

**Table 4-1**  
**Laboratory Methods for Sediment Samples**

Analyte	Laboratory	Sample Preparation		Quantitative Analysis	
		Protocol	Procedure	Protocol	Procedure
Total solids	CAS Kelso	--	--	PSEP 1986	Balance
Grain size	CAS Kelso	--	--	PSEP 1986	Sieve and pipette
				ASTM D422	Sieve and hydrometer
Total organic carbon	CAS Kelso	Plumb 1981	Acid pretreatment	Plumb 1981	Combustion; coulometric
Total sulfide	CAS Kelso	PSEP	Distillation	PSEP	Colorimetry
Ammonia as Nitrogen	CAS Kelso	Plumb 1981	KCl extraction	EPA 350.1	Colorimetry
Antimony, arsenic, cadmium, chromium, copper, lead, nickel, selenium, silver, and zinc	CAS Kelso	EPA 3050/PSEP 1997	Strong acid digestion	EPA 6020	ICP/MS
Aluminum, copper, and zinc	CAS Kelso	EPA 3050/PSEP	Strong acid digestion	EPA 6010B	ICP-AES
Selenium	CAS Kelso	EPA 3050/PSEP	Strong acid digestion	EPA 7742	Borohydride reduction
Mercury	CAS Kelso	EPA 7471A	Acid digestion/oxidation	EPA 7471A	CVAA
Butyltin ion, dibutyltin ion, tributyltin ion, total butyltins	CAS Kelso	Krone et al 1989	Solvent extraction and derivatization	Krone et al 1989	GC/FPD
Diesel- and residual-range organics (DRO/RRO)	CAS Kelso	NWTPH-Dx	Solvent extraction	NWTPH-Dx	GC/FID
			Silica gel cleanup		
Extractable petroleum hydrocarbons	ARI	EPH	Extraction per method	EPH	GC/FID
			Silica Gel cleanup		
Volatile petroleum hydrocarbons	ARI	EPH	Methanol extraction	VPH	GC/FID
			with Purge and Trap		
Organochlorine Pesticides and Selected SVOCs	CAS Kelso	EPA 3541	Automated Soxhlet Extraction	EPA 8081A	GC/ECD
		EPA 3640A	Gel permeation chromatography		
		EPA 3660B	Sulfur cleanup		
PCB Aroclors	CAS Kelso	EPA 3541	Automated Soxhlet Extraction	EPA 8082	GC/ECD
		EPA 3640A	Gel permeation chromatography		
		EPA 3665A	Sulfuric acid cleanup		
		EPA 3660B	Sulfur cleanup		
Semivolatile Organic Compounds	CAS Kelso	EPA 3541	Automated Soxhlet Extraction	EPA 8270C	GC/MS-LVI
		EPA 3640A	Gel permeation chromatography		
Polycyclic Aromatic Hydrocarbons and Alkylated PAHs	CAS Kelso	EPA 3541	Automated Soxhlet Extraction	EPA 8270C-SIM	GC/MS-SIM
		EPA 3640A	Gel permeation chromatography		
		EPA 3630C	Silica Gel cleanup		
Chlorinated Phenols (Tri-,tetra-, and PCP)	CAS Kelso	EPA 8151M	Solvent Extraction and esterification	EPA 8151M	GC/ECD

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		Protocol	Procedure	Protocol	Procedure
Chlorinated Dioxins and Furans	CAS Houston	EPA 1613B	Soxhlet/Dean Stark extraction	EPA 1613B	HRGC/HRMS
			Sulfuric acid cleanup		
			Silica/carbon column cleanup		

**Notes:**

See Sampling and Analysis Plan (GSI, 2008) for laboratory methods for rinsate blanks.

-- = Not applicable.

AAS - Atomic absorption spectrometry

ARI - Analytical Resources, Inc.

CAS - Columbia Analytical Services

CVAA - cold vapor atomic absorption spectrometry

EPA - U.S. Environmental Protection Agency

GC/ECD - gas chromatography/electron capture detection

GC/FID - gas chromatography/flame ionization detection

GC/MS - gas chromatography/mass spectrometry

HRGC/HRMS - high-resolution gas chromatography/high-resolution mass spectrometry

ICP/AES - inductively coupled plasma/atomic emission spectrometry

ICP/MS - inductively coupled plasma - mass spectrometry

LVI - large-volume injector

TPH - total petroleum hydrocarbon

PAH - polycyclic aromatic hydrocarbon

PCB - polychlorinated biphenyl

PSEP - Puget Sound Estuary Program

SIM - selected ion monitoring

SVOC - semivolatile organic compound

Table 4-2

**Data Validation Qualifiers and Definitions**

<b>Data Qualifier</b>	<b>Definition</b>
U	The material was analyzed for, but was not detected. The associated numerical value is the sample quantitation limit.
J	The associated numerical value is an estimated quantity.
R	Rejected.
UJ	The material was analyzed for, but was not detected. The sample quantitation limit is an estimated quantity.
T	The associated numerical value was mathematically derived (e.g., from summing multiple analyte results such as Aroclors, or calculating the average of multiple results for a single analyte). Also indicates all results that are selected for reporting in preference to other available results (e.g., for parameters reported by multiple methods) for the DPSC data.

**Table 4-3**  
**Percent Completeness by Parameter Group**

Analysis	Total # of Data Points <sup>a</sup>	Number of Data Points		Completeness (%)
		Accepted	Rejected	
Conventionals <sup>b</sup>	276	276	0	100
Grainsize	1,651	1,651	0	100
Metals	1,518	1,518	0	100
Butyltins	512	512	0	100
Diesel- and residual-range organics (DRO/RRO)	228	228	0	100
EPH	130	130	0	100
VPH	54	54	0	100
Organochlorine pesticides	4,061	4,061	0	100
PCB Aroclors	1,179	1,179	0	100
SVOCs	6,096	5,941	155	>99
PAHs	5,022	5,022	0	100
Chlorinated Phenols	570	570	0	100
Dioxins/furans	1,900	1,900	0	100
<b>Total<sup>c</sup></b>	<b>23,197</b>	<b>23,042</b>	<b>155</b>	<b>&gt;99</b>

**Notes:**

<sup>a</sup> Totals include reportable results for field replicates and exclude field blanks.

<sup>b</sup> Conventionals include total solids, total organic carbon, ammonia as nitrogen, and total sulfide.

<sup>c</sup> Total includes both DPSC and PP&R data

**Table 4-4**  
**Summary of Field and QC Samples**

Sample Type	Field Samples	Reanalyzed Field Samples	Field QC Splits	Reanalyzed Field QC Splits	Field Rinsate Blanks	Total Number of Field Samples
<b>Surface Sediment - DPSC</b>						
Conventionals <sup>a</sup>	78		4			82
Metals	78		4		4	86
Butyltins	78	1	4		4	87
DRO/RRO	78		4		4	86
Pesticides	78		4		4	86
PCB Aroclors	78		4		4	86
SVOCs	78		4		4	86
PAHs - Parent & Alkylated <sup>b</sup>	78		4		4	86
Phenols	78		4		3	85
Dioxins/Furans	42		2		2	46
<b>Subsurface Sediment - DPSC</b>						
Conventionals <sup>a</sup>	30		2			32
Metals	30		2		2	34
Butyltins	30		2		2	34
Pesticides	30		2		2	34
PCB Aroclors	30		2		2	34
DRO/RRO	30		2		2	34
SVOCs	30		2		2	34
PAHs - Parent <sup>b</sup>	30		2		2	34
PAHs Alkylated	30		2			32
Phenols	30		2		2	34
Dioxins/Furans	30		2		2	34
<b>Subsurface Sediment - PP&amp;R</b>						
Conventionals <sup>c</sup>	12	2	1	2		17
Metals	12		1			13
Butyltins	12		1			13
EPH	12		1			13
VPH	3		1			4
Pesticides	12	2	1	2		17
PCB Aroclors	12	2	1	2		17
SVOCs	12		1			13

Notes:

DRO/RRO = Diesel- and residual-range organics.

<sup>a</sup> All samples analyzed for total solids, grain size, and total organic carbon.

<sup>b</sup> Parent PAHs consist of the standard list of project PAHs - no rinsate blanks for alkylated PAHs.

<sup>c</sup> Selected samples analyzed for total solids, grain size, total organic carbon, total sulfide, ammonia as nitrogen.