Report

State of Oregon Department of Environmental Quality

Columbia Slough Sediment Study

Lower Slough between River Mile 5.9 and 8.7.

January 2012 update

Last Updated: 1/31/12
DEQ 11-NWR-003

January 31, 2012 Lower slough update

As a result of the evaluations conducted for the Whitaker Slough, conclusions associated with toxicity and bioaccumulation screening levels made as part of the Lower Slough evaluation were reconsidered. Because of the increased sensitivity observed in the chronic bioassay tests conducted on sediment in the Whitaker Slough and the lack of chronic testing results for sediment in the Lower Slough, we are no longer recommending that the toxicity screening levels be modified from default values. In addition, further scrutiny of the methods used to derive Lower Slough specific bioaccumulation values revealed that screening levels are approximately equal to the default values established in DEQ's bioaccumulation guidance. Consequently, pending further evaluation of Columbia Slough data, segment-specific risk-based levels are no longer applicable.

The table in Appendix H has been revised to reflect this change. Sections 7.2 and 7.3 of the text have been replaced with a note that data is being re-evaluated as part of the broader Columbia Slough study. A report on that work will be available in 2013.

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Executive Summary

The objective of this study was to evaluate previous estimates of sediment ambient baseline concentrations and identify where hazardous substances are present at concentrations significantly exceeding baseline concentrations in a 4.3-km reach of Portland, Oregon's Columbia Slough. Two sampling methods were used to characterize shallow sediments: incremental and targeted composite. The incremental sampling (IS) method was used to determine representative baseline concentrations for the reach. For IS sampling, 50 sample increments were collected using a grid overlain on the entire study reach. Material from the 50 locations was randomly combined into three replicates such that each of three samples contained sediment from 30 sample locations. Targeted, composite samples were collected in the vicinity of public and private outfalls and areas of known bank contamination where elevated concentrations of hazardous substances were more likely to be present above ambient baseline levels. Target composite samples included up to nine sample locations within the outfall/bank area. Analytes included metals, pesticides, polychlorinated biphenyls (PCBs) (Aroclors and congeners), semi-volatile organic compounds, tributyltin, and polybrominated diphenyl ethers. Results indicate that the highest contaminant levels are generally associated with outfalls and that the IS samples provide a statistically robust indication of reach-wide sediment concentrations that can be used for establishing baseline levels.

IS samples were also used in conjunction with fish tissue data already collected, to determine Biota Sediment Accumulation Factors (BSAF) for bioaccumulative contaminants. BSAFs are used to determine site-specific risk-based clean-up levels for bioaccumulative contaminants in sediment.

In addition to sediment chemistry, bioassays were conducted on sediment collected from 10 locations in the study area. The results of these tests were used to evaluate the potential for benthic toxicity associated with sediment contamination.

Consistent with previous studies, PCBs, were found to be the primary contaminant of concern in this reach of the Columbia Slough due to the potential risk to humans and wildlife that may consume impacted fish.

Several target areas were identified as having elevated concentrations of PCBs or other contaminants in sediment as compared to ambient baseline levels. Those areas in which at least one contaminant was detected at a concentration that was an order of magnitude higher than the risk-based concentration or exceeded the newly established baseline level (whichever was higher) were highlighted. An area-weighted averaging approach was used to identify the five areas where cleanup could lower average PCB concentrations in the segment.

Comprehensive Columbia Slough: Lower Slough Report

Table and Figures

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1.0 INTRODUCTION

In 2008/2009 DEQ initiated a process through which parties determined to have likely contributed to contamination in Columbia Slough sediments could settle their liability for this contamination by paying into an account set up by DEQ. DEQ would use the money collected in this account to complete environmental investigation and cleanup in the portion of the Slough impacted by the contributing parties. The first parties to take advantage of this process are located in the Lower Columbia Slough. Six parties discharging to City and private outfalls in the section of the Slough between City Outfall 59 (near River Mile 5.9) and the upstream limit of the Lower Slough at Pen 2 Levee (River Mile 8.7) (see Figure 1) settled with DEQ. DEQ used settlement money to design and implement a sediment investigation in this area. This report describes the study, documents results, provides analysis and conclusions, and identifies next steps.

1.1 Report Organization

This report is organized as follows:

- Section 1 provides a brief overview of the project and objectives.
- Section 2 describes the Columbia Slough Watershed with more detailed information on the focus area of this study.
- Section 3 summarizes sample collection methods, analytical procedures, and the data quality review.
- Section 4 presents the analytical results for samples and provides some comparisons to ambient and risk-based levels.
- Section 5 lays the foundation for developing a relationship between sediment concentrations and fish tissue levels.
- Section 6 summarizes data from other investigations in the Lower Slough to provide a comprehensive picture of the available data and where additional data may be needed.
- Section 7 presents the study conclusions.
- Section 8 outlines the additional work that may be needed to identify source control needs and develop a sediment remedy for the Lower Slough.

1.2 Study Objectives

The Record of Decision (ROD) for the Columbia Slough specified three primary tasks: 1) source control, 2) sediment cleanup, and 3) long-term monitoring to evaluate the effectiveness of natural recovery at reducing sediment contamination to risk-based levels. This study will characterize the nature and extent of hazardous substances in sediments in this reach of the Columbia Slough to support achieving each of these objectives.

1.2.1 Complete Source Control Evaluation

DEQ and the City of Portland developed the Columbia Slough Sediment Watershed Action Plan in 2005, which identified priority areas within the slough. The lower slough from Interstate 5 to Martin Luther King Jr. Blvd. was identified as one of five areas with elevated sediment concentrations and high total suspended solids (TSS) in stormwater runoff. The DEQ sampling efforts intend to support the Columbia Slough Watershed Action Plan by pinpointing higher concentrations of contaminants of concern at outfall and bank source areas within the study area and helping to identify where additional source control evaluation may be warranted.

1.2.2 Define Sediment Cleanup Areas

The cleanup goal for sediment in the Columbia Slough is the higher of established baseline concentrations (concentrations reflecting area-wide levels below which active cleanup may not be feasible due to potential recontamination) or risk-based levels. The incremental sample (IS) data collected in this study will provide a more defensible, site-specific, and up-to-date representation of baseline concentrations in the lower slough (see Section 3 below).

The study will identify "hot spot" zones, defined as those areas where sediment concentrations are more than an order of magnitude above the corresponding risk-based screening level or where they exceed baseline concentration for the target reach whichever is higher. These are areas where additional point and non-point source control measures for storm water utilities or contaminated bank soils may be needed. If hot spot zones are found, it is likely that further investigation of the depth and full extent of contamination will be required.

Risk based cleanup levels will also be re-evaluated based on toxicity test results and a comparison of fish tissue and sediment data. The toxicity tests will help to define what contaminant concentrations are likely to present a risk to benthic organisms. The fish tissue comparison will be used to estimate a more site-specific bioaccumulation-based sediment cleanup goal. It is recognized that both toxicity and bioaccumulation evaluations will be based on a somewhat limited data set and re-evaluation will be warranted as more data is obtained. This will be further discussed in Section 8.

1.2.3 Evaluate Natural Recovery

Once effective source control measures are implemented, new sediment entering the slough as a result of stormwater runoff should be cleaner and will eventually cover sediment containing residual contamination. This is one natural recovery mechanism we expect to occur in the Columbia Slough and, in fact, is likely already occurring as a result of source control measures implemented to date. Another aspect of this study was collection of samples designed to assess this mechanism by looking at contaminant concentration variation with depth at one location.

2.0 AREA BACKGROUND

The Columbia Slough Watershed drains approximately 32,700 acres of land (see Figure 1). Portland’s city limits end at approximately NE 185th Avenue on the east, but the watershed includes Fairview Lake and Fairview Creek, and portions of Troutdale, Fairview, Gresham, Maywood Park, Wood Village, and unincorporated Multnomah County. The Watershed historically contained a vast system of side channels, streams, ponds, lakes, and wetlands that covered the floodplain of the Columbia River between the mouths of the Willamette and Sandy Rivers. High water seasonally inundated the floodplain, cutting new channels and depositing sediment. Native Americans used these waterways and the uplands for fishing, hunting, and gathering food. Fishing continues in this area.

Over the years, the watershed and waterway have been drastically altered. Beginning in 1918, levees were built and wetlands were drained and filled to provide flood protection and allow for development. The waterway was channelized, and dozens of streams were diverted from natural channels to underground pipes. Today, the Columbia Slough comprises a 19-mile main channel that parallels the Columbia River, as well as approximately 12 additional miles of secondary waterways. Other remaining major surface water features include Fairview Creek, Fairview Lake, and Smith and Bybee Lakes. Floodplain development has resulted in an extensively managed surface water system that includes levees, pumps, and other water control structures. The levee system has greatly changed the historic floodplain and reduced the area available to floodwaters.

Figure 1 Columbia Slough Watershed

The Columbia Slough Watershed includes virtually every type of land use: residential neighborhoods, commercial and industrial development, agriculture, Portland International Airport (PDX), interstate highways, railroad corridors, 54 schools, and large open spaces. Much of Portland's industrial and commercial land is located within the Watershed. In addition to industrial development in the area north of Columbia Boulevard and the Rivergate area, land is preserved for industrial uses in the Columbia South Shore area between NE 82nd and NE 185th Avenues north of Sandy Boulevard.

The Slough is divided into three sections, based on hydraulic characteristics:

- The **Upper Slough** starts at the mouth of Fairview Lake on the east and flows west to the mid-dike levee at NE 142nd Avenue. It receives water from Fairview Lake, Fairview Creek, Wilkes Creek, stormwater outfalls, natural springs, groundwater, and overland flow.

- The **Middle Slough** extends from the mid-dike levee near NE 142nd Avenue to the Pen 2 levee near NE 18th Avenue. It includes a substantial southern arm complex of sloughs and lakes, including Prison Pond, Mays Lake, Johnson Lake, Whitaker Slough, Whitaker Ponds, and Buffalo Slough. The Middle Slough receives water from the Upper Slough, stormwater outfalls, natural springs, overland flow, and groundwater. Pumps are used to move water from the Upper and Middle Slough to the Lower Slough.

- The **Lower Slough** starts at the Pen 2 levee, near NE 18th Avenue, and extends approximately 8.5 miles to the Willamette River. The lowlands of the Lower Slough Watershed are subject to flooding because they are not protected by levees. Water flow and levels in the Lower Slough are affected primarily by the Columbia River and Willamette River stage and the ocean tides, as well as by pumping. During high tide, the Columbia and Willamette Rivers create a backwater effect that complicates flow patterns.

During the Columbia Slough Screening Level Risk Assessment performed in 1994, virtually every sediment sample analyzed contained one or more contaminants at concentrations exceeding conservative screening levels based on impacts to aquatic life and fish consumers. Sediment contaminants of concern include metals, pesticides, polyaromatic hydrocarbons (PAHs), phthalates, and polychlorinated biphenyls (PCBs).

Other concerns in the Columbia Slough include an approved Total Maximum Daily Load (TMDL) for the water body and a fish consumption health advisory. The TMDL, part of the Clean Water Act, includes DDT/DDE, dioxin, lead, and PCBs reduction strategies for the water column. Oregon Department of Human Services has issued a health advisory discouraging the consumption of fish in the Slough because of high PCB levels.

2.1 Project Area

The project area is located within the upper portion of the Lower Slough segment. The sediments in this area, between City outfall 59 and the Pen 2 levee, have consistently contained high levels of contamination, particularly PCBs and metals. This segment also represents one of the oldest industrial areas along the Slough. Unlike the Middle and Upper Slough, the Lower Slough is tidally influenced as it is directly connected to the Willamette River. Salmon have been observed throughout the Lower Slough.

2.2 Contaminant Sources of Concern

Contaminated bank areas and discharges from outfalls, both public and private are thought to be the major contributors to sediment contamination in the Slough.

2.2.1 Outfalls

City of Portland (COP) and Oregon Department of Transportation (ODOT) outfalls tend to drain larger areas than private outfalls and tracking down particular contaminant sources can be more complicated. There are seven COP outfalls and two ODOT outfall along the south shore of the study area. Four of these outfalls were once combined sewer overflow (CSO) outfalls but sanitary wastes throughout the Slough watershed is now directed to the Columbia Blvd treatment plant. Legacy pollutants associated with CSO discharge may however be present in Slough sediments.

There are approximately 20 private outfalls (many of which are associated with DEQ cleanup sites discussed below) along the south bank of the Slough and three on the north bank. The reason for few outfalls on the north bank is that the Peninsula Drainage District maintains a system of waterways and pipes on the north side of the Slough that collects most storm water internally and drains it through two large pump stations that discharge on the north shore. See Figure 2 for project area and outfall locations.

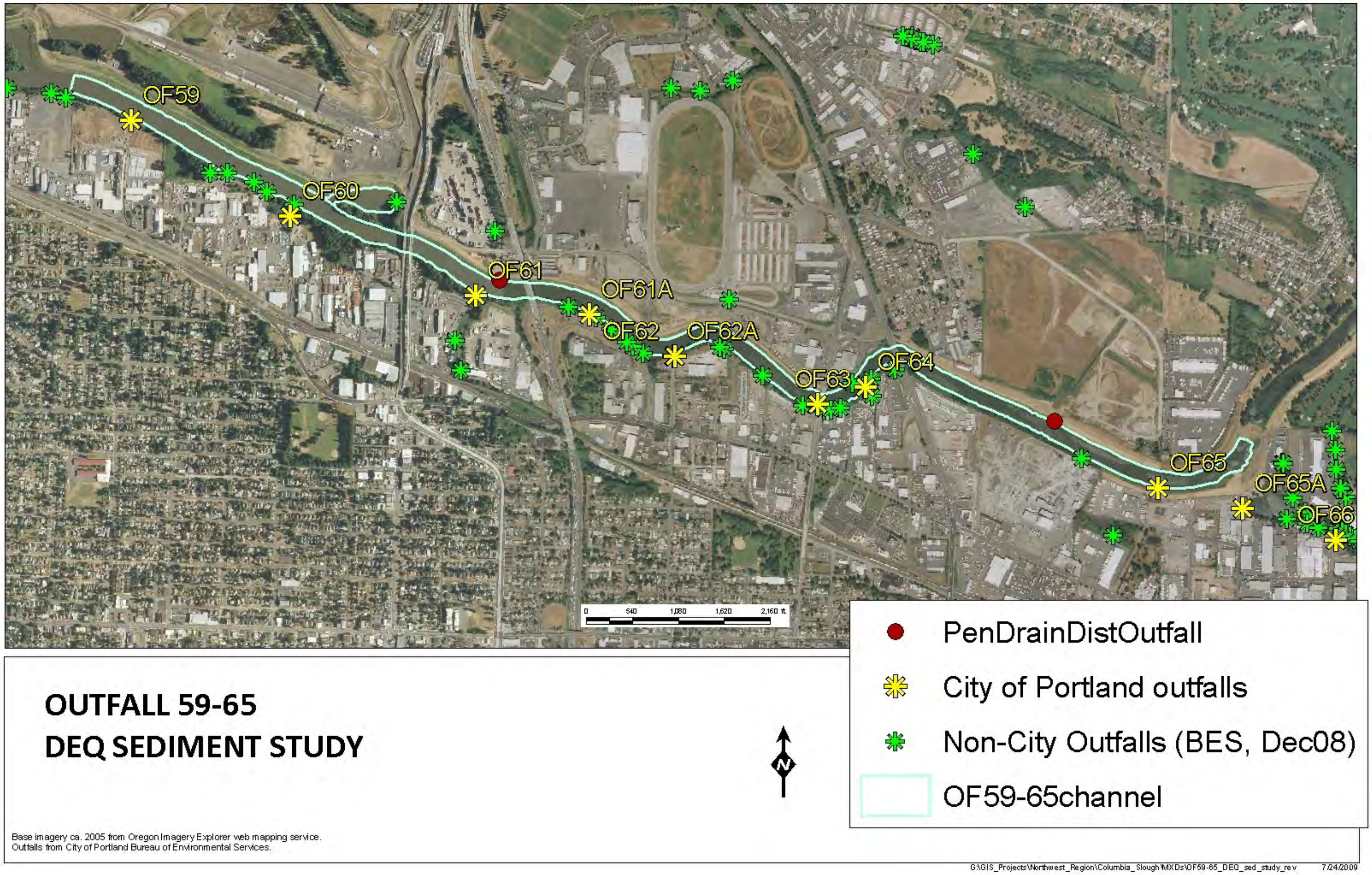


Figure 2 Map of Project Area and Outfalls

2.2.2 DEQ Cleanup Sites

Over thirty cleanup sites listed in DEQ's data base are located in the Lower Columbia Slough. Contaminants of concern at these sites include PCBs, PAHs, metals, and petroleum hydrocarbons. Some of these sites have entered into settlements with DEQ and have implemented source control measures. Some have conducted sediment investigations and others are still in the screening stage. Figures 3 and 4 shows cleanup site locations shaded in red.

Figure 3 Cleanup sites in West Half of Study Area

Figure 4 Cleanup Sites in East Half of Study Area

DEQ is actively working to ensure that source control measures are implemented where needed at these sites and anticipates that major sources will be managed by 2013.

2.3 Previous Sampling Investigations

Several other sampling efforts have been completed in the Lower Slough as part of specific site investigations, as part of the City's long-term monitoring, and to support dredging evaluations for bridge construction or channel maintenance. This data is summarized in Section 6 and has been incorporated into the Slough-wide data base to provide a larger dataset for evaluating data gaps and identifying "hot-spot" areas.

Figure 5 Columbia Slough, near Pacific Meats Cleanup Site

3.0 SAMPLE DESIGN AND STRATEGY

The general sampling strategy included two sample designs: an incremental sampling (IS) strategy to determine average sediment concentrations throughout the outfall 59-Pen 2 levee study reach and targeted samples in locations of suspected contamination within the study area. The IS provides a reliable, defensible, and cost-effective method to determine average concentrations within the reach. The size of a decision unit for an IS sampling grid depends on the purpose of the data and how it will be used. The purpose of the Lower Columbia Slough decision unit is to generate a baseline sediment concentration for the typical three mile home range of carp. The baseline sediment concentrations can then be used to help determine bioaccumulation rates in fish. The baseline sediment concentrations will help to assess the feasibility of active cleanup measures within the reach. The sample design was chosen by DEQ staff after researching available methods and discussing with DEQ chemists, toxicologists, Columbia Slough project managers, and program managers.

3.1 Collection and Field Activities

Field activities were carried out in accordance with the Quality Assurance Project Plan, *Columbia Slough Outfall 59-65 Sediment Study* (DEQ, 2009); document number DEQ09-LQ-

0046-QAPP. Deviations from the QAPP are described in the report where appropriate. The QAPP was developed using EPA document # *EPA-823-B-01-002* and *Recommended Guidelines for Sampling Marine Sediment, Water Column and Tissue in Puget Sound, Puget Sound Water Quality Action Team 1997* as guidance. Sediment was analyzed for a variety of chemicals at all locations and bioassays were performed at selected locations, typically major outfalls. Additionally, sample collection procedures and analyses were matched to previous City of Portland studies when applicable. Preservation and labeling followed laboratory guidelines.

A Nationwide Permit for Survey Activities (NWP-2009-439) from the Army Corps of Engineers was obtained to collect sediment within the waters of the United States. An Oregon Department of State Lands dredge/fill permit was not required for the project. Multnomah County Drainage District provided logistical support including Slough access and boat storage. DEQ Laboratory and Environmental Assessment Division provided sampling equipment for field collection.

3.2 Sediment Sample Location Selection

Sample locations were selected based on the two sampling strategies: IS and targeted composites at suspected source locations. See Appendix A for detailed sample location maps. Sites were located with a Garmin handheld GPS, with an average accuracy of +/- 15 feet. While all efforts were made to collect the sediment at mapped locations, some site locations deviated due to safety or accessibility issues. The majority of the sites were within 15 feet or less of the intended sample point. The two exceptions were: Simpson Cove locations for targeted and IS samples were moved closer to the bank to allow for access from the shore and Pacific Meats Outfall #3 locations were moved towards the Slough channel, to allow for access from a boat. Appendix B describes actual locations of all sample increments.

Incremental Sampling Locations: The IS strategy was designed to integrate sediment information throughout the 2.7 mile length of this Slough reach. A total of 50 sample increments of the upper 10 cm of sediment were collected from a random-start grid overlain on the entire reach. Sediment from the 50 locations was randomly combined such that each of three samples (designated A, B, and C), contained sediment from 30 of the 50 different locations shown in Figure 6.

Targeted Samples: The targeted sampling strategy involved a small array of composite sampling points immediately upstream and downstream of 17 public and private outfalls and 4 known bank contamination areas (Figure 7). The number and location of individual sample points in each composite were based on outfall size and sonic bottom data provided by the City that shows sediment disturbance around outfalls. Sediment was collected from up to eight locations at the larger City outfalls and two ODOT locations; while as few as three locations were sampled at the smaller outfalls. Samples were evenly spaced along the length of bank areas with known contamination. Sample collection depth was 10 cm for targeted sites with the exception of two 5 cm samples that were co-located with 10 cm samples at Pacific Meats outfalls 1&2. The vertical profile obtained in this area will help determine if higher concentration material is being “buried” by recently deposited sediment.

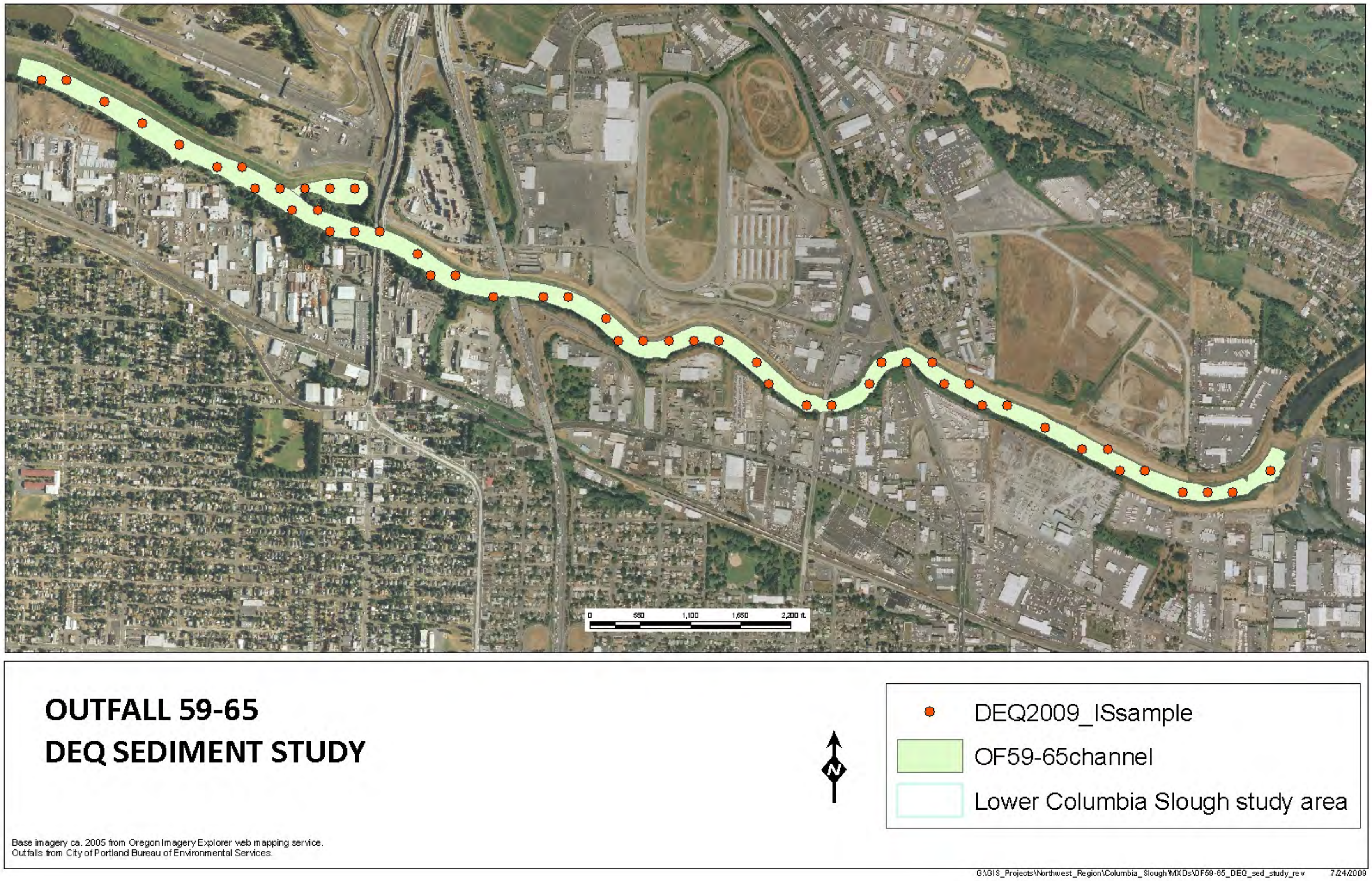


Figure 6 Incremental Sample Locations

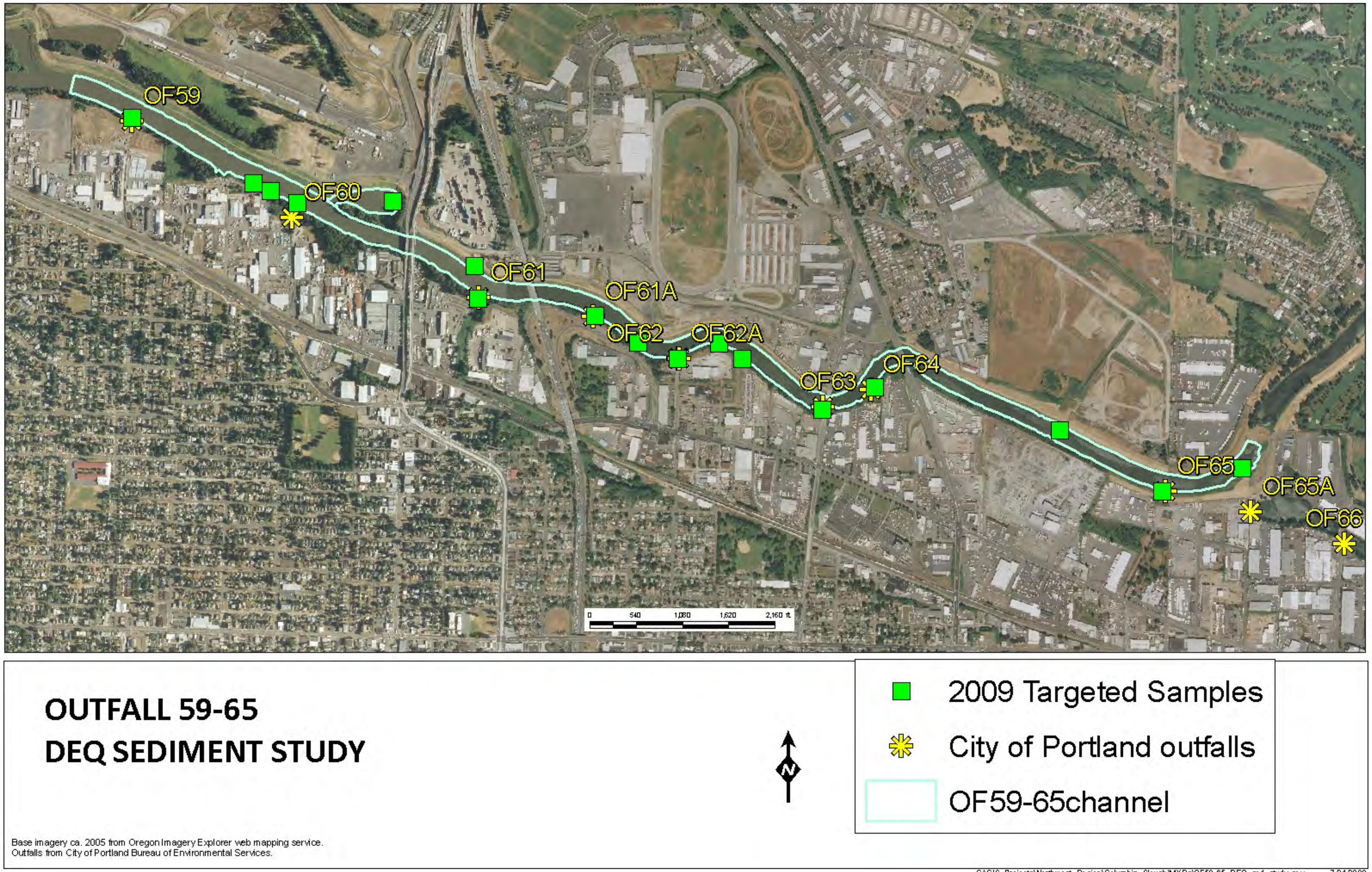


Figure 7 Targeted Sample Locations

3.3 Sampling Procedure

All samples were collected during a three week period in September 2009 during low water levels. The DEQ crew used an electric powered boat or wading to gain access to the sites. Samples were collected using an Ekman Dredge (Figure 8) at deep water sites or by stainless steel spoon or glass scoop (Figure 9) at shallow sites. Once samples were collected and labeled, they were placed on ice for preservation and transport to the laboratory.

Figure 8 Ekman Dredge Sampler

Figure 9 Glass Scoop Sediment Sampler

Incremental Sampling: At each increment point 50 g of sediment was weighed with a digital scale using the sampling methods described above. The sediment was then placed in the appropriate triplicate glass jar. The sediment was later homogenized at the laboratory.

Targeted Samples: Each sample consisted of three to eight composite elements and the total sediment mass required varied between a total of 400 g for chemical analyses only and 3400 g for bioassay and chemical analyses. Sample volume from each composite point depended on the number of composite points and the analyses to be performed. The field crew placed the sediment in labeled glass jars for analysis and the samples were later homogenized by the DEQ lab. Glass jars were separately filled for chemical analyses and bioassays from the same sample points. Field information was collected at each site including sample depth, sediment color, presence of woody debris, observation of oil sheen, and other information (see Appendix B).

3.4 Analytical Methods

Sediment samples were sent to DEQ's Laboratory and Environmental Assessment Division (LEAD) and Pace Analytical, Inc for chemical analysis. Bioassay samples were sent to Northwestern Aquatic Sciences (NAS), based in Newport, Oregon.

3.4.1 Chemical Analyses

The chemical analyses chosen reflect legacy and current-use compounds found in Columbia Slough sediment. Previous studies were examined for historical comparisons. Tributyltin (TBT) and polybrominated diphenyl ethers (PBDEs) were new compounds not previously tested in

Columbia Slough sediment studies. Tributyltin (TBT) is the active ingredient of many products that act as biocides against a broad range of organisms. It is primarily used as an antifoulant paint additive on ship and boat hulls, docks, fishnets, and buoys to discourage the growth of marine organisms such as barnacles, bacteria, tubeworms, mussels and algae, though its use on small boats was prohibited in 1988. PBDEs have been used in a wide array of products as a flame retardant.

Metals, PCB Aroclors, pesticides, semi-volatile organic compounds (SVOCs) and grain size were analyzed in all samples. PCB congeners, TBT, PBDEs, total organic carbon (TOC) and bioassays were analyzed at selected sites, typically at larger diameter outfalls and in the incremental samples. See Table 1 for the list of analyses performed on each sample.

Once all samples were collected, LEAD prepared the sediment for chemical analysis which for the increment samples included drying, homogenization, sieving (<2mm), and sub-sampling. Some volatilization may occur for some semi-volatile organics and mercury during the preparation, although the volatilization is not expected to be substantial. Samples were then frozen to prolong holding time. The analytical methods used can be found in Table 2.

3.4.2 Bioassay Analysis

Two freshwater sediment toxicity tests were performed on 12 sediment samples:

1) a 10-day *Chironomus dilutes* bioassay and

2) a 10-day *Hyalella azteca* bioassay.

These tests were chosen because they are commonly used freshwater bioassays which have been used on cleanup sites throughout Oregon. Bioassays samples were collected at selected sites (see Figure 10), usually larger city outfalls, see Appendix A for the list of sites.

Bioassay methods were based on the ASTM 2001 method and EPA method # 100.2. Samples were refrigerated in dark conditions at the DEQ laboratory until the end of the sampling. Samples were sent via UPS to Newport packed on ice. Once received at NAS, sample sediment was homogenized and split between the two analyses.

Table 1 Sample Locations and Analyses Performed

Composite Name	Label	Latitude	Longitude	Sample Strategy	Depth	QA			Analyses							
					cm		Metals	PCB Aroclors	PCB Congener	Pesticide	SVOCs	Tributlyl Tin	PBDEs	TOC	Grain Size	BioAssay
Columbia Slough- Between Outfall 59-65		45.5866	-122.6746	Increment Sampling	10	Triplicate	X	X	X	X	X	X	X	X	X	
Columbia Slough at PEN Levee 2 Pen2	Pen2	45.58338	-122.64805	Composite	10		X	X		X	X				X	
Columbia Slough at City of Portland Outfall 65 OF65	OF65	45.58259	-122.65192	Composite	10		X	X	X	X	X	X	X	X	X	X
Columbia Slough at 13th Ave. pumpstation	13thPS	45.58435	-122.65688	Composite	10		X	X		X	X				X	
Columbia Slough at City of Portland Outfall 64	OF64	45.58548	-122.66557	Composite	10		X	X	X	X	X	X	X	X	X	X
Columbia Slough at City of Portland Outfall 63	OF63	45.58485	-122.66749	Composite	10		X	X	X	X	X	X	X	X	X	X
Columbia Slough at Prec+BR	Prec+BR	45.58627	-122.67116	Shoreline Composite	10	Duplicate	X	X	X	X	X	X	X	X	X	X
Columbia Slough at Wastech	Wastech	45.58684	-122.67288	Shoreline Composite	10		X	X		X	X			X	X	X
Columbia Slough at City of Portland Outfall 62	OF62	45.58640	-122.67433	Composite	10		X	X	X	X	X	X	X	X	X	X
Columbia Slough at ODOT outfall	ODOT	45.58677	-122.67637	Composite	10		X	X		X	X			X	X	
Columbia Slough at ODOT Outfall 61A –	OF61A	45.58774	-122.67815	Composite	10		X	X	X	X	X	X	X	X	X	X

Composite Name	**Label**	**Latitude**	**Longitude**	**Sample Strategy**	**Depth**	**QA**			**Analyses**							
					cm		**Metals**	**PCB Aroclors**	**PCB Congener**	**Pesticide**	**SVOCs**	**Tributlyl Tin**	**PBDEs**	**TOC**	**Grain Size**	**BioAssay**
Columbia Slough at Blasen	Blasen	45.58805	-122.68234	Shoreline Composite	10		X	X		X	X	X		X	X	
Columbia Slough at Schmeer Pumpstation	Schmeer	45.58849	-122.68250	Composite	10		X	X		X	X			X	X	
Columbia Slough at City of Portland Outfall 61	OF61	45.58838	-122.68360	Composite	10	Duplicate	X	X	X	X	X	X	X	X	X	X
Columbia Slough at Simpson Cove	Simpson Cove	45.59103	-122.68738	Composite	10		X	X		X	X			X	X	
Columbia Slough at City of Portland Outfall 60	OF60	45.59096	-122.69197	Composite	10		X	X	X	X	X	X	X	X	X	X
Columbia Slough at PacificMeats outfall 1	PM1-10	45.59131	-122.69317	Composite	10		X	X		X	X			X	X	X
Columbia Slough at PacificMeats outfall	PM1-5	45.59131	-122.69317	Composite	5		X	X		X	X			X	X	
Columbia Slough at PacificMeats outfall 2	PM2-10	45.59154	-122.69378	Composite	10		X	X		X	X			X	X	X
Columbia Slough at PacificMeats outfall 2	PM2-5	45.59154	-122.69378	Composite	5		X	X		X	X			X	X	
Columbia Slough at PacificMeats outfall 3	PM3	45.59194	-122.69536	Composite	10		X	X		X	X			X	X	
Columbia Slough at City of Portland Outfall 59	OF59	45.59362	-122.69936	Composite	10		X	X	X	X	X	X	X	X	X	X

Figure 10 Targeted Sample Locations-Bioassays

Table 2 Sampling and Analytical Methods

Sampling and Analytical Methods

Analysis	**Method**	**Laboratory**
Metals by ICPMS, Total Recoverable	EPA 6020	DEQ LEAD
Metals by ICPMS(Total Mercury)	EPA 7473	DEQ LEAD
Organic: Aggregate Constituents & Properties	EPA 9060	DEQ LEAD
Grain size	DEQ SOP	DEQ LEAD
Polychlorinated Biphenyls(PCBs)	EPA 1668B	Pace Analytical, Inc
PCB Aroclors	EPA 8082	Pace Analytical, Inc
Pesticides	EPA 1699 & EPA 8081	Pace Analytical, Inc
Semi-volatile Organics	EPA 8270D	DEQ LEAD
Tributyl Tin(TBT)	EPA 8232	DEQ LEAD
PBDE	EPA 1614	Pace Analytical, Inc
Bioassay: 10 day *Chironomous dilutes* Toxicity Test	NAS-XXX-CT4b	Northwest Aquatic Science
Bioassay: 10 day *Hyalella azteca* Toxicity Test	NAS-XXX-HA4b	Northwest Aquatic Science

From document DEQ09-LQ-0046-QAPP

3.5 Data Usability

Sample collection and analyses followed all methods, quality control procedures and reporting as described in the Quality Assurance Project Plan (DEQ09-LQ-0046-QAPP) (DEQ, 2009) and associated documents, except as noted. DEQ conducted a data validation check to ensure data acceptability. Below is a brief summary of data quality controls outlined in the QAPP and areas where the project deviated from the QAPP.

3.6 Summary of Quality Control

Three categories of quality control (QC) were used to assess data quality: sample design and methods, field sampling QC and analytical QC. Sampling designs were chosen to provide quality control for IS and targeted sampling.

Sample Design and Methods:
Integrated Samples: A triplicate sampling QC method, based on *'Draft Guidance on Multi-Increment Soil Sampling'* Alaska Department of Environmental Conservation, 2009) was used for the incremental sampling. Early designs for the project included a more traditional approach to Multi-Increment® sampling with many decision units placed around individual outfalls. The projected field labor cost of collecting 30 or more increments and replicates at each outfall proved prohibitively expensive so a modified design was devised. The entire reach was our "decision unit" and enabled determination of a reach-wide average or background concentration. This length was also appropriate for evaluating bioaccumulation as it is consistent with the average home range of carp in the Lower Slough. Ordinary, targeted, composite samples collected at outfalls produced a reasonable assessment of the outfall's potential to be a point source of contamination. Our IS procedure controls compositional heterogeneity and distributional heterogeneity, two major sources of error in sediment sampling. Grouping and segregation error is controlled by collecting multiple randomly located sample increments to address distributional heterogeneity. The collection of triplicate samples allows for the calculation of relative standard deviation (RSD=100* Standard Deviation/mean) which provides an indication of how well the IS sample represents the decision unit. All results under 30% RSD were considered representative of the decision unit. If the RSD is greater than 35% the data distribution becomes 'non-normal' and the confidence of the results is weakened.

Figure 11 Sample drying & waiting to be processed with IS analytical methods

Targeted Samples: Standard duplicate samples were collected at a rate of 10 percent of the shoreline/outfall sites, in this case at 2 sites-one shoreline site and one outfall site. Relative percent difference was calculated to determine precision/accuracy of results. The analytical quality control target included precision of 20% for all analytes. Accuracy limits varied, depending on laboratory methods. The reporting limit was requested to be the lower of the Limit of Quantitation or Columbia Slough Risk Based Screening Levels. In some cases, estimates were reported and used. Analytical instruments were maintained and inspected within manufacturer's guidelines.

Field Sampling QC:

Daily Activities Log: Daily Activities were recorded on Chain of Custody forms and Columbia Slough Sediment Field Forms, which include date/time, location changes, how sample was collected, sample depth, odor and color. Field notes are summarized in Appendix B. Sample depth was expected to be 10 cm, however 28 of 71 samples (including increment samples) did not reach the 10 cm sample depth. The average depth for all 10 cm samples was 8.6 cm. It was noted that rockier/sandier sediments seemed to produce smaller depths. Wood debris and garbage also limited sample depth at less than 5 samples.

Location**:** Simpson Cove increment and targeted samples were moved to bank locations-as the cove was too shallow to boat and sediments too soft for wading. Pacific Meats Outfall #3 sites were also moved to the closest possible point that was boatable, due to shallow soft sediments. Updated locations can be found in Appendix B.

Minor tracking changes were noted on the field sheet, including crossed out bottle numbers and other minor typos.

Quality control in the field included decontamination of field sampling gear between sites, use of electric boat motor, and isolation of the sediment, whenever possible, to minimize cross contamination.

Analytical QC:

All analytical QA/QC was deemed acceptable, except for deviations noted below. Quality Control included duplicates, matrix spikes, laboratory control standards/calibrations and equipment calibrations. Dilutions were needed for several analyses to minimize interferences. Duplicate sample precision and relative percent difference for the incremental samples were evaluated and are discussed in Section 4.3.2.

Appropriate methods were used for all analyses, ensuring good comparability with other data. Analytical accuracy and precision were determined to be generally acceptable, with noted exceptions. Qualifiers were assigned to data points that exceeded project data criteria. All data was reported and considered representative of the samples collected, except as noted by qualifiers.

Bioassay quality control included water quality testing, replicates and a control sediment test. Test results were considered acceptable, as controls were above the minimum acceptable survival rate of 80% - *Hyalella* (97.5% average survival rate); *Chironomus* (87.5% average survival rate).

3.7 Deviations from Quality Assurance Project Plan

Many analytical quality control concerns were attributed to matrix interference, i.e. sediment samples were very 'dirty' with many compounds. Sample dilution was required for pesticides, PCBs and PBDEs analyses. Method Reporting limits for pesticides were also much higher than normal. Laboratory matrix spikes failed high for several batch analyses, which may bias those results high or low. These results are qualified in Appendix F & G and flagged as JH for estimate biased high and JL for estimate biased low.

A significant delay in the chemical analyses at LEAD was encountered due to laboratory machinery break downs. As a result, it was determined that PCB, PBDE and pesticide analytical work that had not been completed should be sent to a contract laboratory, Pace Analytical. Since samples had been frozen the sediment was analyzed within the holding time period. The pesticide method was changed to EPA 8081 from EPA 1699 for the targeted sample sites because of budget concerns and indications from previous studies that pesticides are not a risk-driver for this section of the slough. Both pesticide methods EPA 1669 and EPA 8081 were performed on IS samples for method comparison.

Some estimates were used after careful consideration by the project managers. For example PCB Aroclor results were used although they were biased high because of interference from other co-eluting Aroclors.

Targeted Samples: Outfall 61 duplicate review determined 81% of analyses met acceptable criteria. Many duplicates for metals and SVOC compounds did not meet the 20% precision limit. The Precision+B&R duplicate passed 88% of the precision limits. The precision check for metals and PCBs passed, but some SVOCs and pesticides failed. Since the incremental samples passed QA/QC checks, DEQ concluded that laboratory methods produced acceptable results and that variability in other duplicate checks was due to a heterogeneous environment. This variability is expected in a diverse environment, based on previous studies within the slough (City of Portland 2009). Appendix E contains a complete review of targeted sample quality assurance.

Incremental Samples: For the IS samples, all results under 30% relative standard deviation (RSD) were considered representative of the decision unit. The QA criteria for a representative sample were met for 96% of the analytes. These data will be used as an average value for conditions across the decision unit. Total silver, tribuytl tin (TBT), hexachlorobenzene, PCB 81, 2,4'-DDT and Aroclor 1254 did not pass the RSD evaluation. Aroclor 1254 RSD was at 38%- just above the acceptable confidence limit. This value will be used as a mean concentration across the decision unit, however there is some uncertainty associated with the value. The other substances are not risk-drivers in this section of the slough and, although there is some uncertainty in the result, these values can be considered estimates for the average conditions across the decision unit with little impact on subsequent environmental decisions. PBDE RSD's could not be fully calculated as there was not enough sample material to analyze PBDE in Triplicate C. Appendix E contains a complete list of incremental sample RSD values.

Table 3 Incremental Sample Relative Standard Deviation (RSD) Failures

Analyte	Relative Standard Deviation (%)
Total Silver	51
2,4'-DDT	44
Hexachlorobenzene	79
Aroclor 1254	38
PCB 81	32
Tributyltin	109

Values below 30% pass standard QC

Results met the project completeness goal of 100% for targeted samples, after some collection locations were moved by the field crew because of safety concerns. The incremental sampling met the project completeness goal of 100% except for PBDEs, which were not a primary target analyte. Project managers believe the dataset is useable and meets the goals outlined in the Columbia Slough Outfall 59-65 Sediment Study. Future data users must evaluate whether this data is acceptable for their project's data quality objectives.

4.0 SAMPLE RESULTS

Sample results are summarized in the following sections. IS results are presented first as they are used in subsequent data comparisons.

4.1 Increment Sample Method Evaluation and Comparison

The IS data shows low variability between the three replicates. The QA criteria for a representative sample (results under 30 percent RSD) were met for 96 percent of the analytes. For comparison purposes, the mean values were calculated from the three IS replicates and then compared to mean values estimated from the discrete samples collected by the City of Portland in 2006 within the Lower Columbia Slough (City of Portland, 2009). The purpose of the comparison is to consider how well standard methods used for estimating average concentrations over an area compare to more rigorous values generated by the IS approach.

In 2006, the City collected 23 sediment samples in the Lower Slough. Among the analytes included in the investigation were Aroclors by Method 8082, pesticides by a modified version of method 8081 and metals by EPA 6020. The results presented in Table 4 show that the IS samples were relatively consistent with the City sampling averages.

The comparison is not intended to be comprehensive and the evaluation was limited to selected chemicals in common between the two sampling events. DEQ evaluated metals, PCBs as represented by Aroclor 1254, and the organochlorine pesticides 4,4'-DDD, 4,4'-DDE, and dieldrin. These representative substances were selected because they are some of the most commonly detected environmental contaminants present in the Lower Slough, and they represent the majority of human health or ecological risk.

In the case of Aroclor 1254, the detection frequency was low at 38% (10 of 26 samples). This low detection frequency, even in the lower slough where PCBs are a significant contaminant is not surprising, given the analytical method used was EPA 8082. This method relies on pattern matching, and if the basic Aroclor patterns are not matched, PCBs are not quantified (EPA 2002). It is probable that any PCBs detected in Slough sediment are highly weathered and some of the PCBs will not match the analytical standards, potentially accounting for the relatively low frequency of detection, even though the detection limit in the 2006 investigation was very good, at 0.16 ug/kg.

For the organic analytes included in the 2006 investigation (Table 4), the analytical results are positively skewed, approximating a log-normal distribution. Therefore, the non-detected values were replaced by estimated "imputed" values using US EPAs ProUCL software (EPA 2010). Each of the metals evaluated were detected in every sample. A few descriptive statistics were calculated using these data and shown in Table 4.

Table 4 Comparison of City 2006 Sediment Data relative to 2009 IS samples.

	2006 Discrete Sample Summary			2009 IS summary					Previous Slough baseline values
Analyte	**CV** [1]	**Median** [2]	**Mean**	**IS A**	**IS B**	**IS C**	**IS mean**	**Ratio**[3]	
Organics (ug/kg)									
Aroclor 1254	217	5.8	33.5	27.3	16.5	37	27	0.8	24
Dieldrin	136	0.82	1.3	0.64	0.76	0.69	0.70	0.54	NA
DDE	78	7.3	8.3	5.9	6.9	6.1	6.3	0.74	6.1
DDD	154	2.8	4.1	3.1	4.4	3.5	3.7	0.9	7
Metals (mg/kg)									
Arsenic	37	6.6	6.8	5.2	5.2	5.6	5.3	0.78	8
Copper	59	48	47	37	34	41	37.5	0.8	54
Lead	83	48	59	40.8	37.6	45.5	41	0.69	90
Zinc	55	273	269	244	227	261	244	0.91	314

1. CV- Coefficient of variation expressed as a percentage of the mean. The CV is presented as a measure of variation in the data. It illustrates which analytes have relatively more or less variability, and more or less certainty.
2. The median is the value at which 50 percent of the observed concentrations are both above and below the value. It is resistant to outliers, and, when shown with the mean, provides an indication of whether the data are symmetric or positively skewed. It is often used as a better indicator of where most of the data are in skewed data sets (e.g., dieldrin).
3. Ratio of IS mean to discrete sample mean.

The results presented in Table 4 show that the IS samples were relatively consistent between replicates indicating the method was successful in reducing sediment sample heterogeneities. The mean from the three IS replicate samples is compared to the mean from the 23 (non-duplicate) discrete samples collected in 2006 generating the ratio of the two means. The comparison shows that for this group of analytes the IS estimates of mean were consistently lower than the average of discrete samples. The difference was less for the metals and greater for the organics - up to a 54 percent lower estimate of the mean for dieldrin. It should be noted that some of the dieldrin values were non-detect and had to be estimated for this comparison using “imputation” methods (US EPA 2010), so the true dieldrin concentration could be slightly to somewhat lower than that estimated by discrete samples.

Comparison of mean and median values for the two sample set shows that for metals these two statistics are similar, indicating that they both indicate similar average concentration. For the bioaccumulative organics, the medians are consistently lower than the mean and the coefficients of variation are relatively high. This is typical of positively skewed environmental data. In these cases, a median may be a better estimate of average concentrations and this appears to be supported by comparison to the IS collected means, with the exception of Arcolor 1254. The reason why Aroclor behaves differently than the other organics is unknown, but may be due to this analyte representing a complex mixture and the analytical methodology.

The confidence intervals or error bars associated with the 2006 discrete and 2009 IS mean values are compared in Table 5.

Table 5: 95 Percent Confidence Intervals for Select Analytes in both Datasets

	95 Percent Confidence Intervals [a]			
Analyte	**2006 Discrete Interval**	**Discrete Interval Size**	**2009 IS Sample Interval**	**IS Interval Size**
Organics (ug/kg)				
Aroclor 1254	2.1-65	63	1.8 - 52	50.2
Dieldrin	0.52 - 2.0	1.5	0.55 -0.85	0.3
DDE	5.5 - 11	5.5	5.1 - 7.5	2.4
DDD	1.3 - 6.9	5.6	2.0 - 5.3	3.3
Metals (mg/kg)				
Arsenic	5.7 - 7.9	2.2	4.8 - 5.9	1.1
Copper	35 - 59	24	8.9 - 10.7	1.8
Lead	38 - 80	42	31 - 54	23
Zinc	205 - 334	129	202- 286	84

a - Interpreted as meaning that the true mean sediment concentration has a 95% chance of being within the interval shown. Based on 23 2006 samples (excluding three duplicates).

There was a significant improvement in the confidence interval for the IS dataset. The improvement is especially notable for pesticides, with the IS interval between 20-60 percent of the discrete sample interval. For the metals, the IS intervals were about ½ the size of the discrete samples interval and substantially better for copper. Overall, the results indicate a significant improvement in estimation of mean concentration using the IS methodology. Although the level of replication was low with only three samples, the quality of the data is high and the method is successful in reducing sampling heterogeneities. A greater level of confidence can be placed in the estimated mean concentrations of the IS dataset.

For comparison, Slough-wide baseline values (DEQ 2002) calculated using the sediment data collected throughout the entire Slough in 1994/1995 (Parametrix, 1995) are also shown. Surprisingly, the historical data generated average concentrations for the organics shown that are very consistent with the IS averages determined in this study. Metals concentrations are consistently lower, but on the same order of magnitude as the historically determined baseline values. The IS data set for the Lower Slough reflects more recent data with a higher level of confidence and is more representative of ambient concentrations in the Lower Slough. In the Lower Slough the average concentration values for the IS data set will replace the baseline values previously developed for the entire Columbia Slough. As expected, the average concentrations (IS data) for some bioaccumulative metals, SVOCs, PCBs and pesticides were above DEQ bioaccumulative risk-based sediment screening levels (DEQ 2007). As outlined in the 2005 Columbia Slough ROD, active remediation of sediment in the Slough to concentrations below baseline is likely to be infeasible due to potential for recontamination. However, a combination of active remediation of sediment exceeding baseline concentrations, source control, and natural recovery is expected to be effective in eventually reaching risk-based cleanup levels.

Another comparison of interest was completed by calculating the area-weighted average concentration for two compounds, total PCBs and dieldren, using the discrete samples present in the Slough segment, including data collected in this study, the City of Portland 2006 study, Pacific Meat data, and ODOT data. The method involved creating polygons around each sample point that are sized based on proximity to the next closest sample point in each direction. The concentration at the sample point was assumed to apply to the entire polygon surrounding it. This process generated a segment-wide weighted average concentration for PCBs of 92.65 ug/kg and for dieldren of 1.82 ug/kg. This compares to the IS averages of 45.5 and 0.7 ug/kg respectively. The higher values for the area-weighted concentrations likely reflects the fact that discrete samples were targeted to release areas which are more contaminated, as discussed in the next section, and by this method were assumed to represent a disproportionate amount of the sediment.

4.2 Targeted Samples

The sediment chemistry results for targeted sites were elevated in comparison to the average IS concentrations in the Lower Slough study area. The following sections discuss contaminants of concern for the Lower Slough and summarize detection characteristics at the targeted source areas. Appendix C provides details on all analytes.

4.2.1. Detection Rates for Analyte Classes

Naturally occurring metals were detected in nearly all samples, ranging from 100 percent for common metals to 46 percent for rare metals, such as antimony. The most common PAHs were found in nearly all samples. PCB Aroclor 1260 was found in 81 percent of sampled sites and PCB Aroclor 1254 was found in 54 percent of sites. Pesticides were analyzed using two methods. The standard lower resolution Method 8081 used for targeted samples detected few analytes. Method 1669, a higher resolution method used for the IS triplicates, detected low concentrations of numerous pesticides, including DDT, DDE and DDD.

A smaller sub-set of 16 samples was analyzed for tributyltin (TBT), PBDEs and PCB congeners. These tests were included on an exploratory basis to assess the value of conducting more comprehensive sampling for these analytes in the future. TBT was found in 63 percent of the samples analyzed but was generally detected at concentrations below risk-based screening levels. PCB Congeners and PBDEs were found in all analyzed samples. There is currently no screening value for PBDEs. Total PCB congeners were generally lower than the Aroclor sum for the same sample.

4.3.2. Common Contaminants at Targeted Sites

Contaminants of concern (COCs) were selected based on their toxicity and frequency of detection throughout the reach. Standard plots were generated to display the data for the targeted sites relative to the IS mean (reach average or baseline) and the Columbia Slough Sediment Screening values (risk-based values). Targeted site location acronyms (x axis) are defined in Table 1.

Metals

Chromium: Targeted chromium values for the reach were generally below risk-based values. The average concentration of chromium at targeted locations was 61 ppm, slightly above the IS mean of 44 ppm and risk-based value of 42 ppm. The sample at Outfall 59 was an outlier at 481 ppm.

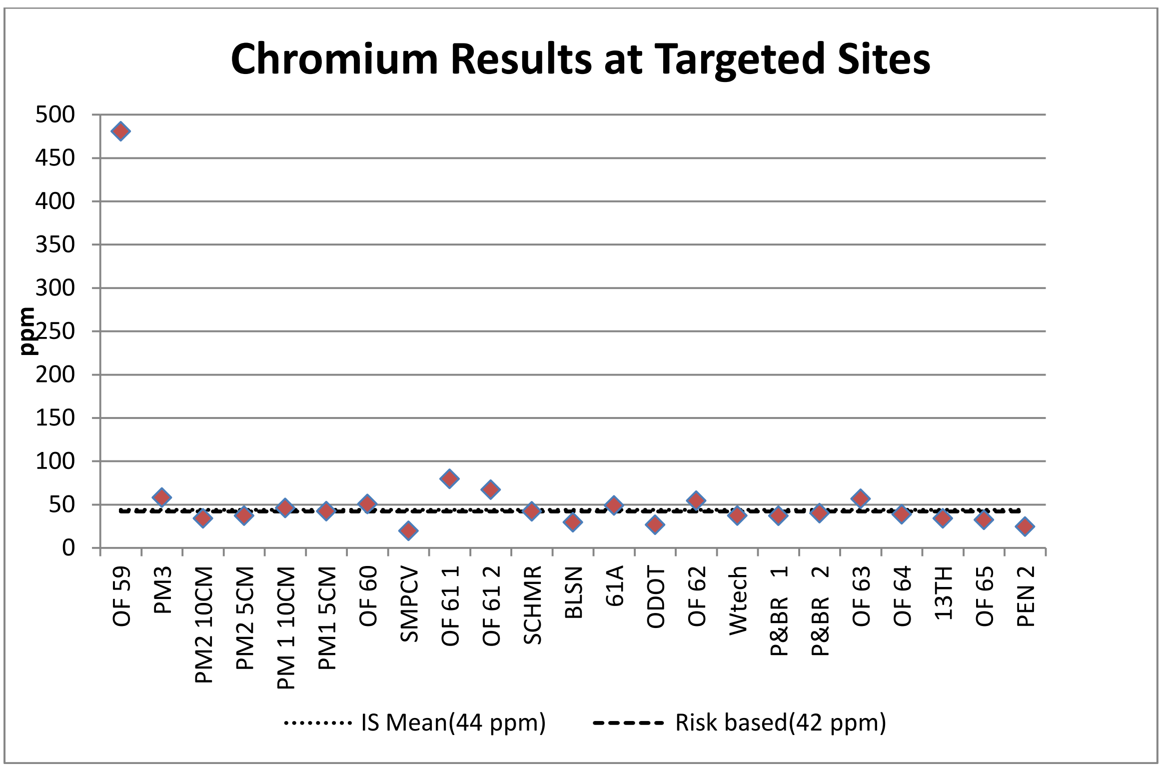


Figure 12 Chromium Results at Targeted Samples

Copper: About 62 percent of targeted copper samples had concentrations that exceeded the risk-based level. The average concentration of targeted samples was 59 ppm, again, above the IS (37.5 ppm) and risk-based (36 ppm) values. Samples at Outfalls #59, 61, 61A and 62 had copper concentrations between 130-148 ppm.

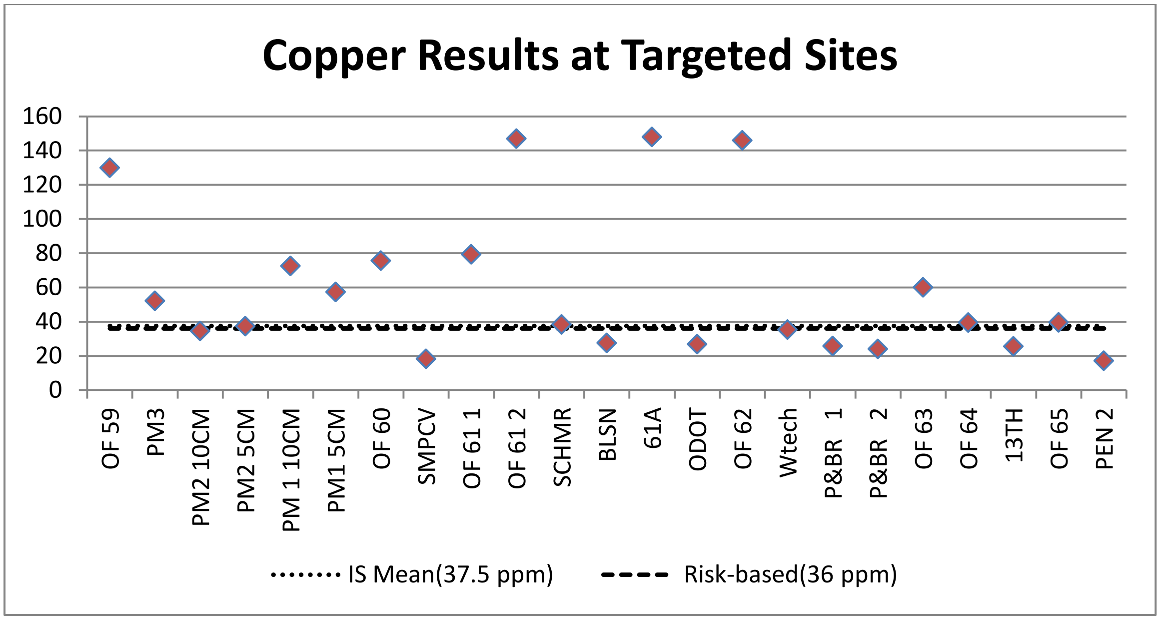


Figure 13 Copper Values for Targeted Samples

Lead: Lead was detected at all sites and the average lead concentration of targeted samples in the reach was 68 ppm, above the IS (41 ppm) and risk-based (17 ppm) values. All targeted sites except two exceeded risk-based concentrations.

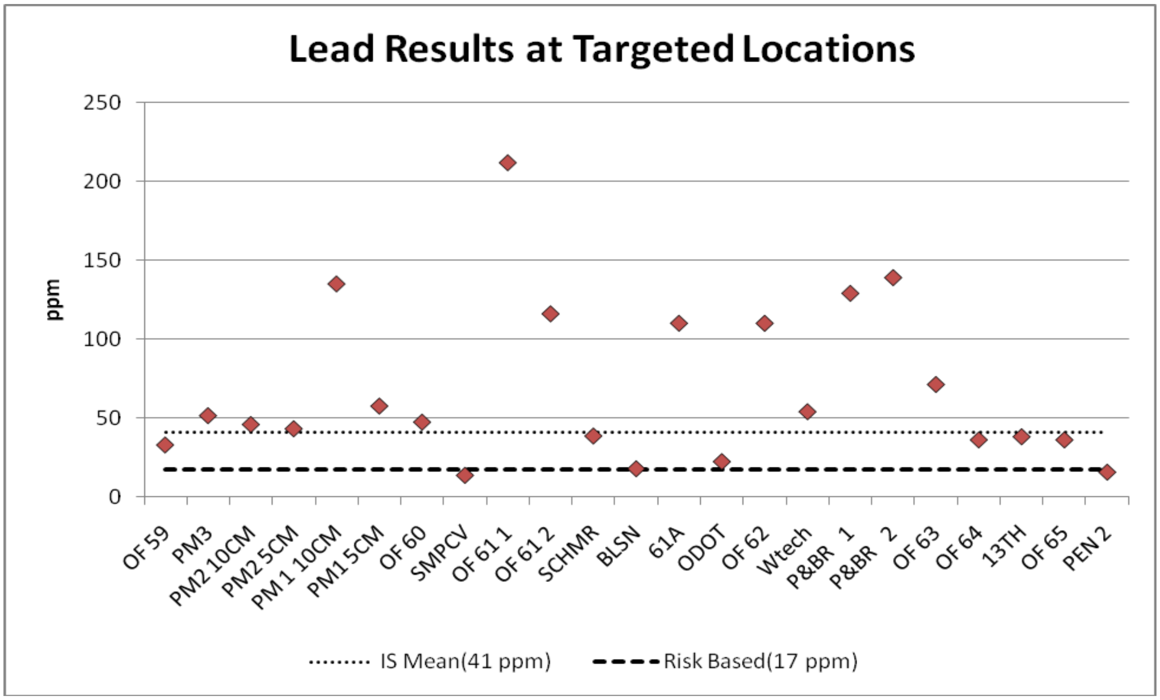


Figure 14 Lead Values for Targeted Samples

<u>Zinc:</u> Zinc concentrations exceeded the risk based value at 54 percent of the targeted sites, with an average concentration of 304 ppm. Samples at outfalls #s 60, 61, 61A, 62, 63 and Pacific Meats #1 & #3 all exceeded the risk base value.

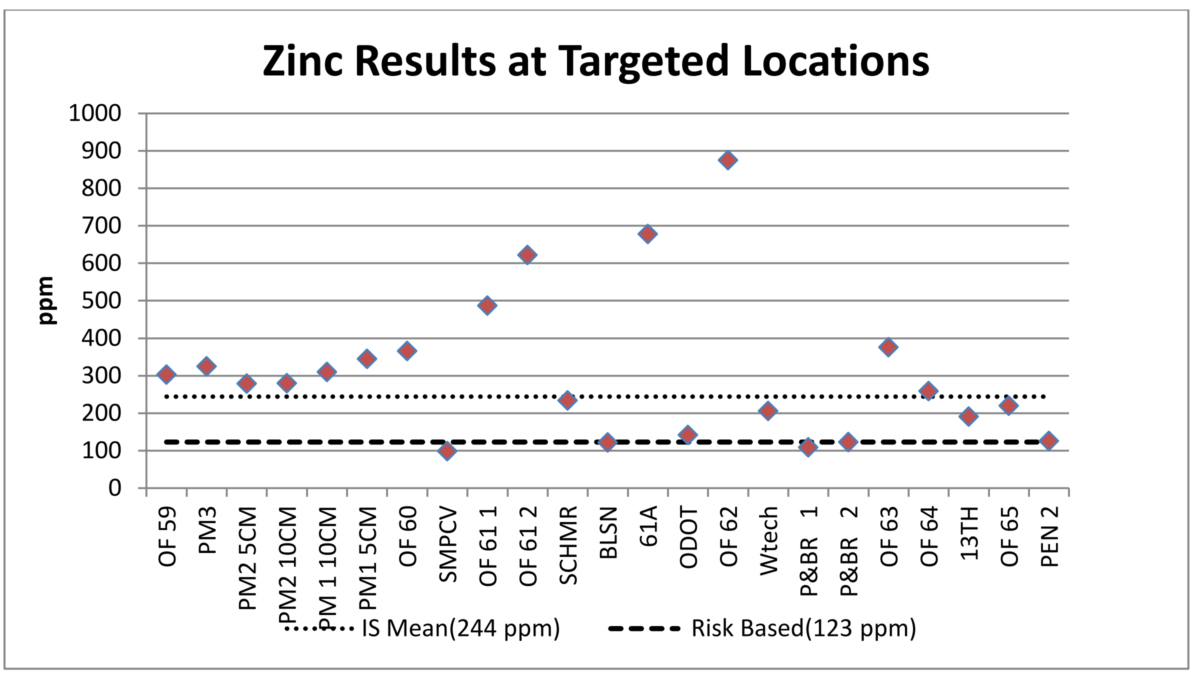


Figure 15 Zinc Results for Targeted Sites

Total Poly-Aromatic Hydrocarbons (PAHs)

Total PAH is the sum of the concentrations of all individual PAHs at each target site. For calculation simplicity, if an analyte was non-detect, the analytical detection limit was used in the calculation. A total PAH risk-based value has not been calculated.

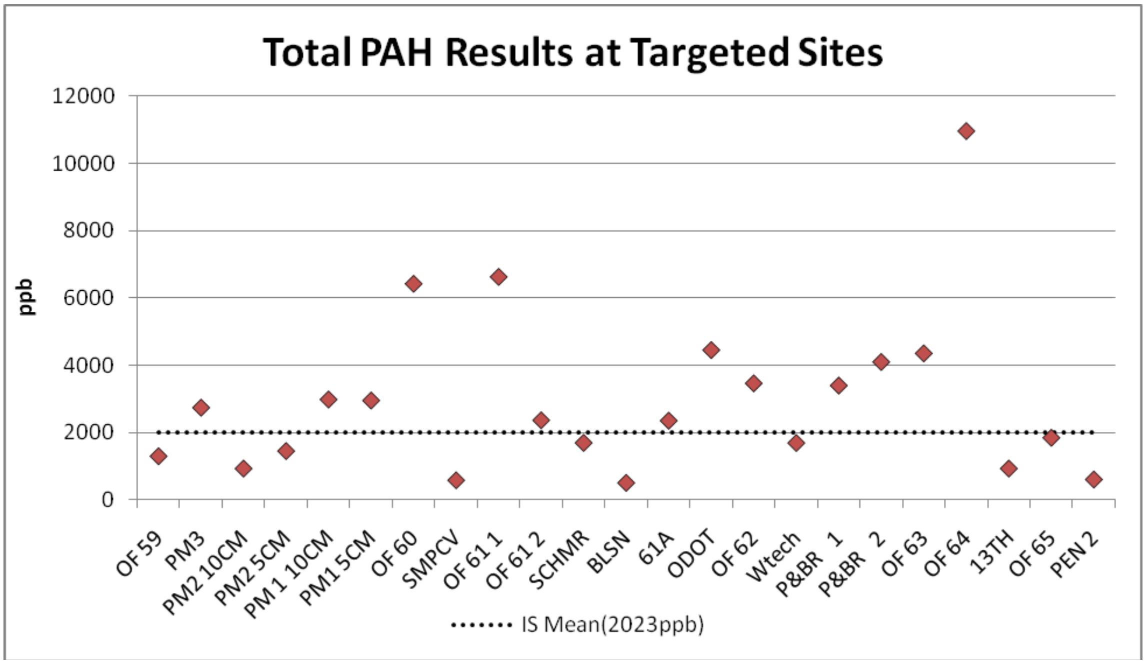


Figure 16 Total PAH's for Targeted Sites

PCBs:

Aroclor 1254: The risk-based concentration and the IS average values were similar for Aroclor 1254. Consequently, targeted concentrations were either above or below both values. It should be noted, however, that the risk-based value from the 2007 Columbia Slough Screening Level Table is not truly risk-based in that it reflects the standard analytical detection limit for Aroclor 1254. The true risk-based value is below this. Consequently, any detection of Aroclor 1254 is above the true risk-based value. See discussion of site-specific risk-based value for this compound presented in Section 5. The highest targeted values were near the Pacific Meat cleanup site (ESCI#145) and Outfall 60, which is the closest city outfall to Pacific Meat.

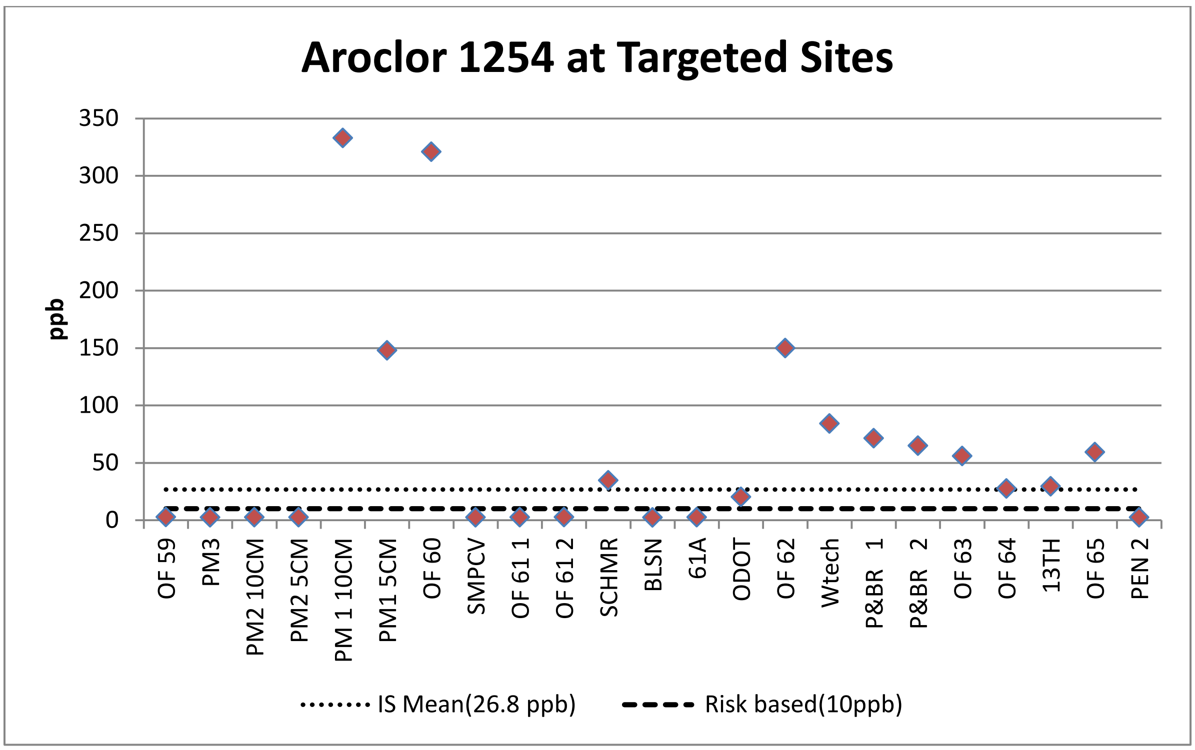


Figure 17 Aroclor 1254 at Targeted Sites

Aroclor 1260: As with Aroclor 1254, the IS average reach value was close to the standard analytical detection limit of 10 ppb for Aroclor 1260 and targeted concentrations were either above or below both values. The highest targeted value was located near Outfall 60 (855ppb) and omitted from the figure below, due to difficulty in showing this value on the graph.

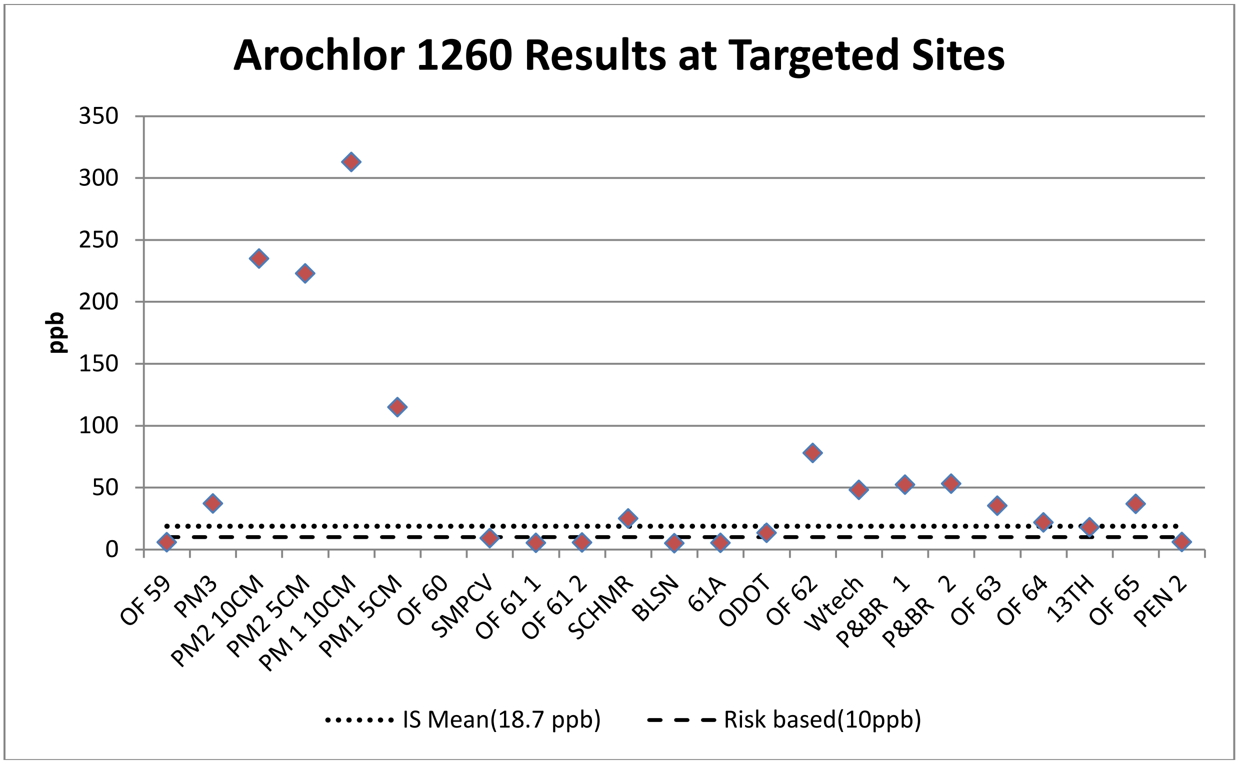


Figure 18 Aroclor 1260 Results at Targeted Sites

Total PCB Aroclors: Total Aroclor values were similar to those in individual Aroclor graphs above. Outfall 62 was unique as results showed additional Aroclor 1248 contamination, where analyses of samples for all other outfalls in the study only found Aroclor 1254 and 1260. The Outfall 60 value (1176 ppb) was omitted from figure so values near the risk based number could be viewed easily.

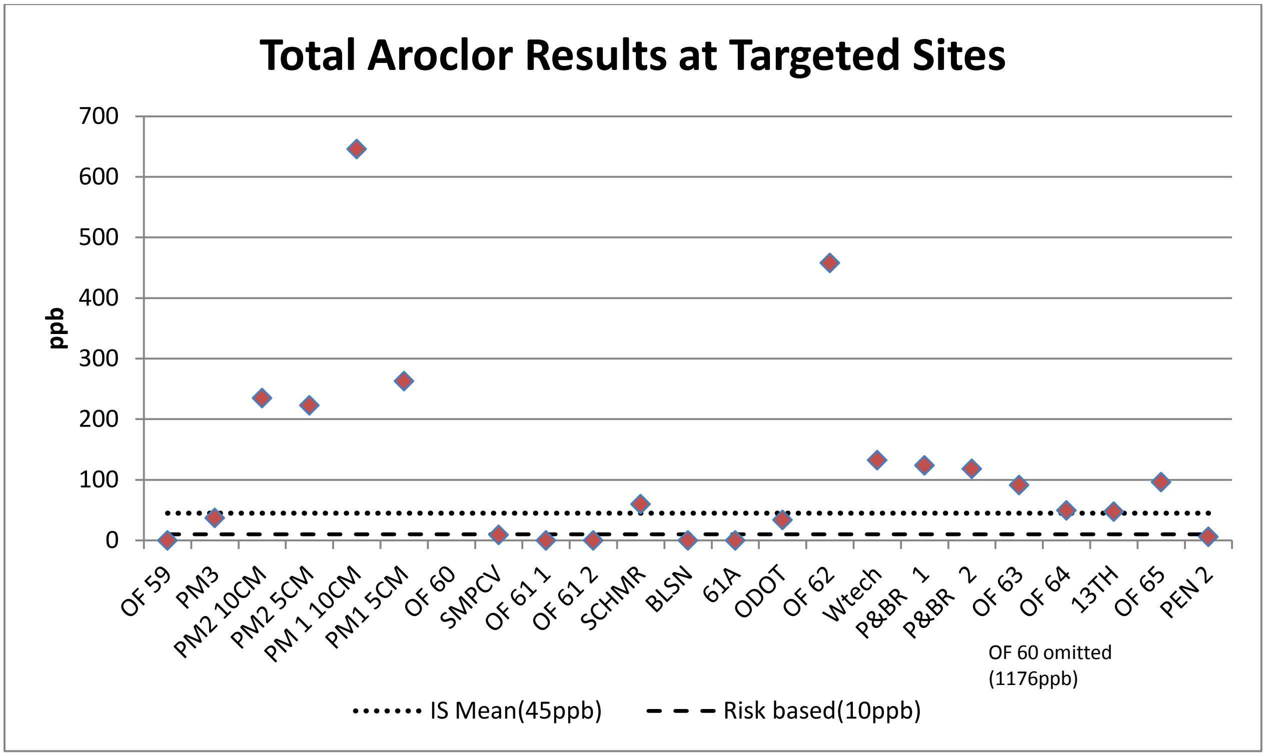


Figure 19 Total Aroclor Results at Targeted Sites

Total PCB Congeners: Total PCB congeners were also measured for a subset of samples. All results were below 103 ppb, with the exception of that for Outfall 62 which had a concentration of 904 ppb. This data point was omitted from the graph below to limit graph compression. The congener method is able to produce lower detection limits than the Aroclor method, therefore the bioaccumulation risk-based value was used for a comparison.

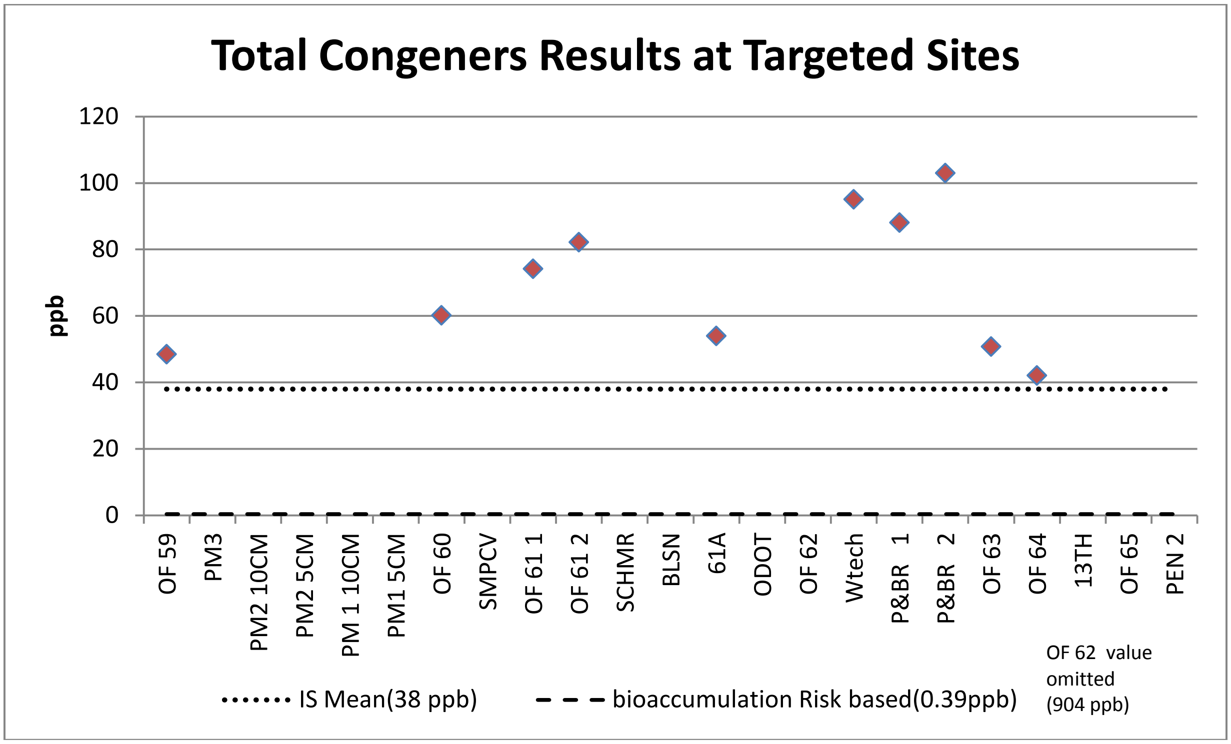


Figure 20 Total Congeners Results at Targeted Sites

Pesticides:
Pesticides were generally found at targeted locations; however, method detection limits for pesticides were above the detection limit referenced in the 2007 Slough Screening Level Table of 1 ppb for many targeted sites and many of the pesticide results were estimated. The IS average for the reach was below the "risk-" based values for all pesticides except DDD and DDE. Note again that the risk-based value was set at the typically achievable concentration of 1 ppb. The true risk-based value is below 1 ppb. Although pesticides were analyzed at all sites, only detected values are graphed in Figure 21 and 22.

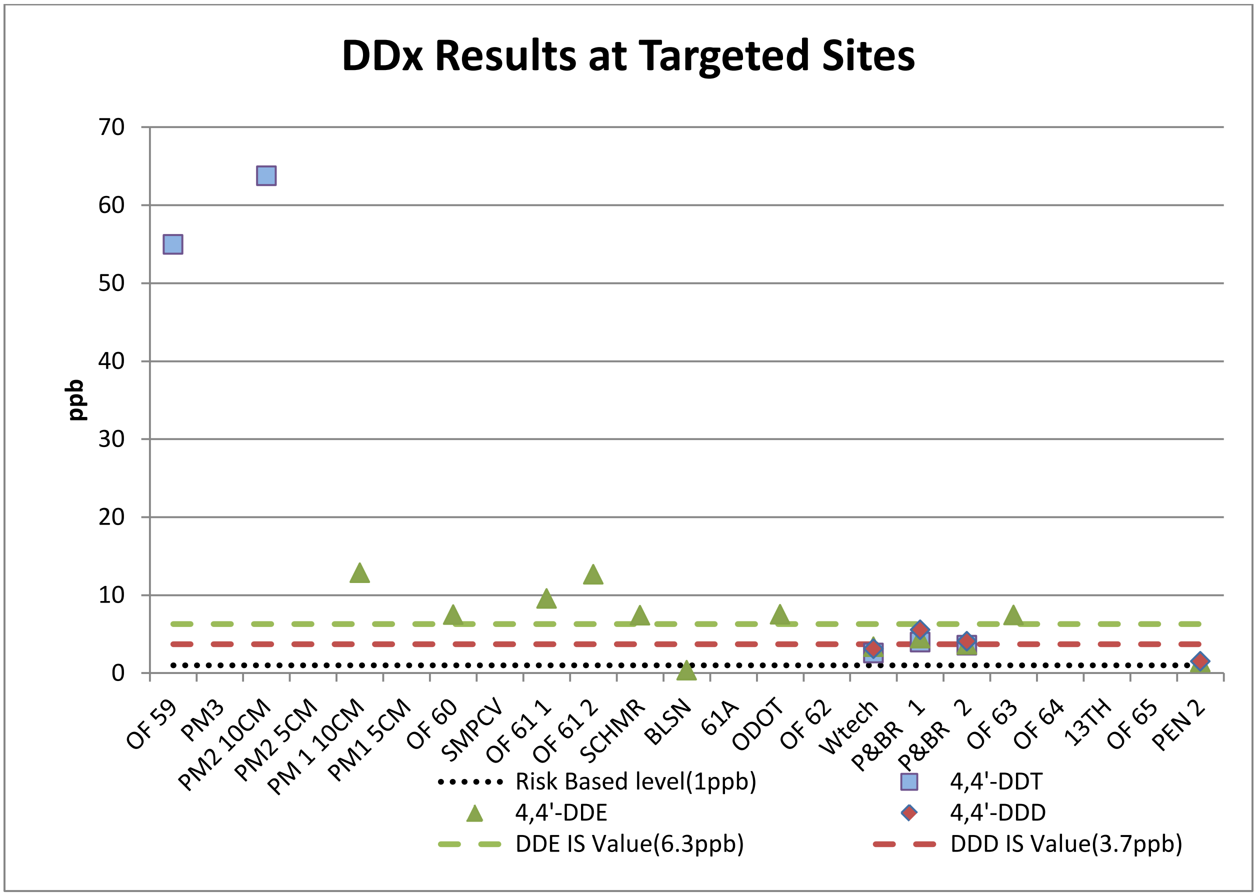


Figure 21 DDx Pesticide Results at Targeted Sites

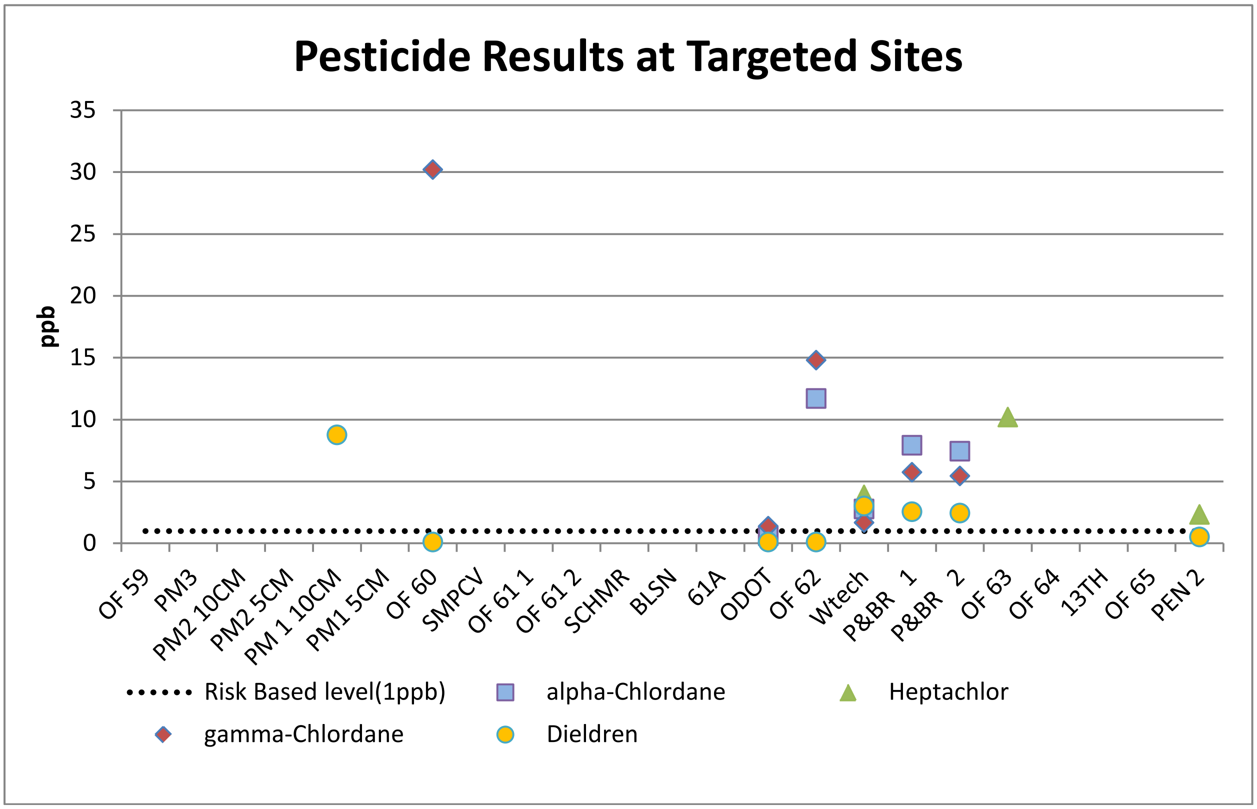


Figure 22 Pesticide Results at Targeted Sites

4.2.3 Vertical Profile Data

Sediment samples were collected at 0-5 cm and 0-10 cm depths at Pacific Meats, an area of known PCB and pesticide contamination, to determine if natural deposition is covering older contaminated sediment with cleaner material. Previous sampling has shown that contaminant concentrations from 1-2 feet below the mud line are up to an order of magnitude higher than concentrations detected in the interval from 0-1 feet. In this study the 0-10 cm below surface level (bsl) and 0-5 cm bsl values from both outfalls were combined to determine average concentrations at these depths.

The graphs below show that PCB and metal contaminants are considerably lower in concentration in the shallow sediment interval. To a lesser extent, this is also true for pesticides. Selected PAH's show a slight concentration increase in shallower sediments, as current on-site source control has yet to be implemented. The results suggest that many contaminants and particularly legacy contaminants such as PCBs and pesticides, are being covered up by cleaner sediment.

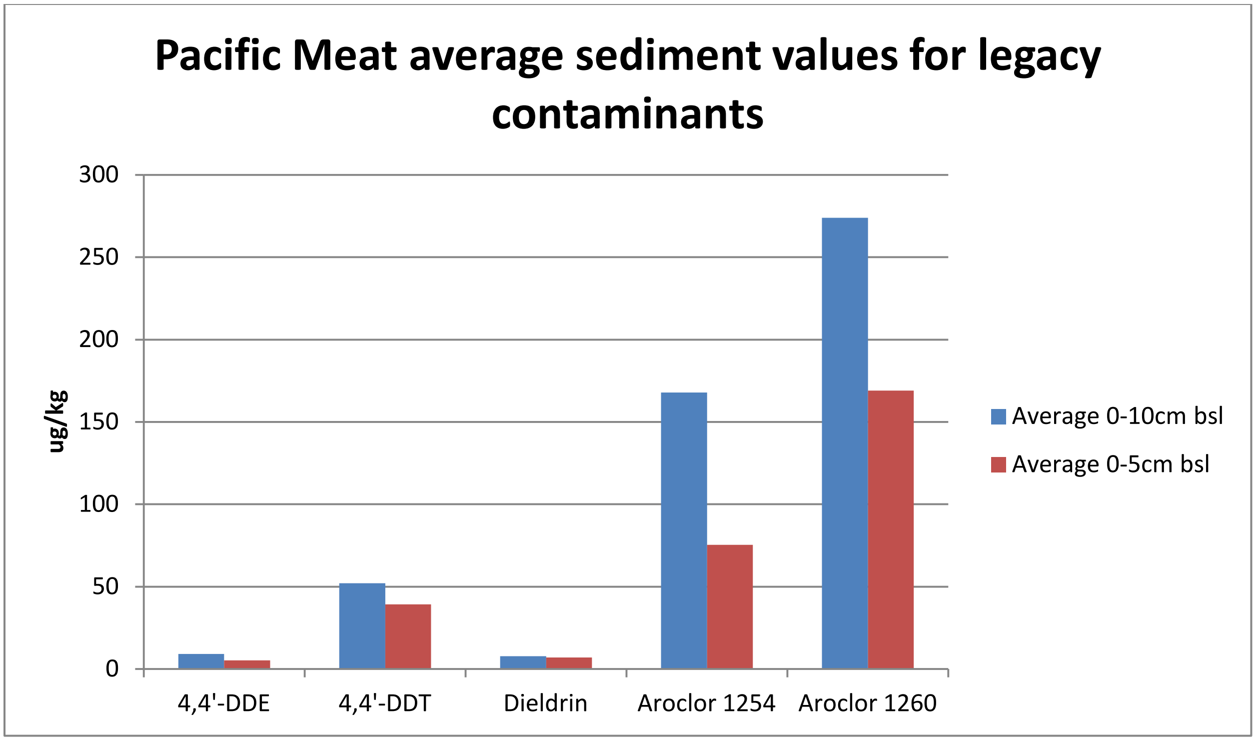


Figure 23 Average Sediment Concentrations at Different Depths: Legacy Contaminants

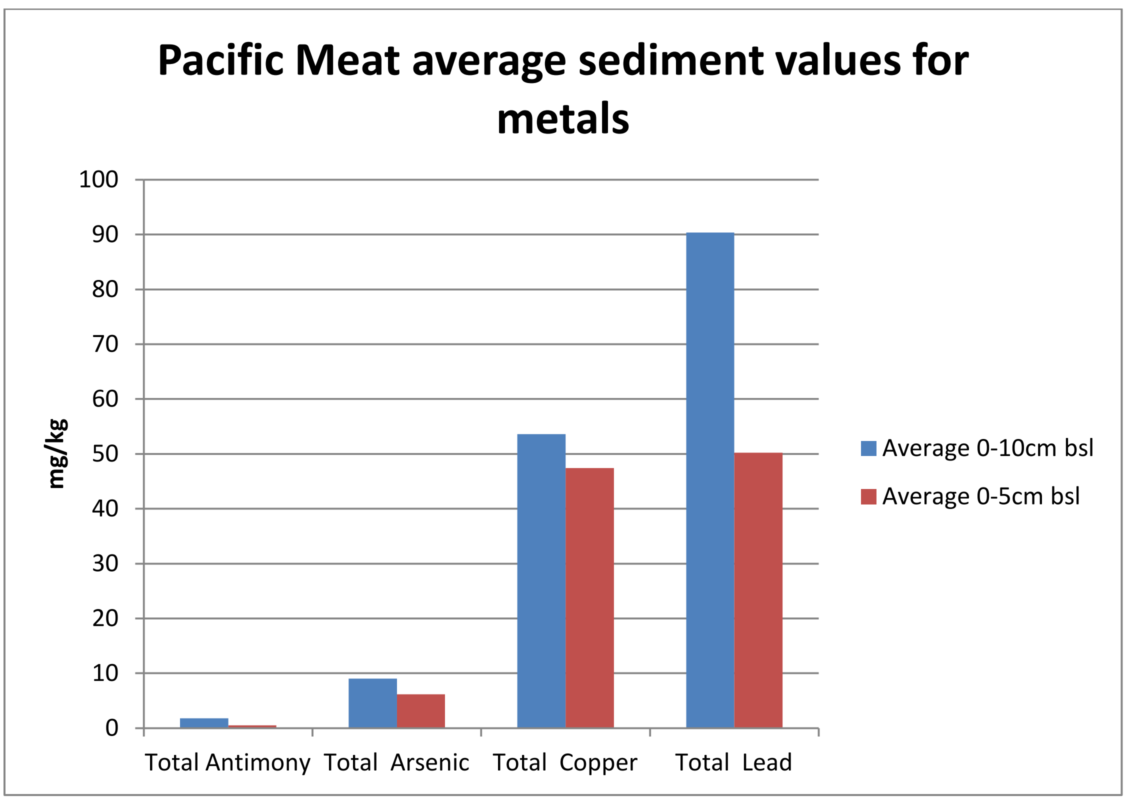


Figure 24 Average Sediment Concentrations at Different Depths: Selected Metals

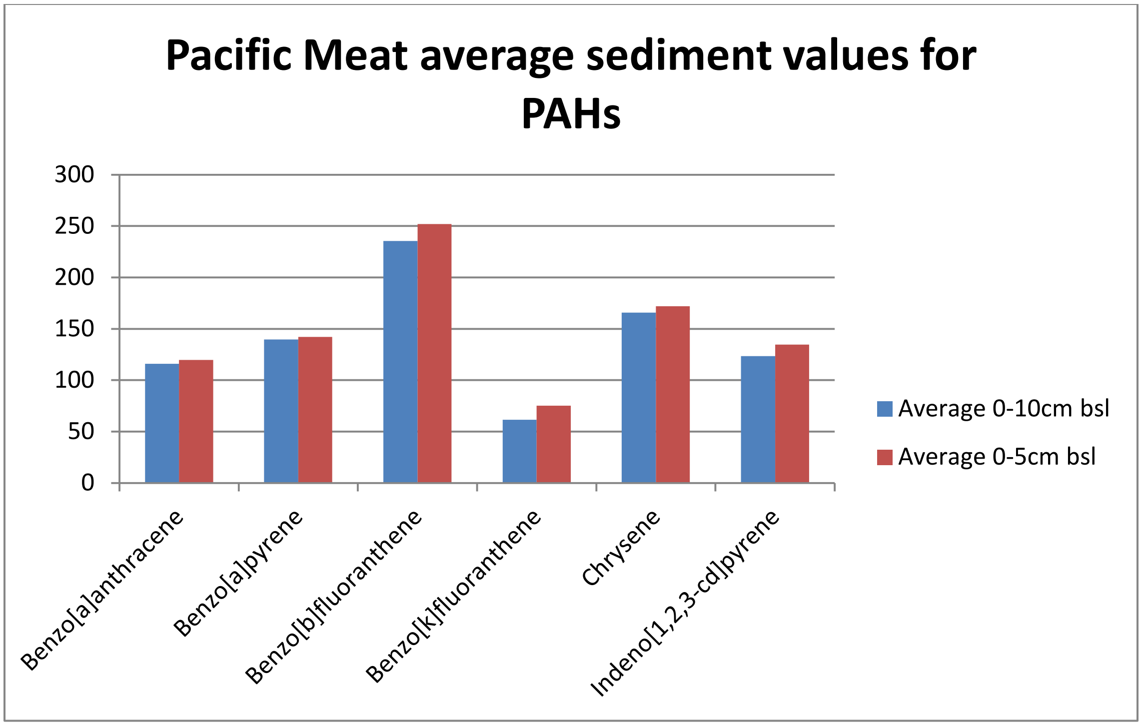


Figure 25 Average Sediment Concentrations at Different Depths: Selected PAHs

4.3 Bioassay Summary

Two acute bioassay tests were performed on sediment samples collected near major outfalls. Locations are shown in Figure 10 and described in Table 6. The two toxicity tests were the 10-day mortality sediment toxicity test with the amphipod *Hyalella azteca* and the 10-day growth and mortality sediment toxicity test with the midge *Chironomus dilutus*. Details of these tests are documented in the laboratory reports from Northwest Aquatic Sciences (NAS 2009 a,b). Bioassay results were evaluated by DEQ for statistical significance of responses associated with test sediment relative to those observed in the laboratory control, and for magnitude of the bioassay endpoint response. Prior to interpreting the bioassay responses, the mean responses of each of the eight replicates were normalized to the control sediment response by dividing each mean test sample response by the control sample response. The normalized data were then evaluated for statistical significance. Because bioassay response data cannot meet the conditions required for use of parametric hypothesis tests, the tests for statistical significance were performed by using both the nonparametric hypothesis test referred to as the Mann-Whitney test on the median, and the robust permutation test on the mean response (Higgins 2004). The conclusions are summarized below. Results were identical when using the median and mean responses (Table 6).

Effect size was evaluated using the reference envelope approach which has also been used to interpret Portland Harbor Sediment Toxicity Tests (EPA 2009). This approach pools all toxicity test results to better identify where impacts are observed. Developed as described in EPA 2009, it is based on a large number of reference area bioassay in the lower Willamette and provides a good regional reference point. The reference envelope was used to differentiate the effect size into three categories - no effect, minor effect, and severe effect. The results are presented in Table 6 and the details of the interpretation are presented in Appendix H. As shown in Table 6, there were statistically significant effects in the *Chironomus* mortality test for four samples. Of these four samples, three of them also showed an effect in the growth endpoint. No samples showed any effect for the *Hyalella* mortality endpoint. Overall, the three samples with significant responses in both *Chironomus* tests are deemed to demonstrate a toxic effect. Because minor effects were observed in both *Chironomus* tests in the OF 62 sample, this sample was interpreted to be possibly toxic.

Table 6 Results of Sediment Bioassay Tests.

	Hyallela		***Chironomus***				
	Percent Survival		*Percent Survival*		*Growth (Biomass)*		
Site	**Statistically Different [a]**	**Reference Envelope Effect Level**	**Statistically Different [a]**	**Reference Envelope Effect Level**	**Statistically Different [a]**	**Reference Envelope Effect Level**	**Overall Interpretation**
Control	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OF 65	No	No Effect	**Yes**	**Severe Effect**	No	No Effect	**Toxic**
OF 63	No	No Effect	No	No Effect	No	Minor Effect	Not Toxic
OF 64	No	No Effect	No	Minor Effect	No	No Effect	Not Toxic
Prec +BR	No	No Effect	**Yes**	**Severe Effect**	**Yes**	**Severe Effect**	**Toxic**
Prec + BR QA	No	No Effect	**Yes**	**Severe Effect**	**Yes**	**Severe Effect**	**Toxic**
Wastech	No	No Effect	No	No Effect	No	Minor Effect	Not Toxic
OF 62	No	No Effect	**Yes**	**Minor Effect**	No	Minor Effect	**Possibly Toxic**
OF 61A	No	No Effect	No	No Effect	No	No Effect	Not Toxic
OF 61	No	No Effect	No	Minor Effect	No	No Effect	Not Toxic
OF 61 QA	No	No Effect	No	No Effect	No	No Effect	Not Toxic
OF 60	No	No Effect	No	No Effect	No	No Effect	Not Toxic
Pac Meat OF 1	No	No Effect	No	No Effect	No	No Effect	Not Toxic
OF 59	No	No Effect	No	No Effect	No	No Effect	Not Toxic

N/A – Not Applicable – Control Sample

a- Statistical significance tested by comparing medians (Mann-Whitney U Test) and means using permutation tests.

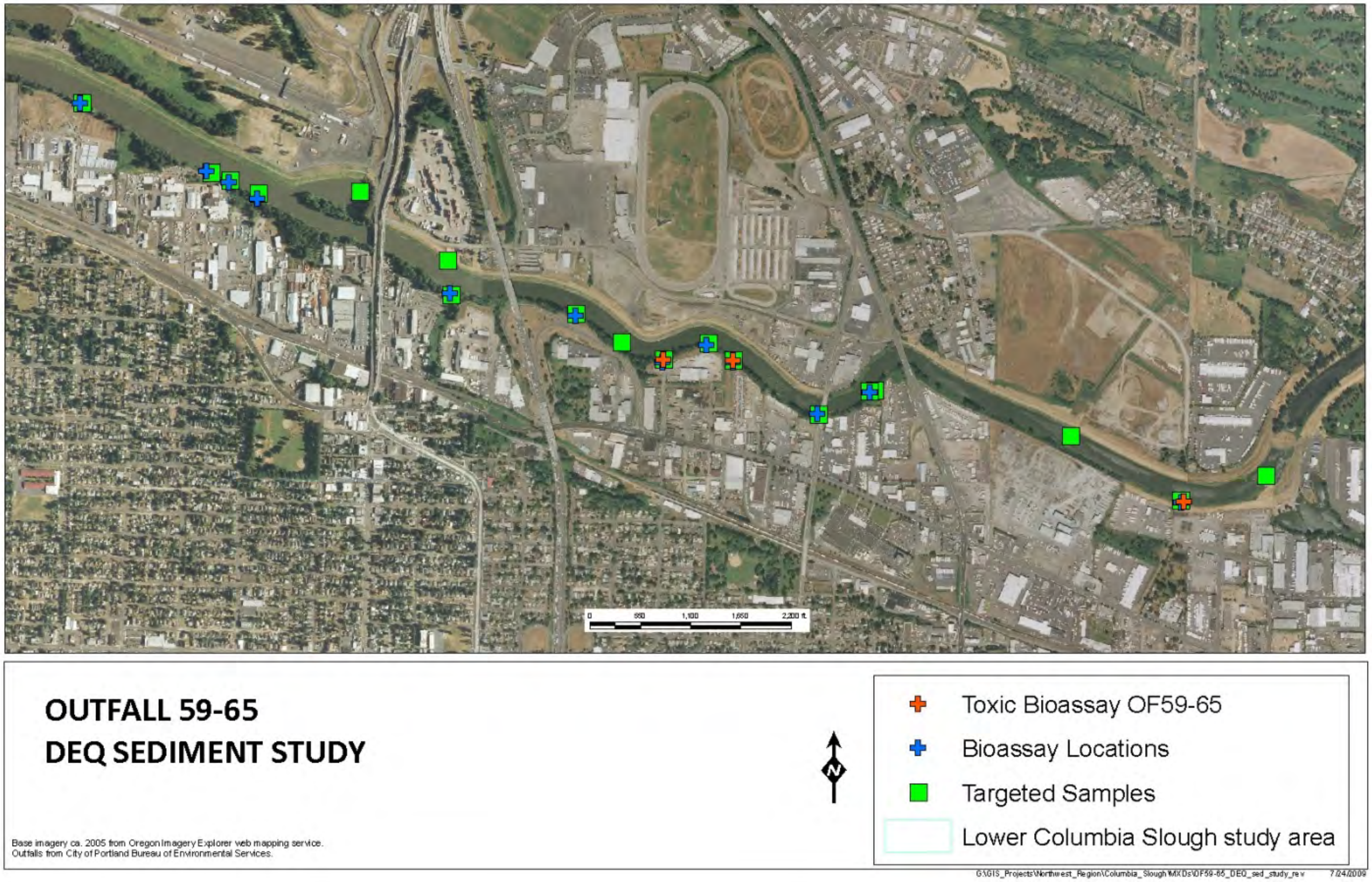


Figure 26 Bioassay Locations and Overall Interpretation

5.0 BIOTA-SEDIMENT ACCUMULATION FACTORS

To obtain site-specific biota-sediment accumulation factors (BSAFs) DEQ used data from both two sediment sampling events:

1) The discrete sediment data with 23[1] sediment samples collected by the City in the Lower Slough in 2006 (BES 2009), and

2) The IS dataset collected by DEQ in 2009.

This sediment data was correlated to the City's 2005 fish tissue and fish lipid (GeoSyntec 2007) data set, for the calculations. BSAFs were calculated for several organic bioaccumulative contaminants that were analyzed in all three sampling events. The sediment and tissue data sets are reasonably spatially and temporally related. For the 2006 dataset BSAFs[i] were calculated using the following equation from DEQ's sediment bioaccumulation guidance (DEQ 2007).

$$BSAF = \frac{Cfish / Fl}{Csed / Foc}$$

Where:

BSAF	= Biota-Sediment Accumulation Factor (unitless)
C_{fish}	= Chemical concentration in fish (ug/kg-wet weight)
C_{Sed}	= Chemical concentration in Sediment (ug/kg-dry weight)
F_{L}	= Fish Lipid, as a fraction (e.g., kg/kg) wet weight.
F_{oc}	= Sediment organic Carbon, as a fraction (e.g., kg/kg) dry weight.

The average fish lipid fraction from the City of Portland study is 0.087 and the average organic carbon fraction from the City of Portland data/IS samples is 0.023.

[1] Three sediment duplicates removed for estimation of BSAFs. For fish lipid, 4 duplicate samples were averaged.

5.1 BSAFs from City 2006 Data

The fish in the 2005 fish tissue dataset were carp (family Cyprinidae) which are reported to have a home range of up to three miles stream length (Geosyntec, 2007) so individual fish may be exposed to a wide range of sediment contaminants. As shown in Table 4, with the exception of Aroclor 1254, median sediment values from the discrete samples tended to be most similar to the results of IS samples. For this reason, BSAFs were calculated assuming median values as a measure of central tendency for both sediment and fish tissue. Since Aroclor 1254 differed from other analytes, and the mean value appeared to be more representative, the mean was used in this case. The BSAF estimates along with comparison to DEQ and EPA published values are presented in Table 7.

Table 7 BSAF estimates using 2006 discrete sediment samples [a]

Analyte	BSAF Estimate [b]	DEQ 2007 [c]	U.S. EPA [d]
Aroclor 1254	1.8	4	1.4
Dieldrin	1.1	24	12.7
DDE	2.4	28	1.3
DDD	1.7	24	0.4

a - All 23 lower slough sediment compared to 15 Lower Slough fish samples

b - Aroclor BSAF estimates based on mean concentration, others on median, based on results shown in Table 4.

C - Default estimates from DEQs 2007 bioaccumulation guidance.

D - U.S. EPA 2010: http://www.epa.gov/med/Prods_Pubs/bsaf.htm (median values for Carp).

The results in Table 7 suggest somewhat less bioaccumulation (on average) than would be predicted using DEQ defaults. However, the DEQ defaults were selected based on 75th percentile values from WDOH 1995, whereas the calculated median values represent the 50th percentile, by definition. Moreover, the WDOH data likely include species other than carp, which may be at a higher trophic position in the food web. The DEQ defaults represent a higher bioaccumulation potential, and may be a reasonable representation of the "high end".

When compared to USEPAs BSAF database, the value calculated for Aroclor 1254 is close to the value reported for total PCBs, while the dieldrin value is lower. The median EPA values for DDE and DDD are relatively close but lower than our calculated values. Differences may partially result from the fact that EPA fish samples for the pesticides were primarily fillets, while samples analyzed for PCBs were primarily whole body, consistent with the DEQ study. The site-specific values generated in the study are assumed to best represent local conditions.

5.2: BSAFs from Linear Regression of 2009 IS Sediment and Fish Tissue Data

The IS sample results are believed to represent average sediment conditions. These results were used in a simple linear regression method[2] to derive a relationship between sediment and carp tissue for the common bioaccumulative compounds. Median concentrations of each analyte in sediment and carp tissue were used to create a single sediment/tissue data pair for the common analytes. The logs of the value were plotted to create a regression with a slope equal to the BSAF. Sediment organic carbon and analytical chemistry were taken from the IS sediment samples, and fish lipid and analytical chemistry were taken from carp samples. Sediment and tissue concentrations were normalized to fraction of organic carbon and lipid, respectively (as in the equation above). The results are shown in Figures 26 to 29. Figures 26 and 27 show all analytes combined, and PCBs and pesticides separately.

The combined sediment data of Figure 26 explain 70% of the variation in fish tissue concentrations, a very good result. Figure 27suggests that the two classes of compounds (pesticides and PCBs) have different slopes and separate regressions were calculated as shown in Figures 28 and 29. For pesticides and PCBs, the regressions explain approximately 80 and 90% of the overall variance in the fish tissue concentrations respectively, an excellent result. The slope of these regression lines are 0.83 and 1.4 for PCBs and pesticides respectively. The regression slopes are equivalent to BSAFs, estimated using the linear regression method. The pesticide estimate of 1.4 compares to BSAF estimates in Table 7 of 1.1 to 2.4 indicating that the regression method using IS samples and the method using medians from discrete samples (Table 7) give comparable results. For Aroclor 1254, the regression method estimate of 0.83 is lower than the values estimated using discrete samples (1.8) from Table 7 but is generally consistent with theoretically expected values for benthic associated species (US EPA 2009 and 2010). The IS methodology appears to effectively reduce variation in sediment results allowing computation of reliable site specific bioaccumulation uptake factors.

There remain various uncertainties associated with this preliminary analysis. The spatial relation of the sediment and fish tissue data is uncertain, and PCB congener data were available for only a single fish. The effects of PCB weathering and differential accumulation by fish cannot be determined using simple Aroclor results by Method 8082. PCB mixtures undergo differential weathering in the environment, based on degree of chlorination and steric hindrances. Method 8082 uses pattern recognition of an un-weathered Aroclor standard that likely does not resemble the weathered environmental mixture. Moreover, many PCB congeners co-elute on

[2] Logarithims used to linearize data and reduce the influence of extreme values.

chromatographic columns. Resolution of the complex compositional differences in environmental PCB mixtures would be required to assess detailed differences in accumulation, and these cannot be assessed with method 8082. It is anticipated that future work will further refine and validate these estimates.

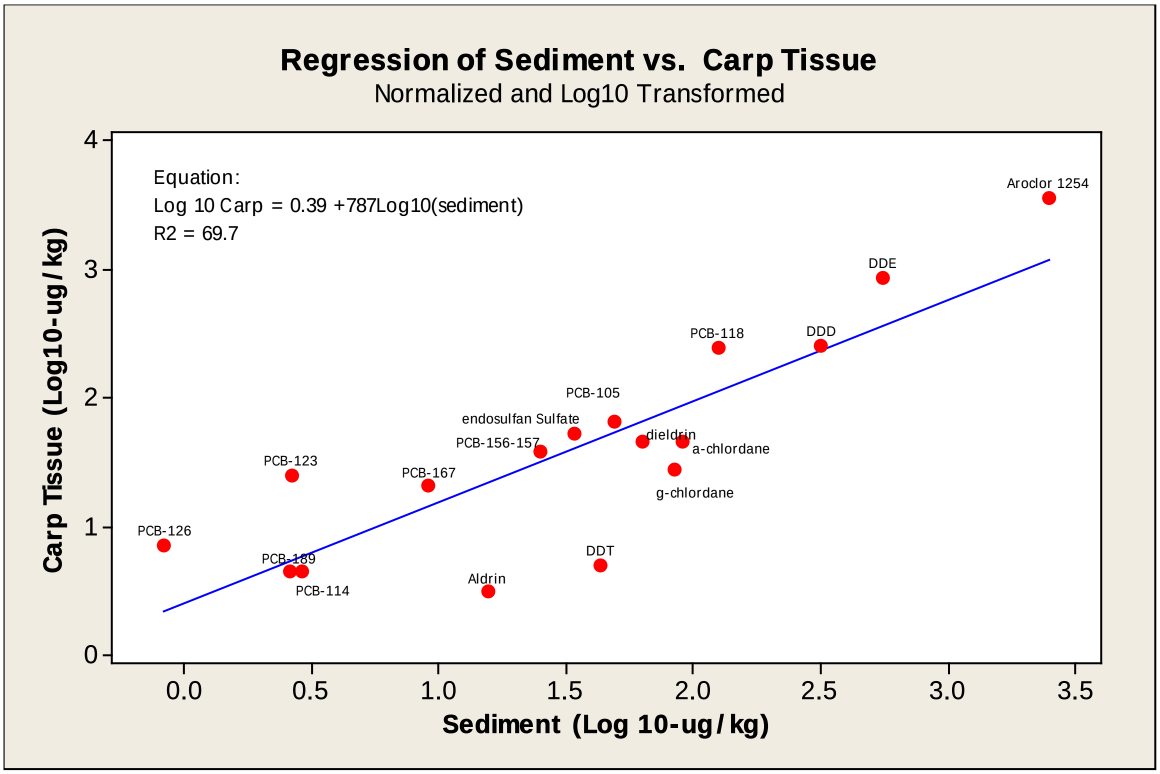


Figure 27 Normalized Regression of Sediment vs Carp Tissue

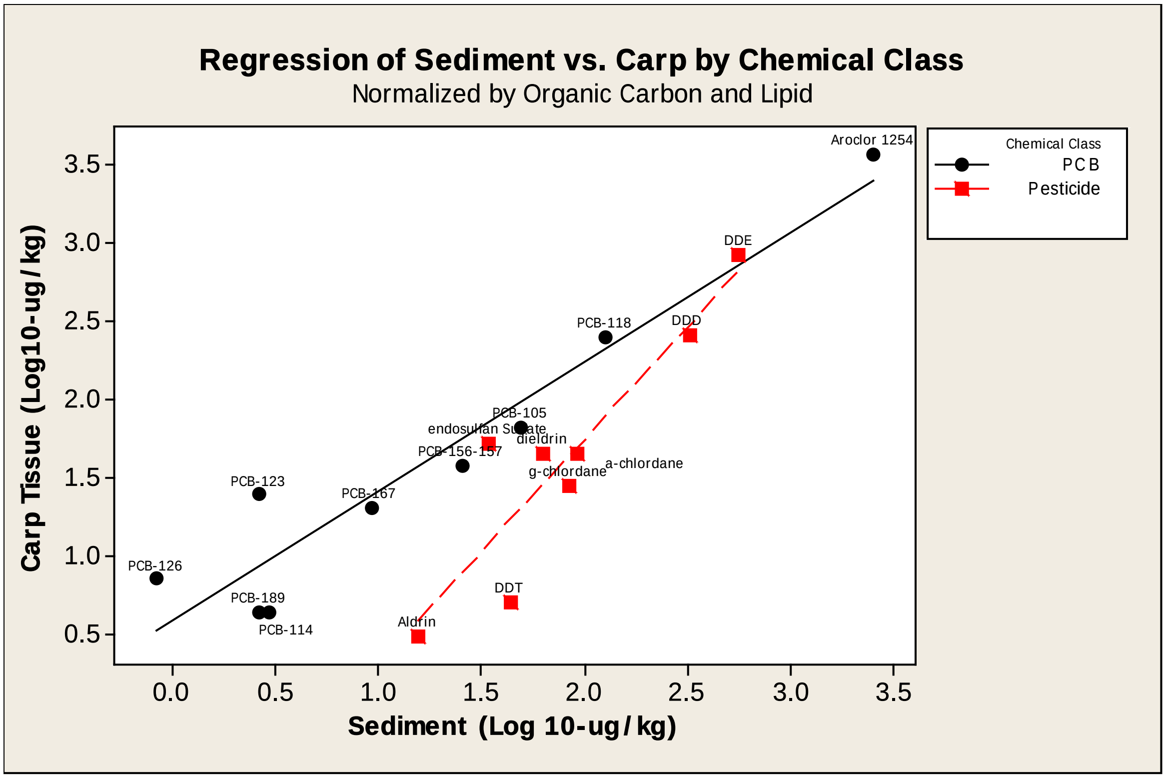


Figure 28 Chemical Class Regression of Sediment vs. Carp

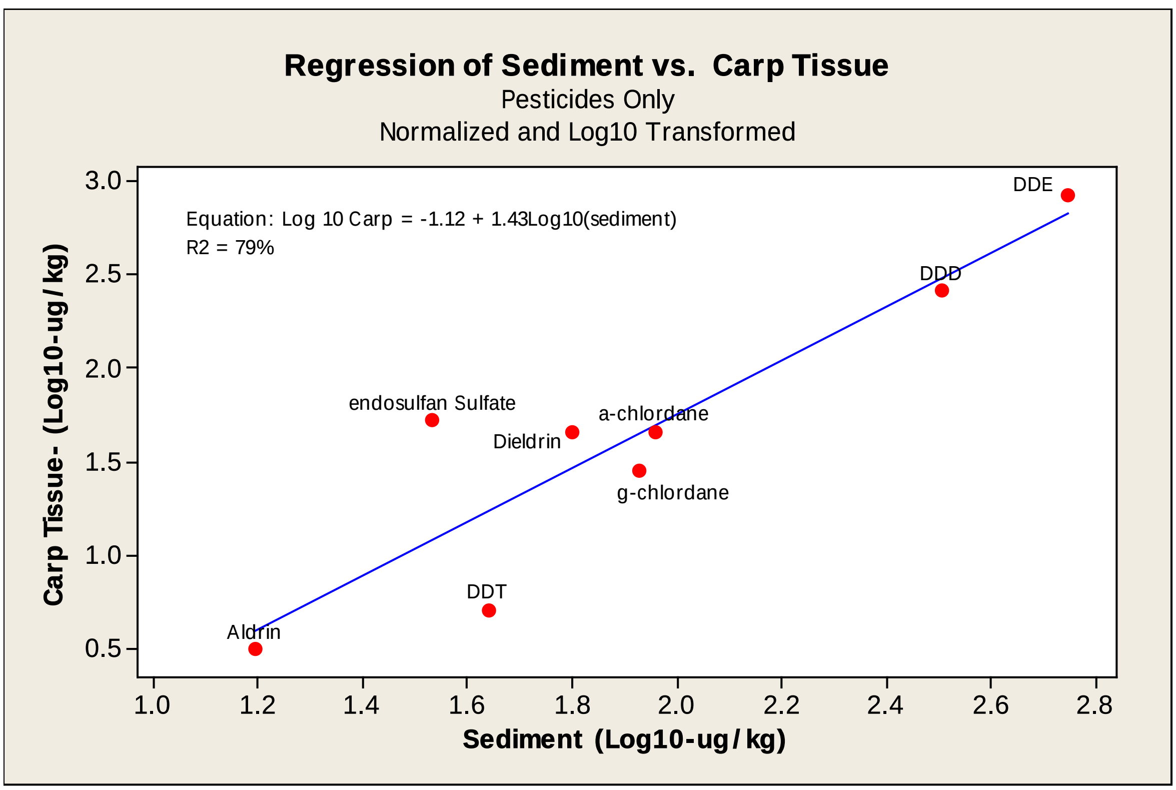


Figure 29 Regression of Sediment vs Carp Tissue: Pesticides

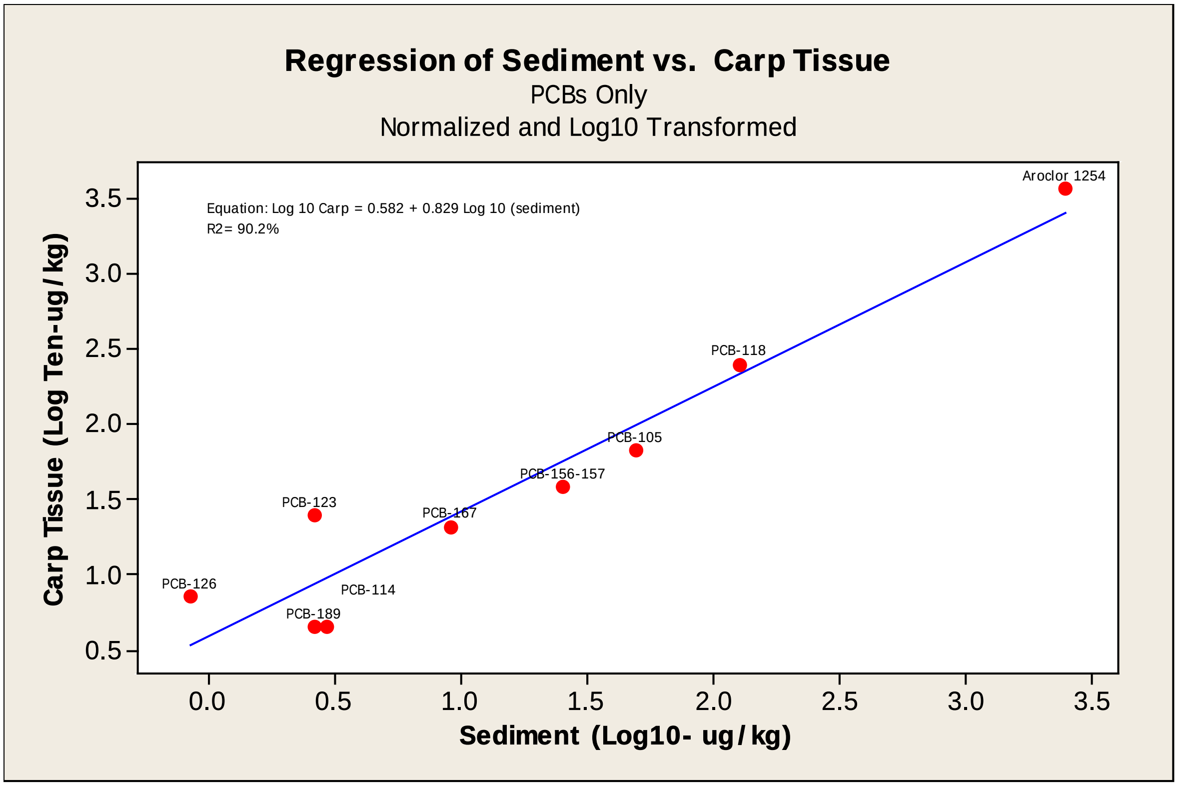


Figure 30 Regression of Sediment vs. Carp Tissue: PCBs

6.0 ADDITIONAL SEDIMENT DATA IN THE LOWER SLOUGH

Data collected by other parties in the Lower Slough since 2006 are summarized below to present available recent sediment information in the Slough. The US Army Corps of Engineers data was collected in 1998, but contains vertical profiling of the Lower Slough sediment and is thought to provide useful albeit somewhat dated information. Each project is summarized below followed by a table that describes contaminants above the IS levels. Sample locations are shown below in Figure 30.

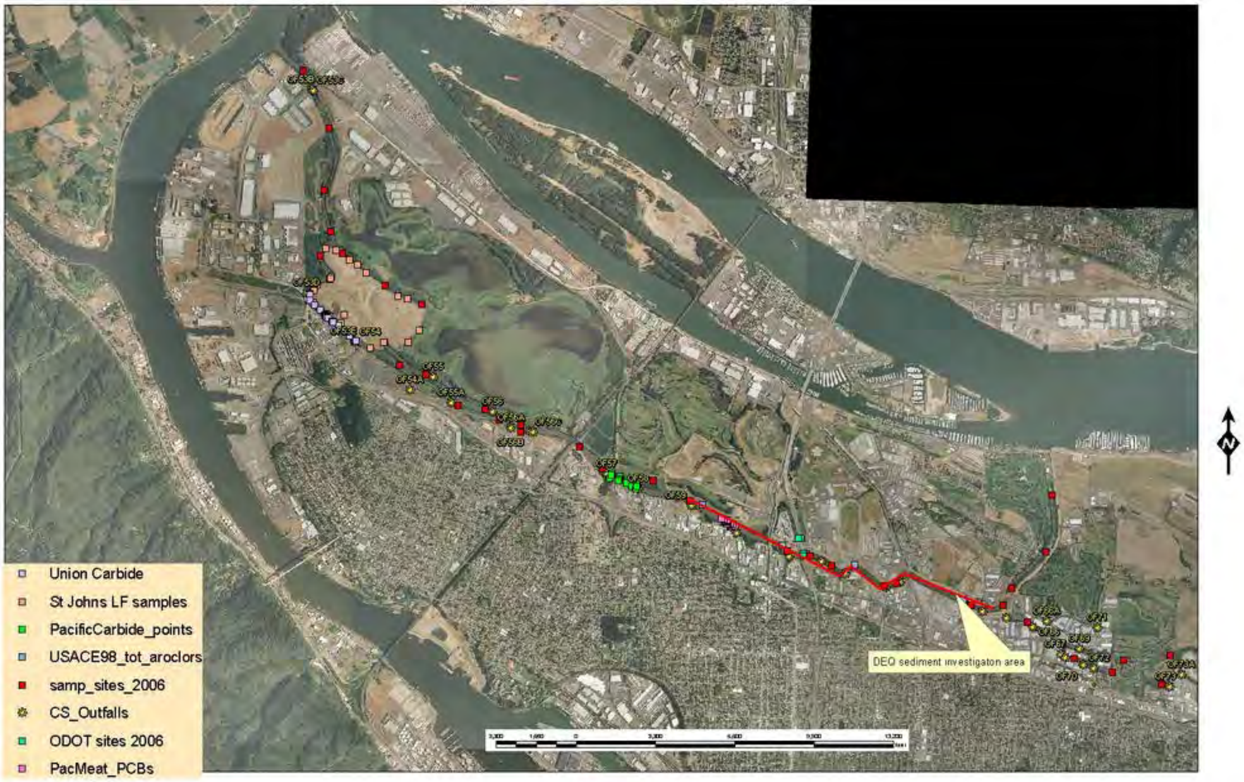


Figure 31 Additional Sediment Data in the Lower Slough

6.1 Past Sediment Investigations within the 2009 Study Area

6.1.1 Pacific Meat

In October 2006 sediment samples were collected from a 600-foot reach of the Lower Slough offshore of the Pacific Meat (ECSI #145) cleanup site. Sediment samples were collected by the responsible party from 16 points in the vicinity of the property and two private outfalls. Sediment cores as deep as three feet below the mud line were collected and sediment down to 2 feet below the mud line were analyzed for PCBs, PAHs, cyanide, and metals. The highest total PCB results from the Pacific Meat site were 2,040 µg/kg at the 0-1 foot depth and 2,450 µg/kg at the 1-2 feet. In general, the deeper sediments from the 1-2- foot depth interval contained higher contaminant concentrations than shallower samples. Nearby outfalls include three private outfalls sampled in the DEQ 2009 study; including PM1, PM2 and PM 3.

6.1.2 Corps of Engineers

The Portland District US Army Corps of Engineers collected 15 sediment surface and core samples from depths as great as nine feet below the sediment surface from a portion of the Lower Slough in March 1998. The Corps selected sites based on their proximity to City outfalls but locations are generally too distant and limited in number to directly characterize outfall sediments. Multiple samples were collected from each core and composited to create an upper and lower profile sample. PCB (total) concentrations ranged up to 990 µg/kg and were commonly between 300-700 µg/kg in the upper part of the core samples. Concentrations in the lower part of the core were considerably lower. DDx results for shallow core samples were commonly around 200 µg/kg, approximately an order of magnitude greater than the corresponding surface sample results. Shallow core samples contained lead at concentrations ranging from 110-360 mg/kg. Deeper core samples and surface samples for lead and other metals were comparable to City surface samples. Core samples contained elevated levels of mercury with concentrations ranging up to 4.5 mg/kg.

6.1.3 Oregon Department of Transportation(ODOT)

ODOT collected 15 sediment samples near Interstate 5 and Vancouver Bridge for bridge replacement projects. When detected, PCBs and pesticides, mainly DDx, were found in surface samples (0-5 ft) and not detected at lower depths (5-25 ft). PCBs were found in surface samples at up to 15 ug/kg and DDxs were found at concentrations between 15-150 ug/kg.

6.2 Past Sediment Investigations Outside the 2009 Study Area

6.2.1 St Johns Landfill

Several sediment investigations have been performed around the perimeter of the St Johns Landfill in the main stem of the Lower Columbia Slough as well as side channels, the North Slough and the Blind Slough. For the “Stage 1” investigation City samples collected in the summer of 2006 were integrated into a fall 2006 investigation by METRO (owner of St Johns Landfill). Sample locations were spaced approximately 500-1000 feet along the Sloughs. METRO samples were collected from 0-0.5, 2-4, and 4-6 ft below mud line. City samples were collected only from the surface. Samples were analyzed for metals, herbicides, pesticides, PCBs, PAHs, phthalates, semi-volatile organic compounds, total organic carbon, and grainsize. The Stage 2 investigation concentrated on two areas where elevated sediment concentrations were found in Stage 1. Both the West Mud Flats and head of Blind Slough were suspected areas of elevated contamination due to their long history of leachate seep areas prior to placement of the landfill cover in the early 1990s. Results indicate moderate levels of sediment contaminants surround the landfill. Concentrations found at the West Mud Flats, head of Blind Slough, and near City Outfall 54 were generally elevated. Aroclor 1254 concentrations up to 64 ug/kg and total DDx concentrations up to 95 ug/kg were found at West Mud Flats. Aroclor 1254 concentrations up to 96 ug/kg were found at Blind Slough. The highest concentrations were often found in the 2-4 foot below mud line interval. Metals were somewhat elevated in surface sediment near Outfall 54.

6.2.2 Union Carbide (ECSI#176)

Union Carbide conducted a sediment investigation with DEQ oversight that included collection of sediment samples from upstream and downstream of the site and in a series of transects adjacent to the site. Samples were collected from the surface (0 – 6 inches) and subsurface (up to 3 feet below mud line). Samples were analyzed for PCBs, metals, SVOCs, and pesticides.

The highest PCB concentration found (86 ug/kg for Aroclor 1260) was near City Outfall 54. Aroclor 1242 was found at 77 ug/kg near the shore opposite the facility. The highest concentrations of metals were found upstream of the site, near Outfall 54 and there was no concentration gradient with depth. The highest concentrations of PAHs were found mid-channel with no apparent lateral concentration trends. Pesticides (primarily DDx) were elevated near Outfall 54 and mid-channel near the facility.

6.2.3 Pacific Carbide(ECSI# 268)

Bioassay tests using sediments near the Pacific Carbide site found mortality to benthic organisms in 2006. Slough banks adjacent to site are composed of lime material which contains elevated PAHs, metals, and some PCBs c from 0-2 feet deep. Total PAHs were found in sediment at up to 770,000 ug/kg and total PCB Aroclors were found in sediment at up to 1,100 ug/kg.

6.3 City of Portland 2006 Investigation

As discussed in Section 5, the City of Portland (COP) collected 23 surface sediment samples from the Lower Slough in 2006 as part of their long-term monitoring of Slough-wide conditions. Samples were analyzed for PCBs, semi-volatile organic compounds including PAHs, metals, pesticides, petroleum hydrocarbons, grain size, and organic carbon. Total PCBs, detected at concentrations ranging from 60-330 μg/kg are generally higher in this reach of the Slough than other Slough reaches and are relatively consistent in concentration.

COP 2006 metals results include: copper from 56-100 mg/kg, lead from 56-139 mg/kg, nickel from 27-36 mg/kg, zinc from 304-576 mg/kg. In general these metals are found at higher concentrations in the Lower Slough than other parts of the Slough. COP samples contained total DDT, DDE and DDD (DDx) at concentration of 12-62 μg/kg. Concentrations of total PAH compounds and oil are relatively higher in this reach compared with other parts of the Slough system.

7.0 CONCLUSIONS

7.1 Baseline concentrations in Lower Slough

This study supports the use of the 2009 incremental sample results as the new “baseline” or “ambient” concentration for the lower slough. While it only represents a portion of the Lower Slough, we believe it is generally representative of the entire Lower Slough based on a comparison to the 2006 data, knowledge of site sources, and the connectivity between the 2009 segment and the remainder of the slough. The IS concentrations do not vary significantly from the baseline values derived by DEQ in 2002 as can be seen for pertinent compounds in Table 4. The new baseline levels for metals in the Lower Slough are consistently lower than the previously established values which will continue to be used for Middle and Upper Columbia Slough evaluation. This is either due to reduced sources contributing to contamination over time or higher metals concentrations elsewhere in the Slough that raised the baseline value. Pesticide screening level concentrations are consistently lower than previous values. This is due in part to lower detection limits achieved using analytical method U.S. EPA 1699 and in part to the fact that there are no known pesticide sources in the lower slough. Baseline screening levels for polycyclic aromatic hydrocarbon (PAHs) are consistently higher in this section of the Slough than the Slough-wide levels. This may reflect the more industrial nature of this portion of the Slough and the higher percentage of roadway surfaces, and runoff from the I-5 Freeway. A Lower Slough-specific screening level table, Table 8, incorporating the new baseline values and risk-based evaluation discussed below is provided at the end of this section.

7.2 Benthic Toxicity in the Lower Slough

Data is being re-evaluated as part of the broader Columbia Slough study.

7.3 Bioaccumulation

Data is being re-evaluated as part of the broader Columbia Slough study.

7.4 Elevated Concentration Zones

Several locations in the study were identified as having significantly elevated concentrations of contaminants in sediment. Those values that exceed the baseline value or one order of magnitude above a risk-based screening level, whichever is higher, are highlighted in this section along with some preliminary information on potential contaminant sources. Table 10 identifies sample locations with the contaminant concentrations meeting these criteria highlighted. Locations are shown in Figure 33.

Table 8 Elevated Concentration Zones

	Significantly Elevated Concentrations						Bioassay
Site	PCBs	Metals	Pesticides	PAHs	TBT	SVOCs	Toxicity
Outfall 59	-		Yes	-	-		-
Pacific Meats & Outfall 60	Yes	-	Yes	-	-	-	-
Outfall 61A	-	-	-	-	Yes	-	-
Outfall 62 & Precision/B&R	Yes	-	Yes	-	-	-	Yes
Outfall 63 & Vancouver Bridge	Yes	-	Yes	-	-	-	-
Outfall 65	-	-	-	-	-	-	Yes

Starting at the downstream end of the study area, the first location is adjacent to City of Portland Outfall 59. Chromium was detected at 481 mg/kg at this location which is more than ten times the baseline (44.1 ppm) and copper and nickel were elevated as well; however the bioassay conducted on this sample did not indicate toxicity. During sampling the field crew observed what appeared to be roofing sand in the sediment near the outfall. Roofing sand often contains metals useful for moss control on roofs. DDT was detected at 55.6 ug/kg. No known source of pesticides is known in this section, but historic use of DDT in the area is possible. The inactive DEQ Cleanup site known as Malarkey Roofing (ECSI No. 690) is located nearby and discharges to this outfall.

Figure 32 Roofing sands at Outfall 59

The second location identified as elevated is centered on Pacific Meats outfalls No. 1 and No. 2 and City of Portland Outfall 60. PCBs were detected at up to 646 ug/kg total Aroclors at the Pacific Meat outfalls. Just upstream from these private outfalls, samples collected adjacent to City Outfall 60 contained higher concentrations, up to 1,176 ug/kg PCB Aroclors, the highest surface sediment concentration detected in the study area. It is not clear if there is any connection between Outfall 60 and the Pacific Meats site. Another possible source for PCBs at Outfall 60 is an inactive DEQ cleanup site known as Goodyear Distribution Center #9000 (ECSI No. 2105). In 1995, DEQ received a report of a spill of transformer oil at the Goodyear Building. It was reported that vandals drained and gutted six transformers releasing 100 gallons of transformer oil with PCBs concentrations exceeding 7 ppm. Stormwater from this site appears to drain to Outfall 60. NW Cast (ECSI #999) is also within the Outfall 60 drainage area and formerly housed a transformer oil and metal smelting shop. On-site soil sampling in 2001 found total PCB's in 8 of 9 soil samples ranging from 500 ppb to 27,500 ppb. The NW Cast site owners are conducting a stormwater Source Control Evaluation under DEQ oversight.

Pacific Meats is an active DEQ Cleanup site. A former operator at the property reclaimed PCB oil-containing transformers and caused considerable upland contamination. A soil cap is being placed on upland areas of contamination. There was evidence of overland flow of waste from site settling ponds as well as discharge of contaminated sediments through outfalls. Sediment sampling at discrete points was performed in 2006 by Pacific Meats at depths of 0.5 and 2.0 feet below the mudline. The deeper samples showed the highest concentrations with total Aroclors detected at up to 2450 ug/kg, consistent with a historic release. Deeper samples also contained elevated DDT and dieldrin values, while shallow samples did not, also consistent with historic releases.

The third area of elevated concentrations is ODOT Outfall 61A where tributyltin was found at 285 ug/kg. This is two orders of magnitude above the risk value for tributyltin of 2.3 ug/kg (EPA 2005). The source of tributyltin at this outfall is unknown. Tributyltin was also found at Outfall 61 and Outfall 63. No tributyltin sources have been identified for Outfall 63. Although bioassays in this area did not indicate toxicity, Outfall 61A has relatively high levels of metals (particularly copper, lead, and zinc) and PAHs in sediment, which may be a reflection of the metal foundries Macadam Aluminum and Bronze (ECSI No. 2765) and CARCO/Varicast (ECSI No. 3389) that discharge to this outfall. Stormwater from 84 acres of I-5 freeway and Columbia Blvd. also drains to Outfall 61A which could be a source of metals and PAHs.

Further upstream is the fourth area of elevated concentrations where Outfall 62 discharges and adjacent to the shoreline extending upstream passed the Wastech (ECSI No. 1271), Precision Equipment (ECSI No. 152), and B&R Auto wrecking sites (ECSI No. 4149). Outfall 62 sediments had the second highest total PCB Aroclor concentration in surface sediments and had the highest concentration of PCB congeners. Specific PCB congener concentrations detected at all these sites appear to match up reasonably well, suggesting a common source. This area was historically low lying and received a considerable amount of imported fill beginning in approximately 1925. The area contained a construction debris landfill, which was active from 1971 to 1973. A used oil recycling facility operated in the area from 1943 to 1974 and apparently discharged waste liquids to an open pond and ditch that emptied into the Slough. Dieldrin and delta-BHC pesticides were also elevated in this area. Bioassay samples at Precision/B&R indicated toxicity and the sample from Wastech indicated possible toxicity.

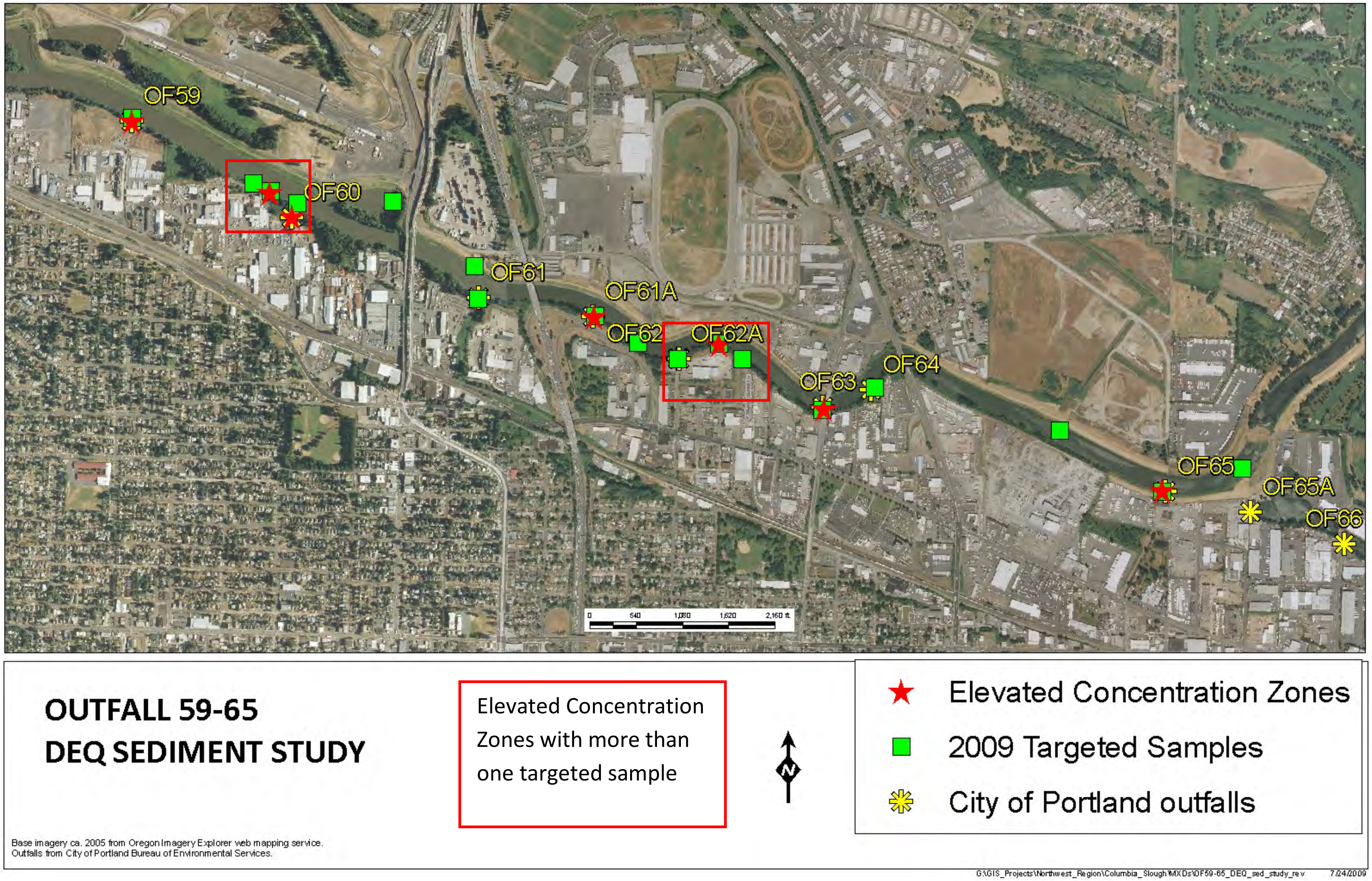
Figure 33 Wastech bank sample area

The fifth area of elevated concentrations is adjacent to Outfall 63 with heptachlor concentrations at 10.2ug/kg , just above the elevated definition criteria. It is likely that this value reflects historic releases. The total Aroclors concentration here was 91.4 ug/kg and samples collected at the nearby Vancouver Bridge construction site had PCBs up to 128 ug/kg, both exceeding the elevated criteria for PCBs. There are no known sources of PCB's in this area. Private outfalls in the vicinity of the sample area, including Ott's Friction (ECSI #5444) and Woodfeathers may also contribute to concentrations in the slough. Ott's is a distributer of truck parts and Woodfeathers is a distributer of roofing materials. Historically, Ott's housed a meat packing plant from 1920's to about 1980. Additionally, the south end of Vancouver Bridge, near the composite area, suffered a major fire to its wooden pilings in 2008.

Finally, the bioassay sample from Outfall 65 indicated toxicity. Chemistry results from the area indicated total PCB Aroclors at 96.3 ug/kg. Concentrations for other contaminants are not particularly high and other bioassays conducted on other samples with higher concentrations did not indicate toxicity, so the reason for toxicity at this outfall is not completely clear. The

Columbia Land Reclamation or Land Reclamation landfill was located on the nearby Hanson Pipe Cleanup site (ECSI #3893). Records indicate that the landfill operated from around 1974 until 1979. A City 2006 sample just downstream of this location contained total PCB Aroclors at 329.5 ug/kg. We assume that these elevated concentrations are connected, and that possible conditions associated with historic landfill discharges may contribute to toxicity.

Figure 34 : All Elevated Concentration Zones between Outfall 59-65



7.5 Natural recovery

At the Pacific Meats Outfalls #1 and #2 sediment contaminants were compared in the intervals from 0-5 cm and 0-10 cms. PCBs, pesticides, and metals concentrations were all consistently higher in the deeper interval while PAHs were slightly higher in the shallow interval. Results suggest that legacy contaminants released historically are being covered up by cleaner sediment. Source control or the curtailed used of contaminants like PCBs may be effectively reducing new accumulation in recently deposited sediments. PAH contamination, on the other hand, appears to be slightly higher in recently deposited sediments, suggesting that sources for PAHs may not be controlled effectively. This may reflect increased traffic and associated vehicular releases that occur on roadways.

8.0 RECOMMENDATIONS/FUTURE STEPS

8.1 Sediment Cleanup Prioritization

Bioaccumulative compounds were determined to contribute the most toward risk for ecologic and human receptors and correspondingly warrant the highest priority for cleanup. Because exposure associated with bioaccumulative contaminants occurs throughout the area fish travel within the slough, it is appropriate to assess exposure based on average concentrations throughout this area. In order to identify priority areas for remedial action of bioaccumulative contaminants, weighted average concentrations of contaminants of concern were calculated. As discussed in Section 7.3, bioaccumulative contaminants of greatest concern for the Lower Slough are PCBs and dieldrin.

The IS average for these compounds exceeds the risk-based concentrations using the BSAF developed for the Lower Slough as documented in Section 5.2. The available discrete sediment data for the Slough segment was used to prioritize areas to target for sediment cleanup efforts. The process consisted of the following steps:

1. Theissen polygons were generated for all available discrete data points in the Slough segment. This included the following data sets: DEQ 2009 data, ODOT Vancouver bridge construction data, Pacific Meat sediment data, and City of Portland 2006 sediment data. Because the discrete data was primarily focused on contaminant source areas, it is expected to generate a higher area weighted average than the IS samples.

2. Five-hundred-foot buffers were drawn around each data point to limit the size of the polygons generated for points with limited surrounding data. This left some “blank” areas or polygons with no associated discrete data points.

3. Areas for each polygon were calculated and the area of non-represented sediment (zones between polygons) was calculated.

4. Area-weighted average concentrations for PCBs and dieldren were calculated by assuming the concentration at the data point reflected the concentration of the polygon and applying the IS average concentration to the zones between polygons.

This process generated a segment-wide weighted average concentration for PCBs of 92.65 ug/kg and for dieldren of 1.82 ug/kg. This compares to the IS averages of 45.5 and 0.7 ug/kg respectively. As a guideline for identifying priority areas, the highest concentration polygons were successively reduced to the method detection limit (MDL) (assumed to be 10 ug/kg for PCBs and 1 ug/kg for dieldren) for these contaminants until the overall weighted average fell below the IS average.

For PCBs, five priority areas were identified as documented in Table 11 below and illustrated in Figure 34.

Table 9 PCB priority areas for cleanup

Sample location	PCB concentrations
Pacific Meat – 9 locations	123 - 2040 ug/kg
City of Portland OF 62–Wastech, Precision, B&R	904 ug/kg
OF 63 and Vancouver St. bridge	128 ug/kg
City of Portland OF 61	138 ug/kg
Downstream of OF 65	329.54 ug/kg

Clearly the Pacific Meat shoreline area has the highest priority for cleanup and is the best characterized area. Feasible cleanup measures can likely be developed with minimal additional data collection. Based on our limited study of the vertical variation of contaminant levels indicated in the Pacific Meat area, it appears likely that contamination is associated with historical as opposed to on-going releases.

Each of the other areas may require additional sediment sampling to define the lateral and vertical extent of significant sediment contamination and evaluating feasible cleanup approaches.

The second highest priority area is the OF 62/Wastech/Precision B&R reach. The likely sources for contamination in this area are an historic oil reclamation facility and contaminated fill along the bank of the Slough.

Figure 35 PCB Priority Cleanup Areas- shaded in light purple.

The dieldren evaluation was somewhat problematic due to the large number of samples in which dieldren was not detected and the elevated method detection limits. Several of the priority areas identified for PCBs were also identified as a priority for dieldren. DEQ recommends that cleanup evaluation focus on the priority areas identified for PCBs, and dieldren concentrations be re-evaluated once those actions have been completed. This focus is supported by the fact that PCB concentrations detected in sediment and fish tissue in this portion of the slough are more significantly elevated relative to risk-based levels than the dieldren concentrations.

In addition to the bioaccumulation evaluation, areas where benthic toxicity may be an issue were also evaluated. The OF62, Wastech, Precision and B&R area was the area with the clearest signal of benthic toxicity and this area has already been identified as the second highest priority for further investigation and cleanup. The only other location where toxicity was identified was OF 65. This is also a priority location but other than a former construction debris landfill there is little information on the likely sources.

8.3 Remedial Options

The US Army Corps of Engineers and the Multnomah County Drainage District have long wanted to do extensive dredging in the Lower Slough for flood control purposes but have been reluctant to do this work due to the significant cost for disposal of contaminated sediments. A safe and local repository for contaminated sediments would be necessary. Dredging of contaminated sediment is costly and carries some risk of stirring up and spreading residual contamination. Thin layer capping may be an option however it would discourage any future dredging operations whether for flood control or mass removal. Monitoring natural attenuation may be an option as it appears that sources are primarily historic in nature and they are being buried by recent, cleaner sediment.

DEQ plans to initiate discussions with local, state and federal officials and other public and private advocacy groups on cleanup approaches and strategies for the lower Slough with a goal of reaching consensus on a preferred strategy. This information will be essential to determine costs and funding mechanism to complete the cleanup.

9.0 REFERENCES:

Adolfson Associates, Inc. 1996 *Technical Memorandum on the Results of the 1995 Fish Consumption and Recreational Use Surveys – Amendment No. 1.*

Alaska Department of Environmental Conservation. 2009. *Draft Guidance on Multi Increment Soil Sampling.*

City of Portland-Bureau of Environmental Services. 2006. *Columbia Slough Sediment Program Watershed Action Plan.*

City of Portland- Bureau of Environmental Services. 2009. *Columbia Slough Sediment Analysis Sampling 2006,* prepared for the Oregon Department of Environmental Quality.

GeoSyntec and City of Portland - Bureau of Environmental Services. 2007. *Columbia Slough Fish Tissue Analysis,* prepared for the Oregon Department of Environmental Quality.

DEQ 2002. Columbia Slough – Baseline Concentrations, Documentation of Methodology, November 21, 2002.

DEQ 2005. *Record of Decision Remedial Action Approach for Columbia Slough Sediment.* Oregon Department of Environmental Quality, Environmental Cleanup Program.

DEQ. 2007. *Guidance for assessing Bioaccumulative Chemicals of Concern in Sediment*, Oregon Department of Environmental Quality, Environmental Cleanup Program.

DEQ. 2009. *Quality Assurance Project Plan-Columbia Slough Outfall 59-65 Sediment Study.* Document Number: DEQ09-LQ-0046-QAPP.

DEQ. 2009. *Standard Operating Procedure Multi-Incremental Sampling and Sub-sampling.* Document Number: DEQ09-LAB-0056-SOP.

DEQ. 2010. *ODEQ Final Laboratory Report for Columbia Slough Sampling Event.* Sampling Event Number 20090823-20090835 and 20090853-20090860 and 20090872-20090874.

Higgins J.J. 2004. *Introduction to Modern Nonparametric Statistics.* Duxbury Press.

ITRC, 2011. *Incremental Sampling Methodology, Technical and Regulatory Guidance*. The Interstate Technology Regulatory Council Incremental Sampling Methodology Team, March 2011.

Northwestern Aquatic Sciences. 2009a. *Toxicity of Freshwater Test Sediment collected for the Columbia Slough Outfall 59-65 Sediment Study using 10-day Chironomus dilutus Sediment Bioassay*. Prepared for the Oregon Department of Environmental Quality.

Northwestern Aquatic Sciences. 2009b. *Toxicity of Freshwater Test Sediment collected for the Columbia Slough Outfall 59-65 Sediment Study using 10-day Hyalella azteca Sediment Bioassay.* Prepared for the Oregon Department of Environmental Quality.

Parametrix, Inc. 1995. Columbia Slough Sediment Remedial Investigations/Feasibility Study Screening- Level Risk Assessment. Prepared for the City of Portland Bureau of Environmental Services

Puget Sound Water Quality Action Team. 1997. *Recommended Guidelines for Sampling Marine Sediment, Water Column and Tissue in Puget Sound.* Prepared for US EPA. http://www.psparchives.com/publications/our_work/science/protocals_guidelines/field.pdf

U.S. EPA. 2001. *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual.* EPA 823-B-01-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC. http://cluin.info/download/contaminantfocus/sediments/methods-for-collection-epa-manual.pdf

US EPA 2002. *Advances in PCB Analysis*. A Presentation by Andy Beliveau, Region 1 USEPA Office of Environmental Measurement and Evaluation. Prepared for the US. EPA Basic Research Program.

US EPA 2005. *Portland Harbor Joint Source Control Strategy.* Table 3-1 Screening Level Values for Soil/Storm Water Sediment, Storm Water,

US EPA 2009. *Calculation and Use of Reference Envelope for Portland Harbor Sediment Toxicity Test Interpretation. Benthic Reanalysis Technical Memorandum, DRAFT,* Prepared for the Lower Willamette Group by Windward Environmental LLC.

US EPA. 2009b. *Estimation of Biota Sediment Accumulation Factors (BSAF) from Paired Observations of Chemical Concentrations in Biota and Sediment*. US EPA Office of Research and Development. EPA/600/R-05/047. ERASC-013F.

U.S. EPA. 2010. *ProUCL Version 4.00.05 User Guide (Draft).* EPA/600/R-07/038, May 2010. Down load from http://www.epa.gov/nerlesd1/databases/datahome.htm

US EPA 2010b. *Biota-Sediment Accumulation Factor data set assembled from Superfund site data*. Available at: http://www.epa.gov/med/Prods_Pubs/bsaf.htm.

U.S. Army Corps of Engineers. 2009. *Nationwide Permit for Survey Activities. Permit # (NWP-2009-439)*. Issued August 28, 2009 expires March 2012.

Appendix A: Maps of Sample Locations

Figure A-1 Overview of IS decision unit and IS Sample points

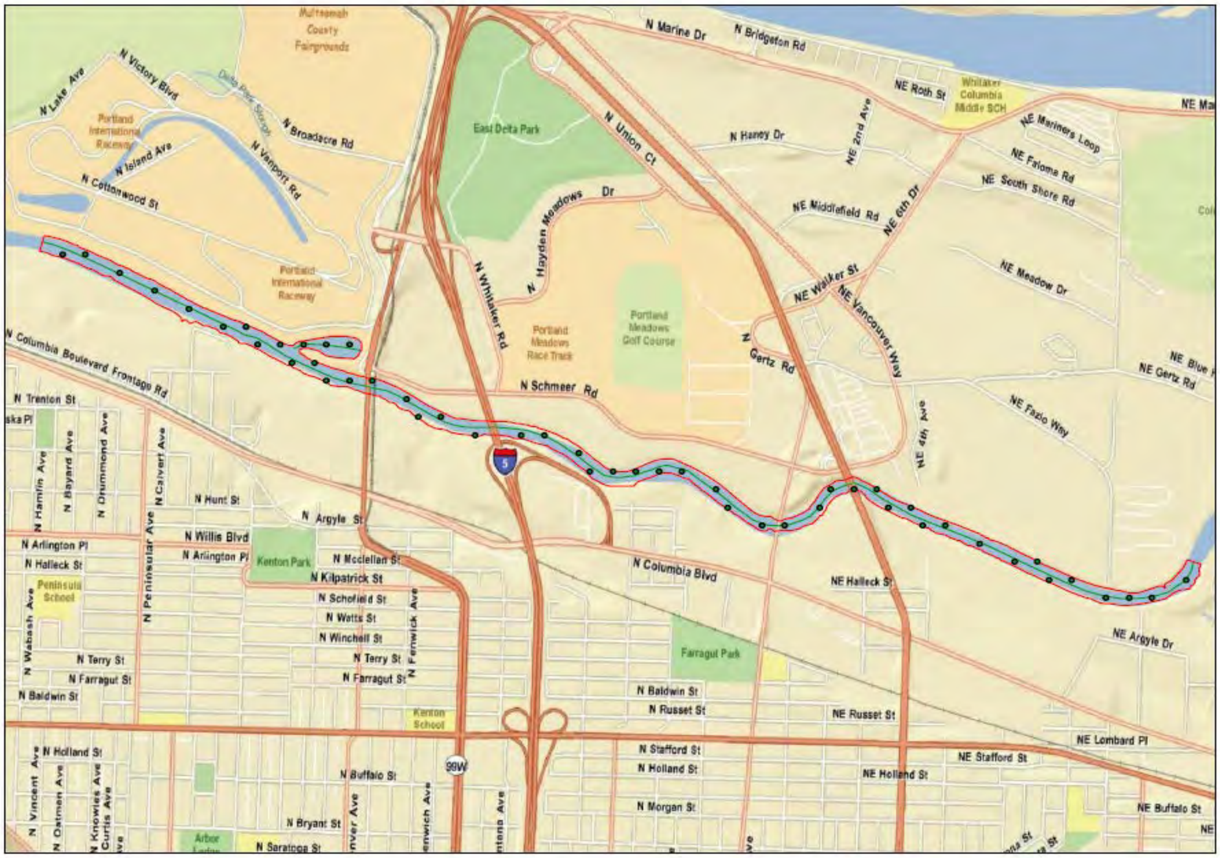


Figure A-2 Detailed Columbia Slough Sediment Study Map 1-11.

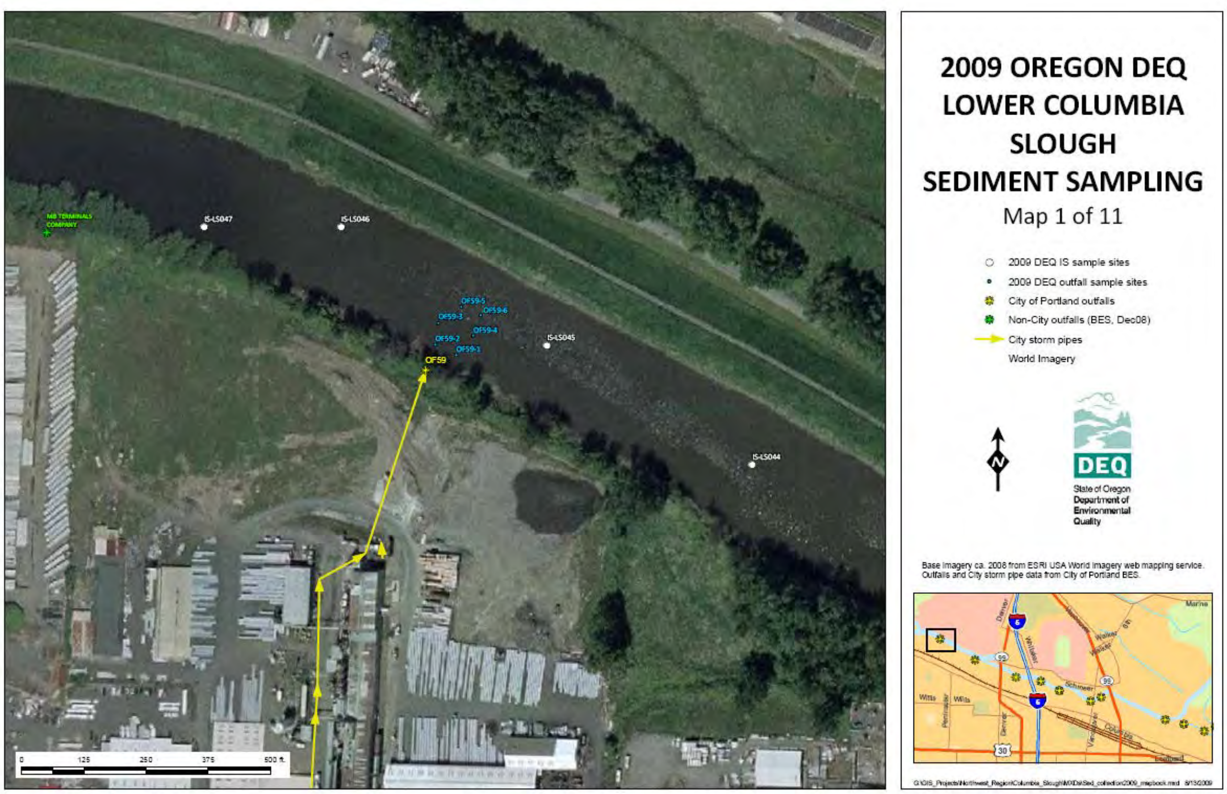


Figure A-3 Detailed Columbia Slough Sediment Study Map 2-11.

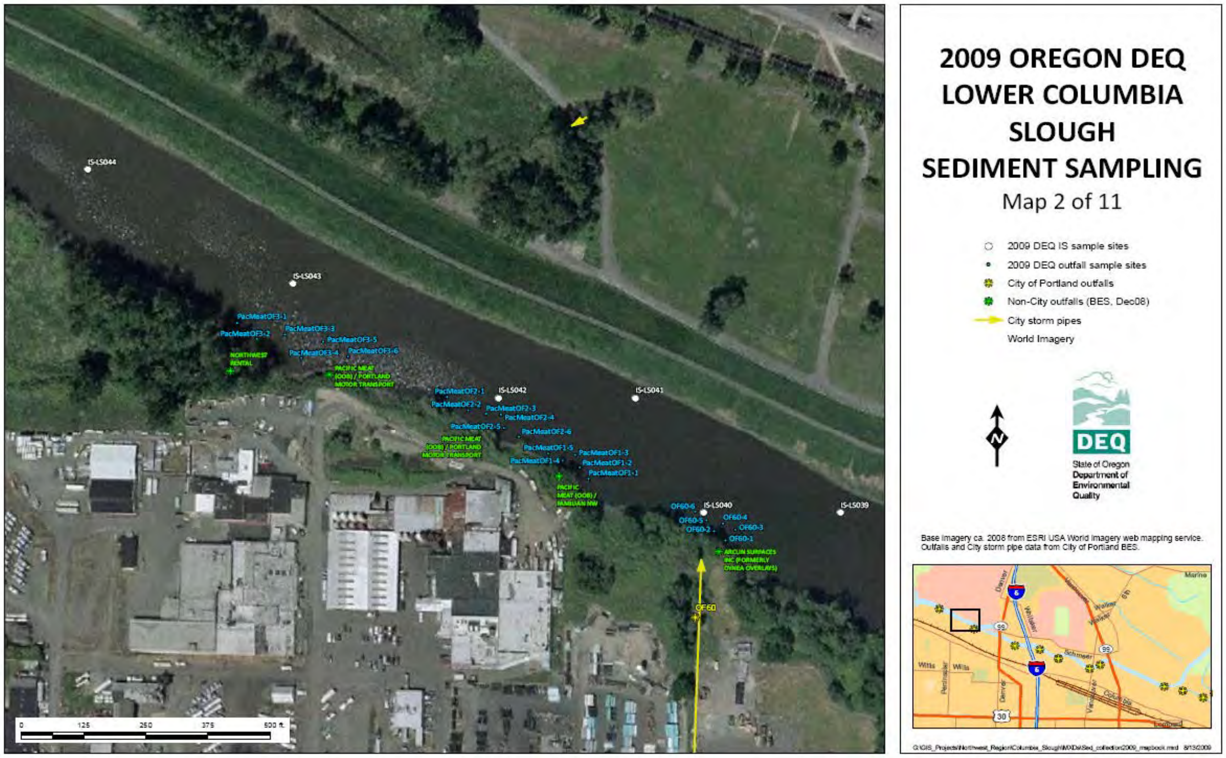
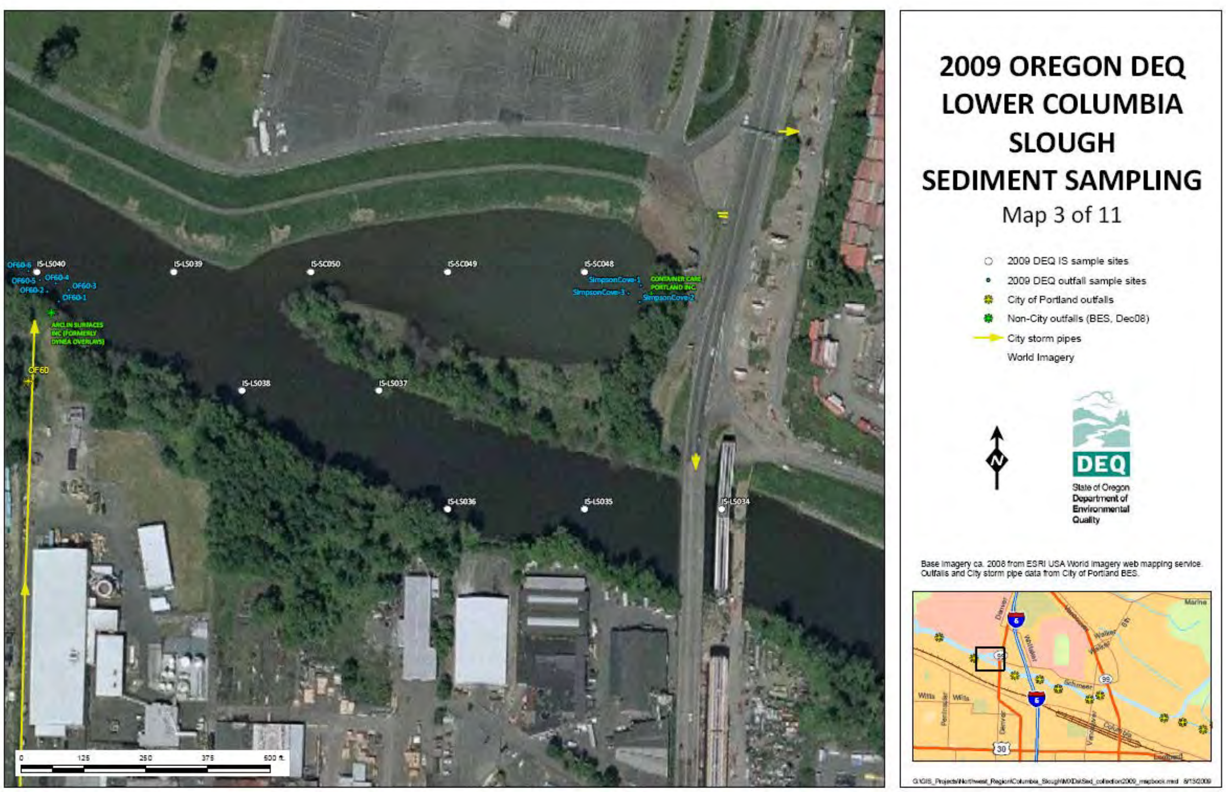


Figure A-4 Detailed Columbia Slough Sediment Study Map 3-11.



Appendix A: Maps of Sample Locations

Figure A-5 Detailed Columbia Slough Sediment Study Map 4-11.

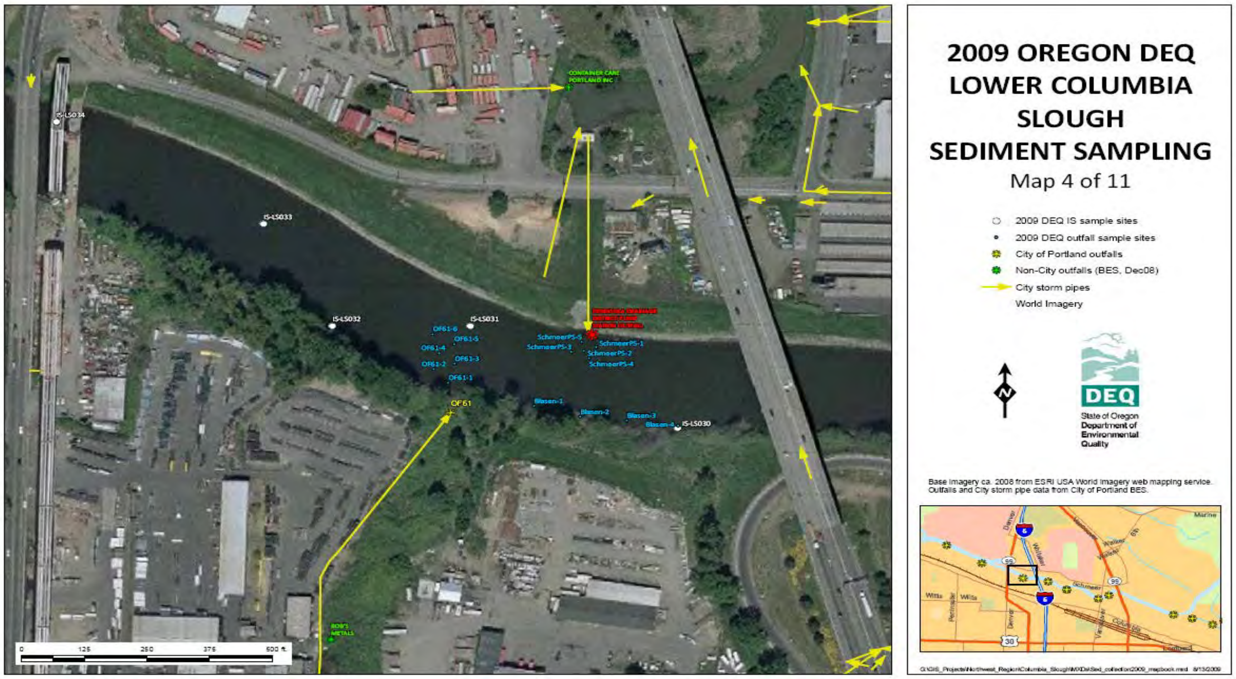
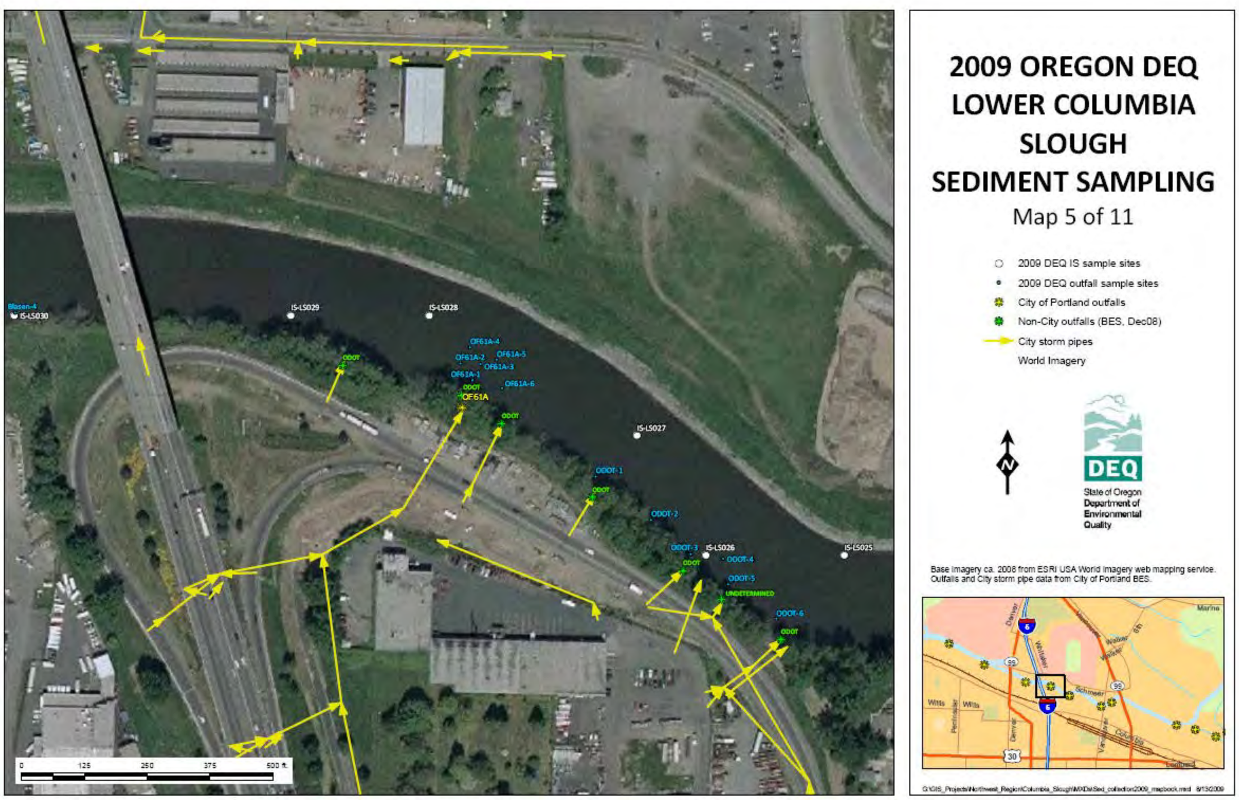


Figure A-6 Detailed Columbia Slough Sediment Study Map 5-11.



Appendix A: Maps of Sample Locations

Figure A-7 Detailed Columbia Slough Sediment Study Map 6-11.

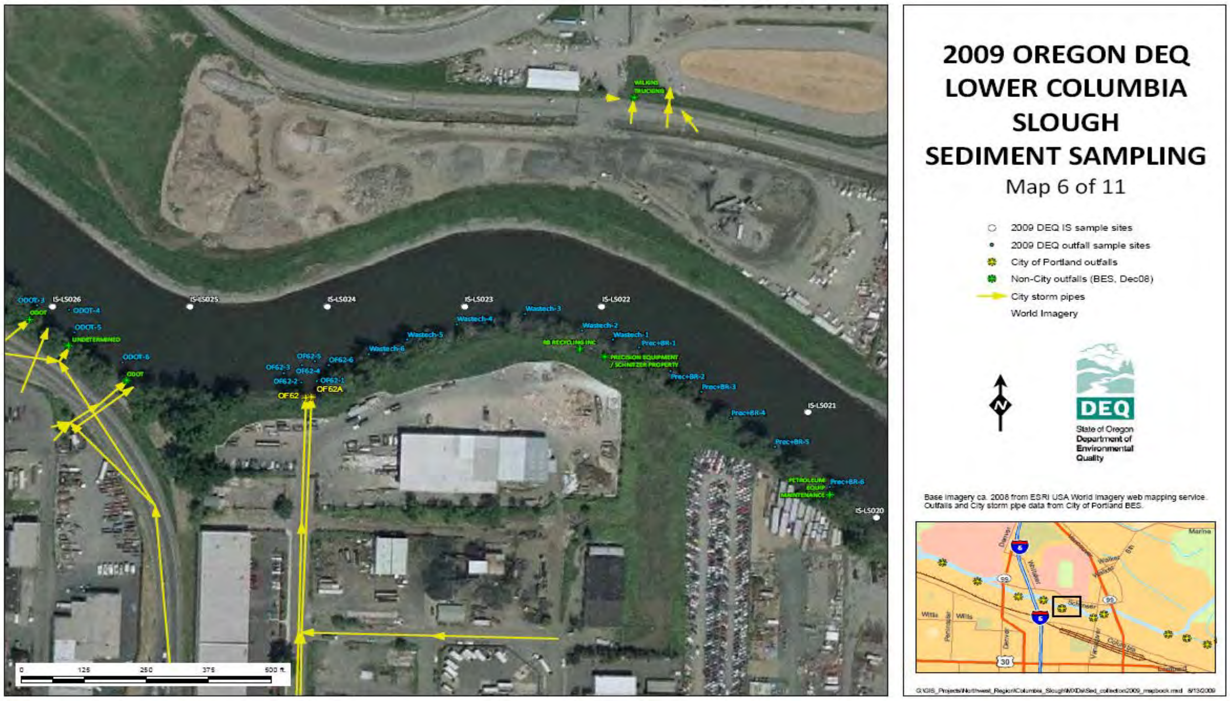
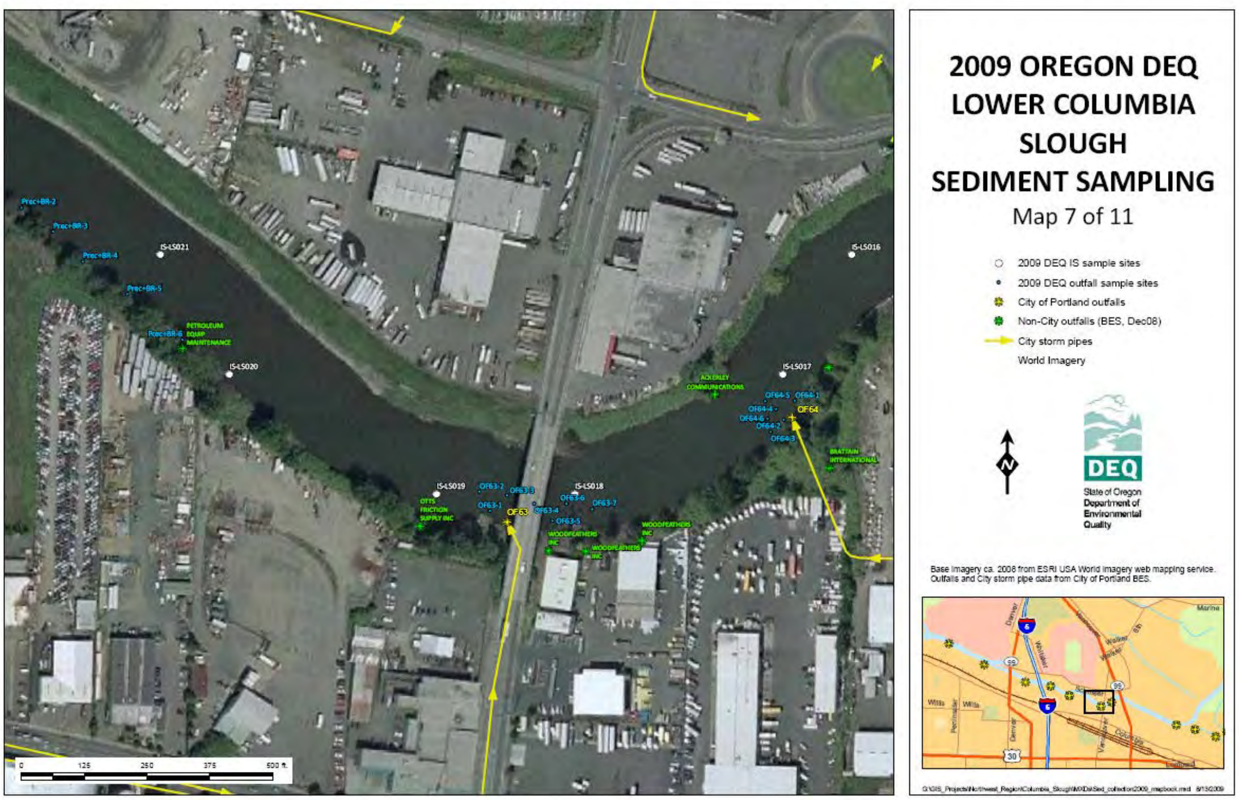


Figure A-8 Detailed Columbia Slough Sediment Study Map 7-11.



Appendix A: Maps of Sample Locations

Figure A-9 Detailed Columbia Slough Sediment Study Map 8-11.

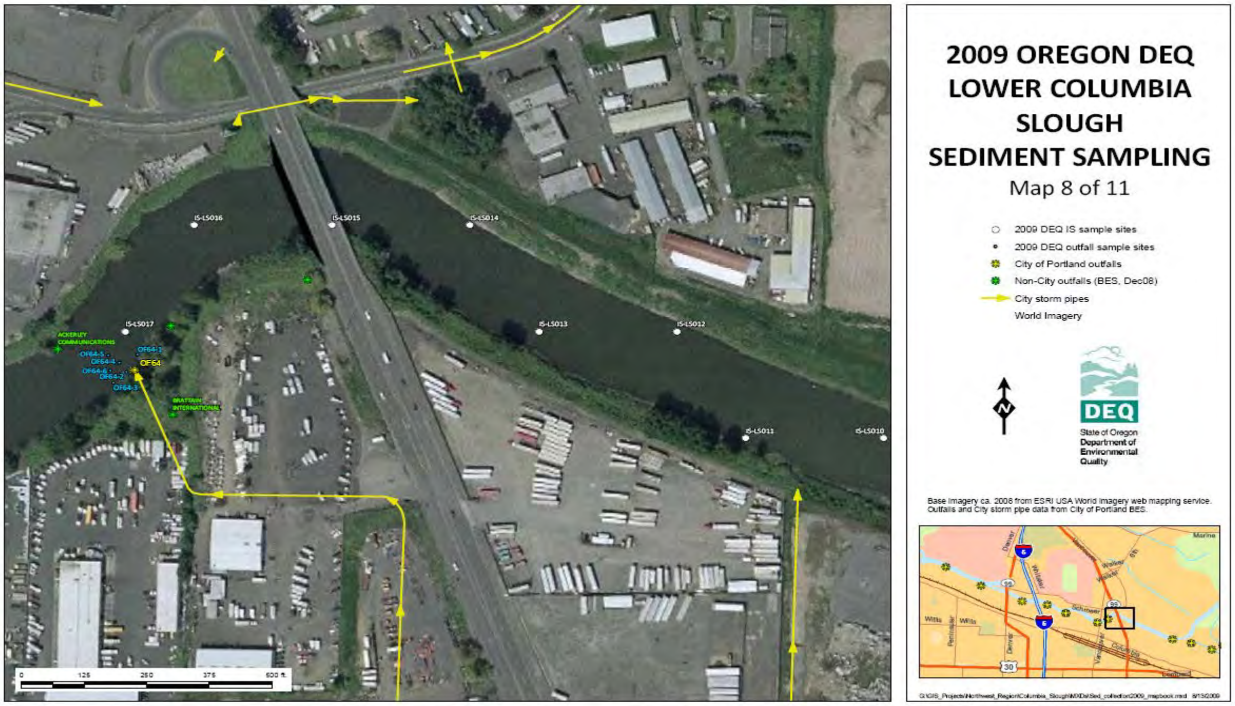
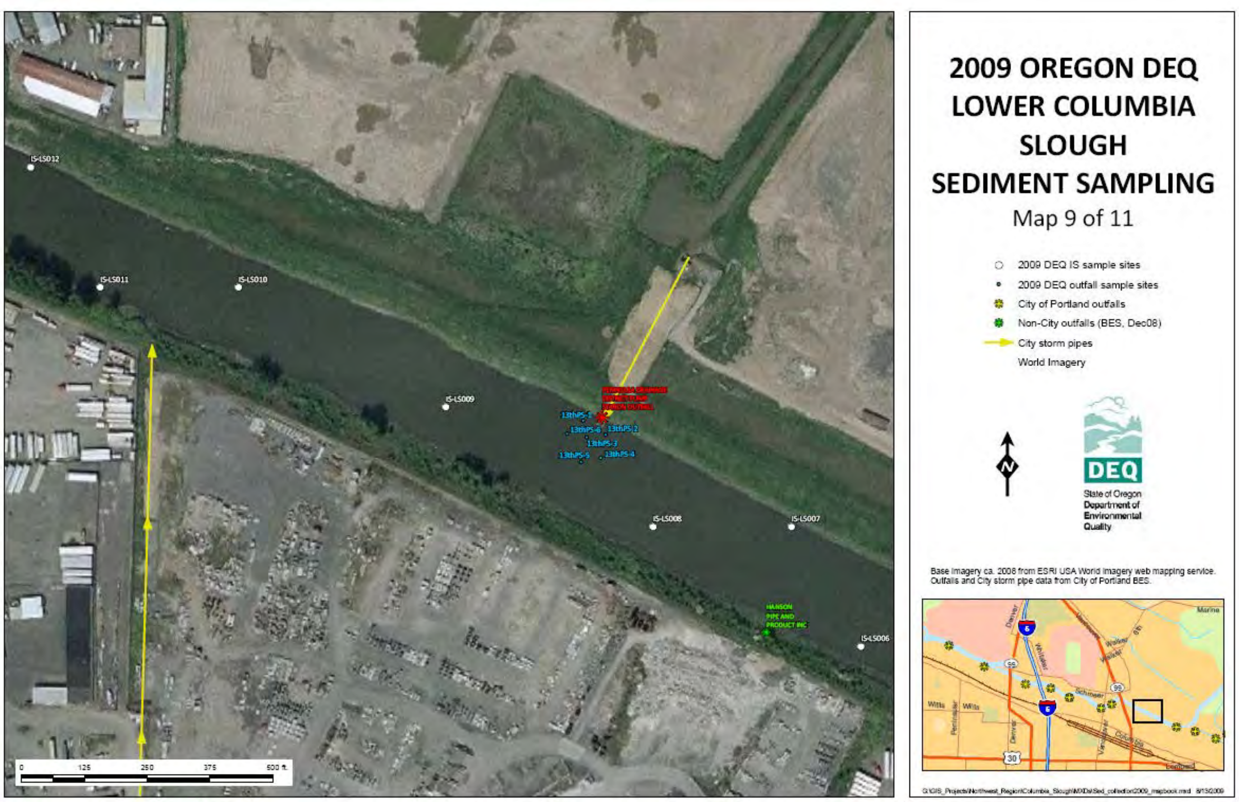


Figure A-10 Detailed Columbia Slough Sediment Study Map 9-11.



Appendix A: Maps of Sample Locations

Figure A-11 Detailed Columbia Slough Sediment Study Map 10-11.

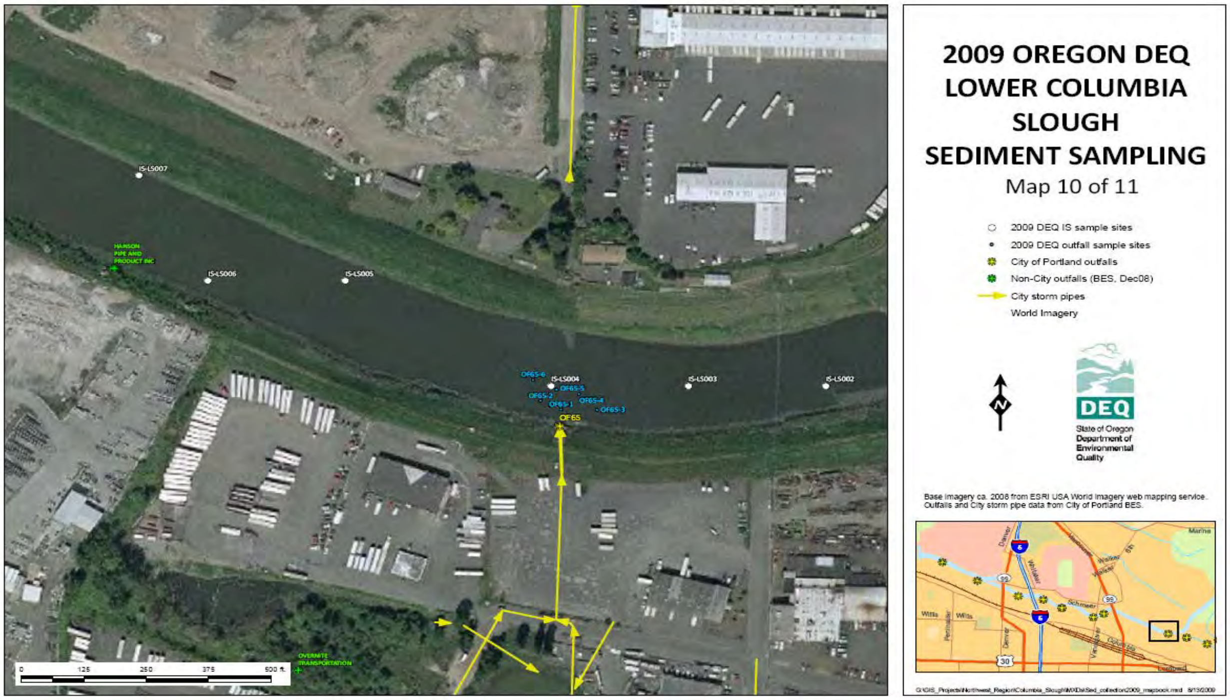
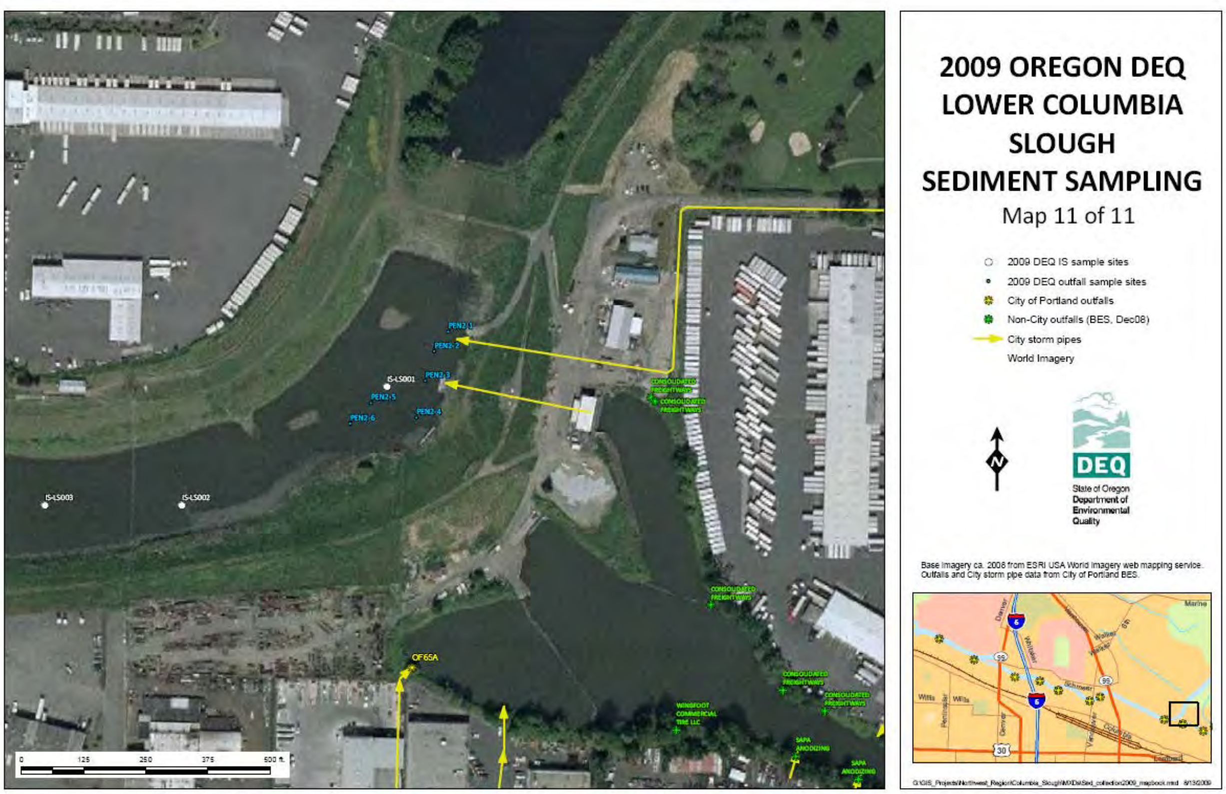


Figure A-12 Detailed Columbia Slough Sediment Study Map 11-11.



Appendix A: Maps of Sample Locations

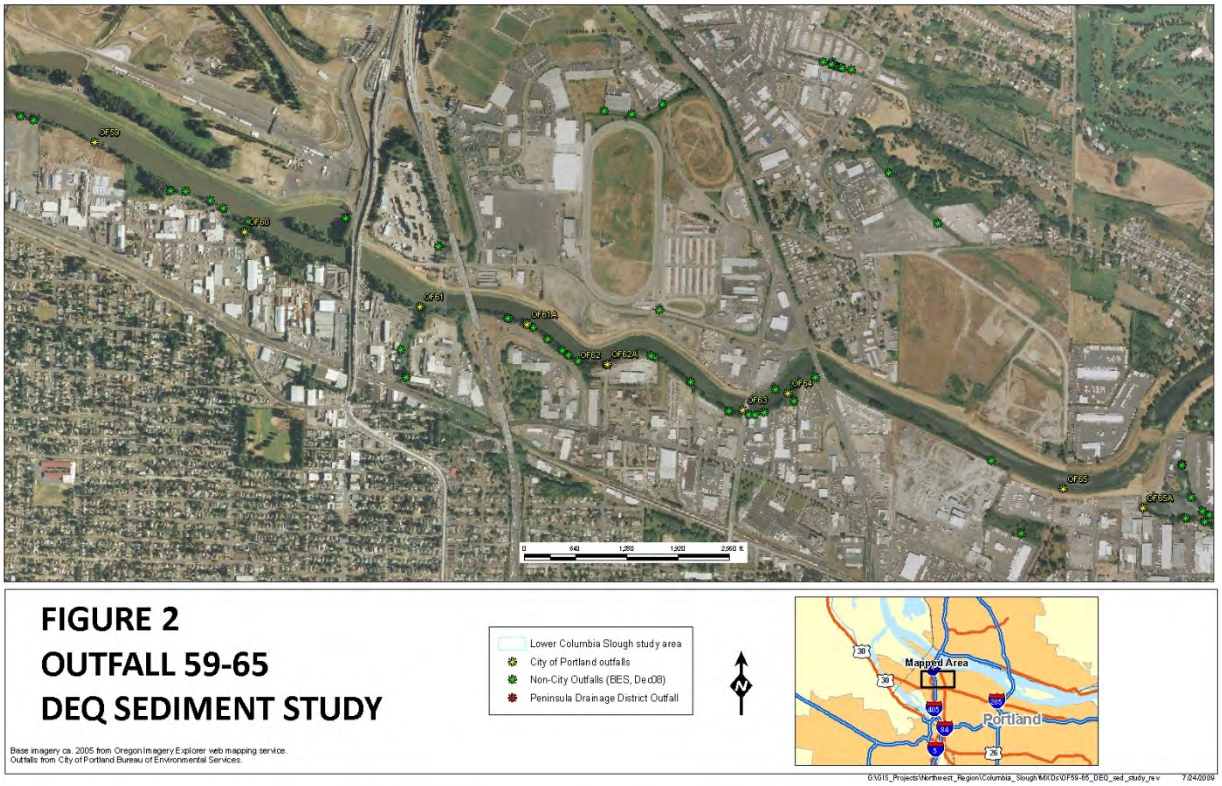


FIGURE 2
OUTFALL 59-65
DEQ SEDIMENT STUDY

Base imagery ca. 2005 from Oregon Imagery Explorer web mapping service.
Outfalls from City of Portland Bureau of Environmental Services.

G:\GIS_Projects\Northwest_Region\Columbia_Slough\MXDs\OF59-65_DEQ_sed_study_rev 7/24/2009

	Appendix B: Table of Sample Locations									
Lasar #	Site Name	Site Location	Lattitude	Longitude	lattitude(dd)	Longitude(dd)	depth(cm)	Number of Scoops	Volume	
					Centroid	Centroid		50mg= 1 scoop	requested	
35962	**Columbia Slough at City of Portland Outfall 65**				45.58259	-122.65192			3400g	
		OF65-1	45° 34.952' N	122° 39.116' W			7	12		
		OF65-3	45° 34.952' N	122° 39.099' W			10	12		
		OF65-2	45° 34.955' N	122° 39.126' W			10	12		
		OF65-4	45° 34.957' N	122° 39.107' W			7	12		
		OF65-5	45° 34.959' N	122° 39.118' W			10	12		
		OF65-6	45° 34.962' N	122° 39.129' W			7	12		
35963	**Columbia Slough at PEN 2 Levee**				45.58338	-122.64805			425g	
		PEN2-1	45° 35.022' N	122° 38.869' W			5	2		
		PEN2-2	45° 35.015' N	122° 38.875' W			5	2		
		PEN2-3	45° 35. 006' N	122° 38.914' W			5	2		
		PEN2-4	45° 34. 994' N	122° 38.888' W			5	2		
		PEN2-5	45° 35.003' N	122° 38.919' W			7	2		
		PEN2-6	45° 34.998' N	122° 38.922' W			10	2		
35964	**Columbia Slough at 13th Ave. pumpstation**				45.58435	-122.65688			425g	
		13thPS-1	45° 35.068' N	122° 39.415' W			5	2		
		13thPS-2	45° 35.063' N	122° 39.404' W			10	2		
		13thPS-3	45° 35.062' N	122° 39.413' W			7	2		
		13thPS-4	45° 35.056' N	122° 39.407' W			10	2		
		13thPS-5	45° 35.054' N	122° 39.416' W			10	2		
		13thPS-6	45° 35.063' N	122° 39.423' W			5	2		
35965	**Columbia Slough at City of Portland Outfall 63**				45.58485	-122.66749			3400g	
		OF63-1	45° 35.093' N	122° 40.068' W			5	10		
		OF63-2	45° 35.100' N	122° 40.073' W			10	10		
		OF63-3	45° 35.099' N	122° 40.061' W			7	10		
		OF63-4	45° 35.096' N	122° 40.048' W			10	10		
		OF63-5	45° 35.099' N	122° 40. 034' W			7	10		
		OF63-6	45° 35.096' N	122° 40.033' W			10	10		
		OF63-7	45° 35.095' N	122° 40.020' W			10	10		
35966	**Columbia Slough at City of Portland Outfall 64**				45.58548	-122.66557			3400g	
		OF64-1	45° 35.132' N	122° 39.928' W			10	12		
		OF64-2	45° 35.126' N	122° 39.932' W			10	12		
		OF64-3	45° 35.122' N	122° 39.938' W			10	12		
		OF64-4	45° 35.129' N	122° 39.936' W			10	12		
		OF64-5	45° 35.132' N	122° 39.941' W			10	12		
		OF64-6	45° 35.126' N	122° 39.940' W			10	12		
35967	**Columbia Slough at Prec+BR**				45.58627	-122.67116			3400g	
		Prec+BR-1	45° 35.197' N	122° 40.305' W			10	12		
		Prec+BR-2	45° 35.188' N	122° 40.290' W			10	12		
		Prec+BR-3	45° 35.181' N	122° 40.284' W			10	12		
		Prec+BR-4	45° 35.171' N	122° 40.261' W			10	12		
		Prec+BR-5	45° 35.161' N	122° 40.240' W			10	12		
		Prec+BR-6	45° 35.147' N	122° 40.213' W			10	12		

Lasar #	Site Name	Site Location	Lattitude	Longitude	lattitude(dd) Centroid	Longitude(dd) Centroid	depth(cm)	Number of Scoops 50mg= 1 scoop	Volume requested	
35968	**Columbia Slough at Wastech**				45.58684	-122.67288			3400g	
		Wastech-1	45° 35.199' N	122° 40.317' W			10	12		
		Wastech-2	45° 35.203' N	122° 40.332' W			10	12		
		Wastech-3	45° 35.208' N	122° 40.359' W			7	12		
		Wastech-4	45° 35.204' N	122° 40.391' W			10	12		
		Wastech-5	45° 35.198' N	122° 40.414' W			10	12		
		Wastech-6	45° 35.192' N	122° 40.432' W			10	12		
35969	**Columbia Slough at City of Portland Outfall 62**				45.5864	-122.67433			3400g	
		OF62-1	45° 35.182' N	122° 40.456' W			10	12		
		OF62-2	45° 35.181' N	122° 40.463' W			10	12		
		OF62-3	45° 35.184' N	122° 40.471' W			10	12		
		OF62-4	45° 35.187' N	122° 40.463' W			10	12		
		OF62-5	45° 35.189' N	122° 40.457' W			10	12		
		OF62-6	45° 35.188' N	122° 40.450' W			10	12		
35970	**Columbia Slough at ODOT outfall**				45.58677	-122.67637			425g	
		ODOT-1	45° 35.232' N	122° 40.633' W			10	2		
		ODOT-2	45° 35.218' N	122° 40.607' W			10	2		
		ODOT-3	45° 35.207' N	122° 40.588' W			10	2		
		ODOT-4	45° 35.206' N	122° 40.573' W			5	2		
		ODOT-5	45° 35.197' N	122° 40.570' W			10	2		
		ODOT-6	45° 35.187' N	122° 40.547' W			5	2		
35971	**Columbia Slough at City of Portland Outfall 61A**				45.58774	-122.67815			3400g	
		OF61A-1	45° 35.262' N	122° 40.692' W			10	12		
		OF61A-2	45° 35.268' N	122° 40.697' W			10	12		
		OF61A-3	45° 35.268' N	122° 40.688' W			10	12		
		OF61A-4	45° 35.273' N	122° 40.693' W			5	12		
		OF61A-5	45° 35.269' N	122° 40.681' W			10	12		
		OF61A-6	45° 35.260' N	122° 40.678' W			10	12		
35972	**Columbia Slough at Blasen**				45.58805	-122.68234			425g	
		Blasen-1	45° 35.287' N	122° 40.973' W			10	2		
		Blasen-2	45° 35.283' N	122° 40.951' W			10	2		
		Blasen-3	45° 35.282' N	122° 40.930' W			10	2		
		Blasen-4	45° 35.280' N	122° 40.906' W			10	2		
35973	**Columbia Slough at Schmeer Pumpstation**				45.58849	-122.6825			425g	
		SchmeerPS-1	45° 35.310' N	122° 40.945' W			10	2		
		SchmeerPS-2	45° 35.308' N	122° 40.951' W			10	2		
		SchmeerPS-3	45° 35.307' N	122° 40.957' W			10	2		
		SchmeerPS-4	45° 35.305' N	122° 40.948' W			10	2		
		SchmeerPS-5	45° 35.312' N	122° 40.952' W			10	2		
35974	**Columbia Slough at City of Portland Outfall 61A**				45.58838	-122.6836			3400g	
		OF61-1	45° 35.295' N	122° 41.014' W			10	12		
		OF61-2	45° 35.300' N	122° 41.020' W			10	12		
		OF61-3	45° 35.302' N	122° 41.011' W			10	12		
		OF61-4	45° 35.306' N	122° 41.018' W			7	12		
		OF61-5	45° 35.310' N	122° 41.011' W			10	12		
		OF61-6	45° 35.313' N	122° 41.022' W			10	12		
35975	**Columbia Slough at Simpson Cove**				45.59103	-122.68738			425g	
		SimpsonCove-1	45° 35.475' N	122° 41.245' W			10	3		
		SimpsonCove-2	45° 35.478' N	122° 41.241' W			10	3		
		SimpsonCove-3	45° 35.485' N	122° 41.247' W			10	3		

Appendix B: Table of Targeted Sample Locations

Lasar #	Site Name	Site Location	Lattitude	Longitude	lattitude(dd)	Longitude(dd)	depth(cm)	Number of Scoops	Volume	
					Centroid	Centroid		50mg= 1 scoop	requested	
35976	**Columbia Slough at City of Portland Outfall 60**				45.59096	-122.69197			3400g	
		OF60-1	45° 35.454' N	122° 41.515' W			10	12		
		OF60-2	45° 35.457' N	122° 41.520' W			10	12		
		OF60-3	45° 35.458' N	122° 41.510' W			10	12		
		OF60-4	45° 35.460' N	122° 41.516' W			10	12		
		OF60-5	45° 35.461' N	122° 41.524' W			10	12		
		OF60-6	45° 35.463' N	122° 41.529' W			10	12		
35977	**Columbia Slough at PacificMeats outfall 1**				45.59131	-122.69317			3400g	
		PacMeatOF1-1	45° 35.474' N	122° 41.580' W			10	14		
		PacMeatOF1-2	45° 35.478' N	122° 41.585' W			10	14		
		PacMeatOF1-3	45° 35.482' N	122° 41.587' W			10	14		
		PacMeatOF1-4	45° 35.480' N	122° 41.593' W			10	14		
		PacMeatOF1-5	45° 35.482' N	122° 41.599' W			10	14		
35977	**Columbia Slough at PacificMeats outfall 1**				45.59131	-122.69317			425g	
		PacMeatOF1-1	45° 35.474' N	122° 41.580' W			5	4		
		PacMeatOF1-2	45° 35.478' N	122° 41.585' W			5	4		
		PacMeatOF1-3	45° 35.482' N	122° 41.587' W			5	4		
		PacMeatOF1-4	45° 35.480' N	122° 41.593' W			5	4		
		PacMeatOF1-5	45° 35.482' N	122° 41.599' W			5	4		
35978	**Columbia Slough at PacificMeats outfall 2**				45.59154	-122.69378			3400g	
		PacMeatOF2-1	45° 35.501' N	122° 41.648' W			10	12		
		PacMeatOF2-2	45° 35.496' N	122° 41.638' W			10	12		
		PacMeatOF2-3	45° 35.495' N	122° 41.629' W			10	12		
		PacMeatOF2-4	45° 35.495' N	122° 41.622' W			10	12		
		PacMeatOF2-5	45° 35.490' N	122° 41.621' W			10	12		
		PacMeatOF2-6	45° 35.488' N	122° 41.614' W			10	12		
35978	**Columbia Slough at PacificMeats outfall 2**				45.59154	-122.69378			425g	
		PacMeatOF2-1	45° 35.501' N	122° 41.648' W			5	3		
		PacMeatOF2-2	45° 35.496' N	122° 41.638' W			5	3		
		PacMeatOF2-3	45° 35.495' N	122° 41.629' W			5	3		
		PacMeatOF2-4	45° 35.495' N	122° 41.622' W			5	3		
		PacMeatOF2-5	45° 35.490' N	122° 41.621' W			5	3		
		PacMeatOF2-6	45° 35.488' N	122° 41.614' W			5	3		
35979	**Columbia Slough at PacificMeats outfall 3**				45.59194	-122.69536			425g	
		PacMeatOF3-1	45. 35. 538 N	122° 41.748' W			10	2		
		PacMeatOF3-2	45. 35. 537 N	122° 41.738' W			10	2		
		PacMeatOF3-3	45. 35. 533 N	122° 41.725' W			10	2		
		PacMeatOF3-4	45. 35. 529 N	122. 41. 722 W			10	2		
		PacMeatOF3-5	45° 35.519' N	122° 41.707' W			10	2		
		PacMeatOF3-6	45° 35.514' N	122° 41.695' W			10	2		
35980	**Columbia Slough at City of Portland Outfall 59**				45.59362	-122.69936				
		OF59-1	45° 35.609' N	122° 41.961' W			10	2	3400g	
		OF59-2	45° 35.612' N	122° 41.971' W			10	2		
		OF59-3	45° 35.619' N	122° 41.970' W			10	2		
		OF59-4	45° 35.615' N	122° 41.953' W			10	2		
		OF59-5	45° 35.625' N	122° 41.959' W			10	2		
		OF59-6	45° 35.622' N	122° 41.950' W			10	2		

Appendix B: Table of Sample Locations

LASAR #	Incremental Sampling Locations Site Name	Triplicate A	B	C	Latitude	Longitude	Actual Latitude*	Actual Longitude*	Sample Depth
35981	Columbia Slough btwn between River Mile 5.9 and 8.7. Integrated Sample(IS)				45.58660	-122.6746			8.6
	IS-LS001	A	B		45° 35.004' N	122° 38.897' W			5
	IS-LS002	A	B		45° 34.962' N	122° 38.992' W			5
	IS-LS003		B	C	45° 34.961' N	122° 39.056' W			5
	IS-LS004	A	B		45° 34.960' N	122° 39.121' W			N/a
	IS-LS005	A	B		45° 34.997' N	122° 39.219' W			7
	IS-LS006		B	C	45° 34.996' N	122° 39.283' W			10
	IS-LS007	A			45° 35.035' N	122° 39.317' W			7
	IS-LS008	A			45° 35.034' N	122° 39.381' W			7
	IS-LS009	A	B		45° 35.071' N	122° 39.480' W			7
	IS-LS010		B	C	45° 35.108' N	122° 39.578' W			7
	IS-LS011		B	C	45° 35.107' N	122° 39.642' W			10
	IS-LS012	A	B		45° 35.146' N	122° 39.676' W			5
	IS-LS013	A		C	45° 35.145' N	122° 39.740' W			7
	IS-LS014		B	C	45° 35.183' N	122° 39.774' W			10
	IS-LS015	A		C	45° 35.182' N	122° 39.838' W			10
	IS-LS016		B	C	45° 35.181' N	122° 39.903' W			10
	IS-LS017	A		C	45° 35.141' N	122° 39.934' W			10
	IS-LS018	A		C	45° 35.100' N	122° 40.029' W			10
	IS-LS019		B	C	45° 35.099' N	122° 40.093' W			10
	IS-LS020	A		C	45° 35.136' N	122° 40.191' W			10
	IS-LS021	A	B		45° 35.175' N	122° 40.225' W			10
	IS-LS022	A		C	45° 35.212' N	122° 40.323' W			N/a
	IS-LS023	A		C	45° 35.211' N	122° 40.388' W			10
	IS-LS024			C	45° 35.210' N	122° 40.452' W			10
	IS-LS025	A		C	45° 35.208' N	122° 40.516' W			10
	IS-LS026		B	C	45° 35.207' N	122° 40.581' W			5
	IS-LS027		B		45° 35.246' N	122° 40.615' W			10
	IS-LS028	A	B		45° 35.283' N	122° 40.713' W			10
	IS-LS029	A		C	45° 35.282' N	122° 40.777' W			7
	IS-LS030		B		45° 35.279' N	122° 40.906' W			7
	IS-LS031	A	B		45° 35.317' N	122° 41.004' W			10
	IS-LS032		B	C	45° 35.316' N	122° 41.069' W			10
	IS-LS033			C	45° 35.354' N	122° 41.102' W			10
	IS-LS034	A		C	45° 35.391' N	122° 41.200' W			7
	IS-LS035	A	B		45° 35.390' N	122° 41.265' W			10
	IS-LS036		B	C	45° 35.389' N	122° 41.329' W			7
	IS-LS037	A	B		45° 35.428' N	122° 41.363' W			10
	IS-LS038			C	45° 35.426' N	122° 41.427' W			7
	IS-LS039	A		C	45° 35.465' N	122° 41.461' W			10
	IS-LS040		B	C	45° 35.464' N	122° 41.526' W			5
	IS-LS041		B		45° 35.502' N	122° 41.559' W			10
	IS-LS042	A	B		45° 35.501' N	122° 41.624' W			7

Appendix B: Table of Sample Locations

LASAR #	Incremental Sampling Locations Site Name	Triplicate A	B	C	Latitude	Longitude	Actual Latitude*	Actual Longitude*	Sample Depth
	IS-LS043			C	45° 35.538' N	122° 41.722' W			10
	IS-LS044	A			45° 35.576' N	122° 41.820' W			10
	IS-LS045		B	C	45° 35.613' N	122° 41.918' W			7
	IS-LS046	A	B		45° 35.650' N	122° 42.016' W			10
	IS-LS047	A		C	45° 35.649' N	122° 42.081' W			10
	IS-SC048	A		C	45° 35.468' N	122° 41.268' W	45. 35. 490 N	122. 41. 294 W	10
	IS-SC049		B	C	45° 35.467' N	122° 41.332' W	45. 35.482 N	122. 41. 351 W	10
	IS-SC050	A	B		45° 35.466' N	122° 41.397' W	45° 35.466' N	122. 41.424 W	10

* unable to get to exact locations due to very soft sediments and Simpson Cove not boatable-even at high tide(6in of water).

Appendix B: Sample Location Field Notes

Lasar #	PaceLab ID #	Site Name	Abrev. Name	lattitude(dd) Centroid	Longitude(dd) Centroid	Date Sampled	Depth (cm-ave)	How Sampled	Field Comments(numbers refer to specific sample locations)
35962	20090827-35962	Columbia Slough at City of Portland Outfall 65	OF 65	45.58259	-122.65192	9/8/2009	8	glass scoop & Dredge	moved site 5 due to gravel bottom
35963	20090823-35963	Columbia Slough at PEN 2 Levee	PEN 2	45.58338	-122.64805	9/2/2009	7	dredge	a lot of gravel/cobble- changed sample points-within 15ft
35964	20090824-35964	Columbia Slough at 13th Ave. pumpstation	13th	45.58435	-122.65688	9/2/2009	8	dredge	
35965	20090829-35965	Columbia Slough at City of Portland Outfall 63	OF 63	45.58485	-122.66749	9/8/2009	8	dredge	#4 all rocky-moved site; #1 gravel-fair sample
35966	20090828-35966	Columbia Slough at City of Portland Outfall 64	OF 64	45.58548	-122.66557	9/8/2009	10	dredge	#6 oil sheen, #1&3 macrophytes
35967	20090834 FP-35967;20090834 FD-35967	Columbia Slough at Prec+BR	Prec+BR	45.58627	-122.67116	9/3/2009	10	glass scoop	iron seap near #6; Field Duplicate
35968	20090835-35968	Columbia Slough at Wastech	Wastech	45.58684	-122.67288	9/3/2009	10	ss spoon	#4 sample smelled 'sweet' woody debris present
35969	20090830-35969	Columbia Slough at City of Portland Outfall 62	OF 62	45.5864	-122.67433	9/9/2009	7	ss spoon & dredge	#3, 4 gravel-all others mud
35970	20090825-35970	Columbia Slough at ODOT outfall	ODOT	45.58677	-122.67637	9/3/2009	10	ss spoon	#1 chemical smell, #6 oil sheen, woody layer at 10-15cm throughout area
35971	20090831-35971	Columbia Slough at City of Portland Outfall 61A	OF 61A	45.58774	-122.67815	9/9/2009	9	ss spoon	some woody debris
35972	20090826-35972	Columbia Slough at Blasen	Blasen	45.58805	-122.68234	9/4/2009	10	ss spoon	
35973	20090832-35973	Columbia Slough at Schmeer Pumpstation	Schmeer	45.58849	-122.6825	9/9/2009	10	dredge	
35974	20090853 FP-35974;20090853 FD-35974	Columbia Slough at City of Portland Outfall 61	OF 61	45.58838	-122.6836	9/14/2009	9	ss spoon & dredge	silt and gravel; Field Duplicate
35975	20090833-35975	Columbia Slough at Simpson Cove	SMPCV	45.59103	-122.68738	9/9/2009	10	ss spoon	moved sample points due to soft mud and unboatable(6in of water at high tide) iron precipitate in cove
35976	20090854-35976	Columbia Slough at City of Portland Outfall 60	OF 60	45.59096	-122.69197	9/14/2009	10	ss spoon & dredge	Dyena outfall flowing; #6 woody debris
35977	20090860-35977 10cm	Columbia Slough at PacificMeats outfall 1	PM 1-10	45.59131	-122.69317	9/15/2009	10	ss spoon & dredge	sweet smell?
35977	20090859-35977 5cm	Columbia Slough at PacificMeats outfall 1	PM 1-5	45.59131	-122.69317	9/15/2009	5	ss spoon & dredge	sweet smell?
35978	20090857-35978 10cm	Columbia Slough at PacificMeats outfall 2	PM 2-10	45.59154	-122.69378	9/15/2009	10	ss spoon & dredge	oil sheen at about 10cm depth? Not on surface-below foot prints, etc
35978	20090858-35978 5cm	Columbia Slough at PacificMeats outfall 2	PM 2-5	45.59154	-122.69378	9/15/2009	5	ss spoon & dredge	
35979	20090855-35979	Columbia Slough at PacificMeats outfall 3	PM 3	45.59194	-122.69536	9/14/2009	10	dredge	very soft sediment, unable to get exact lat due to tide level and too soft to walk on sediment
35980	20090856-35980	Columbia Slough at City of Portland Outfall 59	OF 59	45.59362	-122.69936	9/15/2009	10	ss spoon & dredge	oily sheen; asphalt shingle 'gravel' at outfall pipe continues ~40ft to a fan at edge of low tide mark.

Appendix C:
Lower Columbia Slough between River Mile 5.9 and 8.7 Summary Statistics

			% of total	% of total			
	Columbia Slough RM 5.9 and 8.7 Sampling area		**exceeding**	**exceeding**			
		% Detect	**Risk base Values**	**2009 IS Mean**	**%Estimates**	**Mean**	**Range**
Metals	Total Aluminum	100%	N/A	38%	0%	15765.4	10800-22000
(ppm)	Total Antimony	46%	0%	46%	27%	0.9	<0.50-3.05
	Total Arsenic	100%	27%	58%	0%	6.6	2.5-22.6
	Total Barium	100%	N/A	42%	0%	120.9	80-160
	Total Cadmium	81%	35%	54%	0%	0.9	<0.5-1.9
	Total Chromium	100%	50%	46%	0%	59.8	19-481
	Total Cobalt	100%	N/A	69%	0%	11.0	8.05-19.5
	Total Copper	100%	62%	65%	0%	56.6	17.2-148
	Total Lead	100%	92%	62%	0%	65.1	13.4-212
	Total Manganese	100%	0%	46%	0%	425.5	203-732
	Mercury	100%	81%	54%	4%	0.1	0.02-0.63
	Total Nickel	100%	12%	65%	0%	32.8	15-255
	Total Selenium	0%	N/A	N/A	0%	1.0	<1
	Total Silver	58%	0%	0%	0%	0.2	<0.2-0.49
	Total Thallium	0%	N/A	N/A	0%	0.2	<0.2
	Total Zinc	100%	85%	54%	0%	300.3	98-875
			% Exceeding			ug/kg	ug/kg
Columbia Sloug	**Columbia Slough RM 5.9 and 8.7 Sampling a**	**% Detect**	**Risk base**		**%Estimates**	**Mean**	**Range**
Semi-Vols	1,2,4,5-Tetrachlorobenzene	0%	N/A	N/A	0%	<66.0	<66.0
(ppb)	1,2,4-Trichlorobenzene	0%	N/A	N/A	0%	<66.0	<66.0
	1,2-Dichlorobenzene	0%	N/A	N/A	0%	<66.0	<66.0
	1,3-Dichlorobenzene	0%	N/A	N/A	0%	<66.0	<66.0
	1,4-Dichlorobenzene	0%	N/A	N/A	0%	<66.0	<66.0
	2,3,4,6-Tetrachlorophenol	4%	N/A	0%	4%	<66.0	<66.0- 65
	2,3,5,6-Tetrachlorophenol	0%	N/A	N/A	0%	<66.0	<66.0
	2,4,5-Trichlorophenol	0%	N/A	N/A	0%	<66.0	<66.0
	2,4,6-Trichlorophenol	0%	N/A	N/A	0%	<66.0	<66.0
	2,4-Dichlorophenol	0%	N/A	N/A	0%	<66.0	<66.0
	2,4-Dimethylphenol	0%	N/A	N/A	0%	<66.0	<66.0
	2,4-Dinitrophenol	0%	N/A	N/A	0%	<66.0	<66.0
	2,4-Dinitrotoluene	0%	N/A	N/A	0%	<66.0	<66.0
	2,6-Dichlorophenol	0%	N/A	N/A	0%	<66.0	<66.0
	2,6-Dinitrotoluene	0%	N/A	N/A	0%	<66.0	<66.0
	2-Chloronaphthalene	0%	N/A	N/A	0%	<66.0	<66.0
	2-Chlorophenol	0%	N/A	N/A	0%	<66.0	<66.0
	2-Methylphenol	0%	N/A	N/A	0%	<66.0	<66.0
	2-Nitrophenol	0%	N/A	N/A	0%	<66.0	<66.0
	4,6-Dinitro-2-methylphenol	0%	N/A	N/A	0%	<66.0	<66.0
	4-Bromophenyl phenyl ether	0%	N/A	N/A	0%	<66.0	<66.0
	4-Chloro-3-methylphenol	0%	N/A	N/A	0%	<66.0	<66.0
	4-Methylphenol (p-Cresol)	4%	N/A	0%	0%	49.2	<66.0-95
	Acenaphthene	8%	N/A	0%	8%	<66.0	<66.0
	Acenaphthylene	0%	N/A	N/A	0%	<66.0	<66.0
	Anthracene	23%	15%	15%	12%	76.2	<33 -620
	Benzo[a]anthracene	85%	88%	62%	23%	167.2	<33 -695
	Benzo[a]pyrene	85%	85%	65%	23%	183.0	<33 -717
	Benzo[b]fluoranthene	88%	88%	54%	0%	324.2	<33 -1380
	Benzo[g,h,i]perylene	31%	19%	46%	15%	176.4	<33 -457
	Benzo[k]fluoranthene	54%	54%	42%	23%	96.6	<33 -465
	Bis(2-Chloroethoxy) methane	0%	N/A	N/A	0	<66.0	<66.0
	Bis(2-Chloroethyl) ether	0%	N/A	N/A	0	<66.0	<66.0
	Bis(2-Chloroisopropyl) ether	0%	N/A	N/A	0	<66.0	<66.0
	Bis(2-ethylhexyl)adipate	19%	N/A	15%	0%	61.6	<33.0 - 177
	Bis(2-ethylhexyl)phthalate	100%	35%	58%	12%	1505.4	164-5349
	Butylbenzylphthalate	46%	N/A	31%	23%	149.9	<49-1159

Appendix C:
Lower Columbia Slough between River Mile 5.9 and 8.7 Summary Statistics

			% Exceeding			ug/kg	ug/kg
Columbia Sloug	Columbia Slough RM 5.9 and 8.7 Sampling a	% Detect	Risk base		%Estimates	Mean	Range
	Chrysene	92%	88%	62%	15%	243.9	<33.0 - 1050
	di-n-Butylphthalate	23%	N/A	15%	23%	91.4	<49-392
	Di-n-octylphthalate	0%	N/A	N/A	0%	<66	<66
	Dibenz[a,h]anthracene	12%	8%	4%	8%	52.8	<33-140
	Dibenzofuran	0%	N/A	N/A	0%	<66	<66
	Diethylphthalate	0%	N/A	N/A	0%	<100	<100
	Dimethylphthalate	12%	N/A	0%	0%	93.4	<49-368
	Fluoranthene	96%	88%	65%	4%	513.8	<33-2302
	Fluorene	0%	N/A	N/A	0%	<66	<66
	Hexachloro-1,3-Butadiene	0%	N/A	N/A	0%	<66	<66
	Hexachlorocyclopentadiene	0%	N/A	N/A	0%	<66	<66
	Hexachloroethane	0%	N/A	N/A	0%	<66	<66
	Indeno[1,2,3-cd]pyrene	81%	81%	42%	19%	140.7	<66-597
	Isophorone	15%	N/A	0%	15%	55.8	<66-139
	n-Nitroso-di-n-dipropylamine	0%	N/A	N/A	0%	<66	<66
	n-Nitrosodiphenylamine	0%	N/A	N/A	0%	<66	<66
	Naphthalene	4%	4%	4%	4%	54.0	<66-183
	Nitrobenzene	0%	N/A	N/A	0%	<66	<66
	Pentachlorophenol	27%	27%	27%	4%	98.1	<66-426
	Phenanthrene	62%	62%	58%	17%	184.9	<66-870
	Phenol	0%	N/A	N/A	0%	48.2	<66
	Pyrene	96%	0%	58%	4%	542.3	<33-2020

			% Exceeding			ug/kg	ug/kg
Columbia Sloug	**Columbia Slough RM 5.9 and 8.7 Sampling a**	**% Detect**	**Risk base**		**%Estimates**	**Mean**	**Range**
			% Exceeding			ug/kg	ug/kg
Columbia Slough OF 59-65 Sampling area		**% Detect**	**Risk base**		**%Estimates**	**Mean**	**Range**
Pesticides	Aldrin	0%	0%	0%	0%	<6.3	0.396 -11
Method	alpha-BHC	0%	0%	0%	0%	<6.9	0.43 -12
8081	beta-BHC	0%	0%	0%	0%	<8.1	0.504 -14
(ppb)	delta-BHC	15%	N/A	15%	8%	7.3	0.353 -15.3
	gamma-BHC (Lindane)	0%	0%	0%	0%	<9.5	0.594 -16.5
	Chlordane	0%	0%	0%	0%	<36.2	2.26 -62.8
	alpha-Chlordane	19%	N/A	15%	8%	6.1	0.563 -15.6
	gamma-Chlordane	23%	N/A	23%	15%	9.9	0.603 -30.2
	4,4'-DDD	15%	15%	8%	15%	3.6	0.927 -25.6
	4,4'-DDE	46%	46%	27%	31%	6.6	0.4 -12.9
	4,4'-DDT	19%	19%	12%	19%	23.5	1.98 -63.8
	Dieldrin	19%	15%	15%	19%	3.7	0.354 -9.79
	Endosulfan I	0%	N/A	0%	0%	<8.1	0.502 -13.9
	Endosulfan II	4%	N/A	4%	4%	0.5	0.436 -12.1
	Endosulfan sulfate	12%	N/A	12%	12%	6.8	0.567 -18.4
	Endrin	0%	N/A	0%	0%	<7.7	0.475 -13.2
	Endrin aldehyde	0%	0%	0%	0%	<7.9	0.49 -13.6
	Endrin ketone	0%	N/A	0%	0%	<18.8	1.17 -32.6
	Heptachlor	12%	12%	12%	12%	5.5	0.436 -12
	Heptachlor epoxide	0%	N/A	0%	0%	<6.8	0.426 -11.8
	Methoxychlor	0%	N/A	0%	0%	<18.8	1.1 -30.6
	Toxaphene	0%	N/A	0%	0%	<451.2	28.1 -779
			% Exceeding			ug/kg	ug/kg
Columbia Slough IS samples- 3 samples		**% Detect**	**Risk base**		**%Estimates**	**Mean**	**Range**
Pesticides	2,4'-DDD	100%	N/A	N/A	0%	0.91	0.818 -1.07
ug/kg	2,4'-DDE	100%	N/A	N/A	0%	0.31	0.271 -0.381
Method	2,4'-DDT	67%	N/A	N/A	0%	<0.12	0.0662 -0.172
1669	4,4'-DDD	100%	100%	N/A	0%	3.70	3.14 -4.43
	4,4'-DDE	100%	100%	N/A	100%	6.31	5.93 -6.86
	4,4'-DDT	100%	0%	N/A	0%	0.47	0.405 -0.53
	4,4'-Methoxychlor	0%	N/A	N/A	0%	<0.55	<0.628
	Aldrin	67%	0%	N/A	0%	0.18	0.172 -0.208
	alpha-BHC	33%	0%	N/A	0%	<0.02	0.0168 -0.0194
	beta-BHC	33%	0%	N/A	0%	0.02	0.017 -0.022
	Lindane (gamma-BHC)	0%	0%	N/A	0%	<0.03	<0.0289
	cis-Chlordane (alpha)	100%	N/A	N/A	0%	1.01	0.95 -1.09
	trans-Chlordane (gamma)	100%	N/A	N/A	0%	0.97	0.927 -1.06
	Oxychlordane	0%	N/A	N/A	0%	<0.05	<0.0635
	cis-Heptachlor Epoxide	0%	N/A	N/A	0%	<0.05	<0.0593
	cis-Nonachlor	100%	N/A	N/A	0%	0.32	0.295 -0.346
	delta-BHC	0%	N/A	N/A	0%	<0.02	<0.0166
	Dieldrin	100%	0%	N/A	0%	0.70	0.644 -0.763
	Endosulfan I (alpha)	0%	N/A	N/A	0%	<0.07	<0.0891
	Endosulfan II (beta)	0%	N/A	N/A	0%	<0.09	<0.174
	Endosulfan Sulfate	67%	N/A	N/A	0%	0.38	0.281 -0.485
	Endrin	0%	N/A	N/A	0%	<0.15	<0.239
	Endrin Aldehyde	0%	0%	N/A	0%	<0.29	<0.407
	Endrin Ketone	0%	N/A	N/A	0%	<0.36	<0.439
	Heptachlor	0%	0%	N/A	0%	<0.08	<0.0817
	Hexachlorobenzene	100%	N/A	N/A	0%	0.37	0.192 -0.71
	Hexachlorobutadiene	0%	N/A	N/A	0%	<0.02	<0.0169
	Mirex	0%	N/A	N/A	0%	<0.11	<0.135
	trans-Heptachlor Epoxide	0%	N/A	N/A	0%	<0.14	<0.242
	trans-Nonachlor	100%	N/A	N/A	0%	0.71	0.7 -0.721

Appendix C:
Lower Columbia Slough between River Mile 5.9 and 8.7 Summary Statistics

			% Exceeding			ug/kg	ug/kg
Columbia Sloug	Columbia Slough RM 5.9 and 8.7 Sampling a	% Detect	Risk base		%Estimates	Mean	Range
			% Exceeding			ug/kg	ug/kg
Columbia Slough OF 59-65 Sampling area		**% Detect**	**Risk base**		**%Estimates**	**Mean**	**Range**
PCBs	Aroclor-1016	0%	N/A	N/A	0%	<6.1	<6.1
(ppb)	Aroclor-1242	0%	N/A	N/A	0%	<6.1	<6.1
	Aroclor 1221	0%	N/A	N/A	0%	<8.5	<8.5
	Aroclor 1232	0%	N/A	N/A	0%	<11.3	<11.3
	Aroclor 1248	8%	8%	8%	0%	13.5	<4.4-230
	Aroclor 1254	54%	54%	46%	54%	58.0	<2.5-333
	Aroclor 1260	73%	62%	54%	62%	86.9	<5.4-855
	Total Congeners	100%	N/a	N/A	0%	116.0	18-904
			% Exceeding				
Columbia Slough OF 59-65 Sampling area		**% Detect**	**Risk base**		**%Estimates**	**Mean**	**Range**
PBDE	Total PBDE	100	N/A	58%	100%	15	3.3-36.9
(ppb)	BDE-47	100	N/A	67%	100%	3.0	0.62-11.8
TBT(ppb)	Tributyltin	62.5%	6.3%	15.4%	25.0%	32.0	<5-285
General	Total Organic Carbon(ppm)	100%	N/A	N/A	0%	13436	8500-22000
	Percent Solids(ppm)	N/A	N/A	N/A	0%	84%	72-89%
	Clay(%)	100%	N/A	N/A	0%	7%	1-20%
	Silt(%)	100%	N/A	N/A	0%	34%	1-77%
	Sand(%)	100%	N/A	N/A	0%	52%	9-87%
	Gravel(%)	62%	N/A	N/A	0%	7%	0-41%
	Field Sample Depth(m)	N/A	N/A	N/A	N/A	0.1	0.05-0.1
	Final Weight(g)	N/A	N/A	N/A	N/A	2611	2315-3290
	Initial Weight(g)	N/A	N/A	N/A	N/A	3112	2676-3848

Appendix D- Lower Columbia Slough River Mile 5.9 and 8.7.
Results above Screening Values Highlighted

	Columbia Slough OF 59-65 Sampling 2009		Risk-based Values*	Baseline Values**	OF 59	PM3	PM2 10CM	PM2 5CM	PM 1 10CM	PM1 5CM	OF 60	SMPCV	OF 61 1	OF 61 2	SCHMR	BLSN	61A	ODOT	OF 62	Wtech	P&BR 1	P&BR 2	OF 63	OF 64	13TH	OF 65	PEN 2	IS A	IS B	IS C	IS Mean
					9/15/09	9/15/09	9/15/09	9/15/09	9/15/09	9/15/09	9/14/09	9/9/09	9/14/09	9/14/09	9/9/09	9/4/09	9/9/09	9/3/09	9/9/09	9/10/09	9/10/09	9/10/09	9/8/09	9/8/09	9/2/09	9/8/09	9/2/09	Sample			
Metals	Total Aluminum	mg/Kg dry	17300	16867	15000	22000	17100	17900	17300	17000	16200	10800	14700	13800	14400	21000	11900	17200	14700	17300	15900	16700	14900	14500	13300	13000	12700	17100	16100	17400	16866.7
(mg/kg)	Total Antimony	mg/Kg dry	3.1	0.5	0.5 J, JL	0.58 JL	0.5 J, JL	0.5 J, JL	3.05 JL	0.51 JL	0.97 JL	0.5 U	1.67	2.56	0.5 U	0.5 U	2.41	0.5 U	1.55	0.77	0.73	0.82	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 JL	0.5 U, JL	0.5 U, JL	0.5
	Total Arsenic	mg/Kg dry	22.6	5	5	7.1	5.7	5.9	12.4	6.5	5.4	2.5	9.8	22.6	5.1	5.7	8.1	4	8.4	5.4	4.2	4.2	10.4	5.2	4	3.7	3.3	5.2	5.2	5.6	5.3
	Total Barium	mg/Kg dry	142	124	104	146	138	125	117	120	124	80.9	114	116	92.9	160	139	128	134	142	119	127	115	114	111	100	104	122	122	129	124.3
	Total Cadmium	mg/Kg dry	1.4	1	0.68	1.22	0.8	0.87	1.03	1.15	0.92	0.5 U	1.37	1.2	0.93	0.5 U	0.75	0.64	1.37	0.69	0.5 U	0.5 U	1.43	1.17	0.72	1.06	0.5 U	0.92	0.84	0.96	0.9
	Total Chromium	mg/Kg dry	481	44	481	58.2	34.2	37.3	46.2	42.5	50.8	19.8	79.8	67.3	42.3	29.7	49.1	26.8	54.6	37.4	37.2	40.2	56.8	38.9	34.2	32.5	24.7	45.4	41.5	45.5	44.1
	Total Cobalt	mg/Kg dry	16	10	16	12.1	14.3	14.7	10.8	10.8	9.79	9.21	10.9	11	8.51	9.85	10.8	9.95	19.8	10.1	9.78	10.4	11.1	8.33	8.85	10.3	8.05	9.7	9.54	10.2	9.8
	Total Copper	mg/Kg dry	148	38	130	52.2	34.6	37.4	72.6	57.4	75.7	18.3	79.4	147	38.4	27.6	148	26.9	146	35.4	25.8	24.1	60.1	39.5	25.6	39.6	17.2	37.4	34.2	41	37.5
	Total Lead	mg/Kg dry	212	41	32.7	51.3	45.7	43	135	57.4	47.2	13.4	212	116	38.4	17.6	110	22.1	110	53.8	129	139	71.1	35.9	37.9	35.9	15.4	40.8	37.6	45.5	41.3
	Total Manganese	mg/Kg dry	1100	418	538	732	547	565	542	564	476	203	473	495	432	297	501	261	468	399	374	379	492	308	260	256	249	409	408	436	417.7
	Mercury	mg/Kg dry	0.6	0.1	0.1	0.15	0.12	0.11	0.63	0.13	0.11	0.02	0.12	0.13 JH	0.11	0.04	0.04	0.06	0.4	0.11	0.1	0.11	0.23	0.09	0.08	0.08	0.04	0.1	0.09	0.11	0.1
	Total Nickel	mg/Kg dry	255	20	255	26.5	23.7	28.2	22.1	22.3	21.3	15.1	47.4	37.1	18.6	20.7	32.1	18.2	48.7	29	17.8	18.3	23.4	18.2	17.4	18	15.3	19.8	18.7	20.7	19.7
	Total Selenium	mg/Kg dry		1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.0
	Total Silver	mg/Kg dry	4.5	0.31	0.2	0.3	0.2 U	0.2 U	0.33	0.2 U	0.24	0.2 U	0.26	0.3	0.23	0.2 U	0.23	0.2 U	0.37	0.2 U	0.2 U	0.2 U	0.28	0.2 U	0.29	0.26	0.2 U	0.19 J	0.49	0.25	0.3
	Total Thallium	mg/Kg dry	0.7	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2
	Total Zinc	mg/Kg dry	678	244	303	325	280	279	310	345	366	98.8	487	622	234	122	678	142	875	206	109	123	376	259	191	220	126	244	227	261	244.0
Semi-Vols	1,2,4,5-Tetrachlorobenzene	µg/Kg dry		66	66 U,J	66 U,J	33 U,J	66 U,J	66 U,J	66 U,J	66 U,J	33 U,J	66 U,J	66 U,J	66 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	66 U,J	66 U,J	66 U,J	66.0
(ug/Kg)	1,2,4-Trichlorobenzene	µg/Kg dry		66	66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	1,2-Dichlorobenzene	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	1,3-Dichlorobenzene	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	1,4-Dichlorobenzene	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,3,4,6-Tetrachlorophenol	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	65 J	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,3,5,6-Tetrachlorophenol	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,4,5-Trichlorophenol	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,4,6-Trichlorophenol	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,4-Dichlorophenol	µg/Kg dry		66	66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,4-Dimethylphenol	µg/Kg dry		130	130 U	130 U	66 U,J	130 U	130 U	130 U	130 U	67 U	130 U	130 U	130 U	125 U	66 U.J	125 U	130 U	67 U	67 U	67 U,J	67 U	67 U	125 U.J	66 U.J	125 U.J	130 U.J	130 U.J	130 U.J	130.0
	2,4-Dinitrophenol	µg/Kg dry		Void	Void	Void	Void	Void	Void	Void	Void	Void	Void	Void	Void	625	Void	625 U	Void	Void	Void	Void	Void	Void	625 U.J	Void	625 U.J	Void	Void	Void	Void
	2,4-Dinitrotoluene	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,6-Dichlorophenol	µg/Kg dry		66	66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,6-Dinitrotoluene	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2-Chloronaphthalene	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2-Chlorophenol	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2-Methylphenol	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2-Nitrophenol	µg/Kg dry		66	66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	4,6-Dinitro-2-methylphenol	µg/Kg dry		66	66 U	66 U	33 U,J	66 U,J	66 U,J	66 U	66 U	Void	66 U	66 U	66 U	33 U	Void	33 U	Void	Void	Void	Void	Void	Void	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	4-Bromophenyl phenyl ether	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	4-Chloro-3-methylphenol	µg/Kg dry		66	66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U.J	66 U.J	66.0
	4-Methylphenol (p-Cresol)	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	95 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,y	Acenaphthene	µg/Kg dry	290	66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	37.4 J	52.5 J	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,y	Acenaphthylene	µg/Kg dry	160	66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,y	Anthracene	µg/Kg dry	57	66	66 U	66 U	33 U	66 U	66 U	66 U	85 J	33 U	620.3	66	66 U	33 U	33 U	33 U	33	33 U	49.9 J	82.5	52.4 J	135	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,z	Benzo[a]anthracene	µg/Kg dry	32	113	84.8 J	164.9	57.3 J	94.8 J	174.4	144.6	359.8	33 U	198.5	134.7	84.9	33 U	156.9	272.5	234.9	119.9	232.2	282.4	272.2	695	33 U	111.1	33 U	94.9 J	119.6 J	124.8 J	113.1
x,z	Benzo[a]pyrene	µg/Kg dry	32	110	66 U	189.9	59.8 J	79.8 J	219.2	204.5	424.8	33 U	332.5	139.7	107.4	33 U	181.8	320	242.4	117.4	189.7	234.9	319.7	717.5	50 J	133.3	33 U	79.9 J	119.6 J	129.8 J	109.8
x,z	Benzo[b]fluoranthene	µg/Kg dry	240	241	154.6	359.8	122	184.5	348.8	319.2	714.6	33 U	620.3	299.4	212.3	33 U	296.3	572.5	299.9	182.4	309.5	329.8	554.4	1380	107.4	239.5	33 U	194.7	254.2	274.6	241.2
x,z	Benzo[g,h,i]perylene	µg/Kg dry	500	143	84.8 J	249.9	82.2	114.7 J	279	289.3	374.8	33 U	397	194.6	82.4	33 U	92.1	380	169.9	85	104.8	119.9	322.2	457.5	65 J	113.6	33 U	114.8 J	154.5	159.8	143.0
x,z	Benzo[k]fluoranthene	µg/Kg dry	470	67	66 U	66 U	33 U	66 U	89.7 J	84.4 J	204.9	33 U	158.8	66 U	64.9 J	33 U	84.7	152.5	33 U	65 J	109.8	122.4	184.8	465	33 U	61.7 J	33 U	66 U	66 U	69.9 J	67.3
	Bis(2-Chloroethoxy) methane	µg/Kg dry		66	66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Bis(2-Chloroethyl) ether	µg/Kg dry		66	66 U,J	66 U,J	33 U,J	66 U,J	66 U,J	66 U,J	66 U,J	33 U	66 U,J	67 U,J	68 U,J	33 U.J	33 U.J	33 U.J	33 U.J	33 U.J	33 U.J	33 U,J	33 U.J	33 U.J	33 U.J	33 U	33 U.J	66 U	66 U.J	66 U.J	66.0
	Bis(2-Chloroisopropyl) ether	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Bis(2-ethylhexyl)adipate	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	52.5 J	33 U	33 U	177.4 U	33 U	33 U	33 U	89.9	33	157.4	33 U	67.5 U	66 U	66 U	66 U	66.0
	Bis(2-ethylhexyl)phthalate	µg/Kg dry	4400	923	543.6 JH	1434.3	503 J	753.1	1380.2	1376.6	1899.1	232	4387.1	5349.3	1103.9	164.9	3154.9	2407.5	4088	369.8	626.6	842.1	2457.5	1397.5	602.2	1093.9 J	204.9	713.9 JH	942.2	1113.3	923.1
	Butylbenzylphthalate	µg/Kg dry		100	99.8 U	100 U	49.8 U	99.8 U	99.6 U	99.8 U	1159.4 J	49.9	213.4	99.8 U	84.9	50 U	321.2	135 J	219.9 J	75	49.9 U	50 U	152.3	135	104.9 J	86.4 JH	62.5 J	99.8 U	99.8 U	99.8 U	99.8
x,z	Chrysene	µg/Kg dry	1020	150	119.7 J	249.9	87.2	104.7 J	244.1	239.4	479.8	34.9 J	466.5	189.6	154.8	33 U	225.6	382.5	389.8	137.4	327	369.8	384.6	1015	85	138.3	33 U	109.8 J	164.5	174.7	149.7
	di-n-Butylphthalate	µg/Kg dry		100	99.8 U	100 U	49.8 U	99.8 U	49.8 U	99.8 U	194.9 BH	49.9 U	392.1 J	99.8 U	50 U	50 U	49.8 U	50 U	127.4 BH	50 U	49.9 U	50 U	50 U	80 BH	72.5 BH	111.1 BH	50 U	99.8 U	99.8 U	99.8 U	99.8
	Di-n-octylphthalate	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,z	Dibenz[a,h]anthracene	µg/Kg dry	140	66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	62.5 J	33 U	33 U	33 U	33 U	47.5 J	140	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Dibenzofuran	µg/Kg dry	5100	66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Diethylphthalate	µg/Kg dry		100	99.8 U	100 U	49.8 U	99.8 U	99.6 U	99.8 U	100 U	49.9 U	99.2 U	99.8 U	100 U	50 U	49.8 U	50 U	50 U	50 U	49.9 U	50 U	50 U	50 U	50 U	49.4 U	50 U	99.8 U	99.8 U	99.8 U	99.8
	Dimethylphthalate	µg/Kg dry		100	99.8 U	100 U	49.8 U	99.8 U	368.7 U	278.8 U	100 U	49.9 U	99.2 U	99.8 U	100 U	50 U	49.8 U	50 U	50 U	50 U	49.9 U	50 U	50 U	135 U	50 U	49.4 U	50 U	99.8 U	99.8 U	99.8 U	99.8
x,z	Fluoranthene	µg/Kg dry	2300	303	114.7 J	499.8	119.5	169.6	463.4	478.8	1394.3	72.4	1206	334.3	222.3	33 U	415.8	802.5	472.3	319.8	748.9	924.5	799.2	2302.5	152.4	325.9	80	234.6	319	354.5	302.7
x,y	Fluorene	µg/Kg dry	77	66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Hexachloro-1,3-Butadiene	µg/Kg dry		66	66 U	66 U	33 U,J	66 U,J	66 U,J	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Hexachlorocyclopentadiene	µg/Kg dry		66	66 U	66 U,J	33 U,J	66 U,J	66 U,J	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U.J	66 U.J	66.0
	Hexachloroethane	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,z	Indeno[1,2,3-cd]pyrene	µg/Kg dry	17	101	66 U	66 U	57.3 J	74.8 J	189.3	194.5	319.8	33 U	297.8	134.7	82.4	33 U	87.2	302.5	100	72.5	99.9	114.9	249.8	597.5	52.5 J	96.3	33 U	74.9 J	109.7 J	119.8 J	101.5
	Isophorone	µg/Kg dry		66	110 J	66	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	139 J	33 U	39.9 J	72 J	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	n-Nitroso-di-n-dipropylamine	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	n-Nitrosodiphenylamine	µg/Kg dry		66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,y	Naphthalene	µg/Kg dry	180	66	66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	183.7 J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Nitrobenzene	µg/Kg dry		66	66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Pentachlorophenol	µg/Kg dry	100	66	344.1	66 U	33 U	66 U	66 U	66 U	66 U	33 U	426.8	254.5	33 U	33 U	33	142.5	217.4	33 U	33 U	33 U	33 U	145 U	33 U	33 U	129.9 J	66 U	66 U	66 U	66.0
x,y	Phenanthrene	µg/Kg dry	900	100	66 U	66 U	33 U	66 U	149.5	129.7 J	429.8	33 U	645.2	129.7	66 U	33 U	184.3	285	33 U	114.9	297.1	397.3	284.7	870	33 U	160.5	33 U	66 J	114.7 J	119.8 J	100.2
	Phenol	µg/Kg dry	48	66	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,z	Pyrene	µg/Kg dry	1900	299	229.4	514.7	134.5	184.5	513.2	488.8	1314.3	67.4	1429.3	364.3	239.8	33 U	448.2	767.5	1154.4	297.4	773.8	949.5	764.2	2020	142.4	286.4	85 J	234.6	324	339.5	299.4
	LPAH[y]	µg/Kg dry		430	396	396	198	396	479.5	459.7	778.8	198	1529.5	459.7	396	198	349.3	450	348.7	279.9	483.4	631.3	469.1	1137	198	325.5	198	396	444.7	449.8	430.1667
	HPAH[z]	µg/Kg dry		1594	1052	2426.9	785.8	1139.4	2587.1	2509.5	5653.1	405.7	5172.7	1923.3	1317.2	330	2021.6	4015	3129.6	1429.8	2928.6	3481.1	3898.6	9790	753.7	1539.1	429	1270.2	1697.1	1813.4	1593.567
	Total PAH[x]	µg/Kg dry		2024	1448	2822.9	983.8	1535.4	3066.6	2969.2	6431.9	603.7	6702.2	2383	1713.2	528	2370.9	4465	3478.3	1709.7	3412	4112.4	4367.7	10927	951.7	1864.6	627	1666.2	2141.8	2263.2	2023.733
TBT	Tributyltin	µg/Kg dry	2.3	22.9	5 U						6 J		20.8	28		5 U	285		7 J	5 U	5 U	5 U	72.1	6 J		5 U		6 J	11	51.7	22.9

Appendix D- Lower Columbia Slough River Mile 5.9 and 8.7.
Results above Screening Values Highlighted

Columbia Slough OF 59-65 Sampling 2009

Group	Analyte	Units	Risk-based Values*	Baseline Values**	OF 59 9/15/09	PM3 9/15/09	PM2 10CM 9/15/09	PM2 5CM 9/15/09	PM 1 10CM 9/15/09	PM1 5CM 9/15/09	OF 60 9/14/09	SMPCV 9/9/09	OF 61 1 9/14/09	OF 61 2 9/14/09	SCHMR 9/9/09
Pesticides	Aldrin	ug/kg	1	0.18	8.03 U	8.16 U	7.77 U	7.89 U	8.06 U	7.82 U	7.97 U	3.83 U	8.6 U	8.35 U	11 U
ug/kg	alpha-BHC	ug/kg	1	0.02	8.72 U	8.87 U	8.44 U	8.57 U	8.75 U	8.49 U	8.65 U	4.16 U	9.35 U	9.08 U	12 U
Method	beta-BHC	ug/kg	1	0.02	10.2 U	10.4 U	9.88 U	10 U	10.2 U	9.94 U	10.1 U	4.87 U	10.9 U	10.6 U	14 U
8081	delta-BHC	ug/kg	0.02	0.02	7.12 U	7.24 U	6.9 U	7 U	7.15 U	6.94 U	7.07 U	15.3 J	7.63 U	7.41 U	9.76 U
	gamma-BHC (Lindane)	ug/kg	0.9	0.03	12 U	12.2 U	11.6 U	11.8 U	12.1 U	11.7 U	11.9 U	5.73 U	12.9 U	12.5 U	16.5 U
	Chlordane	ug/kg	0.1		45.8 U	46.6 U	44.4 U	45.1 U	46 U	44.6 U	45.5 U	21.8 U	49.1 U	47.7 U	62.8 U
	alpha-Chlordane	ug/kg		1.01	11.4 U	11.6 U	11.1 U	11.2 U	11.5 U	11.1 U	11.3 U	5.44 U	12.2 U	11.9 U	15.6 U
	gamma-Chlordane	ug/kg		0.97	12.2 U	12.4 U	11.8 U	12 U	12.3 U	11.9 U	30.2 J	5.82 U	13.1 U	12.7 U	16.7 U
	4,4'-DDD	ug/kg	2.3	3.70	18.7 U	19 U	18.1 U	18.4 U	18.8 U	18.2 U	18.6 U	8.91 U	20 U	19.5 U	25.6 U
	4,4'-DDE	ug/kg	2.3	6.31	5.4 U	5.49 U	5.23 U	5.31 U	12.9 J	5.26 U	7.53 J	2.57 U	9.6 J	12.7 J	7.45 J
	4,4'-DDT	ug/kg	2.3	0.47	55.6 J	40.8 U	63.8 J	39.4 U	40.2 U	39 U	39.8 U	19.1 U	43 U	41.7 U	54.9 U
	Dieldrin	ug/kg	0.04	0.70	7.14 U	7.26 U	6.91 U	7.02 U	8.76 J	6.95 U	7.09 U	3.4 U	7.65 U	7.43 U	9.79 U
	Endosulfan I	ug/kg		0.07	10.2 U	10.3 U	9.85 U	10 U	10.2 U	9.91 U	10.1 U	4.85 U	10.9 U	10.6 U	13.9 U
	Endosulfan II	ug/kg		0.09	8.84 U	8.99 U	8.56 U	8.69 U	8.87 U	8.61 U	8.78 U	4.22 U	9.48 U	9.2 U	12.1 U
	Endosulfan sulfate	ug/kg		0.38	11.5 U	11.7 U	18.4 J	11.3 U	11.5 U	11.2 U	11.4 U	5.48 U	12.3 U	12 U	15.8 U
	Endrin	ug/kg		0.15	9.62 U	9.79 U	9.32 U	9.46 U	9.66 U	9.37 U	9.55 U	4.59 U	10.3 U	10 U	13.2 U
	Endrin aldehyde	ug/kg	3	0.29	9.94 U	10.1 U	9.62 U	9.77 U	9.97 U	9.68 U	9.86 U	4.74 U	10.6 U	10.3 U	13.6 U
	Endrin ketone	ug/kg		0.36	23.8 U	24.2 U	23 U	23.4 U	23.8 U	23.1 U	23.6 U	11.3 U	25.5 U	24.7 U	32.6 U
	Heptachlor	ug/kg	1	0.08	8.78 U	8.93 U	8.5 U	8.63 U	8.81 U	8.55 U	8.72 U	4.19 U	9.41 U	9.14 U	12 U
	Heptachlor epoxide	ug/kg			8.64 U	8.78 U	8.36 U	8.49 U	8.67 U	8.41 U	8.57 U	4.12 U	9.26 U	8.99 U	11.8 U
	Methoxychlor	ug/kg			22.3 U	22.7 U	21.6 U	22 U	22.4 U	21.8 U	22.2 U	10.7 U	23.9 U	23.3 U	30.6 U
	Toxaphene	ug/kg			568 U	578 U	550 U	559 U	571 U	554 U	564 U	271 U	609 U	592 U	779 U
Pesticides	2,4'-DDD	ug/kg		0.91	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
ug/kg	2,4'-DDE	ug/kg		0.31	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Method	2,4'-DDT	ug/kg		0.12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1669	4,4'-DDD	ug/kg	2.3	3.70	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	4,4'-DDE	ug/kg	2.3	6.31	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	4,4'-DDT	ug/kg	2.3	0.47	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	4,4'-Methoxychlor	ug/kg		0.55	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Aldrin	ug/kg		0.18	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	alpha-BHC	ug/kg	1	0.02	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	beta-BHC	ug/kg	1	0.02	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Lindane (gamma-BHC)	ug/kg	0.9	0.03	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	delta-BHC	ug/kg		0.02	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	cis-Chlordane (alpha)	ug/kg		1.01	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	trans-Chlordane (gamma)	ug/kg		0.97	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Oxychlordane	ug/kg		0.05	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	cis-Heptachlor Epoxide	ug/kg		0.05	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	cis-Nonachlor	ug/kg		0.32	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Dieldrin	ug/kg	0.04	0.70	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Endosulfan I (alpha)	ug/kg		0.07	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Endosulfan II (beta)	ug/kg		0.09	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Endosulfan Sulfate	ug/kg		0.38	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Endrin	ug/kg		0.15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Endrin Aldehyde	ug/kg	3	0.29	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Endrin Ketone	ug/kg		0.36	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Heptachlor	ug/kg	1	0.08	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Hexachlorobenzene	ug/kg		0.37	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Hexachlorobutadiene	ug/kg		0.02	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Mirex	ug/kg		0.11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	trans-Heptachlor Epoxide	ug/kg		0.14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	trans-Nonachlor	ug/kg		0.71	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
PCBs	Aroclor-1016 (PCB-1016)	µg/Kg dry		7.3	5.5 U	5 U	5 U	5.1 U	4.9 U	5.8 U	4.8 U	4.8 U	5.1 U	5.3 U	6.7 U
(ug/Kg)	Aroclor-1242 (PCB-1242)	µg/Kg dry		3.6	2.8 U	2.5 U	2.5 U	2.5 U	2.4 U	2.9 U	2.4 U	2.4 U	2.5 U	2.6 U	3.3 U
	Aroclor 1221	µg/Kg dry		5.1	3.8 U	3.5 U	3.5 U	3.5 U	3.4 U	4 U	3.3 U	3.4 U	3.5 U	3.7 U	4.6 U
	Aroclor 1232	µg/Kg dry		6.8	5.1 U	4.6 U	4.7 U	4.7 U	4.5 U	5.4 U	4.4 U	4.5 U	4.7 U	4.9 U	6.2 U
	Aroclor 1248	µg/Kg dry	0.59	6.5	4.9 U	4.4 U	4.4 U	4.5 U	4.3 U	5.1 U	4.2 U	4.3 U	4.5 U	4.7 U	5.9 U
	Aroclor 1254	µg/Kg dry	0.59	26.8	2.9 U	2.6 U	2.7 U	2.7 U	333 JH	148 JH	321 JH	2.6 U	2.7 U	2.8 U	34.8 JH
	Aroclor 1260	µg/Kg dry	0.59	18.7	5.9 U	37.2 JL	235	223 JH	313 JH	115 JH	855 JH	9.2 J	5.4 U	5.7 U	25.1 JH
	Total Aroclors	ug/kg		45.5	n/a	37.2	235	223	646	263	1176	9.2 J	n/a	n/a	59.9
Congener	Total Congener PCBs	ug/kg		38	49						60		74	82	
Dioxin-like	PCB- 77	ng/kg	52	96	158						189		186	171	
Congener	PCB 81	ng/kg	17	3	3.84 J						5.48 J		8.79 J	6.48 J	
	PCB 105	ng/kg	170	559	646						824		1100	1180	
	PCB 114	ng/kg	170	34	41						46.8		64.8	67.9	
	PCB 118	ng/kg	120	1420	1540						1950		2900	3250	
	PCB 123	ng/kg	210	27	35.7						42.9		62.7	67	
	PCB 126	ng/kg	0.05	8	7.5 J						11.6		22.5	13.1	
	PCB 156 +PCB157 Co-Elution	ng/kg	210	290	293						358		553	609	
	PCB 167	ng/kg	210	105	105						123		196	216	
	PCB 169	ng/kg	0.21	5	3.92 J						3.53 U		4.27 J	5.49 J	
	PCB 189	ng/kg	1200	31	31.7						35.6		54.2	52.4	
PBDE	Total	ug/kg			21.2 J						18.2 J		9.1 J	12.1 J	
Bioassay	Bioassay	Toxic/not toxic			Not Toxic	N/A	Not Toxic	N/A	Not Toxic	N/A	Not Toxic	N/A	Not Toxic	Not Toxic	N/A
	Effect size	%		0	6		6		1		10		11	3	
General	Total Organic Carbon	mg/Kg dry			18000	22000	14000	11000	14000	14000	18000	8500	13000	12000	20000
	Percent Solids	%			84.88	72.96	86.53	85.7	80.88	86.5	80.21	84.58	86.02	85.51	83.35
	Clay	%			8	14	7	7	5	5	9	4	4	2	6
	Silt	%			51	77	21	18	26	30	18	12	10	9	68
	Sand	%			40	9	69	74	55	52	69	84	45	49	26
	Gravel	%			1	0	3	1	14	13	4	0	41	40	0
	Start Date	Date			9/30/09	9/30/09	9/30/09	9/30/09	9/30/09	9/30/09	9/30/09	9/18/09	9/18/09	9/18/09	9/18/09
	Stop Date	Date			10/14/09	10/20/09	10/13/09	10/13/09	10/14/09	10/13/09	10/15/09	9/28/09	9/28/09	9/28/09	9/28/09
	Field Sample Depth	m			0.1	0.1	0.1	0.05	0.1	0.05	0.1	0.1	0.1	0.1	0.1
	Final Weight	g			2429.3	2445.6	2489	2426	2577.5	2315.4	2540.1	2519.8	2903.5	3290.9	2496.1
	Initial Weight	g			2862.1	3351.8	2877	2831	3186.9	2676.9	3166.7	2979.1	3375.4	3848.5	2994.6
	Initial Weight	g			2862.1	3351.8	2877	2831	3186.9	2676.9	3166.7	2979.1	3375.4	3848.5	2994.6

Analyte	BLSN 9/4/09	61A 9/9/09	ODOT 9/3/09	OF 62 9/9/09	Wtech 9/10/09	P&BR 1 9/10/09	P&BR 2 9/10/09	OF 63 9/8/09
Aldrin	0.398 U	8.06 U	0.399 U	8.03 U	0.413 U	0.399 U	1.7 U	9.04 U
alpha-BHC	0.433 U	8.75 U	0.434 U	8.72 U	0.449 U	0.434 U	1.7 U	9.82 U
beta-BHC	0.506 U	10.2 U	0.508 U	10.2 U	0.526 U	0.508 U	1.7 U	11.5 U
delta-BHC	0.353 U	7.15 U	0.354 U	7.12 U	9.56	2.86	1.7 U	8.02 U
gamma-BHC (Lindane)	0.597 U	12.1 U	0.598 U	12 U	0.619 U	0.598 U	1.7 U	13.5 U
Chlordane	2.27 U	46 U	2.28 U	45.8 U	2.36 U	3.36 U	3.32 U	51.6 U
alpha-Chlordane	0.566 U	11.5 U	0.607 J	11.7 J	2.77	7.92	7.44	12.9 U
gamma-Chlordane	0.606 U	12.3 U	1.38 J	14.8 J	1.67 J	5.74	5.44	13.8 U
4,4'-DDD	0.927 U	18.8 U	0.93 U	18.7 U	3.15 JH	5.58 JH	4.11 JH	21 U
4,4'-DDE	0.4 J	5.42 U	7.57	5.4 U	3.41	4.51	3.7	7.48 J
4,4'-DDT	1.99 U	40.2 U	1.99 U	40.1 U	2.6 JL	4 JL	3.6 JL	45.1 U
Dieldrin	0.354 U	7.17 U	0.355 U	7.14 U	3.01 J	2.55 J	2.44 J	8.04 U
Endosulfan I	0.505 U	10.2 U	0.506 U	10.2 U	0.524 U	0.506 U	1.7 U	11.5 U
Endosulfan II	0.439 U	8.87 U	0.454 J	8.84 U	0.455 U	0.44 U	3.32 U	9.96 U
Endosulfan sulfate	0.57 U	11.5 U	0.572 U	11.5 U	0.86 J	1.01 J	3.32 U	12.9 U
Endrin	0.477 U	9.66 U	0.479 U	9.62 U	0.496 U	0.479 U	3.32 U	10.8 U
Endrin aldehyde	0.493 U	9.97 U	0.494 U	9.93 U	0.512 U	0.494 U	3.32 U	11.2 U
Endrin ketone	1.18 U	23.8 U	1.18 U	23.7 U	1.22 U	1.18 U	3.32 U	26.7 U
Heptachlor	0.436 U	8.81 U	0.437 U	8.78 U	3.91 J	0.437 U	1.7 U	10.2 JL
Heptachlor epoxide	0.429 U	8.67 U	0.43 U	8.64 U	0.445 U	0.43 U	1.7 U	9.72 U
Methoxychlor	1.11 U	22.4 U	1.11 U	22.3 U	1.15 U	16.8 U	16.7 U	25.2 U
Toxaphene	28.2 U	570 U	28.3 U	568 U	29.3 U	67.3 U	66.5 U	640 U
2,4'-DDD	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2,4'-DDE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2,4'-DDT	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4,4'-DDD	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4,4'-DDE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4,4'-DDT	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4,4'-Methoxychlor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Aldrin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
alpha-BHC	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
beta-BHC	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Lindane (gamma-BHC)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
delta-BHC	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
cis-Chlordane (alpha)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
trans-Chlordane (gamma)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Oxychlordane	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
cis-Heptachlor Epoxide	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
cis-Nonachlor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Dieldrin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Endosulfan I (alpha)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Endosulfan II (beta)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Endosulfan Sulfate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Endrin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Endrin Aldehyde	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Endrin Ketone	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Heptachlor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hexachlorobenzene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hexachlorobutadiene	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Mirex	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
trans-Heptachlor Epoxide	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
trans-Nonachlor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Aroclor-1016 (PCB-1016)	4.8 U	5 U	4.9 U	5 U	4.8 U	4.8 U	5.1 U	5.8 U
Aroclor-1242 (PCB-1242)	2.4 U	2.5 U	2.5 U	2.5 U	2.4 U	2.4 U	2.6 U	2.9 U
Aroclor 1221	3.3 U	3.5 U	3.4 U	3.5 U	3.3 U	3.4 U	3.6 U	4 U
Aroclor 1232	4.4 U	4.6 U	4.6 U	4.6 U	4.4 U	4.4 U	4.7 U	5.3 U
Aroclor 1248	4.2 U	4.4 U	4.4 U	230 JL	4.2 U	4.2 U	4.5 U	5.1 U
Aroclor 1254	2.5 U	2.7 U	20.4 JH	150 JL	84.3 JH	71.5 JH	65 JH	56 JH
Aroclor 1260	5.1 U	5.4 U	13.5 J	78 JL	48.2 JH	52.4 JH	53.2 JH	35.4 JH
Total Aroclors	n/a	n/a	33.9 J	458	132.5	123.9	118.2	91.4
Total Congener PCBs		54		904	95	88	103	51
PCB- 77		157		2470 J	95.2	197	228	133
PCB 81		6.26 J		116	4.44 J	5.58 J	7.43 J	5.76 J
PCB 105		705		9500	820	1240	1390	908
PCB 114		41.5		613	46.8	72.1	79.6	50.4
PCB 118		1620		20300	2090	2990	3410	2290
PCB 123		26.4 J		477	50.8	64.1	70.7	40.5
PCB 126		37.4		257	5.46 J	16.5	13.9	16.9
PCB 156 +PCB157 Co-Elution		304		3280	413	546	653	460
PCB 167		103		1090	167	197	239	166
PCB 169		3.55 U		16.8 J	4.54 J	5.09 J	6.46 J	5.52 J
PCB 189		28.9		211	40.6	55.1	71.1	44.2
PBDE Total		23.1 J		14.9 J	6.7 J	4.9 J	3.3 J	23.7 J
Bioassay	N/A	Not Toxic	N/A	Possibly Toxic	Not Toxic	Toxic	Toxic	Not Toxic
Effect size		6		19	4	40	59	1
Total Organic Carbon	10000	12000	8500	21000	18000	8800	8600	21000
Percent Solids	88.63	88.23	87.73	86.74	87.29	89.44	89.92	80.89
Clay	20	5	12	5	7	10	7	1
Silt	51	4	38	25	27	35	35	39
Sand	29	87	48	54	48	54	53	38
Gravel	0	4	2	16	18	1	5	22
Start Date	9/15/09	9/18/09	9/15/09	9/18/09	9/18/09	9/18/09	9/18/09	9/18/09
Stop Date	9/28/09	9/28/09	9/28/09	9/28/09	9/28/09	9/28/09	9/28/09	9/29/09
Field Sample Depth	0.1	0.1	0.1	0.07	0.1	0.1	0.1	0.07
Final Weight	2556	2817.4	2639.3	2445.5	2695	2741.9	2794	2603.7
Initial Weight	2883	3193.2	3008.4	2819.2	3088	3065.5	3107	3218.7
Initial Weight	2883	3193.2	3008.4	2819.2	3088	3065.5	3107	3218.7

Analyte	OF 64 9/8/09	13TH 9/2/09	OF 65 9/8/09	PEN 2 9/2/09	IS A Sample	IS B	IS C	IS Mean
Aldrin	9.61 U	7.98 U	8.07 U	0.396 U	8.02 U	8.04 U	7.87 U	8.0
alpha-BHC	10.4 U	8.67 U	8.77 U	0.43 U	8.71 U	8.73 U	8.55 U	8.7
beta-BHC	12.2 U	10.2 U	10.3 U	0.504 U	10.2 U	10.2 U	10 U	10.1
delta-BHC	8.53 U	7.08 U	7.16 U	1.39 JH	7.12 U	7.13 U	6.98 U	7.1
gamma-BHC (Lindane)	14.4 U	12 U	12.1 U	0.594 U	12 U	12 U	11.8 U	11.9
Chlordane	54.9 U	45.6 U	46.1 U	2.26 U	45.8 U	45.9 U	44.9 U	45.5
alpha-Chlordane	13.7 U	11.4 U	11.5 U	0.563 U	11.4 U	11.4 U	11.2 U	11.3
gamma-Chlordane	14.6 U	12.1 U	12.3 U	0.603 U	12.2 U	12.2 U	12 U	12.1
4,4'-DDD	22.4 U	18.6 U	18.8 U	1.54 JH	18.7 U	18.7 U	18.3 U	18.6
4,4'-DDE	6.46 U	5.37 U	5.43 U	1.45 JH	5.4 U	5.41 U	5.29 U	5.4
4,4'-DDT	48 U	39.9 U	40.3 U	1.98 U	40 U	40.1 U	39.3 U	39.8
Dieldrin	8.55 U	7.1 U	7.18 U	0.51 JH	7.14 U	7.15 U	7 U	7.1
Endosulfan I	12.2 U	10.1 U	10.2 U	0.502 U	10.2 U	10.2 U	9.97 U	10.1
Endosulfan II	10.6 U	8.79 U	8.89 U	0.436 U	8.84 U	8.86 U	8.67 U	8.8
Endosulfan sulfate	13.8 U	11.4 U	11.6 U	0.567 U	11.5 U	11.5 U	11.3 U	11.4
Endrin	11.5 U	9.57 U	9.68 U	0.475 U	9.62 U	9.64 U	9.43 U	9.6
Endrin aldehyde	11.9 U	9.88 U	9.99 U	0.49 U	9.93 U	9.95 U	9.74 U	9.9
Endrin ketone	28.4 U	23.6 U	23.9 U	1.17 U	23.7 U	23.8 U	23.3 U	23.6
Heptachlor	10.5 U	8.73 U	8.83 U	2.33 JH	8.77 U	8.79 U	8.61 U	8.7
Heptachlor epoxide	10.3 U	8.59 U	8.69 U	0.426 U	8.63 U	8.65 U	8.47 U	8.6
Methoxychlor	26.7 U	22.2 U	22.5 U	1.1 U	22.3 U	22.4 U	21.9 U	22.2
Toxaphene	681 U	565 U	572 U	28.1 U	568 U	569 U	557 U	564.7
2,4'-DDD	n/a	n/a	n/a	n/a	0.818	1.07	0.836	0.908
2,4'-DDE	n/a	n/a	n/a	n/a	0.271	0.381	0.291	0.314333
2,4'-DDT	n/a	n/a	n/a	n/a	0.0662	0.121	0.172 U	0.119733
4,4'-DDD	n/a	n/a	n/a	n/a	3.14	4.43	3.52	3.696667
4,4'-DDE	n/a	n/a	n/a	n/a	5.93 JH	6.86 JH	6.14 JH	6.31
4,4'-DDT	n/a	n/a	n/a	n/a	0.405	0.48	0.53	0.471667
4,4'-Methoxychlor	n/a	n/a	n/a	n/a	0.439 U	0.628 U	0.57 U	0.545667
Aldrin	n/a	n/a	n/a	n/a	0.208	0.172 U	0.172	0.184
alpha-BHC	n/a	n/a	n/a	n/a	0.0194 J	0.0168 U	0.0168 U	0.017667
beta-BHC	n/a	n/a	n/a	n/a	0.022 J	0.017 U	0.017 U	0.018667
Lindane (gamma-BHC)	n/a	n/a	n/a	n/a	0.0289 U	0.0289 U	0.0289 U	0.0289
delta-BHC	n/a	n/a	n/a	n/a	0.0166 U	0.0166 U	0.0166 U	0.0166
cis-Chlordane (alpha)	n/a	n/a	n/a	n/a	0.95	1	1.09	1.013333
trans-Chlordane (gamma)	n/a	n/a	n/a	n/a	0.927	1.06	0.931	0.972667
Oxychlordane	n/a	n/a	n/a	n/a	0.0232 U	0.0635 U	0.0631 U	0.049933
cis-Heptachlor Epoxide	n/a	n/a	n/a	n/a	0.0501 U	0.0511 U	0.0593 U	0.0535
cis-Nonachlor	n/a	n/a	n/a	n/a	0.346	0.295	0.318	0.319667
Dieldrin	n/a	n/a	n/a	n/a	0.644	0.763	0.694	0.700333
Endosulfan I (alpha)	n/a	n/a	n/a	n/a	0.0642 U	0.0642 U	0.0891 U	0.0725
Endosulfan II (beta)	n/a	n/a	n/a	n/a	0.102 U	0.174 U	N/A	0.092
Endosulfan Sulfate	n/a	n/a	n/a	n/a	0.375	0.281	0.485 U	0.380333
Endrin	n/a	n/a	n/a	n/a	0.0871 U	0.127 U	0.239 U	0.151033
Endrin Aldehyde	n/a	n/a	n/a	n/a	0.226 U	0.226 U	0.407 U	0.286333
Endrin Ketone	n/a	n/a	n/a	n/a	0.226 U	0.402 U	0.439 U	0.355667
Heptachlor	n/a	n/a	n/a	n/a	0.0817 U	0.0817 U	0.0817 U	0.0817
Hexachlorobenzene	n/a	n/a	n/a	n/a	0.212	0.192	0.71	0.371333
Hexachlorobutadiene	n/a	n/a	n/a	n/a	0.0169 U	0.0169 U	0.0169 U	0.0169
Mirex	n/a	n/a	n/a	n/a	0.0703 U	0.121 U	0.135 U	0.108767
trans-Heptachlor Epoxide	n/a	n/a	n/a	n/a	0.0868 U	0.0868 U	0.242 U	0.138533
trans-Nonachlor	n/a	n/a	n/a	n/a	0.712	0.7	0.721	0.711
Aroclor-1016 (PCB-1016)	6.1 U	4.9 U	5 U	4.8 U,JL	4.9 U	4.8 U	12.2 U	7.3
Aroclor-1242 (PCB-1242)	3 U	2.5 U	2.5 U	2.4 U,JL	2.4 U	2.4 U	6.1 U	3.6
Aroclor 1221	4.2 U	3.4 U	3.5 U	3.4 U,JL	3.4 U	3.4 U	8.5 U	5.1
Aroclor 1232	5.6 U	4.5 U	4.6 U	4.5 U,JL	4.5 U	4.5 U	11.3 U	6.8
Aroclor 1248	5.3 U	4.3 U	4.4 U	4.3 U,JL	4.3 U	4.3 U	10.8 U	6.5
Aroclor 1254	27.7 JH	29.6 JH	59.4 JH	2.6 U,JL	27.3 JH	16.5 JH	36.6 JH	26.8
Aroclor 1260	21.9 JH	18 JH	36.9 JH	6.1 JL	20.2 JH	13.4 JH	22.5 JH	18.7
Total Aroclors	49.6	47.6	96.3	6.1 JL	47.5	29.9 J	59.1 J	45.5
Total Congener PCBs	42		18		38	34	42	37.8
PCB- 77	111		40.9		89	79.9	119	95.96667
PCB 81	7.1 J		2.25 U		2.77 J	2.71 J	4.59 U	3.356667
PCB 105	606		346		540	465	671	558.6667
PCB 114	34.6		15.8		32.4	28.3	41.3	34
PCB 118	1480		858		1390	1180	1690	1420
PCB 123	33.4		17.3		30	23.2	29.1	27.43333
PCB 126	7.47 J		2.76 J		9.94 J	5.77 J	9.29 J	8.333333
PCB 156 +PCB157 Co-Elution	317		166		279	241	351	290.3333
PCB 167	126		59.7		101	89.4	126	105.4667
PCB 169	4.31 U		3.39 U		3.54 U	3.51 U	6.9 U	4.65
PCB 189	37.5		14.2		28.8	23.3	39.8	30.63333
PBDE Total	36.9 J		7.2 J		9.9 J	13.6 J	N/A	#####
Bioassay	Not Toxic	N/A	Toxic	N/A	N/A	N/A	N/A	
Effect size	19		26					0.0
Total Organic Carbon	21000	10000	10000	8500	11000	10000	13000	11333.3
Percent Solids	84.24	84.8	88.33	86.17	75.92	76.04	74.37	75.4
Clay	6	4	9	4	6	4	8	6.0
Silt	55	34	23	18	60	53	57	56.7
Sand	39	62	65	78	34	43	35	37.3
Gravel	0	0	3	0	0	0	0	0.0
Start Date	9/18/09	9/15/09	9/18/09	9/15/09	9/30/09	9/30/09	9/30/09	
Stop Date	9/28/09	9/28/09	9/28/09	9/28/09	10/15/09	10/15/09	10/15/09	
Field Sample Depth	0.1	0.08	0.09	0.05	0.1	0.1	0.1	0.1
Final Weight	2655.2	2746.8	2619.9	2512.7	2524.3	2589.9	2518.6	2544.3
Initial Weight	3151.9	3239.2	2966.2	2916.1	3324.8	3406.1	3386.5	3372.5
Initial Weight	3151.9	3239.2	2966.2	2916.1	3324.8	3406.1	3386.5	3372.5

U	Under method detection limit
J	Estimate below Limit of Quantitation(LOQ)
JH	Esstimate concentration; potential high bias due to lab QC failure
JL	Estimate concentration; potentail low bias due to lab QC failure
MS	3 Matrix Spike failed because sample result is greater than 10 times the spiked concentration.

Risk based Values*	
White Box	*Lower Columbia Slough Sediment Screening Levels Appendix I*
Purple Box	Table 3-1 *Portland Harbor Joint Source Control Strategy*
Blue Box	Table A-1b *Guidance for Assessing Bioaccumlative Chmeicals of Concern in Sediment*
Baseline Value **	IS average value of Lower Slough Segment
Red Box	Over Risk based Values
Elevated Areas	Values that exceed the baseline value or one order of magnitude above a risk-based screening level whichever is hic

Appendix D- Columbia Slough OF 59-65 Elevated Results Highlighted
January 2011

	Columbia Slough OF 59-65 Sampling 2009		Elevated Area Values*	OF 59	PM3	PM2 10CM	PM2 5CM	PM 1 10CM	PM1 5CM	OF 60	SMPCV	OF 61 1	OF 61 2	SCHMR	BLSN	61A	ODOT	OF 62	Wtech	P&BR 1	P&BR 2	OF 63	OF 64	13TH	OF 65	PEN 2	IS A	IS B	IS C	IS Mean
				9/15/09	9/15/09	9/15/09	9/15/09	9/15/09	9/15/09	9/14/09	9/9/09	9/14/09	9/14/09	9/9/09	9/4/09	9/9/09	9/3/09	9/9/09	9/10/09	9/10/09	9/10/09	9/8/09	9/8/09	9/2/09	9/8/09	9/2/09	Sample			
Metals	Total Aluminum	mg/Kg dry	17300	15000	22000	17100	17900	17300	17000	16200	10800	14700	13800	14400	21000	11900	17200	14700	17300	15900	16700	14900	14500	13300	13000	12700	17100	16100	17400	16866.7
(mg/kg)	Total Antimony	mg/Kg dry	31	0.5 J, JL	0.58 JL	0.5 J, JL	0.5 J, JL	3.05 JL	0.51 JL	0.97 JL	0.5 U	1.67	2.56	0.5 U	0.5 U	2.41	0.5 U	1.55	0.77	0.73	0.82	1.1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 JL	0.5 U, JL	0.5 U, JL	0.5
	Total Arsenic	mg/Kg dry	226	5	7.1	5.7	5.9	12.4	6.5	5.4	2.5	9.8	22.6	5.1	5.7	8.1	4	8.4	5.4	4.2	4.2	10.4	5.2	4	3.7	3.3	5.2	5.2	5.6	5.3
	Total Barium	mg/Kg dry	1420	104	146	138	125	117	120	124	80.9	114	116	92.9	160	139	128	134	142	119	127	115	114	111	100	104	122	122	129	124.3
	Total Cadmium	mg/Kg dry	140.0	0.68	1.22	0.8	0.87	1.03	1.15	0.92	0.5 U	1.37	1.2	0.93	0.5 U	0.75	0.64	1.37	0.69	0.5 U	0.5 U	1.43	1.17	0.72	1.06	0.5 U	0.92	0.84	0.96	0.9
	Total Chromium	mg/Kg dry	4810	481	58.2	34.2	37.3	46.2	42.5	50.8	19.8	79.8	67.3	42.3	29.7	49.1	26.8	54.6	37.4	37.2	40.2	56.8	38.9	34.2	32.5	24.7	45.4	41.5	45.5	44.1
	Total Cobalt	mg/Kg dry	160	16	12.1	14.3	14.7	10.8	10.8	9.79	9.21	10.9	11	8.51	9.85	10.8	9.95	19.8	10.1	9.78	10.4	11.1	8.33	8.85	10.3	8.05	9.7	9.54	10.2	9.8
	Total Copper	mg/Kg dry	1480	130	52.2	34.6	37.4	72.6	57.4	75.7	18.3	79.4	147	38.4	27.6	148	26.9	146	35.4	25.8	24.1	60.1	39.5	25.6	39.6	17.2	37.4	34.2	41	37.5
	Total Lead	mg/Kg dry	2120	32.7	51.3	45.7	43	135	57.4	47.2	13.4	212	116	38.4	17.6	110	22.1	110	53.8	129	139	71.1	35.9	37.9	35.9	15.4	40.8	37.6	45.5	41.3
	Total Manganese	mg/Kg dry	110000	538	732	547	565	542	564	476	203	473	495	432	297	501	261	468	399	374	379	492	308	260	256	249	409	408	436	417.7
	Mercury	mg/Kg dry	6	0.1	0.15	0.12	0.11	0.63	0.13	0.11	0.02	0.12	0.13 JH	0.11	0.04	0.04	0.06	0.4	0.11	0.1	0.11	0.23	0.09	0.08	0.08	0.04	0.1	0.09	0.11	0.1
	Total Nickel	mg/Kg dry	2550	255	26.5	23.7	28.2	22.1	22.3	21.3	15.1	47.4	37.1	18.6	20.7	32.1	18.2	48.7	29	17.8	18.3	23.4	18.2	17.4	18	15.3	19.8	18.7	20.7	19.7
	Total Selenium	mg/Kg dry	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.0
	Total Silver	mg/Kg dry	450	0.2	0.3	0.2 U	0.2 U	0.33	0.2 U	0.24	0.2 U	0.26	0.3	0.23	0.2 U	0.23	0.2 U	0.37	0.2 U	0.2 U	0.2 U	0.28	0.2 U	0.29	0.26	0.2 U	0.19 J	0.49	0.25	0.3
	Total Thallium	mg/Kg dry	7	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2
	Total Zinc	mg/Kg dry	6780	303	325	280	279	310	345	366	98.8	487	622	234	122	678	142	875	206	109	123	376	259	191	220	126	244	227	261	244.0
Semi-Vols	1,2,4,5-Tetrachlorobenzene	µg/Kg dry		66 U,J	66 U,J	33 U,J	66 U,J	66 U,J	66 U,J	66 U,J	33 U,J	66 U,J	66 U,J	66 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	33 U,J	66 U,J	66 U,J	66 U,J	66.0
(ug/Kg)	1,2,4-Trichlorobenzene	µg/Kg dry		66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	1,2-Dichlorobenzene	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	1,3-Dichlorobenzene	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	1,4-Dichlorobenzene	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,3,4,6-Tetrachlorophenol	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	65 J	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,3,5,6-Tetrachlorophenol	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,4,5-Trichlorophenol	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,4,6-Trichlorophenol	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,4-Dichlorophenol	µg/Kg dry		66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,4-Dimethylphenol	µg/Kg dry		130 U	130 U	66 U,J	130 U	130 U	130 U	130 U	67 U	130 U	130 U	130 U	125 U	66 U.J	125 U	130 U	67 U	67 U	67 U,J	67 U	67 U	125 U.J	66 U.J	125 U.J	130 U.J	130 U.J	130 U.J	130.0
	2,4-Dinitrophenol	µg/Kg dry		Void	Void	Void	Void	Void	Void	Void	Void	Void	Void	Void	625	Void	625 U	Void	Void	Void	Void	Void	Void	625 U.J	Void	625 U.J	Void	Void	Void	Void
	2,4-Dinitrotoluene	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,6-Dichlorophenol	µg/Kg dry		66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2,6-Dinitrotoluene	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2-Chloronaphthalene	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2-Chlorophenol	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2-Methylphenol	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	2-Nitrophenol	µg/Kg dry		66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	4,6-Dinitro-2-methylphenol	µg/Kg dry		66 U	66 U	33 U,J	66 U,J	66 U,J	66 U	66 U	Void	66 U	66 U	66 U	33 U	Void	33 U	Void	Void	Void	Void	Void	Void	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	4-Bromophenyl phenyl ether	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	4-Chloro-3-methylphenol	µg/Kg dry		66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U.J	66 U.J	66.0
	4-Methylphenol (p-Cresol)	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	95 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,y	Acenaphthene	µg/Kg dry	2900	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	37.4 J	52.5 J	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,y	Acenaphthylene	µg/Kg dry	1600	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,y	Anthracene	µg/Kg dry	6200	66 U	66 U	33 U	66 U	66 U	66 U	85 J	33 U	620.3	66	66 U	33 U	33 U	33 U	33	33 U	49.9 J	82.5	52.4 J	135	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,z	Benzo[a]anthracene	µg/Kg dry	6950	84.8 J	164.9	57.3 J	94.8 J	174.4	144.6	359.8	33 U	198.5	134.7	84.9	33 U	156.9	272.5	234.9	119.9	232.2	282.4	272.2	695	33 U	111.1	33 U	94.9 J	119.6 J	124.8 J	113.1
x,z	Benzo[a]pyrene	µg/Kg dry	7180	66 U	189.9	59.8 J	79.8 J	219.2	204.5	424.8	33 U	332.5	139.7	107.4	33 U	181.8	320	242.4	117.4	189.7	234.9	319.7	717.5	50 J	133.3	33 U	79.9 J	119.6 J	129.8 J	109.8
x,z	Benzo[b]fluoranthene	µg/Kg dry	13800	154.6	359.8	122	184.5	348.8	319.2	714.6	33 U	620.3	299.4	212.3	33 U	296.3	572.5	299.9	182.4	309.5	329.8	554.4	1380	107.4	239.5	33 U	194.7	254.2	274.6	241.2
x,z	Benzo[g,h,i]perylene	µg/Kg dry	4570	84.8 J	249.9	82.2	114.7 J	279	289.3	374.8	33 U	397	194.6	82.4	33 U	92.1	380	169.9	85	104.8	119.9	322.2	457.5	65 J	113.6	33 U	114.8 J	154.5	159.8	143.0
x,z	Benzo[k]fluoranthene	µg/Kg dry	4650	66 U	66 U	33 U	66 U	89.7 J	84.4 J	204.9	33 U	158.8	66 U	64.9 J	33 U	84.7	152.5	33 U	65 J	109.8	122.4	184.8	465	33 U	61.7 J	33 U	66 U	66 U	69.9 J	67.3
	Bis(2-Chloroethoxy) methane	µg/Kg dry		66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Bis(2-Chloroethyl) ether	µg/Kg dry		66 U,J	66 U,J	33 U,J	66 U,J	66 U,J	66 U,J	66 U,J	33 U	66 U,J	67 U,J	68 U,J	33 U.J	33 U.J	33 U.J	33 U.J	33 U.J	33 U.J	33 U,J	33 U.J	33 U.J	33 U.J	33 U	33 U.J	66 U	66 U.J	66 U.J	66.0
	Bis(2-Chloroisopropyl) ether	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Bis(2-ethylhexyl)adipate	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	52.5 J	33 U	33 U	177.4 U	33 U	33 U	33 U	89.9	33	157.4	33 U	67.5 U	66 U	66 U	66 U	66.0
	Bis(2-ethylhexyl)phthalate	µg/Kg dry	43870	543.6 JH	1434.3	503 J	753.1	1380.2	1376.6	1899.1	232	4387.1	5349.3	1103.9	164.9	3154.9	2407.5	4088	369.8	626.6	842.1	2457.5	1397.5	602.2	1093.9 J	204.9	713.9 JH	942.2	1113.3	923.1
	Butylbenzylphthalate	µg/Kg dry		99.8 U	100 U	49.8 U	99.8 U	99.6 U	99.8 U	1159.4 J	49.9	213.4	99.8 U	84.9	50 U	321.2	135 J	219.9 J	75	49.9 U	50 U	152.3	135	104.9 J	86.4 JH	62.5 J	99.8 U	99.8 U	99.8 U	99.8
x,z	Chrysene	µg/Kg dry	10200	119.7 J	249.9	87.2	104.7 J	244.1	239.4	479.8	34.9 J	466.5	189.6	154.8	33 U	225.6	382.5	389.8	137.4	327	369.8	384.6	1015	85	138.3	33 U	109.8 J	164.5	174.7	149.7
	di-n-Butylphthalate	µg/Kg dry		99.8 U	100 U	49.8 U	99.8 U	49.8 U	99.8 U	194.9 BH	49.9 U	392.1 J	99.8 U	50 U	50 U	49.8 U	50 U	127.4 BH	50 U	49.9 U	50 U	50 U	80 BH	72.5 BH	111.1 BH	50 U	99.8 U	99.8 U	99.8 U	99.8
	Di-n-octylphthalate	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,z	Dibenz[a,h]anthracene	µg/Kg dry	1400	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	62.5 J	33 U	33 U	33 U	33 U	47.5 J	140	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Dibenzofuran	µg/Kg dry	51000	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Diethylphthalate	µg/Kg dry		99.8 U	100 U	49.8 U	99.8 U	99.6 U	99.8 U	100 U	49.9 U	99.2 U	99.8 U	100 U	50 U	49.8 U	50 U	50 U	50 U	49.9 U	50 U	50 U	50 U	50 U	49.4 U	50 U	99.8 U	99.8 U	99.8 U	99.8
	Dimethylphthalate	µg/Kg dry		99.8 U	100 U	49.8 U	99.8 U	368.7 U	278.8 U	100 U	49.9 U	99.2 U	99.8 U	100 U	50 U	49.8 U	50 U	50 U	50 U	49.9 U	50 U	50 U	135 U	50 U	49.4 U	50 U	99.8 U	99.8 U	99.8 U	99.8
x,z	Fluoranthene	µg/Kg dry	23000	114.7 J	499.8	119.5	169.6	463.4	478.8	1394.3	72.4	1206	334.3	222.3	33 U	415.8	802.5	472.3	319.8	748.9	924.5	799.2	2302.5	152.4	325.9	80	234.6	319	354.5	302.7
x,y	Fluorene	µg/Kg dry	770	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Hexachloro-1,3-Butadiene	µg/Kg dry		66 U	66 U	33 U,J	66 U,J	66 U,J	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Hexachlorocyclopentadiene	µg/Kg dry		66 U	66 U,J	33 U,J	66 U,J	66 U,J	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U.J	66 U.J	66.0
	Hexachloroethane	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,z	Indeno[1,2,3-cd]pyrene	µg/Kg dry	5980	66 U	66 U	57.3 J	74.8 J	189.3	194.5	319.8	33 U	297.8	134.7	82.4	33 U	87.2	302.5	100	72.5	99.9	114.9	249.8	597.5	52.5 J	96.3	33 U	74.9 J	109.7 J	119.8 J	101.5
	Isophorone	µg/Kg dry		110 J	66	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	139 J	33 U	39.9 J	72 J	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	n-Nitroso-di-n-dipropylamine	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	n-Nitrosodiphenylamine	µg/Kg dry		66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,y	Naphthalene	µg/Kg dry	1760	66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	183.7 J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Nitrobenzene	µg/Kg dry		66 U	66 U	33 U,J	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	66 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
	Pentachlorophenol	µg/Kg dry	1000	344.1	66 U	33 U	66 U	66 U	66 U	66 U	33 U	426.8	254.5	33 U	33 U	33	142.5	217.4	33 U	33 U	33 U	33 U	145 U	33 U	33 U	129.9 J	66 U	66 U	66 U	66.0
x,y	Phenanthrene	µg/Kg dry	8700	66 U	66 U	33 U	66 U	149.5	129.7 J	429.8	33 U	645.2	129.7	66 U	33 U	184.3	285	33 U	114.9	297.1	397.3	284.7	870	33 U	160.5	33 U	66 J	114.7 J	119.8 J	100.2
	Phenol	µg/Kg dry	660	66 U	66 U	33 U	66 U	66 U	66 U	66 U	33 U	66 U	66 U	66 U	33 U	33 U	33 U	33 U	33 U.J	33 U	33 U	33 U	33 U	33 U	33 U	33 U	66 U	66 U	66 U	66.0
x,z	Pyrene	µg/Kg dry	20200	229.4	514.7	134.5	184.5	513.2	488.8	1314.3	67.4	1429.3	364.3	239.8	33 U	448.2	767.5	1154.4	297.4	773.8	949.5	764.2	2020	142.4	286.4	85 J	234.6	324	339.5	299.4
	LPAH^{y}	µg/Kg dry		396	396	198	396	479.5	459.7	778.8	198	1529.5	459.7	396	198	349.3	450	348.7	279.9	483.4	631.3	469.1	1137	198	325.5	198	396	444.7	449.8	430.1666667
	HPAH^{z}	µg/Kg dry		1052	2426.9	785.8	1139.4	2587.1	2509.5	5653.1	405.7	5172.7	1923.3	1317.2	330	2021.6	4015	3129.6	1429.8	2928.6	3481.1	3898.6	9790	753.7	1539.1	429	1270.2	1697.1	1813.4	1593.566667
	Total PAH^{x}	µg/Kg dry		1448	2822.9	983.8	1535.4	3066.6	2969.2	6431.9	603.7	6702.2	2383	1713.2	528	2370.9	4465	3478.3	1709.7	3412	4112.4	4367.7	10927	951.7	1864.6	627	1666.2	2141.8	2263.2	2023.733333
TBT	Tributyltin	µg/Kg dry	229	5 U						6 J		20.8	28		5 U	285		7 J	5 U	5 U	5 U	72.1	6 J		5 U		6 J	11	51.7	22.9

Appendix D- Columbia Slough OF 59-65 Elevated Results Highlighted
January 2011

Columbia Slough OF 59-65 Sampling 2009			Elevated Area Values*	OF 59	PM3	PM2 10CM	PM2 5CM	PM 1 10CM	PM1 5CM	OF 60	SMPCV	OF 61 1	OF 61 2	SCHMR	BLSN	61A	ODOT	OF 62	Wtech	P&BR 1	P&BR 2	OF 63	OF 64	13TH	OF 65	PEN 2	IS A Sample	IS B	IS C	IS Mean
				9/15/09	9/15/09	9/15/09	9/15/09	9/15/09	9/15/09	9/14/09	9/9/09	9/14/09	9/14/09	9/9/09	9/4/09	9/9/09	9/3/09	9/9/09	9/10/09	9/10/09	9/10/09	9/8/09	9/8/09	9/2/09	9/8/09	9/2/09				
Pesticides	Aldrin	ug/kg	10.00	8.03 U	8.16 U	7.77 U	7.89 U	8.06 U	7.82 U	7.97 U	3.83 U	8.6 U	8.35 U	11 U	0.398 U	8.06 U	0.399 U	8.03 U	0.413 U	0.399 U	1.7 U	9.04 U	9.61 U	7.98 U	8.07 U	0.396 U	8.02 U	8.04 U	7.87 U	8.0
ug/kg	alpha-BHC	ug/kg	10.00	8.72 U	8.87 U	8.44 U	8.57 U	8.75 U	8.49 U	8.65 U	4.16 U	9.35 U	9.08 U	12 U	0.433 U	8.75 U	0.434 U	8.72 U	0.449 U	0.434 U	1.7 U	9.82 U	10.4 U	8.67 U	8.77 U	0.43 U	8.71 U	8.73 U	8.55 U	8.7
Method	beta-BHC	ug/kg	10.00	10.2 U	10.4 U	9.88 U	10 U	10.2 U	9.94 U	10.1 U	4.87 U	10.9 U	10.6 U	14 U	0.506 U	10.2 U	0.508 U	10.2 U	0.526 U	0.508 U	1.7 U	11.5 U	12.2 U	10.2 U	10.3 U	0.504 U	10.2 U	10.2 U	10 U	10.1
8081	delta-BHC	ug/kg	0.02	7.12 U	7.24 U	6.9 U	7 U	7.15 U	6.94 U	7.07 U	15.3 J	7.63 U	7.41 U	9.76 U	0.353 U	7.15 U	0.354 U	7.12 U	9.56	2.86	1.7 U	8.02 U	8.53 U	7.08 U	7.16 U	1.39 JH	7.12 U	7.13 U	6.98 U	7.1
	gamma-BHC (Lindane)	ug/kg	10.00	12 U	12.2 U	11.6 U	11.8 U	12.1 U	11.7 U	11.9 U	5.73 U	12.9 U	12.5 U	16.5 U	0.597 U	12.1 U	0.598 U	12 U	0.619 U	0.598 U	1.7 U	13.5 U	14.4 U	12 U	12.1 U	0.594 U	12 U	12 U	11.8 U	11.9
	Chlordane	ug/kg	1.00	45.8 U	46.6 U	44.4 U	45.1 U	46 U	44.6 U	45.5 U	21.8 U	49.1 U	47.7 U	62.8 U	2.27 U	46 U	2.28 U	45.8 U	2.36 U	3.36 U	3.32 U	51.6 U	54.9 U	45.6 U	46.1 U	2.26 U	45.8 U	45.9 U	44.9 U	45.5
	alpha-Chlordane	ug/kg		11.4 U	11.6 U	11.1 U	11.2 U	11.5 U	11.1 U	11.3 U	5.44 U	12.2 U	11.9 U	15.6 U	0.566 U	11.5 U	0.607 J	11.7 J	2.77	7.92	7.44	12.9 U	13.7 U	11.4 U	11.5 U	0.563 U	11.4 U	11.4 U	11.2 U	11.3
	gamma-Chlordane	ug/kg		12.2 U	12.4 U	11.8 U	12 U	12.3 U	11.9 U	30.2 J	5.82 U	13.1 U	12.7 U	16.7 U	0.606 U	12.3 U	1.38 J	14.8 J	1.67 J	5.74	5.44	13.8 U	14.6 U	12.1 U	12.3 U	0.603 U	12.2 U	12.2 U	12 U	12.1
	4,4'-DDD	ug/kg	23.00	18.7 U	19 U	18.1 U	18.4 U	18.8 U	18.2 U	18.6 U	8.91 U	20 U	19.5 U	25.6 U	0.927 U	18.8 U	0.93 U	18.7 U	3.15 JH	5.58 JH	4.11 JH	21 U	22.4 U	18.6 U	18.8 U	1.54 JH	18.7 U	18.7 U	18.3 U	18.6
	4,4'-DDE	ug/kg	23.00	5.4 U	5.49 U	5.23 U	5.31 U	12.9 J	5.26 U	7.53 J	2.57 U	9.6 J	12.7 J	7.45 J	0.4 J	5.42 U	7.57	5.4 U	3.41	4.51	3.7	7.48 J	6.46 U	5.37 U	5.43 U	1.45 JH	5.4 U	5.41 U	5.29 U	5.4
	4,4'-DDT	ug/kg	23.00	55.6 J	40.8 U	63.8 J	39.4 U	40.2 U	39 U	39.8 U	19.1 U	43 U	41.7 U	54.9 U	1.99 U	40.2 U	1.99 U	40.1 U	2.6 JL	4 JL	3.6 JL	45.1 U	48 U	39.9 U	40.3 U	1.98 U	40 U	40.1 U	39.3 U	39.8
	Dieldrin	ug/kg	0.70	7.14 U	7.26 U	6.91 U	7.02 U	8.76 J	6.95 U	7.09 U	3.4 U	7.65 U	7.43 U	9.79 U	0.354 U	7.17 U	0.355 U	7.14 U	3.01 J	2.55 J	2.44 J	8.04 U	8.55 U	7.1 U	7.18 U	0.51 JH	7.14 U	7.15 U	7 U	7.1
	Endosulfan I	ug/kg		10.2 U	10.3 U	9.85 U	10 U	10.2 U	9.91 U	10.1 U	4.85 U	10.9 U	10.6 U	13.9 U	0.505 U	10.2 U	0.506 U	10.2 U	0.524 U	0.506 U	1.7 U	11.5 U	12.2 U	10.1 U	10.2 U	0.502 U	10.2 U	10.2 U	9.97 U	10.1
	Endosulfan II	ug/kg		8.84 U	8.99 U	8.56 U	8.69 U	8.87 U	8.61 U	8.78 U	4.22 U	9.48 U	9.2 U	12.1 U	0.439 U	8.87 U	0.454 J	8.84 U	0.455 U	0.44 U	3.32 U	9.96 U	10.6 U	8.79 U	8.89 U	0.436 U	8.84 U	8.86 U	8.67 U	8.8
	Endosulfan sulfate	ug/kg		11.5 U	11.7 U	18.4 J	11.3 U	11.5 U	11.2 U	11.4 U	5.48 U	12.3 U	12 U	15.8 U	0.57 U	11.5 U	0.572 U	11.5 U	0.86 J	1.01 J	3.32 U	12.9 U	13.8 U	11.4 U	11.6 U	0.567 U	11.5 U	11.5 U	11.3 U	11.4
	Endrin	ug/kg		9.62 U	9.79 U	9.32 U	9.46 U	9.66 U	9.37 U	9.55 U	4.59 U	10.3 U	10 U	13.2 U	0.477 U	9.66 U	0.479 U	9.62 U	0.496 U	0.479 U	3.32 U	10.8 U	11.5 U	9.57 U	9.68 U	0.475 U	9.62 U	9.64 U	9.43 U	9.6
	Endrin aldehyde	ug/kg	30.00	9.94 U	10.1 U	9.62 U	9.77 U	9.97 U	9.68 U	9.86 U	4.74 U	10.6 U	10.3 U	13.6 U	0.493 U	9.97 U	0.494 U	9.93 U	0.512 U	0.494 U	3.32 U	11.2 U	11.9 U	9.88 U	9.99 U	0.49 U	9.93 U	9.95 U	9.74 U	9.9
	Endrin ketone	ug/kg		23.8 U	24.2 U	23 U	23.4 U	23.8 U	23.1 U	23.6 U	11.3 U	25.5 U	24.7 U	32.6 U	1.18 U	23.8 U	1.18 U	23.7 U	1.22 U	1.18 U	3.32 U	26.7 U	28.4 U	23.6 U	23.9 U	1.17 U	23.7 U	23.8 U	23.3 U	23.6
	Heptachlor	ug/kg	10.00	8.78 U	8.93 U	8.5 U	8.63 U	8.81 U	8.55 U	8.72 U	4.19 U	9.41 U	9.14 U	12 U	0.436 U	8.81 U	0.437 U	8.78 U	3.91 J	0.437 U	1.7 U	10.2 JL	10.5 U	8.73 U	8.83 U	2.33 JH	8.77 U	8.79 U	8.61 U	8.7
	Heptachlor epoxide	ug/kg		8.64 U	8.78 U	8.36 U	8.49 U	8.67 U	8.41 U	8.57 U	4.12 U	9.26 U	8.99 U	11.8 U	0.429 U	8.67 U	0.43 U	8.64 U	0.445 U	0.43 U	1.7 U	9.72 U	10.3 U	8.59 U	8.69 U	0.426 U	8.63 U	8.65 U	8.47 U	8.6
	Methoxychlor	ug/kg		22.3 U	22.7 U	21.6 U	22 U	22.4 U	21.8 U	22.2 U	10.7 U	23.9 U	23.3 U	30.6 U	1.11 U	22.4 U	1.11 U	22.3 U	1.15 U	16.8 U	16.7 U	25.2 U	26.7 U	22.2 U	22.5 U	1.1 U	22.3 U	22.4 U	21.9 U	22.2
	Toxaphene	ug/kg		568 U	578 U	550 U	559 U	571 U	554 U	564 U	271 U	609 U	592 U	779 U	28.2 U	570 U	28.3 U	568 U	29.3 U	67.3 U	66.5 U	640 U	681 U	565 U	572 U	28.1 U	568 U	569 U	557 U	564.7
Pesticides	2,4'-DDD	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.818	1.07	0.836	0.908
ug/kg	2,4'-DDE	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.271	0.381	0.291	0.314333333
Method	2,4'-DDT	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0662	0.121	0.172 U	0.119733333
1669	4,4'-DDD	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3.14	4.43	3.52	3.696666667
	4,4'-DDE	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5.93 JH	6.86 JH	6.14 JH	6.31
	4,4'-DDT	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.405	0.48	0.53	0.471666667
	4,4'-Methoxychlor	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.439 U	0.628 U	0.57 U	0.545666667
	Aldrin	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.208	0.172 U	0.172	0.184
	alpha-BHC	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0194 J	0.0168 U	0.0168 U	0.017666667
	beta-BHC	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.022 J	0.017 U	0.017 U	0.018666667
	Lindane (gamma-BHC)	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0289 U	0.0289 U	0.0289 U	0.0289
	delta-BHC	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0166 U	0.0166 U	0.0166 U	0.0166
	cis-Chlordane (alpha)	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.95	1	1.09	1.013333333
	trans-Chlordane (gamma)	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.927	1.06	0.931	0.972666667
	Oxychlordane	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0232 U	0.0635 U	0.0631 U	0.049933333
	cis-Heptachlor Epoxide	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0501 U	0.0511 U	0.0593 U	0.0535
	cis-Nonachlor	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.346	0.295	0.318	0.319666667
	Dieldrin	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.644	0.763	0.694	0.700333333
	Endosulfan I (alpha)	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0642 U	0.0642 U	0.0891 U	0.0725
	Endosulfan II (beta)	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.102 U	0.174 U	N/A	0.092
	Endosulfan Sulfate	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.375	0.281	0.485 U	0.380333333
	Endrin	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0871 U	0.127 U	0.239 U	0.151033333
	Endrin Aldehyde	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.226 U	0.226 U	0.407 U	0.286333333
	Endrin Ketone	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.226 U	0.402 U	0.439 U	0.355666667
	Heptachlor	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0817 U	0.0817 U	0.0817 U	0.0817
	Hexachlorobenzene	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.212	0.192	0.71	0.371333333
	Hexachlorobutadiene	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0169 U	0.0169 U	0.0169 U	0.0169
	Mirex	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0703 U	0.121 U	0.135 U	0.108766667
	trans-Heptachlor Epoxide	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0868 U	0.0868 U	0.242 U	0.138533333
	trans-Nonachlor	ug/kg		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.712	0.7	0.721	0.711
PCBs	Aroclor-1016 (PCB-1016)	µg/Kg dry		5.5 U	5 U	5 U	5.1 U	4.9 U	5.8 U	4.8 U	4.8 U	5.1 U	5.3 U	6.7 U	4.8 U	5 U	4.9 U	5 U	4.8 U	4.8 U	5.1 U	5.8 U	6.1 U	4.9 U	5 U	4.8 U,JL	4.9 U	4.8 U	12.2 U	7.3
(ug/Kg)	Aroclor-1242 (PCB-1242)	µg/Kg dry		2.8 U	2.5 U	2.5 U	2.5 U	2.4 U	2.9 U	2.4 U	2.4 U	2.5 U	2.6 U	3.3 U	2.4 U	2.5 U	2.5 U	2.5 U	2.4 U	2.4 U	2.6 U	2.9 U	3 U	2.5 U	2.5 U	2.4 U,JL	2.4 U	2.4 U	6.1 U	3.6
	Aroclor 1221	µg/Kg dry		3.8 U	3.5 U	3.5 U	3.5 U	3.4 U	4 U	3.3 U	3.4 U	3.5 U	3.7 U	4.6 U	3.3 U	3.5 U	3.4 U	3.5 U	3.3 U	3.4 U	3.6 U	4 U	4.2 U	3.4 U	3.5 U	3.4 U,JL	3.4 U	3.4 U	8.5 U	5.1
	Aroclor 1232	µg/Kg dry		5.1 U	4.6 U	4.7 U	4.7 U	4.5 U	5.4 U	4.4 U	4.5 U	4.7 U	4.9 U	6.2 U	4.4 U	4.6 U	4.6 U	4.6 U	4.4 U	4.4 U	4.7 U	5.3 U	5.6 U	4.5 U	4.6 U	4.5 U,JL	4.5 U	4.5 U	11.3 U	6.8
	Aroclor 1248	µg/Kg dry	7	4.9 U	4.4 U	4.4 U	4.5 U	4.3 U	5.1 U	4.2 U	4.3 U	4.5 U	4.7 U	5.9 U	4.2 U	4.4 U	4.4 U	230 JL	4.2 U	4.2 U	4.5 U	5.1 U	5.3 U	4.3 U	4.4 U	4.3 U,JL	4.3 U	4.3 U	10.8 U	6.5
	Aroclor 1254	µg/Kg dry	27	2.9 U	2.6 U	2.7 U	2.7 U	333 JH	148 JH	321 JH	2.6 U	2.7 U	2.8 U	34.8 JH	2.5 U	2.7 U	20.4 JH	150 JL	84.3 JH	71.5 JH	65 JH	56 JH	27.7 JH	29.6 JH	59.4 JH	2.6 U,JL	27.3 JH	16.5 JH	36.6 JH	26.8
	Aroclor 1260	µg/Kg dry	19	5.9 U	37.2 JL	235	223 JH	313 JH	115 JH	855 JH	9.2 J	5.4 U	5.7 U	25.1 JH	5.1 U	5.4 U	13.5 J	78 JL	48.2 JH	52.4 JH	53.2 JH	35.4 JH	21.9 JH	18 JH	36.9 JH	6.1 JL	20.2 JH	13.4 JH	22.5 JH	18.7
	Total Aroclors	ug/kg		n/a	37.2	235	223	646	263	1176	9.2 J	n/a	n/a	59.9	n/a	n/a	33.9 J	458	132.5	123.9	118.2	91.4	49.6	47.6	96.3	6.1 JL	47.5	29.9 J	59.1 J	45.5
Congener	Total Congener PCBs	ug/kg		49						60		74	82			54		904	95	88	103	51	42		18		38	34	42	37.8
Dioxin-like	PCB- 77	ng/kg		158						189		186	171			157		2470 J	95.2	197	228	133	111		40.9		89	79.9	119	95.96666667
Congener	PCB 81	ng/kg		3.84 J						5.48 J		8.79 J	6.48 J			6.26 J		116	4.44 J	5.58 J	7.43 J	5.76 J	7.1 J		2.25 U		2.77 J	2.71 J	4.59 U	3.356666667
	PCB 105	ng/kg		646						824		1100	1180			705		9500	820	1240	1390	908	606		346		540	465	671	558.6666667
	PCB 114	ng/kg		41						46.8		64.8	67.9			41.5		613	46.8	72.1	79.6	50.4	34.6		15.8		32.4	28.3	41.3	34
	PCB 118	ng/kg		1540						1950		2900	3250			1620		20300	2090	2990	3410	2290	1480		858		1390	1180	1690	1420
	PCB 123	ng/kg		35.7						42.9		62.7	67			26.4 J		477	50.8	64.1	70.7	40.5	33.4		17.3		30	23.2	29.1	27.43333333
	PCB 126	ng/kg		7.5 J						11.6		22.5	13.1			37.4		257	5.46 J	16.5	13.9	16.9	7.47 J		2.76 J		9.94 J	5.77 J	9.29 J	8.333333333
	PCB 156 +PCB157 Co-Elution	ng/kg		293						358		553	609			304		3280	413	546	653	460	317		166		279	241	351	290.3333333
	PCB 167	ng/kg		105						123		196	216			103		1090	167	197	239	166	126		59.7		101	89.4	126	105.4666667
	PCB 169	ng/kg		3.92 J						3.53 U		4.27 J	5.49 J			3.55 U		16.8 J	4.54 J	5.09 J	6.46 J	5.52 J	4.31 U		3.39 U		3.54 U	3.51 U	6.9 U	4.65
	PCB 189	ng/kg		31.7						35.6		54.2	52.4			28.9		211	40.6	55.1	71.1	44.2	37.5		14.2		28.8	23.3	39.8	30.63333333
PBDE	Total	ug/kg		21.2 J						18.2 J		9.1 J	12.1 J			23.1 J		14.9 J	6.7 J	4.9 J	3.3 J	23.7 J	36.9 J		7.2 J		9.9 J	13.6 J	N/A	#VALUE!
Bioassay	Bioassay	Toxic/not toxic		Not Toxic	N/A	Not Toxic	N/A	Not Toxic	N/A	Not Toxic	N/A	Not Toxic	Not Toxic	N/A	N/A	Not Toxic	N/A	Possibly Toxic	Not Toxic	Toxic	Toxic	Not Toxic	Not Toxic	N/A	Toxic	N/A	N/A	N/A	N/A	
	Effect size	%	0	6		6		1		10		11	3			6		19	4	40	59	1	19		26					0.0
General	Total Organic Carbon	mg/Kg dry		18000	22000	14000	11000	14000	14000	18000	8500	13000	12000	20000	10000	12000	8500	21000	18000	8800	8600	21000	21000	10000	10000	8500	11000	10000	13000	11333.3
	Percent Solids	%		84.88	72.96	86.53	85.7	80.88	86.5	80.21	84.58	86.02	85.51	83.35	88.63	88.23	87.73	86.74	87.29	89.44	89.92	80.89	84.24	84.8	88.33	86.17	75.92	76.04	74.37	75.4
	Clay	%		8	14	7	7	5	5	9	4	4	2	6	20	5	12	5	7	10	7	1	6	4	9	4	6	4	8	6.0
	Silt	%		51	77	21	18	26	30	18	12	10	9	68	51	4	38	25	27	35	35	39	55	34	23	18	60	53	57	56.7
	Sand	%		40	9	69	74	55	52	69	84	45	49	26	29	87	48	54	48	54	53	38	39	62	65	78	34	43	35	37.3
	Gravel	%		1	0	3	1	14	13	4	0	41	40	0	0	4	2	16	18	1	5	22	0	0	3	0	0	0	0	0.0
	Start Date	Date		9/30/09	9/30/09	9/30/09	9/30/09	9/30/09	9/30/09	9/30/09	9/18/09	9/18/09	9/18/09	9/18/09	9/15/09	9/18/09	9/15/09	9/18/09	9/18/09	9/18/09	9/18/09	9/18/09	9/18/09	9/15/09	9/18/09	9/15/09	9/30/09	9/30/09	9/30/09	
	Stop Date	Date		10/14/09	10/20/09	10/13/09	10/13/09	10/14/09	10/15/09	10/15/09	9/28/09	9/28/09	9/28/09	9/28/09	9/28/09	9/28/09	9/28/09	9/28/09	9/28/09	9/28/09	9/28/09	9/29/09	9/28/09	9/28/09	9/28/09	9/28/09	10/15/09	10/15/09	10/15/09	
	Field Sample Depth	m		0.1	0.1	0.1	0.05	0.1	0.05	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.07	0.1	0.1	0.1	0.07	0.1	0.08	0.09	0.05	0.1	0.1	0.1	0.1
	Final Weight	g		2429.3	2445.6	2489	2426	2577.5	2315.4	2540.1	2519.8	2903.5	3290.9	2496.1	2556	2817.4	2639.3	2445.5	2695	2741.9	2794	2603.7	2655.2	2746.8	2619.9	2512.7	2524.3	2589.9	2518.6	2544.3
	Initial Weight	g		2862.1	3351.8	2877	2831	3186.9	2676.9	3166.7	2979.1	3375.4	3848.5	2994.6	2883	3193.2	3008.4	2819.2	3088	3065.5	3107	3218.7	3151.9	3239.2	2966.2	2916.1	3324.8	3406.1	3386.5	3372.5
	Initial Weight	g		2862.1	3351.8	2877	2831	3186.9	2676.9	3166.7	2979.1	3375.4	3848.5	2994.6	2883	3193.2	3008.4	2819.2	3088	3065.5	3107	3218.7	3151.9	3239.2	2966.2	2916.1	3324.8	3406.1	3386.5	3372.5

U Under method detection limit
J Estimate below Limit of Quantitation(LOQ)
JH Esstimate concentration; potential high bias due to lab QC failure
JL Estimate concentration; potenail low bias due to lab QC failure
MS 3 Matrix Spike failed because sample result is greater than 10 times the spiked concentration.
Elevated Area Values * Values that exceed the baseline value or one order of magnitude above a risk-based screening level whichever is higher
Red Box Elevated Results

Appendix E Lower Columbia Slough Sediment between River Mile 5.9 and 8.7.
Duplicate QA/QC Review

	Columbia Slough OF 59-65 Sampling 2009		Precision acceptable when <20% OF 61 1 9/14/09		OF 61 2 9/14/09		Precision relative percent difference	P&BR 1 9/10/09		P&BR 2 9/10/09		Precision relative percent difference
Metals	Total Aluminum	mg/Kg dry	14700		13800		6.3%	15900		16700		-4.9%
	Total Antimony	mg/Kg dry	1.67		2.56		-42.1%	0.73		0.82		-11.6%
	Total Arsenic	mg/Kg dry	9.8		22.6		-79.0%	4.2		4.2		0.0%
	Total Barium	mg/Kg dry	114		116		-1.7%	119		127		-6.5%
	Total Cadmium	mg/Kg dry	1.37		1.2		13.2%	0.5	U	0.5	U	0.0%
	Total Chromium	mg/Kg dry	79.8		67.3		17.0%	37.2		40.2		-7.8%
	Total Cobalt	mg/Kg dry	10.9		11		-0.9%	9.78		10.4		-6.1%
	Total Copper	mg/Kg dry	79.4		147		-59.7%	25.8		24.1		6.8%
	Total Lead	mg/Kg dry	212		116		58.5%	129		139		-7.5%
	Total Manganese	mg/Kg dry	473		495		-4.5%	374		379		-1.3%
	Mercury	mg/Kg dry	0.12		0.13		-8.0%	0.1		0.11		-9.5%
	Total Nickel	mg/Kg dry	47.4		37.1		24.4%	17.8		18.3		-2.8%
	Total Selenium	mg/Kg dry	1	U	1	U	0.0%	1	U	1	U	0.0%
	Total Silver	mg/Kg dry	0.26		0.3		-14.3%	0.2	U	0.2	U	0.0%
	Total Thallium	mg/Kg dry	0.2	U	0.2	U	0.0%	0.2	U	0.2	U	0.0%
	Total Zinc	mg/Kg dry	487		622		-24.3%	109		123		-12.1%
Semi-Vols	1,2,4,5-Tetrachlorobenzene	µg/Kg dry	66	U,E	66	U,E	0.0%	33	U,E	33	U,E	0.0%
	1,2,4-Trichlorobenzene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	1,2-Dichlorobenzene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	1,3-Dichlorobenzene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	1,4-Dichlorobenzene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	2,3,4,6-Tetrachlorophenol	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	2,3,5,6-Tetrachlorophenol	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	2,4,5-Trichlorophenol	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	2,4,6-Trichlorophenol	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	2,4-Dichlorophenol	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	2,4-Dimethylphenol	µg/Kg dry	130	U	130	U	0.0%	67	U	67	U,E	0.0%
	2,4-Dinitrophenol	µg/Kg dry	Void		Void		#VALUE!	Void		Void		#VALUE!
	2,4-Dinitrotoluene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	2,6-Dichlorophenol	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	2,6-Dinitrotoluene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	2-Chloronaphthalene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	2-Chlorophenol	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	2-Methylphenol	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	2-Nitrophenol	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	4,6-Dinitro-2-methylphenol	µg/Kg dry	66	U	66	U	0.0%	Void		Void		#VALUE!
	4-Bromophenyl phenyl ether	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	4-Chloro-3-methylphenol	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	4-Methylphenol (p-Cresol)	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Acenaphthene	µg/Kg dry	66	U	66	U	0.0%	37.4	E	52.5	E	-33.6%
	Acenaphthylene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Anthracene	µg/Kg dry	620.3		66		161.5%	49.9		82.5		-49.2%
	Benzo[a]anthracene	µg/Kg dry	198.5		134.7		38.3%	232.2		282.4		-19.5%
	Benzo[a]pyrene	µg/Kg dry	332.5		139.7		81.7%	189.7		234.9		-21.3%
	Benzo[b]fluoranthene	µg/Kg dry	620.3		299.4		69.8%	309.5		329.8		-6.4%
	Benzo[g,h,i]perylene	µg/Kg dry	397		194.6		68.4%	104.8		119.9		-13.4%
	Benzo[k]fluoranthene	µg/Kg dry	158.8		66	U	82.6%	109.8		122.4		-10.9%
	Bis(2-Chloroethoxy) methane	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Bis(2-Chloroethyl) ether	µg/Kg dry	66	U,E	67	U,E	-1.5%	33	U,E	33	U,E	0.0%
	Bis(2-Chloroisopropyl) ether	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Bis(2-ethylhexyl)adipate	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Bis(2-ethylhexyl)phthalate	µg/Kg dry	4387.1		5349		-19.8%	626.6		842.1		-29.3%
	Butylbenzylphthalate	µg/Kg dry	213.4		99.8	U	72.5%	49.9	U	50	U	-0.2%
	Chrysene	µg/Kg dry	466.5		189.6		84.4%	327		369.8		-12.3%
	di-n-Butylphthalate	µg/Kg dry	392.1	E	99.8	U	118.8%	49.9	U	50	U	-0.2%
	Di-n-octylphthalate	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Dibenz[a,h]anthracene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Dibenzofuran	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Diethylphthalate	µg/Kg dry	99.2	U	99.8	U	-0.6%	49.9	U	50	U	-0.2%
	Dimethylphthalate	µg/Kg dry	99.2	U	99.8	U	-0.6%	49.9	U	50	U	-0.2%
	Fluoranthene	µg/Kg dry	1206		334.3		113.2%	748.9		924.5		-21.0%
	Fluorene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Hexachloro-1,3-Butadiene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Hexachlorocyclopentadiene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Hexachloroethane	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Indeno[1,2,3-cd]pyrene	µg/Kg dry	297.8		134.7		75.4%	99.9		114.9		-14.0%
	Isophorone	µg/Kg dry	66	U	66	U	0.0%	39.9	E	72		-57.4%
	n-Nitroso-di-n-dipropylamine	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	n-Nitrosodiphenylamine	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Naphthalene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Nitrobenzene	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Pentachlorophenol	µg/Kg dry	426.8		254.5		50.6%	33	U	33	U	0.0%
	Phenanthrene	µg/Kg dry	645.2		129.7		133.0%	297.1		397.3		-28.9%
	Phenol	µg/Kg dry	66	U	66	U	0.0%	33	U	33	U	0.0%
	Pyrene	µg/Kg dry	1429.3		364.3		118.8%	773.8		949.5		-20.4%

Appendix E Lower Columbia Slough Sediment between River Mile 5.9 and 8.7.
Duplicate QA/QC Review

	Columbia Slough OF 59-65		Precision acceptable when <20%										
			OF 61 1		OF 61 2		Precision relative percent difference		P&BR 1		P&BR 2		Precision relative percent difference
	Sampling 2009		9/14/09		9/14/09				9/10/09		9/10/09		
Pesticides	Aldrin	ug/kg	8.6	U	8.35	U	2.9%		0.399	U	1.7	U	-124.0%
ug/kg	alpha-BHC	ug/kg	9.35	U	9.08	U	2.9%		0.434	U	1.7	U	-118.7%
Method	beta-BHC	ug/kg	10.9	U	10.6	U	2.8%		0.508	U	1.7	U	-108.0%
8081	delta-BHC	ug/kg	7.63	U	7.41	U	2.9%		2.86		1.7	U	50.9%
	gamma-BHC (Lindane)	ug/kg	12.9	U	12.5	U	3.1%		0.598	U	1.7	U	-95.9%
	Chlordane	ug/kg	49.1	U	47.7	U	2.9%		3.36	U	3.32	U	1.2%
	alpha-Chlordane	ug/kg	12.2	U	11.9	U	2.5%		7.92		7.44		6.2%
	gamma-Chlordane	ug/kg	13.1	U	12.7	U	3.1%		5.74		5.44		5.4%
	4,4'-DDD	ug/kg	20	U	19.5	U	2.5%		5.58		4.11		30.3%
	4,4'-DDE	ug/kg	**9.6**	J	**12.7**	J	-27.8%		4.51		3.32	U	30.4%
	4,4'-DDT	ug/kg	43	U	41.7	U	3.1%		1.99	U	3.32	U	-50.1%
	Dieldrin	ug/kg	7.65	U	7.43	U	2.9%		0.355	U	3.32	U	-161.4%
	Endosulfan I	ug/kg	10.9	U	10.6	U	2.8%		0.506	U	1.7	U	-108.3%
	Endosulfan II	ug/kg	9.48	U	9.2	U	3.0%		0.44	U	3.32	U	-153.2%
	Endosulfan sulfate	ug/kg	12.3	U	12	U	2.5%		0.572	U	3.32	U	-141.2%
	Endrin	ug/kg	10.3	U	10	U	3.0%		0.479	U	3.32	U	-149.6%
	Endrin aldehyde	ug/kg	10.6	U	10.3	U	2.9%		0.494	U	3.32	U	-148.2%
	Endrin ketone	ug/kg	25.5	U	24.7	U	3.2%		1.18	U	3.32	U	-95.1%
	Heptachlor	ug/kg	9.41	U	9.14	U	2.9%		0.437	U	1.7	U	-118.2%
	Heptachlor epoxide	ug/kg	9.26	U	8.99	U	3.0%		0.43	U	1.7	U	-119.2%
	Methoxychlor	ug/kg	23.9	U	23.3	U	2.5%		16.8	U	16.7	U	0.6%
	Toxaphene	ug/kg	609	U	592	U	2.8%		67.3	U	66.5	U	1.2%
PCBs	Aroclor-1016 (PCB-1016)	µg/Kg dry	5.1	U	5.3	U	-3.8%		4.8	U	5.1	U	-6.1%
	Aroclor-1242 (PCB-1242)	µg/Kg dry	2.5	U	2.6	U	-3.9%		2.4	U	2.6	U	-8.0%
	Aroclor 1221	µg/Kg dry	3.5	U	3.7	U	-5.6%		3.4	U	3.6	U	-5.7%
	Aroclor 1232	µg/Kg dry	4.7	U	4.9	U	-4.2%		4.4	U	4.7	U	-6.6%
	Aroclor 1248	µg/Kg dry	4.5	U	4.7	U	-4.3%		4.2	U	4.5	U	-6.9%
	Aroclor 1254	µg/Kg dry	2.7	U	2.8	U	-3.6%		71.5		65		9.5%
	Aroclor 1260	µg/Kg dry	5.4	U	5.7	U	-5.4%		52.4		53.2		-1.5%
Congener	PCB- 77	ng/Kg	186		171		8.4%		197		228		-14.6%
	PCB 81	ng/Kg	8.79	J	6.48	J	30.3%		5.58	J	7.43	J	-28.4%
	PCB 105	ng/Kg	1100		1180		-7.0%		1240		1390		-11.4%
	PCB 114	ng/Kg	64.8		67.9		-4.7%		72.1		79.6		-9.9%
	PCB 118	ng/Kg	2900		3250		-11.4%		2990		3410		-13.1%
	PCB 123	ng/Kg	62.7		67		-6.6%		64.1		70.7		-9.8%
	PCB 126	ng/Kg	22.5		13.1		52.8%		16.5		13.9		17.1%
	PCB 156+157	ng/Kg	553		609		-9.6%		546		653		-17.8%
	PCB 167	ng/Kg	196		216		-9.7%		197		239		-19.3%
	PCB 169	ng/Kg	4.27	J	5.49	J	-25.0%		5.09	J	6.46	J	-23.7%
	PCB 189	ng/Kg	54.2		52.4		3.4%		55.1		71.1		-25.4%
PBDE	Total PBDE	ug/kg	9.1		12.1		-28.7%		4.9		3.3		38.6%
TributylTin	Tributyltin	µg/Kg	20.8		28		-29.5%		5		5		0.0%
Bioassay	Bioassay	Toxic/not tox	Not Toxic		Not Toxic				Toxic		Toxic		
General	Total Organic Carbon	mg/Kg dry	13000		12000		8.0%		8800		8600		2.3%
	Percent Solids	%	86.02		85.51		0.6%		89.44		89.92		-0.5%
	Clay	%	4		2		66.7%		10		7		35.3%
	Silt	%	10		9		10.5%		35		35		0.0%
	Sand	%	45		49		-8.5%		54		53		1.9%
	Gravel	%	41		40		2.5%		1		5		-133.3%
	Start Date	Date	9/18/09		9/18/09				9/18/09		9/18/09		
	Stop Date	Date	9/28/09		9/28/09				9/28/09		9/28/09		
	Field Sample Depth	m	0.1		0.1		0.0%		0.1		0.1		0.0%
	Final Weight	g	2903.5		3291		-12.5%		2742		2794		-1.9%
	Initial Weight	g	3375.4		3849		-13.1%		3066		3107		-1.3%
U	Under method detection limit												
J	Estimate below Limit of Quantitation(LOQ)												
	Precision >20%												

Appendix E Columbia Slough Triplicate QA/QC Review
Decision Area: Columbia Slough between River Mile 5.9 and 8.7.

	Columbia Slough OF 59-65 Sampling 2009		IS A Sample	IS B	IS C	Simple Mean		Standard Deviation	Relative Standard Deviation	95% UCL Factor	
Metals	Total Aluminum	mg/Kg dry	17100	16100	17400	16867		680.7	4.0	18014.2	
	Total Antimony	mg/Kg dry	0.5	0.5	0.5	0.5		0.0	0.0	0.5	
	Total Arsenic	mg/Kg dry	5.2	5.2	5.6	5.3		0.2	4.3	5.7	
	Total Barium	mg/Kg dry	122	122	129	124.3		4.0	3.3	131.1	
	Total Cadmium	mg/Kg dry	0.92	0.84	0.96	0.9		0.1	6.7	1.0	
	Total Chromium	mg/Kg dry	45.4	41.5	45.5	44.1		2.3	5.2	48.0	
	Total Cobalt	mg/Kg dry	9.7	9.54	10.2	9.8		0.3	3.5	10.4	
	Total Copper	mg/Kg dry	37.4	34.2	41	37.5		3.4	9.1	43.3	
	Total Lead	mg/Kg dry	40.8	37.6	45.5	41.3		4.0	9.6	48.0	
	Total Manganese	mg/Kg dry	409	408	436	417.7		15.9	3.8	444.4	
	Mercury	mg/Kg dry	0.1	0.09	0.11	0.1		0.0	10.0	0.1	
	Total Nickel	mg/Kg dry	19.8	18.7	20.7	19.7		1.0	5.1	21.4	
	Total Selenium	mg/Kg dry	1	1	1	1.0		0.0	0.0	1.0	
	Total Silver	mg/Kg dry	0.19	0.49	0.25	0.3		0.2	51.2	0.6	
	Total Thallium	mg/Kg dry	0.2	0.2	0.2	0.2		0.0	0.0	0.2	
	Total Zinc	mg/Kg dry	244	227	261	244.0		17.0	7.0	272.7	
Semi-Vols	1,2,4,5-Tetrachlorobenzene	µg/Kg dry	227	240	281	249.3		28.2	11.3	296.8	
	1,2,4-Trichlorobenzene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	1,2-Dichlorobenzene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	1,3-Dichlorobenzene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	1,4-Dichlorobenzene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	2,3,4,6-Tetrachlorophenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	2,3,5,6-Tetrachlorophenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	2,4,5-Trichlorophenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	2,4,6-Trichlorophenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	2,4-Dichlorophenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	2,4-Dimethylphenol	µg/Kg dry	130	130	130	130.0		0.0	0.0	130.0	
	2,4-Dinitrophenol	µg/Kg dry	Void	Void	Void	Void		Void		Void	
	2,4-Dinitrotoluene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	2,6-Dichlorophenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	2,6-Dinitrotoluene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	2-Chloronaphthalene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	2-Chlorophenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	2-Methylphenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	2-Nitrophenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	4,6-Dinitro-2-methylphenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	4-Bromophenyl phenyl ether	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	4-Chloro-3-methylphenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	4-Methylphenol (p-Cresol)	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Acenaphthene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Acenaphthylene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Anthracene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Benzo[a]anthracene	µg/Kg dry	94.9	119.6	124.8	113.1		16.0	14.1	140.0	
	Benzo[a]pyrene	µg/Kg dry	79.9	119.6	129.8	109.8		26.4	24.0	154.2	
	Benzo[b]fluoranthene	µg/Kg dry	194.7	254.2	274.6	241.2		41.5	17.2	311.2	
	Benzo[g,h,i]perylene	µg/Kg dry	114.8	154.5	159.8	143.0		24.6	17.2	184.5	
	Benzo[k]fluoranthene	µg/Kg dry	66	66	69.9	67.3		2.3	3.3	71.1	
	Bis(2-Chloroethoxy) methane	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Bis(2-Chloroethyl) ether	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Bis(2-Chloroisopropyl) ether	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Bis(2-ethylhexyl)adipate	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Bis(2-ethylhexyl)phthalate	µg/Kg dry	713.9	942.2	1113	923.1		200.4	21.7	1260.9	
	Butylbenzylphthalate	µg/Kg dry	99.8	99.8	99.8	99.8		0.0	0.0	99.8	
	Chrysene	µg/Kg dry	109.8	164.5	174.7	149.7		34.9	23.3	208.5	
	di-n-Butylphthalate	µg/Kg dry	99.8	99.8	99.8	99.8		0.0	0.0	99.8	
	Di-n-octylphthalate	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Dibenz[a,h]anthracene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Dibenzofuran	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Diethylphthalate	µg/Kg dry	99.8	99.8	99.8	99.8		0.0	0.0	99.8	
	Dimethylphthalate	µg/Kg dry	99.8	99.8	99.8	99.8		0.0	0.0	99.8	
	Fluoranthene	µg/Kg dry	234.6	319	354.5	302.7		61.6	20.3	406.5	
	Fluorene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Hexachloro-1,3-Butadiene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Hexachlorocyclopentadiene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Hexachloroethane	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Indeno[1,2,3-cd]pyrene	µg/Kg dry	74.9	109.7	119.8	101.5		23.6	23.2	141.2	
	Isophorone	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	n-Nitroso-di-n-dipropylamine	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	n-Nitrosodiphenylamine	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Naphthalene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Nitrobenzene	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Pentachlorophenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Phenanthrene	µg/Kg dry	66	114.7	119.8	100.2		29.7	29.6	150.2	
	Phenol	µg/Kg dry	66	66	66	66.0		0.0	0.0	66.0	
	Pyrene	µg/Kg dry	234.6	324	339.5	299.4		56.6	18.9	394.8	

Appendix E Columbia Slough Triplicate QA/QC Review
Decision Area: Columbia Slough between River Mile 5.9 and 8.7.

Columbia Slough OF 59-65	Sampling 2009		IS A Sample	IS B	IS C	Simple Mean	Standard Deviation	Relative Standard Deviation	95% UCL Factor
Pesticides	Aldrin	ug/kg	8.02	8.04	7.87	8.0	0.1	1.2	8.1
Method	alpha-BHC	ug/kg	8.71	8.73	8.55	8.7	0.1	1.1	8.8
8081	beta-BHC	ug/kg	10.2	10.2	10	10.1	0.1	1.1	10.3
	delta-BHC	ug/kg	7.12	7.13	6.98	7.1	0.1	1.2	7.2
	gamma-BHC (Lindane)	ug/kg	12	12	11.8	11.9	0.1	1.0	12.1
	Chlordane	ug/kg	45.8	45.9	44.9	45.5	0.6	1.2	46.5
	alpha-Chlordane	ug/kg	11.4	11.4	11.2	11.3	0.1	1.0	11.5
	gamma-Chlordane	ug/kg	12.2	12.2	12	12.1	0.1	1.0	12.3
	4,4'-DDD	ug/kg	18.7	18.7	18.3	18.6	0.2	1.2	19.0
	4,4'-DDE	ug/kg	5.4	5.41	5.29	5.4	0.1	1.2	5.5
	4,4'-DDT	ug/kg	40	40.1	39.3	39.8	0.4	1.1	40.5
	Dieldrin	ug/kg	7.14	7.15	7	7.1	0.1	1.2	7.2
	Endosulfan I	ug/kg	10.2	10.2	9.97	10.1	0.1	1.3	10.3
	Endosulfan II	ug/kg	8.84	8.86	8.67	8.8	0.1	1.2	9.0
	Endosulfan sulfate	ug/kg	11.5	11.5	11.3	11.4	0.1	1.0	11.6
	Endrin	ug/kg	9.62	9.64	9.43	9.6	0.1	1.2	9.8
	Endrin aldehyde	ug/kg	9.93	9.95	9.74	9.9	0.1	1.2	10.1
	Endrin ketone	ug/kg	23.7	23.8	23.3	23.6	0.3	1.1	24.0
	Heptachlor	ug/kg	8.77	8.79	8.61	8.7	0.1	1.1	8.9
	Heptachlor epoxide	ug/kg	8.63	8.65	8.47	8.6	0.1	1.1	8.7
	Methoxychlor	ug/kg	22.3	22.4	21.9	22.2	0.3	1.2	22.6
	Toxaphene	ug/kg	568	569	557	564.7	6.7	1.2	575.9
Pesticides	2,4'-DDD		0.818	1.070	0.836	0.91	0.14	15.5	1.1
Method	2,4'-DDE		0.271	0.381	0.291	0.31	0.06	18.6	0.4
1669	2,4'-DDT		0.066	0.121	0.172	0.12	0.05	44.2	0.2
	4,4'-DDD		3.140	4.430	3.520	3.70	0.66	17.9	4.8
	4,4'-DDE		5.930	6.860	6.140	6.31	0.49	7.7	7.1
	4,4'-DDT		0.405	0.480	0.530	0.47	0.06	13.3	0.6
	4,4'-Methoxychlor		0.439	0.628	0.570	0.55	0.10	17.7	0.7
	Aldrin		0.208	0.172	0.172	0.18	0.02	11.3	0.2
	alpha-BHC		0.019	0.017	0.017	0.02	0.00	8.5	0.0
	beta-BHC		0.022	0.017	0.017	0.02	0.00	15.5	0.0
	Lindane (gamma-BHC)		0.029	0.029	0.029	0.03	0.00	0.0	0.0
	delta-BHC		0.017	0.017	0.017	0.02	0.00	0.0	0.0
	cis-Chlordane (alpha)		0.950	1.000	1.090	1.01	0.07	7.0	1.1
	trans-Chlordane (gamma)		0.927	1.060	0.931	0.97	0.08	7.8	1.1
	Oxychlordane		0.023	0.064	0.063	0.05	0.02	46.4	0.1
	cis-Heptachlor Epoxide		0.050	0.051	0.059	0.05	0.01	9.4	0.1
	cis-Nonachlor		0.346	0.295	0.318	0.32	0.03	8.0	0.4
	Dieldrin		0.644	0.763	0.694	0.70	0.06	8.5	0.8
	Endosulfan I (alpha)		0.064	0.064	0.089	0.07	0.01	19.8	0.1
	Endosulfan II (beta)		0.102	0.174		0.14	0.05	36.9	0.2
	Endosulfan Sulfate		0.375	0.281	0.485	0.38	0.10	26.8	0.6
	Endrin		0.087	0.127	0.239	0.15	0.08	52.1	0.3
	Endrin Aldehyde		0.226	0.226	0.407	0.29	0.10	36.5	0.5
	Endrin Ketone		0.226	0.402	0.439	0.36	0.11	32.0	0.5
	Heptachlor		0.082	0.082	0.082	0.08	0.00	0.0	0.1
	Hexachlorobenzene		0.212	0.192	0.710	0.37	0.29	79.0	0.9
	Hexachlorobutadiene		0.017	0.017	0.017	0.02	0.00	0.0	0.0
	Mirex		0.070	0.121	0.135	0.11	0.03	31.3	0.2
	trans-Heptachlor Epoxide		0.087	0.087	0.242	0.14	0.09	64.7	0.3
	trans-Nonachlor		0.712	0.700	0.721	0.71	0.01	1.5	0.7
TBT	Tributyltin	µg/Kg dry	6	11	51.7	22.9	25.1	109.5	65.2
PCBs	Aroclor-1016 (PCB-1016)	µg/Kg dry	4.9	4.8	12.2	7.3	4.2	58.1	14.5
	Aroclor-1242 (PCB-1242)	µg/Kg dry	2.4	2.4	6.1	3.6	2.1	58.8	7.2
	Aroclor 1221	µg/Kg dry	3.4	3.4	8.5	5.1	2.9	57.7	10.1
	Aroclor 1232	µg/Kg dry	4.5	4.5	11.3	6.8	3.9	58.0	13.4
	Aroclor 1248	µg/Kg dry	4.3	4.3	10.8	6.5	3.8	58.0	12.8
	Aroclor 1254	µg/Kg dry	27.3	16.5	36.6	26.8	10.1	37.5	43.8
	Aroclor 1260	µg/Kg dry	20.2	13.4	22.5	18.7	4.7	25.3	26.7
Dioxin-like	PCB- 77	ng/Kg	89	79.9	119	96.0	20.5	21.3	130.5
Congener	PCB 81	ng/Kg	2.77	2.71	4.59	3.4	1.1	31.8	5.2
	PCB 105	ng/Kg	540	465	671	558.7	104.3	18.7	734.4
	PCB 114	ng/Kg	32.4	28.3	41.3	34.0	6.6	19.5	45.2
	PCB 118	ng/Kg	1390	1180	1690	1420.0	256.3	18.1	1852.1
	PCB 123	ng/Kg	30	23.2	29.1	27.4	3.7	13.5	33.7
	PCB 126	ng/Kg	9.94	5.77	9.29	8.3	2.2	26.9	12.1
	PCB 156 + 157	ng/Kg	279	241	351	290.3	55.9	19.2	384.5
	PCB 167	ng/Kg	101	89.4	126	105.5	18.7	17.7	137.0
	PCB 169	ng/Kg	3.54	3.51	6.9	4.7	1.9	41.9	7.9
	PCB 189	ng/Kg	28.8	23.3	39.8	30.6	8.4	27.4	44.8
	Total PCBs	ng/Kg	37800	33500	42400	37900	4450.8	11.7	45403.5
PBDE	BDE-(28/33)	ng/Kg	160.0	154.0		157.0	4.2	2.7	164.2
	BDE-47	ng/Kg	1830	2020		1925.0	134.4	7.0	2151.5
	BDE-99	ng/Kg	2180	5030		3605.0	2015.3	55.9	7002.4
	BDE-100	ng/Kg	538	1140		839.0	425.7	50.7	1556.6
	BDE-153	ng/Kg	349	898		623.5	388.2	62.3	1278.0
	BDE-154	ng/Kg	270	697		483.5	301.9	62.4	992.5
	BDE-183	ng/Kg	166	201		183.5	24.7	13.5	225.2
	BDE-209	ng/Kg	4420	3430		3925.0	700.0	17.8	5105.2
	Total BDE	ng/Kg	9913	13570		11741.5	2585.9	22.0	16101.0

Appendix E Columbia Slough Triplicate QA/QC Review
Decision Area: Columbia Slough between River Mile 5.9 and 8.7.

	Columbia Slough OF 59-65 Sampling 2009		IS A Sample	IS B	IS C	Simple Mean		Standard Deviation	Relative Standard Deviation	95% UCL Factor	
General	Total Organic Carbon	mg/Kg dry	**11000**	**10000**	**13000**	11333.3		1527.5	13.5	13908.5	
	Percent Solids	%	**75.92**	**76.04**	**74.37**	75.4		0.9	1.2	77.0	
	Clay	%	**6**	**4**	**8**	6.0		2.0	33.3	9.4	
	Silt	%	**60**	**53**	**57**	56.7		3.5	6.2	62.6	
	Sand	%	**34**	**43**	**35**	37.3		4.9	13.2	45.6	
	Gravel	%	**0**	**0**	**0**	0.0		0.0	0.0	0.0	
	Start Date	Date	9/30/09	9/30/09	9/30/09						
	Stop Date	Date	0/15/09	0/15/09	0/15/09						
	Field Sample Depth	m	**0.1**	**0.1**	**0.1**	0.1		0.0	0.0	0.1	
	Final Weight	g	**2524.3**	**2589.9**	**2519**	2544.3		39.6	1.6	2611.1	
	Initial Weight	g	**3324.8**	**3406.1**	**3387**	3372.5		42.4	1.3	3444.0	
	Initial Weight	g	**3324.8**	**3406.1**	**3387**	3372.5		42.4	1.3	3444.0	

Bold values are detected values

Green — RSD>30% for detected values

Value above SLV

RST=100* StDv/mean

95% UCL=
mean+(2.92*StDv)/SQRT(3)

Appendix F -- 2009 Lower Colulmbia Slough Sediment between River Mile 5.9 and 8.7.
Congener Data Table

Parameter	Unit	35980	35976	35974	35974	35971	35969	35968	35967	35967	35965	35966	35962	35981	35981	35981
	Site Name	OF 59 #59	OF #60	OF #61	OF #61	OF #61A	OF62	Wastech	Prec +BR	Prec +BR	OF 63	OF 64	OF 65	IS Triplicate A	IS (Triplicate B)	IS (Triplicate C)
		09/15/2009 0	09/14/2009 1	09/14/2009 0	09/14/2009 0	09/09/2009 1	09/09/2009 09:	09/10/2009 1	09/10/2009 0	09/10/2009 09:	09/08/2009 1	09/08/2009 1	09/08/2009 0	09/18/2009	09/18/2009	09/18/2009
		Sample	Sample	Sample - Field	Sample - Field	Sample	Sample	Sample	Sample - Field	Sample - Field	Sample	Sample	Sample	Sample	Sample	Sample
Total PCBs	ug/kg dry wt	48.5	60.2	74.2	82.2	54	904	95.1	88.1	103	50.8	42.1	17.5	37.8	33.5	42.4
Total Deca PCBs	ng/Kg dry wt	197	221	200	353	80.9	321	337	192	207	187	115	53.9	151	148	205
Total Di PCBs	ng/Kg dry wt	628	1030	657	715	865	27400	641	625	855	688	729	248	443	408	1170
Total Hepta PCBs	ng/Kg dry wt	5170	5410	8570	7660	5520	40100	8290	10000	12800	6200	6140	2100	4420	4060	5270
Total Hexa PCBs	ng/Kg dry wt	12400	15700	21000	23700	12600	99300	28500	24800	30200	15500	12500	5290	11100	10000	11800
Total Mono PCBs	ng/Kg dry wt	62.0	74.4	98.4	140	80.9	523	64.8	66.3	78.6	90.2	97.4	30.5	56.9	60.5	196
Total Nona PCBs	ng/Kg dry wt	421	397	381	464	242	1720	403	452	496	370	397	118	314	299	404
Total Octa PCBs	ng/Kg dry wt	1700	1740	2400	2210	1480	10300	2050	2640	3250	1760	1710	562	1320	1320	1940
Total PCB	ng/Kg dry wt	48500	60200	74200	82200	54000	904000	95100	88100	103000	50800	42100	17500	37800	33500	42400
Total Penta PCBs	ng/Kg dry wt	13700	16900	24000	28400	15200	142000	34000	29600	31600	16400	10900	5920	11600	9740	10900
Total Tetra PCBs	ng/Kg dry wt	10400	12900	12900	14300	12500	387000	17200	14100	17100	7410	7110	2480	6300	5660	7210
Total Tri PCBs	ng/Kg dry wt	3870	5920	4020	4360	5460	196000	3630	5520	6800	2270	2320	677	2080	1810	3310
PCB-1	ng/Kg dry wt	17.4	23.9	27.7	33	20.6	307	21.8	21.8	27.7	26.2	35.3	13.8	15.4	18.3	52.8
PCB-10	ng/Kg dry wt	3.17 U	3.36 J	3.34 U	2.42 J	3.21 U	272	3.72 J	5.17 J	5.58 J	3.59 U	4.39 J	3.06 U	3.2 U	3.17 U	6.24 U
PCB-100 C-E 93+98+100+102	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-101 C-E 90+101+113	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-102 C-E 93+98+100+102	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-103	ng/Kg dry wt	34	29.1	56.1	69.1	22.5	262	429	38	37.4	22	16.5	8.01 J	21.1	19.3	16.9
PCB-104	ng/Kg dry wt	1.86 U	1.87 U	1.96 U	0.362 U	1.88 U	1.88 U	1.92 U	1.87 U	1.85 U	2.11 U	2.29 U	1.8 U	1.88 U	1.86 U	3.66 U
PCB-105	ng/Kg dry wt	646	824	1100	1180	705	9500	820	1240	1390	908	606	346	540	465	671
PCB-106	ng/Kg dry wt	4.26 U	4.29 U	4.48 U	0.828 U	4.31 U	4.3 U	4.39 U	4.29 U	4.22 U	4.83 U	5.23 U	4.11 U	4.29 U	4.26 U	8.38 U
PCB-107 C-E 107+123	ng/Kg dry wt	67.3	84.5	111	130	69.8	942	98.5	128	148	97.3	68.2	34.6	59.8	52.4	64.7
PCB-108 C-E 86+87+97+108+119+125	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-109	ng/Kg dry wt	117	136	200	248	93.3	1240	162	204	224	164	104	54.4	96.8	86.5	127
PCB-11	ng/Kg dry wt	215	234	183	210	267	541	137	127	144	275	251	130	172	162	692
PCB-110 C-E 110+115	ng/Kg dry wt	2350	3040	4230	5090	2690	15400	4980	5870	5670	2890	1880	1080	1970	1660	1920
PCB-111	ng/Kg dry wt	2.24 U	2.25 U	4.76 J	0.434 U	2.26 U	2.25 U	12.7	2.25 U	2.22 U	2.53 U	2.74 U	2.16 U	2.25 U	2.23 U	4.4 U
PCB-112	ng/Kg dry wt	2.82 U	2.84 U	2.96 U	0.548 U	2.85 U	2.84 U	2.91 U	2.83 U	2.79 U	3.19 U	3.46 U	2.72 U	2.84 U	2.82 U	5.54 U
PCB-113 C-E 90+101+113	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-114	ng/Kg dry wt	41	46.8	64.8	67.9	41.5	613	46.8	72.1	79.6	50.4	34.6	15.8	32.4	28.3	41.3
PCB-115 C-E 110+115	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-116 C-E 85+116+117	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-117 C-E 85+116+117	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-118	ng/Kg dry wt	1540	1950	2900	3250	1620	20300	2090	2990	3410	2290	1480	858	1390	1180	1690
PCB-119 C-E 86+87+97+108+119+125	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-12 C-E 12+13	ng/Kg dry wt	38.3	60.2	40.8	46.3	41	730	32.2	33.1	44.1	35.5	31.1	16.5 J	29.7	25.9	66
PCB-120	ng/Kg dry wt	7.61 J	9.84 J	33.9	29.3	2.56 U	8.88 J	33.9	16.4	12.6	8.95 J	5.33 J	3.29 J	6.32 J	6.29 J	5.13 J
PCB-121	ng/Kg dry wt	2.52 U	2.54 U	2.65 U	0.49 U	2.55 U	2.54 U	23.8	2.53 U	2.5 U	2.85 U	3.09 U	2.43 U	2.54 U	2.52 U	4.95 U
PCB-122	ng/Kg dry wt	23.8	27.6	34.8	41.4	26.1	270	31.7	37.3	46.3	31.4	19.6	9.13 J	19.6	18.1	22.2
PCB-123	ng/Kg dry wt	35.7	42.9	62.7	67	26.4 J	477	50.8	64.1	70.7	40.5	33.4	17.3	30	23.2	29.1
PCB-124 C-E 107+123	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-125 C-E 86+87+97+108+119+125	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-126	ng/Kg dry wt	7.5 J	11.6	22.5	13.1	37.4	257	5.46 J	16.5	13.9	16.9	7.47 J	2.76 J	9.94 J	5.77 J	9.29 J
PCB-127	ng/Kg dry wt	2.36 U	2.83 J	6.64 J	6.07	2.39 U	34.6	11.5	5.29 J	6.89 J	4.42 J	3.19 J	2.28 U	2.38 U	2.36 U	4.65 U
PCB-128 C-E 128+166	ng/Kg dry wt	342	454	678	749	390	3800	635	733	837	537	399	195	336	288	410
PCB-129 C-E 129+138+163	ng/Kg dry wt	2580	3360	4700	5200	2660	26700	4870	5390	6410	3690	2860	1280	2430	2150	2910
PCB-13 C-E 12+13	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-130	ng/Kg dry wt	169	214	304	359	167	1780	306	337	378	240	170	85.3	165	144	176
PCB-131	ng/Kg dry wt	34.2	54.1	67.6	87.2	39.2	528	70.8	79.1	94.8	55.4	36.4	20.4	35.9	32.2	38.7
PCB-132	ng/Kg dry wt	911	1190	1540	1880	978	9000	1740	1730	2190	1180	899	405	829	754	811
PCB-133	ng/Kg dry wt	47.4	51.9	80.2	86.2	43.7	319	174	76.3	88.9	56.4	42.3	17.8	39.5	36.9	44.4

Appendix F -- 2009 Lower Colulmbia Slough Sediment between River Mile 5.9 and 8.7.
Congener Data Table

	Lab ID #	35980	35976	35974	35974	35971	35969	35968	35967	35967	35965	35966	35962	35981	35981	35981
	Site Name	OF 59 #59	OF #60	OF #61	OF #61	OF #61A	OF62	Wastech	Prec +BR	Prec +BR	OF 63	OF 64	OF 65	IS Triplicate A	IS (Triplicate B)	IS (Triplicate C)
		09/15/2009 09	09/14/2009 10	09/14/2009 09	09/14/2009 09	09/09/2009 10	09/09/2009 09:	09/10/2009 10	09/10/2009 09	09/10/2009 09:	09/08/2009 11	09/08/2009 10	09/08/2009 09	09/18/2009	09/18/2009	09/18/2009
Parameter	Unit	Sample	Sample	Sample - Field	Sample - Field	Sample	Sample	Sample	Sample - Field	Sample - Field	Sample	Sample	Sample	Sample	Sample	Sample
PCB-134 C-E 134+143	ng/Kg dry wt	159	199	288	345	184	1690	369	325	379	205	156	68	147	125	146
PCB-135 C-E 135+151	ng/Kg dry wt	1100	1350	1660	1820	1130	4900	3400	2380	2790	1070	971	348	896	843	863
PCB-136	ng/Kg dry wt	442	526	661	787	471	2170	1590	929	1080	437	371	145	367	332	303
PCB-137	ng/Kg dry wt	129	135	224	265	114	1470	206	194	260	155	99.5	61.4	104	108	109
PCB-138 C-E 129+138+163	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-139 C-E 139+140	ng/Kg dry wt	50.2	61	89	105	46.2	561	135	88.8	99.3	64.6	42	21.8	44.8	39.7	46.5
PCB-14	ng/Kg dry wt	3.83 U	3.86 U	4.03 U	0.745 U	3.88 U	3.86 U	3.95 U	3.86 U	3.8 U	4.34 U	4.71 U	3.7 U	3.86 U	3.83 U	7.54 U
PCB-140 C-E 139+140	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-141	ng/Kg dry wt	460	616	796	877	520	5060	822	1050	1350	597	509	204	431	387	477
PCB-142	ng/Kg dry wt	2.14 U	2.15 U	2.25 U	0.415 U	2.16 U	2.15 U	2.2 U	2.15 U	2.12 U	2.42 U	2.62 U	2.06 U	2.15 U	2.14 U	4.2 U
PCB-143 C-E 134+143	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-144	ng/Kg dry wt	146	199	238	262	177	699	295	343	436	164	147	55.3	131	118	111
PCB-145	ng/Kg dry wt	2.32 U	2.34 U	2.45 U	0.452 U	2.35 U	2.34 U	2.4 U	2.34 U	2.3 U	2.63 U	2.85	2.24 U	2.34 U	2.32 U	4.57 U
PCB-146	ng/Kg dry wt	409	486	715	779	372	3300	1070	726	864	489	402	165	358	326	389
PCB-147 C-E 147+149	ng/Kg dry wt	2340	2930	3690	4320	2340	8640	6990	4500	5630	2600	2250	862	2010	1840	1830
PCB-148	ng/Kg dry wt	13.9	2.71 U	13.9	11.4	2.72 U	2.71 U	90.4	2.71 U	2.67 U	3.05 U	3.31 U	2.6 U	2.71 U	2.69 U	5.3 U
PCB-149 C-E 147+149	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-15	ng/Kg dry wt	199	411	222	231	265	6970	184	217	299	174	150	48.4	124	114	188
PCB-150	ng/Kg dry wt	9.93 J	2.09 U	14.3	13.8	2.1 U	19	76.6	7.11 J	9.07 J	2.35 U	2.55 U	2 U	2.09 U	2.08 U	4.08 U
PCB-151 C-E 135+151	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-152	ng/Kg dry wt	5.48 J	2.21 U	2.31 U	6.01	2.22 U	26.7	2.26 U	4.12 J	7.57 J	2.49	2.7 U	2.12	2.21 U	2.19 U	4.32 U
PCB-153 C-E 153+168	ng/Kg dry wt	2170	2740	3650	4030	2030	19900	4000	4160	5250	2670	2230	909	1950	1790	2190
PCB-154	ng/Kg dry wt	52.8	46.7	91.9	88.2	31.1	63.6	361	53.7	52.2	34.2	26.2	11.4	30.9	26.2	28.6
PCB-155	ng/Kg dry wt	2.04 U	2.06 U	2.15 U	0.397 U	2.06 U	2.06 U	2.1 U	2.05 U	2.02 U	2.31 U	2.51 U	1.97 U	2.06 U	2.04 U	4.01 U
PCB-156 C-E 156+157	ng/Kg dry wt	293	358	553	609	304	3280	413	546	653	460	317	166	279	241	351
PCB-157 C-E 156+157	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-158	ng/Kg dry wt	215	292	429	462	257	2570	385	496	588	329	254	118	203	179	251
PCB-159	ng/Kg dry wt	30.4	35.1	8.94 J	42.6	23.3	8.23 J	44.7	45.4	64.7	39.4	39.3	13.1	26	25.6	8.01 J
PCB-16	ng/Kg dry wt	118	182	138	133	253	14100	153	338	405	75.8	69.2	22.7	63.4	52.3	125
PCB-160	ng/Kg dry wt	4.63 U	4.66 U	4.87 U	0.9 U	4.68 U	4.67 U	4.77 U	4.66 U	4.59 U	5.24 U	5.68 U	4.47 U	4.67 U	4.63 U	9.11 U
PCB-161	ng/Kg dry wt	2.22 U	2.24 U	2.34 U	0.432 U	2.25 U	2.24 U	2.29 U	2.23 U	2.2 U	2.51 U	2.73 U	2.14 U	2.24 U	2.22 U	4.37 U
PCB-162	ng/Kg dry wt	10	12.9	14	18.3	4.6 J	183	9.4 J	10.2	50.7	34.7	7.97 J	4.22 U	10.3	5.52 J	9.58 J
PCB-163 C-E 129+138+163	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-164	ng/Kg dry wt	149	217	293	286	182	1600	275	373	402	231	192	78	147	121	197
PCB-165	ng/Kg dry wt	1.89 U	1.9 U	2.68 J	0.368 U	1.91 U	1.91 U	19.3	1.9 U	1.88 U	2.14 U	2.32 U	1.83 U	1.91 U	1.89 U	3.72 U
PCB-166 C-E 128+166	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-167	ng/Kg dry wt	105	123	196	216	103	1090	167	197	239	166	126	59.7	101	89.4	126
PCB-168 C-E 153+168	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-169	ng/Kg dry wt	3.92 J	3.53 U	4.27 J	5.49 J	3.55 U	16.8 J	4.54 J	5.09 J	6.46 J	5.52 J	4.31 U	3.39 U	3.54 U	3.51 U	6.9 U
PCB-17	ng/Kg dry wt	155	241	170	176	260	14500	173	305	379	98.3	104	27.4	80.6	67.9	159
PCB-170	ng/Kg dry wt	514	600	1070	868	579	4720	887	1110	1430	736	718	253	476	422	766
PCB-171 C-E 171+173	ng/Kg dry wt	183	220	330	302	208	1650	290	373	473	240	234	84.2	161	147	182
PCB-172	ng/Kg dry wt	103	126	187	160	117	919	162	213	270	144	141	48.5	99	87.6	126
PCB-173 C-E 171+173	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-174	ng/Kg dry wt	638	756	947	929	683	5170	934	1200	1550	774	752	259	577	516	547
PCB-175	ng/Kg dry wt	32.1	37.1	49.6	46.2	41.6	231	47	61.9	78.4	34.9	36.9	12.8	27.2	27.7	28.6
PCB-176	ng/Kg dry wt	102	123	150	154	118	811	173	208	261	105	102	34.7	88.1	84.4	83.1
PCB-177	ng/Kg dry wt	371	439	605	549	396	2890	604	696	887	460	468	154	319	283	353
PCB-178	ng/Kg dry wt	169	178	236	219	165	1150	303	294	360	169	158	53.6	130	126	132
PCB-179	ng/Kg dry wt	374	413	490	494	387	2230	665	641	826	333	323	109	290	274	260
PCB-18 C-E 18+30	ng/Kg dry wt	283	436	308	314	502	29700	343	683	821	176	158	53.7 JH	147	125	284
PCB-180 C-E 180+193	ng/Kg dry wt	1210	1380	2260	1830	1330	9630	1880	2500	3250	1580	1590	536	1040	964	1490

Appendix F -- 2009 Lower Colulmbia Slough Sediment between River Mile 5.9 and 8.7.
Congener Data Table

	Lab ID #	35980	35976	35974	35974	35971	35969	35968	35967	35967	35965	35966	35962	35981	35981	35981
	Site Name	OF 59 #59	OF #60	OF #61	OF #61	OF #61A	OF62	Wastech	Prec +BR	Prec +BR	OF 63	OF 64	OF 65	IS Triplicate A	IS (Triplicate B)	IS (Triplicate C)
		09/15/2009 0	09/14/2009 1	09/14/2009 0	09/14/2009 0	09/09/2009 1	09/09/2009 09:	09/10/2009 1	09/10/2009 0	09/10/2009 09:	09/08/2009 1	09/08/2009 1	09/08/2009 0	09/18/2009	09/18/2009	09/18/2009
Parameter	Unit	Sample	Sample	Sample - Fiel	Sample - Fiel	Sample	Sample	Sample	Sample - Fiel	Sample - Field	Sample	Sample	Sample	Sample	Sample	Sample
PCB-181	ng/Kg dry wt	2.04 U	2.05 U	10.4 J	11.2	2.06 U	44.5	8.73 J	11.1	10.7	6.89 J	2.5 U	1.96 U	2.05 U	2.04 U	4 U
PCB-182	ng/Kg dry wt	1.93 U	1.94 U	8.65 J	7.77	1.95 U	1.94 U	1.99 U	1.94 U	1.91 U	2.18 U	2.37 U	1.86 U	1.94 U	1.93 U	3.79 U
PCB-183 C-E 183+185	ng/Kg dry wt	484	690 J	689	652	472	3600	672	875	1110	529	525	183	378	361	406
PCB-184	ng/Kg dry wt	1.81 U	1.82 U	1.91 U	0.352 U	1.83 U	1.83 U	1.87 U	1.82 U	1.8 U	2.05 U	2.22 U	1.75	1.83 U	1.81 U	3.56 U
PCB-185 C-E 183+185	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-186	ng/Kg dry wt	1.84 U	1.85 U	1.93 U	0.357 U	1.86 U	1.85 U	1.89 U	1.85 U	1.82 U	2.08 U	2.26 U	1.77 U	1.85 U	1.84 U	3.61 U
PCB-187	ng/Kg dry wt	836	958	1250	1170	852	5700	1430	1540	1890	879	882	295	690	640	677
PCB-188	ng/Kg dry wt	4.82 J	2.57 U	2.69 U	0.496 U	2.58 U	2.57 U	2.63 U	2.57 U	2.53 U	2.89 U	3.14 U	2.46 U	2.57 U	2.55 U	5.02 U
PCB-189	ng/Kg dry wt	31.7	35.6	54.2	52.4	28.9	211	40.6	55.1	71.1	44.2	37.5	14.2	28.8	23.3	39.8
PCB-19	ng/Kg dry wt	40.7	57	41.3	46.9	77.8	2710	57.4	96.4	106	41.3	49.4	11	17.3	18.6	27.1
PCB-190	ng/Kg dry wt	99.7	119	201	171	123	1030	160	204	312	144	141	49.9	88.4	85.1	146
PCB-191	ng/Kg dry wt	20	25.1	45.3	37.6	25.8	157	36.7	45	60.5	28.1	30.4	10.5	20.8	17.6	29.8
PCB-192	ng/Kg dry wt	3.69 U	3.72 U	3.89 U	0.718 U	3.74 U	3.72 U	3.81 U	3.71 U	3.66 U	4.18 U	4.53 U	3.56 U	3.72 U	3.69 U	7.27 U
PCB-193 C-E 180+193	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-194	ng/Kg dry wt	381	371	571	502	303	2680	441	606	785	384	379	123	285	284	452
PCB-195	ng/Kg dry wt	140	143	206	188	113	893	175	215	291	148	143	46.8	111	111	168
PCB-196	ng/Kg dry wt	199	210	294	267	186	1050	248	325	400	217	200	66.6	158	164	242
PCB-197 C-E 197+200	ng/Kg dry wt	68.1	69.8	92.3	84.1	68.5	468	85.3	115	134	72.8	69.5	23	54	54.5	65.2
PCB-198 C-E 198+199	ng/Kg dry wt	430	456	610	571	417	2770	548	684	813	464	455	148	349	355	507
PCB-199 C-E 198+199	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-2	ng/Kg dry wt	21.3 JH	23.3 JH	30.4 JH	55.1 JH	30.9 JH	49.5 JH	20.9 JH	19.1 JH	21.4 JH	31.8 JH	31.3 JH	16.7 JH	20.2 JH	20.5 JH	83.7 JH
PCB-20 C-E 20+28	ng/Kg dry wt	999	1520	1010	1100	1250	35400	753	1120	1420	553	565	165	524	469	810
PCB-200 C-E 197+200	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-201	ng/Kg dry wt	65.6	61.5	75.1	78.3	59.4	412	73.2	98.7	113	60.6	58.4	20.5	49.7	47.5	54.6
PCB-202	ng/Kg dry wt	113	121	138	136	90	655	129	157	183	109	111	38.1	82.1	82	110
PCB-203	ng/Kg dry wt	277	284	373	348	240	1200	327	405	483	277	266	86.8	211	205	317
PCB-204	ng/Kg dry wt	1.77 U	1.78 U	1.86 U	0.344 U	1.79 U	1.79 U	1.83 U	1.78 U	1.76 U	2.01 U	2.18 U	1.71 U	1.79 U	1.77 U	3.49 U
PCB-205	ng/Kg dry wt	24.4	26.7	37.3	32.2	5.1 U	147	28.3	38.1	48	25.9	27.3	8.98 J	21.6	17.3	25.1
PCB-206	ng/Kg dry wt	291	270	245	297	183	1170	270	319	357	253	274	79.6	216	212	287
PCB-207	ng/Kg dry wt	35.1	37.6	34.2	39.2	4.41	206	36.1	41.4	43.5	36.8	34.2	11.6	26.4	25.1	35.9
PCB-208	ng/Kg dry wt	95.1	88.8	101	128	59.3	342	96.2	91.9	95.1	80.6	88.1	27.3	71.8	62.1	80.9
PCB-209	ng/Kg dry wt	197	221	200	353	80.9	321	337	192	207	187	115	53.9	151	148	205
PCB-21 C-E 21+33	ng/Kg dry wt	369	588	398	435	573	20100	390	549	675	203	222	65.5	217	189	326
PCB-22	ng/Kg dry wt	304	502	298	337	433	12300	258	378	465	171	174	50.2	162	144	237
PCB-23	ng/Kg dry wt	2.95 U	2.97 U	3.11 U	0.574 U	2.99 U	55.1	3.04 U	2.97 U	2.93 U	3.34 U	3.62 U	2.85 U	2.97 U	2.95 U	5.81 U
PCB-24	ng/Kg dry wt	5.96 J	9.53 J	5.52 J	5.36	9.32 J	538	6.37 J	9.32 J	11.6	4.63 J	3.78 U	2.97 U	3.18 J	3.08 U	6.18 J
PCB-25	ng/Kg dry wt	82.1	124	98.5	105	103	2990	105	81.9	102	51.2	43.1	16.3	44.2	37.7	69.2
PCB-26 C-E 26+29	ng/Kg dry wt	173	253	186	205	213	7420	273	201	247	104	95.1	30	92.3	79	153
PCB-27	ng/Kg dry wt	41.5	51.5	41.6	45.2	61.3	2550	35.4	65.7	80.1	27.4	36.6	6.98 J	19.5	14.6	37.8
PCB-28 C-E 20+28	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-29 C-E 26+29	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-3	ng/Kg dry wt	23.3	27.2	40.3	52.3	29.3	166 J	22.1	25.4	29.5	32.2	30.8	15.9 U	21.3	21.8	59.9
PCB-30 C-E 18+30	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-31	ng/Kg dry wt	737	1120	739	852	982	33900	659	994	1260	381	432	121	398	347	640
PCB-32	ng/Kg dry wt	164	213	150	175	262	8980	153	260	300	93.4	95.9	25.1 JH	74.8	63.8	128
PCB-33 C-E 21+33	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-34	ng/Kg dry wt	7.36 J	9.18 J	7.12 J	6.77	3.75 U	152	4.54 J	7.09 J	11.1	4.19 U	4.55 U	3.57 U	3.79 J	3.7 U	7.28 U
PCB-35	ng/Kg dry wt	25.1	37.5	27.6	31.4	30.4	491	19.2	28.4	30.8	21.7	22.8	7.31 J	16.4	15.5	21
PCB-36	ng/Kg dry wt	2.31 U	2.33 U	2.78 J	0.45 U	2.34 U	2.33 U	2.39 U	2.33 U	2.29 U	2.62 U	2.84 U	2.23 U	2.33 U	2.31 U	4.55 U
PCB-37	ng/Kg dry wt	360	564	381	383	435	9710	246	402	469	257	246	75.3	207	179	279
PCB-38	ng/Kg dry wt	3.1 U	3.12 U	3.26 U	0.603 U	3.14 U	3.13 U	3.2 U	3.12 U	3.07 U	3.51 U	3.81 U	2.99 U	3.13 U	3.1 U	6.1 U
PCB-39	ng/Kg dry wt	8.15 J	10.6	10.5 J	10.2	7.85 J	132	5.57 J	8.94 J	13.9	5.73 J	5.42 J	2.06 U	5.06 J	3.57 J	6.77 J

Appendix F -- 2009 Lower Colulmbia Slough Sediment between River Mile 5.9 and 8.7.
Congener Data Table

Lab ID #		35980	35976	35974	35974	35971	35969	35968	35967	35967	35965	35966	35962	35981	35981	35981
Site Name		OF 59 #59	OF #60	OF #61	OF #61	OF #61A	OF62	Wastech	Prec +BR	Prec +BR	OF 63	OF 64	OF 65	IS Triplicate A	IS (Triplicate B)	IS (Triplicate C)
		09/15/2009 0	09/14/2009 1	09/14/2009 0	09/14/2009 0	09/09/2009 1	09/09/2009 09:	09/10/2009 1	09/10/2009 0	09/10/2009 09:	09/08/2009 1	09/08/2009 1	09/08/2009 0	09/18/2009	09/18/2009	09/18/2009
Parameter	Unit	Sample	Sample	Sample - Fiel	Sample - Fiel	Sample	Sample	Sample	Sample - Fiel	Sample - Field	Sample	Sample	Sample	Sample	Sample	Sample
PCB-4	ng/Kg dry wt	32.6	67.4	37.6	43.5	64.7	4510	75.1	76.1	97.1	66.9	163	11.5	23.1	19	44.1
PCB-40 C-E 40+41+71	ng/Kg dry wt	704	868	731	790	918	33000	573	912	1050	423	483	124	337	344	410
PCB-41 C-E 40+41+71	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-42	ng/Kg dry wt	363	448	410	461	452	14800	286	478	519	220	242	69.1	191	180	257
PCB-43 C-E 43+73	ng/Kg dry wt	40	43.5	41.7	40	64	2380	30.5	51.3	58.9	14.5	16	4.13 U	22.2	10.1	31.2
PCB-44 C-E 44+47+65	ng/Kg dry wt	1260	1580	1580	1730	1580	54200	1460	1760	2200	862	844	284	739	660	927
PCB-45 C-E 45+51	ng/Kg dry wt	280	322	271	285	423	15300	310	373	474	137	139	36.4	126	115	187
PCB-46	ng/Kg dry wt	90.1	114	99.9	96.5	166	5470	113	145	178	49.6	51.5	14.4	44.3	39.4	64.5
PCB-47 C-E 44+47+65	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-48	ng/Kg dry wt	217	295	241	256	314	14900	173	300	372	120	161	38.1	127	115	152
PCB-49 C-E 49+69	ng/Kg dry wt	831	1060	1180	1280	1030	37700	2600	1120	1330	551	529	187	509	468	545
PCB-5	ng/Kg dry wt	4.43 U	4.46 U	4.66 U	4.09	4.48 U	140	4.57 U	4.46 U	5.08 J	5.02 U	5.44 U	4.28 U	4.46 U	4.43 U	8.71 U
PCB-50 C-E 50+53	ng/Kg dry wt	206	243	212	235	309	10800	271	295	365	122	119	32.4	98.2	86.4	143
PCB-51 C-E 45+51	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-52	ng/Kg dry wt	1750	2280	2460	2890	2210	82200	7020	2850	3610	1300	1080	472	1210	1030	1620
PCB-53 C-E 50+53	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-54	ng/Kg dry wt	3.46 J	3.11 U	3.97 J	3.55	3.13 U	73.6	3.64 J	5 J	4.19 J	3.5 U	3.8 U	2.98 U	3.12 U	3.09 U	6.08 U
PCB-55	ng/Kg dry wt	4.17 U	4.2 U	4.39 U	0.811 U	22.1	4.21 U	4.3 U	4.2 U	4.13 U	4.72 U	5.12 U	4.03 U	4.2 U	4.17 U	13.5 J
PCB-56	ng/Kg dry wt	529	596	525	570	517	10400	357	616	695	364	358	120	292	266	265
PCB-57	ng/Kg dry wt	4.19 J	9.79 J	6.37 J	7.59	6.71 J	187	38.6	3.35 J	5.25 J	5.37 J	3.62 J	1.71 U	4.66 J	3.83 J	6.62 J
PCB-58	ng/Kg dry wt	5.39 J	6.7 J	8.2 J	11.7 J	4.5 J	66.5 J	232	6.05 J	4.67 J	3.51 J	3.99 J	2.68 U	4.16 J	2.8 J	5.45 U
PCB-59 C-E 59+62+75	ng/Kg dry wt	130	161	141	153	171	4840	113	147	176	79.4	87.3	22 J	66.4	62.3	85.3
PCB-6	ng/Kg dry wt	28.4	52.1	39.2	40.3	46.5	2320	42.5	33.9	46.2	27.6	26.1	11.2	19.9	17.4	47.4
PCB-60	ng/Kg dry wt	184	235	187	190	240	5390	142	260	289	144	170	45.6	97.3	85.3	111
PCB-61 C-E 61+70+74+76	ng/Kg dry wt	1760	2220	2340	2640	1970	47100	1750	2470	3010	1510	1400	544	1230	1100	1220
PCB-62 C-E 59+62+75	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-63	ng/Kg dry wt	48.6	57.1	52.6	62.7	54.7	1240	34.7	47.9	57.2	33.1	38.1	12	29.9	26.2	26.3
PCB-64	ng/Kg dry wt	565	680	626	663	732	22500	467	713	826	374	406	118	302	279	351
PCB-65 C-E 44+47+65	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-66	ng/Kg dry wt	1190	1380	1400	1550	1070	20400	863	1320	1560	885	808	293	712	656	626
PCB-67	ng/Kg dry wt	38.1	50.6	49.3	55.9	43.6	904	68.9	35.2	42.4	27.2	32.1	9.71	24.9	23.2	24.7
PCB-68	ng/Kg dry wt	11.3	16.2	24.1	29.9	8.61 J	93.6	34.2	11.5	10.9	12.3	8.17 J	4.41 J	10.5	8.4 J	9.74 J
PCB-69 C-E 49+69	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-7	ng/Kg dry wt	5.06 J	7.81 J	6.77 J	7.79	9.69 J	464	8.92 J	6.64 J	9.76 J	7.36 J	5.79 J	3.25 U	4.76 J	4.21 J	9.49 J
PCB-70 C-E 61+70+74+76	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-71 C-E 40+41+71	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-72	ng/Kg dry wt	20.6	25.5	54.5	70.7	16	194	73.9	20.4	18.4	16.5	12 J	4.95 J	14.3	14.0	12 J
PCB-73 C-E 43+73	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-74 C-E 61+70+74+76	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-75 C-E 59+62+75	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-76 C-E 61+70+74+76	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-77	ng/Kg dry wt	158	189	186	171	157	2470 J	95.2	197	228	133	111	40.9	89	79.9	119
PCB-78	ng/Kg dry wt	2.64 U	2.66 U	2.78 U	0.513 U	2.67 U	2.66 U	2.72 U	2.65 U	2.62 U	2.99 U	3.24 U	2.55 U	2.66 U	2.64 U	5.19 U
PCB-79	ng/Kg dry wt	12.5	15.6	33.5	37	13.5	115	26.2	25.8	26.5	19.4	13.2	7.9 J	12.3	9.74 J	16.6 J
PCB-8	ng/Kg dry wt	102	176	118	122	167	10700	144	133	190	91.5	98.7	30.7 JH	63.1 JH	59.1 JH	126
PCB-80	ng/Kg dry wt	2.56 U	2.58 U	2.7 U	0.498 U	2.59 U	2.58 U	43.4	13.2	16.9	2.9 U	3.15 U	2.47 U	2.58 U	2.56	5.04 U
PCB-81	ng/Kg dry wt	3.84 J	5.48 J	8.79 J	6.48	6.26 J	116	4.44 J	5.58 J	7.43 J	5.76 J	7.1 J	2.25 U	2.77 J	2.71 J	4.59 U
PCB-82	ng/Kg dry wt	264	308	389	448	305	1590	381	617	627	286	190	99.8	191	161	197
PCB-83	ng/Kg dry wt	144	177	174	239	119	912	344	256	317	204	114	53.2	106	66.7	94.1
PCB-84	ng/Kg dry wt	631	806	1070	1330	769	8220	1270	1340	1510	710	426	254	523	438	483
PCB-85 C-E 85+116+117	ng/Kg dry wt	331	414	527	622	368	2740	537	778	787	388	275	142	259	214	246
PCB-86 C-E 86+87+97+108+119+125	ng/Kg dry wt	1380	1730	2440	2750	1590	11900	2460	3390	3480	1600	1090	588	1200	1010	1040

Appendix F -- 2009 Lower Colulmbia Slough Sediment between River Mile 5.9 and 8.7.
Congener Data Table

Parameter	Lab ID #	35980	35976	35974	35974	35971	35969	35968	35967	35967	35965	35966	35962	35981	35981	35981
	Site Name	OF 59 #59	OF #60	OF #61	OF #61	OF #61A	OF62	Wastech	Prec +BR	Prec +BR	OF 63	OF 64	OF 65	IS Triplicate A	IS (Triplicate B)	IS (Triplicate C)
		09/15/2009 09	09/14/2009 10	09/14/2009 09	09/14/2009 09	09/09/2009 10	09/09/2009 09:1	09/10/2009 10	09/10/2009 09	09/10/2009 09:3	09/08/2009 11	09/08/2009 10	09/08/2009 09	09/18/2009	09/18/2009	09/18/2009
Parameter	Unit	Sample	Sample	Sample - Field	Sample - Field	Sample	Sample	Sample	Sample - Field	Sample - Field	Sample	Sample	Sample	Sample	Sample	Sample
PCB-87 C-E 86+87+97+108+119+125	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-88 C-E 88+91	ng/Kg dry wt	361	423	635	774	393	5200	1720	650	719	364	230	128	277	235	259
PCB-89	ng/Kg dry wt	38.1	40.7	40.5	45.9	46	403	46	68.8	70.6	26.6	21.9	9.18 J	22.4	17.2	11.3 J
PCB-9	ng/Kg dry wt	7.7 J	14.3	10 J	10.2	12.8	790	13.2	9.16 J	13.7	10.1 J	9.28 J	4.63 U	6.28 J	5.42 J	9.69 J
PCB-90 C-E 90+101+113	ng/Kg dry wt	2130	2610	3790	4420	2350	20300	5650	4540	4950	2520	1730	889	1870	1550	1550
PCB-91 C-E 88+91	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-92	ng/Kg dry wt	446	501	741	903	462	3540	1720	928	947	514	356	181	404	318	321
PCB-93 C-E 93+98+100+102	ng/Kg dry wt	136	129	175	193	131	1190	338	168	189	91.7	63.1	30 J	71.2	63.0	69.6 J
PCB-94	ng/Kg dry wt	22.2	17.5	22	27.1	1.41 U	277	24.3	26.8	27.3	10.7 J	9.21 J	1.35 U	11.2	10.3	9.69 J
PCB-95	ng/Kg dry wt	1960	2390	3390	4290	2380	30200	8540	4230	4980	2170	1510	778	1750	1430	1330
PCB-96	ng/Kg dry wt	24.7	25.2	28.6	33.8	27.7	459	46.5	36.7	43.3	15.3	11.9 J	4.38 J	12.6	12.7	15.7 J
PCB-97 C-E 86+87+97+108+119+125	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-98 C-E 93+98+100+102	ng/Kg dry wt	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E	C-E
PCB-99	ng/Kg dry wt	931	1110	1740	2090	933	5500	2140	1920	1810	958	631	341	776	680	645

C-E Co-Elution

Appendix G : PBDE 2009 Lower Slough Sediment between River Mile 5.9 and 8.7.

PBDE	Unit	IS Value*	OF 59	OF 60	OF 61 1	OF 61 2	61A	OF 62	Wtech	P&BR 1	P&BR 2	OF 63	OF 64	OF 65	IS A	IS B	IS C	IS Mean
Date			9/15/09	9/14/09	9/14/09	9/14/09	9/9/09	9/9/09	9/10/09	9/10/09	9/10/09	9/8/09	9/8/09	9/8/09				
BDE-(28/33)	ng/Kg	157	184 J	209 J	196 J	202 J	184 J	300 J	153 J	192 J	0 J	216 J	199 J	125 J	160 J	154 J	N/A	157 J
BDE-47	ng/Kg	1925	2240 J	4370 J	2520 J	3010 J	3600 J	11800 J	1190 J	714 J	618 J	4210 J	3350 J	1570 J	1830 J	2020 J	N/A	1925 J
BDE-99	ng/Kg	3605	1990 J	5260 J	2950 J	2970 J	3380 J	0 J	912 J	232 J	166 J	5150 J	6050 J	1550 J	2180 J	5030 J	N/A	3605 J
BDE-100	ng/Kg	839	575 J	1280 J	734 J	766 J	860 J	2830 J	257 J	70.2 J	49.5 J	1390 J	1200 J	376 J	538 J	1140 J	N/A	839 J
BDE-153	ng/Kg	624	237 J	533 J	0 J	450 J	417 J	0 J	182 J	199 J	169 J	526 J	924 J	231 J	349 J	898 J	N/A	623.5 J
BDE-154	ng/Kg	484	227 J	456 J	366 J	381 J	188 J	0 J	162 J	197 J	114 J	539 J	597 J	183 J	270 J	697 J	N/A	483.5 J
BDE-183	ng/Kg	184	260 J	219 J	185 J	200 J	187 J	0 J	92.2 J	166 J	186 J	271 J	265 J	147 J	166 J	201 J	N/A	183.5 J
BDE-209	ng/Kg	3925	15500 J	5920 J	2150 J	4170 J	14300 J	0 J	3740 J	3140 J	2020 J	11400 J	24300 J	3010 J	4420 J	3430 J	N/A	3925 J
Total BDE	ng/Kg	11742	21213 J	18247 J	9101 J	12149 J	23116 J	14930 J	6688.2 J	4910.2 J	3322.5 J	23702 J	36885 J	7192 J	9913 J	13570 J	N/A	11742 J
Total BDE	ug/kg	11.74	21.21 J	18.25 J	9.10 J	12.15 J	23.12 J	14.93 J	6.69 J	4.91 J	3.32 J	23.70 J	36.89 J	7.19 J	9.91 J	13.57 J	N/A	11.74 J

J Estimate only-
* MIS value only for two replicates
(shaded) Above IS value

Appendix H: Lower Columbia Slough Sediment Screening Levels

Lower Columbia Slough Screening Levels - (1/27/12)				
Compound	**Source Control Screening Level (mg/kg-dry weight)**		**Sediment Screening Level (mg/kg)**	
	Concentration	Basis	Concentration	Basis
Metals				
Aluminum	NA		16867	baseline
Antimony	4	background (Oregon)	4.0	background
Arsenic	7	background (Oregon)	7.0	background
Barium	NA		124	baseline
Cadmium	1	background (Oregon)	1.0	background
Chromium	42	background	44	baseline
Copper	36	background	38	baseline
Cobalt	NA		10	baseline
Lead	17	background	41	bseline
Manganese	1100	toxicity	1100	toxicity
Mercury (inorganic)	0.07	background	0.1	baseline
Selenium	2	background	2.0	background
Silver	4.5	toxicity	4.5	toxicity
Nickel	38	background	38	backgound
Thallium	0.7	bioaccum	0.7	bioaccum
Zinc	123	toxicity	244	baseline
Polychlorinated Biphenyls				
Aroclor 1254	0.01	MRL	0.027	baseline
Aroclor 1260	0.01	MRL	0.019	baseline
Aroclor 1248	0.01	MRL	0.007	baseline

Appendix H: Lower Columbia Slough Sediment Screening Levels

Lower Columbia Slough Screening Levels - (1/27/12)				
Compound	**Source Control Screening Level (mg/kg-dry weight)**		**Sediment Screening Level (mg/kg)**	
	Concentration	Basis	Concentration	Basis
Pesticides				
alpha-BHC	0.001	MRL	1.8 x 10-5	baseline
beta-BHC	0.001	MRL	1.9 x 10-5	baseline
gamma-BHC	0.0009	toxicity	2.9 x 10-5	MRL/baseline (a)
delta-BHC	NA		1.7 x 10-5	MRL/baseline (a)
DDD	0.002	bioaccum	0.005	baseline
DDE	0.002	bioaccum	0.007	baseline
DDT	0.002	bioaccum	0.0006	baseline
Endosulfan	0.35	bioaccum	0.35	bioaccum
Endrin Aldehyde	0.003	toxicity	0.003	toxicity
Aldrin	0.001	MRL	1.8 x 10-4	baseline
Chlordane	0.001	MRL	0.002	baseline
Dieldrin	0.001	MRL	7 x 10-4	baseline
Heptachlor	0.001	MRL	5.4 x 10-5	MRL/baseline (a)
Semivolatile Organics				
2-Methylnaphthalene	0.02	toxicity	0.020	toxicity
Acenaphthene	0.29	toxicity	0.290	toxicity
Acenaphthylene	0.16	toxicity	0.160	toxicity
Anthracene	0.057	toxicity	0.620	toxicity test
Benzo(a)anthracene	0.032	toxicity	0.695	toxicity test
Benzo(a)pyrene	0.032	toxicity	0.718	toxicity test
Benzo(b)fluoranthene	NA		1.380	toxicity test
Benzo(g,h,i)perylene	0.3	toxicity	0.457	toxicity test
Benzo(k)fluoranthene	0.03	toxicity	0.465	toxicity test
Bis(2-ethylhexyl)phthal	0.75	toxicity	4.387	toxicity test
Chrysene	0.057	toxicity	1.015	toxicity test
Dibenzo(a,h)anthracen	0.06	toxicity	0.140	toxicity test
Dibenzofuran	5.1	toxicity	5.100	toxicity
Fluoranthene	0.111	toxicity	2.303	toxicity test
Fluorene	0.077	toxicity	0.077	toxicity
Indeno(1,2,3-cd)pyrene	0.017	toxicity	0.598	toxicity test
Naphthalene	0.176	toxicity	0.176	toxicity
Phenanthrene	0.042	toxicity	0.870	toxicity test
Phenol	0.048	toxicity	0.066	MRL/baseline (a)
4-methylphenol	NA		0.066	MRL/baseline (a)
Pyrene	1.9	CTL	2.020	toxicity test
Pentachlorophenol	0.1	bioaccum	0.100	bioaccum

N/A - Not Available

(a) MRL/baseline indicates that the compound was not detected in the 2009 incremental samples at the indicated MRL