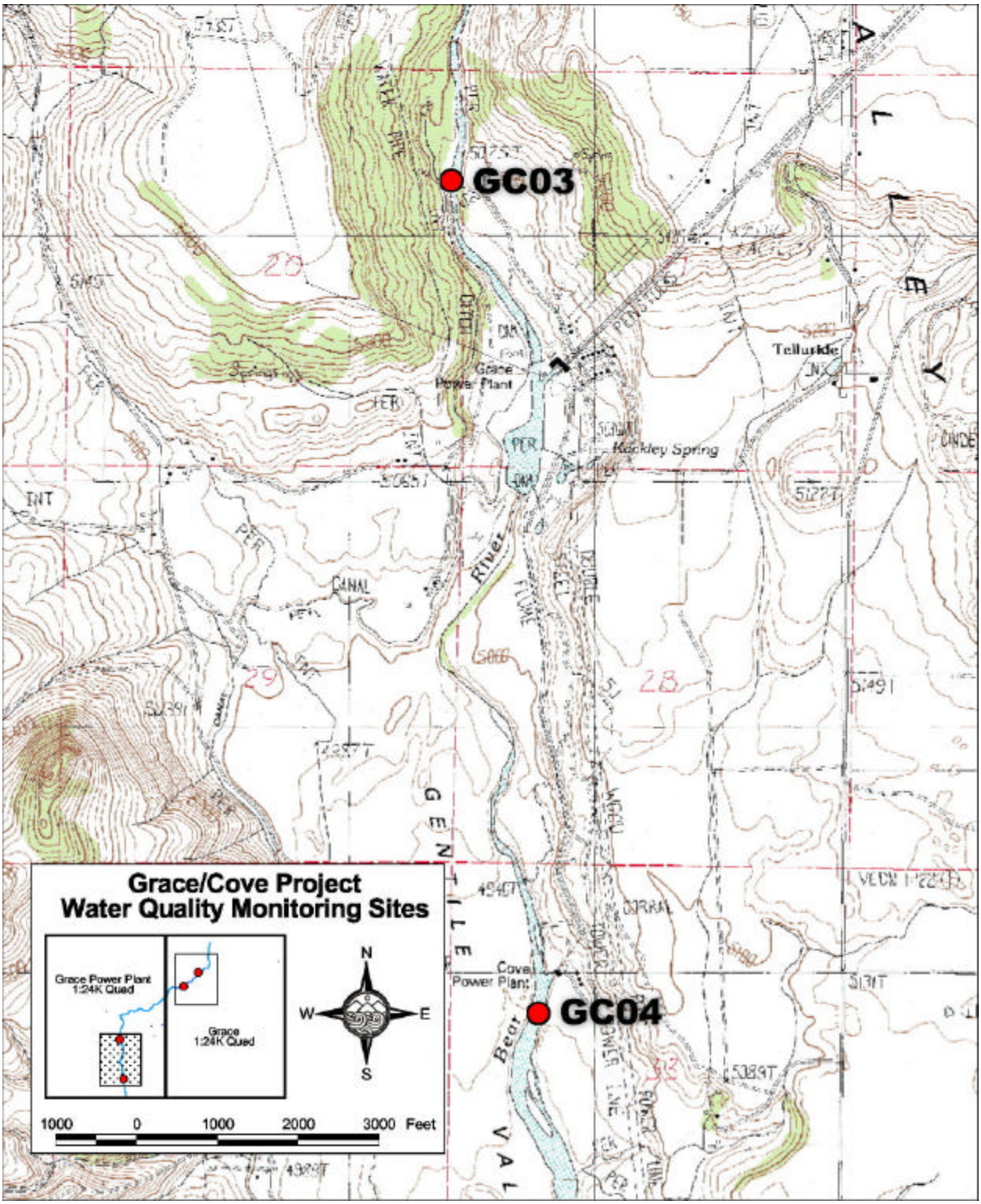

Figure 2. The location of the lowermost monitoring sites for the Grace/Cove WQMP.

3.0 MONITORING FREQUENCY

The Grace WQMP will last for a 6-year period beginning in 2004. On an annual basis starting on July 1 through September 30, water quality data will be collected at the four stations described previously. Continuous monitoring probes (YSI Model 6920) will collect dissolved oxygen, temperature, turbidity and specific conductance at hourly intervals over a continuous 7-day period during the months of July, August and September.

In addition to the continuous electronic data, water quality "grab" samples will be collected by technicians from Ecosystems Research Institute (ERI) and returned to the ERI laboratory for determining the concentration of selected nutrients and total suspended solids (parameters are described in the following section). Samples for each site will be taken once during each of the continuous 7-day periods for each month (July, August and September) during each year of the Grace WQMP.

The flow in the Bear River immediately below the Grace Diversion Dam at the gage located below the railroad trestle will be continuously monitored (hourly) and reported as an average daily flow. This location corresponds to the continuous water quality station, GC02.

4.0 MONITORING PARAMETERS

As noted above, two separate data sets will be collected as part of the Grace WQMP. The parameters are defined below.

4.1 Continuously Monitoring Probes

YSI Model 6920 probes will be installed by ERI at each of the four sites and will be set to collect data at an hourly time step. Parameters will include:

1) specific conductance (:mhos/cm);

2) temperature (°C);

3) dissolved oxygen (mg O_2/L); and,

4) turbidity (NTU).

Flow (cfs) will be measured using separate equipment and will be the responsibility of PacifiCorp.

4.2 Instantaneous Sampling

Grab samples will be collected once during each week of continuous monitoring. Samples will be analyzed by ERI's EPA and state of Utah certified laboratory and will include:

1) total phosphorus (mg P/L);

2) orthophosphorus (mg P/L);

3) ammonia (mg N/L);

4) nitrate (mg N/L);

5) nitrite (mg N/L);

6) total suspended solids (mg/L); and,

7) turbidity (NTU).

5.0 QUALITY ASSURANCE AND QUALITY CONTROL

Ecosystems Research Institute laboratory is certified by the Utah Division of Epidemiology and Laboratory Services (DELS) for the analysis of ammonia, nitrate, nitrite, all forms of phosphorus, BOD_5, conductivity, total suspended solids, total dissolved solids and turbidity.

This section will be confined to the quality assurance of sampling, sample handling, field techniques, field analyses, and data treatment from the time samples are collected until the samples are submitted to the laboratory and after the results are reported until they are permanently stored. The procedures for calibration, maintenance, and downloading of the YSI Model 6920, used for the continuous monitoring task of this project, will also be included in this section.

The measurement of data should provide adequate precision and accuracy for the program objective, which is to:

1) Characterize water quality conditions in the Grace bypass reach; and,

2) Help determine the project's contribution, if any, to violations of water quality criteria as set forth in the Idaho Water Quality Standards and Wastewater Treatment Requirements, IDAPA 53.01.02 (Water Quality Standards).

All data generated will be reported in units consistent with data generated by other organizations reporting similar analyses to allow comparability of data among organizations. Specific data quality objectives for accuracy precision and completeness for laboratory analyses are discussed in Ecosystems Research Institute Laboratory Quality Assurance Operations Manual and Standard Operating Procedures (ERI 2003). Specific data quality objectives for accuracy and precision of sampling are for measurements to fall within a 95 percent confidence interval around the true value. The confidence interval for each parameter is based on prior knowledge of the measurement system and is generated from the EPA publication "Estimation of Generic Acceptance Limits for Quality Control Purposes for Use in a Water Pollution Laboratory" (May 1991).

5.1 Continuously Monitoring Probes

Four YSI Model 6920 monitoring probes will be installed at each of the stations. A backup probe will be available in the case any problems are encountered with the equipment. Custom steel boxes will be built in order to house, conceal and protect each probe. The probes will be calibrated for each parameter according to the manufacturer's specifications (YSI 2001) before being placed in the field. Data will be downloaded at the end of each continuous 7-day monitoring period using a laptop computer and the software EcoWatch for Windows. Each time the monitoring field crew is at the site, a grab sample will be taken at each location and analyzed for turbidity in ERI's lab. These samples will assist in verifying the probe's readings. The probe will be cleaned and calibrated in the field and a measurement taken in situ to verify drift of turbidity, dissolved oxygen and conductance. This measurement is necessary in order to qualify the data according to the criteria in Table 1. The data quality rating will be recorded and stored in the master database. Rejection of any data will be according to the USGS maximum allowable criteria limits outlined in Table 2. To further assist in the calibration of turbidity, turbidity standards will be run prior to and after the continuous 7-day sampling period. After each of the continuous 7-day periods is complete, the probes will be removed from their steel housing and stored off-site. Storage will be according to manufacturer's specifications.

5.2 Instantaneous Sampling

On each monitoring run, each of the four sites will be sampled for total and orthophosphorus, ammonia, nitrate, nitrite, total suspended solids, and turbidity. All samples will be integrated both vertically and horizontally. Field temperature, dissolved oxygen, pH, conductivity and turbidity will be measured with an In-Situ TROLL 9000 multiparameter water quality instrument.

Each site will monitored once during the continuous 7-day period (July, August and September) for a total of three monitoring runs each year of the program. At each site, the integrated sample will be split immediately into two bottles with acid preservative for the ammonia and total phosphorus analyses, and one unpreserved bottle for the suspended sediment, nitrate, nitrite and orthophosphorus sample. All samples will be kept cool and dark from the moment of collection until delivery to the laboratory. Samples will be analyzed at ERI's laboratory, which maintains state and EPA certification for all parameters in this study (Table 3). The unpreserved sample will be filtered immediately upon return to the laboratory. All analyses will be conducted within the required holding times. Certification for a specific parameter includes a rigorous quality assurance and quality control program. This includes a set of standards for standard curve generation for each analysis run, and spikes, spike duplicates, check samples and blanks analyzed within each sample run (a minimum of one set of QA/QC samples for every 20 field samples). In addition, a field and trip blank will be collected during each sample trip to identify any contamination occurring during the sampling process, and at least one field duplicate will be collected.

Table 1. Rating continuous water quality records (Source: USGS, 2000. WRIR 00-4252, Table 9).

Measured physical property	Ratings			
	Excellent	Good	Fair	Poor
Water temperature	= ± 0.2 ° C	> ± 0.2 to 0.5 ° C	> ± 0.5 to 0.8 ° C	> ± 0.8 ° C
Specific Conductance	= ± 3 %	> ± 3 to 10 %	> ± 10 to 15 %	> ± 15 %
Dissolved oxygen	= ± 0.3 mg/L	> ± 0.3 to 0.5 mg/L	> ± 0.3 to 1.0 mg/L	> ± 1.0 mg/L
PH	= ± 0.2 unit	> ± 0.2 to 0.5 units	> ± 0.5 to 0.8 units	> ± 0.8 units
Turbidity	= ± 5 %	> ± 5 to 10 %	> ± 10 to 15 %	> ± 15%

Table 2. Rejection criteria for continuous water-quality monitoring sensors.

Constituent	Manufacturer's Specifications[a]	Maximum Allowable Limits (USGS)[b]
Water temperature	> ± 0.15 ° C	> ± 2.0 ° C
Specific Conductance	> ± 0.5 %	> ± 30 %
Dissolved oxygen	> ± 0.2 mg/L or ± 2%, whichever is greater	> ± 2.0 mg/L or ± 20%, whichever is greater
PH	> ± 0.2 units	> ± 2.0 units
Turbidity	> ± 5% or 2 NTU whichever is greater	> ± 30%

Notes:

[a] YSI Incorporated. 6-Series Environmental Monitoring Systems Operations Manual
[b] USGS, 2000. WRIR 00-4252, Table 8.

Table 3. Laboratory procedures and detection limits at ERI's water lab.

Parameter	Method Number	Reporting Limit	Units
Total Suspended Solids	EPA 160.2	1	mg/liter
Turbidity	EPA 180.1	1	NTU
Ammonia, as N	EPA 350.3	0.02	mg/liter
Nitrate+Nitrite, as N	EPA 353.3	0.004	mg/liter
Nitrite, as N	EPA 354.1	0.0003	mg/liter
Total Phosphorus, as P	EPA 365.2	0.006	mg/liter
Orthophosphorus, as P	EPA 365.2	0.001	mg/liter

All samples will be kept dark and at 4°C while being transported back to the laboratory. Sample sheets (sampling records and chain of custody forms) will be filled out in the field, and each bottle will be identified with a unique sample number, location, date and time.

Samplers will adhere to sampling and preservation techniques presented in the Quality Assurance and Standard Operating Procedures Manual for ERI. Samplers will prepare and complete all forms before samples will be delivered to the laboratory.

All QAQC sampling used in verifying and qualifying the continuous monitoring probes will be done with the same instrument used in collecting the week's data unless a malfunction has been detected in the probe

5.3 Data Validation and Usability

Validation and Verification Methods

Field Data: Field data will be assessed continuously. If a pH value less than 6.5 or greater than 9.0 is measured, an immediate calibration of the instrument will be required and the site re-analyzed. If a specific conductance value greater than 10 times or less than 1/10 the standard is measured, an immediate calibration of the instrument with a standard of proper magnitude will be required and the site re-analyzed. Field data for the entire run will be assessed by the quality assurance coordinator and quality assurance officer. All data will be assigned a data quality rating according to the criteria outlined in Table 1. The data quality rating will be recorded and stored in the master database. Rejection of any data will be according to the USGS maximum allowable criteria limits outlined in Table 2.

Routine Laboratory Data: Laboratory reports are reviewed by the quality assurance officer for accuracy and completeness.

Duplicate Sample Data: After all duplicate sample data are received from the laboratory, the duplicate measurements will be compared to a 95% confidence interval generated around the original site value. The 95% confidence interval is generated from regression equations published in the EPA document "Estimation of Generic Quality Control Limits for Quality Control Purposes in a Water Pollution Laboratory" will be used. If statistics are not available in the document, the document from the EPA entitled "Estimation of Generic Quality Control Limits for Quality Control Purposes in a Drinking Water Laboratory" will be used. If statistics are not available in either document, the DELS QAPP quality assurance goals will be used. In any case, the most current documentation available will be used. The data will be collected and evaluated quarterly and reported to the quality assurance coordinator in writing before the end of the following quarter.

Reconciliation with Data Quality Objectives

Corrective actions will be initiated as a result of the following quality assurance activities:

1. Daily field data assessment found to be beyond control limits.
2. Unacceptable results on performance evaluation audits.
3. Unacceptable performance found in system audits.
4. Previously reported results found to be in error.

It is imperative that early and effective corrective action be taken when control data fall outside acceptable limits. Since the samplers and laboratory are responsible for recording all quality assurance data on forms daily, they will be the first to determine that a method is out of control and will initiate the appropriate immediate corrective measures necessary to bring data within control limits. Corrective actions taken by samplers will include, but not be limited to, recalibration of field instrumentation. Any such corrective action will be documented and completed forms will be maintained by the quality assurance officer. Corrective action taken in the laboratory will include, but not be limited to, sample re-analysis for all necessary parameters. ERI laboratory corrective actions and documentation are detailed in the Quality Assurance Operations Manual and Standard Operating Procedures.

6.0 REPORTING

For each year of the six year WQMP, an annual report will be prepared and submitted to IDEQ in November. A summary of the report will also be included in PacifiCorp's annual report to the FERC in March. The report will contain a written description and analysis of the data collected during that year, as well as a comparison to relevant water quality standards or criteria. This report will also contain an electronic copy of all data collected and QA/QC information.

7.0 LITERATURE CITED

Ecosystems Research Institute. 2003. Quality Assurance Operations Manual.122 pp.

U.S. Environmental Protection Agency. May 1991. Estimation of Generic Quality Control Limits for Quality Control Purposes in a Water Pollution Laboratory.

YSI Incorporated. YSI 6_Series Environmental Monitoring Systems Operations Manual. In website: http://www.ysi.com/environmental.htm. Downloaded February 13, 2004. 332 pp.

AGENCY CONSULTATION

The following contains Idaho Department of Environmental Quality's comments on PacifiCorp's Water Quality Monitoring Plans for Grace/Cove. Responses by PacifiCorp are indented and **bolded.**

Grace/Cove Plan

Section 3 – paragraph 3. Why not use the gage that is located below the railroad trestle?

> **PacifiCorp response: We agree with this comment and have incorporated it into the final plan.**

Section 4.2 – suggest replacing grab samples with depth/spatially integrated.

> **PacifiCorp response: We feel that using a spatially integrated sampler would improve the accuracy of the determining total suspended solids (TSS) passing a set transect in the river. However, the purpose of the "grab" sample is to develop a regression equation between the instantaneous water quality probe data (measured as NTU) and the quantitative concentration of suspended solids (measured as TSS mg/l) at the location of probe measurement. Using this regression, we can calculate the TSS instantaneously in the river over time. By integrating the sample across the river, we would be adding error to the regression analysis. We propose instead to use a Van Doren water sampler and collect the "grab" sample at the exact location (same depth) as the *in situ* probe; thus accurately measuring what the probe is sensing.**

Section 5.1 – at the end of each 7-day run of continuous monitoring a QA/QC reading should be taken in situ with a freshly calibrated sonde to verify drift of turbidity, dissolved oxygen and conductance. This is necessary to be able to qualify the data. The following criteria are suggested for use to qualify the data.

Table . Rating continuous water quality records (Source: USGS, 2000. WRIR 00-4252, Table 9.

Measured physical property	Ratings			
	Excellent	Good	Fair	Poor
Water temperature	= ± 0.2 ° C	> ± 0.2 to 0.5 ° C	> ± 0.5 to 0.8 ° C	> ± 0.8 ° C
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Dissolved oxygen	= ± 0.3 mg/L	> ± 0.3 to 0.5 mg/L	> ± 0.3 to 1.0 mg/L	> ± 1.0 mg/L
PH	= ± 0.2 unit	> ± 0.2 to 0.5 units	> ± 0.5 to 0.8 units	> ± 0.8 units
Turbidity	= ± 5 %	> ± 5 to 10 %	> ± 10 to 15 %	> ± 15%

Table Rejection criteria for continuous water-quality monitoring sensors

Constituent	Manufacturer's Specifications[a]	Maximum Allowable Limits (USGS)[b]	Rejection Criteria for Portneuf River *(under review)*
Water temperature	> ± 0.15 ° C	> ± 2.0 ° C	> ± 1.0° C
Specific Conductance	> ± 0.5 %	> ± 30 %	> ± 20%
Dissolved oxygen	> ± 0.2 mg/L or ± 2%, whichever is greater	> ± 2.0 mg/L or ± 20%, whichever is greater	> ± 1.0 mg/L
PH	> ± 0.2 units	> ± 2.0 units	> ± 1.0 units
Turbidity	> ± 5% or 2 NTU whichever is greater	> ± 30%	> ± 20%

Notes:

[a] USGS, 2000. WRIR 00-4252, Table 8.

[b] YSI Incorporated. 6-Series Environmental Monitoring Systems Operations Manual

PacifiCorp response: We agree with this comment and have incorporated it into the final plan.

Section 5.2 – recommend that QA/QC sampling be done with the same instrumentation (i.e. YSI 6920 to YSI 6920) unless it can be shown that different instruments are equivalent.

PacifiCorp response: We agree with this comment and have incorporated it into the final plan.

Section 5.3 – use data qualifiers as provided above for verification of field parameter runs.

PacifiCorp response: We agree with this comment and have incorporated it into the final plan.