REVISED DRAFT

SAMPLING AND ANALYSIS PLAN
POST REMOVAL SAMPLING

Bonneville Dam Project
Cascade Locks, Oregon

January 2003

Prepared for:

U.S. Army Corps of Engineers
Portland District
333 SW First Avenue
Portland, Oregon 97208-2946

Prepared by:

URS
111 S.W. Columbia, Suite 900
Portland, Oregon 97201-5814
25692710

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The U.S. Army Corps of Engineers (USACE) has contracted URS Corporation (URS) to collect sediment samples offshore of Bradford Island. The information collected will be used to determine the nature and extent of contamination remaining after the retrieval of in-water debris offshore of Bradford Island.

Bradford Island is part of the Bonneville Lock and Dam, located within the Columbia River, near Cascade Locks, Oregon. The Bonneville Lock and Dam is located on the Columbia River at river mile 146.1, approximately 40 miles east of Portland, Oregon. USACE is the owner of the Bradford Island Landfill, and is in the process of investigating the landfill. USACE is conducting the landfill investigation under the oversight of the Oregon Department of Environmental Quality (DEQ), through the Voluntary Cleanup Program..

This Sampling and Analysis Plan (SAP) addresses the Detailed Statement of Work prepared by the USACE for Contract No. DACW57-99-D-0005, Task Order No. 0004, Modification 006: Bradford Island Post Removal Sampling (dated June 27, 2002). The work described within this SAP will occur in the water off the north and east shorelines of Bradford Island, and in the area of the catch basin system located just west of the landfill (near the sandblast building).

This SAP is one of the four components that constitute the Management Plans for this phase of work at the Bradford Island site. The Management Plans include a Work Plan, this SAP, an Accident Prevention Plan, and a Dive Safety Plan. The SAP has two major components: Part I - the Field Sampling Plan (FSP) and Part II - the Quality Assurance Project Plan (QAPP). The FSP presents the detailed scope of work associated with field activities (e.g., sample groups and sample locations) and specifies the procedures to be used for sampling and other field operations. The QAPP describes the analytical data quality objectives, laboratory analytical procedures, quality assurance and quality control (QA/QC) procedures, and data quality evaluation criteria.

The purpose of the SAP is to establish procedures that will produce high quality data that meet the project objectives and requirements and accurately characterize measurement parameters. This SAP provides the protocols for collecting samples, measuring and controlling data, and documenting field and laboratory data.

TABLE OF CONTENTS

Executive Summary i

List of Abbreviations v

Section 1 Project Description 1-1

1.1 Site Location and Features 1-1

Section 2 Project Organization and Responsibilities 2-1

2.1 Introduction 2-1
2.2 USACE Project Manager – Mark Dasso 2-1
2.3 USACE Technical Manager – Paul Huebschman 2-1
2.4 USACE Site Contact – Brian McCavitt 2-1
2.5 USACE Dive Safety Officer – Don Hibbs 2-1
2.6 DEQ Project Manager – Matt McClincy 2-2
2.7 URS Project Manager – Jeff Wallace 2-2
2.8 URS Analytical Chemistry Task Manager – Madi Novak 2-2
2.9 URS Field Manager – Chris Moody 2-2
2.10 URS Independent Technical Reviewer – David Weymann 2-2
2.11 Subcontractor Services 2-3

Section 3 Scope and Objectives 3-1

Section 4 Field Activities 4-1

4.1 Source Area Sediment Sampling 4-1
4.1.1 Sample Locations 4-1
4.1.1.1 Temporal 4-1
4.1.1.2 Grid 4-2
4.1.1.3 Transect 4-2
4.1.2 Sample Methods 4-2
4.1.3 Sample Analysis 4-3
4.2 Potential Depositional Sediment Sampling 4-3
4.2.1 Sample Locations 4-3
4.2.1.1 Depositional 4-4
4.2.1.2 Southeast Side of Bradford Island 4-4
4.2.2 Sample Methods 4-4
4.2.3 Sample Analysis 4-5
4.3 Goose Island Sampling 4-5
4.3.1 Sample Locations 4-5
4.3.2 Sample Methods 4-5
4.3.3 Sample Analysis 4-6
4.4 Fish Ladder Disposal Pile 4-6
4.4.1 Sample Locations 4-6
4.4.2 Sample Methods 4-6
4.4.3 Sample Analysis 4-6
4.5 Reference Sediment Sampling 4-6
4.5.1 Sample Locations 4-6
4.5.2 Sample Methods 4-7

4.5.3 Sample Analysis 4-7
4.6 Sediment Contaminant Bioavailability Analysis 4-7
4.6.1 Sample Locations 4-7
4.6.2 Sample Methods 4-7
4.6.3 Sample Analysis 4-7
4.7 Water Column Sampling 4-7
4.7.1 Sample Locations 4-7
4.7.2 Sample Methods 4-7
4.7.3 Sample Analysis 4-8
4.8 Site-Specific Sampling and Analysis Contingencies 4-8
4.9 Field QA/QC Sampling 4-9

Section 5 Sample Chain-of-Custody Documentation 5-1

5.1 Field Logbooks 5-1
5.2 Video and Photographs 5-1
5.3 Sample Numbering System 5-2
5.4 Sample Documentation 5-2
5.4.1 Sample Labels 5-2
5.4.2 Field Sampling Sheets 5-3
5.4.3 Chain-of-Custody Records 5-3
5.5 Corrections to Documentation 5-4

Section 6 Sample Packaging and Shipping 6-1

6.1 Sample Packaging 6-1
6.2 Sample Shipping 6-1

Section 7 Investigation-Derived Wastes (IDW) 7-1

7.1 Waste Storage and Handling 7-1
7.2 Drum Labeling 7-1

Section 8 Contractor Quality Control 8-1

8.1 Introduction 8-1
8.2 Preparatory Phase 8-1
8.3 Initial Phase 8-2
8.4 Daily Quality Control Reports 8-2

Section 9 Corrective Actions 9-1

Section 10 Sampling Equipment and Field Instrumentation 10-1

Section 11 References 11-1

TABLES

Table 2-1 Subcontractors and Services
Table 4-1 Sample Summary
Table 4-2 Sampling Method Flowchart
Table 4-3 Sample Sequence Summary
Table 4-4 Field QA/QC Samples

Table 4-5 Laboratory Container, Preservation, and Holding Times for Sediment
Table 4-6 Laboratory Container, Preservation, and Holding Times for Water

FIGURES

Figure 1-1 Vicinity Map
Figure 1-2 Site Plan
Figure 4-1 Sampling Stations
Figure 4-2 Sampling Locations – Source Area
Figure 4-3 Sampling Locations – Depositional and Reference
Figure 4-4 Sampling Locations – Goose Island
Figure 4-5 Sampling Locations – Bioavailability and Water Column Samples

APPENDICES

Appendix A Standard Operating Procedures
Appendix B Forms

LIST OF ABBREVIATIONS

AVS	acid volatile sulfide
AWS	auxiliary water supply
CFS	cubic feet per second
COC	Chain-of-Custody
CQAB	USACE Chemical Quality Assurance Branch
CQR	contractor quality control
DEQ	Oregon Department of Environmental Quality
DOC	dissolved organic carbon
DQCR	daily quality control report
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
GPS	global-positioning system
IDW	investigation derived waste
Kw	Kilowatts
LIMS	laboratory information management system
MSL	mean sea level
MS/MSD	matrix spike/matrix spike duplicate
NWTPH-Dx	northwest total petroleum hydrocarbons-diesel and heavy oil range
PCBs	polychlorinated biphenyls
PCOI	preliminary contaminant of interest
PPE	personal protective equipment
PSEP	Puget Sound Estuary Program
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance and quality control
SAP	Sampling and Analysis Plan
SEM	simultaneously extractable metals
SOP	standard operating procedure
SOW	Statement of Work
SVOCs	semivolatile organic compounds
TOC	total organic carbon
TSS	total suspended solids
URS	URS Corporation
USACE	U.S. Army Corps of Engineers
USCS	Unified Soil Classification System
USFS	United States Fish and Wildlife
VOCs	volatile organic compounds

1.0 PROJECT DESCRIPTION

Bradford Island is located in the southwest quadrant of Section 22, Township 2 North, Range 7 East, Willamette Meridian, and within the state of Oregon. Bradford Island is part of the Bonneville Lock and Dam, which spans the Columbia River between Oregon and Washington (Figure 1-1). The Bradford Island Landfill is a former waste disposal site, situated on the eastern (upstream) end of Bradford Island.

During hydrographic and underwater dive surveys conducted in October and November 2000, the U.S. Army Corps of Engineers (USACE) identified the presence of waste-related items submerged in the Columbia River, just offshore of the landfill. Some of these items included electrical components that contained polychlorinated bipheynls (PCBs). Most of the identified electrical items were located near three debris piles located in shallow water, along the north and east shorelines of the island. USACE conducted an investigation of the river to help assess the extent and impacts of site-related contaminants. The scope of the investigation was based on Oregon Department of Environmental Quality (DEQ) and United States Fish and Wildlife (USFW) input and included sampling and analysis of water, sediment, and benthic aquatic specimens. PCBs were detected in all matrices. The findings of this investigation are presented in the In-Water Investigation Report, Bradford Island Landfill (URS, 2002a). The in-water debris was removed in February and March, 2002. The removal activities are described in the Technical Memorandum, In-Water Removal Work (URS, 2002b).

This Sampling and Analysis Plan (SAP) consists of a Field Sampling Plan (FSP) in conjunction with the Quality Assurance Project Plan (QAPP). The FSP was prepared in general accordance with Bradford Island Post Removal Sampling project (hereinafter referred to as “post removal sampling”) outlined in the Detailed Statement of Work prepared by the USACE for Contract No. DACW57-99-D-0005, Task Order No. 0004. Modification No. 006 (dated June 27, 2002). The FSP provides the detailed scope of work for field activities (e.g., sample groups, sample locations, etc.) and specifies the procedures to be used during the post removal sampling at Bradford Island.

The purpose of this investigation is to establish the nature and extent of contamination remaining in the sediments after the removal of debris and to collect data that may be used in a Level 1 and Level II Ecological and Human Health Risk Assessment.

1.1 SITE LOCATION AND FEATURES

The Bonneville Dam is the most downstream dam within the Columbia-Snake River navigation system that consists of eight locks and dams. The dam is located at 45° 38. 27 N - 121° 56. 31 W. Bonneville Lock and Dam create a 48-mile-long reservoir from the Bonneville Dam upstream to the Dalles Dam. The river at the dam is divided into three channels by two islands, Bradford and Cascade Islands. The tailrace for the first powerhouse forms one channel, the

spillway channel the middle channel, and the tailrace channel for the second powerhouse the third channel (Figure 1-2).

The major features of the dam complex include the spillway, two powerhouses, two navigation locks, and a fish hatchery. The fish hatchery, main office, and navigation lock visitor center are located on the Oregon shore of the Columbia River. A warehouse and automotive garage facility, and navigation lock support facilities are located on Robins Island. The major features on Bradford Island include the visitor center, fish ladders, the service center building, the equipment building, and the sandblast building. A fish ladder is also located on Cascades Island, and a second visitor center is located on the north shore of the Columbia River in Washington State.

The old navigation lock is located adjacent to the first powerhouse and is no longer in use. The upstream side of the old navigation lock consists of an end sill where the lock doors are located that extends from the riverbed to an elevation of 40 feet mean sea level (msl). The current navigation lock is located immediately south of the old navigation lock and has an end sill that extends up to an elevation of 51 feet msl.

The first powerhouse has a flow capacity of approximately 128,000 cubic feet per second (cfs) and a rated power output of 526,700 kilowatts (kW) (USACE, 2000). The second powerhouse has a flow capacity of approximately 160,000 cfs and a rated power output of 558,200 kW (USACE, 2000).

The normal operating range for the Bonneville pool is between 71.5 feet msl elevation and 76.5 feet msl as measured at the dam. The tailwater elevation varies in direct relationship to the river flow from about 7.0 feet msl at 70,000 cfs to 36.3 feet msl at a river flow of 660,000 cfs (USACE, 1998).

An authorized federal navigation channel in this reach of the river is 300 feet wide and 27 feet deep, although the depth is currently maintained at 17 feet (USACE, 1991). Bathymetric surveys conducted by the USACE indicate that the depth of the pool near the Bonneville Dam ranges from a few feet to over 100 feet.

The spillway is a concrete, gravity structure with eighteen 50-foot-wide bays separated by 10-ft-wide piers. The spillway releases are controlled by eighteen 50-foot-wide by 60-ft-high spillway gates. The crest of the spillway is at 24.0 feet msl.

The landfill site is in the northeast corner of Bradford Island and is located within the State of Oregon. The landfill is not currently used as a part of the routine operation of the Bonneville Lock and Dam and is managed long term as a wildlife habitat for geese under the Bonneville Master Plan. The elevation of the ground surface on the east side (upstream side) of Bradford Island ranges from 110 feet msl to 130 feet msl.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 INTRODUCTION

This section defines the overall project organization, identifies the project team, indicates each team member's responsibilities, and provides URS' approach to management of the project team.

The primary members of the project team are listed below. The following is a brief discussion of the project team members' responsibilities.

2.2 USACE PROJECT MANAGER – MARK DASSO

The USACE Project Manager is responsible for directing the removal action in accordance with the USACE scope of work. He will monitor project progress by reviewing the monthly reports provided by the URS Project Manager. The USACE Project Manager may initiate delivery order modifications to address changing project requirements or unforeseen circumstances, if such modifications are deemed necessary to achieve the project objectives. He will be notified by telephone and email in advance of fieldwork by the URS Project Manager. Mr. Dasso's phone number is (503) 808-4728.

2.3 USACE TECHNICAL MANAGER – PAUL HUEBSCHMAN

The USACE Technical Manager will work with the URS Project Manager and URS Field Manager to ensure the work is completed in accordance with USACE engineering manuals and regulatory guidance. The USACE Technical Manager may initiate delivery order modifications to address changes to project requirements. Mr. Huebschman will be notified by telephone and e-mail in advance of the fieldwork by the URS Project Manager. Mr. Huebschman's phone number is (503) 808-4914.

2.4 USACE SITE CONTACT – BRIAN MCCAVITT

The USACE Site Contact will coordinate the site work. Primary tasks will include providing access to the Bradford Island Landfill site and notifying USACE personnel of sampling activities at the site. Mr. McCavitt will be notified by telephone and e-mail in advance of fieldwork by the URS Project Manager. Mr. McCavitt's phone number is (541) 374-4575.

2.5 USACE DIVE SAFETY OFFICER – DON HIBBS

The USACE Dive Safety Officer will review the dive safety plan generated by the dive contractor for compliance with USACE requirements. He will also provide oversight of the contractor on diving specific issues. Mr. Hibbs' phone numbers are (541) 374-4591 (office) and (541) 980-1900 (mobile).

2.6 DEQ PROJECT MANAGER – MATT McCLINCY

The DEQ Project Manager may provide oversight during field activities at the Bradford Island Landfill site. He will be notified by telephone at least five days before starting field work by a USACE representative. Issues or concerns identified by the DEQ Project Manager will be directed to the USACE Project Manager, Mark Dasso. Mr. McClincy's phone number is (800) 452-4011.

2.7 URS PROJECT MANAGER – JEFF WALLACE

The URS Project Manager has overall responsibility for project activities and monitoring of the project progress. The URS Project Manager is responsible for planning, scheduling, cost control, and documenting completion of project tasks. The Project Manager also has overall responsibility for the development and implementation of this Work Plan, for monitoring the quality of the technical and managerial aspects of the project, interfacing with the USACE, and ensuring the timeliness of project deliverables. The URS Project Manager can be reached by telephone at (503)-948-7242.

2.8 URS ANALYTICAL CHEMISTRY TASK MANAGER – MADI NOVAK

The Analytical Chemistry Task Manager will be the QA manager for analytical chemistry. She will perform oversee the analytical laboratories and direct the review of chemical data. She will work closely with the URS Project Manager, the URS Field Manager, and the analytical laboratory. The Analytical Chemistry Task Manager can be reached by telephone at (503) 478-2766.

2.9 URS FIELD MANAGER – CHRIS MOODY

The URS Field Manager is responsible for coordinating and overseeing the field and field laboratory operations conducted by URS, including compliance with the SAP, change orders, scheduling, liaison with USACE, sample record-keeping, and inventorying and documenting waste removal activities. The URS Field Manager will also function as the Site Health and Safety Officer, and will be responsible for implementing of the Accident Prevention Plan, including reviewing its contents with project personnel, confirming that personnel have received the required health and safety training, determining personal protection levels, providing necessary personal protective equipment and supplies, and correcting any unsafe work practices. The URS Field Manager can be reached by telephone at (503)-948-7208.

2.10 URS INDEPENDENT TECHNICAL REVIEWER – DAVID WEYMANN

The URS Independent Technical Reviewer will perform an independent technical review of all project deliverables prepared under this contract and delivery order. The reviewer will not be

involved in the preparation of the documents. The Independent Technical Reviewer can be reached by telephone at (503) 478-2769.

2.11 SUBCONTRACTORS AND SERVICES

Table 2-1 lists subcontractors and the services they will provide for this project.

3.0 SCOPE AND OBJECTIVES

The detailed Statement of Work (SOW; date June 27, 2002a) provided to URS by the USACE required preparation of plans to investigating the nature and extent of contamination in the Bonneville forebay area, due to the presence of the waste-related items. Specific sampling objectives are to:

- Collect data to define the nature and extent of sediment impacts
- Evaluate upstream contributions to sediment impacts
- Define preliminary contaminants of interest (PCOIs)
- Collect data for the risk scoping process
- Collect data for the risk screening process

Data quality objectives for each sample group are discussed in the work plan in Table 5-1.

The results of this investigation will be used to identify potential problem chemicals or areas within the Bonneville forebay, make decisions for additional investigations, and to attempt to link chemical sources to sediment contamination. The identification of potential problem chemicals or areas will be based on exceedances of the screening level risk assessment.

4.0 FIELD ACTIVITIES

The following section describes in detail the sampling methods and procedures for the Bradford Island Landfill Post Removal Sampling. Ten sample groups will be collected in order to define the nature and extent of sediment contamination. Two sample groups will be collected in order to provide information for fate and transport and risk assessment conceptual modeling. The sample groups are listed in Table 4-1 along with sample methods and analyses. Table 4-2 details the priority of sampling method for each area. Table 4-3 lists the order in which sediment samples will be collected. Figure 4-1 presents a summary of sample locations. Figures 4-2 through 4-5 present sample location coordinates.

4.1 SOURCE AREA SEDIMENT SAMPLING

The following sections describe the locations and procedures for the collection of sediment samples in the area of the former debris piles and catchbasin outfalls. Three sample groups will be collected within the source area: temporal samples, grid samples, and transect samples. A sample summary describing the sample groups and collection methods is presented in Table 4-1. Collection of sediment samples from the source areas will assist in the characterization of the nature and extent of sediment contamination.

4.1.1 Sample Locations

Sample locations and coordinates are presented on Figure 4-2. With the exception of two the temporal sediment samples (see Section 4.1.1.2), sediment sampling locations are approximate. If the amount of sediment available at the intended sample location is not adequate for sample analysis, the sample location may be field determined according to sediment availability within approximately ten feet of the original sample coordinates.

Surface samples will be collected at a zero to six-inch depth interval at all source area locations. If the surface sample is collected less than the six-inch depth interval due to a rocky subsurface, the actual sediment sampling depth will be noted. Subsurface sample collection will be attempted in areas that may be depositional (between Pile #3 and the spillway, as described in Section 5.1 of the Work Plan). Previous investigations in the source area east of Pile #3 have established that the river bottom consists mostly of gravel and cobble and that subsurface sampling is not feasible.

4.1.1.1 Temporal

Samples will be collected in areas previously sampled in order to determine whether temporal changes in sediment contamination exist.

A total of four surface sediment samples will be collected. Two of the sediment samples will be collected at locations previously sampled and exhibiting high PCB Aroclor concentrations. global positioning system (GPS) coordinates are known for these two samples. Two additional

sediment samples will be collected from areas from which highly contaminated sediment was removed. While GPS coordinates are not available for these locations, the vicinity is known, and samples will be collected from these areas.

4.1.1.2 Grid

Unbiased sampling in the source area in a grid formation will assist in the characterization of nature and extent of contamination. The grid sampling scheme allows for good coverage of this area and to allows a higher level of confidence in detecting areas of elevated sediment impacts.

Thirty-six surface samples will be collected at regular intervals from within a grid encompassing the source areas (i.e., former debris piles and catchbasin outfalls). Of these 36 locations, subsurface sampling will be attempted in 19 locations (Figure 4-2) and up to eight samples will be submitted for analysis. If more than eight subsurface samples are retrieved, samples will be selected for analysis based on visual observation of grain size (i.e., the more fine grained samples will be submitted for analysis)

4.1.1.3 Transect

Unbiased sampling in the source area in a transect formation will assist in the characterization of the lateral extent of contamination.

Sixteen surface samples will be collected along transects originating in the source areas and extending beyond the area encompassed by the grid. Of these 16 locations, subsurface sampling will be attempted in 6 locations.

4.1.2 Sample Methods

Sediment samples will be collected using one of two methods: a standard sampling method or with diver assistance. Standard sampling methods, including a box core or grab sampler (e.g., Van Veen or ponar) will be attempted first at the potential depositional locations noted on Figure 4-2. The standard operating procedures (SOP) for standard sampling methods are presented in Appendix A. If sediment is not retrieved with a standard sampling method, a diver will collect a surface sample with a stainless steel spoon. The diver will position the container down current in an attempt to capture any fines, and will place sediment into the container. The sampling method priority is presented in Table 4-2.

After a sample is collected, it will be given to URS for logging and proper handling and labeling. The following information will be noted for each sediment sample and recorded on a sediment sampling form (Appendix B):

- Sediment samples will be classified by a URS geologist according to the Unified Soil Classification System.
- Depth from which the sediment was collected, based on the diver's estimate (e.g., 0-2, 0-6, 6-18 inches).

- Physical characteristics of the sediment, including color, texture, odor/sheen, benthic organisms, depth of bioactive layer, vegetation, presence of grit, and any other observations.
- Sample location coordinates will be collected using a hand-held range finder and precise GPS equipment to establish the coordinates of the sample location. The hand-held range finder will pinpoint the location of the diver, and the GPS equipment will establish the coordinates of that location. GPS equipment used will provide sub-meter accuracy.
- Water depth at each sample location will be collected. This information will be collected from the boat depth sounder the requested from the dive master.
- Samples will be collected in precleaned and certified (under chain-of-custody) containers supplied by the contract analytical laboratory (Table 4-4). Each sample will be given a unique sample identification number. The samples will be labeled according to the procedure outlined in Section 5.3 of this FSP. Each cooler should contain enough ice to maintain the samples at 4ºC + 2ºC during continued sample collection and shipping.
- Non-dedicated sampling equipment will be decontaminated as specified in Appendix A.

4.1.3 Sample Analysis

Sediment samples will be submitted to the contract laboratory for analysis. Analytical testing is summarized in Table 4-1. Extra volume will be collected for all samples and will be frozen and archived at the laboratory for one year for future potential analysis.

4.2 POTENTIAL DEPOSITIONAL SEDIMENT SAMPLING

The following sections describe the locations and procedures for the collection of sediment samples in potential depositional areas. Potential depositional areas are defined as those locations modeled by the USACE to exhibit relative low bottom velocity. (Refer to the Work Plan for discussion of depositional areas.) Two sample groups will be collected within the depositional areas: depositional samples and a southeast side of Bradford Island sample. A sample summary describing the sample groups and collection methods is presented in Table 4-1. Collection of sediment samples in the potential depositional areas will assist in the characterization of the nature and extent of sediment contamination.

4.2.1 Sample Locations

Sample locations and coordinates are presented on Figure 4-3. Surface samples will be collected at the zero to six-inch depth interval. Subsurface sample collection will be attempted at the six to 18-inch depth interval. Previous investigations have established that the river bottom consists mostly of course grained materials (sand to cobbles), making sampling at subsurface depths infeasible. However, the potential depositional sampling locations have been located specifically to capture areas likely to be affected by sediment deposition. Therefore, subsurface sample collection will be attempted in these locations.

4.2.1.1 Depositional

Bonneville Dam Forebay locations modeled to experience relative low velocities may be depositional. These modeled locations will be sampled to determine if impacted sediments are transported from the source area to the depositional zones.

Thirteen surface and 13 subsurface samples will be collected in areas that may be depositional.

4.2.1.2 Southeast Side of Bradford Island

Sample collection will be attempted off of the southeastern shore of Bradford Island. This area was not modeled as a depositional zone, however due to detections of PCBs downstream of source former Pile #1, sample collection will be attempted in this area. Sample collection will be attempted at 100-foot intervals for a total of 14 attempted sample locations. One surface and one subsurface samples that exhibit depositional characteristics (i.e., exhibit higher percentages of fine-grained sediments) will be selected for analysis. Sample locations and coordinates are presented on Figure 4-3.

4.2.2 Sample Methods

Sediment samples will be collected using the following methods. Sample collection will first be attempted with a box core sediment sampler. The box core sampler will be used, if possible, in order to use sampling techniques consistent with recent USACE sampling (USACE, 2002b) and in order to retrieve sediment up to a depth of 18 inches. If the box core sampling method does not collect adequate sample volume, a sediment grab-sampling device will be deployed, such as a Van Veen or ponar. A grab-sampling device is effective in retrieving most types of sediment. Box corer and grab sediment sampling protocols are presented in Appendix A. The sampling method priority is presented in Table 4-2.

The recovered sample will be logged and labeled. The following information will be noted for each sediment sample and recorded on a sediment sampling sheet (Appendix B):

- Sediment samples will be classified by a URS geologist according to the Unified Soil Classification System.
- Depth from which the sediment was collected (e.g., 0-2, 0-6, 6-18 inches).
- Physical characteristics of the sediment, including color, texture, presence of grit, presence and type of biological structures, other debris, or odors.
- Sample location coordinates will be collected using a hand-held range finder and precise GPS equipment to establish the coordinates of the sample location. The hand-held range finder will pinpoint the location of the diver, and the GPS equipment will establish the coordinates of that location. GPS equipment used will provide sub-meter accuracy.
- Water depth at each sample location will be collected. This information will be collected from the boat depth sounder the requested from the dive master.

- Samples will be collected in precleaned and certified (under chain-of-custody) containers supplied by the contract analytical laboratory (Table 4-4). Each sample will be given a unique sample identification number. The samples will be labeled according to the procedure outlined in Section 5.3 of this FSP. Each cooler should contain enough ice to maintain the samples at 4ºC + 2ºC during continued sample collection and shipping.
- Non-dedicated sampling equipment will be decontaminated as specified in Appendix A.

4.2.3 Sample Analysis

Sediment samples will be submitted to the contract laboratory for analysis. Analytical testing for surface sediment samples is summarized in Table 4-1. Extra volume will be collected for all samples and will be frozen and archived at the laboratory for one year for future potential analysis.

4.3 GOOSE ISLAND SAMPLING

The sediments around Goose Island may be impacted from either transport from the source areas or from sediments taken from the south side of Bradford Island to construct the island. Previous sediment and tissue sampling indicate that PCBs were detected in both media. Samples will be collected to establish the nature and extent of the contamination and to determine whether Goose Island is a source of contamination.

Three surface and three subsurface sediment samples will be collected offshore of Goose Island. Two surface (6 inches below ground surface) soil samples will be collected upland on Goose Island. Sample results will assist in the characterization of the extent of contamination from the source area. In addition, results may establish whether Goose Island is a source of contamination due to the materials used for its construction.

4.3.1 Sample Locations

Sample locations and coordinates are presented on Figure 4-4 and sample coordinates are listed in Table 4-1. Upland soil sample locations will be field selected to represent the east and west areas of the Island.

4.3.2 Sample Methods

Sediment samples will be collected using the same method used to collect potential depositional samples (box corer or grab sampling). This method is detailed in Section 4.2.2.

Soil samples will be collected with a hand auger six inches below the ground surface.

4.3.3 Sample Analysis

Samples will be submitted to the contract laboratory for analysis. Analytical testing for samples is summarized in Table 4-1. Extra volume will be collected for all samples and will be frozen and archived at the laboratory for one year for future potential analysis.

4.4 FISH LADDER DISPOSAL PILE

Sediment that collects in the fish ladder is cleaned out and deposited on the south (upland) side of Bradford Island. The sediment that collects in the fish ladder is depositional and may have been impacted by contaminated sediments. The disposal piles will be sampled to establish whether impacted sediments are transported into the fish ladder.

4.4.1 Sample Locations

One sample will be collected from the fish ladder disposal piles. Approximate sample locations are presented on Figure 4-3.

4.4.2 Sample Methods

One composite sample will be collected from the pile. Five aliquots will be collected per sample using a hand auger. The aliquots will be collected at least six inches beneath the pile surface. The aliquots will be composited in a stainless steel bowl and placed in sample containers.

Non-dedicated sampling equipment will be decontaminated as specified in Appendix A.

4.4.3 Sample Analysis

Samples will be submitted to the contract laboratory for analysis. Analytical testing for samples is summarized in Table 4-1. Extra volume will be collected for all samples and will be frozen and archived at the laboratory for one year for future potential analysis.

4.5 REFERENCE SEDIMENT SAMPLING

Reference sediment samples will be collected upstream of the extent of impact of Bradford Island contaminated sediments. The reference sediment samples may indicate presence of any upstream contamination transport into the Bonneville forebay area. In addition, background metals results may be compared to site metals results in order to establish whether site concentrations are below, at, or above background levels.

4.5.1 Sample Locations

Two surface sediment samples will be collected from the zero to six-inch depth interval. Sample location coordinates are depicted on Figure 4-3.

4.5.2 Sample Methods

Sediment samples will be collected using the same method used to collect source area samples (a scuba diver will collect samples with a spoon). This method is detailed in Section 4.1.2.

4.5.3 Sample Analysis

Surface samples will be submitted to the contract laboratory for analysis. Analytical testing for surface sediment samples is summarized in Table 4-1. Extra volume will be collected for all samples and will be frozen and archived at the laboratory for one year for future potential analysis.

4.6 SEDIMENT CONTAMINANT BIOAVAILABILITY ANALYSIS

Selected sediment samples will be analyzed for parameters that may indicate the fate and transport and bioavailibility of contaminants in sediment.

4.6.1 Sample Locations

Samples that will be analyzed for the bioavailibility parameters are depicted on Figure 4-5.

4.6.2 Sample Methods

Sample methods will be identical to those used to collect sediment for chemistry analysis.

4.6.3 Sample Analysis

Samples will be submitted to the contract laboratory for analysis. Analytical testing for samples is summarized in Table 4-1.

4.7 WATER COLUMN SAMPLING

Water column sampling and monitoring will be conducted for physical parameters. The results will assist in characterization of sediment contaminant transport and contaminant availability to potential receptors.

4.7.1 Sample Locations

Water column samples will be collected at ten locations. Sample locations and coordinates are depicted on Figure 4-5.

4.7.2 Sample Methods

Water column samples will be collected with a Kemmerer discrete depth water sampler. The sampler is attached to a cable and enters the water in the open position. A messenger is sent

down the cable to activate closure of the sampler. Kemmerer sampling protocols are presented in Appendix A.

In order to minimize sediment disturbance before water column samples are collected, thereby increasing the total suspended solids, water samples will be collected before sediment samples are collected.

A water quality meter will be deployed concurrent with the water sampler. Upon stabilization of readings, conductivity, temperature, dissolved oxygen, pH, turbidity, and reduction-oxidation potential will be recorded on a water sampling form (Appendix B).

Sample location coordinates will be collected using a hand-held range finder and precise GPS equipment to establish the coordinates of the sample location. The hand-held range finder will pinpoint the location of the diver, and the GPS equipment will establish the coordinates of that location. GPS equipment used will provide sub-meter accuracy.

Water depth will be collected at each sample location. This information will be collected from the boat depth sounder the requested from the dive master.

Samples will be collected in precleaned and certified (under chain-of-custody) containers supplied by the contract analytical laboratory (Table 4-5). Each sample will be given a unique sample identification number. The samples will be labeled according to the procedure outlined in Section 5.3 of this FSP. Each cooler should contain enough ice to maintain the samples at 4ºC + 2ºC during continued sample collection and shipping.

Non-dedicated sampling equipment will be decontaminated as specified in Appendix A.

4.7.3 Sample Analysis

Samples will be submitted to the contract laboratory for analysis. Analytical testing for samples is summarized in Table 4-1.

4.8 SITE-SPECIFIC SAMPLING AND ANALYSIS CONTINGENCIES

Site-specific sampling and analysis problems could be encountered during sampling. The following contingencies have been developed to address potential field problems.

- During previous sediment investigations in the Bonneville forebay area there was difficulty in recovering adequate volume of sediment for sample analysis. The near shore area of Bradford Island was observed to consist of cobble-size particles with small pockets of fine-grained sediment in between the cobbles. Sample collection was attempted at locations throughout the Bonneville forebay area with a box core sampler. Sediment was not retrieved in many of these areas. Attempts will be made to collect samples at pre-determined locations, however due to the difficulty experienced in collecting adequate sample volume the actual location may be field determined in areas of retrievable sediment.

- Due to shipping logistics - such as drop off times and locations - it may not be feasible to ship QA samples to USACE the same day that they are collected. If QA samples cannot be shipped the same day, they will be stored on ice in a cooler under chain of custody and shipped the following day.

4.9 FIELD QA/QC SAMPLING

Seven and four field duplicate samples will be submitted to the contract and USACE Chemical Quality Control Branch laboratory, respectively. One equipment rinsate blank for every day of sampling and four matrix spikes (MS) and matrix spike duplicates (MSD) will be submitted to the contract laboratory. Field QC sampling is summarized in Table 4-3.

The field duplicate, MS, and MSD samples all will be collected from primary sample locations that require the full suite of analytical testing. The collection procedures for the duplicate, MS, and MSD will follow those outlined for the primary sediment samples.

Two additional field duplicates will be collected to establish the variability that may be introduced by different sampling techniques. These duplicates will be collected at any two depositional sampling locations for which adequate sediment sample volume was retrieved using a box core device.

The equipment rinsate blank will be collected when it is necessary to use non-dedicated equipment. Non-dedicated equipment will be decontaminated following the procedures outlined in Appendix A. The rinsate blank will consist of laboratory-provided analyte-free water collected from the final rinse of sampling equipment after completion of decontamination procedures. The blank will be collected after decontamination from the final rinse of sampling equipment.

5.0 SAMPLE CHAIN-OF-CUSTODY DOCUMENTATION

This section describes sample handling and documentation procedures. The procedures described are designed to provide a thorough record of the sampling events. The recordkeeping procedures are designed to provide information to allow useful interpretation of the data.

5.1 FIELD LOGBOOKS

Permanently bound field books with waterproof paper will be used as the field logbooks for this project because of their compact size, durability, and secure page binding. The pages of the logbook should be numbered consecutively and should not be removed for any reason. Entries will be made in black waterproof indelible ink.

Logbooks will document the procedures performed by field personnel. Each entry should be dated, legible, and contain accurate and complete documentation of the individual's activities. Documentation in the field logbook will be at a level of detail sufficient to explain and reconstruct field activities without relying on recollection by the field team members. Because the logbook is a complete documentation of field procedures, it should contain only facts and observations. Language should be objective, clear, concise, and free of personal interpretation or terminology that might be misconstrued.

No erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark and the change initialed and dated by the team member making the change.

Field logbooks will be identified by the project name and a project-specific number (e.g., "Bradford Island Post Removal Sampling, Project Number 25692710"), and stored in the field project files when not in use. Field logbooks will be photocopied after the field investigation, and photocopies will be stored in the project files. After field activities are completed, logbooks will be stored in the permanent project file.

5.2 VIDEO AND PHOTOGRAPHS

A video camera will document all of the diver activities. The camera is attached to the diver's helmet. Sound, including the dialog between the diver and dive master, will be recorded.

Representative photographs will be taken during the field investigation activities for the following reasons: (1) to help identify sampling locations, and, (2) to document field activities or field observations.

Information about each photograph will be entered into the logbook immediately after the photograph has been taken. Each slide or photographic print will be labeled with the time and date of the photograph, site location, frame (if applicable), and roll number (if applicable). If available, a digital camera will be used with date-back capabilities to automatically imprint the photograph with the time and date. Alternatively, a standard camera may be used.

5.3 SAMPLE NUMBERING SYSTEM

Sediment samples collected during the post removal sampling will be numbered as follows:

- The first six numerals will represent the date, as year, month, day of sample collection (e.g., 021112 = November 12, 2002).
- The next three letters will designate the work site ("IW" for "in-water", "AWS" for "auxiliary water system", "GI" for "Goose Island", "FLP" for "fish ladder disposal piles", "RF" for "reference").
- The next two numerals will represent consecutive sample numbers for a given site (e.g., 01, 02, 03).
- The last two letters will designate the sample matrix (e.g., SD = sediment sample).
- A field duplicate sample will be labeled with a separate consecutive sample number (except for the duplicate samples that are sent to the USACE CQAB laboratory, which will be labeled identically to the respective primary sample).

An example of a sample identification number for the fourth sediment sample collected on November 12, 2002 is 021112IW04SD. No dashes or slash marks will be used to separate integers within the sample number.

5.4 SAMPLE DOCUMENTATION

Detailed information such as the circumstances of collection and disposition of samples results in a well-documented investigation. Accurate sample and project records and proper chain-of-custody procedures are imperative.

The purposes of establishing documentation procedures for this investigation are to:

- Provide a complete record of procedures as performed in the field.
- Permit accurate identification of samples and tracking of their status.
- Facilitate chain-of-custody and traceable accountability procedures for samples.
- Facilitate retention of project records.

Verifiable sample custody will be an integral part of field and laboratory operations. Sufficient documentation will be made in the field and laboratory to document sample collection preservation, and identification. The following sections specify the procedures to be used for field documentation.

5.4.1 Sample Labels

Sample containers will be labeled before collecting each sample using a permanent waterproof marker. The following information will be recorded on each sample label:

- Site name
- Sampling date
- Sampling time
- Sample identification number
- Preservative used if applicable
- Initials of sampling personnel
- Requested analysis

5.4.2 Field Sampling Sheets

Field sampling sheets used during the investigation will provide information on sediment and water samples. Examples of these forms are presented in Appendix B.

5.4.3 Chain-of-Custody Records

The primary purpose of a Chain-of-Custody (COC) is to document sample custody and to provide the laboratory with the appropriate analysis request. A separate COC form will accompany each shipping cooler, and contain sample information for only those samples contained in the cooler. The URS Field Investigation Task Manager will retain the sender's copy (last or pink copy) of the COC. This copy will be kept with the project files. Each chain of custody will contain the following information:

- Sample identification number
- Date and time of sampling
- Sample matrix
- Number of sample containers and or volume of sample
- Requested chemical analysis
- Names and signatures of sampling personnel
- Project number
- Any additional notes regarding sample collection or preservation (e.g., field filtered)

COCs sent to the USACE Quality Assurance laboratory will also contain the appropriate laboratory information management system (LIMS) number. For this project, the LIMS number is 5012. Each shipping cooler will be sealed with custody seals. Each custody seal will have the date and the sampler's signature. Custody seals will be attached to the left front and right rear side of the cooler in such a manner that they will be broken if the cooler is opened.

5.5 CORRECTIONS TO DOCUMENTATION

If corrections are required to field documentation including field log book, field sampling sheets, development forms, or COC, the correction will be made in the following manner:

- Draw a single line through the incorrect entry.
- The person making the entry will initial and date the correction.

6.0 SAMPLE PACKAGING AND SHIPPING

6.1 SAMPLE PACKAGING

The procedures and material used for sample packaging must adequately protect the sample containers from accidental breakage during shipment. Sample packaging and will conform to the requirements of Appendix F of USACE Engineering Regulation ER-200-1-3 (USACE, 2001). Glass containers will be placed in plastic bags and will be wrapped and cushioned in inert packing material, such as foam or bubble wrap packing material. Caps will be screwed on tightly, and the containers will be placed into individual, resealable bags, which will then be sealed. Ice will be placed in the container in a manner to promote adequate and equal cooling for all samples.

Ice will be packaged in the following manner. Approximately 1/2 bag of cubed ice will be transferred into a 1-gallon resealable plastic bag. The bag will be sealed and placed inside a second resealable plastic bag. The outer bag will be sealed and taped with duct tape to prevent the bag from opening.

6.2 SAMPLE SHIPPING

Sample containers will be placed inside a strong shipping container, such as a metal or plastic picnic cooler with a hard plastic liner. The shipping container should be sufficient quality to minimize the potential for leaks or spills of ice water or potentially broken sample containers. The drain plug at the bottom of the cooler will be taped shut so that the contents from potential broken containers of prepackaged ice or sample will not escape. The completed COC (minus the sampler's copy) will be placed inside a resealable plastic bag and secured with duct tape to the inside lid of the cooler. The shipping container lid will be adequately secured with tape to prevent opening during shipping. The shipping container will be adequately cleaned between shipments to prevent potential cross-contamination of samples.

Samples will be shipped from the project site to the project analytical laboratory via overnight courier (Federal Express). Field personnel will transport sample shipments from the field to the appropriate Federal Express office. COC forms do not require the signature of the shipping agent.

When possible, samples will be shipped the same day as collection. Due to the location of the project and time constraints for overnight shipping to the eastern US, some shipments may not be sent until the following day. This may be especially true in the case of QA samples sent to the USACE laboratory in Omaha, Nebraska. In such cases, samples will be repacked with fresh ice before shipping.

Samples will only be shipped on Fridays if required by field circumstances and URS has received approval for Saturday delivery from the laboratory.

Samples will be shipped to the laboratory overnight via Federal Express. The contract laboratory address will be included when the laboratory is contracted.

QA samples will be shipped overnight via Federal Express to the following address:

US Army Corps of Engineers
CQAB Lab
Attn: CEWES-EE-Q
420 S. 18th Street
Omaha, NE 68102-2586
Point of contact: Laura Percifield
(402) 444-4313
LIMS #5012

7.0 INVESTIGATION-DERIVED WASTES (IDW)

Proper storage of wastes is necessary to minimize potential spread of contaminated or potentially contaminated media. The following section describes the procedure for containerizing and storing the decontamination water generated accumulated during the sampling.

7.1 WASTE STORAGE AND HANDLING

All decontamination water generated during in-water work, will be stored onsite in removable-head steel 55-gallon capacity drums (DOT 1A2) complete with lids, lid gaskets and bolts. Drums will be transferred to the public sewer system for disposal.

USACE has determined that the personal protective equipment (PPE) is a non-hazardous solid waste. Therefore, PPE will be disposed of in the nearest USACE dumpster.

7.2 DRUM LABELING

IDW drums will be labeled on both the side and lid of the drum using a permanent marking pen. Labels will have the following information:

- Generator's name (U.S. Army Corps of Engineers)
- Project Name (Bradford Island Post Removal Sediment Sampling)
- Name and Telephone number of USACE Project Manager: Paul Huebschman (503) 808-4914
- Description of contents (e.g., Decontamination Water)
- Date
- Drum number of total drums

8.0 CONTRACTOR QUALITY CONTROL

8.1 INTRODUCTION

The URS Field Investigation Task Manager will oversee the fieldwork to ensure that the field team, specifically the sampling team, is cognizant of the overall project objectives as well as any specific sampling and analysis requirements. Contractor quality control (CQC) will be performed in three phases: preparatory, initial, and follow-up. The activities associated with each of the CQC phases will be documented in a daily quality control report (DQCR), as described in Section 8.5. Detailed checklist plans and a description for each CQC phase are provided below.

8.2 PREPARATORY PHASE

Prior to beginning any definable feature of work, the sampling team will review all of the work requirements, inspect all materials and equipment, inspect all work areas to ascertain completion of all preliminary work, and demonstrate all field activities. The checklist below outlines the requirements of the preparatory phase. The sampling team will be responsible for ensuring that the following checklist items are performed:

- Review all work requirements identified in the SAP and the QAPP.
- Calibrate each piece of field equipment during the preparatory inspection meeting using certified calibration standards.
- Discuss the sample custody procedures and sample numbering system, and prepare a full set of custody forms to be used as a reference.

As part of the preparatory phase, the sampling team will physically examine and gather all field equipment and other materials prior to fieldwork. The checklist below summarizes the essential field equipment and materials:

- Personal protective equipment
- Packing tape
- Base map to record sample locations
- QA/QC sample tracking sheets
- Air bills
- Field log books
- Field forms/chain-of-custody records
- Sampling and Analysis Plan
- Instrument operating manuals and procedures for equipment maintenance and repair

- Laboratory bottles with Teflon lids (as needed)

8.3 INITIAL PHASE

The field team is responsible for overseeing every step of each fieldwork task when the work is first initiated. The required elements for the initial phase are indicated in the checklist below:

- Oversee sampling activities and review work for compliance with contract requirements.
- Inspect all sample labels and chain-of-custody forms for accuracy, completeness, and consistency.
- Inspect all coolers to ensure that environmental samples are packaged and shipped properly and check for sample integrity.
- Observe, verify, and document all calibration of field equipment.
- Inspect all field notes to ensure that all field personnel document the required information.
- Track samples as fieldwork proceeds on field sampling forms and the logbook.
- Prepare Daily Quality Control Reports discussed in Section 8.4.

8.4 DAILY QUALITY CONTROL REPORTS

The field team will complete DQCRs daily during the site activities. The DQCRs will be dated and signed by a field team representative and stored in project files weekly. If significant modifications to the SAP are required, USACE will be contacted immediately. The DQCR form is included in Appendix B. Attachments to the DQCR may include quality assurance sample tables, chain-of-custody records, field screening results, and any other pertinent project forms. The DQCR will contain, at a minimum, the following information:

- Location at time of sampling.
- Field instrument measurements.
- Field instrument calibrations.
- Departures from the SAP.
- Discussion of problems encountered and resolutions.
- Instructions from USACE.

9.0 CORRECTIVE ACTIONS

The ultimate responsibility for maintaining quality throughout the expanded site investigation rests with the URS Project Manager. The day-to-day responsibility for managing field and laboratory activities rests with the URS Field Investigation Task Manager, and the URS Analytical Chemistry Task Manager.

Any nonconformance with the established QC procedures will be expeditiously identified and controlled. Where procedures are not in compliance with the established protocol, corrective actions will be taken immediately. Subsequent work that depends on the nonconforming activity will not be performed until the identified nonconformance is corrected.

The URS Field Investigation Task Manager will review the procedures being implemented in the field for consistency with the established protocols. Tasks such as sample collection, preservation, and labeling will be checked for completeness. Where procedures do not comply with the established protocol, the deviations will be documented and discussed in the report.

10.0 SAMPLING EQUIPMENT AND FIELD INSTRUMENTATION

Standard Operating Procedures for sampling equipment, field instrument operation and calibration are included in Appendix A.

11.0 REFERENCES

URS. 2002. In-Water Investigation Report, Bradford Island Landfill.

URS. 2002. Technical Memorandum, In-Water Removal Work, Bradford Island Landfill.

U.S. Army Corps of Engineers. 2002a. Detailed Statement of Work Contract No. DACW57-99-D-0005, URS Greiner Woodward Clyde Delivery Order No. 0004, Modification No. 0006, Bradford Island Post Removal Sampling.

U.S. Army Corps of Engineers. 2002b. Sampling and Analysis Plan, Bonneville Forebay Sediment Characterization. July 2002.

U.S. Army Corps of Engineers. 2001. Environmental Quality, Requirements for the Preparation of Sampling and Analysis Plans, EM200-1-3.

U.S. Army Corps of Engineers. 2000. First Powerhouse, Bonneville Dam, Columbia River, Oregon, Report 2, Tracking Velocities Hydraulic Model Investigation. Robert Davidson, April.

U.S. Army Corps of Engineers 1998. Navigation Conditions at Bonneville Locks and Dam, Columbia River, Ronald T. Wooley. February.

U.S. Army Corps of Engineers 1991. Bonneville Navigation Lock Sediment Evaluation, Jim Britton, September 6.

U.S.G.S. Topographic Map, 7.5 minute series, Bonneville Dam Quadrangle, Washington – Oregon, 1994.

TABLES

TABLE 2-1
Subcontractors and Services

Subcontractor	Service	Address and Contact
Contract Laboratory – To be determined	Analysis	To be determined
David Evans and Associates, Inc.[1]	Surveying	2828 SW Corbett Avenue Portland, OR 97201 Contact: Joanna Hawkins (503) 223-6663
Advanced American Diving[1]	Diving	415 S. McLoughlin Blvd. Oregon City, OR 97045 Contact: Mike Johns (503) 650-8207

[1]These companies have not been contracted. It is anticipated that these companies will be contracted due to extensive previous site experience and site knowledge.

TABLE 4-1
Sample Summary

Sample Number	Sample Group	Description	Sampling Method	No. Surface Samples (0-6”)	No. Subsurface Samples (6-18”)	Sample Analysis
Source Area Sampling						
1	**Temporal**	Collect samples in Pile #1 and #2 in locations that were previously sampled and exhibited high PCB concentrations.	Diver with a stainless steel spoon	4	0	PCB Aroclors by EPA Method 8082, total organic carbon by EPA Method 9060, grain size by ASTM D422
2	**Grid**	Collect unbiased samples in tight grid in area encompassing former debris pile areas and drain outfall area.	Box core or grab sampler (Van Veen or ponar) or a diver with a stainless steel spoon	36	8	Full analytical suite*
3	**Transect**	Collect samples from 14 transects extending from former debris piles and catch basin outfall area.	Box core or grab sampler (Van Veen or ponar) or a diver with a stainless steel spoon	16	6	Full analytical suite*
Potential Depositional Sampling						
4	**Depositional**	Collect samples in areas of low bottom velocity as modeled by the USACE, including 2 samples at each end sill, the docking area, and the south abutment of Powerhouse 1.	Box core or grab sampler (Van Veen or ponar)	13	13	Full analytical suite*
5	**Southeast Side of Bradford Island**	Attempt to collect samples along the southeast shore of Bradford Island. Five samples exhibiting fine-grained sediment will be chosen for analysis.	Box core or grab sampler (Van Veen or ponar)	1	1	Full analytical suite*

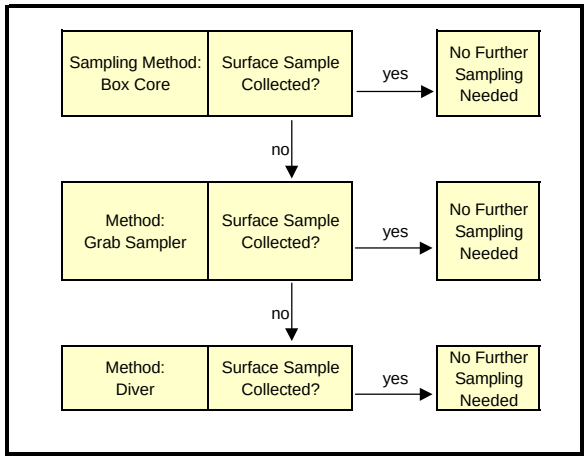
TABLE 4-1
Sample Summary

Sample Number	Sample Group	Description	Sampling Method	No. Surface Samples (0-6")	No. Subsurface Samples (6-18")	Sample Analysis
Goose Island						
6	**Goose Island**	Collect samples in water near the shore of Goose Island and upland on Goose Island.	Box core or grab sampler (Van Veen or ponar)	5**	3**	Full analytical suite*
Other						
7	**Fish ladder disposal piles**	Collect samples of sediment removed from the east lateral of the Bradford Island fish ladder and disposed of upland on the west end of Bradford Island.	Hand auger	1	0	Full analytical suite*
Reference Sampling						
8	**Reference**	Collect samples upstream of the site in location not impacted by Bradford Island contaminant sources.	Diver with a stainless steel spoon	2	0	Full analytical suite*
Risk Assessment Sampling						
9	**Bioavailability analysis**	Analyze samples that exhibit fine-grained characteristics in both source and depositional areas.	Box core or grab sampler (Van Veen or ponar)	10	0	AVS/SEM by EPA Draft 1991, pH by EPA 9045C, Moisture content by ASTM D2216-90
10	**Water column**	Collect water samples at locations that exhibit fine grained sediment characteristics	Kemmerer Sampler	10	0	Total suspended solids by EPA 160.2, dissolved organic carbon by EPA 415.1, hardness by EPA 130.2, pH by EPA 150.1

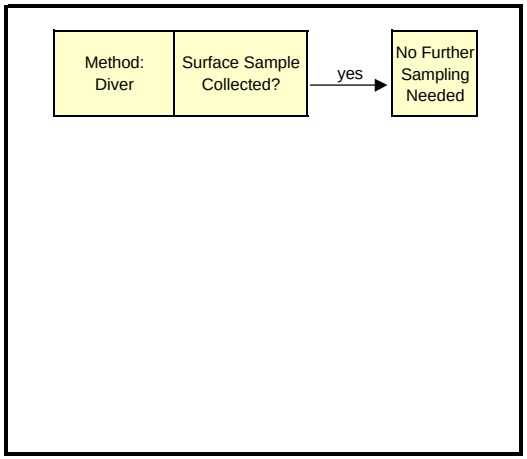
*The full suite of parameters is: PCB-Aroclors by EPA Method 8082, metals by EPA Method 6000/7000, semivolatiles by EPA Method 8270C, pesticides by EPA Method 8081A, butyltins by the Krone Method, diesel and heavy oil range organics by NWTPH-Dx, total organic carbon by EPA Method 9060, and grain size by ASTM-D422.
**Six of the samples are sediment samples collected near the shore of Goose Island. Two of the samples are soil samples collected upland on Goose Island six inches below ground surface.

Table 4-2
Sampling Method Flowchart

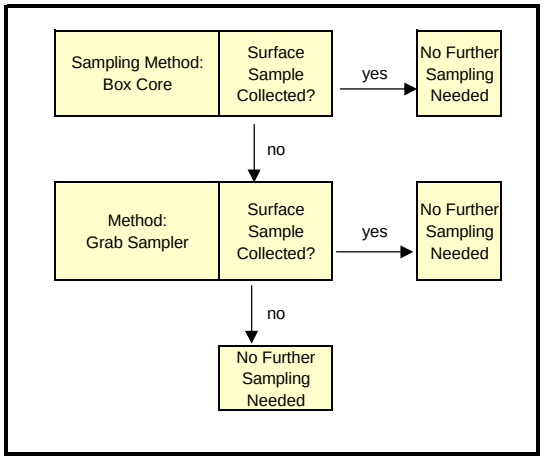
Source Area Samples: West End of Source Area Through Pile #3[1]



Source Area Samples: East of Pile #3 Through Pile #1[2]



Depositional Area Samples



[1]Former Pile #3, Grid, and Transect Samples
[2]Former Pile #3, Temporal, Grid, and Transect Sample Groups
Each sampling method will be attempted three times before attempting a different sampling method.
Subsurface sample collection will be attempted with a box core sampling device. If a subsurface sample is not retrieved with the box core, a subsurface sample will not be collected.

TABLE 4-3
Sample Sequence Summary

Sequence	Sample Group	Method	Rational
1	Source Area Samples from east end through Pile #3 (see Figure 4-3)[1]	Standard Sediment Sampling Methods[3]	First attempt to retrieve samples with standard sampling equipment. Start in the area closest to spillway in the event the spillway must be opened during the sampling event.
2	Depositional Samples in the Spillway Forebay Area	Standard Sediment Sampling Methods[3]	Start in the area closest to spillway in the event the spillway must be opened during the sampling event.
3	Depositional Samples (including the southeast side of Bradford Island samples) in the First and Second Powerhouse Forebays	Standard Sediment Sampling Methods[3]	Finish standard sampling event.
4	Goose Island Sediment and Soil Samples	Standard Sediment Sampling Methods[3]	Finish standard sampling event.
5	Source Area Samples[2]	Diver	Begin diver sampling event in area closest to spillway in the event the spillway must be opened during the sampling event.
6	Reference Samples	Diver	Attempt to match sediment grain size reference samples with site samples.
7	Fish Disposal Pile Sample	Hand Auger	Upland sampling may be conducted at any time during the sampling event.

[1]Grid and Transect Sample Groups

[2]Temporal, Grid, and Transect Sample Groups

[3]Standard sediment sampling methods are box core or grab samplers.

Note: in locations where water column samples are collected, the water column sample will be collected before the sediment sample is collected.

TABLE 4-4
Field QA/QC Samples

Media	Number Collected	Field Quality Control Samples
Sediment	1 per 20 primary samples	Field Duplicate[1]
	1 per 10 primary samples	Field Duplicate[2]
	1 per day or 1 per 20 samples (whichever is greater)	Equipment Rinsate Blank
	1 per 20 primary samples	Matrix Spike
	1 per 20 primary samples	Matrix Spike Duplicate
Water	1 per 20 primary samples	Field Duplicate[1]
	1 per 10 primary samples	Field Duplicate[2]
	Not Applicable	Equipment Rinsate Blank
	Not Applicable	Matrix Spike
	Not Applicable	Matrix Spike Duplicate

Notes:
[1] = field duplicate samples analyzed by USACE CQAB
[2] = field duplicate samples analyzed by the contract laboratory
Temperature blanks will be submitted with each cooler

TABLE 4-5
Laboratory Container, Preservation, and Holding Times for Sediment

ANALYTICAL PARAMETER	METHOD	CONTAINER**	PRESERVATION	HOLDING TIMES***
Semivolatile Organic Compounds (SVOCs)	SW8270C	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Polychlorinated Biphenyls (PCBs) - Aroclors	SW8082	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Organochlorinated Pesticides	SW8081A	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Northwest Total Petroleum Hydrocarbons – Diesel Range Organics (NWTPH-Dx)	NWTPH-Dx	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Butyltins	Krone GC/MS	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Metals	SW6020	1-8 oz CWM glass	4 °C	180 days to analyze
Mercury	SW7471A	1-8 oz CWM glass	4 °C	28 days to analyze
Total Organic Carbon (TOC)	SW9060	1-8 oz CWM glass	4 °C	28 days to analyze
Grain Size (Sieve and Hydrometer)	ASTM D422	32 oz CWM	None	None
pH	9045C	1-4 oz CWM glass	4 °C	Upon receipt
Moisture Content	ASTM D2216-90	1-4 oz CWM glass	4 °C	None
Acid Volatile Sulfide (AVS) and Simultaneously Extractable Metals (SEM)	EPA Draft 821/R-91-100****	1-8 oz CWM glass	4 °C	14 days to analyze

Notes:

*Triple volume must be collected for MS/MSD samples.
**Samples collected for analysis for SW8270C/SW8082/SW8081A/NWTPH-Dx /SW6020/ SW7471A/SW9060 may be collected in the same 8 oz CWM jar. Extra sample volume will be collected for archiving in an 8 oz CWM jar.
***Holding times are from date of sample collection.
****EPA Draft document entitled Analytical Method for Determination of Acid Volatile Sulfide and Selected Simultaneously Extractable Metals in Sediment. (December 1991).
All containers will have Teflon-lined seals or septa (i.e.; NWTPH-Gx)
CWM – Clear wide mouth glass jar

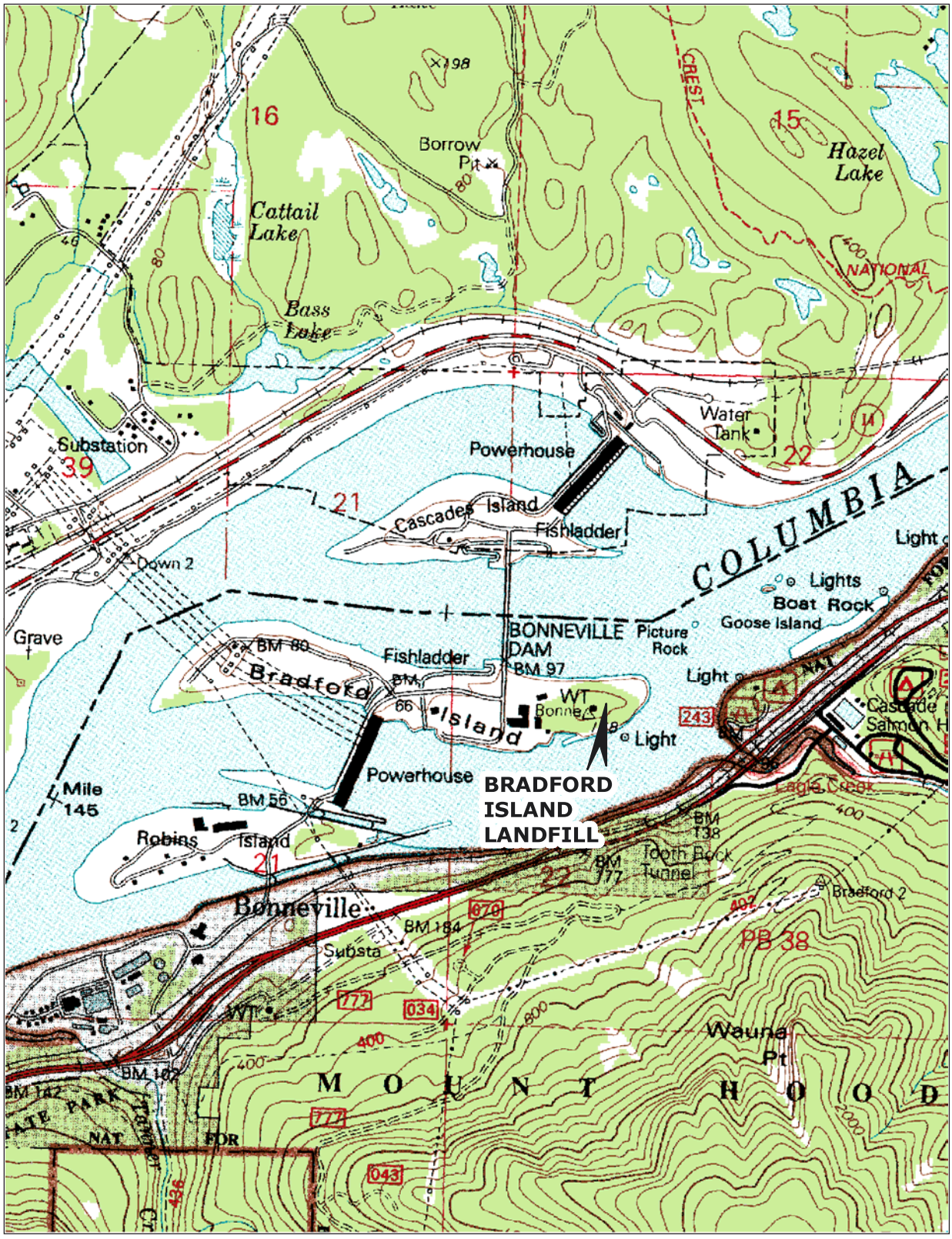
TABLE 4-6
Laboratory Container, Preservation, and Holding Times for Water

ANALYTICAL PARAMETER	METHOD	CONTAINER	PRESERVATION	HOLDING TIMES**
Total Suspended Solids (TSS)	EPA 160.2	1-250 ml HDPE	4 °C	7 days
Dissolved Organic Carbon (DOC)***	EPA 415.1	1-250 ml AGJ	4 °C , H_2SO_4 to pH<2	28 days
Hardness	EPA 130.2	1- 125 ml HDPE	4 °C , H_2SO_4 to pH<2	6 months
pH	EPA 150.1	1- 125 ml HDPE	4 °C	Upon receipt

Notes:

*Triple volume must be collected for MS/MSD samples.
**Holding times are from date of sample collection.
***DOC sample must be field filtered before filling the sample container.
AGJ – Amber Glass Jar
HDPE- High Density Polyethylene Bottles

FIGURES



Source: Bonniville Dam (45121f8) 7.5 Minute USGS Topographic Map

0 1,000 2,000 3,000 Feet

VICINITY MAP

BONNEVILLE DAM FOREBAY
CASCADE LOCKS, OREGON

URS

111 SW Columbia, Suite 900
Portland, Oregon

DECEMBER 2002

25692710.00002

FIGURE 1-1

Print Date November 2002 k:\bradford_island\apr\Workplan\figure-1-1(Vicinity).mxd

Extent of Potential Upstream Sediment Transport from Bradford Island

RM 147

Second Powerhouse

Cascade Island

RM 146

Bonneville Dam and Spillway

Boat Rock

Picture Rock

Goose Island

Trash Rock

AWS

Area of Detail

Fish Ladder Disposal Piles

Fish Ladder East Arm

Bradford Island

First Powerhouse

Eagle Creek

RM 145

AWS

Old Navigation Lock

End Sills

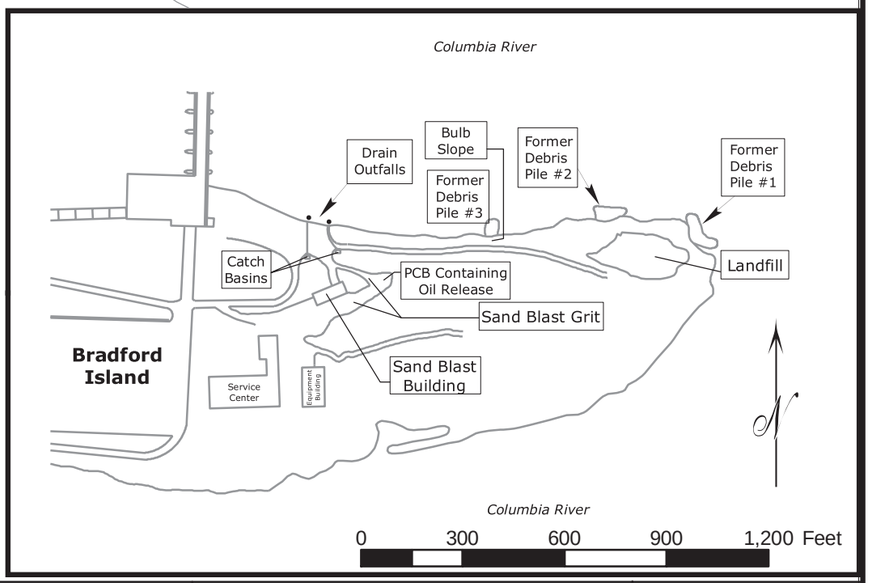
New Navigation Lock

Robins Island

84

0 0.1 0.2 0.3 0.4 0.5 Miles

DETAIL



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Base Map provided by USACE	DRAWN BY: CW	APPROVED BY: JTW	111 S.W. Columbia, Suite 900 Portland, Oregon 97201 (tel) 503-222-7200 (fax) 503-222-4292	CASCADE LOCKS, OREGON	SITE PLAN	GIS FILE NUMBER: figure-1-2(forebay).mxd
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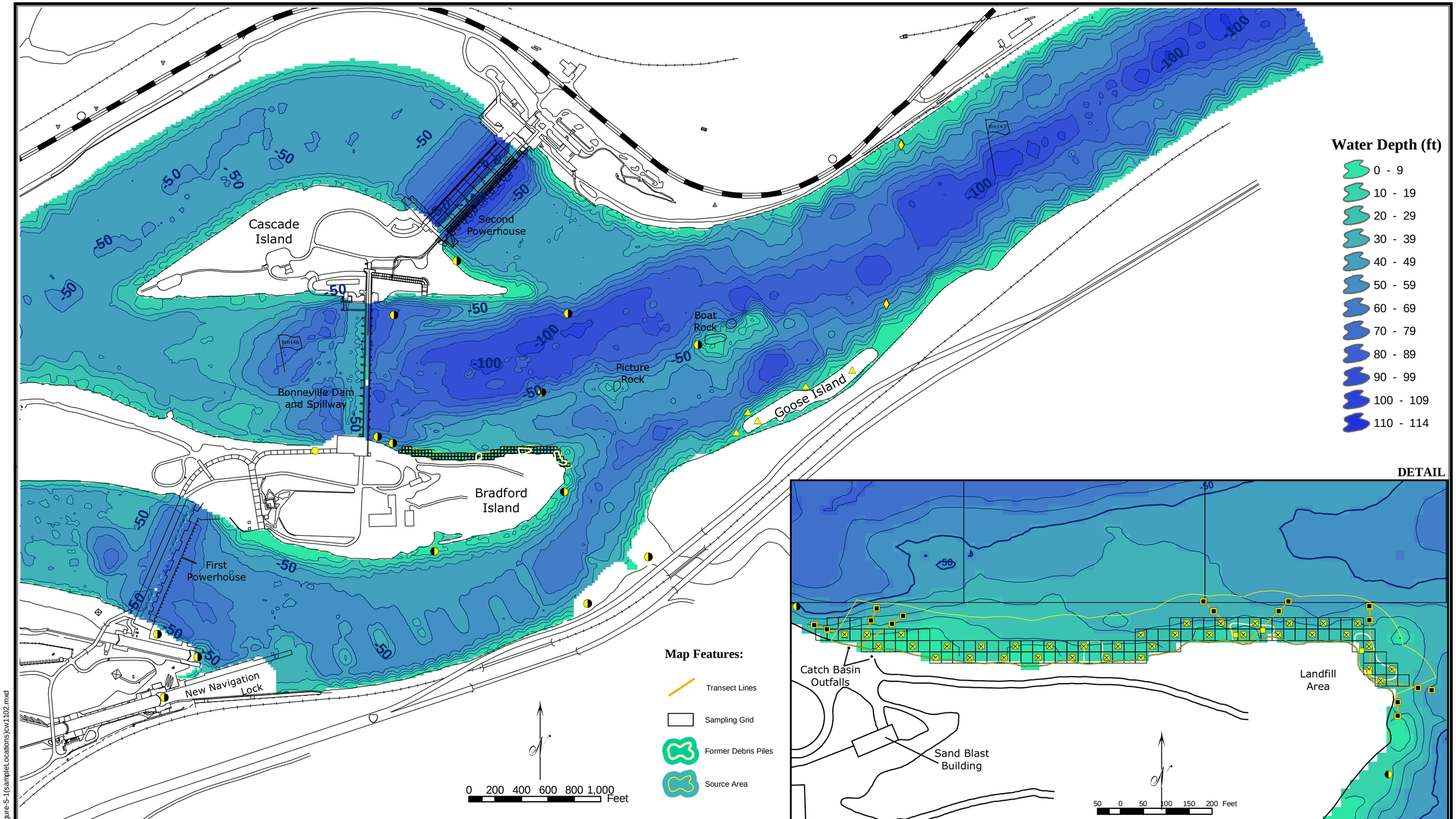

Sample Features:

- Source Area Grid Sample Locations
- Source Area Temporal Sample Locations
- Fish Ladder Sediment Disposal Pile Sample Location
- Source Area Transect Sample Locations
- Reference Sample Locations
- Depositional Sample Locations
- Southeast Side of Bradford Island sample locations
- Goose Island Sample Locations

JOB No. 25692710.00002	DESIGNED: MN	PROJ. ENGINEER: –	URS	Bonneville Dam Forebay	DRAWING NUMBER: FIGURE 4-1
Base Map provided by USACE	DRAWN BY: CW	APPROVED BY: JTW	111 S.W. Columbia, Suite 900 Portland, Oregon 97201 (tel) 503-222-7200 (fax) 503-222-4292	CASCADE LOCKS, OREGON	Sampling Stations
	CHECKED BY: –	DATE: 9/20/02			GIS FILE NUMBER: fig-3(Post removal - sample pts) cw.mxd
					SHEET: REV.

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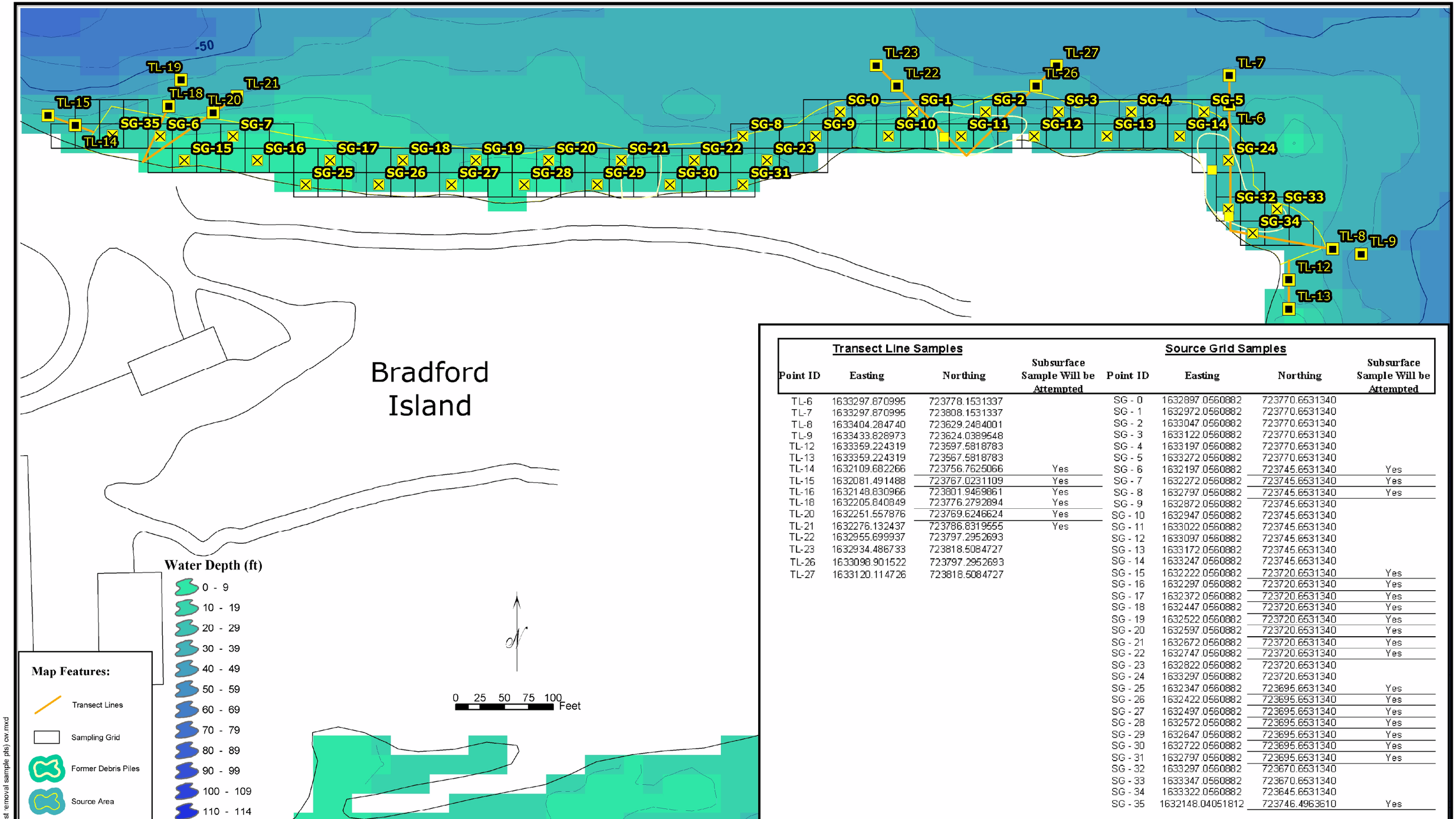

Transect Line Samples				Source Grid Samples			
Point ID	Easting	Northing	Subsurface Sample Will be Attempted	Point ID	Easting	Northing	Subsurface Sample Will be Attempted
TL-6	1633297.870995	723778.1531337		SG - 0	1632897.0560882	723770.6531340	
TL-7	1633297.870995	723808.1531337		SG - 1	1632972.0560882	723770.6531340	
TL-8	1633404.284740	723629.2484001		SG - 2	1633047.0560882	723770.6531340	
TL-9	1633433.828973	723624.0389548		SG - 3	1633122.0560882	723770.6531340	
TL-12	1633359.224319	723597.5818783		SG - 4	1633197.0560882	723770.6531340	
TL-13	1633359.224319	723567.5818783		SG - 5	1633272.0560882	723770.6531340	
TL-14	1632109.682266	723756.7625066	Yes	SG - 6	1632197.0560882	723745.6531340	Yes
TL-15	1632081.491488	723767.0231109	Yes	SG - 7	1632272.0560882	723745.6531340	Yes
TL-16	1632148.830966	723801.9469861	Yes	SG - 8	1632797.0560882	723745.6531340	Yes
TL-18	1632205.840849	723776.2792894	Yes	SG - 9	1632872.0560882	723745.6531340	
TL-20	1632251.557876	723769.6246624	Yes	SG - 10	1632947.0560882	723745.6531340	
TL-21	1632276.132437	723786.8319555	Yes	SG - 11	1633022.0560882	723745.6531340	
TL-22	1632955.699937	723797.2952693		SG - 12	1633097.0560882	723745.6531340	
TL-23	1632934.486733	723818.5084727		SG - 13	1633172.0560882	723745.6531340	
TL-26	1633098.901522	723797.2952693		SG - 14	1633247.0560882	723745.6531340	
TL-27	1633120.114726	723818.5084727		SG - 15	1632222.0560882	723720.6531340	Yes
				SG - 16	1632297.0560882	723720.6531340	Yes
				SG - 17	1632372.0560882	723720.6531340	Yes
				SG - 18	1632447.0560882	723720.6531340	Yes
				SG - 19	1632522.0560882	723720.6531340	Yes
				SG - 20	1632597.0560882	723720.6531340	Yes
				SG - 21	1632672.0560882	723720.6531340	Yes
				SG - 22	1632747.0560882	723720.6531340	Yes
				SG - 23	1632822.0560882	723720.6531340	
				SG - 24	1633297.0560882	723720.6531340	
				SG - 25	1632347.0560882	723695.6531340	Yes
				SG - 26	1632422.0560882	723695.6531340	Yes
				SG - 27	1632497.0560882	723695.6531340	Yes
				SG - 28	1632572.0560882	723695.6531340	Yes
				SG - 29	1632647.0560882	723695.6531340	Yes
				SG - 30	1632722.0560882	723695.6531340	Yes
				SG - 31	1632797.0560882	723695.6531340	Yes
				SG - 32	1633297.0560882	723670.6531340	
				SG - 33	1633347.0560882	723670.6531340	
				SG - 34	1633322.0560882	723645.6531340	
				SG - 35	1632148.04051812	723746.4963610	Yes

Sample Features:

- Source Area Grid Sample Locations
- Source Area Temporal Sample Locations
- Source Area Transect Sample Locations

JOB No. 25692710.00002	DESIGNED: MN	PROJ. ENGINEER: –	
Base Map provided by USACE	DRAWN BY: CW	APPROVED BY: JTW	
	CHECKED BY: –	DATE: 9/20/02	

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Portland, Oregon 97201
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(fax) 503-222-4292

Bonneville Dam Forebay

CASCADE LOCKS, OREGON

Sampling Locations
Source Area

DRAWING NUMBER: FIGURE 4-2

GIS FILE NUMBER: fig-3(Post removal - sample pts) cw.mxd

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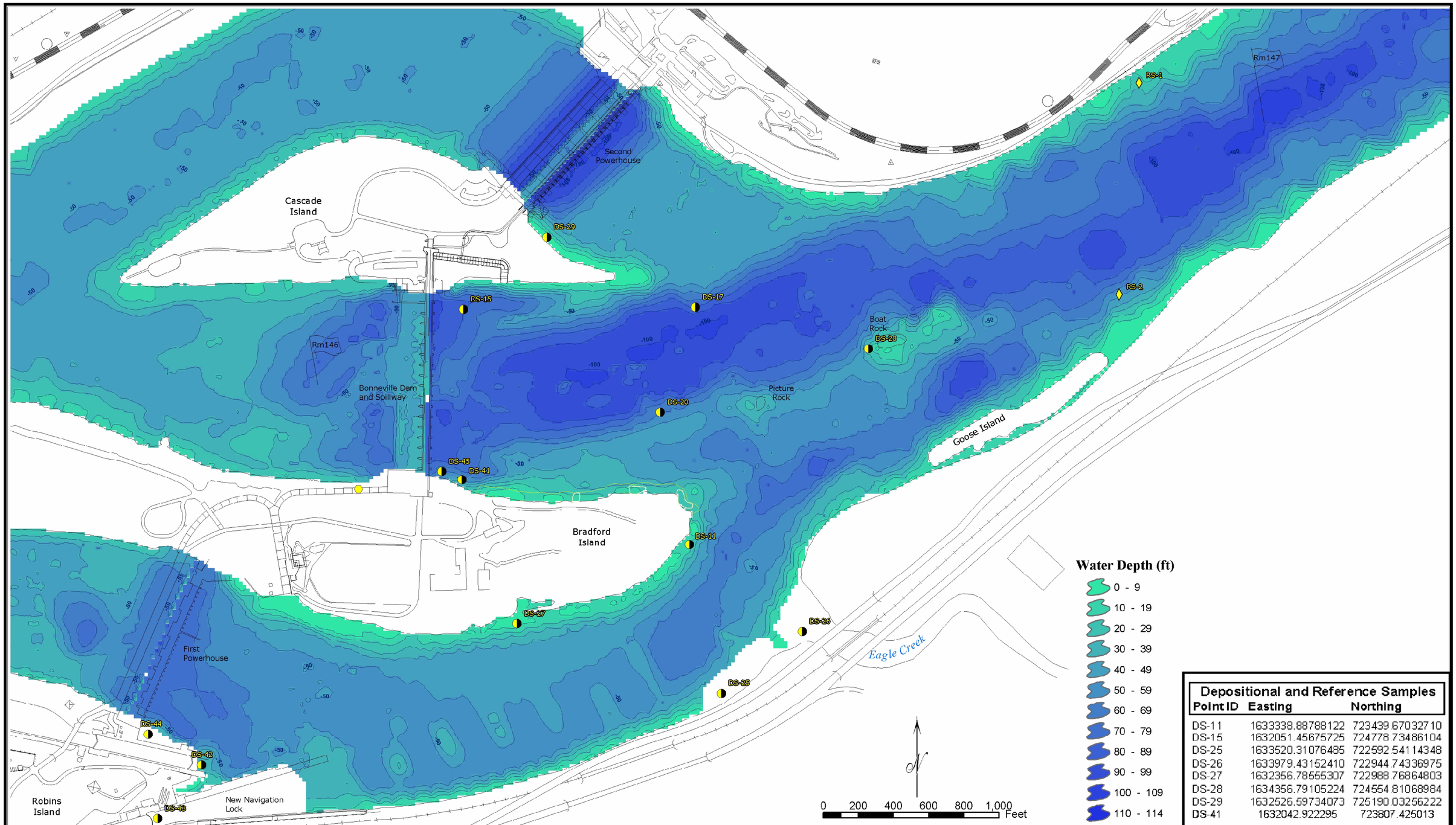

Depositional and Reference Samples

Point ID	Easting	Northing
DS-11	1633338.88788122	723439.67032710
DS-15	1632051.45675725	724778.73486104
DS-25	1633520.31076485	722592.54114348
DS-26	1633979.43152410	722944.74336975
DS-27	1632356.78555307	722988.76864803
DS-28	1634356.79105224	724554.81068984
DS-29	1632526.59734073	725190.03256222
DS-41	1632042.922295	723807.425013

Sample Features:

- Depositional Sample Locations
- Southeast Side of Bradford Island
- Fish Ladder sediment disposal pile sample location
- Reference Sample Locations

JOB No. 25692710.00002	DESIGNED: MN	PROJ. ENGINEER: –	URS	Bonneville Dam Forebay	DRAWING NUMBER: FIGURE 4-3
Base Map provided by USACE	DRAWN BY: CW	APPROVED BY: JTW	111 S.W. Columbia, Suite 900 Portland, Oregon 97201 (tel) 503-222-7200 (fax) 503-222-4292	CASCADE LOCKS, OREGON	Sampling Locations Depositional and Reference
	CHECKED BY: –	DATE: 9/20/02			GIS FILE NUMBER: fig-4-3(Dep&REF) cw1102.mxd; SHEET: ; REV.

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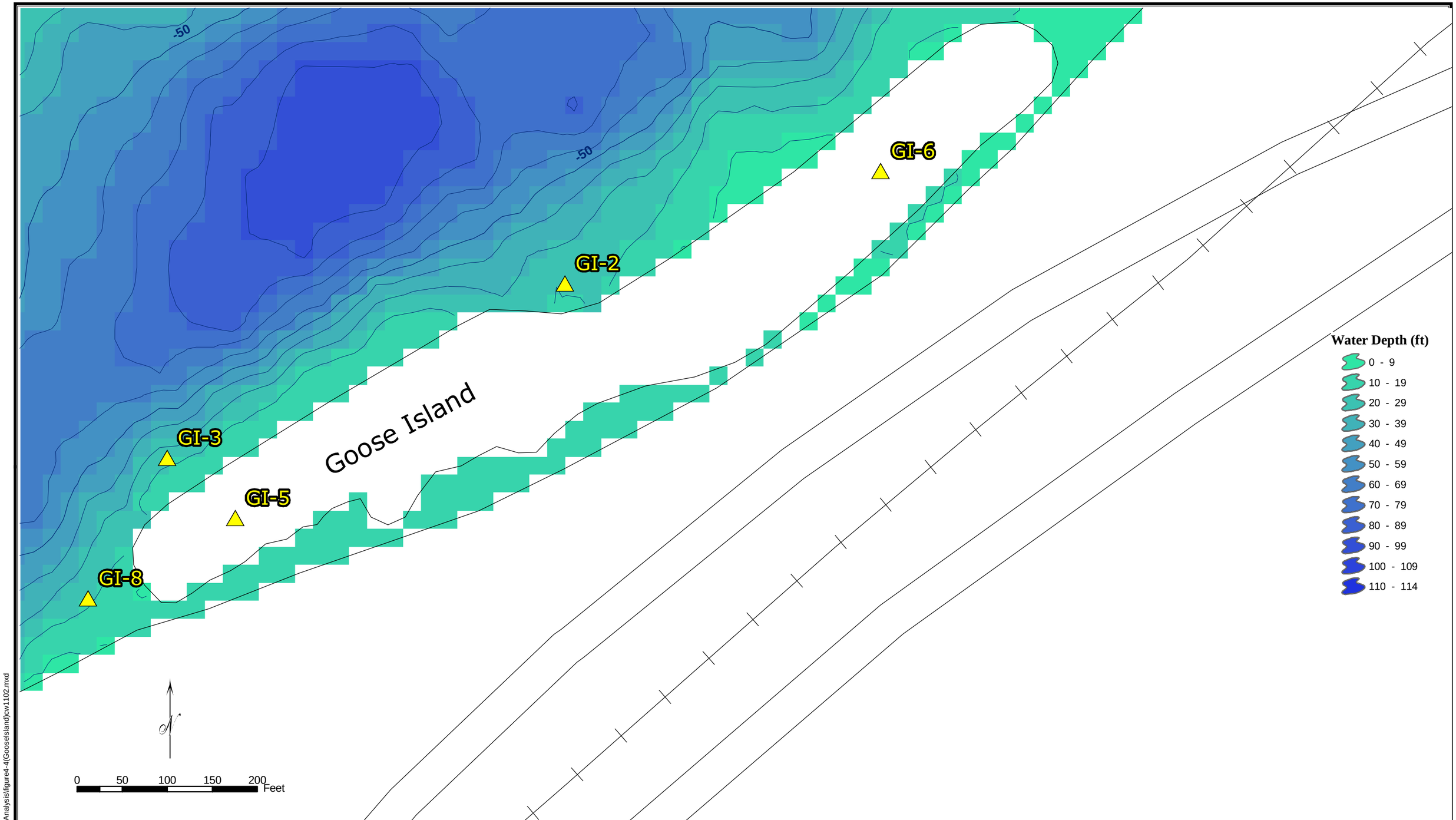

Sample Features:

Goose Island Sample Locations

JOB No. 25692710.00002	DESIGNED: MN	PROJ. ENGINEER: –	URS	Bonneville Dam Forebay	Sampling Locations Goose Island
Base Map provided by USACE	DRAWN BY: CW	APPROVED BY: JTW	111 S.W. Columbia, Suite 900 Portland, Oregon 97201 (tel) 503-222-7200 (fax) 503-222-4292	CASCADE LOCKS, OREGON	
	CHECKED BY: –	DATE: 9/20/02			

DRAWING NUMBER: FIGURE 4-4

GIS FILE NUMBER: fig-4-4(GooseIsland) cw.mxd

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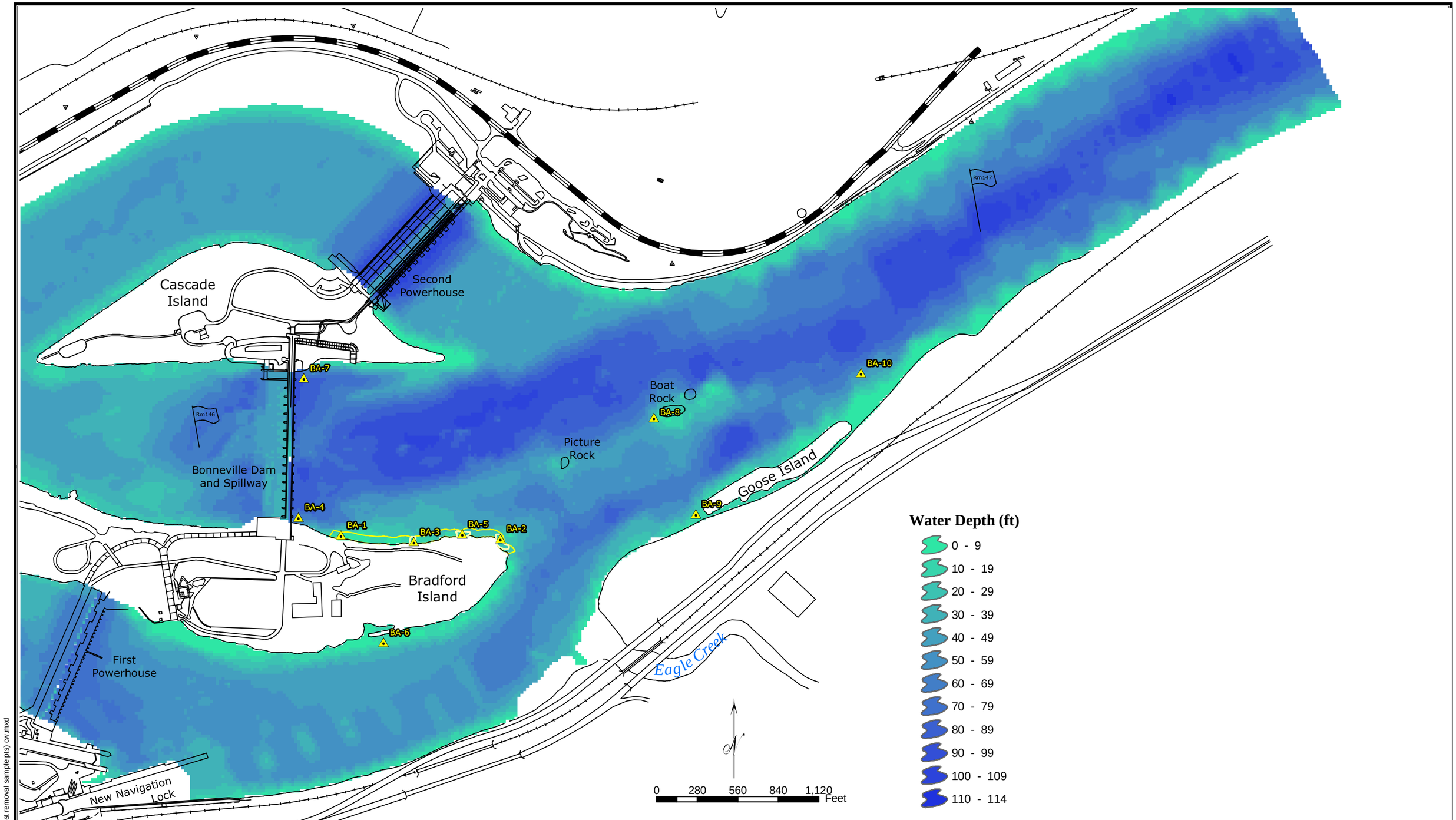

Sample Features:

Bioavailability and Water Column Samples

JOB No. 25692710.00002	DESIGNED: MN	PROJ. ENGINEER: –	URS	Bonneville Dam Forebay	Sampling Locations Bioavailability and Water Column Samples
Base Map provided by USACE	DRAWN BY: CW	APPROVED BY: JTW	111 S.W. Columbia, Suite 900 Portland, Oregon 97201 (tel) 503-222-7200 (fax) 503-222-4292	CASCADE LOCKS, OREGON	
	CHECKED BY: –	DATE: 9/20/02			

DRAWING NUMBER: FIGURE 4-5

GIS FILE NUMBER: fig-4-5(Bioavailability and WaterColumn) cw1102.mxd

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Using visual examination techniques, the sediment samples will be described in the field in general accordance with the Unified Soil Classification System.

Specific sample criteria to be noted includes:

- Sediment Name
- USCS Group Symbol
- Color (Munsell Soil Color Charts, revised 1992)
- Grain size and distribution
- Soil particle lithology
- Gradation
- Plasticity
- Bedding or sedimentary structures
- Chemical precipitates
- Organic material
- Moisture content
- Background odor

Other observations, such as field screening data, visual evidence of contamination or lack thereof, or the presence of debris will also be noted. Observations will be recorded on the field-sampling sheet for future reference. An example Field Sampling Data Sheet is presented in Appendix B. Other information to be noted on the Field Sampling Data Sheet include:

- Project name and location
- Project number
- Geologist's name
- Sample number
- Sample location

Sediment

This SOP describes the decontamination procedures for any non-dedicated sampling equipment, which comes into contact with potentially contaminated sediment. Equipment will be decontaminated as follows:

1. Soap wash (dilute solution of Alconox or equivalent in potable water solution),
2. Distilled water rinse,
3. Hexane rinse,
4. Distilled water rinse.

Any decontamination fluids will be containerized and marked in accordance with Section 7 of this FSP.

Water

This SOP describes the decontamination procedures for any non-dedicated water sampling equipment. Equipment will be decontaminated as follows:

1. Soap wash (dilute solution of Alconox or equivalent in potable water solution),
2. Distilled water rinse,

Any decontamination fluids will be containerized and marked in accordance with Section 7 of this FSP.

This SOP describes the procedure used to collect sediment samples with a box corer.

1. Assemble the coring device by inserting the acetate core into the sampling tube.
2. Insert the check valve mechanisms into the tip of the sampling tube with the convex surface positioned inside the acetate core.
3. Lower the box corer to within approximately six feet of the river bottom using an electric winch.
4. Release the cable when the corer is in position to allow sharp drop into sediment.
5. Immediately after core penetration, reestablish tension on the cable to establish vertical stability.
6. Retrieve the corer with the electronic winch.
7. Lift the corer off of the core liner.
8. Siphon any supernatant water from the surface of the sample being careful to retain fine sediments.
9. Measure core length.
10. Push sediment core upward 6 inches.
11. Inspect and describe core.
12. Collect sample for laboratory submission.
13. Push sediment core upward to collect sample from the 6 to 18 inch interval.

A grab sampler (a Van Veen or ponar sampler) is a 'clamshell' like device that operates using a cantilever trip system. This SOP describes the procedure used to collect sediment samples with a grab sampler.

1. Attach the sampler to an electric winch.
2. Arrange the sampler in the open position, setting the trip bar so the sampler remains open when lifted.
3. Slowly lower the sampler to a point just above the sediment.
4. Drop the sampler sharply into the sediment, then pull sharply up on the line, releasing the trip bar and closing the dredge.
5. Raise the sampler to the surface and slowly decant any free liquid through the screens on top of the dredge. Be careful to retain fine sediments.
6. Open the dredge and transfer the sediment to sampling containers.

A Kemmerer water sampler is a depth-discrete sampler constructed of PVC. This SOP describes the procedure used to collect sediment samples with a grab sampler.

1. Attach the sampler to a cable with depth measurements and to the water quality meter.
2. Deploy the sampler (along with the meter) in the water in the open position, lowering the sampler until the river bottom is reached.
3. Reel up the sampler six inches and wait approximately three minutes for disturbance created by the sampler to dissipate.
4. Take water quality readings for pH, turbidity, dissolved oxygen, conductivity, reduction-oxidation potential, and temperature.
5. Send the messenger down the cable to activate closure.
6. Retrieve the water sample.
7. Agitate the sampler to re-suspend any solids prior to filling sample bottles.
8. Sample bottles not requiring filtration will be filled directly from the sampler.
9. For sample bottles requiring filtration, a disposable 0.7-micron in-line filter will be attached to tubing.
10. Fill the appropriate sample bottles for dissolved parameters with the filtered sample water.

Field measurements of water quality parameters will be made with a portable, battery powered water quality meter, such as a Horiba-U22. This SOP describes the procedure used to measure pH, specific conductance, temperature, turbidity, reduction-oxidation potential, and dissolved oxidation in the water column.

1. Calibrate the instrument according to the manufacturer's instructions at the beginning of the day and when deemed necessary.
2. Rinse the sample probe with distilled water.
3. Deploy the water quality meter with the Kemmerer water sampler (see SOP 5).
4. Reel up the sampler six inches and wait approximately three minutes for disturbance created by the sampler to dissipate.
5. Wait for readings to stabilize.
6. Record readings for pH, specific conductance, temperature, turbidity, reduction-oxidation potential, and dissolved oxidation.

Bradford Island Post Removal Sediment Sampling

Sample Number:	Date:
Weather Conditions:	Time:

Analyses		
_____PCB-Aroclors	_____VOCs	_____% Moisture
_____PCB – Congeners	_____Pesticides	_____AVS/SEM
_____Metals	_____Butyltins	_____Grain Size
_____SVOCs	_____Diesel/Heavy Range Organics	_____pH
_____PAHs		_____TOC

Sample Collection
Sampling Method:
QC Samples Collected:
Water Sample Collected:
Decontamination Method:
Sample Team:

Sample Location
Latitude: _____ N Longitude: _____W
Description of Location:
Description of River Bottom:
Water Depth:
Sediment Depth:

Sediment Description
Color:
Texture:
UCSC Classification:
Odor/sheen:
Benthic Organisms:
Depth of bioactive layer:
Vegetation:

Other Comments

Bradford Island Post Removal Water Sampling

Sample Number:	Date:
Weather Conditions:	Time:

Analyses		
_____PCB-Aroclors	_____VOCs	_____TSS
_____PCB – Congeners	_____Pesticides	_____Hardness
_____Metals	_____Butyltins	_____pH
_____SVOCs	_____Diesel/Heavy Range Organics	_____TOC
_____PAHs		_____DOC

Sample Collection
Sampling Method:
QC Samples Collected:
Sediment Sample Collected:
Decontamination Method:
Sample Team:

Sample Location
Latitude: _____ N Longitude: _____W
Description of Location:
Water Depth:

Water Quality Readings
pH
Turbidity
Dissolved Oxygen
Conductivity
Reduction-Oxidation Potential
Temperature

Other Comments

URS

DATE _____

DAY	S	M	T	W	TH	F	S

WEATHER	Bright Sun	Clear	Overcast	Rain	Snow
TEMP	To 32	32-50	50-70	70-85	85 up
WIND	Still	Moder	High	Report No.	
HUMIDITY	Dry	Moder	Humid		

PROJECT MANAGER _____

PROJECT _____

JOB No. _____

CONTRACT No. _____

SUB-CONTRACTORS ON SITE:

EQUIPMENT ON SITE:

WORK PERFORMED (INCLUDING SAMPLING):

SHEET _____ OF _____

DAILY QUALITY CONTROL REPORT

PROJECT _____ REPORT No. _____

JOB No. _____ DATE _____

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

PROBLEMS ENCOUNTERED/CORRECTION ACTION TAKEN:

SPECIAL NOTES:

TOMORROW'S EXPECTATIONS:

BY _____ TITLE _____

REVISED DRAFT

SAMPLING AND ANALYSIS PLAN
PART II – QUALITY ASSURANCE PROJECT PLAN
POST REMOVAL SAMPLING

Bonneville Dam Project
Cascade Locks, Oregon

January 2003

Prepared for:

U.S. Army Corps of Engineers
Portland District
333 SW First Avenue
Portland, Oregon 97208-2946

Prepared by:

URS
111 S.W. Columbia, Suite 900
Portland, Oregon 97201-5814
25692710

TABLE OF CONTENTS

List of Abbreviations ..... **iv**

Section 1 Project Description **1-1**

Section 2 Project Organization and Responsibilities **2-1**

Section 3 Data Quality Objectives **3-1**

3.1 Background 3-1
3.2 QA Objectives for Chemical Data Measurement 3-1
3.2.1 Precision 3-2
3.2.2 Accuracy 3-2
3.2.3 Representativeness 3-2
3.2.4 Comparability 3-3
3.2.5 Completeness 3-3
3.2.6 Sensitivity 3-3

Section 4 Sampling Locations and Procedures **4-1**

Section 5 Sample Custody and Holding Times **5-1**

Section 6 Analytical Procedures **6-1**

6.1 Laboratory Procedures 6-1
6.1.1 Semivolatile Organic Compounds (SVOCs) 6-1
6.1.1.1 Sample Preparation 6-1
6.1.1.2 Analytical Method 6-1
6.1.2 Polychlorinated Biphenyls (PCBs) - Aroclors 6-1
6.1.2.1 Sample Preparation 6-1
6.1.2.2 Analytical Method 6-1
6.1.3 Organochlorine Pesticides (Pesticides) 6-2
6.1.3.1 Sample Preparation 6-2
6.1.3.2 Analytical Method 6-2
6.1.4 Diesel and Heavy Oil Range Organics 6-2
6.1.4.1 Sample Preparation 6-2
6.1.4.2 Analytical Method 6-2
6.1.5 Butyltins 6-2
6.1.5.1 Sample Preparation 6-2
6.1.5.2 Analytical Method 6-3
6.1.6 Total Metals (except mercury) 6-3
6.1.6.1 Sample Preparation 6-3
6.1.6.2 Analytical Method 6-3
6.1.7 Mercury 6-3
6.1.7.1 Sample Preparation 6-3
6.1.7.2 Analytical Method 6-3
6.1.8 Total Organic Carbon (TOC) 6-3
6.1.8.1 Sample Preparation 6-3
6.1.8.2 Analytical Method 6-4
6.1.9 Grain Size 6-4
6.1.9.1 Sample Preparation 6-4

6.1.9.2 Analytical Method 6-4
6.1.10 pH 6-4
6.1.11 Moisture Content 6-4
6.1.12 Acid Volatile Sulfides (AVS) and Simultaneously Extracted Metals (SEM) 6-4
6.1.12.1 Sample Preparation 6-4
6.1.12.2 Analytical Method 6-4
6.1.13 Total Suspended Solids (TSS) 6-5
6.1.14 Dissolved Organic Carbon (DOC) 6-5
6.1.15 Hardness 6-5

Section 7 Calibration Procedures and Frequency 7-1

7.1 Analytical Support Areas 7-1
7.2 Laboratory Instruments 7-2
7.3 Field Instruments 7-2

Section 8 Internal Quality Control Checks 8-1

8.1 Batch QC 8-1
8.2 Matrix-Specific QC 8-1
8.3 Additional QC 8-2

Section 9 Calculation of Data Quality Indicators 9-1

9.1 Precision 9-1
9.2 Accuracy 9-1
9.3 Completeness 9-2
9.4 Method Detection Limits (MDLs) 9-2

Section 10 Corrective Actions 10-1

10.1 Incoming Samples 10-1
10.2 Sample Holding Times 10-1
10.3 Instrument Calibration 10-1
10.4 Reporting Limits 10-1
10.5 Method QC 10-2
10.6 Calculation Errors 10-2

Section 11 Data Reduction, Review, Validation, and Reporting 11-1

11.1 Data Reduction 11-1
11.2 Data Review 11-1
11.3 Data Validation 11-2
11.4 Data Reporting 11-2
11.5 Laboratory Turnaround Time 11-2

Section 12 Preventative Maintenance 12-1

Section 13 Performance and System Audits 13-1

13.1 Performance and External Audits 13-1
13.2 Systems/Internal Audits 13-1

TABLE OF CONTENTS

Section 14 QC Reports to Management 14-1

Section 15 References 15-1

TABLES

Table 3-1 QA Objectives Summary
Table 5-1 Sample Methods and Container, Preservation, and Holding Time Requirements for Sediment Samples
Table 5-2 Sample Methods and Container, Preservation, and Holding Time Requirements for Water Samples
Table 6-1 Analytical Methods
Table 6-2 Sediment Reporting Limits
Table 6-3 Water Reporting Limits

APPENDICES

Appendix A Laboratory USACE Certifications

LIST OF ABBREVIATIONS

ºC	Degrees Celsius
CLP	Contract Laboratory Program
DQO	Data Quality Objective
ECD	Electron Capture Detector
FSP	Field Sampling Plan
GC	Gas Chromatography
ICP	Inductively Coupled Plasma
ID	Identification
kg	Kilograms
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System
MDL	Method Detection Limit
mg/kg	Milligrams per kilogram
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NWTPH-Gx	Northwest Total Petroleum Hydrocarbon – Gasoline Range Organics
NWTBP-Dx	Northwest Total Petroleum Hydrocarbon – Diesel Range Organics
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PCB	Polychlorinated Biphenyl
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
RL	Reporting Limit
SAP	Sampling and Analysis Plan
SI	Site Investigation
SOW	Scope of Work
TOC	Total Organic Carbon
µg/kg	Microgram per kilogram
URS	URS Corporation
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

1.0 PROJECT DESCRIPTION

This Quality Assurance Project Plan (QAPP) describes the policy, organization, functional activities, and quality assurance and quality control (QA/QC) for anticipated sediment and water sampling and analysis for the Post Removal Sampling (Post Removal Sampling) at the Bonneville Dam Project near Cascade Locks, Oregon.

The Sampling and Analysis Plan (which is composed of this QAPP and the Field Sampling Plan (FSP)), are the work plans that URS Corporation (URS) has prepared to fulfill the requirements of the United States Army Corps of Engineers (USACE) Delivery Order No. 0004 Modification No. 0006. These plans will govern the work conducted at this site.

A description of the location, historical use, and existing site data is presented in Section 1.0 of the FSP.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The URS organizational structure for this project is presented in Section 2-1 of the Field Sampling Plan.

The Project Manager has overall responsibility for project activities and monitoring the project progress. The Project Manager is responsible for planning, scheduling, cost control, and completion of project tasks. The Project Manager also has overall responsibility for the development and implementation of this Management Plan, for monitoring the quality of the technical and managerial aspects of the project, interfacing with the USACE, and ensuring the timeliness of all project deliverables.

The Field Manager is responsible for coordinating and overseeing the field operations, including compliance with the SAP, change orders, scheduling, liaison with USACE, and sample record keeping.

The Analytical Chemistry Task Manager will be responsible for ensuring QA procedures are being performed in the field. The Analytical Chemistry Task Manager will also be in direct contact with the analytical laboratory to monitor laboratory activities to ensure that holding times and other QA/QC requirements are met. will oversee the analytical laboratories and will direct the validation of chemical data. The Analytical Chemistry Task Manager will work closely with the URS Project Manager, the URS Field Manager, and the analytical laboratory.

A subcontracted laboratory will provide analytical services for this project. USACE validation letters for the contract laboratory will be provided in Appendix A following URS' selection of the contract laboratories. The laboratories' QA Scientists will be responsible for performing project-specific audits and for overseeing the quality control data generated. Also, the laboratories will be in daily communication with the Analytical Chemistry Task Manager.

3.0 DATA QUALITY OBJECTIVES

3.1 BACKGROUND

Data quality objectives (DQOs) are statements which specify the quality of data required to support objectives of the investigation. The quantity and type of data to be collected during this sampling were developed on the basis of USACE's Request for Proposal (RFP) No. DACW57-99-D-005, Task Order No. 0004 Modification No. 0006.

The following DQOs have been developed for the Post Removal Sampling:

- Characterize the lateral and vertical extent of sediment contamination.
- Characterize transport and bioavailibility of contaminants for human health and ecological risk assessment.
- Determine the nature of contaminants that may pose a human health or ecological risk.
- Determine background or ambient concentrations of contaminants in reference samples not impacted by site-specific contamination.
- Produce defensible high quality data.

In order to achieve the project DQOs, two levels of data will be generated during the investigation: field screening data and definitive data.

Field screening level data will be obtained in the field with a water quality meter. Turbidity, pH, dissolved oxygen, conductivity, reduction-oxidation potential, and temperature will be measured. Field measurement methodology is discussed in the FSP.

Definitive data will be obtained by collecting samples in an approved USACE manner and sending for offsite laboratory analysis. Table 3-1 provides a summary of definitive data to be collected during the Post Removal Sampling. All definitive data will be generated using rigorous analytical methods, including approved United States Environmental Protection Agency (USEPA) reference methods, as further discussed in Section 6.0. QA objectives for chemical data measurement are further discussed in the following section.

3.2 QA OBJECTIVES FOR CHEMICAL DATA MEASUREMENT

In order to ensure high quality and defensible data, standards will be set and measured for the following data quality indicators: precision, accuracy, representativeness, comparability, completeness, and sensitivity. These QA objectives apply to all definitive data produced by offsite chemical analysis. Calculation of data quality indicators is presented in Section 9.0.

3.2.1 Precision

Precision refers to the distribution of a set of reported values about the mean, or the closeness of agreement between individual test results obtained under prescribed conditions. Precision reflects the random error and may be affected by systematic error. Precision also characterizes the natural variation of the matrix and how the contamination exists or varies within that matrix (USACE, 2001). Precision is evaluated using analyses of an analytical sample and its corresponding matrix duplicate and/or laboratory matrix spike/matrix spike duplicate, which not only exhibit sampling precision, but indicate analytical precision through the reproducibility of the analytical results. Relative Percent Difference (RPD) is used to evaluate precision. RPD criteria must meet the method requirements summarized in Table 3-1.

3.2.2 Accuracy

Accuracy is the measure of the closeness of an observed value to the "true" value (e.g., theoretical or reference value, or population mean). Accuracy includes a combination of random error and systematic error (bias) components that result from sampling and analytical operations (USACE, 2001). Sources of potential error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis techniques. Sampling accuracy may be assessed by evaluating the results of rinse blanks. These data help to assess the potential concentration contribution from various outside sources. The laboratory objective for accuracy is to equal or exceed the accuracy demonstrated for the applied analytical methods on samples of the same matrix. The percent recovery criterion is used to estimate accuracy based on recovery in the matrix spike and matrix spike duplicate samples. The spike and spike duplicate, which will give an indication of matrix effects that may be affecting target compounds, are also a good gauge of method efficiency. Acceptable ranges of recovery are summarized in Table 3-1.

3.2.3 Representativeness

Representativeness expresses the degree to which the sample data accurately and precisely represent the characteristics of a population of samples, parameter variations at a sampling point, or environmental conditions. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program or subsampling of a given sample (USACE, 2001). Objectives for representativeness are defined for sampling and analysis tasks and are a function of the investigative objectives. The sampling procedures, as described in the FSP, have been selected with the goal of obtaining representative samples for the media of concern. Representativeness can be assessed qualitatively by the use of field and laboratory duplicate samples.

3.2.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another (USACE, 2001). A DQO for this program is to produce data with the greatest possible degree of comparability. This goal is achieved using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units. Complete field documentation using standardized data collection forms will support the assessment of comparability. Comparability is limited by the other parameters, because only when precision and accuracy are known can data sets be compared with confidence. In order that data sets may be comparable, it is imperative that contract-required methods and procedures be explicitly followed.

3.2.5 Completeness

Completeness is defined as the percentage of measurements that are judged to be usable (i.e., which meet project-specific requirements) compared to the total number of measurements planned (USACE, 2001). It is important that appropriate QA procedures be maintained to verify that valid data are obtained in order to meet project needs. For the data generated, the goals required for completeness (or usability) of the analytical data are presented on Table 3-1. If these goals are not met, then USACE and URS project personnel will determine whether the deviations might cause the data to be rejected.

3.2.6 Sensitivity

The term sensitivity is used to describe detection/quantitation/reporting limits established to meet project-specific DQOs (USACE, 2001). The reporting limits that are required for each analysis are those listed in Table 6-2 and are consistent with applicable method requirements. The reporting limit is the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The reporting limit is generally 5 to 10 times the method detection limit (USEPA, 1997). Instrument detection limits, method detection limits, and reporting limits published within USEPA methods are based on a reagent water matrix, and ignore sample matrix interferences and the resulting effect on limits, therefore the published limits may not be achievable for environmental samples.

4.0 SAMPLING LOCATIONS AND PROCEDURES

Sampling locations and procedures are discussed in Section 4.0 of the FSP.

5.0 SAMPLE CUSTODY AND HOLDING TIMES

Procedures addressing field and laboratory sample chain-of-custody and holding times are presented in the FSP. Table 5-1 and Table 5-2 contains analytical methods and container, preservation, and holding time requirements for sediment and water matrices, respectively.

6.0 ANALYTICAL PROCEDURES

6.1 LABORATORY PROCEDURES

The laboratory procedures to be performed include methodologies from the United States Environmental Protection Agency (USEPA), Washington State Department of Ecology Analytical Methods for Petroleum Hydrocarbons, American Society for Testing and Materials (ASTM) Annual Book of ASTM Standards, and the Puget Sound Water Quality Authority (PSWQA, 1996) as presented in Table 6-1. All samples will be analyzed following the USACE Shell guidance present in Appendix I of EM 200-1-3 (USACE, 2001). Briefly described below are the sample preparation and analytical methods to be performed.

6.1.1 Semivolatile Organic Compounds (SVOCs)

6.1.1.1 Sample Preparation

Sediment sample preparation required prior to analysis for SVOCs will be performed in accordance with USEPA Method 3550B, as referenced in Table 6-1. Sample cleanup may be performed by Gel Permeation Chromatography (GPC) by USEPA Method 3640A if necessary. Additional cleanups (i.e., USEPA Method 3650B acid-base partition cleanup, or USEPA Method 3660B sulfur cleanup) may be applied if necessary.

6.1.1.2 Analytical Method

The extract will be analyzed for SVOCs by GC/MS in accordance with USEPA Method 8270C (Table 6-1). The reporting limits (RLs) for SVOCs are presented in Table 6-2. The RLs are on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.2 Polychlorinated Biphenyls (PCBs) - Aroclors

6.1.2.1 Sample Preparation

Sediment sample preparation required prior to analysis for PCBs will be performed in accordance with USEPA Method 3550B, as referenced in Table 6-1. Sample cleanup will be performed by sulfur by USEPA Method 3660B. Additional cleanups (i.e., USEPA Method 3620B florisil cleanup, USEPA Method 3630C silica gel cleanup, or USEPA Method 3665A sulfuric acid/permanganate cleanup) may be applied if necessary.

6.1.2.2 Analytical Method

The extract will be analyzed for PCBs (Aroclors) by gas chromatography (GC) utilizing an electron capture detector (ECD) in accordance with USEPA Method 8082 (Table 6-1). The RLs

for PCB Aroclors are presented in Table 6-2. The RLs are on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.3 Organochlorine Pesticides (Pesticides)

6.1.3.1 Sample Preparation

Sediment sample preparation required prior to analysis for pesticides will be performed in accordance with USEPA Method 3550B, as referenced in Table 6-1. Sample cleanup will be performed by florisil by USEPA Method 3620B. Additional cleanups (i.e., USEPA Method 3640B GPC cleanup) may be applied if necessary.

6.1.3.2 Analytical Method

The extract will be analyzed for pesticides by GC/ECD in accordance with USEPA Method SW8081A (Table 6-1). The RLs for pesticides are presented in Table 6-2. The RLs are on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.4 Diesel and Heavy Oil Range Organics

6.1.4.1 Sample Preparation

Sediment sample preparation prior to analysis for diesel and heavy oil range organics will be performed in accordance with USEPA Method 3550B, as referenced in Table 6-1. Sample cleanup by USEPA Method 3620B florisil cleanup or USEPA Method 3630C silica gel cleanup may be applied if necessary.

6.1.4.2 Analytical Method

Diesel and heavy oil range organics analysis will be performed following Washington State Department of Ecology Method Northwest Total Petroleum Hydrocarbon – Diesel Range Organics (NWTPH-Dx) for solid matrices (WDOE, 1997). The RL for diesel range hydrocarbons is presented in Table 6-2. The RLs are on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.5 Butyltins

6.1.5.1 Sample Preparation

Sediment samples for butyltins are prepared by methylene chloride/tropolone extraction and be silica/alumina cleanup.

6.1.5.2 Analytical Method

Sample digestates will be analyzed by GC/MS as described in the Krone, 1988 method reference in Table 6-1.

6.1.6 Total Metals (except mercury)

6.1.6.1 Sample Preparation

Sediment sample preparation for total metals involves acid digestion prior to analysis. This will be performed in accordance with USEPA Method 3050B (Acid Digestion of Sediments, Sludges and Soils), as referenced in Table 6-1.

6.1.6.2 Analytical Method

Total metal digestates will be analyzed following USEPA Method 6020, as presented in Table 6-1. The RLs for total metals are presented in Table 6-2. The RLs are on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.7 Mercury

6.1.7.1 Sample Preparation

Sediment sample preparation for mercury involves digestion prior to analysis, as described in USEPA Method 7471A.

6.1.7.2 Analytical Method

Mercury will be analyzed following USEPA Method 7471A for solid matrices. The RL for mercury is presented in Table 6-2. The reporting limit is on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.8 Total Organic Carbon (TOC)

6.1.8.1 Sample Preparation

Sediment sample preparation will be performed in accordance with Method 9060, as referenced in Table 6-1.

6.1.8.2 Analytical Method

Total organic carbon (TOC) will be analyzed following USEPA Method 9060. The RL for TOC is presented in Table 6-2. The reporting limit is on a wet-weight basis. Sample RLs are highly matrix-dependent. RLs are provided as guidance and may not always be achievable.

6.1.9 Grain Size

6.1.9.1 Sample Preparation

Sediment samples do not require preparation prior to analysis, as referenced in Table 6-1, but may require cleanup for anticoagulation.

6.1.9.2 Analytical Method

Grain size will be determined following ASTM Method D422.

6.1.10 pH

Sediment pH will be measured in accordance with Method SW9045C, as referenced in Table 6-1. Water samples will be measured for pH in accordance with Method 150.1, as referenced in Table 6-1.

6.1.11 Moisture Content

Moisture content will be determined following ASTM Method D2216-90.

6.1.12 Acid Volatile Sulfides (AVS) and Simultaneously Extracted Metals (SEM)

6.1.12.1 Sample Preparation

The sediment sample is prepared for AVS and SEM with hydrochloric acid as specified in the EPA Draft Method as referenced in Table 6-1. The acidified sediment sample is membrane filtered before SEM determination.

6.1.12.2 Analytical Method

Hydrogen sulfide will be determined by the colorimetric method as described in the EPA Draft Method referenced in Table 6-1. SEM will be analyzed by EPA Methods 6020 and 7471 (see Section 6.1.6 and 6.1.7).

6.1.13 Total Suspended Solids (TSS)

Water samples will be measured for TSS in accordance with Method 160.2, as referenced in Table 6-1.

6.1.14 Dissolved Organic Carbon (DOC)

Water samples will filtered in the field and measured for DOC in accordance with Method 415.1, as referenced in Table 6-1.

6.1.15 Hardness

Water samples will be measured for hardness as calcium carbonate in accordance with Method 130.2, as referenced in Table 6-1.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

In order to obtain a high level of precision and accuracy during sample processing procedures, laboratory instruments must be calibrated properly. Several analytical support areas must be considered so the integrity of standards and reagents is upheld prior to instrument calibration. The following sections describe the analytical support areas and laboratory instrument calibration procedures.

7.1 ANALYTICAL SUPPORT AREAS

Prior to generating quality data, several analytical support areas must be considered:

Standard/Reagent Preparation - Primary reference standards and secondary standard solutions shall be obtained from National Institute of Standards and Technology (NIST), or other reliable commercial sources to verify the highest purity possible. The preparation and maintenance of standards and reagents will be accomplished per the methods referenced in Table 6-1. All standards and standard solutions are to be formally documented (i.e., in a bound logbook) and should identify the supplier, lot number, purity/concentration, receipt/preparation date, preparer's name, method of preparation, expiration date, and any other pertinent information. All standard solutions shall be validated prior to use. Care shall be exercised in the proper storage and handling of standard solutions (e.g., separating volatile standards from nonvolatile standards). The laboratory shall continually monitor the quality of the standards and reagents through well documented procedures.

Balances - The analytical balances shall be calibrated and maintained in accordance with manufacturer specifications. Calibration is conducted with two Class "A" weights that bracket the expected balance use range. The laboratory shall check the accuracy of the balances daily and they must be properly documented in permanently bound logbooks.

Refrigerators/Freezers - The temperature of the refrigerators and freezers within the laboratory shall be monitored and recorded daily. This will verify that the quality of the standards and reagents is not compromised and the integrity of the analytical samples is upheld. Appropriate acceptance ranges (2ºC to 6ºC for refrigerators) shall be clearly posted on each unit in service.

Water Supply System - The laboratory must maintain a sufficient water supply for all project needs. The grade of the water must be of the highest quality (analyte-free) in order to eliminate false-positives from the analytical results. Ultraviolet cartridges or carbon absorption treatments are recommended for organic analyses and ion-exchange treatment is recommended for inorganic tests. Appropriate documentation of the quality of the water supply system(s) will be performed on a regular basis.

7.2 LABORATORY INSTRUMENTS

Calibration of instruments is required to verify that the analytical system is operating properly and at the sensitivity necessary to meet established quantitation limits. Each instrument for organic and inorganic analyses shall be calibrated with standards appropriate to the type of instrument and linear range established within the analytical method(s). Calibration of laboratory instruments will be performed according to methods specified in Table 6-1.

Calibration of an instrument must be performed prior to the analysis of any samples and then at periodic intervals (i.e., continuing calibration) during the sample analysis to verify that the instrument is still calibrated. If the contract laboratory cannot meet the method required calibration requirements, corrective action shall be taken as discussed in Section 10.0. All corrective action procedures taken by the contract laboratory are to be documented, summarized within the case narrative, and submitted with the analytical results.

7.3 FIELD INSTRUMENTS

Calibration and general maintenance of field instruments will be the responsibility of the Field Investigation Task Manager. All calibration procedures and measurements will be made in accordance with manufacturers' specifications. Field instruments will be checked and calibrated prior to their use on site, and batteries will be charged and checked daily, where applicable. Instrument calibrations will be performed at the beginning of each workday and checked and recalibrated if necessary throughout the course of the day. A calibration check will be conducted at the end of each sampling day.

Equipment that fails calibration and/or becomes otherwise inoperable during the field investigation will be removed from service and segregated to prevent inadvertent use. Such equipment will be tagged to indicate that it should not be used until repaired.

8.0 INTERNAL QUALITY CONTROL CHECKS

Internal QC checks are used to determine if analytical operations at the laboratory are in control, as well as determining the effect sample matrix may have on data being generated. Two types of internal checks are performed and are described as batch QC and matrix-specific QC procedures. The type and frequency of specific QC samples performed by the contract laboratory will be according to the specified analytical method and project specific requirements. Acceptable criteria and/or target ranges for these QC samples are presented in Table 6-1.

QC results which vary from acceptable ranges shall result in the implementation of appropriate corrective measures, potential application of data qualifiers, and/or an assessment of the impact these corrective measures have on the established data quality objectives. Quality control samples including any project-specific QC which will be analyzed, are discussed below.

8.1 BATCH QC

Method Blanks - A method blank is defined as laboratory-distilled or deionized water that is carried through the entire analytical procedure. The method blank is used to determine the level of laboratory background contamination. Method blanks are analyzed at a frequency of one per analytical batch.

Laboratory Control Samples - A laboratory control sample is an aliquot of standard control matrices spiked (fortified) with all the elements being analyzed for calculation of precision and accuracy to verify that the analysis that is being performed is in control. A laboratory control sample will be performed for each matrix and parameter for which it is applicable.

8.2 MATRIX-SPECIFIC QC

Matrix Spike Samples - An aliquot of a matrix is spiked with known concentrations of specific compounds/analytes as stipulated by the methodology. The matrix spike (MS) and matrix spike duplicate (MSD) are subjected to the entire analytical procedure in order to assess both accuracy and precision of the method for the matrix by measuring the percent recovery and relative percent difference of the two spiked samples. The samples are used to assess matrix interference effects on the method, as well as to evaluate instrument performance. MS/MSDs are analyzed at a frequency of one each per twenty samples per matrix. MS and/or MSDs will be performed for all parameters listed in Table 6-1 with the exception of the grain size analysis.

Blind Field Duplicates - The field duplicate (blind or unknown to laboratory) is two representative aliquots of the same sample which are prepared and analyzed identically. Collection of duplicate samples provides for the evaluation of precision both in the field and at the laboratory by comparing the analytical results of two samples taken from the same location. Every effort will be made to obtain replicate samples; however, due to interferences, lack of homogeneity, and the nature of the solid samples, the analytical results are not always reproducible. Duplicate samples are to be included at a maximum of ten percent per matrix.

8.3 ADDITIONAL QC

Rinsate (Equipment) Blanks - A rinsate blank is a sample of laboratory demonstrated analyte-free water passed through and over the cleaned sampling equipment. A rinsate blank is used to indicate potential contamination from sample instruments used to collect and transfer samples. One rinsate blanks will be collected per twenty samples collected, or one rinsate blank will be collected for each day sediment sampling is conducted, whichever is greater.

Split Samples - Split samples (or QA samples) are used for performance audits or interlaboratory comparability of data. A split sample is defined as two separate samples taken from a single aliquot which has been thoroughly mixed or homogenized prior to the formation of the two separate samples. One split sample will be taken at a five percent frequency of all field samples and sent to a QA laboratory. The QA laboratory for this project is identified below. The QA laboratory will be notified approximately two weeks prior to any QA samples being shipped.

The QA laboratory shipping address is:

US Army Corps of Engineers
CQAB Lab
420 S. 18th Street
Omaha, NE 68102-2586
Attn: Laura Percifield
Phone - (402) 444-4300

QA samples will be assigned in the field. A Laboratory Information Management System (LIMS) # will be applied to the labels, chain-of-custody records, and all correspondence for all QA samples shipped to the QA lab throughout the project. The LIMS # is 5012.

9.0 CALCULATION OF DATA QUALITY INDICATORS

As discussed in Section 3.2, in order to ensure high quality and defensible data, data quality indicators will be measured during offsite chemical analysis. Calculation of these data quality indicators is presented below.

9.1 PRECISION

According to EM 200-1-3 (USACE 2001):

Precision refers to the distribution of a set of reported values about the mean, or the closeness of agreement between individual test results obtained under prescribed conditions. Precision reflects the random error and may be affected by systematic error. Precision also characterizes the natural variation of the matrix and how the contamination exists or varies within that matrix. Precision is evaluated using analyses of an analytical sample and its corresponding matrix duplicate and/or laboratory matrix spike/matrix spike duplicate, which not only exhibit sampling precision, but indicate analytical precision through the reproducibility of the analytical results. Precision determined by RPD shall be calculated as follows:

$$RPD = \frac{(X_1 - X_2)}{\left[\left(\frac{X_1 - X_2}{2}\right)\right]} x100$$

where:

X_1 = *Measured value of sample or matrix spike*

X_2 = *Measured value of duplicate or matrix spike duplicate*

9.2 ACCURACY

Analytical accuracy may be assessed through the use of known and unknown QC samples and spiked samples. Accuracy is presented as percent recovery. Accuracy will be determined from matrix spike, matrix spike duplicate, and laboratory control samples, as well as from surrogate compounds added to organic fractions and is calculated as follows:

$$Accuracy(\%R) = \frac{(X_s - X_u)}{K} x100$$

where:

Xs - Measured value of the spike sample

Xu - Measured value of the unspiked sample

K - Known amount of spike in the sample

9.3 COMPLETENESS

Completeness is calculated on a per matrix basis for the project and is calculated as follows:

$$Completeness(\%C) = \frac{(X_y - X_n)}{N} x100$$

where:

Xv - Number of valid measurements

Xn - Number of invalid measurements

N - Number of valid measurements expected to be obtained

9.4 METHOD DETECTION LIMITS (MDLS)

MDLs shall be determined for each target analyte using procedures outlined in 40 CFR Part 136, Appendix B. The method detection limit normally is calculated using data generated from reagent water. MDLs are calculated as follows:

$$MDL = t_{(n-1,\ 1-\mu\ =\ 0.99)}\ (S)$$

where: $t_{(n-1,\ 1-\mu\ =\ 0.99)}$ = Student's t-value appropriate to a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom

S = Standard deviation of the replicate analyses

10.0 CORRECTIVE ACTIONS

Laboratory corrective actions shall be implemented to resolve problems and restore proper functioning to the analytical system when errors, deficiencies, or out-of-control situations exist at the laboratory. Full documentation of the corrective action procedure needed to resolve the problem shall be filed in the project records, and the information summarized in the case narrative. A discussion of the corrective actions to be taken is presented in the following sections.

10.1 INCOMING SAMPLES

Problems noted during sample receipt shall be documented on a Cooler Receipt Form. The USACE/URS Managers shall be contacted immediately for problem resolution. All corrective actions shall be documented thoroughly.

10.2 SAMPLE HOLDING TIMES

If any sample extraction and/or analyses exceed method holding time requirements, USACE/URS Managers shall be notified immediately for problem resolution. All corrective actions shall be documented thoroughly.

10.3 INSTRUMENT CALIBRATION

Sample analysis shall not be allowed until all initial calibrations meet the appropriate requirements. All laboratory instrumentation must be calibrated in accordance with USACE Shell requirements (USACE, 2001). If any initial/continuing calibration standards exceed method QC limits, recalibration must be performed, and if necessary, reanalysis of all samples affected back to the previous acceptable calibration check.

10.4 REPORTING LIMITS

The laboratory must meet all project-required detection limits. If difficulties arise in achieving these limits due to a particular sample matrix, the laboratory must notify USACE/URS project personnel for problem resolution. In order to achieve those detection limits, the laboratory must utilize all appropriate cleanup procedures (e.g., sulfur and acid cleanup for Method 8082) in an attempt to retain the project required detection limits. When any sample requires a secondary dilution due to high levels of target analytes, the laboratory must document all initial analyses and secondary dilution results. Secondary dilution will be permitted only to bring target analytes within the linear range of calibration. If samples are analyzed at a secondary dilution with no target analytes detected, USACE/URS Managers will be immediately notified so that appropriate corrective actions can be initiated, if necessary.

The laboratory will report all detections below the MRL but above the MDL and flag these semiquantitative data points as estimated.

10.5 METHOD QC

All QC, including blanks, matrix duplicates, matrix spikes, matrix spike duplicates, surrogate recoveries, laboratory control samples, and other method-specified QC samples, shall meet the requirements referenced in Table 6-1. Failure of QC will result in the review and possible qualification of all affected data. If the laboratory cannot find any errors, the affected sample(s) shall be reanalyzed and/or re-extracted/redigested, then reanalyzed within method-required holding times to verify the presence or absence of matrix effects. If matrix effect is confirmed, the corresponding data shall be flagged accordingly using the flagging symbols and criteria as defined by the data validation guidelines identified in Section 11.3. If matrix effect is not confirmed, then the entire batch of samples may have to be reanalyzed and/or re-extracted/redigested, then reanalyzed at no cost to the Government. The USACE shall be notified as soon as possible to discuss possible corrective actions should unusually difficult sample matrices be encountered.

10.6 CALCULATION ERRORS

All analytical results must be reviewed systematically for accuracy prior to submittal. If upon data review, calculation and/or reporting errors exist, the laboratory will be required to reissue the analytical data report with the corrective actions appropriately documented in the case narrative.

11.0 DATA REDUCTION, REVIEW, VALIDATION, AND REPORTING

The analytical data generated by the laboratory shall be reviewed to assure the usability of the reported results. This internal data review process will consist of data generation, reduction, a minimum of three levels of documented review, and reporting.

11.1 DATA REDUCTION

Laboratory analytical data are first generated in raw form at the instrument. These data may be in either graphic or tabular form. Specific data reduction, generation procedures, and calculations are found in each of the methods referenced in Table 6-1, as well as within the laboratory LQAPP. Analytical results must be reported consistently. Data reduction will be performed by individuals experienced with a particular analysis, and knowledgeable of project QA/QC requirements.

11.2 DATA REVIEW

The technician/analyst who generates the analytical data is responsible for its correctness and completeness. The data review process involves evaluating both the results of the QC data and the professional judgement of the person(s) conducting the review. Applying technical knowledge and experience to the evaluation of data is essential in verifying that high quality data are generated.

The laboratory has documented procedures, which are to be followed and must be accessible to all laboratory personnel. The data review is generally conducted in a three-step process at the laboratory prior to submittal:

Level 1 - Technical Data Review - The analysts review the quality of their work based on an established set of guidelines. The review will verify, at a minimum, that appropriate preparation, analysis, and standards operating procedures have been followed; analytical results are correct and complete; QC samples are within established control limits; and that documentation is complete (e.g., any anomalies have been documented).

Level 2 - Technical Review - This level of review will be performed by a supervisor or data review specialist whose function is to provide an independent review of the data package. This review shall also be conducted according to an established set of guidelines (i.e., method requirements and laboratory standard operating procedures). The Level 2 review includes a review of qualitative and quantitative data, and a review of documented anomalies.

Level 3 - Administrative Data Review - The final review of the data, prior to submittal, is performed by the QA/QC officer or program administrator at the laboratory. This level provides a total overview of the data package to verify its consistency and compliance with project requirements.

11.3 DATA VALIDATION

Data validation is a systematic procedure of reviewing a body of data against a set of established criteria to provide a specified level of assurance of validity prior to its intended use. The validation will be performed following the general guidelines in USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review, EPA540/R-99/008, October 1999, USEPA CLP National Functional Guidelines for Inorganic Data Review, EPA540/R-01/008, July 2002. All samples will be reviewed independently (i.e., separately from the laboratory) for evaluation of data completeness, verification of chain-of-custody forms for correctness, review of holding time criteria, instrument calibration, assessment of QC blanks for contamination, assessment of laboratory precision and accuracy based upon duplicates and spike results and assessment of matrix interference. The independent review of data will be performed by environmental chemists, under the supervision of the URS Analytical Chemistry Task Manager, to verify compliance with specified analytical methods and project-specific precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters.

11.4 DATA REPORTING

The laboratory hardcopy analytical reports will be equivalent to the Contract Laboratory Program (CLP) Organic and Inorganic Statement of Works, OLM04.2 and ILM04.0, respectively (or most current versions). A "Cooler Receipt Form" will also be required with each cooler and included in the deliverable data package for the purposes of noting problems in sample packaging, chain-of-custody, and sample preservation.

The laboratory will submit GISKey Electronic Data Deliverables.

11.5 LABORATORY TURNAROUND TIME

The contract laboratory will be required to submit the analytical hardcopy and electronic data packages, in accordance with Section 11.4, 21 working days from validated time of sample receipt at the laboratory.

12.0 PREVENTATIVE MAINTENANCE

The laboratory is responsible for the maintenance of its analytical equipment. Preventive maintenance is provided on a regular basis to minimize down-time and the potential interruption of analytical work. Instruments are maintained in accordance with the manufacturer's recommendations. If instruments require maintenance, only trained laboratory personnel or manufacturer-authorized service specialists are permitted to do the work. Maintenance activities will be documented and kept in permanent logs. These logs will be available for inspection by auditing personnel.

13.0 PERFORMANCE AND SYSTEM AUDITS

Audits are systematic examinations to determine whether activities comply with planned arrangements, whether the arrangements are implemented effectively, and whether the results are suitable to achieve project objectives.

No field or laboratory audits are anticipated for this project. The contract laboratory regularly undergoes performance evaluation audits by the USACE and has current validations for the analytical methods to be used for this project.

13.1 PERFORMANCE AND EXTERNAL AUDITS

In addition to conducting internal reviews and audits, as part of its established quality assurance program, the laboratory is required to take part in regularly-scheduled performance evaluations and laboratory audits from state and federal agencies. They are conducted as part of the certification process and to monitor the laboratory performance. The audits also provide an external quality assurance check of the laboratory and provide reviews and information on the management systems, personnel, standard operating procedures, and analytical measurement systems. Acceptable performance on evaluation samples and audits is required for certification and accreditation. The laboratory shall use the information provided from these audits to monitor and assess the quality of its performance. Problems detected in these audits shall be reviewed by the QA Scientist and Laboratory Manager, and corrective action shall be instituted as necessary.

13.2 SYSTEMS/INTERNAL AUDITS

As part of its Quality Assurance Program, the Laboratory Quality Assurance Scientist shall conduct periodic checks and audits of the analytical systems. The purpose of these is to verify that the analytical systems are working properly, and that personnel are adhering to established procedures and documenting the required information. These checks and audits also assist in determining or detecting where problems are occurring.

The QA Scientist periodically will submit laboratory control samples. These samples will serve to check the entire analytical method, the efficiency of the preparation method, and the analytical instrument performance. The results of the control samples are reviewed by the QA Scientist who reports the results to the analyst and the Laboratory Director. When a problem is indicated, the QA Scientist will assist the analyst and laboratory management in determining the reason and in developing solutions. The QA Scientist also will recheck the systems as required.

14.0 QC REPORTS TO MANAGEMENT

After the fieldwork and the final analyses have been completed and reviewed, the Analytical Task Manager will submit a Data Review Report evaluating the PARCC parameters. The Data Quality Control report will be submitted as an appendix to the Post-Removal Sediment Sampling Report.

15.0 REFERENCES

American Society for Testing and Materials (ASTM), 2001. Annual Book of ASTM Standards. American Society for Testing and Materials.

Krone, 1988. *Method for Analysis of Butyltin Species and Measurment of Butyltins in Sediment and English Sole Livers.*

Oregon Department of Environmental Quality. 2001. Guidance for Ecological Risk Assessment, Level II Screening Level Values.

Puget Sound Water Quality Authority (PSWQA), 1996. Recommended guidelines for measuring organic compounds in Puget Sound water, sediment, and tissue samples. Environmental laboratory for the Puget Sound Water Quality Authority, Lacey, Washington.

USACE. 2001. *Environmental Quality, Requirements for the Preparation of Sampling and Analysis Plans, Regulation No. EM 200-1-3.* 1 February. Washington: USACE.

USEPA. 2002. CLP National Functional Guidelines for Inorganic Data Review, EPA540/R-01/008, July.

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USEPA. 1997. *Test Methods For Evaluating Solid Waste, Physical/Chemical Methods, SW-846 Integrated Manual*, Final Update III. June. Washington, DC: OSWER.

USEPA. 1993. *Data Quality Objectives Process for Superfund*, Interim Final Guidance, EPA540-R-93-071. September. Washington: USEPA.

USEPA. 1991. *Draft - Analytical Method for Determination of Acid Volatile Sulfide and Selected Simultaneously Extractable Metals in Sediment.* Office of Water. EPA821/R-91-100. December 1991.

Washington State Department of Ecology. 1997. Analytical Methods for Petroleum Hydrocarbons. ECY 97-602.

TABLES

TABLE 3-1
QA Objectives Summary

Data Use	Matrix	Analytical Method	No. of Field Samples	No. of Field Duplicate Samples	No. of Equipment Rinsate Samples	No. of QA (Split) Samples	Data Category	Precision (RPD)		Lab Accuracy (Matrix Spikes)	Completeness
								Field Dups	Lab Dups		
Characterize nature and extent of sediment contamination and determination of background/ambient concentrations	Sediment	EPA 8270C for SVOCs	105	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	45-135% Recovery	100%
	Sediment	EPA 8082 for PCB Aroclors	109	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	40-140% Recovery	100%
	Sediment	EPA 8081A for Organochlorinated Pesticides	105	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	40-140% Recovery	100%
	Sediment	NWTPH-Dx for Diesel Range Organics	105	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	50-150% Recovery	100%
	Sediment	Krone GC-MS For Butyltins	105	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	30-125% Recovery	100%
	Sediment	EPA 6020 for TAL Metals	105	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	75-125% Recovery	100%
	Sediment	EPA 7471A for Mercury	105	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	Not Applicable	80-120% Recovery	100%
Determine contaminant fate and bioavailability	Sediment	EPA 9060 for TOC	109	10	1 per day or 6 (whichever is greater)	5	Definitive	≤ 50 RPD	≤ 25 RPD	85-115% Recovery	100%
	Sediment	ASTM D422 for Grain Size	109	10	NA	5	Definitive	≤ 50 RPD	Not Applicable	Not Applicable	100%
	Sediment	EPA 9045C for pH	10	1	NA	1	Definitive	≤ 50 RPD	≤ 10 RPD	Not Applicable	100%
	Sediment	ASTM D2216-90 for Moisture Content	10	1	NA	1	Definitive	≤ 50 RPD	≤ 10 RPD	Not Applicable	100%
	Sediment	EPA Draft 821/R-91-100 for AVS/SEM	10	1	NA	1	Definitive	≤ 50 RPD	Not Applicable	75-125% Recovery	100%

TABLE 3-1
QA Objectives Summary

Data Use	Matrix	Analytical Method	No. of Field Samples	No. of Field Duplicate Samples	No. of Equipment Rinsate Samples	No. of QA (Split) Samples	Data Category	Precision (RPD)		Lab Accuracy (Matrix Spikes)	Completeness
								Field Dups	Lab Dups		
Determine contaminant fate and bioavailability	Water	EPA 160.2 for TSS	10	1	NA	1	Definitive	≤ 20 RPD	≤ 10 RPD	Not Applicable	100%
	Water	EPA 415.1 for DOC	10	1	NA	1	Definitive	≤ 20 RPD	≤ 10 RPD	Not Applicable	100%
	Water	EPA 130.2 for Hardness	10	1	NA	1	Definitive	≤ 20 RPD	≤ 10 RPD	Not Applicable	100%
	Water	EPA 150.1 for pH	10	1	NA	1	Definitive	≤ 20 RPD	≤ 10 RPD	Not Applicable	100%

Notes:

AVS/SEM – Acid Volatile Sulfides/Simultaneously Extracted Metals
DOC – Dissolved Organic Carbon
EPA – Environmental Protectin Agency
GC-MS – Gas Chromatography-Mass Spectrometry
No. – Number
NWTPH – Northwest Total Petroleum Hydrocarbons
PCB – Polychlorinated Biphenyls
PSEP – Puget Sound Estuary Program
QA – Quality Assurance (Field Duplicate submitted to the USACE QA Laboratory)
RPD - Relative Percent Difference
SVOCs- Semivolatile Organic Compounds
TAL – Target Analyte List
TOC – Total Organic Carbon
TSS- Total Suspended Solids

TABLE 5-1
Sample Methods and Container, Preservation, and Holding Time Requirements for Sediment Samples*

ANALYTICAL PARAMETER	METHOD	CONTAINER	PRESERVATION	HOLDING TIMES**
Semivolatile Organic Compounds (SVOCs)	SW8270C	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Polychlorinated Biphenyls (PCBs) - Aroclors	SW8082	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Organochlorinated Pesticides	SW8081A	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Northwest Total Petroleum Hydrocarbons – Diesel Range Organics (NWTPH-Dx)	NWTPH-Dx	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Butyltins	Krone GC/MS	1-8 oz CWMglass	4 °C	14 days to extract, then 40 days to analyze
Metals (except mercury)	SW6020	1-8 oz CWM glass	4 °C	180 days to analyze
Mercury	SW7471A	1-8 oz CWM glass	4 °C	28 days to analyze
Total Organic Carbon (TOC)	SW9060	1-8 oz CWM glass	4 °C	28 days to analyze
Grain Size (Sieve and Hydrometer)	ASTM D422	32 oz CWM	None	None
pH	9045C	1-4 oz CWM glass	4 °C	Upon receipt
Moisture Content	ASTM D2216-90	1-4 oz CWM glass	4 °C	None
Acid Volatile Sulfide (AVS) and Simultaneously Extractable Metals (SEM)	EPA Draft 821/R-91-100***	1-8 oz CWM glass	4 °C	14 days to analyze

Notes:

* An extra 8-oz CWM glass jar will be collected at each sample location to be frozen and archived at the laboratory.
*Triple volume must be collected for MS/MSD samples.
**Holding times are from date of sample collection.
***EPA Draft document entitled Analytical Method for Determination of Acid Volatile Sulfide and Selected Simultaneously Extractable Metals in Sediment. (December 1991).
All containers will have Teflon-lined seals or septa (i.e.; NWTPH-Gx)
CWM – Clear wide mouth glass jar

TABLE 5-2
Sample Methods and Container, Preservation, and Holding Time Requirements for Water Samples*

ANALYTICAL PARAMETER	METHOD	CONTAINER	PRESERVATION	HOLDING TIMES**
Total Suspended Solids (TSS)	EPA 160.2	1-250 ml HDPE	4 °C	7 days
Dissolved Organic Carbon (DOC)***	EPA 415.1	1-250 ml AGJ	4 °C , H_2SO_4 to pH<2	28 days
Hardness	EPA 130.2	1- 125 ml HDPE	4 °C , H_2SO_4 to pH<2	6 months
pH	EPA 150.1	1- 125 ml HDPE	4 °C	Upon receipt

Notes:

*Triple volume must be collected for MS/MSD samples.
**Holding times are from date of sample collection.
***DOC sample must be field filtered before filling the sample container.
AGJ – Amber Glass Jar
HDPE- High Density Polyethylene Bottles

TABLE 6-1
Analytical Methods

Parameter	Preparation Method Number	Cleanup Method Number*	Analysis Method Number	Reference
Sediment				
Semivolatile Organic Compounds (SVOCs)	3550B	3640A if necessary	8270C	1
Polychlorinated Biphenyls (PCB) - Aroclors	3550B	3660B	8082	1
Organochlorinated Pesticides	3550B	3620B	8081A	1
Northwest Total Petroleum Hydrocarbons – Diesel Range Organics (NWTPH-Dx)	3550B	3620B or 3630C if necessary	NWTPH-Dx	1/3
Butyltins	Krone	Krone	Krone	6
Metals	3050B	None	6020	1
Mercury	Not Applicable	None	7471A	1
Total Organic Carbon (TOC)	Not Applicable	None	9060	1
Grain Size (Sieve and Hydrometer)	Not Applicable	Anticoagulation (optional)	D422	4
pH	Not Applicable	None	9045C	1
Moisture Content	Not Applicable	None	D2216-90	4
Acid Volatile Sulfide (AVS) and Simultaneously Extractable Metals (SEM)	Not Applicable	None	EPA Draft 821/R-91-100	5
Water				
Total Suspended Solids (TSS)	Not Applicable	None	160.2	2
Dissolved Organic Carbon (DOC)	Not Applicable	None	415.1	1
Hardness	Not Applicable	None	130.2	2
pH	Not Applicable	None	150.1	2

*Additional cleanup options are available as discussed in Section 6.0 and will be applied as necessary.

References:

1. USEPA, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Integrated Manual, Final Update III*, June 1997.
2. USEPA, *Methods for Chemical Analysis of Water and Wastes, EPA-600*, Revised March 1983.
3. Washington State Department of Ecology, 1997. Analytical Methods for Petroleum Hydrocarbons. ECY 97-602.
4. American Society for Testing and Materials (ASTM), 2001. Annual Book of ASTM Standards.
5. USEPA, 1991. *Draft Analytical Method for Determination of Acid Volatile Sulfide and Selected Simultaneously Extractable Metals in Sediment.* December 1991.
6. Krone, 1988. *Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers.*

TABLE 6-2
Sediment Reporting Limits

Analyte	Sediment Reporting Limits* (µg/kg)	DEQ Level II Screening Level Values for Freshwater Sediment ** (µg/kg)
SVOCs-8270C		
1,2,4-Trichlorobenzene	20	No value
1,2-Dichlorobenzene	20	No value
1,3-Dichlorobenzene	20	No value
1,4-Dichlorobenzene	20	No value
2,4,5-Trichlorophenol	100	No value
2,4,6-Trichlorophenol	100	No value
2,4-Dichlorophenol	60	No value
2,4-Dimethylphenol	20	No value
2,4-Dinitrophenol	200	No value
2,4-Dinitrotoluene	100	No value
2,6-Dinitrotoluene	100	No value
2-Chloronaphthalene	20	No value
2-Chlorophenol	20	No value
2-Methylnaphthalene	20	No value
2-Methylphenol	20	No value
2-Nitroaniline	100	No value
2-Nitrophenol	100	No value
4-Methylphenol	20	No value
3,3´-Dichlorobenzidine	100	No value
3-Nitroaniline	120	No value
4,6-Dinitro-2-methylphenol	200	No value
4-Bromophenyl phenyl ether	20	No value
4-Chloro-3-methylphenol	40	No value
4-Chloroaniline	60	No value
4-Chlorophenyl phenyl ether	20	No value
4-Nitroaniline	100	No value
4-Nitrophenol	100	No value
Acenaphthene	20	290
Acenaphthylene	20	160
Aniline	20	No value
Anthracene	20	57
Benzo (a) anthracene	20	32
Benzo (a) pyrene	20	32
Benzo (b) fluoranthene	20	No value
Benzo (ghi) perylene	20	300
Benzo (k) fluoranthene	20	27
Benzoic Acid	200	No value
Benzyl alcohol	20	No value
Bis(2-chloroethoxy)methane	20	No value
Bis(2-chloroethyl)ether	40	No value
Bis(2-ethylhexyl)phthalate	20	750
Butyl benzyl phthalate	20	No value
Carbazole	20	140

TABLE 6-2
Sediment Reporting Limits

Analyte	Sediment Reporting Limits* (µg/kg)	DEQ Level II Screening Level Values for Freshwater Sediment ** (µg/kg)
Chrysene	20	57
Di-n-butyl phthalate	20	110
Di-n-octyl phthalate	20	No value
Dibenz (a,h) anthracene	20	33
Dibenzofuran	20	5100
Diethyl phthalate	20	No value
Dimethyl phthalate	20	No value
Fluoranthene	20	111
Fluorene	20	77
Hexachlorobenzene	20	100
Hexachlorobutadiene	20	No value
Hexachlorocyclopentadiene	100	No value
Hexachloroethane	20	No value
Indeno (1,2,3-cd) pyrene	20	17
Isophorone	20	No value
N-Nitrosodimethylamine	20	No value
N-Nitrosodi-n-propylamine	40	No value
N-Nitrosodiphenylamine	100	No value
Naphthalene	20	176
Nitrobenzene	20	No value
Pentachlorophenol	100	No value
Phenanthrene	20	42
Phenol	20	48
Pyrene	20	53
PCBs - Aroclors		
Aroclor 1016	20	No value
Aroclor 1242	20	No value
Aroclor 1248	20	21
Aroclor 1254	20	7
Aroclor 1260	20	No value
Organochlorinated Pesticides		
Alpha-BHC	1	No value
Beta-BHC	1	No value
Gamma-BHC (Lindane)	1	0.9
Delta-BHC	1	No value
Heptachlor	1	10
Aldrin	1	40
Heptachlor Epoxide	1	0.6
Gamma chlordane	1	4.5
Alpha chlordane	1	No value
Endosulfan I	1	No value
DDE	2	1.5
Dieldrin	2	3
Endrin	2	3
Endosulfan II	2	No value
DDD	2	4

TABLE 6-2
Sediment Reporting Limits

Analyte	Sediment Reporting Limits* (µg/kg)	DEQ Level II Screening Level Values for Freshwater Sediment ** (µg/kg)
Endrin Aldehyde	2	No value
DDT	2	4
Endosulfan Sulfate	2	No value
Endrin Ketone	2	No value
Methoxychlor	10	No value
Hexchlorobutadiene	1	No value
Hexachlorobenzene	1	100
Toxaphene	100	No value
Diesel Range Hydrocarbons	5000	No Value
Heavy Oil Range Hydrocarbons	5000	No Value
Butyltins		
Monobutyltin	12	No Value
Dibutyltin	12	No Value
Tributyltin	6	No Value
Metals		
Arsenic	500	6000
Chromium	500	37000
Cobalt	200	No value
Copper	500	36000
Iron	20000	No value
Lead	1000	35000
Mercury	50	200
Nickel	500	18000
Selenium	500	No Value
Zinc	400	123000
TOC	200,000	No Value
Grain Size (Sieve and Hydrometer)	0.0014 mm	No Value

Notes:

* Reporting limits listed are highly matrix-dependent and may not always be achievable. Reporting limits for sediments are based on wet weight. The reporting limits, calculated on a dry-weight basis, will be higher. In order to compare typical laboratory reporting limits with screening values, reporting limits from Analytical Resources Incorporated laboratory were used. The laboratory contracted to conduct the analysis will obtain similar reporting limits.

**Oregon Department of Environmental Quality. 2001. Guidance for Ecological Risk Assessment, Level II Screening Level Values.

Highlighted cells indicate method reporting limits above the DEQ Level II Freshwater Sediment Screening Level Value. In all cases, the method detection limit for these compounds is below the screening level value.

TABLE 6-3
Water Reporting Limits

Analyte	Water Reporting Limits* (mg/L)	DEQ Level II Screening Level Values for Surface Water (µg/kg)
Total Suspended Solids	1.0	No value
Dissolved Organic Carbon	1.5	No value
Hardness	1.0	No value

* Reporting limits listed are from Analytical Resources Incorporated laboratory. The laboratory contracted to conduct the analysis will obtain similar reporting limits.

Laboratory USACE Certification will provided following selection of the laboratory.