APPENDIX C

QAPP ADDENDUM

LOWER DUWAMISH WATERWAY SLIP 4 EARLY ACTION AREA

Quality Assurance Project Plan for Boundary Definition

Addendum: Pre-Design Investigation Sampling

Submitted to
U.S. Environmental Protection Agency, Region 10
1200 Sixth Avenue
Seattle, WA 98101

Submitted by
City of Seattle
King County

Prepared by

integral consulting inc.

7900 SE 28th Street, Suite 300
Mercer Island, WA 98040

June 8, 2006

A PROJECT MANAGEMENT

A1 TITLE AND APPROVAL SHEET

QUALITY ASSURANCE PROJECT PLAN FOR BOUNDARY DEFINITION
PRE-DESIGN INVESTIGATION SAMPLING ADDENDUM

LOWER DUWAMISH WATERWAY SLIP 4 EARLY ACTION AREA
SEATTLE, WASHINGTON

Quality Assurance Project Plan Approvals

EPA Project Coordinator:	Karen Keeley	_____	Date: _____
EPA QA Manager:	Ginna Grepo-Grove	_____	Date: _____
City of Seattle Project Manager:	Jennie Goldberg	_____	Date: _____
Integral Principal in Charge:	Betsy Day	_____	Date: _____
Integral Project Manager:	David Schuchardt	_____	Date: _____
Integral Project QA Coordinator:	Reid Carscadden	_____	Date: _____
ARI Project Manager:	Sue Dunnihoo	_____	Date: _____
ARI QA Manager:	Dave Mitchell	_____	Date: _____

This page intentionally left blank.

A2 TABLE OF CONTENTS

A PROJECT MANAGEMENT ii
A1 TITLE AND APPROVAL SHEET ii
A2 TABLE OF CONTENTS iv
A3 DISTRIBUTION LIST vii
A4 INTRODUCTION AND PROJECT AND TASK ORGANIZATION 1
A4.1 Introduction 1
A4.2 Project and Task Organization 1
A5 PROBLEM DEFINITION AND BACKGROUND 1
A6 TASK DESCRIPTION 2
A7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA 3
SECTION B: DATA GENERATION AND ACQUISITION 5
B1 SAMPLING PROCESS DESIGN 5
B2 SAMPLING METHODS 7
B3 SAMPLE HANDLING AND CUSTODY 7
B4 ANALYTICAL METHODS 7
B5 QUALITY CONTROL 7
B5.1 Field Quality Control Samples 7
REFERENCES 9

LIST OF FIGURES

Figure A4-1. Organization Chart

LIST OF TABLES

Table A4-1. Project Team Contact Information
Table A6-1. Estimated Numbers of Pre-Design Samples by Sample Type
Table A6-2. Target Analytes, Methods, and Method Reporting Limits for Pre-Design Investigation Samples
Table A7-1. Measurement Quality Objectives
Table B2-1. Sample Containers, Preservation, Holding Times, and Sample Volume

ACRONYMS AND ABBREVIATIONS

ARI	Analytical Resources Inc.
ASTM	American Society for Testing and Materials
bml	below the mudline
DOC	dissolved organic carbon
DQOs	data quality objectives
EDD	electronic data deliverables
EE/CA	engineering evaluation/cost analysis
EPA	U.S. Environmental Protection Agency
EQuIS	Environmental Quality Information System
LDW	Lower Duwamish Waterway
MDLs	method detection limits
MQOs	measurement quality objectives
MRLs	method reporting limits
MS	mass spectrometry
PCB	polychlorinated biphenyl
PSEP	Puget Sound Estuary Program
QAPP	quality assurance project plan
QC	quality control
SAP	sampling and analysis plan
SVOCs	semivolatile organic compounds
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TPH-Dx	extended diesel-range total petroleum hydrocarbon
TPH-G	gasoline-range total petroleum hydrocarbon
TSCA	Toxic Substances Control Act
USCS	Unified Soil Classification System

A3 DISTRIBUTION LIST

U.S. EPA Region 10 Remedial Project Manager:	Karen Keeley
U.S. EPA QA Manager:	Ginna Grepo-Grove
City of Seattle Project Coordinator:	Jennie Goldberg
Integral Principal in Charge:	Betsy Day
Integral Project Manager:	David Schuchardt
Integral Project QA Coordinator:	Reid Carscadden
Integral Field Coordinator:	Jane Sund or Susan FitzGerald
Integral Laboratory Coordinator & QA Manager:	Maja Tritt
Integral Data Manager:	Tom Schulz
ARI Project Manager:	Sue Dunnihoo
ARI QA Manager:	Dave Mitchell

A4 INTRODUCTION AND PROJECT AND TASK ORGANIZATION

A4.1 Introduction

This quality assurance project plan (QAPP) addendum describes procedures that will be used to complete a pre-design investigation to characterize seep water, sediment, and bank soil in the Slip 4 Early Action Area of the Lower Duwamish Waterway (LDW). This addendum supplements the Boundary Definition QAPP (Integral 2004a). The Boundary Definition QAPP describes procedures and requirements for the generation of data of documented acceptable quality that will be used for the pre-design investigation. This Pre-Design QAPP Addendum addresses procedures that will be used for the pre-design investigation that are not described in the Boundary Definition QAPP.

Supplemental information to Sections A and B of the Boundary Definition QAPP is provided in this Pre-Design QAPP Addendum. Special training and certification, and documents and records are described in Sections A8 and A9, respectively, of the Boundary Definition QAPP and are not addressed further in this QAPP addendum.

Procedures for project assessment and oversight will be completed as described in Section C of the Boundary Definition QAPP.

All data for organic, inorganic, and conventional analytes, including total solids used for dry-weight conversions, will be verified and validated. Data for geotechnical characteristics do not require validation because of the mechanical nature of these tests. Data verification and validation, and data quality assessment procedures will be completed as described in Section D of the Boundary Definition QAPP.

A4.2 PROJECT AND TASK ORGANIZATION

The organizational structure for this project is illustrated in Figure A4-1. Contact information related to the pre-design investigation is provided in Table A4-1 of this QAPP addendum. Project and quality assurance responsibilities are described in detail in Section 3.1 of the Boundary Definition sampling and analysis plan (SAP) and Pre-Design SAP Addendum (Integral 2004b and 2006b, respectively).

A5 PROBLEM DEFINITION AND BACKGROUND

The primary objective of this Slip 4 pre-design investigation is to fill identified data gaps to support the design of the removal action alternative recommended by the City of Seattle and King County, as presented in the engineering evaluation/cost analysis (EE/CA) (Integral 2006a). Data will be collected to support the following activities:

- Verification of the removal boundary
- Characterization of seep water
- Dredging evaluation of the removal area
- Characterization of removal area sediment and bank soil for disposal
- Geotechnical characterization of the capping area.

Sampling activities will include collection of seep samples, surface and subsurface sediment samples, and subsurface bank samples. Details are provided in Sections 2.1 and 2.2 of the Pre-Design SAP Addendum.

A6 TASK DESCRIPTION

The tasks to be completed for this project include fieldwork, laboratory analyses, data quality evaluation, data management, data analysis, and report preparation. The Slip 4 pre-design elements include a field conditions survey, seep water sampling, intertidal surface sediment sampling, subsurface bank soil sampling, and subsurface sediment coring. The methods to be used for the collection of these samples are described in Section 3.3 of the Pre-Design SAP Addendum. All field documentation, station positioning, sample handling, equipment decontamination, waste disposal, chain-of-custody, and quality control procedures will follow those described in the Boundary Definition SAP (Integral 2004b), except where noted in the Pre-Design SAP Addendum.

Integral will collect the various sediment, bank soil, and seep water samples and prepare samples for delivery to the laboratory. Susan FitzGerald or Jane Sund of Integral will serve as field coordinator and will assume custody of cores and samples as they are collected. A list of samples and analyses is provided in Table A6-1. Sample locations are provided in Figure 2-2 of the Pre-Design SAP Addendum (Integral 2006b).

Samples will undergo chemical and geotechnical testing by Analytical Resources Inc. (ARI, Seattle, WA) for analytes listed in Table A6-2. Analyses will be completed using U.S. Environmental Protection Agency (EPA), American Society for Testing and Materials (ASTM), and Puget Sound Estuary Program (PSEP) methods (USEPA 2003; PSEP 1986; 1997a,b; ASTM 2003), as indicated in Table A6-2. Full laboratory data reports will be provided in hardcopy, and electronic data deliverables (EDDs) will be provided in spreadsheet format as required for importing into the database. The Environmental Quality Information System (EQuIS) database application will be used to manage the field and laboratory data. Data will also be submitted electronically to EPA in SEDQUAL format.

Data verification will be completed by Integral for data generated in the field and by ARI for data generated at the laboratory. The accuracy and completeness of the final database will be verified by Integral. Data validation and data quality assessment will be

completed by an independent validation firm, which will be selected at a later date. The validation firm will also complete data verification (i.e., verifying that analytical procedures and calculations were completed correctly and checking transcriptions of the laboratory data) for the first data package for each analysis as part of the full validation that will be completed for these packages.

The results of the Pre-Design SAP Addendum field sampling will be presented in the 60% Design Documents for the Slip 4 Early Action, currently scheduled for completion in fall 2006.

The start date for field sampling will be determined following EPA approval of the project SAP and QAPP addenda, and pending property access permission from property owners. Currently, it is anticipated that field sampling will begin in June 2006. The field and reporting schedules are discussed further in Sections 3.2 and 4.4, respectively, of the Pre-Design SAP Addendum.

A7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

Data quality objectives (DQOs) for the pre-design investigation are described in Section A7 of the Boundary Definition QAPP. Target method reporting limits (MRLs) and method detection limits (MDLs) for this project are summarized in Table A6-2. Measurement quality objectives (MQOs) for this project are summarized in Table A7-1. Analyte concentrations for this project will be reported to the MDL, as described in the Boundary Definition QAPP.

This page intentionally left blank.

SECTION B: DATA GENERATION AND ACQUISITION

B1 SAMPLING PROCESS DESIGN

This section supplements Section B1 of the Boundary Definition QAPP. The sampling effort for this study will include the collection of seep water, surface sediment, subsurface sediment, and subsurface bank soil from Slip 4 in the LDW.

Seep water will be collected as discrete samples from individual seep locations (to be determined in the field). Water quality parameters (conductivity, turbidity, temperature, dissolved oxygen, pH, salinity, and oxidation-reduction potential) will be measured in the field at each seep and in adjacent surface water prior to sample collection. Seep samples will be filtered in the field through 1.0-µm glass filters and submitted for laboratory analysis for polychlorinated biphenyl (PCB) Aroclors and dissolved organic carbon (DOC).

Surface sediment samples will be collected from the 0–10 cm interval at four locations and will be analyzed for total organic carbon (TOC) and PCB Aroclors.

All subsurface soil samples will be characterized according to the Unified Soil Classification System (USCS), as per current annual American Society for Testing and Materials (ASTM) Methods. This visual/manual classification will occur in the field per ASTM D2488 and will be recorded on boring logs, except where undisturbed samples for geotechnical characterization are submitted to the laboratory. For those samples, the laboratory will perform the USCS classification following ASTM D2487. Field USCS classification is not considered an "analysis" in the QAPP.

Sediment cores from 0 to 5 ft below the mudline (bml) will be collected from seven locations to characterize sediment in the area to be dredged. Chemical analyses will be required on six samples, as follows:

- One composite sample representing the entire 0- to 5-ft lengths of cores from three of the locations will be submitted for chemical analysis to evaluate whether the material will require disposal as a Washington State Dangerous Waste. Analysis of this sample will include PCB Aroclors, chlorinated pesticides, semivolatile organic compounds (SVOCs), metals, extended diesel-range total petroleum hydrocarbons (TPH-Dx), gasoline-range TPH (TPH-G), and TOC. An additional aliquot of this sample will be archived for potential future Toxicity Characteristic Leaching Procedure (TCLP) analyses for SVOCs, chlorinated pesticides, and metals.

- Five samples representing the 0- to 5-ft lengths of five discrete cores near the head of the slip will be submitted for PCB Aroclor analysis to determine if segregation of an area potentially requiring disposal under the Toxic Substances Control Act (TSCA) regulations is practicable.

The cores will also be subsampled into three sample intervals (0–2 ft bml, 2–4 ft bml, and 4–5 ft bml). These discrete samples will be analyzed for geotechnical parameters as follows:

- Nine subsamples from three cores (SC12, SC13, and SC16) representing the area to be dredged will be analyzed for grain-size distribution, water content, specific gravity, Atterberg limits, and TOC. One of the cores in this group (SC16) is located in the potential TSCA area.
- Three archived samples from SC01 (0–2 ft, 2–4 ft, and 4–6 ft), collected in 2004, will be analyzed for grain-size distribution, water content, USCS classification, specific gravity, Atterberg limits, and TOC.

Samples of bank soil from bank removal areas are needed to characterize the material for disposal. Two composite samples will be collected using hand auger boring or hand dug test pit: one sample from Zone 2, and one sample from Zones 3, 4, and 5. These samples will be submitted for chemical and geotechnical analyses. Chemical analytes will include PCB Aroclors, chlorinated pesticides, SVOCs, metals, TPH-Dx, TPH-G, TOC, and TCLP analysis for SVOCs, chlorinated pesticides, and metals. Samples collected for TCLP analysis of SVOCs, metals, and chlorinated pesticides will be archived at the laboratory, and analysis will be contingent on the results of dry-weight analysis. TCLP analysis will only need to be performed when the TCLP contaminants in the results from the total analysis are greater than or equal to 20 times the maximum concentration for toxicity characteristic regulatory levels (set forth in Table 1 of 40 CFR 261.24). The "20 times rule" is allowable because of the sample dilution that is a component of the TCLP Method 1311 (Section 1.2 of this method), as is clarified in EPA 540-R-94-005a. Geotechnical analyses will include grain-size distribution, water content, specific gravity, Atterberg limits, and TOC.

Sediment samples from four cores will be collected for geotechnical analyses to determine the consolidation properties, strength, and bearing capacity of the underlying sediments. These samples will be analyzed by consolidation testing, unconsolidated, undrained (UU) triaxial shear, grain-size distribution, USCS classification, water content, bulk density, specific gravity, Atterberg limits, and TOC.

Field quality control (QC) samples will be collected for chemical analysis as specified in the QAPP (Integral 2004a), with the exception that field duplicate cores will not be

collected. Field QC samples are described in Section 3.6 of the Boundary Definition SAP (Integral 2004b), and Section 3.4 of the Pre-Design SAP Addendum (Integral 2006b).

B2 SAMPLING METHODS

This section supplements Section B2 of the Boundary Definition QAPP.

Seep samples will be collected using either a funnel or peristaltic pump with attached dedicated disposal tubing. Intertidal surface sediment will be collected using stainless-steel bowls and spoons. Subsurface sediment cores for dredge area characterization and for geotechnical evaluation will be collected using Shelby tubes and split-spoon samplers advanced through hollow-stem augers using a barge-mounted drill rig. Subsurface bank soil samples will be collected using hand augers or hand-dug test pits. Sampling methods are described in Section 3.3 of the Pre-Design SAP Addendum. Requirements for sample containers, storage temperature, and holding times for sediment and seep water samples are summarized in Table B2-1 of this Pre-Design QAPP Addendum.

B3 SAMPLE HANDLING AND CUSTODY

Sample handling and custody procedures will be completed as described in Section 3.3.4 of the Pre-Design SAP Addendum (Integral 2006b).

B4 ANALYTICAL METHODS

Analyses will be completed according to the methods provided in Table A6-2. These methods will be modified in some cases, as described in the Boundary Definition QAPP. Sediment samples will be analyzed for SVOCs by full-scan mass spectrometry (MS). Selected ion monitoring will not be used because the sensitivity of full-scan MS is sufficient to meet the study objectives.

B5 QUALITY CONTROL

Quality control samples will be prepared in the field and at the laboratories to monitor the bias and precision of the sample collection and analysis procedures. Field quality control samples are described below. Laboratory quality control will be completed as described in the Boundary Definition QAPP.

B5.1 Field Quality Control Samples

Field QC samples for the pre-design investigation will include field duplicates (for surface sediment sampling), field replicates (for seep sampling), and equipment rinse blanks (for

seep and surface sediment sampling). Field QC samples will be collected, at a minimum, for seep and surface sediment samples at a frequency of 5 percent of the sample total. The procedures for preparing field replicates, duplicates, and rinse blanks are presented in Section 3.6 of the Boundary Definition SAP (Integral 2004b) and Section 3.4 of the Pre-Design SAP Addendum (Integral 2006b). Validation criteria and procedures for field QC samples are described in Sections D1 and D2 of the Boundary Definition QAPP (Integral 2004a).

REFERENCES

ASTM. 2003. *Annual Book of ASTM Standards.* Volume 04.08. American Society for Testing and Materials, Philadelphia, PA.

Integral. 2004a. Lower Duwamish Waterway Slip 4 Early Action Area: Quality Assurance Project Plan for Boundary Definition. Prepared for Seattle City Light and King County, Seattle, WA. Integral Consulting Inc., Mercer Island, WA.

Integral. 2004b. Lower Duwamish Waterway Slip 4 Early Action Area: Sampling and Analysis Plan for Boundary Definition. Prepared for City of Seattle and King County, WA. Integral Consulting Inc., Mercer Island, WA.

Integral. 2006a. Lower Duwamish Waterway Slip 4 Early Action Area: Engineering Evaluation/Cost Analysis. Submitted to U.S. EPA, Region 10, City of Seattle, King County, Seattle, WA. Integral Consulting Inc., Mercer Island, WA.

Integral. 2006b. Lower Duwamish Waterway Slip 4 Early Action Area: Sampling and Analysis Plan for Boundary Definition Addendum: Pre-Design Investigation Sampling. Prepared for Seattle City Light and King County, Seattle, WA. Integral Consulting Inc., Mercer Island, WA.

Plumb, Jr., R.H. 1981. Procedures for Handling and Chemical Analysis of Sediment and Water Samples. Technical Report EPA/CE-81-1. Prepared by Great Lakes Laboratory, State University College at Buffalo, Buffalo, NY, for the U.S. Environmental Protection Agency/U.S. Army Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material. Published by the U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, MS.

PSEP. 1986. Puget Sound Estuary Program: Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound. Final Report TC-3991-04. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Tetra Tech and HRA, Inc., Bellevue, WA. (minor corrections, April 2003)

PSEP. 1997a. Puget Sound Estuary Program: Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water, Sediment and Tissue Samples. *In:* Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Puget Sound Action Team, Olympia, WA.

PSEP. 1997b. Puget Sound Estuary Program: Recommended Quality Assurance and Quality Control Guidelines for the Collection of Environmental Data in Puget Sound. *In:* Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Puget Sound Action Team, Olympia, WA.

USEPA. 2003. SW-846 On-line, Test Methods for Evaluating Solid Waste - Physical/Chemical Methods. U.S. Environmental Protection Agency. http://www.epa.gov/epaoswer/hazwaste/test/main.htm. Accessed January 8, 2004.

Windward. 2004. Data Report: Survey and Sampling of Lower Duwamish Waterway Seeps. Prepared for Lower Duwamish Waterway Group for submittal to U.S. Environmental Protection Agency and Washington State Department of Ecology. Windward Environmental LLC, Seattle, WA.

FIGURE

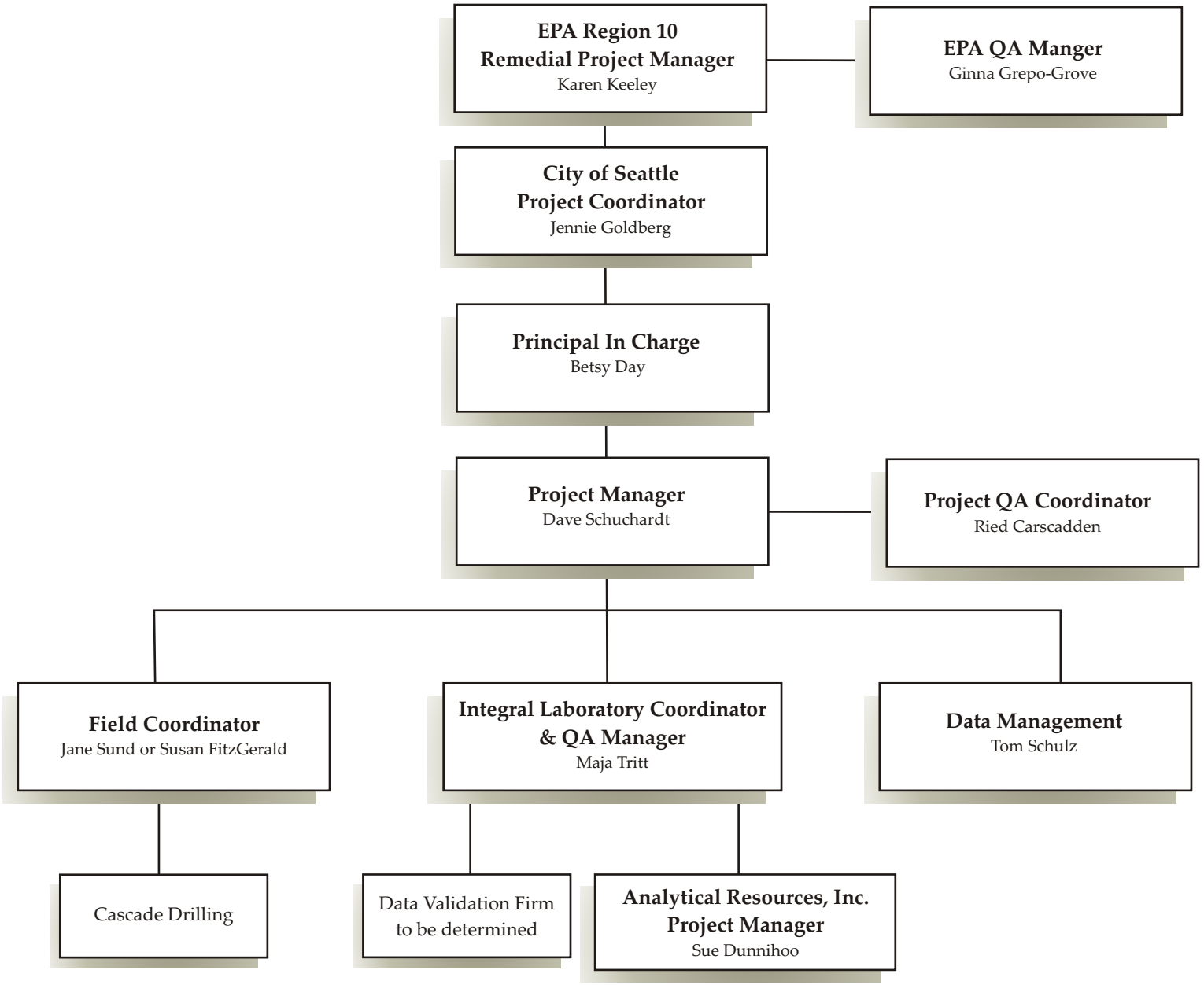

Figure A4-1. Organization Chart

TABLES

Table A4-1. Project Team Contact Information.

Organization	Individual	Project Role	Phone	Fax	Email
EPA Region 10	Karen Keeley	Project Coordinator	206-553-2141	206-553-0124	Keeley.Karen@epa.gov
	Ginna Grepo-Grove	QA Manager	206-553-1632	206-553-8210	Grepo-Grove.Gina@epa.gov
City of Seattle	Jennie Goldberg	SCL Project Coordinator	206-684-3167	206-386-4589	jennie.goldberg@seattle.gov
Integral Consulting	Betsy Day	Principal in Charge	206-957-0346	206-230-9601	bday@integral-corp.com
	David Schuchardt	Project Manager	206-957-0350	206-230-9601	dschuchardt@integral-corp.com
	Reid Carscadden	Project QA Coordinator	206-957-0343	206-230-9601	rcarscadden@integral-corp.com
	Jane Sund or Susan FitzGerald	Field Coordinator	503-284-5545 ext.15 or 206-957-0352	503-284-5755 or 206-230-9601	jsund@integral-corp.com; sfitzgerald@integral-corp.com
	Ian Stupakoff	Field Staff	360-705-3534 360-259-2518	360-705-3669	istupakoff@integral-corp.com
	Maja Tritt	Laboratory Coordinator/QA Manager	206-957-0353	206-230-9601	mtritt@integral-corp.com
	Tom Schulz	Data Manager	360-705-3534 ext.17	360-705-3669	tschulz@integral-corp.com
Analytical Resources, Inc. (ARI)	Sue Dunnihoo	Laboratory Project Manager	206-695-6207	206-621-7523	sued@arilabs.com
	Dave Mitchell	Laboratory QA Manager	206-695-6205	206-621-7523	davem@arilabs.com

Table A6-1. Estimated Numbers of Pre-Design Samples by Sample Type.

Sample Type and Analysis	Number of Samples[1]	Field Duplicates[2]	Field Replicates[2]	Equipment Rinse Blanks	Total Number of Field Samples
Seep Water					
PCB Aroclors	4–6	0	1	1	6–8
DOC	4–6	0	1	1	6–8
Surface Sediment					
PCB Aroclors	4	1	0	1	6
Total Organic Carbon	4	1	0	NA	5
Subsurface Sediment					
PCB Aroclors	6	0	0	0	6
SVOCs	1	0	0	0	1
Metals	1	0	0	0	1
Chlorinated Pesticides	1	0	0	0	1
TPH-Dx	1	0	0	0	1
TPH-G	1	0	0	0	1
TCLP SVOCs [3]	1	0	0	NA	1
TCLP Metals [3]	1	0	0	NA	1
TCLP Chlorinated Pesticides [3]	1	0	0	NA	1
Grain-Size Distribution	20	0	0	NA	20
Total Organic Carbon	20	0	0	NA	20
Water Content	20	0	0	NA	20
Bulk Density	8	0	0	NA	8
Specific Gravity	20	0	0	NA	20
Atterberg limits	20	0	0	NA	20
USCS Classification [4]	11	0	0	NA	11
Consolidation	8	NA	0	NA	8
UU Triaxial Shear	8	NA	0	NA	8
Subsurface Sediment (Archived Analysis)					
Grain-Size Distribution	3	0	0	NA	3
Total Organic Carbon	3	0	0	NA	3
Water Content	3	0	0	NA	3
Bulk Density	0	0	0	NA	0
Specific Gravity	3	0	0	NA	3
Atterberg Limits	3	0	0	NA	3
USCS Classification [4]	3	0	0	NA	3
Subsurface Bank Soil					
PCB Aroclors	2	0	0	0	2
SVOCs	2	0	0	0	2
Metals	2	0	0	0	2
Chlorinated Pesticides	2	0	0	0	2
TPH-Dx	2	0	0	0	2
TPH-G	2	0	0	0	2
TCLP SVOCs [3]	2	0	0	NA	2
TCLP Metals [3]	2	0	0	NA	2
TCLP Chlorinated Pesticides [3]	2	0	0	NA	2
Grain-Size Distribution	2	0	0	NA	2

Table A6-1. Estimated Numbers of Pre-Design Samples by Sample Type.

Sample Type and Analysis	Number of Samples[1]	Field Duplicates[2]	Field Replicates[2]	Equipment Rinse Blanks	Total Number of Field Samples
Total Organic Carbon	2	0	0	NA	2
Water Content	2	0	0	NA	2
Bulk Density	0	0	0	NA	0
Specific Gravity	2	0	0	NA	2
Atterberg Limits	2	0	0	NA	2

Notes:

DOC = dissolved organic carbon
PCB = polychlorinated biphenyls
SVOCs = semivolatile organic compounds
TCLP = Toxicity Characteristic Leaching Procedure
TPH-Dx = total petroleum hydrocarbons, diesel- and oil-range

[1] Numbers are based on the Pre-Design SAP Addendum; Integral 2006b, Table 2-1.
[2] Duplicate, replicate, and rinsate samples will not be collected for waste disposal characterization samples.
[3] TCLP samples will be archived for potential future analysis.
[4] Only laboratory USCS Classification samples by ASTM D2487 are shown.

Table A6-2. Target Analytes, Methods, and Method Reporting Limits for Pre-Design Investigation Samples.

Analyte	Sample Preparation Method	Sample Cleanup Method[1]	Analysis Method	MDL	MRL
Seep Water					
PCB Aroclors (ug/L)	ARI Low Level (Modified EPA 3510)	EPA 3660B (sulfur) EPA 3665A (acid) EPA 3630C (silica gel) optional[2]	GC/ECD (EPA 8082)[3]	0.005	0.01
Dissolved Organic Carbon (mg/L)	EPA 415.1	--	Direct combustion (EPA 415.1)	0.018	0.02
Sediments and Bank Soils					
Conventional analytes					
USCS Classification	--	--	ASTM D-2487	--	--
Grain Size (% dry wt)	--	--	PSEP (1986)	--	0.1
TOC (% dry wt)	--	--	Plumb (1981)	0.018	0.02
Geotechnical Charactersitics					
Atterberg limits (% moisture)	--	--	ASTM D-4318	--	0.1
Specific gravity (g/cc)	--	--	ASTM D-854	--	0.01
Water content (percent)	--	--	ASTM D-2216	--	0.1
Bulk density (g/cc)	--	--	ASTM D-2937	--	0.1
Consolidation	--	--	ASTM D-2435 Method B	--	--
UU Triaxial Shear	--	--	ASTM D-2850	--	--
PCB Aroclors (ug/kg, dry weight)	ARI Low Level (EPA 3550B-mod)	EPA 3660B (sulfur) optional[2] EPA 3665A (acid) optional[2]	GC/ECD (EPA 8082)[3]	0.4	4.0
Pesticides (ug/kg, dry weight)					
4,4'-DDT	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.199	2.0
4,4'-DDE	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.125	2.0
4,4'-DDD	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.095	2.0
2,4'-DDT	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.091	2.0
2,4'-DDE	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.033	2.0
2,4'-DDD	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.037	2.0
Aldrin	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.044	1.0
alpha-BHC	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.051	1.0
beta-BHC	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.091	1.0
delta-BHC	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.021	1.0
gamma-BHC	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.09	1.0
Oxychlordane	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.123	2.0
alpha-chlordane	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.058	1.0
gamma-chlordane	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.12	1.0
cis-nonachlor	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.55	2.0

Table A6-2. Target Analytes, Methods, and Method Reporting Limits for Pre-Design Investigation Samples.

Analyte	Sample Preparation Method	Sample Cleanup Method[1]	Analysis Method	MDL	MRL
trans-nonachlor	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.024	2.0
Dieldrin	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.085	2.0
Endosulfan	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.063	1.0
Endosulfan II	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.125	2.0
Endosulfan sulfate	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.148	2.0
Endrin	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.082	2.0
Endrin aldehyde	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.184	2.0
Heptachlor	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.073	1.0
Heptachlor epoxide	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.054	1.0
Hexachlorobenzene	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.066	1.0
Methoxychlor	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	1.12	10.0
Mirex	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	0.013	2.0
Toxaphene	Sonication (EPA 3550B)	EPA 3660B/EPA3630C	EPA 8081A	2.96	100.0
Metals (mg/kg)					
Arsenic	EPA 3050	--	EPA 6010B	0.78	5.0
Cadmium	EPA 3050	--	EPA 6010B	0.04	0.2
Chromium	EPA 3050	--	EPA 6010B	0.09	0.5
Copper	EPA 3050	--	EPA 6010B	0.06	0.2
Lead	EPA 3050	--	EPA 6010B	0.11	2.0
Mercury	EPA 7471A	--	EPA 7471A	0.003	0.05
Silver	EPA 3050	--	EPA 6010B	0.04	0.3
Zinc	EPA 3050	--	EPA 6010B	0.34	0.6
Semivolatiles (mg/kg)					
1,2,4-Trichlorobenzene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	9.53	20
1,2-Dichlorobenzene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	11.5	20
1,3-Dichlorobenzene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	8.4	20
1,4-Dichlorobenzene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	10.3	20
2,4-Dimethylphenol	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	6.3	20
2-Methylnaphthalene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	18.3	20
2-Methylphenol	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	6.79	20
4-Methylphenol	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	7.3	20
Acenapthene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	10.4	20
Acenapththylene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	9.38	20
Anthracene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	7.95	20
Benz[a]anthracene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	8.67	20
Benzo[a]pyrene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	8.05	20

Table A6-2. Target Analytes, Methods, and Method Reporting Limits for Pre-Design Investigation Samples.

Analyte	Sample Preparation Method	Sample Cleanup Method[1]	Analysis Method	MDL	MRL
Benzo[b+j+k]fluoranthene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	8.63	20
Benzo[ghi]perylene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	8.5	20
Benzoic acid	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	89	200
Benzyl alcohol	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	14.7	20
Bis[2-ethylhexyl]phthalate	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	11	20
Butyl benzyl phthalate	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	9.1	20
Chrysene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	9.7	20
Dibenz[a,h]anthracene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	8.5	20
Dibenzofuran	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	17	20
Diethyl phthalate	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	10.6	20
Dimethyl phthalate	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	9.4	20
Di-n-butyl phthalate	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	6.6	20
Di-n-octyl phthalate	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	10.1	20
Fluoranthene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	8.6	20
Fluorene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	11.6	20
Hexachlorobenzene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	10.4	20
Hexachlorobutadiene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	9.2	20
Hexachloroethane	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	9.7	20
Indeno[1,2,3-cd]pyrene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	6.2	20
Naphthalene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	11.7	20
N-nitrosodiphenylamine	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	8.7	20
Pentachlorophenol	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	47.3	100
Phenanthrene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	10.3	20
Phenol	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	12.2	20
Pyrene	EPA 3550B	EPA 3640A	EPA 8270C - PSEP (Full scan)	9.4	20
Total Petroleum Hydrocarbons (mg/kg, dry weight)					
Diesel-Range Hydrocarbons	NWTPH-Dx	EPA 3550B	NWTPH-Dx	0.94	5.0
Oil-Range Hydrocarbons		EPA 3630C silica gel (as needed)		2.11	10.0
Gasoline-range hydrocarbons	NWTPH-G	Methanol extraction Purge and trap	NWTPH-G	3.18	5.0
TCLP Metals (mg/L)					
Arsenic	EPA 1311	--	EPA 6010B	0.59	5.0
Barium	EPA 1311	--	EPA 6010B	0.02	0.2
Cadmium	EPA 1311	--	EPA 6010B	0.11	0.5
Chromium	EPA 1311	--	EPA 6010B	0.04	0.2
Lead	EPA 1311	--	EPA 6010B	0.06	2.0

Table A6-2. Target Analytes, Methods, and Method Reporting Limits for Pre-Design Investigation Samples.

Analyte	Sample Preparation Method	Sample Cleanup Method[1]	Analysis Method	MDL	MRL
Mercury	EPA 1311	--	EPA 7471A	0.0004	0.1
Selenium	EPA 1311	--	EPA 6010B	0.04	0.3
Silver	EPA 1311	--	EPA 6010B	0.17	0.6
TCLP Semivolatiles (mg/L)					
1,4-Dichlorobenzene	EPA 1311 followed by EPA 3510C	--	EPA 8270C (1:5)	0.00217	0.005
2,4,5-Trichlorophenol	EPA 1311 followed by EPA 3510C	--	EPA 8270C (1:5)	0.00115	0.025
2,4,6-Trichlorophenol	EPA 1311 followed by EPA 3510C	--	EPA 8270C (1:5)	0.0013	0.025
2,4-Dinitrotoluene	EPA 1311 followed by EPA 3510C	--	EPA 8270C (1:5)	0.00157	0.025
Hexachlorobenzene	EPA 1311 followed by EPA 3510C	--	EPA 8270C (1:5)	0.00214	0.005
Hexachlorobutadiene	EPA 1311 followed by EPA 3510C	--	EPA 8270C (1:5)	0.0027	0.005
Hexachloroethane	EPA 1311 followed by EPA 3510C	--	EPA 8270C (1:5)	0.002025	0.005
Nitrobenzene	EPA 1311 followed by EPA 3510C	--	EPA 8270C (1:5)	0.00243	0.005
o-Cresol	EPA 1311 followed by EPA 3510C	--	EPA 8270C (1:5)	0.000915	0.005
p-Cresol and *m*-Cresol (coelute)	EPA 1311 followed by EPA 3510C	--	EPA 8270C (1:5)	0.001505	0.005
Total cresol (summed from above)	--	--	--	--	0.010
Pentachlorophenol	EPA 1311 followed by EPA 3510C	--	EPA 8270C (1:5)	0.0061	0.005
Pyridine	EPA 1311 followed by EPA 3510C	--	EPA 8270C (1:5)	--	0.025
TCLP Pesticides (mg/L)					
Chlordane	EPA 1311 followed by EPA 3510C	EPA 3630C/EPA3630C	EPA 8081A (1:10)	0.0001	0.0005
Endrin	EPA 1311 followed by EPA 3510C	EPA 3630C/EPA3630C	EPA 8081A (1:10)	0.00022	0.001
Heptachlor	EPA 1311 followed by EPA 3510C	EPA 3630C/EPA3630C	EPA 8081A (1:10)	0.00009	0.0005
Heptachlor epoxide	EPA 1311 followed by EPA 3510C	EPA 3630C/EPA3630C	EPA 8081A (1:10)	0.00015	0.0005
Lindane	EPA 1311 followed by EPA 3510C	EPA 3630C/EPA3630C	EPA 8081A (1:10)	0.00014	0.0005
Methoxychlor	EPA 1311 followed by EPA 3510C	EPA 3630C/EPA3630C	EPA 8081A (1:10)	0.00097	0.005
Toxaphene	EPA 1311 followed by EPA 3510C	EPA 3630C/EPA3630C	EPA 8081A (1:10)	--	0.1

[1] Gel permeation chromatography is required for organics analyses under PSEP. Additional cleanups will be used as required to meet MRLs.

[2] The need for cleanup to be based on screens and the color of extracts (Windward 2004).

[3] If more than one Aroclor is detected in a sample, the laboratory will choose unique peaks to quantitate each individual Aroclor (i.e., a peak can only be used in the quantitation of one Aroclor; Windward 2004).

Table A7-1. Measurement Quality Objectives.

Analysis	Bias (percent)	Precision (RPD)	Completeness (percent)
Conventional Analytes			
Grain Size (% dry weight)	--	±20	95
TOC (% dry weight)	75-125	±30	95
Inorganic Compounds			
Metals	75-125	±35	95
TCLP Metals	--	±35	95
Organic Compounds			
Pesticides	50-150	±50	95
PCB Aroclors	50-150	±50	95
Semivolatile organic compounds	50-150	±50	95
Total petroleum hydrocarbons	50-150	±50	95
TCLP Semivolatile organic compounds	50-150	±50	95
TCLP Pesticides	50-150	±50	95

Notes:
RPD = relative percent difference
PCB = polychlorinated biphenyl
TCLP = Toxicity Characterization Leaching Procedure
TOC = total organic carbon

Table B2-1. Sample Containers, Preservation, Holding Times, and Sample Volume.

Analysis[1]	Container Type[2]	Container Size	Approximate Laboratory Subsample	Preservation	Holding Time
Sediment Samples for Chemical and Geotechnical Testing on Disturbed Samples [3,4]					
TOC	WMG	2 oz	2 g	4±2ºC	14 days
Grain size	WMG	16 oz	100 g	4±2ºC	6 months
Atterberg Limits and Specific Gravity	WMG	16 oz	225 g	4±2ºC	6 months
Pesticides	WMG	8 oz	25 g	4±2ºC	14 days/40 days[5]
Diesel- and Oil-Range Hydrocarbons	WMG	8 oz	20 g	4±2ºC	14 days/40 days[5]
Gasoline-Range Hydrocarbons	WMG	2 oz	5 g	No headspace; 4±2ºC (do not freeze)	14 days
SVOCs	WMG	8 oz	50 g	4±2ºC	14 days/40 days[5]
Metals	WMG	8 oz	10 g	4±2ºC	6 months[6]
TCLP Metals (includes mercury)	WMG	8 oz	100 g	4±2ºC	6 months[6]
TCLP SVOCs	WMG	8 oz	100 g	4±2ºC	14 days
TCLP Pesticides	WMG	8 oz	100 g	4±2ºC	14 days
Undisturbed Sediment Samples for Geotechnical Analysis					
Bulk Density	Shelby tube	--	--	4±2ºC	--
Consolidation	Shelby tube	--	--	4±2ºC	--
UU Triaxial Shear	Shelby tube	--	--	4±2ºC	--
Seep Water and Equipment Rinse Blanks for Chemical Analysis					
Dissolved Organic Carbon[7]	AG	250 mL	250 mL	H_2SO_4 to pH<2, cool, 4°C	28 days
PCB Aroclors[7]	AG	Two - 1000 mL	1000 mL	4±2ºC	7 days/40 days[8]

Notes:
AG = Amber glass
HDPE = high density polyethylene
-- = not applicable
WMG = wide mouth glass jar
TCLP = Toxicity Characterization Leaching Procedure

[1] The laboratory may modify sample jar sizes or analyte groupings.
[2] Teflon®-lined lids will be used for glass sample containers. Some samples may be combined with other analytes.
[3] Undisturbed core segments contained in capped Shelby tubes will be submitted for some geotechnical analyses.
[4] Geotechnical analysis also conducted on archived sediment cores.
[5] Holding time is 14 days to extraction, and extracts must be analyzed within 40 days from extraction.
[6] Holding time for mercury is 28 days.
[7] Rinsates submitted for seep sample equipment (DOC and PCB analyses) will be field filtered through 1.0-µm glass filters.
[8] Holding time is 7 days to extraction, and extracts must be analyzed within 40 days from extraction.