Surface Sediment Sampling at Outfalls in the Lower Duwamish Waterway
Seattle, WA

Sampling and Analysis Plan / Quality Assurance Project Plan

Prepared for

Washington State Department of Ecology
Toxics Cleanup Program
Northwest Regional Office
Bellevue, Washington

Prepared by

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List of Acronyms

AET	apparent effects threshold
CCV	continuing calibration verification
COC	chain of custody
cPAH	carcinogenic polynuclear aromatic hydrocarbon
DGPS	Differential Global Positioning System
Ecology	Washington State Department of Ecology
EDD	Electronic Data Deliverable
EIM	Environmental Information Management
EPA	Environmental Protection Agency
FM	field manager
GIS	Geographic Information Systems
GPM	Government Project Manager
HSP	Health and Safety Plan
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
MTCA	Model Toxics Control Act
NAD83	North American Datum 1983
NPDES	National Pollutant Elimination System
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEF	potency equivalency factor
PPE	personal protective equipment
PSEP	Puget Sound Estuary Protocols
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RI	Remedial Investigation
RL	reporting limit
RPD	relative percent difference
SA	Selective Availability
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SIM	selected ion monitoring
SMS	Sediment Management Standards
SRM	Standard Reference Material
SVOC	semi-volatile organic compounds
TEF	toxic equivalent factor
TEQ	toxic equivalency quotient
TOC	total organic carbon
UCL	95% upper confidence limit on the mean

USEPA	United States Environmental Protection Agency
WAC	Washington Administrative Code

1.0 Introduction

The Lower Duwamish Waterway (LDW) is the 5.5-mile portion of the Duwamish River south of Harbor Island, Seattle, Washington. It has been identified as a Superfund site by the U.S. Environmental Protection Agency (USEPA) and a Model Toxics Control Act (MTCA) site by the Washington State Department of Ecology (Ecology). Remediation of contaminated sediment within the waterway is a high priority. Significant investigation previously conducted by the Lower Duwamish Waterway Group (LDWG) includes the Remedial Investigation Report, Final, July 9, 2010 (RI) (Windward 2010).

Ecology is leading the efforts to control sources of sediment pollution in the LDW. Source control is the process of finding and stopping or reducing, to the maximum extent practicable (or "as much as is feasible"), releases of pollution to waterway sediments. The goal of source control is to minimize the potential for sediment recontamination after cleanup. In order to facilitate this goal, Ecology must determine what source control actions are necessary for each identified cleanup area.

Science Applications International Corporation (SAIC) has been asked by Ecology to complete a stormwater outfall inventory and develop a surface sediment sampling program to better understand the potential for sediment contamination associated with outfalls and storm drains in the LDW area. To help identify these potential sources of contamination, approximately 250 stormwater outfalls were evaluated with the following objectives:

- Document what is known about the chemical concentrations in sediments around these outfalls by amending the outfall inventory and identifying apparent data gaps.
- Develop and implement a comprehensive approach to address the identified data gaps.

The stormwater outfall inventory is being used to determine the locations in the LDW for the collection and chemical analysis of surface sediment grab samples at areas adjacent to selected outfalls and storm drains along the LDW. This document provides the rationale for the selection of these surface sediment sampling locations, a description of the sample collection and handling procedures, the analytical methods, data quality objectives, and quality assurance/quality control (QA/QC) requirements for this study.

1.1 Purpose and Objectives

Appendix H of the RI contains an inventory of outfalls that discharge to the LDW. The Appendix includes some information about National Pollutant Discharge Elimination System (NPDES) permits associated with these outfalls, but there is no discussion of the nature of outfall effluent or any examination of sediment contamination in the waterway in relation to many of the outfalls. SAIC has verified and updated this outfall inventory with additional research (e.g., paper or electronic files from Ecology or other sources) and will continue to do so based on observations made over the course of this field effort.

SAIC has reviewed the database supporting the RI for existing surface sediment chemistry data relative to outfall locations. Outfall locations with insufficient sediment chemistry data available were identified as a data gap for source control purposes and consequently selected for sediment chemistry characterization under this Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP). Thirty-three sampling locations identified for sample collection based on insufficient sediment chemistry data were subsequently disqualified because their location overlapped with another outfall sampling location (e.g., one upstream sample for a given outfall fulfilled the downstream sample requirement for another nearby outfall).

Approximately 250 stormwater outfalls were evaluated by SAIC. The outfalls with sufficient chemistry data available within 50 feet of each outfall with a diameter of 24 inches or less, or within 100 feet of each outfall with a diameter greater than 24 inches were not selected for additional sampling under this SAP/QAPP. Outfalls and storm drains with no or limited chemistry data available were selected for chemical analysis of surface sediment samples to be collected within the described location criteria immediately adjacent to, upstream of, and/or downstream of the outfall.

SAIC plans to collect surface sediment grab samples near 114 outfall locations with a total of up to 248 sediment samples, as listed in Table 1 and presented on Figures 1a, 1b, 1c, and 1d. Modifications to the sampling design may be made during field operations depending on sample location accessibility or sample location criteria overlap (e.g., one upstream sample for a given outfall may fulfill the downstream sample requirement for another nearby outfall). All field deviations to the sampling plan will be noted in the final data report. The purpose of this SAP/QAPP is to ensure that all outfalls along the waterway are represented by adequate surface sediment chemistry data in order to evaluate whether sediment contamination is occurring as a result of stormwater discharge.

1.2 Outfall Inventory

SAIC has prepared a preliminary outfall inventory spreadsheet and maps (Figures 1a, 1b, 1c, and 1d) depicting LDW outfalls and proposed sediment sampling areas. Any additional outfalls that are identified during document review, reconnaissance efforts, field sampling, or other work assignments will be added to the outfall inventory, as appropriate. This spreadsheet will also be updated with the additional information listed below for each outfall, as available:

1) For all outfalls:
    a) Summarize sediment data within 50 and 100 feet of the outfall.
    b) Identify NPDES permits associated with each outfall.
    c) For each NPDES permit include:
        i) Permittee name and address
        ii) Permit number
        iii) Type of permit
        iv) Required monitoring parameters
        v) Monitoring results for the most recent four quarters available
        vi) Any other sampling data available
2) For facilities adjacent to the LDW with multiple outfalls, identify which of the outfalls the facility is monitoring for its NPDES permit.

SAIC will prepare a technical memorandum to document and present existing information on the LDW outfalls and storm drains and include the outfall inventory summary table. The memorandum will discuss the sources of information, identified data gaps, limitations of available Ecology information systems and files, and any further necessary recommendations for sediment sampling.

1.3 Public Outreach

SAIC will prepare a public outreach plan, a fact sheet describing briefly the planned sampling activities, and public notice letters describing the planned field work. Public notice may include bulletins and emails to ensure adjacent property owners are aware of the sampling. In addition, SAIC will gather signed property access agreements for several select properties in early 2011. Non-responsive property owners will receive a follow-up phone call within one week, and secondary calls or site visits will be made to non-responsive property owners within two weeks.

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2.0 Project Organization and Responsibilities

SAIC and its subcontractors will implement this SAP/QAPP under the direction of Ecology. The following sections describe the key roles and responsibilities of the project team.

2.1 Project Planning and Coordination

Dan Cargill of Ecology will serve as the Government Project Manager (GPM) who will conduct overall project coordination, supply government-furnished services, review reports, and coordinate with contractors. Glen T. Vedera will serve as the SAIC project manager and be responsible for executing the approved SAP/QAPP, overseeing the collection and analysis of field samples, and reporting analytical results.

SAIC
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2.2 Sample Collection

Glen T. Vedera of SAIC will also serve as field manager (FM) responsible for a one day reconnaissance survey of the outfalls along the LDW, collecting and processing samples in accordance with the SAP/QAPP, and transporting samples to the analytical laboratories for analysis. The FM will oversee field preparation to ensure all sampling equipment is in accordance with the SAP/QAPP. The FM will oversee field staff during the collection and processing of samples.

2.3 Laboratory Coordination and QA/QC Management

Marina I. Mitchell of SAIC will serve as project chemist, laboratory coordinator, and data manager responsible for subcontracting state-certified laboratories, and ensuring observation of established protocols for decontamination, sample preservation, holding times, chain-of-custody (COC) documentation, and laboratory reporting. She will provide quality assurance oversight for the laboratory programs, ensuring that the laboratory analytical and QA/QC data are considered valid, and that procedures meet the required analytical quality control limits.

2.4 Health and Safety Manager

Michael A. Pagel of SAIC will serve as the designated SAIC Health and Safety Manager. The Health and Safety Manager is responsible for ensuring that all personnel are properly trained, fully aware of potential site hazards, conduct all work in a safe manner, wear appropriate personal protective equipment (PPE), and abide by the conditions set forth in the site-specific Health and Safety Plan (HSP).

2.5 Subcontractor Support

The SAIC project team will include the following subcontractor to support the data collection activities and laboratory analytical services:

- Analytical Chemistry

  Analytical Resources, Incorporated
  Sue Dunnihoo
  4611 South 134th Place
  Tukwila, WA 98166
  Phone: (206) 695-6200
  sue@arilabs.com

- Dioxin/Furan Congener Analysis

  Axys Analytical Services, Ltd.
  Devin Mitchell
  2045 Mills Road
  Sidney BC V8L 3S8
  CANADA
  Phone: (250) 655-5812
  Fax: (250) 655-5811
  dmitchell@axys.com

- Data Validation

  EcoChem, Inc.
  Christina Mott
  710 Second Avenue
  Suite 660
  Seattle, WA 98104
  Phone: (206) 233-9332 x110
  Fax: (206) 233-0114
  cmott@ecochem.net

2.6 Project Schedule

The project schedule is as follows:

- A reconnaissance survey took place on January 31, 2011.
- Property access agreements were sent to property owners on February 17, 2011, one week prior to the start of field sampling.
- Field preparation and mobilization began in mid February during the development of this SAP/QAPP. Field sampling is scheduled to begin on February 28, 2011, following approval of this SAP/QAPP. Field sampling is expected to last four weeks.

- Following the completion of the sampling effort, estimated for March 25, 2011, the analytical laboratory results should arrive three to four weeks later, by April 22, 2011.
- Following the receipt of the last data package from ARI, data validation will be completed by EcoChem three to four weeks later, by May 20, 2011,
- After SAIC receives the validated data from EcoChem, the Draft Summary Report will be due to Ecology within four weeks, by June 17, 2011.
- Ecology's comments are due within one week of receiving the Draft Summary Report. SAIC will then submit the Final Summary Report to Ecology, no later than June 30, 2011.

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3.0 Field Sampling Plan

The purpose of the field sampling plan is to describe the procedures by which sample collection will be performed. This section describes the procedures for positioning, sample collection, processing, identification, documentation, equipment decontamination, and sample handling for the field investigation. The laboratory methods for chemical analysis are presented in Section 4.0.

3.1 Sampling Platforms

The R/V *Growler*, owned and operated by SAIC, will be used to collect surface sediment grab samples. Some nearshore sediment samples may be collected by personnel on foot during low tide conditions and processed onshore or on the R/V *Growler*.

3.2 Station Positioning and Navigation

The positioning and recording of sampling locations will be accomplished using a Topcon Differential Global Positioning System (DGPS) unit owned by Ecology. The DGPS employs a receiver that tracks and times signals emitted by satellites orbiting the earth, a Coast Guard reference beacon located in the vicinity of the survey area, and a differential receiver. The receiver deployed at the Coast Guard reference beacon (horizontal control point) is used to correct for Selective Availability (SA) (satellites emit an encrypted signal designed to degrade the accuracy for non-military users by dithering the time code embedded in the signal). This receiver calculates position based on the satellite signals and compares the calculated position to the known position at the horizontal control point. A positional offset of correction factor is calculated and transmitted to the GPS receiver, which applies the correction factor to calculate the corrected position. All station coordinates will be recorded by latitude and longitude to the decimal minute and State Plane Coordinates (NAD 83).

Vertical position (i.e., water depth) will be determined using a fathometer (when feasible) or a lead-line (weighted measuring tape) or measuring stick to measure to the nearest 0.1 foot from the water surface to the mudline. The recovery depth of each sediment grab sample will be measured to the nearest centimeter using a decontaminated stainless steel ruler along the wall of the sampling device.

The target sampling locations are listed in Table 1 and are displayed in Figures 1a, 1b, 1c, and 1d. All sampling locations will be analyzed for standard Washington State Sediment Management Standards (SMS) chemistry (i.e., metals, semi-volatile organic compounds [SVOCs], polychlorinated biphenyls [PCBs], total organic carbon [TOC], percent solids, and grain size). Surface sediment samples from 40 locations will also be analyzed for dioxins/furans.

Table 1. Locations of Outfalls and Surface Sediment Samples

Outfall ID	River Mile [a]	Coordinates of Outfall [b]		Surface Sediment Grab Sampling Locations	
		Y	X	Number	Target Sampling Locations Relative to Outfall
2156	0.0	211372.32	1266306.53	3	(w/in 50 ft) upstream, downstream, ***<u>at outfall</u>***
2151	0.1 E	211322.85	1266594.69	1	(w/in 50 ft) ***<u>at outfall</u>***
HRE 1	0.1 E	211399.22	1266887.46	3	(w/in 50 ft) upstream, downstream, ***<u>at outfall</u>***

Outfall ID	River Mile [a]	Coordinates of Outfall [b]		Surface Sediment Grab Sampling Locations	
		Y	X	Number	Target Sampling Locations Relative to Outfall
2154	0.1 E	211338.63	1267089.16	3	(w/in 50 ft) upstream, downstream, at outfall
Nevada SD	0.3 E	210057.02	1266991.25	3	(w/in 50 ft) upstream, downstream, at outfall
2003	0.7 E	207920.41	1267396.12	3	(w/in 50 ft) upstream, downstream, **at outfall**
2006	0.7 E	207760.18	1267441.22	3	(w/in 50 ft) upstream, downstream, at outfall
2004	0.9 E	207048.00	1267931.00	3	(w/in 50 ft) upstream, downstream, at outfall
2005	0.9 E	207056.00	1267692.00	3	(w/in 50 ft) upstream, downstream, **at outfall**
2246	0.9 E	206978.00	1267717.00	2	(w/in 50 ft) upstream, at outfall
2247	0.9 E	206859.00	1267756.00	2	(w/in 50 ft) upstream, at outfall
5000	0.9 E	206894.00	1268129.00	3	(w/in 100 ft) upstream, downstream, **at outfall**
2223	1.1 E	205981.00	1268177.00	3	(w/in 50 ft) upstream, downstream, at outfall
2244	1.1 E	206052.25	1268060.44	2	(w/in 50 ft) downstream, at outfall
2007	1.2 E	205308.11	1268301.94	1	(w/in 50 ft) downstream
2008	1.2 E	205267.68	1268320.73	3	(w/in 50 ft) upstream, downstream, **at outfall**
2009	1.3 E	205005.74	1268388.87	3	(w/in 50 ft) upstream, downstream, at outfall
2010	1.4 E	204526.51	1268557.68	3	(w/in 50 ft) upstream, downstream, at outfall
2011	1.4 E	204315.80	1268642.65	3	(w/in 50 ft) upstream, downstream, at outfall
2013	1.4 E	204200.73	1268729.59	3	(w/in 50 ft) upstream, downstream, **at outfall**
2017	1.5 E	203702.69	1268796.33	3	(w/in 50 ft) upstream, downstream, at outfall
2014	1.6 E	203555.97	1268864.50	3	(w/in 50 ft) upstream, downstream, at outfall
2015	1.6 E	203423.18	1268913.73	2	(w/in 50 ft) downstream, at outfall
2018	1.7 E	203003.89	1269061.03	2	(w/in 50 ft) upstream, downstream
2019	1.7 E	203373.60	1269623.24	1	(w/in 50 ft) at outfall
2021	1.8 E	202708.10	1269384.60	3	(w/in 50 ft) upstream, downstream, **at outfall**
2022	1.9 E	202048.07	1269350.63	3	(w/in 50 ft) upstream, **downstream**, **at outfall**
2501	1.9 E	201869.00	1269569.00	1	(w/in 100 ft) upstream
2502	1.9 E	201876.00	1269565.00	1	(w/in 50 ft) downstream
2503	1.9 E	201959.00	1269661.00	1	(w/in 100 ft) at outfall
S River Street SD	2.0 E	201635.15	1269791.75	3	(w/in 50 ft) upstream, downstream, at outfall
2025	2.1 E	201469.52	1270767.84	1	(w/in 50 ft) at outfall
S Brighton St SD	2.1 E	201114.13	1270333.61	3	(w/in 50 ft) upstream, downstream, at outfall
2027	2.3 E	200343.91	1271299.30	1	(w/in 50 ft) at outfall
2029	2.3 E	200408.37	1271097.96	2	(w/in 50 ft) downstream, at outfall
2030	2.3 E	200408.32	1271132.35	3	(w/in 50 ft) upstream, downstream, at outfall
2032	2.3 E	200445.25	1271125.95	1	(w/in 50 ft) at outfall
2034	2.5 E	199975.31	1271389.85	2	(w/in 50 ft) upstream, downstream
2035	2.5 E	199792.64	1271520.68	3	(w/in 100 ft) upstream, downstream, **at outfall**
2036	2.6 E	199517.09	1271754.70	2	(w/in 50 ft) downstream, **at outfall**
2037	2.6 E	199501.97	1271792.00	3	(w/in 50 ft) upstream, downstream, at outfall
2038	2.6 E	199402.04	1271876.80	2	(w/in 50 ft) downstream, at outfall
2039	2.6 E	199409.10	1271865.26	3	(w/in 50 ft) upstream, downstream, at outfall
2040	2.6 E	199233.15	1272044.02	3	(w/in 50 ft) upstream, downstream, **at outfall**
2078	4.2 E	193006.55	1277310.70	3	(w/in 50 ft) upstream, downstream, at outfall
2080	4.2 E	193059.84	1277423.28	1	(w/in 50 ft) at outfall

Outfall ID	River Mile [a]	Coordinates of Outfall [b]		Surface Sediment Grab Sampling Locations	
		Y	X	Number	Target Sampling Locations Relative to Outfall
2082	4.2 E	192601.41	1277043.01	1	(w/in 50 ft) ***upstream***
2083	4.2 E	192597.47	1277030.69	1	(w/in 50 ft) downstream
2089	4.4 E	191885.89	1276945.65	2	(w/in 50 ft) downstream, at outfall
2085	4.5 E	191349.32	1276988.05	1	(w/in 100 ft) at outfall
2090	4.6 E	190869.70	1277164.03	2	(w/in 100 ft) downstream, ***at outfall***
BDC-2	4.7 E	190595.238	1277462.523	3	(w/in 50 ft) upstream, downstream, at outfall
BDC-3	4.7 E	190554.011	1277588.675	2	(w/in 50 ft) upstream, downstream
BDC-4	4.7 E	190523.297	1277746.081	3	(w/in 50 ft) upstream, downstream, at outfall
2091	4.8 E	190503.90	1277884.58	1	(w/in 100 ft) ***upstream***
2092	4.9 E	190453.55	1278215.95	1	(w/in 50 ft) at outfall
2093	4.9 E	190264.88	1278537.25	1	(w/in 50 ft) downstream
2094	4.9 E	190382.22	1278326.98	2	(w/in 50 ft) downstream, at outfall
2096	4.9 E	190336.19	1278445.29	2	(w/in 50 ft) upstream, at outfall
2097	4.9 E	190416.48	1278263.53	2	(w/in 50 ft) downstream, at outfall
Ryan Way SD	5.3 E	188907.50	1279964.79	1	(w/in 100 ft) at outfall
2148	0.0 W	210881.39	1265430.05	1	(w/in 50 ft) at outfall
2149	0.0 W	210889.04	1265146.46	1	(w/in 50 ft) at outfall
2150	0.1 W	210847.02	1265682.85	1	(w/in 50 ft) ***at outfall***
2233	0.1 W	210625.00	1265917.00	2	(w/in 100 ft) upstream, downstream
2232	0.2 W	210242.00	1265938.00	3	(w/in 50 ft) upstream, downstream, at outfall
2144	0.3 W	209841.45	1266135.28	2	(w/in 50 ft) upstream, at outfall
2145	0.3 W	209839.00	1266119.57	1	(w/in 50 ft) at outfall
2146	0.3 W	209858.55	1266127.59	2	(w/in 50 ft) downstream, at outfall
2147	0.3 W	209890.62	1266120.92	1	(w/in 100 ft) downstream
2157	0.4 W	209501.43	1266273.06	3	(w/in 50 ft) upstream, ***downstream***, ***at outfall***
Siphon-West CSO	0.4 W	209127.62	1266421.55	2	(w/in 100 ft) upstream, at outfall
2140	0.5 W	208666.51	1265735.64	1	(w/in 50 ft) at outfall
2141	0.5 W	208663.03	1265752.58	1	(w/in 50 ft) at outfall
2142	0.5 W	208615.74	1265706.02	1	(w/in 50 ft) at outfall
2143	0.5 W	208597.63	1265675.78	1	(w/in 50 ft) at outfall
2226	0.5 W	208706.00	1266067.00	2	(w/in 100 ft) ***upstream***, ***at outfall***
2138	1.0 W	206113.97	1266883.85	3	(w/in 50 ft) upstream, downstream, at outfall
2139	1.0 W	206177.32	1266689.52	1	(w/in 50 ft) ***at outfall***
2137	1.2 W	205095.07	1267772.11	1	(w/in 50 ft) at outfall
5002	1.2 W	205164.00	1267798.00	2	(w/in 100 ft) downstream, at outfall
5004	1.2 W	205142.00	1267806.00	2	(w/in 100 ft) upstream, downstream
5005	1.2 W	205109.00	1267795.00	1	(w/in 100 ft) at outfall
2136	1.3 W	204791.85	1267921.15	2	(w/in 50 ft) upstream, ***at outfall***
6146	1.6 W	203170.05	1268465.52	3	(w/in 50 ft) upstream, downstream, ***at outfall***
2220	1.8 W	202385.00	1268617.00	3	(w/in 50 ft) upstream, downstream, at outfall
2122	1.9 W	201764.47	1269042.45	3	(w/in 50 ft) upstream, ***downstream***, ***at outfall***
Port - SF	1.9 W	201651.24	1269150.03	3	(w/in 50 ft) ***upstream***, downstream, ***at outfall***
2505	2.0 W	201091.00	1269537.00	1	(w/in 50 ft) at outfall

Outfall ID	**River Mile** [a]	**Coordinates of Outfall** [b]		**Surface Sediment Grab Sampling Locations**	
		Y	**X**	**Number**	**Target Sampling Locations Relative to Outfall**
2506	2.0 W	201164.00	1269541.00	2	(w/in 100 ft) downstream, at outfall
2512	2.1 W	201015.00	1269577.00	2	(w/in 50 ft) upstream, at outfall
2116	2.3 W	200013.06	1270642.68	3	(w/in 50 ft) upstream, downstream, at outfall
2115	2.4 W	199844.85	1270730.03	3	(w/in 50 ft) upstream, downstream, ***at outfall***
2114	2.5 W	199600.09	1271026.55	2	(w/in 50 ft) downstream, ***at outfall***
2113	2.6 W	198902.38	1271707.69	3	(w/in 50 ft) upstream, downstream, at outfall
2112	2.7 W	198565.17	1271932.39	1	(w/in 50 ft) at outfall
2106	2.8 W	198183.86	1272551.20	3	(w/in 50 ft) upstream, downstream, ***at outfall***
2108	2.8 W	198140.87	1272552.00	2	(w/in 50 ft) upstream, at outfall
2109	2.9 W	197835.26	1272891.41	3	(w/in 50 ft) upstream, downstream, at outfall
2110	2.9 W	197881.06	1272801.50	1	(w/in 50 ft) at outfall
2111	2.9 W	197925.64	1272772.16	2	(w/in 50 ft) downstream, ***at outfall***
3037	3.2 W	196820.50	1274014.09	3	(w/in 50 ft) upstream, downstream, ***at outfall***
2214	3.5 W	195811.00	1275086.00	3	(w/in 50 ft) upstream, downstream, at outfall
SP 5	3.7 W	195104.983	1275634.894	3	(w/in 50 ft) upstream, downstream, at outfall
2103	3.8 W	194900.30	1275700.82	2	(w/in 50 ft) downstream, ***at outfall***
SP 3	3.8 W	194507.273	1275765.874	3	(w/in 50 ft) upstream, downstream, at outfall
SP 4	3.8 W	194835.645	1275703.151	3	(w/in 50 ft) upstream, downstream, ***at outfall***
SP 1	3.9 W	194091.189	1275843.515	3	(w/in 50 ft) upstream, downstream, at outfall
SP 2	3.9 W	194275.159	1275809.552	3	(w/in 50 ft) upstream, downstream, at outfall
2100 (B)	4.2 W	192699.58	1276000.92	1	(w/in 50 ft) at outfall
2099	4.4 W	191244.13	1276538.65	3	(w/in 50 ft) upstream, downstream, ***at outfall***
2098	4.5 W	191072.22	1276580.24	3	(w/in 50 ft) upstream, downstream, ***at outfall***
2200	4.6 W	190696.98	1276531.31	2	(w/in 100 ft) downstream, ***at outfall***
2201	4.6 W	190488.77	1276535.83	3	(w/in 100 ft) upstream, downstream, ***at outfall***
114	**Total Number of Outfalls**			**246**	**Total Number of Surface Sediment Samples Planned for Collection**

NOTE: Sampling locations that are ***bold and underlined*** will be analyzed for dioxins/furans.

a River Mile: E = east side of the LDW, W = west side of the LDW

b Coordinates are presented in NAD83 horizontal datum; X-Y coordinates in Washington State Plane N (US survey ft)

3.3 Surface Sediment Sampling

A maximum of 246 sampling locations from 114 outfalls are planned for the collection of surface sediment grab samples (0 – 10 cm). This section describes the collection and processing of surface sediment samples. Table 2 lists the analytical methods, sample container, preservation, and holding time requirements.

3.3.1 Sample Collection and Handling Methods

This section describes the procedures for sample collection, processing, identification, documentation, equipment decontamination, and waste handling for the proposed field investigation. A field laboratory or similar space will be established to provide a secure and clean area for equipment storage.

Surface sediment for chemical analysis will be collected from a small boat using a stainless-steel Van Veen, Young's, or similar grab sampling device. If the location is accessible by foot (e.g., during low tide), then the surface sediment samples from nearshore areas may be collected directly with stainless steel spoons. The grab sampler will be deployed from the sampling vessel using a manually triggered handle (for the Ekman in shallow water less than 3 feet deep) or using a davit, winch, and cable (Van Veen, Young's, or ponar grab samplers in water greater than 3 feet deep). Multiple grab samples may be collected and composited for each sampling location to provide sufficient volume for chemical analysis. If multiple grabs are collected at the same location, they should be within one square meter of each other. The general procedure for collecting sediment using a grab sampler is as follows:

1. Make logbook and field form entries as necessary throughout the sampling process to ensure accurate and thorough record-keeping. Field documentation is described in Section 3.4.
2. Position the sampling vessel at the targeted sampling location.
3. Set the sampler jaws in the open position, place the sampler over the edge of the boat, and lower the sampler to the bottom of the river bed.
4. Trip the sampler manually if using the Ekman sampler with a handle (< 3 feet deep) to close, capturing the sediment grab sample.
5. Record the location using the DGPS; measure and record the water depth.
6. Retrieve the sampler and place it securely in the sampling vessel.
7. Examine the sample for the following sample acceptance criteria:
    - The sampler is not overfilled with sample so that the sediment surface is pressing against the top of the sampler.
    - The sample does not contain large foreign objects (i.e., trash or debris). A sample that is rock/gravel fill will be rejected in favor of depositional material (i.e., sand/silt/clay).
    - Overlying water is present indicating minimal leakage.
    - Overlying water is not excessively turbid indicating minimal sample disturbance.
    - Sediment surface is relatively flat and/or intact without any indications of disturbance or winnowing.

- A penetration depth has been achieved that allows the collection of the upper 10 cm of sediment.

8. Siphon off any overlying surface water.
9. Measure and collect the top 10 cm with a decontaminated stainless steel spoon, avoiding any sediment that is in contact with the inside surface of the grab sampler, then place the sediment into a decontaminated stainless steel bowl and cover with aluminum foil.
10. If additional sample volume is required, then repeat steps 4 through 9.
11. Record the following observations of sediment sample characteristics on the field form (see Appendix B);
    - Sediment Type (e.g., cobble, gravel, sand, clay)
    - Color
    - Biological organisms or structures (i.e., shells)
    - Presence of debris (i.e., natural or anthropogenic objects)
    - Presence of oily sheen or obvious contamination
    - Odor type and strength (e.g., slight hydrogen sulfide, strong petroleum)
12. Photos will be taken throughout the field effort, especially if anything unusual is encountered (e.g., cement kiln dust or brick fragments).
13. Wash excess sediment back into the water away from any areas remaining to be sampled.
14. Once sufficient sediment volume has been collected, the sediment will be homogenized in decontaminated stainless steel containers or bowls using decontaminated stainless steel spoons. Using the stainless steel spoons, put the sediment in appropriate, pre-cleaned, labeled sample containers leaving at least 1 cm headspace in the jar, place the sample jars in a sturdy cooler on ice (i.e., 0–6ºC), and prepare for transfer to ARI under proper chain-of-custody procedures.
15. Confirm all relevant documentation has been completed, entries are accurate, and paperwork has been signed.
16. Decontaminate all sampling equipment as described in Section 3.3.2 before proceeding to the next sampling location.

If sample acceptance criteria are not achieved, the sample will be rejected and another sample collection attempt will be made. If the location has two or three more failed collection attempts because of inherent difficulties at the sampling location (e.g., accessibility issues, riprap), then the sampling location may be moved at the discretion of the field manager in consultation with the project manager (e.g., moved 10 feet away from the target coordinates). All such field deviations will be noted in the field sampling logs.

3.3.2 Equipment Decontamination

Prior to field operations, all sampling and sample processing equipment will be thoroughly washed with a laboratory-grade detergent (e.g., Alconox or Liquinox™) and water solution, rinsed with tap water, and rinsed with deionized or distilled water. Decontaminated sample processing equipment (i.e., spoons, bowls, and reusable containers from which samples are transferred to sample jars) will be wrapped or covered with aluminum foil. Sub-sampling and sample processing equipment will be decontaminated before use at each sampling location in order to prevent cross contamination of samples in accordance with Puget Sound Estuary

Program (PSEP 1997a) protocols. Equipment will be washed on site with laboratory-grade detergent and water mixture, and thoroughly rinsed with site water. No additional solvents or acids will be used during equipment decontamination in the field. Deviations from these procedures will be documented in the field notebook.

All sampling will be conducted using phthalate-free, nitrile disposable gloves, which will be changed frequently to prevent cross-contamination between samples. Personal non-disposable field equipment (i.e., boots and waterproof gloves and garments) will be rinsed with water and brushed clean prior to leaving the immediate vicinity of the sample collection area. Special attention will be given to removing mud and sediments that may adhere to boot treads.

3.3.3 Waste Disposal

During field sampling, field personnel will be responsible for placing wastes in appropriate storage containers and properly disposing of wastes. Small quantities of excess sediment and rinse blank water generated during sample processing will be returned to the site at or near the point of collection. Care will be taken to not dispose of sediment and/or rinse blank at locations targeted for subsequent sampling. Material wastes (e.g., disposable gloves, paper towels, and aluminum foil) that cannot be recycled will be placed in plastic storage bags and disposed of as municipal waste.

3.3.4 Sample Identification, Containers, and Labels

All samples collected during the investigation will be labeled clearly and legibly. Sample labels will be affixed to the sample jar with self-adhering, waterproof material. Indelible ink will be used to complete each label. Each sample label will contain the project name, sample identification, date and time of collection, complete list of analyses to be conducted, and the initials of the person preparing the sample.

Sediment samples will be identified by the project area “LDW-“, “SS” to indicate surface sediment, the outfall number or abbreviated name, and additional suffix (i.e., “-A” for adjacent, “-U” for upstream, “-D” for downstream, and “-2” for field duplicate samples), as applicable.

> <u>For example:</u>
>
> *LDW-SS2223-U is the surface sediment sample collected upstream from outfall number 2223 in the LDW.*
>
> *LDW-SSHRE1-A-2 is the field duplicate surface sediment sample collected at the outfall named “HRE1”in the LDW.*

Rinse blank samples will be identified by the project “LDW-SS,“ the date collected in month day year (mmddyy) format with the additional suffix “-RB” for rinse blank.

> <u>For example:</u>
>
> *LDW-SS022011-RB is the rinse blank sample collected on February 22, 2011, during the surface sediment collection event on the LDW.*

Table 2 lists the analytical methods, sample container, preservation, and holding time requirements for all analyses.

Table 2. Analytical Methods, Sample Containers, Preservation and Holding Time Requirements

Analyte Group	Analytical Method	Sample Container	Preservation	Holding Time
Sediment Samples				
Dioxins/Furans	EPA 1613B	8-oz glass jar	freeze (-20°C)	1 year to extract, 40 days to analyze
PCB Aroclors	EPA 8082	8-oz glass jar [a]	cool (0-6°C)	14 days to extract, 40 days to analyze (1 year to extract if frozen)
SVOCs (including phthalates and PAHs)	EPA 8270D			
Selected SVOCs by SIM	EPA 8270D-SIM			
Mercury	EPA 6010B/200.8	8-oz glass jar	cool (0-6°C)	28 days (6 months if frozen)
Other metals	EPA 7471A			6 months (2 years if frozen)
TOC	Plumb (1981)			14 days (6 months if frozen)
Total solids	EPA 160.3			
Grain Size	PSEP (1986)	16-oz glass or HDPE jar [b]	cool (0-6°C)	6 months
Aqueous Samples (Rinse Blanks)				
PCB Aroclors	EPA 8082	(2) 500-mL glass amber bottles	cool (0-6°C)	7 days to extract, 40 days to analyze
SVOCs (including phthalates and PAHs)	EPA 8270D	(2) 500-mL glass amber bottles	cool (0-6°C)	7 days to extract, 40 days to analyze
Metals including mercury	EPA 6010B/200.8/7470A	500-mL HDPE bottle	nitric acid	28 days for mercury, 6 months for other metals

a Duplicate sample volume should be collected at a rate of one per 20 samples for laboratory QA/QC.
b Triplicate sample volume should be collected at a rate of one per 20 samples for laboratory QA/QC.

3.3.5 Sample Storage and Delivery

All samples will be stored and transported in sturdy, insulated coolers, and placed on ice or frozen gel-packs immediately following sample collection (i.e., at 0–6°C). Samples will be hand-delivered to ARI upon completion of sampling each day or within 24 hours. The COC will be signed by the individual relinquishing samples to the onsite laboratory representative. Upon receipt of samples at the laboratory, the condition of the samples will be recorded. Field personnel will be responsible for:

- Packaging the samples;
- Signing the COC before placing inside the cooler or delivering to ARI;
- Notifying the laboratory coordinator of when the samples are being delivered to the laboratory; and
- Storing samples under the proper chain-of-custody procedures described in Section 3.4.1 until they are delivered to the laboratory.

Preparation of bottles for shipment will be performed in the following manner:

1. Wipe or decontaminate the outside of filled, capped sample bottles to ensure there is no sample residual on the outside of the container.
2. Label jars with prepared labels.
3. Each set of samples will have a unique sample ID.
4. Secure labels with clear packaging tape.
5. Record the samples on the COC forms (described in Section 3.4.2).
6. Place individual sample containers in plastic bubble-pack bags, or zip-lock and wrap in bubble wrap and secure with packaging tape or rubber bands.
7. Prepare an empty insulated cooler by placing three to four ice packs at the bottom of the cooler; it is recommended to place the ice packs in a garbage bag first to prevent leakage during ice melt. Place sample containers in the garbage bag on ice (if applicable) and fill the cooler with jars and additional packing material to ensure adequate protection to prevent breakage. Add additional bags of ice as needed to surround the sample containers (or the garbage bag containing samples).
8. Seal the cooler on two sides with strapping tape and custody seals. Samples for chemical analyses will be hand delivered to ARI daily, accompanied by the COC form, which identifies the shipment contents. The field personnel will be responsible for packaging the samples; signing the COC form before placing inside the cooler to be sealed; applying a shipping label, an air bill, a custody seal, and strapping tape to the cooler; and shipping the samples in accordance with the maximum holding time allowed for the analyses to be performed.

Sample containers submitted for dioxin/furan analysis will immediately be frozen upon receipt at ARI. When 20 samples have been collected and/or at the end of the field sampling efforts, ARI will ship the frozen sediment samples via overnight courier (e.g., FedEx) to Axys for dioxin/furan analysis with a COC form and all paperwork required for international shipping.

All excess sediment sample submitted to the analytical laboratories will be retained for a minimum of 6 months from the date of receipt at the laboratory using the thermal preservation requirements listed in Table 2. They may be removed from the laboratory prior to the end of the 6-month period only at the direction of the project manager in consultation with Ecology.

3.4 Field Documentation

A complete record of field activities will be maintained. Documentation necessary to meet QA objectives for this project include field logbooks and field forms, sample container labels (as discussed in Section 3.3.4), and COC forms. The field documentation will provide descriptions of all sampling activities, sampling personnel, and weather conditions, and will record all modifications, decisions, and/or corrective actions to the study design and procedures identified in this SAP.

3.4.1 Field Logbooks and Forms

Field logbook(s) will be kept on site during field operations. Daily activities will be recorded in a bound field logbook of water-resistant paper. All entries will be made legibly, in indelible ink, and will be signed and dated. Information recorded will include the following:

- Date, time, place, and location of sampling;
- Onsite personnel and visitors;
- Daily safety discussion and any safety issues;
- Field QC samples (i.e., duplicate samples and rinse blanks);
- Observations about site, location, and samples (weather, odors, appearance, etc.); and
- Equipment decontamination verification.

Field logbooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occur during project field activities. Entries will be factual, detailed, and objective. Unless restricted by weather conditions, all original data recorded in field logbooks and on sample identification tags, COC records, and field forms will be written in waterproof ink. If an error is made, the individual responsible may make corrections simply by crossing out the error and entering the correct information. The erroneous information will not be obliterated. All corrections must be initialed and dated. All documentation, including voided entries, must be maintained within project files.

3.4.2 Chain-of-Custody Procedures

The field crew will keep all samples securely in their possession at all times until the samples are delivered to the laboratory. COC forms will be initiated at the time of sample collection to ensure that all collected samples are properly documented and traceable through storage, transport, and analysis. When all line items on the form are completed or when the samples are relinquished, the sample collection custodian will sign and date the form, list the time, and confirm the completeness of all descriptive information contained on the form. Each individual who subsequently assumes responsibility for the sample will sign the COC form and provide the reason for assuming custody. The field chain-of-custody terminates when the laboratory receives the samples. The field manager will retain a copy of the completed, signed COC form(s) for project files. An example COC form can be found in Appendix C.

3.5 Laboratory Analyses

ARI will analyze all sediment samples for SMS metals, PCBs, SVOCs including polycyclic aromatic hydrocarbons (PAHs) and phthalates, selected SVOCs by selected ion monitoring (SIM), TOC, total solids, and grain size. Forty of these samples will also be analyzed for dioxins/furans by Axys. Rinse blanks will be collected weekly for analysis of metals, PCBs, and SVOCs at ARI. All chemical analyses will be conducted in accordance with Ecology, USEPA, and PSEP guidelines. Analyses will also be required to conform to accepted standard methods and the laboratory’s internal QA Plan and standard operating procedures.

Analytical laboratory reports will be accompanied by sufficient raw data and QC results to enable independent reviewers to evaluate the quality of the data and recalculate the results. The analytical laboratory deliverables will include but are not limited to the following:

- Method detection limits (MDLs) and reporting limits (RLs) for each sample;
- Laboratory qualifiers reported with analyte concentrations and a summary of qualifier definitions;
- Case narrative including any problems encountered, protocol modifications, and/or corrective actions taken;
- Sample analytical and QA/QC results with units and control limits;
- All method references used during analyses;
- Any protocol deviations from the approved sampling plan;
- Surrogate recovery results and control limits;
- Matrix spike/matrix spike duplicate (MS/MSD) results and control limits;
- Laboratory duplicate results and control limits;
- Method blank results;
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results;
- Initial and continuing calibration results and control limits;
- Sample custody records (including original COC forms); and
- Sample and QC results in the electronic data deliverable format specified in Appendix D.

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4.0 Quality Assurance Project Plan

The purpose of the project QAPP is to provide confidence in the project data results through a system of QA/QC performance checks with respect to data collection methods, laboratory analysis, data reporting, and appropriate corrective actions to achieve compliance with established performance and data quality criteria. This section presents the QA/QC procedures to ensure that the investigation data results are defensible and usable for their intended purpose.

4.1 Measurements of Data Quality

The tolerable limits for the data reported by the laboratory will be measured with accuracy, precision, representativeness, completeness, and comparability as described below.

Accuracy is the degree to which an observed measurement agrees with an accepted reference or true value. Accuracy is a measure of the bias in the system and is expressed as the percent recoveries of spiked analytes in MS/MSD and LCS/LCSD samples. Accuracy will also be evaluated through the surrogate spikes in each sample during organic chemistry analysis. The performance-based laboratory control limits for accuracy will be used for the project.

Precision is a measure of mutual agreement among individual measurements of the same property under prescribed conditions. Precision will be assessed by the analysis of MS/MSD samples, field duplicate samples, and LCS/LCSD samples. The calculated relative percent differences (RPDs) for field and MS/MSD pairs will provide information on the precision of sampling and analytical procedures, and the RPDs for LCS/LCSD pairs will provide information on precision of the analytical procedures.

Representativeness expresses the degree to which data accurately and precisely represent an actual condition or characteristic at a particular sampling point. Representativeness is achieved by collecting samples representative of the matrix at the time of collection. Representativeness can be evaluated using replicate samples and blanks.

Completeness refers to the amount of measurement data collected relative to that needed to assess the project's technical objectives. It is calculated as the number of valid data points achieved divided by the total number of data points requested by virtue of the study design. For this project, completeness objectives have been established at 95 percent.

Comparability is based on the use of established USEPA-approved methods for the analysis of the selected parameters. The quantification of the analytical parameters is based on published methods, supplemented with well-documented procedures used in the laboratory to ensure reproducibility of the data.

4.2 Quality Assurance and Quality Control

Field and laboratory QA/QC samples will be used to evaluate the data precision, accuracy, representativeness, and comparability of the analytical results. The field QA samples to be collected are described in Section 4.2.1. The laboratory QA samples are discussed in Section 4.2.2.

4.2.1 Field QA/QC Samples

Field QC samples will be collected during sampling to quantitatively measure and ensure the quality of the sampling effort and the analytical data. Field QC samples include field duplicate samples and equipment rinse blanks. Field QC samples will be handled in the same manner as the environmental samples collected. Descriptions of the field QC samples are provided below.

Field Duplicate Samples

Field duplicate samples will be collected at a rate of one per twenty normal samples collected for analysis. Field duplicate samples will be collected at the same time and analyzed for the same chemicals as the original sample. Field duplicate sample results are used to assess the precision of the sample collection process and to help determine the representativeness of the sample. If the results of the field duplicate samples exceed QA/QC criteria for precision, this information will be discussed in the data validation report, but data qualifiers will not be applied to the associated results.

Rinse Blanks

Rinse blank samples provide a quality control check on the potential for cross contamination by measuring the effectiveness of the decontamination procedures of the sampling equipment. The rinse blank samples consist of reagent grade water provided by ARI rinsed across sample collection and processing equipment. One rinse blank sample will be collected per week of sample collection and analyzed for SVOCs, PCBs, and metals. If chemicals are detected in the rinse blank samples, the detected concentrations will be compared to the associated sample results to evaluate the potential for cross contamination. The blank results will be discussed in the data validation report, and data qualifiers may be applied to the associated results.

4.2.2 Laboratory QA/QC Samples

Laboratory calibration and QA/QC sample requirements are defined in the test methods. One laboratory method blank and LCS will be analyzed for metals and organics test methods in every analytical batch to assess potential laboratory contamination and accuracy. An LCSD should be analyzed if the laboratory does not have enough sample volume to prepare a project-specific MS/MSD for PCBs and SVOCs, and/or laboratory duplicate sample for metals. Laboratory QA/QC requirements are listed in Table 3. The results of these samples will provide information on the accuracy and precision of the chemical analysis.

Table 3. Laboratory QA/QC Requirements

Analysis Type	Initial Calibration	CCV	LCS	Method Blanks[1]	Lab Duplicate	MS/MSD	Surrogates	SRM
Dioxins/furans	prior to analysis	start of 12 hour batch	one per prep batch	one per prep batch	na	na	every sample	one per prep batch
PCBs	prior to analysis	start of batch, every 12 hours and end of batch	one per prep batch	one per prep batch	na	MS/MSD at rate of 5% of samples	every sample	one per prep batch
SVOCs and selected SVOCs by SIM	prior to analysis	start of 12 hour batch	one per prep batch	one per prep batch	na	MS/MSD at rate of 5% of samples	every sample	one per prep batch
Metals including mercury	daily, prior to analysis	start of batch, every 10 samples and end of batch	one per prep batch	one per prep batch	one at rate of 5% of samples	MS at rate of 5% of samples	na	one per prep batch
Total Organic Carbon	daily, prior to analysis	start of batch, every 10 samples and end of batch	one per prep batch	one per prep batch	one at rate of 5% of samples	MS at rate of 5% of samples	na	one per prep batch
Total Solids	na	na	na	na	one per prep batch	na	na	na
Grain Size	na	na	na	na	one per prep batch	na	na	na

CCV = continuing calibration verification
LCS/LCSD = laboratory control sample/laboratory control sample duplicate; an ongoing precision and recovery sample may be substituted for an LCS for analysis of dioxins/furans
MS/MSD = matrix spike/matrix spike duplicate
SRM = Standard Reference Material

4.3 Data Validation

All chemical results gathered during this investigation will undergo independent data validation by EcoChem, Inc. of Seattle, WA. A summary-level Stage 3 data validation will be performed for all standard sediment chemistry; a full-level Stage 4 data validation will be performed for dioxins/furans, and a compliance-level screening including a comparison of detected results to sample concentrations will be performed for rinse blank samples. Data validation will be performed following USEPA guidance (USEPA 1994, 2008, 2009, 2010). If data quality concerns are noted, the laboratory will be contacted and the data will be reanalyzed, qualified, and/or discussed in the data validation report. The results of the data validation will be summarized in a data validation report, which will be included as an appendix to the data report.

The analytical laboratories will provide one hardcopy data package to EcoChem and electronic copies (i.e., pdf) to SAIC. The data packages will contain sufficient information to allow for the data validation and review of all sample and laboratory QC sample results (i.e., method blanks, LCS/LCSD, and MS/MSD).

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5.0 Data Analysis, Recordkeeping, and Reporting Requirements

5.1 Analysis of Chemistry Data

The chemical data results will be summarized and presented in tables indicating locations and detected contaminants, along with any data qualifiers assigned by the laboratory or during data validation.

5.2 Recordkeeping

At the conclusion of the study, all records including field records, laboratory analytical data, reports, and reviews will be transmitted to Ecology for archive.

5.3 Data Report

A written data report documenting all activities associated with collection and chemical analyses of samples will be prepared. At a minimum, the following will be included in the data report:

- Description of sampling and analysis activities.
- Protocols used during sampling and testing and an explanation of any deviations from the sampling plan protocols or the approved SAP.
- COC records.
- Chemistry results and laboratory reports.
- QA/QC summary and data validation report.
- The toxic equivalency quotient (TEQ) concentration of dioxin/furan compounds will be normalized to the toxicity of 2,3,7,8-TCDD using toxic equivalent factors (TEFs) updated by the World Health Organization in 2005 (Van den Berg et al. 2006) and incorporated into the Model Toxics Control Act (MTCA) (WAC 173-340-900; Ecology 2007). The TEQ is equivalent to the sum of the concentrations of individual congeners multiplied by their TEF (potency relative to 2,3,7,8-TCDD). Non-detected values will be assessed as half of the reporting limit for data evaluation purposes.
- Carcinogenic PAH (cPAH) values will be calculated using potency equivalency factor (PEF) values (California EPA 1994) based on an individual compound's relative toxicity to benzo(a)pyrene. Final cPAH concentrations are equivalent to the sum of the concentrations of the seven individual cPAH compounds multiplied by their associated PEF. Non-detected values will be assessed as half of the reporting limit for data evaluation purposes.
- Chemical concentrations will be compared to Washington State SMS criteria if TOC results are ≥0.5% or ≤4.0%. Samples with TOC concentrations <0.5% or >4.0% will be compared to the lowest and second lowest dry weight apparent effects thresholds (AET) values (Barrick et al. 1988).

- Chemical concentrations for the following four LDW RI risk driver chemicals will be compared to the 95% upper confidence limit on the mean (UCL95) of natural background concentrations (AECOM 2010): total PCBs (6.5 µg/kg dw), arsenic (7.3 mg/kg dw), cPAHs (8.9 µg TEQ/kg dw), and dioxins/furans (1.6 ng TEQ/kg dw).
- Recommendations for sampling effluent and stormwater solids at specific outfalls.

SAIC will provide all deliverables electronically in MS Word or Excel formats as appropriate and Adobe .pdf format for all documents. Additionally, three hardcopies of both the draft and final data reports will be submitted to Ecology. SAIC will provide georeferenced data files in the appropriate format specified by Ecology for all figures created with CAD or GIS software. The draft data report (including original laboratory data sheets) will be due to Ecology four weeks after SAIC receives the validated data. SAIC will submit the final report to Ecology two weeks following receipt of Ecology's comments on the draft report but no later than June 30, 2011.

The report will include outfall GIS-rendered maps noting exceedance detections and be organized such that any outfall sediment locations with sediment contaminants exceeding the standards will be easily identified for the tracing of future upstream sources. The draft and final report will include a summary section describing the difficulties and recommendations or modifications for future efforts that will be developed.

In addition, the validated chemistry data from the sediment investigation will be uploaded into Ecology's Environmental Information Management (EIM) database. Information for entering environmental data into EIM can be found on Ecology's website: http://www.ecy.wa.gov/eim/.

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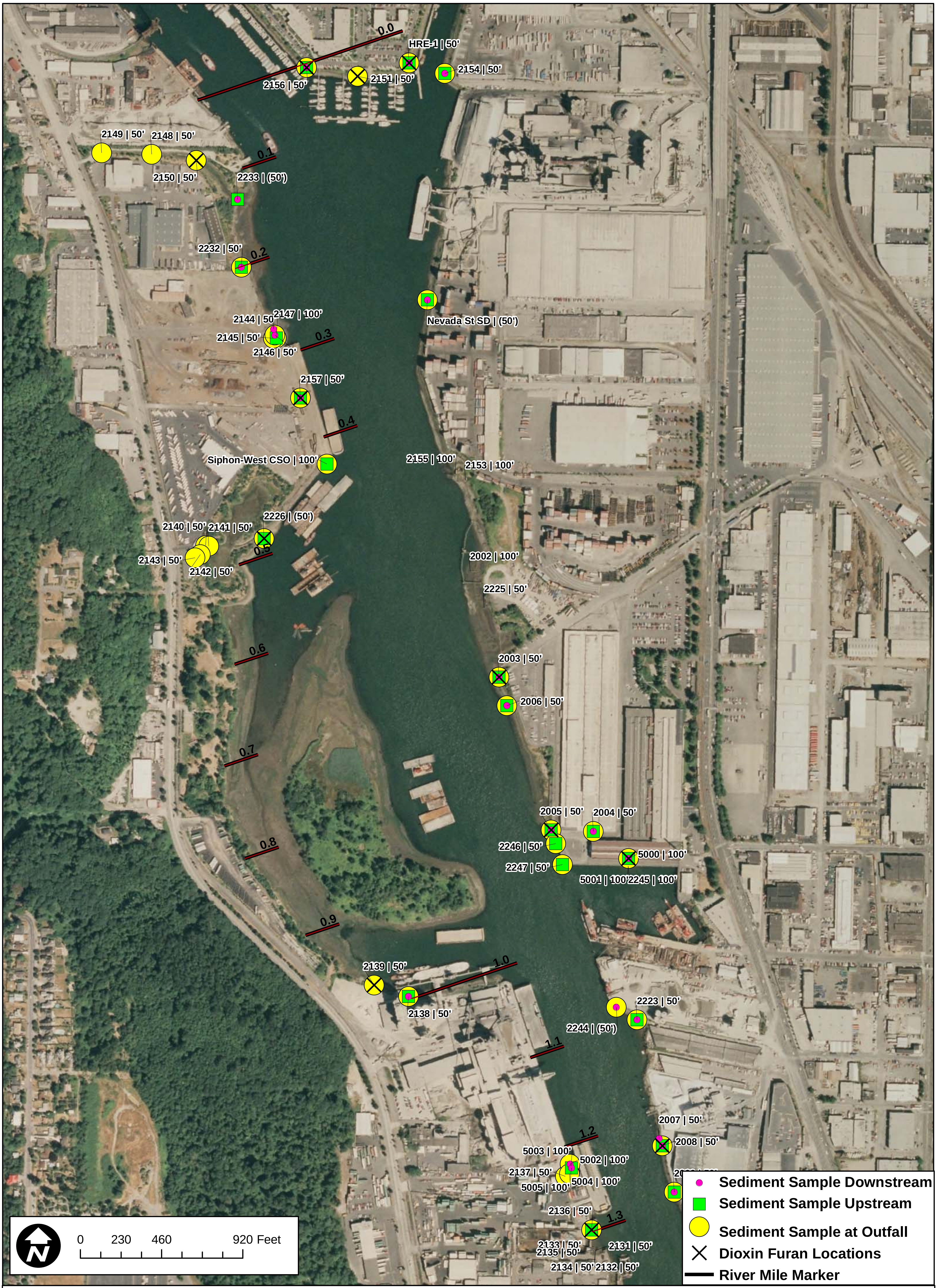

From Science to Solutions

DEPARTMENT OF ECOLOGY
State of Washington

Surface Sediment Sample Locations at Outfalls

Figure 1A: River Mile 0.0 to 1.1

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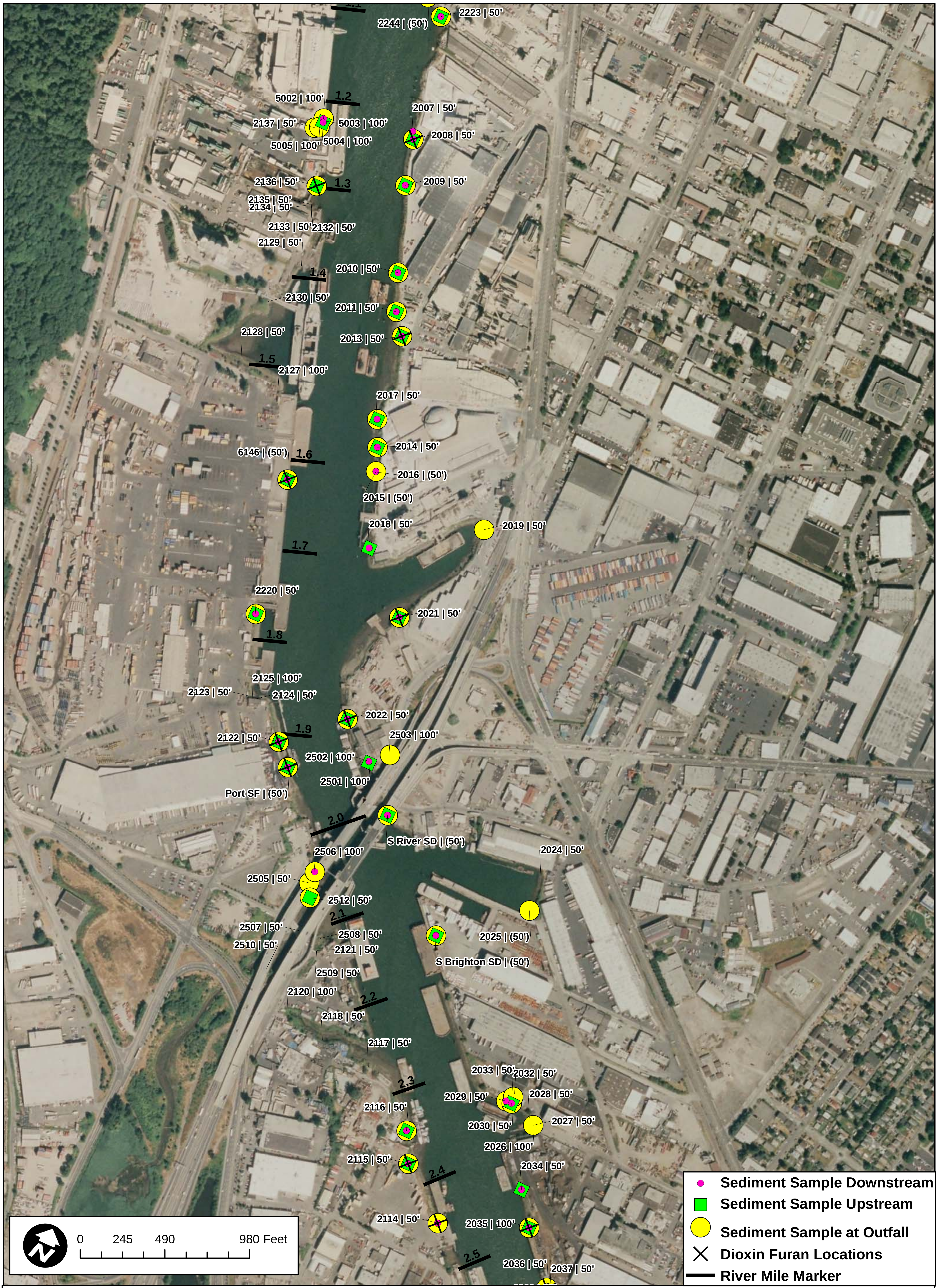

From Science to Solutions

Surface Sediment Sample Locations at Outfalls

Figure 1B: River Mile 1.1 to 2.6

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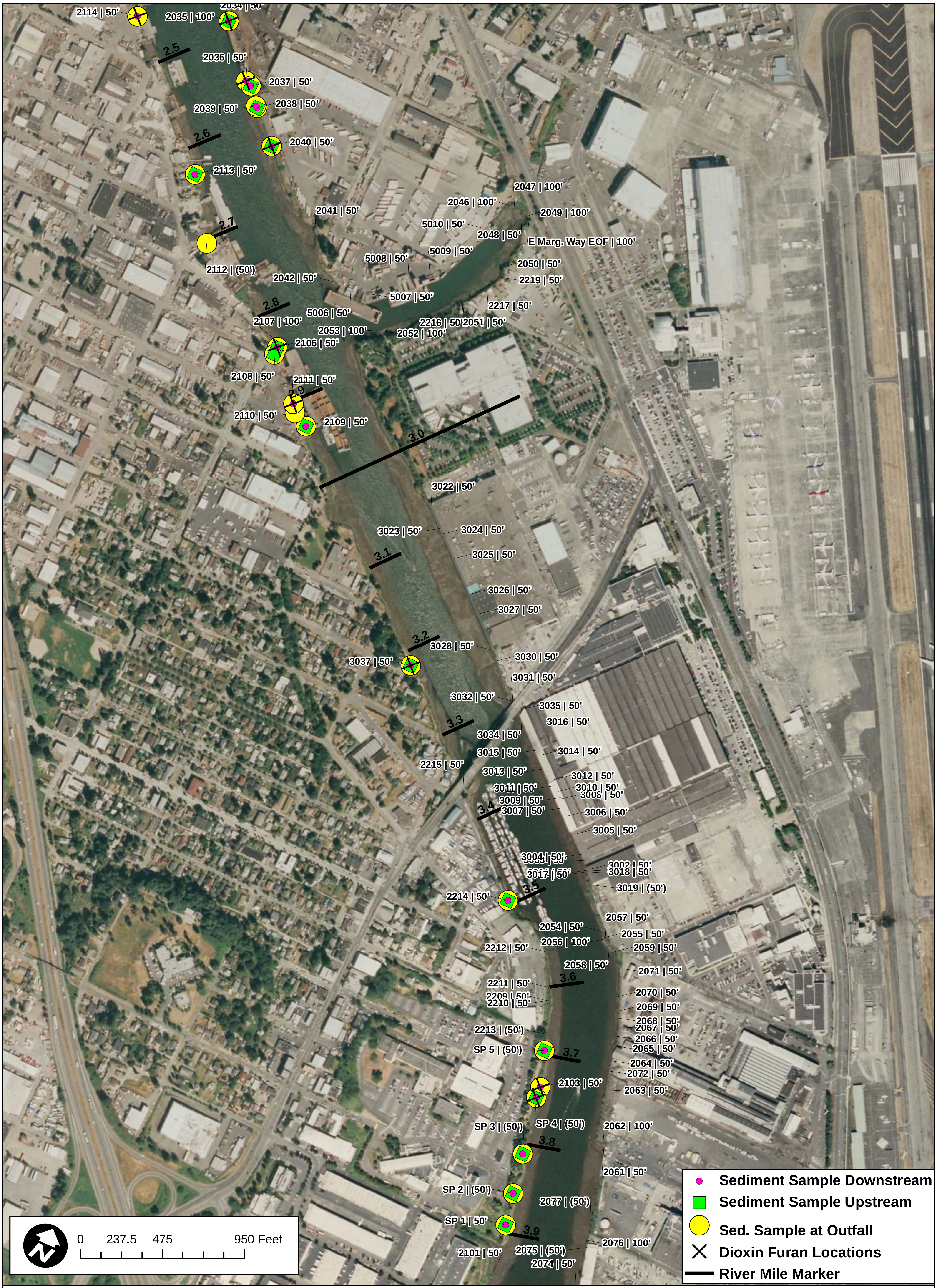
State of Washington

X:\GIS_Projects\Ecology Toxics Contract\WA-XX LDW Outfall Sampling\MapDocuments\MAP_outfall_stripmap_11092010.mxd



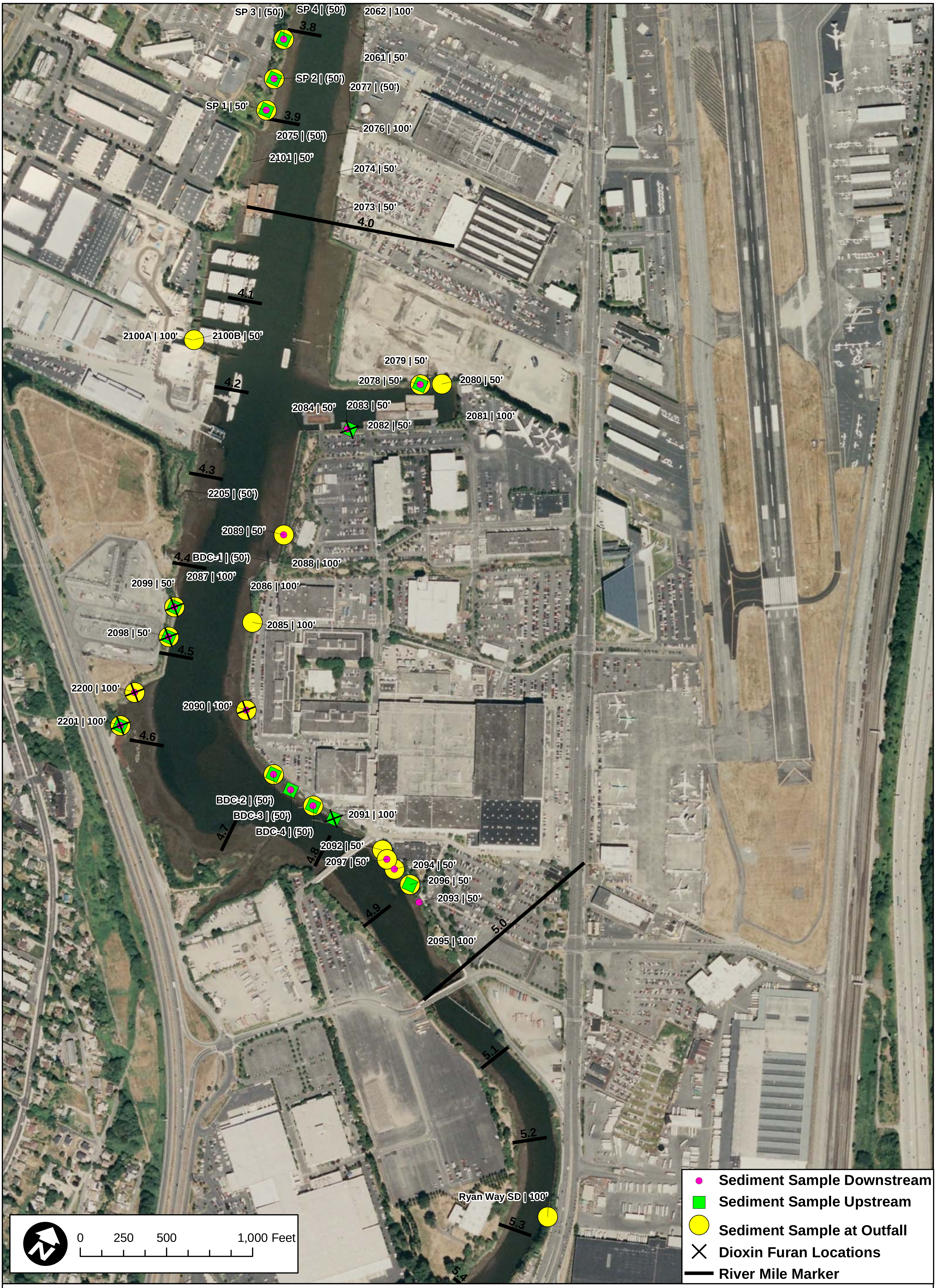
From Science to Solutions

Surface Sediment Sample Locations at Outfalls

Figure 1C: River Mile 2.6 to 4.0

DEPARTMENT OF ECOLOGY
State of Washington

X:\GIS_Projects\Ecology Toxics Contract\WA-XX LDW Outfall Sampling\MapDocuments\MAP_outfall_stripmap_11092010.mxd



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Surface Sediment Sample Locations at Outfalls

Figure 1D: River Mile 4.0 to 5.5

DEPARTMENT OF ECOLOGY
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X:\GIS_Projects\Ecology Toxics Contract\WA-XX LDW Outfall Sampling\MapDocuments\MAP_outfall_stripmap_11092010.mxd

Appendix A

Target Chemicals, Reporting Limits and Method Detection Limits

Appendix A
Target Chemicals, Reporting Limits and Method Detection Limits

Sensitivity is a measure of an analytical method's ability to detect a chemical and the concentration that the chemical can be reliably quantified by that method. The minimum concentration of a chemical that can be detected is called the method detection limit (MDL). The minimum concentration that can be reliably quantified is called the reporting limit (RL). Detected concentrations above the RL will be reported by the laboratories without qualification. Values between the MDL and RL will be reported by the laboratories with a J qualifier indicating that the reported concentration is estimated. Values below the MDL will be reported as non-detect (U-qualified) at the RL value.

Analytes, Test Methods, Method Detection Limits, Reporting Limits, Accuracy Limits, and Precision Limits for Sediment Samples

Analyte	Prep Method [a]	Analytical Method [a]	MDL [b]	RL [b]	Accuracy Limits	Precision Limits
Metals (mg/kg DW)						
Arsenic	EPA 3050B	EPA 6010B/200.8	0.31	0.5–5.0	80-120%	35%
Cadmium	EPA 3050B	EPA 6010B/200.8	0.02	0.2	80-120%	35%
Chromium	EPA 3050B	EPA 6010B/200.8	0.26	0.5	80-120%	35%
Copper	EPA 3050B	EPA 6010B/200.8	0.04	0.5	80-120%	35%
Lead	EPA 3050B	EPA 6010B/200.8	0.18	2.0	80-120%	35%
Mercury	EPA 7471A	EPA 7471A	0.002	0.025	80-120%	35%
Silver	EPA 3050B	EPA 6010B/200.8	0.04	0.3	80-120%	35%
Zinc	EPA 3050B	EPA 6010B/200.8	1.9	4.0	80-120%	35%
PCB Aroclors (µg/kg DW)						
Aroclor 1016	EPA 3550B	EPA 8082	1.1	4.0	lab limits[c]	50%
Aroclor 1021	EPA 3550B	EPA 8082	1.1	4.0	lab limits[c]	50%
Aroclor 1221	EPA 3550B	EPA 8082	1.1	4.0	lab limits[c]	50%
Aroclor 1232	EPA 3550B	EPA 8082	1.4	4.0	lab limits[c]	50%
Aroclor 1242	EPA 3550B	EPA 8082	1.4	4.0	lab limits[c]	50%
Aroclor 1248	EPA 3550B	EPA 8082	1.4	4.0	lab limits[c]	50%
Aroclor 1254	EPA 3550B	EPA 8082	1.4	4.0	lab limits[c]	50%
Aroclor 1260	EPA 3550B	EPA 8082	1.4	4.0	lab limits[c]	50%
PAHs (µg/kg DW)						
1-Methylnaphthalene	EPA 3550B	EPA 8270D	20	20	lab limits[c]	50%
2-Chloronaphthalene	EPA 3550B	EPA 8270D	9.2	20	lab limits[c]	50%
2-Methylnaphthalene	EPA 3550B	EPA 8270D	18	20	lab limits[c]	50%

Analyte	Prep Method [a]	Analytical Method [a]	MDL [b]	RL [b]	Accuracy Limits	Precision Limits
Acenaphthene	EPA 3550B	EPA 8270D	10	20	lab limits[c]	50%
Acenaphthylene	EPA 3550B	EPA 8270D	9.4	20	lab limits[c]	50%
Anthracene	EPA 3550B	EPA 8270D	8.0	20	lab limits[c]	50%
Benzo(a)anthracene	EPA 3550B	EPA 8270D	8.7	20	lab limits[c]	50%
Benzo(a)pyrene	EPA 3550B	EPA 8270D	8.1	20	lab limits[c]	50%
Benzo(g,h,i)perylene	EPA 3550B	EPA 8270D	8.5	20	lab limits[c]	50%
Chrysene	EPA 3550B	EPA 8270D	9.7	20	lab limits[c]	50%
Dibenzo(a,h)anthracene	EPA 3550B	EPA 8270D-SIM[d]	2.8	6.7	lab limits[c]	50%
Dibenzofuran	EPA 3550B	EPA 8270D	17	20	lab limits[c]	50%
Fluoranthene	EPA 3550B	EPA 8270D	8.6	20	lab limits[c]	50%
Fluorene	EPA 3550B	EPA 8270D	12	20	lab limits[c]	50%
Indeno(1,2,3-cd)Pyrene	EPA 3550B	EPA 8270D	6.2	20	lab limits[c]	50%
Naphthalene	EPA 3550B	EPA 8270D	12	20	lab limits[c]	50%
Phenanthrene	EPA 3550B	EPA 8270D	10	20	lab limits[c]	50%
Pyrene	EPA 3550B	EPA 8270D	9.4	20	lab limits[c]	50%
Phthalates (µg/kg DW)						
Bis(2-ethylhexyl)phthalate	EPA 3550B	EPA 8270D	11	20	lab limits[c]	50%
Butyl benzyl phthalate	EPA 3550B	EPA 8270D-SIM[d]	1.8	6.7	lab limits[c]	50%
Dimethylphthalate	EPA 3550B	EPA 8270D-SIM[d]	3.2	6.7	lab limits[c]	50%
Dimethyl phthalate	EPA 3550B	EPA 8270D	9.4	20	lab limits[c]	50%
Di-n-butyl phthalate	EPA 3550B	EPA 8270D	6.6	20	lab limits[c]	50%
Di-n-octyl phthalate	EPA 3550B	EPA 8270D	10	20	lab limits[c]	50%
Other SVOCs (µg/kg DW)						
1,2,4-Trichlorobenzene	EPA 3550B	EPA 8270D-SIM[d]	4.6	6.7	lab limits[c]	50%
1,2-Dichlorobenzene	EPA 3550B	EPA 8270D-SIM[d]	3.4	6.7	lab limits[c]	50%
1,3-Dichlorobenzene	EPA 3550B	EPA 8270D	8.4	20	lab limits[c]	50%
1,4-Dichlorobenzene	EPA 3550B	EPA 8270D-SIM[d]	3.2	6.7	lab limits[c]	50%
2,2'-oxybis(1-chloropropane)	EPA 3550B	EPA 8270D	12	20	lab limits[c]	50%
2,4,5-Trichlorophenol	EPA 3550B	EPA 8270D	6.0	100	lab limits[c]	50%
2,4,6-Trichlorophenol	EPA 3550B	EPA 8270D	8.8	100	lab limits[c]	50%
2,4-Dichlorophenol	EPA 3550B	EPA 8270D	8.3	100	lab limits[c]	50%
2,4-Dimethylphenol	EPA 3550B	EPA 8270D or EPA 8270D-SIM[d]	6.3 - 17	20	lab limits[c]	50%
2,4-Dinitrophenol	EPA 3550B	EPA 8270D	29	200	lab limits[c]	50%

Analyte	Prep Method [a]	Analytical Method [a]	MDL [b]	RL [b]	Accuracy Limits	Precision Limits
2,4-Dinitrotoluene	EPA 3550B	EPA 8270D	10	100	lab limits[c]	50%
2,6-Dinitrotoluene	EPA 3550B	EPA 8270D	12	100	lab limits[c]	50%
2-Chlorophenol	EPA 3550B	EPA 8270D	9.0	20	lab limits[c]	50%
2-Methylphenol	EPA 3550B	EPA 8270D-SIM[d]	3.6	6.7	lab limits[c]	50%
2-Nitroaniline	EPA 3550B	EPA 8270D	54	100	lab limits[c]	50%
2-Nitrophenol	EPA 3550B	EPA 8270D	8.8	100	lab limits[c]	50%
3,3'-Dichlorobenzidine	EPA 3550B	EPA 8270D	47	100	lab limits[c]	50%
3-Nitroaniline	EPA 3550B	EPA 8270D	53	100	lab limits[c]	50%
4,6-Dinitro-2-methylphenol	EPA 3550B	EPA 8270D	110	200	lab limits[c]	50%
4-Bromophenyl-phenyl ether	EPA 3550B	EPA 8270D	13	20	lab limits[c]	50%
4-Chloro-3-methylphenol	EPA 3550B	EPA 8270D	10	100	lab limits[c]	50%
4-Chloroaniline	EPA 3550B	EPA 8270D	40	100	lab limits[c]	50%
4-Chlorophenyl-phenyl ether	EPA 3550B	EPA 8270D	12	20	lab limits[c]	50%
4-Methylphenol	EPA 3550B	EPA 8270D	7.3	20	lab limits[c]	50%
4-Nitroaniline	EPA 3550B	EPA 8270D	26	100	lab limits[c]	50%
4-Nitrophenol	EPA 3550B	EPA 8270D	37	100	lab limits[c]	50%
Aniline	EPA 3550B	EPA 8270D	9.6	20	lab limits[c]	50%
Benzoic Acid	EPA 3550B	EPA 8270D	89	200	lab limits[c]	50%
Benzyl Alcohol	EPA 3550B	EPA 8270D	15	20	lab limits[c]	50%
Bis-(2-chloroethoxy) methane	EPA 3550B	EPA 8270D	12	20	lab limits[c]	50%
Bis-(2-chloroethyl) ether	EPA 3550B	EPA 8270D	12	20	lab limits[c]	50%
Carbazole	EPA 3550B	EPA 8270D	7.5	20	lab limits[c]	50%
Hexachlorobenzene	EPA 3550B	EPA 8270D-SIM[d]	2.6	6.7	lab limits[c]	50%
Hexachlorobutadiene	EPA 3550B	EPA 8270D-SIM[d]	1.6	6.7	lab limits[c]	50%
Hexachlorocyclopentadiene	EPA 3550B	EPA 8270D	45	100	lab limits[c]	50%
Hexachloroethane	EPA 3550B	EPA 8270D	9.7	20	lab limits[c]	50%
Isophorone	EPA 3550B	EPA 8270D	11	20	lab limits[c]	50%
Nitrobenzene	EPA 3550B	EPA 8270D	11	20	lab limits[c]	50%
n-Nitrosodimethylamine	EPA 3550B	EPA 8270D-SIM[d]	33	33	lab limits[c]	50%
n-Nitrosodi-n-propylamine	EPA 3550B	EPA 8270D-SIM[d]	11	33	lab limits[c]	50%
n-Nitrosodiphenylamine	EPA 3550B	EPA 8270D-SIM[d]	1.6	6.7	lab limits[c]	50%
Pentachlorophenol	EPA 3550B	EPA 8270D-SIM[d]	33	33	lab limits[c]	50%
Phenol	EPA 3550B	EPA 8270D	12	20	lab limits[c]	50%

Analyte	**Prep Method** [a]	**Analytical Method** [a]	**MDL** [b]	**RL** [b]	**Accuracy Limits**	**Precision Limits**
Dioxins/Furans (pg/g DW)						
2,3,7,8-TCDD	EPA 1613B	EPA 1613B	0.05	1.0	lab limits[c]	50%
1,2,3,7,8-PeCDD	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
1,2,3,4,7,8-HxCDD	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
1,2,3,6,7,8-HxCDD	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
1,2,3,7,8,9-HxCDD	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
1,2,3,4,6,7,8-HpCDD	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
OCDD	EPA 1613B	EPA 1613B	0.50	10.0	lab limits[c]	50%
2,3,7,8-TCDF	EPA 1613B	EPA 1613B	0.05	1.0	lab limits[c]	50%
1,2,3,7,8-PeCDF	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
2,3,4,7,8-PeCDF	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
1,2,3,4,7,8-HxCDF	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
1,2,3,6,7,8-HxCDF	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
1,2,3,7,8,9-HxCDF	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
2,3,4,6,7,8-HxCDF	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
1,2,3,4,6,7,8-HpCDF	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
1,2,3,4,7,8,9-HpCDF	EPA 1613B	EPA 1613B	0.10	5.0	lab limits[c]	50%
OCDF	EPA 1613B	EPA 1613B	0.50	10.0	lab limits[c]	50%
Conventionals (%)						
TOC	Plumb (1981)	Plumb (1981)	na	0.5	80-120%	35%
Total Solids	EPA 160.3	EPA 160.3	na	0.1	80-120%	35%
Grain Size	PSEP (1986)	PSEP (1986)	na	0.1	80-120%	35%

MDL = method detection limit

RL = reporting limit

a. Recommended sample preparation and analytical methods are from SW-846 [USEPA 1986] and USEPA updates. Cleanup methods will be employed at the laboratory’s discretion.

b. Actual MDLs and RLs will vary based on the sample volumes used for analysis, percent moisture, dilution factors, analytical conditions at the time of analysis, and matrix interferences.

c. The QC limits used to evaluate accuracy will be provided by the laboratory in each data package using performance-based control charted results.

d. This chemical will be analyzed by both EPA 8270D and EPA 8270D-SIM. Method EPA 8270D-SIM has lower MDLs and RLs, with one exception: both methods have the same RL for 2,4-Dimethylphenol. If both methods yield non-detect results, then the result with the lowest RL will be selected for final reporting. If both methods yield detected results, then the result with the highest concentration and/or the lowest analytical dilution will be selected for final reporting. If the test methods yield detected and non-detected results, then the detected result from the lowest analytical dilution will be selected for final reporting.

Appendix B

Sample Collection Form

Surface Sediment Collection Form

Project: LDW Outfall Sediment Sampling

Sample ID: LDW-SS__________-______

Sampled By:__________________________________

Date: ______/______/ 2011

Grab #1	**Bottom depth:** ___________**cm**	**Penetration Depth:** _________**cm**	**Acceptable / Rejected** *(circle one)* **Time:** _____________
Sediment type: Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris Worms Polychaetes	***Sediment color:*** Drab olive Brown Brown surface Gray Black *Other:*____________	***Sediment Odor:*** None Slight Moderate Strong Overwhelming H_2S Petroleum	***Comments:*** Latitude: ___________________ Longitude: __________________
Grab #2 *or* N/A ☐	**Bottom depth:** ___________**cm**	**Penetration Depth:** _________**cm**	**Acceptable / Rejected** *(circle one)* **Time:** _____________
Sediment type: Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris Worms Polychaetes	***Sediment color:*** Drab olive Brown Brown surface Gray Black *Other:*____________	***Sediment Odor:*** None Slight Moderate Strong Overwhelming H_2S Petroleum	***Comments:*** Latitude: ___________________ Longitude: __________________
Grab #3 *or* N/A ☐	**Bottom depth:** ___________**cm**	**Penetration Depth:** _________**cm**	**Acceptable / Rejected** *(circle one)* **Time:** _____________
Sediment type: Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris Worms Polychaetes	***Sediment color:*** Drab olive Brown Brown surface Gray Black *Other:*____________	***Sediment Odor:*** None Slight Moderate Strong Overwhelming H_2S Petroleum	***Comments:*** Latitude: ___________________ Longitude: __________________
Grab #4 *or* N/A ☐	**Bottom depth:** ___________**cm**	**Penetration Depth:** _________**cm**	**Acceptable / Rejected** *(circle one)* **Time:** _____________
Sediment type: Cobble Gravel Sand C M F Silt/clay Organic matter Woody debris Shell debris Worms Polychaetes	***Sediment color:*** Drab olive Brown Brown surface Gray Black *Other:*____________	***Sediment Odor:*** None Slight Moderate Strong Overwhelming H_2S Petroleum	***Comments:*** Latitude: ___________________ Longitude: __________________

Coordinates are presented in NAD83 horizontal datum; X-Y coordinates in Washington State Plane N (US survey ft)

Recorded By/Date:_________________________ **Reviewed By/Date:** ___________________________

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Appendix C

Chain-of-Custody Forms

SAIC
From Science to Solutions

18912 North Creek Parkway, Suite 101
Bothell, Washington 98011
TEL: 425.485.5800 • FAX: 425.485.5566

CHAIN OF CUSTODY RECORD

Project Number: 196900
Project Name: LDW Outfall Sampling
Project Location: Lower Duwamish Waterway, Seattle, WA
Contact Name: Marina Mitchell 425.482.3310 marina.i.mitchell@saic.com
Samples Collected by: Michael Pagel

Shipping Information

Number of Shipping Containers:
Date Shipped:
Carrier: SAIC
Waybill No.: N/A

<table>
<tr><th colspan="6"></th><th colspan="10">Analyses / Tests</th><th></th></tr>
<tr><th>Sample ID</th><th>Depth</th><th>Matrix</th><th>Date</th><th>Time</th><th># of Containers</th><th>archive - Dioxins/Furans (EPA 1613B)*</th><th>PCB Aroclors (EPA 8082)</th><th>SVOCs by SIM (EPA 8270D-SIM)</th><th>SVOCs (EPA 8270D)</th><th>Mercury (EPA 7471A)</th><th>Other Metals (EPA 6010B/200.8)</th><th>Total Organic Carbon (Plumb 1981)</th><th>Total Solids (EPA 160.3)</th><th>Grain Size (PSEP 1986)</th><th><i>extra volume for lab QC</i></th><th>Comments</th></tr>
<tr><td>LDW-SS__________-_____</td><td>0-10 cm</td><td>sediment</td><td>/ /11</td><td></td><td></td><td></td><td colspan="3">X</td><td colspan="5">X</td><td>X</td><td></td><td>*Archive dioxins/furans jar</td></tr>
<tr><td>LDW-SS__________-_____</td><td>0-10 cm</td><td>sediment</td><td></td><td></td><td></td><td></td><td colspan="3">X</td><td colspan="5">X</td><td>X</td><td></td><td>frozen upon receipt. Sample will</td></tr>
<tr><td>LDW-SS__________-_____</td><td>0-10 cm</td><td>sediment</td><td></td><td></td><td></td><td></td><td colspan="3">X</td><td colspan="5">X</td><td>X</td><td></td><td>be shipped to Axys for analysis</td></tr>
<tr><td>LDW-SS__________-_____</td><td>0-10 cm</td><td>sediment</td><td></td><td></td><td></td><td></td><td colspan="3">X</td><td colspan="5">X</td><td>X</td><td></td><td>at a later date.</td></tr>
<tr><td>LDW-SS__________-_____</td><td>0-10 cm</td><td>sediment</td><td></td><td></td><td></td><td></td><td colspan="3">X</td><td colspan="5">X</td><td>X</td><td></td><td></td></tr>
<tr><td>LDW-SS__________-_____</td><td>0-10 cm</td><td>sediment</td><td></td><td></td><td></td><td></td><td colspan="3">X</td><td colspan="5">X</td><td>X</td><td></td><td>Analyze per SAP/QAPP,</td></tr>
<tr><td>LDW-SS__________-_____</td><td>0-10 cm</td><td>sediment</td><td></td><td></td><td></td><td></td><td colspan="3">X</td><td colspan="5">X</td><td>X</td><td></td><td>provided under separate cover.</td></tr>
<tr><td>LDW-SS__________-_____</td><td>0-10 cm</td><td>sediment</td><td></td><td></td><td></td><td></td><td colspan="3">X</td><td colspan="5">X</td><td>X</td><td></td><td></td></tr>
<tr><td>LDW-SS__________-_____</td><td>0-10 cm</td><td>sediment</td><td></td><td></td><td></td><td></td><td colspan="3">X</td><td colspan="5">X</td><td>X</td><td></td><td>Do not dispose of samples</td></tr>
<tr><td>LDW-SS__________-_____</td><td>0-10 cm</td><td>sediment</td><td></td><td></td><td></td><td></td><td colspan="3">X</td><td colspan="5">X</td><td>X</td><td></td><td>without written authorization</td></tr>
<tr><td>LDW-SS__________-_____</td><td>0-10 cm</td><td>sediment</td><td></td><td></td><td></td><td></td><td colspan="3">X</td><td colspan="5">X</td><td>X</td><td></td><td>from SAIC.</td></tr>
<tr><td>LDW-SS__________-_____</td><td>0-10 cm</td><td>sediment</td><td></td><td></td><td></td><td></td><td colspan="3">X</td><td colspan="5">X</td><td>X</td><td></td><td></td></tr>
</table>

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature:	Signature:	Signature:	Signature:
Date/Time: / /2011 @	Date/Time:	Date/Time:	Date/Time:
Affiliation: SAIC	Affiliation:	Affiliation:	Affiliation:

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Bothell, Washington 98011
TEL: 425.485.5800 • FAX: 425.485.5566

CHAIN OF CUSTODY RECORD

Project Number: 196900
Project Name: LDW Outfall Sampling
Project Location: Lower Duwamish Waterway, Seattle, WA
Contact Name: Marina Mitchell 425.482.3310 marina.i.mitchell@saic.com
Samples Collected by: Michael Pagel

Shipping Information

Number of Shipping Containers:
Date Shipped:
Carrier: SAIC
Waybill No.: N/A

						Analyses / Tests										
Sample ID	Depth	Matrix	Date	Time	# of Containers	archive - Dioxins/Furans (EPA 1613B)*	PCB Aroclors (EPA 8082)	SVOCs by SIM (EPA 8270D-SIM)	SVOCs (EPA 8270D)	Mercury (EPA 7471A)	Other Metals (EPA 6010B/200.8)	Total Organic Carbon (Plumb 1981)	Total Solids (EPA 160.3)	Grain Size (PSEP 1986)	*extra volume for lab QC*	Comments
LDW-SS__________-_____	0-10 cm	sediment	/ /11					X			X			X		*Archive dioxins/furans jar
																frozen upon receipt. Sample will
																be shipped to Axys for analysis
																at a later date.
																Analyze per SAP/QAPP,
																provided under separate cover.
																Do not dispose of samples
																without written authorization
																from SAIC.

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature:	Signature:	Signature:	Signature:
Date/Time: / /2011 @	Date/Time:	Date/Time:	Date/Time:
Affiliation: SAIC	Affiliation:	Affiliation:	Affiliation:

SAIC From Science to Solutions

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CHAIN OF CUSTODY RECORD

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Project Location: Lower Duwamish Waterway, Seattle, WA
Contact Name: Marina Mitchell 425.482.3310 marina.i.mitchell@saic.com
Samples Collected by: Michael Pagel

Sample ID	Depth	Matrix	Date	Time	# of Containers	PCB Aroclors (EPA 8082)	SVOCs (EPA 8270D)	Mercury (EPA 7470A)	Other Metals (EPA 6010B/200.8)						
LDW-SS______________-RB	n/a	water	/ /11		5	X	X	X							

Analyses / Tests

Shipping Information

Number of Shipping Containers:
Date Shipped:
Carrier: SAIC
Waybill No.: N/A

Comments

Analyze per SAP/QAPP, provided under separate cover.

RINSATE BLANK

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
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Appendix D

Electronic Data Deliverable Format

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Electronic Data Deliverable Format

Laboratory electronic data deliverables (EDDs) will be submitted as tab delimited text or csv files and will conform to the specifications listed below. This format provides all data required for an EIM submittal.

Field	Name	Type[1]	Data Required[2]
1	PROJID	T	No
2	STUDYID	T	No
3	FIELDID	T	No
4	LABID	T	Yes
5	LABBATCH	T	Yes
6	CAS NUMBER	T	Special
7	ANALYTE	T	Yes
8	VALUE	N	Yes
9	VALUESF	N	No
10	LABQUAL	T	Special
11	UNITS	T	Yes
12	MDL	N	Special
13	REPLIMIT	N	Yes
14	ANLGROUP	T	No
15	PREPMETHOD	T	No
16	ANLMETHOD	T	Yes
17	MATTYPE	T	Yes
18	BASIS	T	Yes
19	LEACHDATE	T	No
20	EXTRDATE	D	Special
21	ANLDATE	D	Yes
22	DILFACTOR	N	Yes
23	COLUMN	T	Yes
24	FRACTION	T	Yes
25	LABNAME	T	Yes
26	PARENTID	T	Special
27	SAMPLEQTY	N	No
28	QTYUNITS	T	No
29	MOISTURE	N	No
30	QCTYPE1	T	Special
31	QCTYPE2	T	Special
32	SURROGATE	N	Special
33	SPIKE	N	Special
34	RECOVERY	N	No
35	RPD	N	No
36	LOWLIMIT	N	No
37	UPPLIMIT	N	No
38	RPDLIMIT	N	No

Notes:

1. ***Type*** field refers to the following data types:

T	Text, preferably left justified.
N	Numeric, no decimal defined.
D	Date/time, Date must be 8 characters long for the date with the format MM/DD/YY. Time must be 6 or 8 characters long in the format of HH:MM (hours and minutes) or HH:MM:SS (hours, minutes, and seconds). The time must be presented in 24 hour clock (not 12 hour clock).

2. ***Data required*** field indicates the following:

Yes	The field must contain some information and a blank value is not acceptable.
No	The field does not require information and if left blank, is assumed to mean no information was supplied.
Special	A special case where the field may be left blank if appropriate; however, a blank field does not represent a lack of information, rather, it indicates some meaning (*i.e.,* a blank in LABQUAL indicates a detected result).

Field Descriptions:

1. **PROJID:** Project name, provided by the client at the beginning of the work assignment and is also listed on the COC forms, sample labels, and other project documentation.

2. **STUDYID:** Unique 8 character ID to identify the study in the Washington Department of Ecology's EIM database.

3. **FIELDID:** The sample identification number as reported on the COC form and on sample labels, or the laboratory QC sample identification.

   QC samples created by the Laboratory from field samples (*e.g.,* laboratory duplicates) must contain the exact SAMPID of the field sample. Other Laboratory QC samples (*e.g.,* blanks, spikes, duplicates) must have unique sample identifiers which may be identical to the LABID below.

4. **LABID:** The Laboratory internal identification number. The combination of the FIELDID and LABID field should be sufficient to uniquely define either an environmental or QC sample; but may not be sufficient to distinguish reanalyses and dilutions.

5. **LABBATCH:** The laboratory identification number used to associate laboratory generated QC samples.

6. **CAS NUMBER:** A unique identifying number assigned by the Chemical Abstracts Service (CAS) Division of the American Chemical Society to each distinct chemical substance recorded in the CAS Chemical Registry System. The CAS Number is accepted nationally and internationally as an identifier for specific, definable chemical substances.

7. **ANALYTE:** Analyte or parameter reported. All compounds should be reported in upper case.

8. **VALUE:** Concentration, value, or result of the compound tested, reported to the correct number of significant figures. The reporting limit (RL) will be reported for non-detect values. Only numbers are acceptable for this field.

   In the case of spiked results, the VALUE will be the spiked sample result and will not be adjusted for the original sample results. If spiked compounds are diluted beyond detection, then the reporting limit (RL) shall be reported in the VALUE field and a "U" added with other qualifiers in the LABQUAL field.

9. **VALUESF:** The number of significant figures that should be reported for the VALUE field.
10. **LABQUAL:** Lab flags or qualifiers are reported in this field.

    Qualifier codes may be used from the *Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration,* and Document OLM01.0 through revision OLM01.8 (USEPA, August 1991). More than one qualifier may be used per record. If other qualifiers are used, then the Laboratory must include a list of the definitions of the codes with the electronics. The list may be present as a paper copy or an electronic text file.

    All non-detected results shall be reported with a "U" qualifier. The qualification "ND" for non-detected results is unacceptable. Blank values are acceptable and implied to mean a detected result. If a range will be reported (*e.g.*, greater than 50) the symbol ">" shall be reported in this field.

11. **UNITS:** The units of measure for each record will be reported in this field.
12. **MDL:** Used to report the method detection limit (MDL), a value determined by MDL studies performed in accordance with 40 CFR or sample specific estimated detection limits (e.g., 2.5 x signal to noise ratio) for high resolution, isotope dilution test methods. This value is corrected for dilution, percent moisture, or related factors that affect the MDL and/or RL. MDLs are required for all results, as applicable (e.g., not applicable for total solids).
13. **REPLIMIT:** Used to report the reporting limit (RL presented in REPLIMIT field). Non-detect results reported in the VALUE field should contain the RL corrected for dilution, percent moisture, or related factors that affect the RL.
14. **ANLGROUP:** Field used to group results from various methods. For instance, an entry of ‘METALS’ may be entered to report results from methods SW-846 6010, SW-846 7041, and SW-846 7470.
15. **PREPMETHOD:** Indicate the extraction or digestion method used (*e.g.,* SW-846 3550B).
16. **ANLMETHOD:** Indicate the analytical method used (*e.g.,* SW-846 8270). Dissolved metals must be clearly identified versus total metals results.
17. **MATTYPE:** Indicate one of the following for the matrix analyzed: SOIL, SEDIMENT, TISSUE, and WATER. If a sample or laboratory QC material does not match one of these, indicate with a code of "X" and explain in the cover letter.
18. **BASIS:** Indicate whether results are reported on a dry weight or wet weight basis, using the terms DRY or WET. If a sample or laboratory QC material does not match one of these, indicate with a code of "X" and explain in the cover letter.

19. **LEACHDATE:** Date the sample was extracted for TCLP or SPLP test methods. If leaching extraction is not applicable, then the field must be left blank.

20. **EXTRDATE:** Date the sample was extracted or prepared. If an extraction or preparation step is not applicable, then the field may be blank.

21. **ANLDATE:** Date the sample was analyzed.

22. **DILFACTOR:** The dilution factor. This should also reflect "effective" dilutions achieved by increasing or decreasing sample or extracting solvent volumes from standard amounts. That is, pre-concentration steps will result in a dilution factor of less than 1; this is OK.

23. **COLUMN:** This field is used to identify the analytical column from which the result was reported, if applicable.

Code	Definition
1	Primary column
2	Secondary column, also known as conformational column
N	Not applicable

24. **FRACTION:** This field identifies when an aqueous sample is filtered prior to analysis to determine the “dissolved” portion of the chemical of interest. Unfiltered aqueous samples are reported as the “total” fraction. This nomenclature is typically used for metals analysis.

Code	Definition
T	Total
D	Dissolved
N	Not applicable

25. **LABNAME**: The full name (and location if appropriate) of or abbreviated name (and location) of the laboratory performing the analysis.

26. **PARENTID**: For duplicate samples only (i.e., laboratory duplicate, MSD, or LCSD). List the parent sample ID.

27. **SAMPLEQTY:** Quantity or weight of the sample aliquot used for analysis.

28. **QTYUNITS:** The units of measure for the quantity or weight of the sample used for analysis.

29. **MOISTURE:** Moisture content of solid samples, expressed as percent moisture.

30. **QCTYPE1:** This field is used to identify laboratory QC samples. A blank value is acceptable, indicating the record is not one of the sample types below. One of the following codes must be used to identify the laboratory QC sample type:

Code	Definition
RM	Reference material.
MB	Method blank.
LCS	Laboratory control sample (blank spike or ongoing precision and recovery check).
MS/MSD	Matrix spike / matrix spike duplicate samples.
DUP	Duplicate (Laboratory duplicates only; field duplicates will have a unique SAMPID).

31. **QCTYPE2:** This field is used to identify analyte types, including tentatively identified compounds (TICs), surrogate compounds, internal standards (IS), and labeled compounds (LC). A blank value is acceptable, indicating the record is not one of the analyte types below. One of the following codes must be used to identify the analyte type:

Code	Definition
SUR	Surrogate or labeled compound result.
TIC	Tentatively identified compound.
IS	Internal standard.

32. **SURROGATE:** If added, this refers to the surrogate or labeled compound concentration or amount expected, for example 100 for 100 ug/kg. Units of measure are implied from the UNITS field.

33. **SPIKE:** If added, this refers to the spike concentration or amount expected, for example 100 for 100 ug/kg. Units of measure are implied from the UNITS field.

34. **RECOVERY:** Percent (%) recovery. A blank value is acceptable, indicating a non-spiked, non-reference material result. This field should be filled in for surrogates and labeled compounds as well as spiked QC samples and reference materials.

35. **RPD:** Relative percent difference. This field should be filled in for field and laboratory duplicate, matrix spike duplicates, and laboratory control sample duplicates.

36. **LOWLIMIT:** Lower recovery control limit. This field should be filled in for surrogates, QC samples and reference materials.

37. **UPPLIMIT:** Upper recovery control limit. This field should be filled in for surrogates, QC samples and reference materials.

38. **RPDLIMIT:** Relative percent difference control limit. This field should be filled in for laboratory duplicates and spiked sample duplicates.

The EDD used for data validation will include all of the fields noted above with data populated by the laboratory, and the following additional fields populated by the data validator.

Field	Name	Type[1]	Data Required[2]
39	val_name	T	Yes
40	val_date	D	Yes
41	val_qual	T	Special
42	val_level	T	Yes
43	val_reason	T	Special
44	val_notes	T	No

Notes:

1. ***Type*** field refers to the following data types:

   T Text, preferably left justified.

   D Date/time, Date must be 8 characters long for the date with the format MM/DD/YY. Time must be 6 or 8 characters long in the format of HH:MM (hours and minutes) or HH:MM:SS (hours, minutes, and seconds). The time must be presented in 24 hour clock (not 12 hour clock).

2. ***Data required*** field indicates the following:

   Yes The field must contain some information and a blank value is not acceptable.

   No The field does not require information and if left blank, is assumed to mean no information was supplied.

   Special A special case where the field may be left blank if appropriate; however, a blank field does not represent a lack of information, rather, it indicates some meaning (*i.e.,* a blank in LABQUAL indicates a detected result).

39. **val_name:** The full or abbreviated name of the data validation firm.

40. **val_date:** The date on which data validation was completed.

41. **val_qual:** Any data qualifiers added during data validation.

42. **val_level:** The level of data validation (e.g., full or summary, S2AVEM).

43. **val_reason:** The reason (or reason code) for data qualification. This field is required if validation qualifiers were added.

44. **val_notes:** Any additional notes. If numeric results changed during data validation, it must be noted here.