



**U.S. Army Corps
of Engineers**
Seattle District

Albeni Falls Dam: Flexible Winter Power Operations Lake Pend Oreille Water Quality Monitoring Plan 2012

By Kent Easthouse
U.S. Army Corps of Engineers, Seattle District
Water Management Section

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Introduction

The Seattle District has been conducting water quality monitoring of Lake Pend Oreille and the Pend Oreille River since 2005 in order to establish baseline information on the physical, chemical, and biological condition of Lake Pend Oreille and the Pend Oreille River. This baseline data allows the Seattle District to define the relationship between Albeni Falls Dam and the water quality in the Pend Oreille River downstream of Lake Pend Oreille. An understanding of the possible impact of Albeni Falls Dam on the water quality in the Pend Oreille River is of paramount importance because of the current, proposed, and possible future Lake Pend Oreille and Pend Oreille River Total Daily Maximum Loads (TMDLs) for various water quality parameters that may be implemented by the Idaho Department of Environmental Quality (IDEQ), the Washington State Department of Ecology (Ecology) and the United States Environmental Protection Agency (EPA).

Prior to the implementation of the flexible winter power operations plan, Lake Pend Oreille's pool elevation was held constant during the winter. However, the flexible winter power operations allows BPA to utilize up to 5 feet (2,051 feet to 2,056 feet) of flexibility available in Lake Pend Oreille during the winter instead of holding the winter pool at a constant elevation. The 5 foot fluctuation in the elevation of Lake Pend Oreille during the winter months may have an impact on the water quality of the nearshore areas of the lake. Because a nearshore nutrient TMDL exists on Lake Pend Oreille, the Seattle District will conduct a nearshore water quality sampling program during calendar year 2012 in Lake Pend Oreille. This sampling effort will monitor any possible impacts of the pool fluctuations on the nearshore water and sediment quality of Lake Pend Oreille.

This sampling and analysis plan provides details on the methods and protocols that will be used for the flexible winter pool water and sediment quality sampling at Albeni Falls Dam. This monitoring plan was developed in accordance with *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies* (Ecology 2001), and includes the following elements:

- Project organization and schedule
- Project description
- Sampling procedures
- Analytical procedures
- Data quality objectives
- Data assessment procedures and corrective actions
- Data management procedures and reporting.

Project Organization and Schedule

The following section will outline the project organization and schedule for the Pend Oreille River and Lake Pend Oreille water and sediment quality monitoring project.

Project Organization

The Seattle District is the project proponent and lead agency for the Albeni Falls Dam water and sediment quality monitoring program. The Seattle District is responsible for conducting all water and sediment quality monitoring. Albeni Falls Dam personnel will assist the Seattle District with collecting water and sediment samples in the Pend Oreille River and Lake Pend Oreille. A Washington State Department of Ecology or U.S. EPA approved water quality laboratory will be responsible for analysis of the water and sediment samples. Specific responsibilities of key personnel are shown below:

U.S. Army Corps of Engineers, Seattle District

Hydraulics and Hydrology Branch
Water Management Section
Seattle, WA 98124
(206) 764-5523
Carolyn Fitzgerald
Kent Easthouse

Branch Chief
Principal Investigator

U.S. Army Corps of Engineers, Albeni Falls Dam

Albeni Falls Dam Project Office
Old Town, ID 83822
(208) 437-3133
Joe Summers
Dennis Dopps

Chief of Operations
Boat Operator

Aquatic Research, Inc.

3927 Aurora Avenue North
Seattle, WA 98103
(206) 632-2715
Steven Lazoff

Laboratory Manager

Project Schedule

Water and sediment quality samples will be delivered to the laboratory within 24 hours of collection. The laboratory will report the analytical results to the Seattle District project manager within 30 days. The sample and quality control data will be reviewed by the quality assurance (QA) officer within 28 days. A draft project report will be completed within 12 weeks of receiving the final set of data from the laboratory. A final project report will be completed within 8 weeks of receiving comments on the draft project report.

Project Description

The following section will provide background information, project goals and objectives for the Pend Oreille River and Lake Pend Oreille water and sediment quality monitoring project.

Background Information

The Clark Fork-Pend Oreille River basin drains about 25,000 square miles in southern British Columbia, western Montana, northern Idaho, and northeastern Washington (Figure 1). The Clark Fork River originates in the Rocky Mountains of western Montana and flows northeast about 350 miles to Lake Pend Oreille. Major tributaries to the Clark Fork include the Flathead River, Blackfoot River, and Bitterroot River. The Pend Oreille River begins at the outlet of Lake Pend Oreille, flows eastward for about 29 miles to Albeni Falls Dam and then flows to the northeast for about 90 miles to the confluence with the Columbia River in British Columbia. Major tributaries to the Pend Oreille River include the Priest River (Figure 1).

Albeni Falls Dam is a United States Army Corps of Engineers (COE) project located near the Washington-Idaho border on the Pend Oreille River at river mile (RM) 90.1. The dam became operational in 1952 and is about 2.5 miles upstream and east of the city of Newport, Washington, 26 miles west of the city of Sandpoint, Idaho, and 29 miles downstream from Lake Pend Oreille (Figure 1). Lake Pend Oreille is a natural lake that is located in a glacially scoured basin in the Purcell Trench in Northern Idaho (Fields et al. 1996). The Clark Fork is the major inflow to the lake supplying about 85 percent of the surface water inflow to the lake and the outlet arm (Frenzel, 1991).

Current and Proposed Regulating Procedures

Although Lake Pend Oreille is a natural lake, Albeni Falls Dam is authorized for regulation of the lake level for flood control, navigation, fish and wildlife conservation, recreation, and power generation. Before the project became operational in 1952, the annual surface elevation of Lake Pend Oreille varied according to seasonal inflows, from an average fall/winter low of about 2,048.0 feet to an average spring runoff high of about 2,062.0 feet, with a maximum spring elevation of 2071.8 feet recorded on June 9, 1948 (COE 2000). After reaching a maximum elevation during spring runoff, the lake gradually receded to an elevation of about 2,050.0 feet by August and reached its minimum elevation of about 2,048.0 feet by October.

Current Lake Pend Oreille regulating procedures are briefly described below. After the spring runoff period is completed (usually late May to early July), Lake Pend Oreille is maintained in a 0.5-foot summer operation range between elevations 2,062.0 and 2,062.5 feet until the end of the summer recreation season. A fall drawdown generally begins after Labor Day and the lake is stabilized at a minimum control elevation for the winter typically by December 1. Historically, the Corps has drafted Lake Pend Oreille to a winter elevation 2,051 feet for kokanee spawning

and managed within a one-foot operating band through March. However, since 1995, IDFG requested the Corps to hold the lake at two different lake elevations (2,051 feet and 2,055 feet) to see if there was a kokanee egg-to-fry survival difference between the two elevations. Utilizing the results from this test IDFG determined that there would be sufficient gravel at elevation 2,051 feet for the number of kokanee spawning this year, and filling above to elevation 2,056 feet would have minimal impact to kokanee egg-to-fry survival. The lake is held at the minimum control elevation until April 1, after which spring runoff typically occurs and the lake is refilled during May and June. The current operation of Lake Pend Oreille maintains the lake at a summer elevation of about 2,062.0 to 2,062.5 feet compared to pre-dam conditions where summer elevations ranged from a high of about 2,062.0 feet in June to a low of about 2,050.0 feet in August and September (COE 2000).

Under the flexible winter power operations plan in operation since 2011, BPA may to utilize up to 5 feet (2,051 feet to 2,056 feet) of flexibility available in Lake Pend Oreille during the winter instead of holding the winter pool at a constant elevation. Such an operation would result in Lake Pend Oreille's pool fluctuating up to 5 feet during the winter months which is in contrast to historical operations in which the lake was held at a near constant elevation during the winter. The BPA can utilize this operating range from late December to the end of March in order to better meet the region's power needs. In addition, BPA contends that the flexible operations will also help the utility-owned run of the river hydro projects downstream of Albeni Falls Dam to meet utility loads more cost effectively. Operating between lake elevations of 2051 feet and 2056 feet from the end of kokanee spawning through April 1st is consistent with the existing operational limitations on the Albeni Falls project.

Nearshore Nutrient Total Maximum Daily Load

A nearshore Total Maximum Daily Load (TMDL) for nutrients was developed for Lake Pend Oreille in 2002 in response to an increasing trend in nuisance algal growth in the nearshore areas (TSWQC 2002). The TMDL is designed to set target and action levels for total phosphorus concentrations measured in the nearshore waters of Lake Pend Oreille. The TMDL identifies the nearshore waters as the littoral zone of the lake where light can penetrate to the bottom. For the purpose of implementing the TMDL, nearshore waters were determined to be those waters less than 50 feet in depth (TSWQC 2004). The Pend Oreille Lake nearshore TMDL established a lake wide nearshore average total phosphorus concentration of 9 µg/L with an action threshold of 12 µg/L during the summer months of June through September (TSWQC 2004). The June through September time frame represents the critical summer months when algae growth occurs in the nearshore areas (TSWQC 2004).

Project Goals and Objectives

The goal of the water quality sampling program is to establish baseline data for the nearshore areas of Lake Pend Oreille. This data will allow the Seattle District to properly address and respond to any future water and sediment quality issues for the nearshore areas of Lake Pend

Oreille that may be a result of the flexible winter elevations. Baseline nearshore water quality data will allow the Seattle District to understand the relationship between Albeni Falls Dam winter operations and the nearshore water quality in the Pend Oreille River and Lake Pend Oreille.

The objective of the monitoring program is to determine the existing physical, chemical, and biological condition of the nearshore areas of Lake Pend Oreille and the Pend Oreille River. Meeting this objective will allow the Seattle District to compare existing nearshore water quality to Idaho and Washington State standards, and the nearshore nutrient TMDL. This information will allow a better understand the role of Albeni Falls Dam winter operations on the nearshore water quality in Lake Pend Oreille.

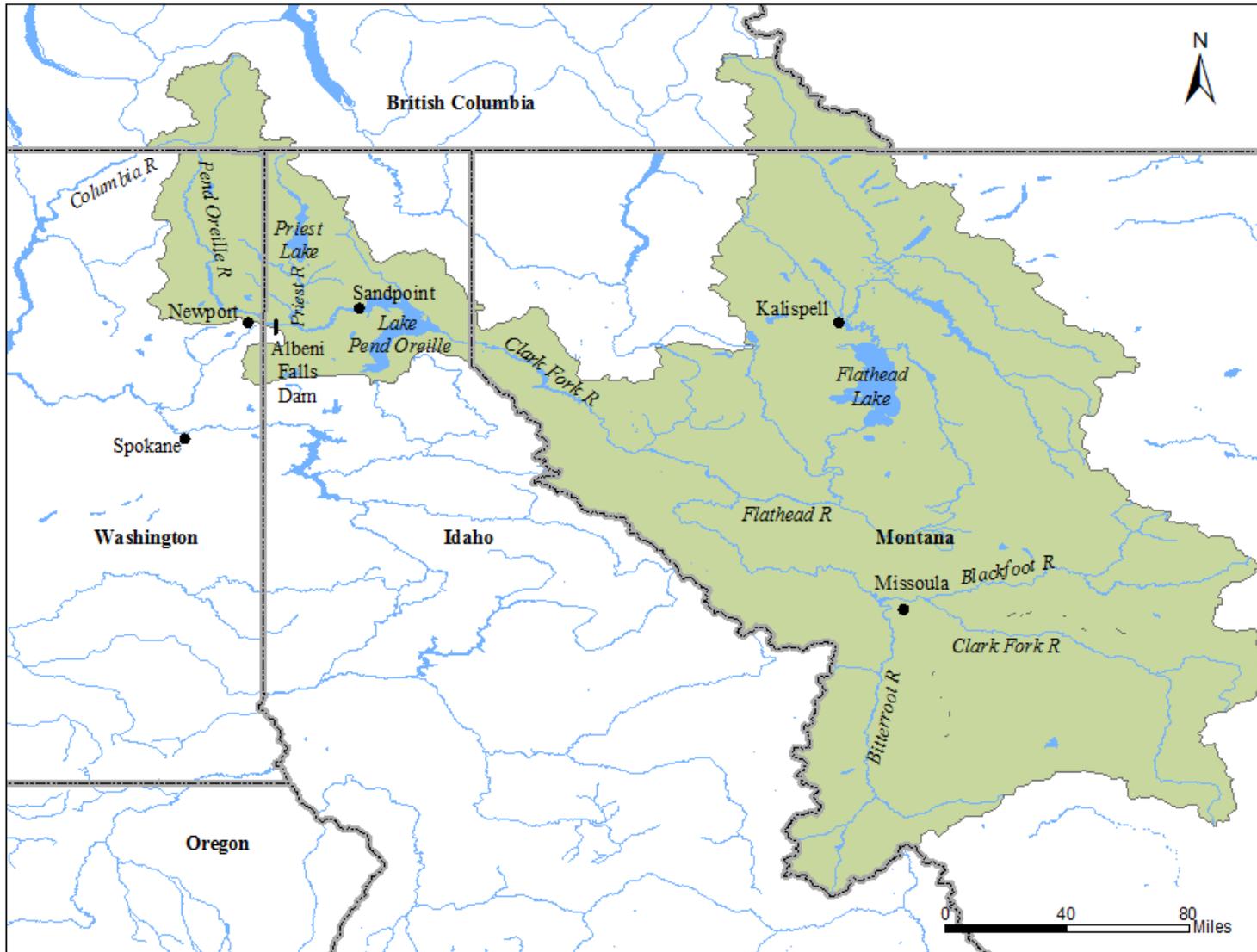


Figure 1. Location of the Clark Fork-Pend Oreille River watershed.

Sampling Procedures

Sampling procedures will generally follow Puget Sound Estuary Program (PSEP) protocols (U.S. EPA 1990, 1997) and United States Geological Survey (USGS) protocols (USGS 1999). Prior to each sampling event, the COE project manager will review sampling procedures and equipment needs with field technicians. This section identifies specific procedures for water and sediment sampling, preparing field notes, and decontaminating equipment. It also describes requirements for sample containers, preservation, holding times, identification, labeling, and handling.

Sampling Design

To meet the project goals and objectives described in the previous section, water quality will be monitored at five nearshore locations in Lake Pend Oreille where the lake is less than 50 feet deep at full pool (Figure 2). Sampling stations will be located in proximity to nearshore stations established for the TMDL water quality sampling program (TSWQC 2004). Water quality parameters of concern include temperature, pH, dissolved oxygen, alkalinity, nutrients (i.e. phosphorus and nitrogen) and Chlorophyll a (Table 1).

Water Sampling

From June through September 2012, water quality data will be collected at monthly intervals at five nearshore shallow water stations (i.e. Lake Pend Oreille depth less than 50 feet at full pool). One set of field duplicates will be collected to assess both environmental and analytical variability. Each sample will be analyzed for the parameters presented in Table 1.

All water quality sampling will be performed by two field technicians wearing new vinyl gloves and practicing clean hands-dirty hands field techniques. Samples will be collected by submerging a cleaned and decontaminated 3.0 liter (L) polycarbonate (Lexan) van-dorn style sampler with ultra-clean seals to depth and filling. If the lake is not stratified at the station, samples will be collected from four depths between the surface and bottom, and equally composited in laboratory-cleaned, prelabelled sample containers at the surface. If the lake is stratified, samples will be collected from four depths in the epilimnion and hypolimnion, and equally composited in laboratory-cleaned, prelabelled sample containers at the surface. Photic zone samples for chlorophyll a analysis will be collected from up to five depths in the photic zone, and compositing them into a clean 22 L bucket at the surface. Measurements of field parameters (see Table 1) will be performed in situ using a Hydrolab MiniSonde 5 multiprobe coupled with a Surveyor 4a surface display and recording unit. Equipment used for field measurements will be calibrated prior to each sampling event.

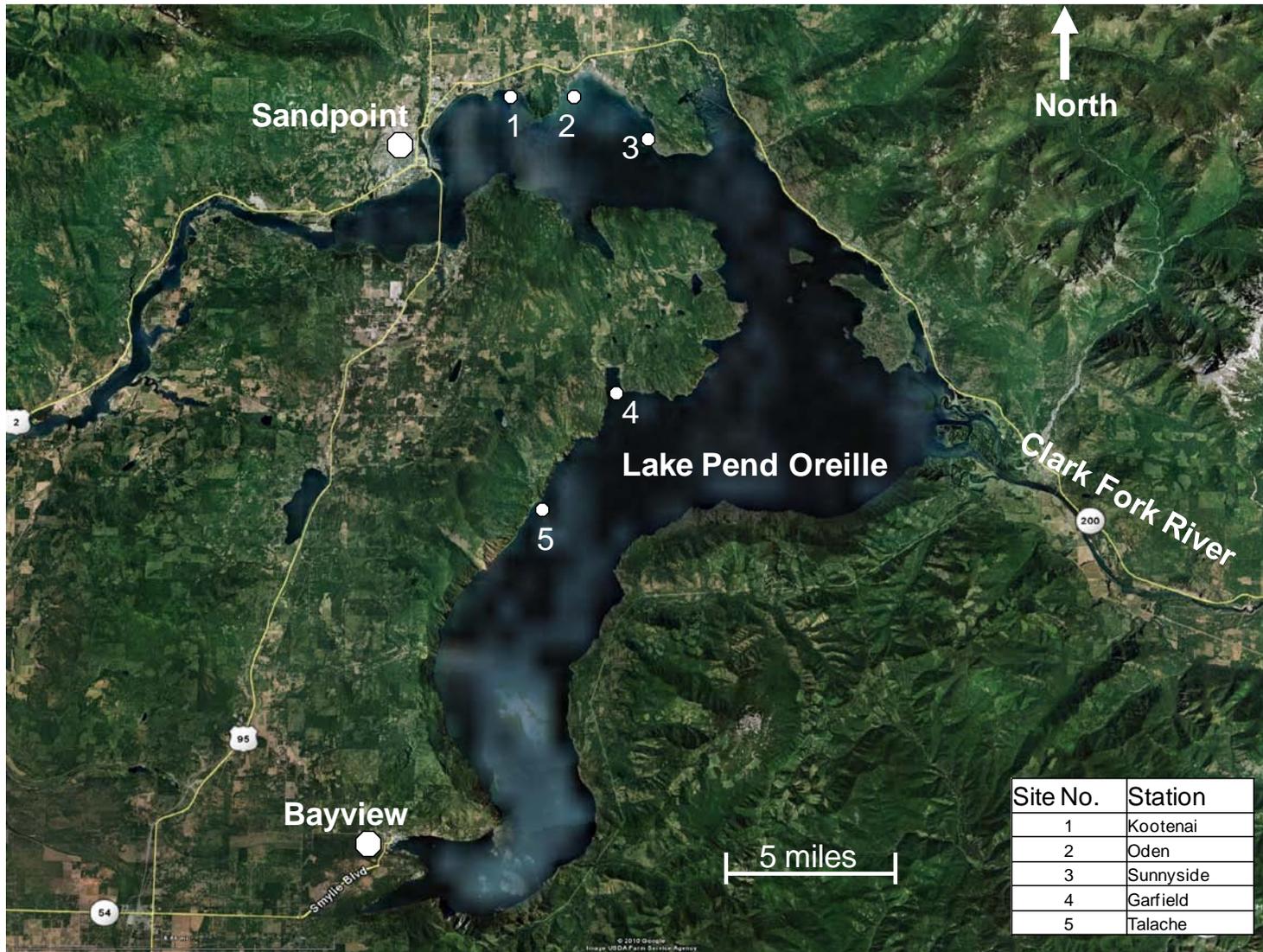


Figure 2. Locations of Lake Pend Oreille nearshore water quality monitoring stations.

Table 1. Methods and detection limits for water quality analyses.

	Method Number^a	Detection Limit/Unit	Container and Preservative	Holding Time
Field Parameters				
Temperature	SM 2550-B	0.1°C	—	Analyze
pH	SM 4500-H	—	P/G, 4° C	3 hours
Conductivity	SM 2510-B	1 µS/cm	P/G, 4° C	28 days
Dissolved Oxygen	SM 4500-O-G	0.1 mg/L	G, Dark	8 hours
Laboratory Chemical Parameters				
Total Phosphorus	EPA 365.1	0.002 mg/L	P/G, 4° C, H ₂ SO ₄ to pH<2	28 days
Soluble Phosphorus	EPA 365.1	0.001 mg/L	P/G, 4° C, filter immediately	48 hours
Total Nitrogen	SM204500N	0.050 mg/L	P/G, 4° C, H ₂ SO ₄ to pH<2	28 days
Nitrate+Nitrite	EPA 353.2	0.010 mg/L	P/G, 4° C, H ₂ SO ₄ to pH<2	28 days
Ammonia	EPA 350.1	0.005 mg/L	P/G, 4° C, H ₂ SO ₄ to pH<2	28 days
Alkalinity	EPA 310.1	1.00 mg/L	P/G, 4° C	14 days
Laboratory Biological Parameters				
Chlorophyll a	SM 1810200	0.0001 mg/L	P, 4°C, filter, add MgCO ₃	28 days

^a SM method numbers are from APHA et al. (2000); EPA method numbers are from U.S. EPA (1983, 1984, and 1992).

Equipment Decontamination

Sampling equipment used during the project will be decontaminated prior to collection of samples using the following procedure:

- Wash with phosphate-free detergent
- Rinse thoroughly with potable water
- Rinse thoroughly with deionized water.

Field Notes

At each water quality monitoring station, the following information will be recorded in a waterproof bound field notebook:

- Sampling date and name of sampler
- Time of sample collection, measurement, or observation
- Station location
- Weather and flow conditions
- Calibration results for field instruments
- Field measurements
- Number and type of samples collected
- Modifications of established sampling procedures.

Sample Containers, Preservation, and Holding Times

Pre-cleaned sample containers will be obtained from the analytical laboratory for the required analyses. Spare sample containers will be carried by the sampling team in case of breakage or possible contamination. Sample containers, preservation techniques, and holding times will follow PSEP (U.S. EPA 1997), U.S. EPA (40 Code of Federal Regulations [CFR] 136, July 1, 1992) and Ecology (2001) guidelines (see Table 1).

Sample Identification and Labeling

Each sample will be identified by its station number and the date of collection. Prior to filling, sample containers will be labeled with the following information using indelible ink:

- Station ID
- Date of collection (month/day/year)
- Time of collection (military format)
- Project ID
- Company/sampler initials.

Sample Handling

Pre-cleaned sample containers will be provided by the analytical laboratory and secured in a clean cooler prior to use. Samples will be stored at 4° C in a cooler and transported to the laboratory within 24 hours of collection. A chain-of-custody record will accompany the samples that clearly identifies the analytical parameters and methods.

Analytical Procedures

Analytical methods and detection limits are presented in Table 1. Field measurements of temperature, pH, conductivity, turbidity and dissolved oxygen will be conducted in situ using portable meters operated according to the manufacturer's directions and following standard measurement procedures (APHA, et al. 2000). Laboratory analytical procedures will follow U.S. EPA approved methods (APHA et al. 2000; U.S. EPA 1983, 1984). These methods provide detection limits that are below the state and federal regulatory criteria or guidelines, and will enable direct comparison of analytical results with these criteria.

The laboratory used for this project will be certified by Ecology and participate in audits and interlaboratory studies by Ecology and U.S. EPA. These performance and system audits have verified the adequacy of the laboratory standard operating procedures, which include preventative maintenance and data reduction procedures.

The laboratory will report the analytical results within 30 days of receipt of the samples. Sample and quality control data will be reported in a standard format. The reports will also include a case narrative summarizing any problems encountered in the analyses.

Data Quality Objectives

The overall quality assurance objective is to ensure that data of known and acceptable quality are obtained. All measurements will be performed to yield consistent results that are representative of the media and conditions measured. Specific objectives and procedures for precision, accuracy, representativeness, completeness, and comparability are identified below. In this document, the term “detection limit” refers to the practical quantitation level established by the laboratory, not the method detection limit.

- **Precision.** Precision will be assessed using a laboratory duplicate that will be analyzed at random with every sample batch (i.e., sampling event) and a field duplicate that will be analyzed at a frequency of at least 5 percent of the total number of samples submitted (i.e., one in 20 samples). For inorganic analysis and total organic carbon, the relative percent difference (RPD) of laboratory duplicates will be less than or equal to 25 percent for values that are greater than 5 times the detection limit, and ± 2 times the detection limit for values that are less than or equal to 5 times the detection limit.
- **Accuracy.** Accuracy will be assessed using laboratory preparation blanks, matrix spikes, and control standards. Where applicable, these quality control analyses will be performed for every sample batch at a frequency of at least 5 percent of the total number of samples submitted. The values for blanks will not exceed 2 times the detection limit. For inorganic analysis and total organic carbon, the percent recovery of matrix spikes will be between 75 and 125 percent. The percent recovery of control standards for all samples will be between 80 and 120 percent.
- **Representativeness.** Sample representativeness will be ensured by employing consistent and standard sampling procedures.
- **Completeness.** A minimum of 95 percent of the sample analysis results reported by the laboratory will be judged valid. It is anticipated that all samples will be collected. An equipment checklist will be used to prevent loss of data resulting from missing containers or inoperable instruments prior to embarking on field sampling trips.
- **Comparability.** Data comparability will be ensured through the application of standard sampling procedures, analytical methods, units of measurement, and detection limits. The results will be tabulated in standard spreadsheets for comparison with threshold limits and background data.

Data Assessment Procedures and Corrective Actions

Field and laboratory data will be reviewed by the quality assurance officer immediately upon receipt. Quality control problems and corrective actions will be summarized in a quality assurance worksheet. Values associated with minor quality control problems will be considered estimates and assigned a “J” qualifier. Values associated with major quality control problems will be rejected and assigned an “R” qualifier. Estimated values may be used for evaluation purposes, while rejected values will not be used. Data assessment procedures are described below for the following quality control elements:

- Completeness
- Methodology
- Holding times
- Blanks
- Detection limits
- Laboratory duplicates
- Matrix spikes
- Control standards.

Completeness

Completeness will be assessed by comparing valid sample data with this quality assurance project plan and the chain-of-custody records. Completeness will be calculated by dividing the number of valid values by the total number of values. Samples will be reanalyzed or re-collected if completeness is less than 95 percent.

Methodology

Methodology will be assessed by examination of the field notebook and laboratory reports for deviation from this quality assurance project plan. Unacceptable deviations will result in rejected values (R) and will be corrected for future analyses.

Holding Times

Analysis dates will be reported by the laboratory. Holding times will be assessed by comparing analytical dates to sample collection dates and times. Values that exceed the maximum holding

time required by U.S. EPA (1992 and 1996) will be considered estimates (J), whereas severe exceedances will result in rejected values (R).

Blanks

Preparation blanks consisting of de-ionized distilled water will be analyzed and the results will be reported in each laboratory report. Sample values that are less than 5 times a detected blank value will be considered estimates (J).

Detection Limits

Detection limits will be reported in each laboratory report. If proposed detection limits are not met by the laboratory, the laboratory will be requested to reanalyze the samples and/or revise the method, if time permits.

Laboratory Duplicates

Precision of laboratory duplicate results will be presented in each laboratory report. Data for batch samples (i.e., samples from other projects analyzed with samples from this project) will be acceptable as long as project sample duplicates are analyzed at a frequency of at least 5 percent. Precision of field and laboratory duplicate results will be calculated according to the following equation:

$$RPD = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2) / 2}$$

where:

- RPD = relative percent difference
- C₁ = larger of two values
- C₂ = smaller of two values.

Laboratory duplicate results exceeding the objectives will be noted in the quality assurance worksheets, and associated values will be flagged as estimates (J). If the objectives are severely exceeded (e.g., more than twice the objective), then associated values will be rejected (R). Field duplicate results exceeding the objectives will be noted and only used to flag data upon consideration of all quality control data.

Matrix Spikes

Accuracy of matrix spike results will be presented in each laboratory report. Data for batch samples will be acceptable as long as spikes of project samples are analyzed at a frequency of at least 5 percent. Accuracy of matrix spike results will be calculated according to the following equation:

$$\%R = \frac{(S - U) \times 100\%}{C_{sa}}$$

where:

%R	=	percent recovery
S	=	measured concentration in spike sample
U	=	measured concentration in unspiked sample
C _{sa}	=	actual concentration of spike added.

If the analyte is not detected in the unspiked sample, then a value of zero will be used in the equation.

Results exceeding the objective will be noted in the quality assurance worksheets, and associated values will be flagged as estimates (J). However, if the percent recovery exceeds 125 and a value is less than the detection limit, the result will not be flagged as an estimate. Nondetected values will be rejected (R) if percent recovery is less than 30 percent.

Control Standards

Accuracy of control standards will be presented in each laboratory report and checked by the quality assurance officer. Accuracy for these elements will be calculated according to the following equation:

$$\%R = \frac{(M - T) \times 100\%}{T}$$

where:

%R	=	percent recovery
M	=	measured value
T	=	true value.

Results exceeding the objective will be noted in the quality assurance worksheets, and associated values will be flagged as estimates (J). If the objectives are severely exceeded (e.g., more than twice the objective), then associated values will be rejected (R).

Data Management and Reporting

Water quality data will be entered in a numerical format in a Microsoft Excel spreadsheet following a quality assurance review. The results will be arranged chronologically for each station by sampling date across the spreadsheet columns. Data flags will be entered in separate columns adjacent to each data column using the following coding system:

- U = Analyte not detected at specified detection limit
- J = Estimated value
- R = Rejected value.

A monitoring report will be prepared upon completion of the data review and entry. This report will provide background information, data collection and analysis methods, tabulated and graphical presentations of the data, statistical test results, discussion of the results, conclusions, references, and appendices. Laboratory reports and quality assurance worksheets will be included in the monitoring report. Any problems and associated corrective actions taken will be reported. Specific quality assurance information that will be noted in the report includes the following:

- Changes in the monitoring/quality assurance plan
- Results of performance and/or system audits
- Significant quality assurance problems and recommended solutions
- Data quality assessment in terms of precision, accuracy, representativeness, completeness, comparability, and detection limits
- Discussion of whether the quality assurance objectives were met, and the resulting impact on decision-making
- Limitations on use of the measurement data.

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