Final

Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project

Prepared for

City of Portland
Bureau of Environmental Services

In Cooperation with

Oregon Department of Environmental Quality

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Prepared by

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Contents

Page

Appendixes

Tables

Figures

Acronyms and Abbreviations

AOC	Administrative Order on Consent
BES	Bureau of Environmental Services
BMP	best management practice
CBWTP	Columbia Boulevard Wastewater Treatment Plant
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	chlorofluorocarbon
CFR	*Code of Federal Regulations*
City	City of Portland
CSO	combined sewer overflow
CWA	Clean Water Act
DEQ	Oregon Department of Environmental Quality
DQO	data quality objective
ECSI	Environmental Cleanup Site Information
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
GPS	global positioning system
HPAH	high molecular weight polynuclear aromatic hydrocarbon
IDEP	Illicit Discharge Elimination Program
IGA	intergovernmental agreement
ISA	initial study area
LPAH	low molecular weight polynuclear aromatic hydrocarbon
LWG	Lower Willamette Group
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OAR	Oregon Administrative Rule
ODOT	Oregon Department of Transportation
ORS	Oregon Revised Statute
PCB	polychlorinated biphenyl
PCOI	potential contaminant of interest
Pilot Project	Source Control Pilot Project
PMP	Project Management Plan
PRP	potentially responsible party
QAPP	quality assurance project plan
QC	quality control

RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RI/SCM	remedial investigation/source control measure
RM	river mile
ROD	Record of Decision
ROW	right-of-way
SAP	sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act of 1986
SCM	source control measure
SCP	Site Characterization Plan
SD/SA	Site Discovery/Site Assessment
SIC	Standard Industrial Classification
SOP	standard operating procedure
SOW	scope of work
SPCC	spill prevention, control, and countermeasure
SPCR	Spill Protection and Citizen Response
SSO	storm sewer overflow
SWPCP	Stormwater Pollution Control Plan
TMDL	total maximum daily load
TSCA	Toxic Substances Control Act
USGS	U.S. Geological Survey
UST	underground storage tank
VCP	Voluntary Cleanup Program
WPCL	Water Pollution Control Laboratory

SECTION 1

Introduction

This programmatic remedial investigation (RI) work plan describes the approach that will be used to evaluate the potential for discharges to City of Portland (City) stormwater conveyance systems to contribute to Willamette River sediment contamination within the initial study area (ISA) of the Portland Harbor Superfund Site. This work will be conducted in accordance with an intergovernmental agreement (IGA) between the City's Bureau of Environmental Services (BES) and the Oregon Department of Environmental Quality (DEQ), and in coordination with the U.S. Environmental Protection Agency (EPA).

Stormwater conveyance systems drain stormwater from private upland facilities. Some of these upland facilities contaminate the stormwater before discharging it to the stormwater conveyance systems. These upland facilities will need various federal, state, and local regulatory programs to assist in source investigation and controls. Therefore, this work will be conducted cooperatively among the government agencies to accomplish the common goal of ensuring the protection of Willamette River sediment and surface water quality with respect to human health and the environment. It is anticipated that the City and DEQ will conduct most of the upland source investigation work, except where EPA is the lead agency for an upland site.

The overall objectives of the RI are to determine the nature of contamination associated with upland facilities' discharges to the City stormwater conveyance system, the migration pathways of those contaminants, and potential upland sources of the contamination. After potential contaminant sources are identified, EPA, DEQ, and BES will identify and evaluate the use of source control measures (SCMs) for discharges to the City stormwater systems.

1.1 Background

A 1997 study by DEQ and EPA identified elevated levels of hazardous substances in shallow, nearshore sediments throughout the Portland Harbor. On December 1, 2000, EPA placed the Portland Harbor Superfund site on the National Priorities List of sites requiring cleanup under the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The roles of the lead agencies involved with the investigation, cleanup, and source control of this site were defined by a Memorandum of Understanding (MOU) entered among DEQ, EPA, other agencies, and Tribes effective February 8, 2001. DEQ is designated the lead agency for implementing environmental investigation and source control at upland facilities in the Portland Harbor using state cleanup authorities. EPA is designated the lead agency for implementing environmental investigation and cleanup of in-water sediments in the Portland Harbor using CERCLA authorities.

As a result of an Administrative Order on Consent (AOC) entered into in September 2001 by EPA and members of the Lower Willamette Group (LWG), a remedial investigation/ feasibility study (RI/FS) for in-water sediment below the mean high water mark in the

Portland Harbor portion of the Willamette River was initiated. This RI/FS is being implemented by the LWG under EPA supervision.

The City's collection system serves as a conduit for stormwater draining from industrial, commercial, residential, municipal, and vacant lands. These upland sources may contribute stormwater runoff with sediments containing a variety of chemicals, depending on the land use, to the stormwater conveyance system. Twenty[1] City outfalls discharge stormwater to the reach of the Willamette River that has been identified as the Portland Harbor Initial Study Area (ISA). BES and DEQ are working together to develop an approach to evaluate the extent to which the stormwater collection system acts as a conduit for sources of upland contamination to river sediments.

1.2 Joint Interagency Purpose and Objectives

The joint interagency purpose of the RI is to evaluate potential upland sources of discharges to the City stormwater conveyance system that might adversely affect sediment and surface water quality in Portland Harbor.

RI objectives include, but are not limited to, the following:

- Evaluate the potential for upland discharges from City outfalls to contribute to Willamette River sediment contamination or the post-remediation recontamination (after remediation) of sediments within the Portland Harbor Superfund site.
- Identify significant sources of upland contaminants discharged from each outfall using the authorities of DEQ, EPA, and the City.
- Collect and evaluate sufficient data for each outfall to determine whether source control measures are needed for upland discharges.
- Perform an RI satisfying the Oregon Hazardous Substance Remedial Action Rule (Oregon Administrative Rule [OAR] 340-122-0080), applicable elements of the scope of work (SOW) provided in Attachment B of the IGA for the City of Portland Outfalls Project, and the terms and schedule presented in this work plan.

1.3 Intergovernmental Agency Roles

The City outfall remedial investigation/source control measure (RI/SCM) project will be conducted by BES and DEQ in a collaborative manner, building on the approach used in the Source Control Pilot Project (Pilot Project) for Outfalls M-1 and 18. Figure 1-1 (the Portland Harbor ISA site location map) shows the location of City outfalls. Collaboration on the RI/SCM project is essential because the City and DEQ each have regulatory authorities related to the City stormwater conveyance systems. The City administers certain DEQ stormwater permits (authority for which has been delegated from EPA to DEQ), and both

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[1] In addition to the 20 City outfalls that discharge stormwater within the ISA, there are two additional CSO outfalls that no longer discharge stormwater and will not be addressed in this evaluation. Also, of the 26 outfalls originally addressed in earlier City documents (such as Preliminary Outfall Evaluations), 20 are currently stormwater outfalls, two are controlled CSOs with no stormwater, two outfalls were abandoned, and two have undetermined ownership.

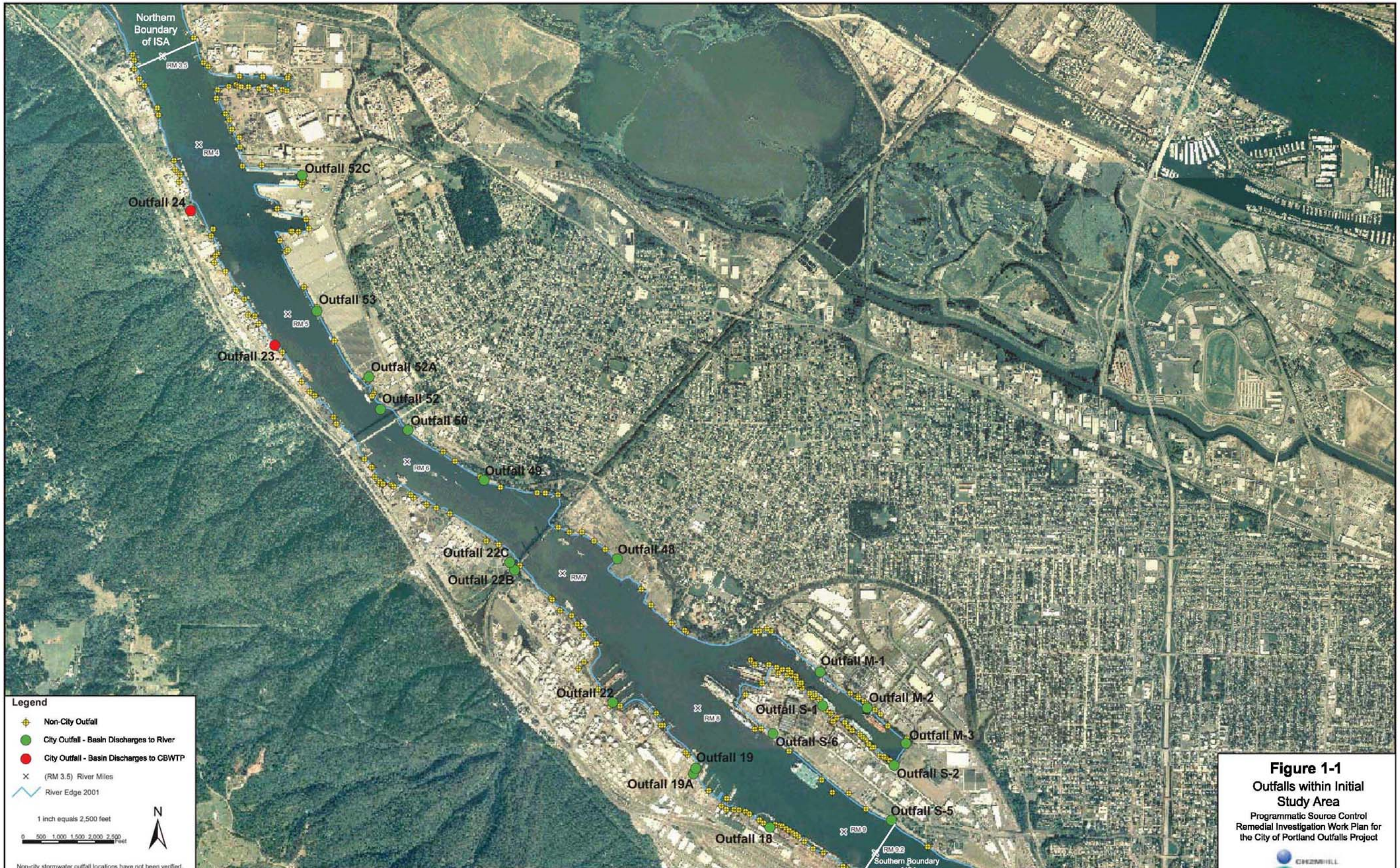

Figure 1-1
Outfalls within Initial Study Area
Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project

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DEQ and the City have inspection and enforcement authorities relevant to stormwater management. DEQ also is overseeing investigations of properties with known or suspected releases of contaminants in the upland portion of the Portland Harbor Superfund site that drain to the City's stormwater conveyance systems. Documents and records from these investigations will be an important part of the RI.

EPA will also be a partner in portions of the RI because federal hazardous waste or Superfund authorities have been used at upland properties within the ISA. At DEQ-led sites, EPA will be reviewing the proposed source control activities for the upland sites. Additionally, the in-water RI being conducted by the LWG, with EPA oversight, will define the location and concentration of sediment contaminants and whether these contaminants pose a risk to human health and the environment; these studies will ultimately provide the target analytes and concentrations that long-term source control measures need to address.

DEQ and EPA are also developing a *Portland Harbor Joint Source Control Strategy* (DEQ and EPA, April 15, 2003; currently under revision) that will guide the evaluation of stormwater discharging from upland sites. The RI/SCM project will need to be consistent with the *Portland Harbor Joint Source Control Strategy*, and implementation of DEQ upland site stormwater evaluations will need to be coordinated with the City evaluations.

A more comprehensive description of the regulatory framework involved in implementing site discovery and source control activities is included in Appendix A. This appendix also includes a description of existing City programs to control sources that could contaminate stormwater.

1.4 RI Scope

The City stormwater conveyance system includes 20 outfalls that discharge stormwater to the Willamette River within the ISA. (see Figure 1-1.) The RI will address the following:

- East Side outfalls (including Swan Island): S-5, S-6, 48, 49, 50, 52, 52A, 53, and 52C
- West Side outfalls: 18, 19A, 19, 22, 22B, and 22C
- Swan Island Lagoon: M-1, M-2, M-3, S-2, and S-1

Efforts to reduce combined sewer overflows (CSOs) began in 1991 with a 20-year project that will cost the City more than $1 billion. Projects completed to date have eliminated CSO discharge to the Columbia Slough and have separated or eliminated eight Willamette River CSO outfalls. By 2006, West Side CSOs will be controlled. By 2011, the CSO improvements will reduce the discharges from CSO outfalls to the Willamette River by 94 percent. Much of the separation work for the CSO project within the ISA has been completed, and these outfalls will not be significant sources of flow to the Willamette River in the future. CSO Outfalls 23 and 24 will not be included in the RI because they are no longer used for discharge of stormwater (which is now directed to the Columbia Boulevard Wastewater Treatment Plant [CBWTP]). CSO Outfalls 50, 52, and 53 have received a high level of separation; the primary use of these outfalls is for the discharge of stormwater, and they will be addressed in this RI as stormwater outfalls.

The characteristics of these outfalls and their associated drainage basins, including construction information, drainage area, current and historical land use within the basin, and other pertinent information, will be evaluated in the RI process. The RI scope may be adjusted to match the characteristics of each outfall and basin. This programmatic RI work plan describes the approaches and resources that will be used in the RI, but it does not list all actions that will be taken for each outfall and associated stormwater drainage basin. Specific work plans will be prepared for individual outfalls or groups of outfalls.

This work plan presents a programmatic strategy for conducting investigations and evaluations. This strategy employs a detailed framework for guiding work but allows flexibility to adjust to the circumstances of each outfall basin. The work plan reflects the City's current understanding of stormwater drainage to outfalls in the ISA and experience gained from the Pilot Project. The approach is well suited to the collaborative nature of the joint BES/DEQ investigations. As the RI progresses, revisions to the work plan to address improvements in sampling methodologies, changes in the priorities of outfall investigations, or other factors may be proposed.

The RI will be conducted consistent with the SOW described in the IGA. This Programmatic RI work plan is intended to provide a framework for investigations and evaluations of upland discharges to City outfalls within the ISA. The SOW describes specific elements to be addressed by the City. Elements are addressed in subsequent sections of this work plan as follows:

- Project Management Plan (Section 2)
  - Schedule
  - Description of project personnel and their respective project roles
  - Change management plan
- Site Description (Section 3)
  - Physical setting of the City outfall basins
  - History of City outfall construction
  - Identification of potential sources of hazardous substance discharges to the outfalls
  - Summary of outfall operations and current condition
- Outfall Prioritization (Section 4)
- Site Characterization Plan (Section 5)
- Programmatic Remedial Investigation Sampling and Analysis Plan (SAP) (Section 6)

1.5 Approach

1.5.1 General Approach

The RI approach by BES and DEQ for upland discharges to City stormwater outfalls consists of the following five main steps:

1. Identify potential contaminants of interest (PCOIs) for each City outfall.
2. Identify and evaluate potential migration pathways to the river.
3. Identify potential upland sources of the PCOIs.
4. Investigate the identified potential sources.

5. Identify and evaluate source control options and actions.

The City's general approach for addressing SCMs is to first identify upland sites that have a potential to contribute significantly to sediment contamination and work collaboratively with DEQ to determine appropriate SCMs that will be protective of sediment at the end of the City stormwater conveyance system. PCOIs will be preliminarily developed on the basis of several sediment comparison values that help to identify which analytes might be of interest for source investigation and source control. These PCOIs (and the concentrations used to identify them) may not be identical to the analytes ultimately determined to be risk drivers by the CERCLA in-water risk evaluation. Because source control investigations cannot wait for in-water risk values to be finalized without jeopardizing in-water remedial activities, the City and DEQ have agreed to preliminarily identify PCOIs for each outfall and use these to identify potential upland sources that merit further investigation. Upland investigations will then be conducted in accordance with the DEQ/EPA *Portland Harbor Joint Source Control Strategy*.

When in-water risk values have been developed through the CERCLA process, the City and DEQ will evaluate whether additional source investigations are needed and whether the SCMs being implemented within the City drainage basin are appropriate to meet in-water objectives. Additional investigations and SCMs may be required, including those from more diffuse sources (for example, roads and low-level contributions from upland sites that may cumulatively contribute to in-water risk). This may require evaluation of state and local regulatory programs that affect stormwater, including DEQ general permits and City stormwater programs. Since 1995, the City has been implementing a stormwater management program (SWMP) pursuant to the City's National Pollutant Discharge Elimination System (NPDES) Municipal Separated Storm Sewer System (MS4) permit. The SWMP includes numerous actions that improve stormwater quality throughout the City, such as:

- New development and redevelopment requirements for stormwater quality and quantity
- Erosion control and construction site management
- Modifications of City Code to provide incentives to preserve natural areas and vegetation
- Operations and maintenance improvements for rights-of-way (ROWs)
- Development of stormwater best management practices (BMPs) for transportation
- Illicit discharge program
- Administration of DEQ's NPDES general stormwater permits
- Structural stormwater treatment facilities, such as constructed wetlands
- Public involvement and education

Additional information on City Source Control programs to improve stormwater quality is provided in Appendix A.

This RI focuses on the City stormwater outfalls and the potential of these outfalls to serve as conduits for upland sources of contamination to travel to the river and adversely affect sediments. Therefore, soil, groundwater, surface water, or other contamination issues at upland sites draining to the City outfalls that do not affect sediment will not be addressed in this RI. Instead, they will be referred to the appropriate agency or program for action.

1.5.2 Progress to Date

Since the recognition of the sediment contamination in the Portland Harbor site, BES and DEQ have taken multiple steps to better understand the potential for City outfalls to act as a conduit for upland contamination to reach the river. Steps taken include conducting outfall preliminary assessments, initiation of the Pilot Project, and collection of sediment samples near City outfalls.

1.5.2.1 Preliminary Outfall Basin Assessments

In May 2000, BES entered into a letter agreement with DEQ to perform preliminary assessments of the upland basins draining to 26 stormwater and CSO outfalls located within the ISA.[2] These preliminary assessments were provided to DEQ in draft form in *Preliminary Evaluation of City Outfalls – Portland Harbor Study Area*, Notebook 1 and Notebook 2 (CH2M HILL, July 2000 and CH2M HILL, December 2000). The information in these notebooks will likely need to be updated as further outfall research is conducted, drainage basin delineations refined, and the type of outfalls (CSO or stormwater) determined. In addition, specific information on the facilities within the drainage basins will require updating as facilities relocate or additional site data are collected through BES or DEQ programs. These basin assessments will be updated as necessary as individual outfalls are evaluated.

1.5.2.2 Source Control Pilot Project

BES and DEQ initiated a Pilot Project for two City outfall basins (M-1 and 18) in July 2002. The Pilot Project was a collaborative effort among BES, DEQ, and EPA to develop a process for the following activities:

- Evaluate the impacts of upland contaminants discharged to the City stormwater outfalls on sediment quality in the Willamette River.
- Identify upland sources of contaminants within the outfall stormwater drainage basins.
- Guide source control efforts.

The Pilot Project consisted of two distinct phases. Phase 1 included collecting sediment samples adjacent to and in the vicinity of City Outfalls M-1 and 18, and conducting an assessment of potential upland sources of sediment contamination within the two outfall stormwater drainage basins. Phase 1 results are described in the following reports: *Phase 1 Data Evaluation Report and Phase 2 Work Planning for City of Portland Outfall M-1* (CH2M HILL, January 2003) and the agency review draft of *Phase 1 Data Evaluation Report and Phase 2 Work Planning for City of Portland Outfall 18* (CH2M HILL, November 2003).

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[2] Upon additional investigation, some of these outfalls were determined to be non-City outfalls or outfalls no longer in operation.

Phase 2 was initiated to develop a process for identifying current upland sources of elevated constituents identified in Phase 1 and to determine appropriate source control actions. Phase 2 actions currently are being performed primarily by the City and DEQ, with participation from EPA. Phase 2 has consisted of the following activities:

- The City collected inline solids samples from the M-1 and 18 City stormwater conveyance systems to determine if this type of sampling could assist in identifying sources from specific subbasins within the drainage basins.
- DEQ sent site discovery letters to various facilities in the Outfall M-1 and 18 stormwater drainage basins to gain additional information on potential sources located in those basins.
- City industrial stormwater staff are conducting stormwater site inspections and reviewing historical inspection reports to compile historical drainage information for the site.
- DEQ is currently evaluating how to update Environmental Cleanup Site Information (ECSI) files on selected sites within the basin.
- Interviews with DEQ ECSI project managers are being conducted as needed.

Following completion of Phase 2 actions, BES and DEQ will determine whether further investigation is needed at specific facilities and whether specific source control actions are warranted. The results of the Pilot Project will guide future City outfall investigations, as well as DEQ and City source control efforts.

1.5.2.3 Collection of Sediment Samples

In addition to the preliminary assessment and the Pilot Project, BES collected in-river sediment samples near many of the City outfalls located within the ISA. Surface sediment samples were collected to identify PCOIs that may require source investigations within the basins. The results of the investigation are provided in Appendix B.

1.5.3 Collaboration on Source Control Measures

On August 13, 2003, BES and DEQ entered into an RI/SCM IGA. The objective of this collaboration is to evaluate and control potential upland sources of discharges to the City stormwater conveyance systems that might adversely affect sediment and surface water quality in Portland Harbor. As outfalls are characterized and significant sources of contamination to the Willamette River via the City's stormwater conveyance systems are identified, DEQ and BES will identify SCMs to address the upland sources. In general, it will be the responsibility of the upland users of the City stormwater conveyance systems to implement SCMs.

SECTION 2

Project Management Plan

The Project Management Plan (PMP) for the RI work plan provides the administrative and organizational framework for effectively managing RI tasks. This PMP describes the project team organization, lines of communication, reporting requirements, change management, and scheduling elements of the RI project.

2.1 Project Team Organization

The RI will be conducted using input and resources from the City, DEQ, EPA, and the City's contractors. Members of the project team and their roles are outlined in Table 2-1. Figure 2-1 shows the project organization and lines of communication.

TABLE 2-1
Project Team Roles and Responsibilities

Project Role	Key Individuals	RI Responsibilities
Regulatory Policy	Rick Applegate—City of Portland BES Chip Humphrey—EPA Region 10 Jim Anderson—DEQ	Serve as the policy representatives for EPA, DEQ, and the City and provide guidance to the Upland Source Control Team as required.
Upland Source Control Project Managers	Dawn Sanders—City of Portland BES	Manages City tasks related to Portland Harbor City Outfalls Project RI. Responsible for implementation and management of an initial City outfall characterization program, the Pilot Project outlined in the IGA, and the preparation of the RI Work Plan. Will lead basin-specific RIs as required. Will evaluate the need for source control measures jointly with DEQ. Coordinates with DEQ and EPA on state and federal tasks.
	Rod Struck—DEQ	Responsible for coordinating site discovery and source control measures at suspected upland sources of contamination in City drainage basins. Coordinates review, comment, and approval of City deliverables with stakeholders. Coordinates communication among DEQ, EPA, other agencies, and Tribes. Will coordinate with the City to solicit BES's comments on proposed site discovery, assessment, source control actions, remedy selection, and cleanup activities directly related to discharges to the City stormwater conveyance systems.
CERCLA In-Water Coordination	Jim Anderson—DEQ Tara Martich—EPA Region 10	Responsible for understanding the IGA source control activities and facilitates integration with the in-water RI/FS. Oversees development of in-water sediment risk criteria that will be used in determining whether upland sources pose a significant risk to the Willamette River. Provides information on in-water activities to the Upland Source Control Team and assists in coordinating upland source control actions with corresponding in-water actions as required.
EPA Source Control Program	Tara Martich—EPA Region 10	Coordinates EPA review of and comment on City deliverables. Coordinates communication with others within EPA, including EPA-led upland cleanup sites.

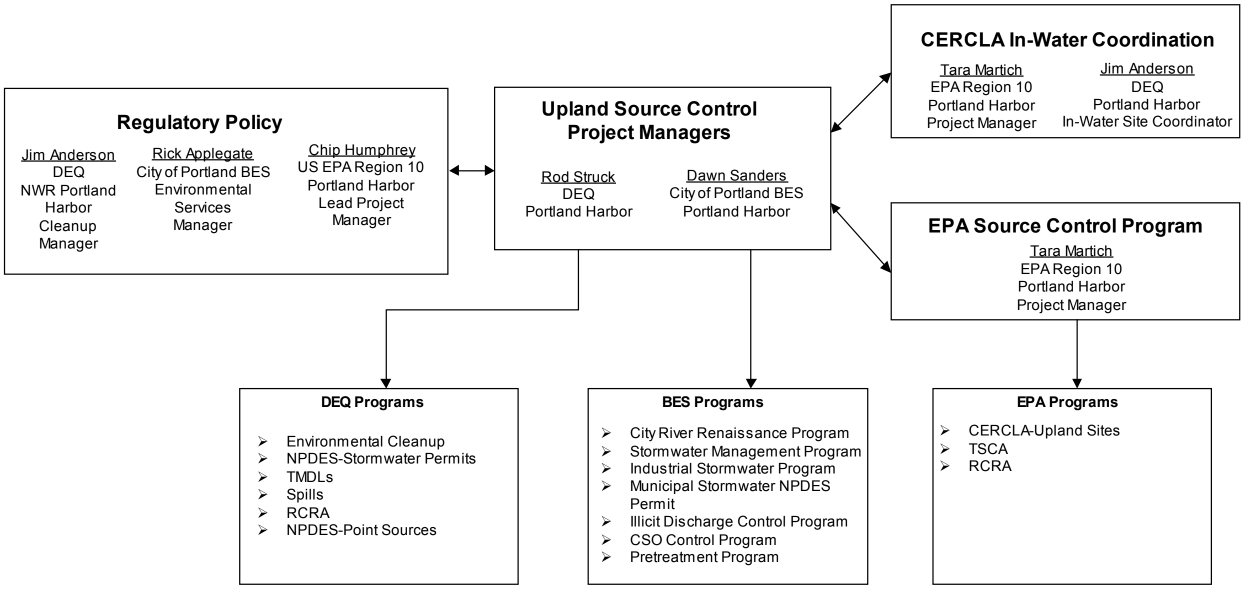


Figure 2-1
Project Organization Chart
Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project

2.2 Communication Among Governmental Agencies

The City's primary communication regarding details of the RI project will be with DEQ, conducted through BES's Program Manager, Dawn Sanders, and DEQ's Project Manager, Rod Struck. Ms. Sanders also will be the contact for communicating information between the City and DEQ, EPA, the LWG, the City's contractor team, and other programs within the City. Mr. Struck will serve as the contact for communicating information between DEQ ECSI project managers and other DEQ programs, EPA, state agencies, natural resource trustee agencies, and the Tribes.

DEQ and the City will address upland sites in accordance with their respective regulatory authorities as potential upland sources to the stormwater system are identified. Plans, activities, updates, schedules, change management issues, and other topics will be communicated during regularly scheduled meetings (bi-weekly or monthly, depending on the level of activity). These meetings will typically include the DEQ and City outfall project managers, DEQ and City staff as appropriate for topics and issues under discussion, and contractor staff as requested by the City. EPA will be invited to participate, especially when in-water topics or other issues of direct significance to EPA are to be addressed.

2.3 Reporting

2.3.1 Progress Reports

Formal reporting of plans, actions, and accomplishments is prescribed by the IGA between DEQ and the City. Specifically, the City submits quarterly reports to DEQ by the 15th of the month following the end of each quarter (January 15, April 15, July 15, October 15). These quarterly reports contain updates on tasks performed under this RI work plan. Update information includes investigation activities within outfall basins, problems or barriers encountered, any proposed changes to the RI approach, schedules of deliverables or outfall basin reports, and the number of and tentative schedule for reports on the next group of outfalls planned for investigation.

2.3.2 RI Documents

Individual RI reports will be prepared for each basin that drains to an outfall or group of outfalls as the project progresses. These RI reports will be submitted to DEQ in accordance with the schedule identified in this work plan. DEQ will provide review, approvals/disapprovals, and oversight in accordance with the schedule set forth in the SOW presented in Attachment B of the IGA for the City of Portland Outfalls Project. In the event DEQ staff resources or workload prevent compliance with the schedule, documents will be reviewed as soon thereafter as practicable. Any DEQ delay will correspondingly extend BES's schedule for a related deliverable or activity. In accordance with the February 2001 MOU among DEQ, EPA, other agencies, and Tribes, DEQ will consult with those entities and submit for EPA review and comment proposed key source control decisions arising from this work.

2.4 Change Management Plan

Investigations of City outfall basins within the ISA will rely significantly on existing data resources and permitting and regulatory programs at the City, DEQ, and EPA. Information sources and data collection methodologies developed during the Pilot Project investigations of outfall drainage basins M-1 and 18 will serve as the models for work to be performed during the RI. However, each outfall drainage basin has unique mixes of land use, types of industry, status of property, physical characteristics of the stormwater conveyance system, and other factors that will create basin-specific circumstances. In addition, experience from each round of outfall basin investigations will be applied to subsequent investigations to improve the efficiency and effectiveness of efforts. These changes will be addressed through the change management approach described below.

Similarly, source control options and approaches will be evaluated during the RI. The efficacy of selected measures and emerging source control options will be evaluated for each new set of basin RI reports and managed through the change management process.

The approaches described in this RI work plan will be evaluated in quarterly reports from the City to DEQ, and any proposed modifications to the work plan will be described. Agency (DEQ, City, and EPA) meetings will also be used to collaboratively discuss potential additions, deletions, or modifications to the approaches described in the work plan. New procedures will be evaluated during the following quarter and reported to DEQ, with regularly scheduled agency meetings serving as earlier opportunities to discuss and address relevant issues. The City will propose modifications for inclusion in subsequent outfall investigations.

2.5 Schedules and Key Milestones

The RI approach described in this work plan will be applied to prioritized groups of outfalls and their associated drainage basins. Higher priority outfalls (as described in Section 4), representing those with greater potential to be current or future conduits for upland sources of contamination to the Willamette River, will be investigated first, followed by progressively lower priority outfalls. The goal of the project is to complete the identification of major upland contaminant sources to the City's stormwater conveyance systems, and to identify SCMs before or concurrent with EPA's completion of the Portland Harbor In-water Record of Decision (ROD). This schedule will allow the design and implementation of in-water remedies that consider the potential for recontamination and the plans for upland source control.

It is not possible to develop a detailed schedule for the RI effort at this time without outfall-specific planning efforts completed in coordination with DEQ. To a large degree, individual outfall schedules depend on site-specific conditions within individual basins, and on the status of DEQ's site discovery and site investigations conducted under the state of Oregon's cleanup program. Data obtained from key DEQ site cleanup investigations will be important in developing appropriate SCMs, but the progress of these investigations is beyond the City's control.

The City proposes to initiate basin-specific RIs for all Priority 1 basins in 2004. To meet this key milestone, basin-specific work plans will be completed for each Priority 1 basin. These documents will be reviewed by DEQ prior to implementation. Detailed schedules will be included in the basin-specific RI planning documents, and as the project progresses, more accurate RI schedule information can be presented in the Quarterly Progress Reports.

SECTION 3

Site Description

This section describes stormwater pathways within the ISA and the City stormwater outfalls and corresponding drainage basins.

3.1 Stormwater in the ISA

The ISA is defined as the area from Sauvie Island (river mile [RM] 3.5) to Swan Island (RM 9.2). Although the ISA is the focus for implementation of the Portland Harbor RI/FS, the boundaries of the site may expand or contract as the investigation proceeds. The final boundaries of the site will not be established until a ROD is issued for the Portland Harbor Superfund site based on the results of the RI/FS.

Stormwater is one pathway by which contaminants may enter the Willamette River. Stormwater can infiltrate into pervious ground surfaces, as well as through dry wells, sumps, and other infiltration facilities. In impervious areas, stormwater can be transported to the Willamette River via overland flow or through conveyance systems. These pathways to the river will be addressed by DEQ under the *Portland Harbor Joint Source Control Strategy* (DEQ and EPA, April 15, 2003; currently under revision).

Stormwater conveyance systems located along the Willamette River typically consist of storm drains, inlets, and catch basins connected to pipes that discharge to the river via outfalls. Stormwater conveyance systems have been installed within the ISA by a variety of entities, including the Port of Portland, the state of Oregon, the City of Portland, and private owners. In some locations in the ISA watershed, stormwater is captured in combined (stormwater plus sanitary discharges) systems and is routed to the Columbia Boulevard Wastewater Treatment Plant [CBWTP].

Most of the flow from the west side of the river comes from Forest Park stream drainage; the park has little development and is not expected to contribute significant contaminant loading. In general, Forest Park streams enter underground pipes at the base of the West Hills, near State Highway 30. The one exception is Saltzman's Creek, which is a predominantly open channel to the river except for approximately 1,400 feet of culverts close to the river. In contrast, there are few open channel drainages on the east side. On both sides of the river, most properties along the shoreline do not discharge to large conveyance systems but have direct discharge via overland flow or their own stormwater outfalls.

Approximately 250 non-City stormwater outfalls have been identified along both shores of the Portland Harbor ISA. In addition, 20 City stormwater outfalls[3] discharge stormwater to the river within the Portland Harbor ISA. The City also has two outfall basins (Outfalls 23 and 24) that now discharge to the CBWTP. While Outfalls 23 and 24 are still physically present, they will not be evaluated in the RI because they do not discharge stormwater to

[3] The number of City and non-City outfalls may need to be changed as new information regarding ownership is discovered.

the Willamette River. Figure 1-1 (the Portland Harbor ISA site location map) shows the locations of City outfalls, as well as non-City outfalls.

As discussed in Section 1 of this work plan, the City RI will focus on investigating the nature of contamination that may enter the City stormwater conveyance systems and discharge into the Willamette River, resulting in contamination of river sediments. Because the RI work plan is focused on current sources, historical drainage conditions that differ from current conditions will not be a primary focus in the RI. Historical releases will be addressed as part of the in-water RI/FS.

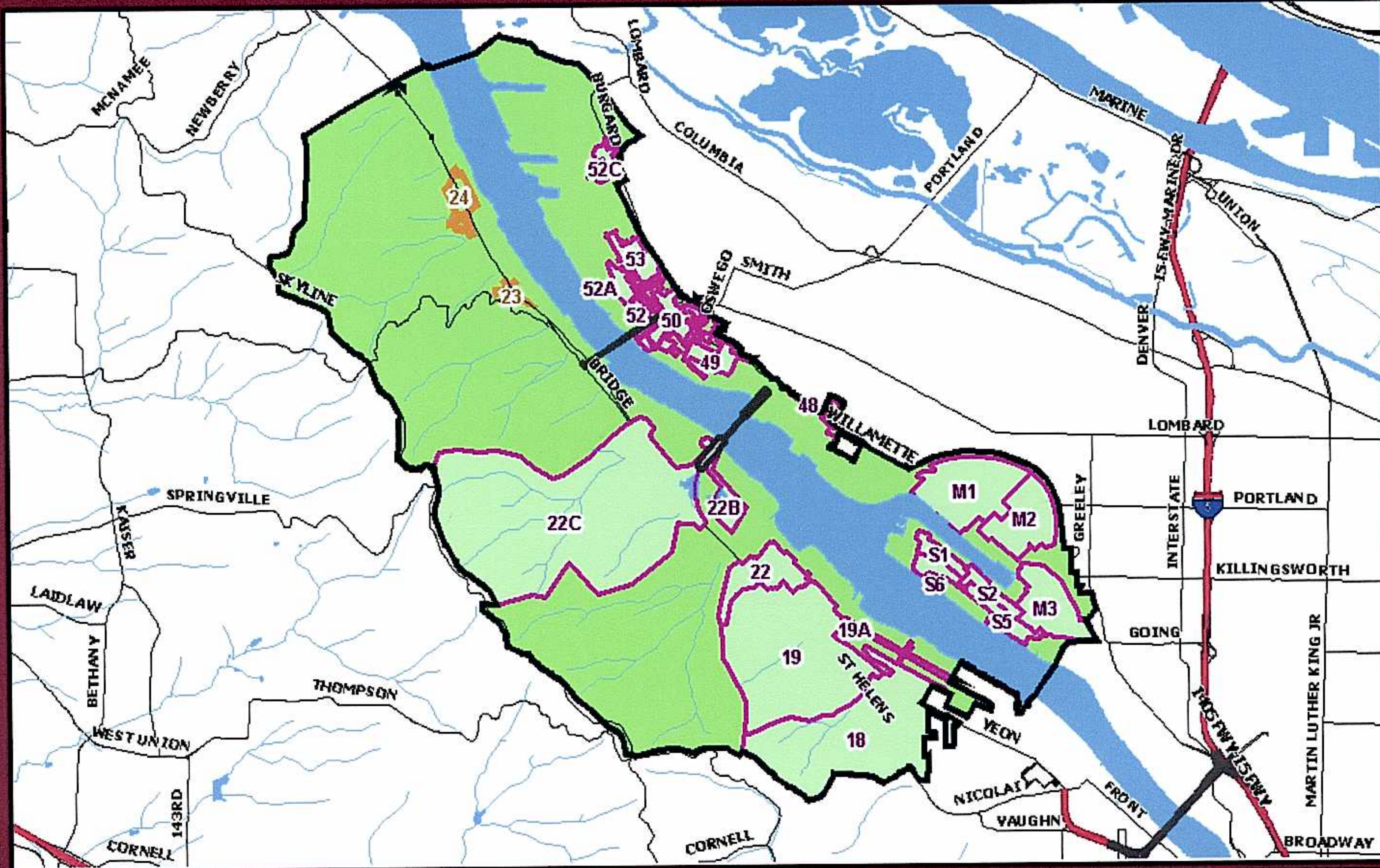
3.2 City Stormwater Outfalls and Corresponding Basins

Figure 3-1 shows the hydrologic basin boundary associated with the Portland Harbor ISA. The hydrologic boundary represents the area that drains into the Willamette River within the bounds of the ISA. Also shown on this figure is the approximate basin delineation for each of the 22 City outfalls (the 20 outfalls evaluated in this RI plus Outfalls 23 and 24). As shown in Figure 3-1, the City's stormwater conveyance systems transport stormwater to the river for approximately 35 percent of the total area that drains to the Willamette River within the ISA.[4]

The map in Figure 3-2 shows current land use zoning types for the area draining to the ISA. Current zoning regulates general land use patterns for development in the City. Properties in the City are mapped with zoning designations grouped into the general categories of single- and multi-dwelling residential, commercial, industrial, employment, and open space. Each zoning class has a land use specification, but other uses do exist for a variety of reasons. For example, commercial zones can contain properties with residential properties that were built before this type of regulation existed. There are also processes that allow new development to occur at variance with current zoning. Figure 3-2 may not represent actual existing land uses but, rather, the desired land use pattern set out in the goals and policies of Portland's *Comprehensive Plan* (BES, 1999) and implemented through the *Portland Zoning Code,* Chapter 33.100– 33.140. The code also sets development, density, and design standards for new development and property alterations.

Table 3-1 provides a more detailed analysis of the drainage areas for City and non-City outfalls for each land use zoning classification. The acreages presented in this table are estimates. An explanation is warranted for the ROW acreage determination. The acreage estimates of ROW represent the area quantified as the undeeded area between tax lots, as defined by the Multnomah County tax assessor. The ROW acreage includes such land uses as railroad tracks and locally and state-owned roads. It includes both pervious and impervious roads. Most of the pervious roads (for example, Leif Erickson Road) are in Forest Park. There are also undeeded ROWs that have not been used as roadways. For example, there is a web of undeeded property in the West Hills/Forest Park. These ROWs predate the park and were platted when the area was planned for neighborhood

[4] In some City basins, stormwater is directed to the CBWTP as part of the CSO project. This RI work plan focuses only on the stormwater that is transported to the Willamette River via the City stormwater conveyance systems.



Legend

ISA Hydrologic Boundary

Approximate Boundary

City Basin Types

Stormwater To CBWTP

Stormwater to River

Figure 3-1

Hydrologic Boundary of ISA and Area Served by the City Conveyance System

0 2,500 5,000 10,000 Feet

Program Manager: Dawn Sanders, Portland Harbor Superfund

Source:

Sheet No. 1 OF 1

Date Printed: 1/10/04

TABLE 3-1
Drainage Area by Land Use Zoning Classification: Comparison of City and Non-City Drainage to the Willamette River within the ISA

Outfall Number	Acres per Zoning Classification: Commercial	Employment District	Industrial	High-Density Residential	Low-Density Residential	Rural/ Open Space	Right-of-Way	Total
City and Non-City Drainage to River (Acres)								
City Drainage in ISA—to River								
18	0.0	0.0	167.4	1.2	4.4	236.7	58.0	**467.8**
19	0.0	0.0	136.3	0.0	1.3	324.1	36.3	**498.0**
19A	0.0	0.0	1.2	0.0	0.0	0.0	2.6	**3.8**
22	0.0	0.0	52.4	0.0	0.0	22.4	13.6	**88.4**
22B	0.0	0.0	30.0	0.0	0.0	0.0	7.0	**37.0**
22C	0.0	0.0	49.8	0.4	1.4	888.1	69.7	**1009.3**
48	0.0	0.0	0.0	0.0	0.0	0.0	5.9	**5.9**
49	2.7	2.0	0.0	6.3	14.9	0.0	18.5	**44.4**
50	8.3	8.6	0.0	8.7	1.1	0.0	18.2	**44.9**
52	0.0	5.5	5.6	2.5	0.3	1.4	7.4	**22.8**
52A	0.0	3.5	11.8	0.1	1.2	0.0	7.0	**23.6**
52C	0.0	0.0	18.3	0.0	0.0	0.0	3.2	**21.5**
53	0.2	0.0	0.0	1.8	22.5	0.0	14.3	**38.9**
M1	0.0	0.0	152.5	0.0	0.0	0.0	21.5	**174.0**
M2	0.0	0.0	98.8	0.0	0.0	0.6	18.9	**118.3**
M3	0.0	15.1	80.1	0.0	0.0	0.0	15.4	**110.5**
S1	0.0	0.0	23.9	0.0	0.0	0.0	0.9	**24.8**
S2	0.0	0.0	20.7	0.0	0.0	0.0	5.8	**26.5**
S5	0.0	13.5	18.0	0.0	0.0	0.0	7.4	**38.8**
S6	0.0	0.0	19.2	0.0	0.0	0.0	3.7	**22.9**
Subtotal	11.2	48.1	885.9	21.1	47.1	1473.3	335.5	**2822.1**
Percentage	0.4%	1.7%	31.4%	0.7%	1.7%	52.2%	11.9%	
City Drainage in ISA—to Columbia Boulevard Water Treatment Plant (CBWTP)								
23	0.0	0.0	0.1	0.0	0.9	0.0	0.7	**1.8**
24	2.5	0.3	3.8	0.0	9.9	0.5	15.6	**32.7**
Subtotal	2.5	0.3	3.9	0.0	10.8	0.5	16.4	**34.5**
Non-City Drainage in ISA—to River								
Subtotal	15.1	89.0	1502.6	119.3	385.7	2647.2	493.1	**5251.9**
Total Within ISA That Drains to River and Columbia Boulevard Water Treatment Plant								
	28.8	137.4	2392.4	140.4	443.6	4121.0	844.9	**8108.5**
Total Within ISA That Drains to River								
	26.3	137.1	2388.5	140.4	432.8	4120.5	828.6	**8074.0**
Percentage City vs. Non-City to River								
City	43%	35%	37%	15%	11%	36%	40%	**35%**
Non-City	57%	65%	63%	85%	89%	64%	60%	**65%**
Percentage of Total Drainage in Each Zoning Classification: City and Non-City to River								
City and Non-City	0.3%	1.7%	29.6%	1.8%	5.4%	51.0%	10.3%	**100.0%**

Note: These are estimates only. Portions of the St. Johns area drain to the CBWTP and are included in the non-City estimates.

development. The development never occurred and the deeded parcels changed ownership, but the ROWs still remain on the tax maps. These areas appear as roads because of their shape, but they are currently forested and indistinguishable from surrounding areas. These undeveloped roads are included in the ROW acreage estimates.

To further refine the area that is representative of paved street ROW, additional analysis would be required using field verification, aerial photographs, and other information on a site-specific basis. This analysis may be performed for specific outfall basins as the RI proceeds.

The predominant land use zoning classifications for the ISA hydrologic basin draining to the river are rural/open space (51 percent of total drainage) and industrial (29.6 percent of total drainage), as shown in Table 3-1. For all categories of land use zoning, the City conveyance systems drain less acreage than non-City outfalls.

Of the 35 percent of the watershed drained by City stormwater conveyance systems, approximately 0.4 percent is commercial, 1.7 percent is employment district[5], 31.4 percent is industrial, 0.7 percent is high-density residential, 1.7 percent is low-density residential, 52.2 percent is rural/open space, and 11.9 percent is right-of-way land (Table 3-1).

Tables 3-2 and 3-3 summarize the outfall construction, location, and drainage area for each outfall basin, as well as the predominant land use zoning classifications within each basin. Table 3-2 summarizes this information for CSO and historical CSO outfalls. Table 3-3 summarizes this information for the other City stormwater outfalls within the ISA. Detailed outfall and basin descriptions and figures are provided in Appendix B of this work plan. The number of City outfalls that need to be addressed may grow if the Portland Harbor Superfund area is expanded. In addition, outfalls may be removed from the list in Table 3-2 or 3-3 if additional information becomes available and shows that the City does not control a particular outfall.

The sediment data report provided in Appendix B lists potential sources of contamination that have been identified within the 22 City outfall basins (see in particular Section 3 of this appendix). Information gathered in 2000 and contained in the draft *Preliminary Evaluation of City Outfalls – Portland Harbor Study Area* Notebooks (CH2M HILL, July 2000 and CH2M HILL, December 2000) is summarized in Section 3 of Appendix B, as well as information gathered through recent DEQ file searches. Citations of land or outfall ownership described in this work plan may not be current or accurate. Similarly, much of the ECSI material used in this assessment was compiled several years ago and may not reflect current conditions. Information related to industrial stormwater permits also may be dated and potentially incomplete or incorrect. As the RI progresses, information will be updated.

[5] The Employment zone allows a wide range of employment opportunities without potential conflicts from interspersed residential uses. The emphasis of the zone is on industrial and industrially related uses. Other commercial uses are allowed to support a wide range of services and employment opportunities.

TABLE 3-2
City Outfalls: CSO and Historical CSO Within the ISA

Location	Outfall Number and Size	Construction Date	CSO Control Date	Future CSO Potential	Location (river mile)	Stormwater Drainage Basin Zoning	Notes
High-Level Separation* CSO Outfalls Within the ISA							
East Side	**50** 30-inch pipe	1906	High-level separation since 1995	Yes	Upstream of St. Johns Bridge (5.87)	45 acres; mix residential, commercial, employment district, and ROW	Partially separated under St. Johns Basin Separation Project. Stormwater in basin treated at Water Pollution Control Laboratory (WPCL) stormwater treatment pond, then discharges to pipe above outfall. Treatment facility constructed in 1996 and designed for 20-year rainfall event.
	52 30-inch pipe	1920	High-level separated since 1995	Yes	Down-stream of St. Johns Bridge (5.69)	23 acres; mostly employment district, industrial, and ROW	Partially separated under St. Johns Basin Separation Project. Around 1990, the 15-inch outfall was abandoned and the flow from Outfall 52 was routed into Outfall 51, which was renamed Outfall 52. Has a storm sewer overflow (SSO) connection from St. Johns Pump Station. Overflow permitted in NPDES permit. No stormwater treatment constructed due to SSO potential.
	53 48-inch pipe	1970	High-level separation since 1995	Yes	Terminal 4, off Toyota site (5.06)	39 acres; mostly residential and ROW	Partially separated under St. Johns Basin Separation Project. No stormwater treatment constructed due to lack of land availability.
West Side	**24** 12-inch pipe	1923	Diversion modified 2000	Limited	Linnton (4.29)	N/A: discharges to CBWTP—Linnton Pump Station relief only	This outfall and connecting pipe exist only as an emergency relief for the Linnton Interceptor and the Linnton Pump Station. In the case of a large storm or a backup at the Linnton Pump Station, the combination flow from the Linnton Interceptor will back up through diversion manhole AAB398 and out Outfall 24.

TABLE 3-2, CONTINUED
City Outfalls: CSO and Historical CSO Within the ISA

Location	Outfall Number and Size	Construction Date	CSO Control Date	Future CSO Potential	Location (river mile)	Stormwater Drainage Basin Zoning	Notes
Historical CSO Outfalls Within the ISA							
East Side	**48** 30-inch pipe	1948	Separated since 1997	No	Upstream of McCormick and Baxter (7.17)	6 acres; ROW	Fully separated under Fiske Basin Separation Project. Water treated in stormwater treatment facility, then discharges back to pipe above outfall. The Fiske treatment facility was constructed in 1998 and designed for 20-year rainfall event.
	49 15-inch pipe	1945	Separated since 1997	No	Downstream of McCormick and Baxter (6.39)	44 acres; mostly residential and ROW	Fully separated under St. Johns Basin Separation Project. Water treated in stormwater treatment facility, then discharges back to pipe above outfall. The Richmond treatment facility was constructed in 1996 and designed for 20-year rainfall event.
West Side	**23** 27-inch pipe	Before 1925 Modified 1989	Plugged below diversion in 1992	No	At Mobil Terminal (~5)	N/A: discharges to CBWTP	CSO Outfall 23 was originally constructed prior to 1925 and was a 16-inch pipe (now called 23 Abandoned). It was reconstructed and moved to its present location in 1989, approximately 350 feet downstream of the abandoned Outfall 23. CSO diversion plugged in 1992, and all stormwater collected in the basin is routed to the CBWTP.

* By design, there should be no CSO overflows into river ("Update to Portland CSO Facility Plan," BES, December 1, 2001). City CSO program is conducting additional modeling at 50, 52, and 53 to further evaluate potential for CSO; the report is expected to be completed by June 2004 (Virgil Adderley, pers. comm.) If additional control is needed, these outfalls will be addressed by 2006.

Abbreviations:

CBWTP = Columbia Boulevard Wastewater Treatment Plant
CSO = combined sewer overflow
N/A = not applicable
NPDES = National Pollutant Discharge Elimination System
ROW = right-of-way

TABLE 3-3
City Outfalls: Stormwater Outfalls Within the ISA

Location	Outfall Number and Size	Construction Date	Location (river mile)	Stormwater Drainage Basin Zoning
East Side	**M-1** 60-inch pipe	1964	Swan Island Lagoon (8.37)	175 acres; mostly industrial
	M-2 60-inch pipe	1959	Swan Island Lagoon (8.69)	118 acres; mostly industrial
	M-3 60-inch pipe	1989	Swan Island Lagoon (8.96)	111 acres; mostly industrial
	S-1 36-inch pipe	1964	Swan Island Lagoon (~8.8)	25 acres; mostly industrial
	S-2 36-inch pipe	1963	Swan Island Lagoon (8.99)	27 acres; mostly industrial
	S-5 36-inch pipe	1963	Swan Island (9.19)	39 acres; mostly industrial and employment district
	S-6 36-inch pipe	1964	Swan Island (8.39)	23 acres; mostly industrial
	52A 36-inch pipe	1972	At Mar Com (5.52)	24 acres; mostly industrial and ROW
	52C 36-inch pipe	1985	Terminal 4, Slip 1 (4.39)	22 acres; mostly industrial
West Side	**18** 72-inch pipe	1958, rebuilt 1985	Behind Equilon dock adjacent to Gunderson (8.69)	468 acres; mostly park and industrial
	19 42-inch pipe	1977	Adjacent to Front Ave. LP and Shaver (8.18)	498 acres; mostly park, some industrial
	19A 60-inch pipe	About 1977	Adjacent to Front Ave. LP and Shaver (8.20)	4 acres; mix industrial and right-of-way
	22 60-inch pipe	1973	Near Willbridge (7.68)	88 acres; mostly industrial
	22B 48-inch pipe	1980	Upstream of train bridge, near Atofina (6.80)	37 acres; mostly industrial
	22C 84-inch pipe	1978	Downstream of train bridge, near Wacker (6.75)	1010 acres; mostly park

SECTION 4

Outfall Prioritization

Twenty City outfalls within the Portland Harbor ISA convey stormwater from upland sites adjacent to the Portland Harbor ISA portion of the Willamette River. Pursuant to the IGA between DEQ and the City, this Work Plan prioritizes each City outfall located in the ISA that currently discharges stormwater to the Willamette River. This section presents the prioritization approach and the City's recommendations for proceeding with the outfall evaluations. This approach was developed in accordance with the DEQ and EPA draft *Portland Harbor Joint Source Control Strategy* (DEQ and EPA, April 15, 2003; currently under revision). The priorities developed in this Work Plan are based on current information and are subject to change. It is expected that as new data are developed through the *Portland Harbor Joint Source Control Strategy*, or the sitewide RI/FS, the prioritization may change in the future. Other factors such as recontamination evaluations conducted for CERCLA early actions may also modify an outfall's priority as determined in this Work Plan.

The initial phase of the investigations will focus on outfalls where existing data suggest there are potential upland sources within City outfall basins that may be affecting sediment quality. DEQ and EPA will continue a broader, harbor-wide effort to evaluate upland sources discharging to private outfalls and other sources of sediment contamination. Following completion of the evaluation of higher priority outfalls, broader programmatic issues, such as impacts to sediment from industrial discharges covered under NPDES permits or from right-of-way runoff, will be considered to address potential issues associated with the remaining lower priority basins and other basins as deemed necessary.

4.1 Prioritization Approach

The City outfalls were placed into four general priorities using surface sediment data collected by BES near the outfalls, harbor-wide sediment data compiled by the LWG, and known upland conditions. Concentrations of selected constituents were plotted by river mile to determine whether surface sediment chemistry near each City outfall is distinctly different from harbor-wide data. Because of the absence of sediment standards and risk-based cleanup levels for the Willamette River, the DEQ sediment benchmarks were used for comparative purposes. The outfall priorities are defined in Table 4-1 and reflect the general order in which the outfall evaluations will be conducted.

The guidelines for prioritizing outfalls using sediment data are shown in Figure 4-1. It is important to note that while this is a comparative process, it is not a statistically based quantitative model. The main consideration was the relative magnitude of contamination in sediments measured by BES (looking at the average concentration and data range) in comparison with the harbor-wide data collected in earlier events by EPA and various other public and private entities. Other qualitative factors include outfall proximity to known contaminant sources (for example, Outfall 48 is located within the McCormick and Baxter Superfund site), river hydrodynamics, and upland institutional issues such as property ownership and the presence and status of DEQ cleanup sites.

TABLE 4-1 Guidelines for Outfall Priorities	
Priority	**Guidelines**
1	Considerably elevated concentrations of contaminants in sediment were measured by BES that may be associated with upland discharges from the outfall. These outfalls will be evaluated first under the IGA by the City and DEQ.
2	No contaminants with considerably elevated concentrations in sediment were measured; however, some constituents with slightly elevated concentrations suggest upland discharge from the outfall may affect sediment quality. These outfalls are a secondary priority and will be evaluated following the initiation of Priority 1 outfalls.
3	Considerably elevated concentrations of contaminants were measured in sediment near the outfall; however, the elevated concentrations are likely attributable to upriver or nearby sources.* Source control and in-water investigations at these locations will be evaluated under DEQ and/or EPA programs.
4	Based on current data, the outfall does not appear to be a significant pathway for contamination. Confirmation of the absence of contamination will be completed through the in-water RI/FS.
* Determination of an upriver or nearby source is based on information contained in the conceptual site models prepared for each outfall and included in Section 3 of Appendix B.	

4.2 Analysis of Data Used for Prioritization

A total of 24 "concentration versus river mile" charts were developed as a tool for use in outfall prioritization. These charts consist of scatter plots with river mile plotted on the abscissa (x-axis) and chemical concentration on the ordinate (y-axis). Samples have been grouped by riverbank (West Side or East Side/Swan Island Lagoon) and plotted separately. All charts display river miles between 3.5 and 9.5 to focus on the outfalls located in the Portland Harbor ISA.

Separate charts were developed for chemicals with elevated concentrations for prioritization of source investigation activities. These were identified because they are general indicators of sediment contamination and were chemicals that exceeded the DEQ High Toxicity Screening Level for freshwater receptors.[6]

The chemicals used for prioritization are as follows:

- Metals: arsenic, cadmium, chromium, copper, mercury, lead, zinc
- Bis(2-ethylhexyl) phthalate (DEHP) [7]
- Dichlorodiphenyltrichloroethanes (DDT and multiple isomers)
- High molecular weight polynuclear aromatic hydrocarbons (HPAHs)
- Low molecular weight polynuclear aromatic hydrocarbons (LPAHs)
- Polychlorinated biphenyls (PCBs)

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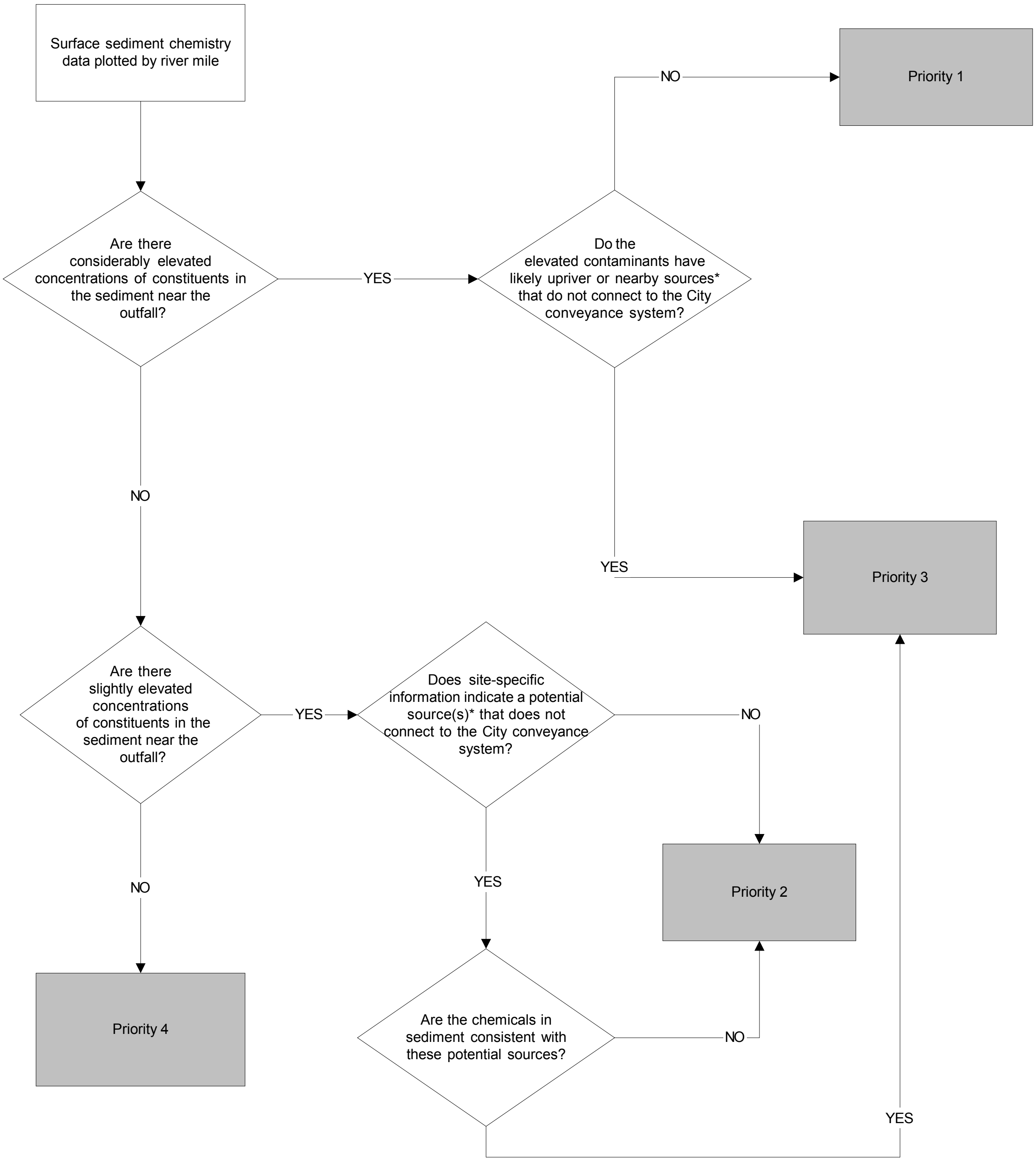
[6] As presented in the external review draft of the *Guidance for Evaluation of Sediment at State Cleanup Sites* (DEQ, 2002).

[7] DEHP was selected to represent the phthalates because it occurred the most frequently.



* Determination of upriver or nearby sources is based on information in the conceptual site models prepared for each outfall and included in Section 3 of the data report in Appendix B of this work plan.

NOTE: This is a general guideline for prioritization. Additional site information may be used to assign priority. See specific justification for individual outfall prioritization in Table 4-2.

Figure 4-1
Guidelines for Prioritizing Outfalls
Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project

This list of PCOIs incorporates a representative range of organic and inorganic constituents and meets the project's needs for prioritization purposes.

In addition to the chemicals shown above, the following chemicals were detected above the DEQ High Toxicity Screening Level:

- Silver (detected at Outfall S-2 and Outfall 22-C)
- Pentachlorophenol (PCP) (detected in one sample at Outfall 52-C)
- Selenium (detected at Outfall 22B)

These chemicals were detected only at the outfalls listed above and were not included in the overall PCOI list or used in the outfall prioritization. However, these chemicals may be evaluated more closely for these outfalls during the basin-specific RIs.

4.2.1 Data Sources

The chemical concentration versus river mile charts are derived from three data sources:

- Surface sediment samples from the LWG database (based on the criteria below)[8]
- Surface sediment samples from the BES Source Control Pilot Project
- Surface sediment samples from the BES Source Control Sediment Investigation

For comparability among data sets, the LWG data were filtered to contain only those samples that met all of the following criteria:

- Obtained from a depth of 15 centimeters or less
- Obtained since March 1, 1996 (post-flood)
- Included a "Cat1" quality control (QC) level. The Cat 1 QC level was obtained when backup data existed and there were enough data for the LWG to perform a validation.

All samples were assigned to a riverbank (West Side or East Side/Swan Island Lagoon) based on their geographic proximity to the respective banks. Mid-channel sediment sample designations were based on the sample's location with regard to the river center line.

4.2.2 Data Presentation

The data plots for the selected PCOIs are shown in Figures 4-2 through 4-25 (located at the end of this section). Chemical data are plotted as individual points corresponding to sample concentrations and sample location by river mile. At City outfalls, the data collected by BES are grouped together at a single river mile corresponding to the outfall location. Upriver samples collected by BES are also included in this group. The BES data are illustrated with a vertical bar extending from the minimum to the maximum concentrations of a given PCOI. The statistical mean of each group is shown as a point on the vertical range bar. This approach was taken because the river mile range on the x-axis is too large to distinguish points collected less than several hundred feet apart. (Typically, samples collected near each outfall were spaced 50 to 100 feet apart and distributed around the outfall.)

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8 The LWG database is a compilation of sediment data from various studies in the lower Willamette LWG database that is periodically updated. The database was queried in August of 2002 to obtain the LWG data that were used to prepare the river mile charts.

BES collected one sample at private outfall WP-16, river mile 8.95 in the Swan Island Lagoon. This location is in the vicinity of Outfall M-3 (Sample number SI01M301); however, the data are not included in the M-3 sample group because the outfall discharges at a higher elevation above and away from the shoreline, and the sample is not considered representative of potential impacts from M-3.

4.2.2.1 Treatment of Nondetects

Nondetects were treated differently for charts plotting individual contaminants than for those plotting estimated total parameters for a family of contaminants (for example, Total LPAHs or HPAHs). These differences are described below.

For the individual contaminant parameters, nondetects were shown as individual points for the LWG data at the detection limit. For the BES data, nondetects were included at the detection limit in the displayed ranges at each outfall. The detect ratio, which indicates the number of detects over the total number of samples collected at each outfall, is labeled at the top of each displayed range.

For the total parameters, the procedure for both the LWG and BES data sets includes the summation of detected samples only. There were instances in both the LWG and BES data where all analytes used to compute the totals were nondetects. These situations are referred to here as nondetect totals. For the LWG data, nondetect totals were plotted on the x-axis (zero concentration). For the BES data, when one or more nondetect total was included in an outfall group, the range bar was extended down to the x-axis. The detect ratio is labeled nearest to each displayed range.

Treatment of outliers. For some constituents, the observed concentration range for all samples was very large. In these cases, the concentration range on the chart was scaled to allow for proper display of the majority of the data set. Data outliers beyond the scaled range are listed in a dedicated area at the upper right corner of each chart. Outliers in the list are color coded to delineate riverbank association.

Treatment of QA/QC samples and blank detections. Field duplicates were included as separate samples to best portray the full range of detections. This approach may bias (high) the average shown in the river mile plots (Figures 4-2 through 4-25). However, a true mean will be established when individual outfalls are evaluated. Equipment rinsate blanks were not included.

There were nine instances when the field samples contained DEHP at less than 10 times the concentration reported in the associated laboratory method blanks (B1 qualified). Eight of these occurrences were at Outfall S-5 and one was at Outfall 22. These data, as well as the field sample concentrations that were greater than 10 times the concentration reported in the laboratory method blank (B2 qualified samples), were not included in the river mile plots.

4.2.3 Preparation of River Mile Charts

Separate charts are used to display data obtained nearest the west bank of the river versus samples obtained nearest the east bank of the river. Samples obtained within the Swan Island Lagoon are included on the east bank figure, but are shown in a different color. A consistent color scheme was used on all of the charts to distinguish whether the samples were obtained nearest to the west bank (red), east bank (blue), or lagoon (green).

4.2.3.1 River Mile Determinations for Samples and Outfalls

River mile determinations for samples and outfalls were made based on the U.S. Geological Survey (USGS) Portland Quadrangle map. The Arcview "spatial join" feature was used as a tool to determine the river mile to the nearest one hundredth of a mile for each sample and outfall location based on global positioning system (GPS) coordinates of longitude and latitude obtained at sample and outfall locations.

Industry locations. Industries were selected for inclusion on the river mile charts based on the DEQ figure *Portland Harbor Upland Cleanup Sites* (July 2003). Industries from the figure were included that met all of the following criteria:

- Cleanup under way or High Priority Remedial Investigation or High Priority Expanded Preliminary Assessment
- Had a property boundary on the river

River miles for the industries were determined from the shoreline property boundaries shown on Figures 4-14a,b,c in *Portland Harbor RI/FS* (Striplin Environmental Associates, September 2003). River miles for the property boundaries were determined graphically by extrapolation to linear centerline segments between river mile markers.

4.3 Prioritization Results

Table 4-2 contains the results of the prioritization process. The table presents information on the PCOIs that drive the prioritization and identifies additional information on potential sources that may contribute to the levels of contaminants observed in sediment. There is also a brief description for each outfall basin of the overall justification for the prioritization. On the basis of the information summarized in Table 4-2, City outfall basins were assigned the following priorities:

- Priority 1: M-3, M-1, 18, 19/19A, 22B, and 22C
- Priority 2: S-5, 49
- Priority 3: 22, 48, 50, 52A, and 52C
- Priority 4: S-6, S-1, S-2, M-2, 52 and 53

Outfall basins 19 and 19A have been grouped together because the outfalls are located very close to one another and the adjacent over-water activities (tugboat operations) tend to stir up sediment in this area and mask any potential sediment gradients in this area. Therefore, PCOIs identified in the vicinity of these outfalls will be addressed within both basins, as appropriate.

The City plans to address the highest priority outfall basins first; therefore, the Priority 1 outfall basins will be studied in the first year, followed by the Priority 2 outfall basins. Investigations of sediment and sources near Priority 3 outfalls are being evaluated under DEQ and EPA programs. Priority 4 outfall basin assessments will be deferred because these outfalls do not appear to be significant sources to sediment. In addition, the Priority 4 outfalls are not located in erosional areas, suggesting that the BES sediment samples likely represent recent solids discharge from the outfalls. Confirmation of the absence of contamination at Priority 4 outfalls will be completed through the EPA in-water program. Following completion of the Priority 1 and 2 outfall basin evaluations, broader programmatic issues, such as impacts to sediment from industrial discharges covered under NPDES permits, will be considered to address potential issues associated with Priority 3 and Priority 4 basins as deemed necessary.

These priorities do not reflect in-water ecological and human health risk criteria or cleanup levels. This information will become available over the next few years as the CERCLA program progresses. As additional information is developed through the CERCLA program, *Portland Harbor Joint Source Control Strategy* (DEQ and EPA, April 15, 2003; currently under revision), or other relevant agency programs, this prioritization may change to more appropriately direct resources.

TABLE 4-2
Outfall Prioritization[1]

Outfall ID	Priority	Chemicals with Considerably Elevated Concentrations[2]	Chemicals with Slightly Elevated Concentrations[2]	Potential Sources in the Outfall Basin with PCOIs that Match the PCOIs that Exceed Comparison Levels[3]	Potential Sources Upstream or Near the Outfall with PCOIs that Match the PCOIs that Exceed Comparison Levels[3]	Justification for Listed Priority
OF M-3	1	HPAH, LPAH, and DEHP.	DDT.	Fred Meyer (ECSI #44)–DEHP.	M-3 is located at the head of the Swan Island Lagoon. This is a backwater area that may receive sediment deposition derived from many upstream sources including shipyard operations, over-water activities, and private outfall discharge. Island Holdings, Inc (ECSI # 260)–2,4-D and other pesticide contamination. The Island Holdings site is located directly north of Outfall M-3 on property currently occupied by NW Paper Box. NW Paperbox discharges to private outfall WP-16.	River mile data plots show considerably elevated concentrations of multiple constituents. Complex hydrodynamic regime with no clear source for measured constituents.
OF M-1	1	DEHP, PCBs, and chromium.	Cadmium and zinc.	Fred Devine Diving and Salvage Co. (ECSI #2365)–Phthalates, and zinc. There is also over-water work conducted in this area. Freightliner Truck Manufacturing Plant (ECSI #2366)–Suspected paint waste contamination. Periodic benchmark exceedances of zinc in stormwater.	M-1 is located along the east bank of the heavily industrialized Swan Island Lagoon. This is a backwater area that may receive sediment deposition derived from many upstream sources including shipyard operations, over-water activities, and private outfall discharge.	River mile data plots show considerably elevated concentrations of multiple constituents. PCBs are elevated; however, there are much higher concentrations of PCBs throughout the lagoon. Complex hydrodynamic regime with no clear source for measured constituents.
OF 18	1	PCBs and lead.	DDT, DEHP, mercury, and zinc.	Burlington Northern Railroad Lake Yard (ECSI #100)–PCBs, phthalates, mercury, and zinc. Christenson Oil–Plant Number 1 (ECSI 2426)–Lead, mercury, and zinc. Columbia American Plating Co. (ECSI #29)–Lead and zinc. Magnus Co. (ECSI #69)–Lead. Schnitzer Investment (ECSI #2424)–Lead. Texaco Portland Terminal (ECSI #169) –Lead. Texaco Product Pipeline (ECSI #2117)–DEHP, lead, mercury, and zinc. Trumbull Asphalt Plant (ECSI #1160)–Petroleum hydrocarbons.	Gunderson Inc. (ECSI #1155)–PCBs, phthalates, lead, mercury, and zinc.	Considerably elevated concentrations of PCBs and lead were detected in the in-river sediments near Outfall 18. For purposes of schedule, this outfall will be considered a Priority 1.

TABLE 4-2
Outfall Prioritization[1]

Outfall ID	Priority	Chemicals with Considerably Elevated Concentrations[2]	Chemicals with Slightly Elevated Concentrations[2]	Potential Sources in the Outfall Basin with PCOIs that Match the PCOIs that Exceed Comparison Levels[3]	Potential Sources Upstream or Near the Outfall with PCOIs that Match the PCOIs that Exceed Comparison Levels[3]	Justification for Listed Priority
OFs 19/ 19A	1	DEHP, LPAH, chromium, copper, mercury, lead, and zinc.	HPAH, PCBs, arsenic, and cadmium.	Brazil and Co. (ECSI #970)–PCBs. Calbag Metals (ECSI #2454)–Cadmium, lead, mercury, and zinc. Dura Industries (ECSI #111)–Cadmium, chromium, and lead. Schnitzer Investment Corp. (ECSI #2442)–Cadmium, lead, mercury, and zinc. PGE–Forest Park (ECSI #2406)–PCBs. Anderson Brothers (ECSI #970)– Paint waste. Glacier Northwest Inc. (ECSI #2378)–DEHP. Front Avenue LLP (ECSI #1239)–Cadmium, lead, mercury, and zinc. Unocal-Willbridge Terminal (ECSI #177)–diesel, gasoline, and heavy oil, and related constituents	Gunderson (ECSI #1155) PAHs, PCBs, phthalates, and metals. Lakeside Industries (ECSI #2372)–Cadmium, lead, and zinc. McCall Oil (ECSI #134)–PAHs, and lead. Shaver Transportation Company (ECSI #2377)–Operates tugboats and barges, and over-water activities include general ship maintenance, such as refueling and oil changes.	Considerably elevated concentrations of LPAH, DEHP, chromium, copper, mercury, lead, and zinc were detected in the in-river sediments near 19/19A. There is no attributable upriver or nearby source for DEHP, mercury, chromium, or copper.
OF 22B	1	DDT, arsenic, chromium, mercury, lead, and zinc.	Copper.	Gould Inc./NL Industries Inc. (ECSI #49)–Arsenic, lead, and zinc. Metro Central Transfer Station (ECSI #1398)–Heavy metals and pesticides. Doane Lake Study Area (ECSI #36)–Lead and arsenic. Schnitzer Investment–Doane Lake (ECSI #395)–arsenic and lead.	ATOFINA Chemicals (ECSI #398)–DDT. ESCO Corp.–Willbridge Landfill (ECSI #397)–Lead, foundry sand, slag, demolition debris, dust, and foundry yard debris. Rhone Poulenc–East Doane Lake (ECSI #155)–lead, arsenic, and pesticides. The Rhone Poulenc site discharges to private outfall WP-06 directly adjacent to Outfall 22B.	Considerably elevated concentrations of DDT, arsenic, chromium, lead, and zinc were detected in the in-river sediments near 22B. There is no attributable upriver or nearby source for chromium or zinc.
OF 22C	1	DDT, HPAH, LPAH, and arsenic.	Chromium, copper, lead, and zinc.	Koppers Industries Inc. (ECSI #2348)–See Wacker Siltronic (ECSI #183). Wacker Siltronic (ECSI # 183)–PAHs, DDT, and zinc. Santa Fe Pacific Pipeline Co. (ECSI #2104)–PAHs. Doane Lake Study Area (ECSI #36)–PAHs, coal tar, arsenic, and lead.	ATOFINA Chemicals (ECSI #398)–DDT. ESCO Corp.–Willbridge Landfill (ECSI #397)–Lead, foundry sand, slag, demolition debris, dust, and foundry yard debris. Rhone Poulenc–East Doane Lake (ECSI #155)–lead, arsenic, and pesticides. The Rhone Poulenc site discharges to private outfall WP-06 upstream of Outfall 22B.	Considerably elevated concentrations of DDT, HPAH, LPAH, and arsenic were detected in the in-river sediments near 22C. Although potential upstream/nearby sources for all of the considerably elevated PCOIs detected at this outfall exist (except PAHs), because of the proximity of this stormwater drainage basin to the 22B drainage basin, and the potential sources in the basin, this outfall is considered a Priority 1 outfall.
OF S-5	2	DEHP.	Lead, copper, and zinc.	None identified.	None identified.	Slightly elevated average concentrations of metals were detected in the in-river sediments near S-5. DEHP was detected above method blanks (at less than 10 times the blank concentration). These data may represent false positives, therefore this outfall was assigned Priority 2.

TABLE 4-2
Outfall Prioritization[1]

Outfall ID	Priority	Chemicals with Considerably Elevated Concentrations[2]	Chemicals with Slightly Elevated Concentrations[2]	Potential Sources in the Outfall Basin with PCOIs that Match the PCOIs that Exceed Comparison Levels[3]	Potential Sources Upstream or Near the Outfall with PCOIs that Match the PCOIs that Exceed Comparison Levels[3]	Justification for Listed Priority
OF 49	2	Mercury.	LPAH.	None identified.	Willamette Cove (ECSI #2066)–mercury. McCormick and Baxter Creosoting Co. (ECSI #74)–PAHs.	Considerably elevated concentrations of only one PCOI, mercury, was detected in the in-river sediments near 49. Therefore, this outfall was assigned Priority 2.
OF 22	3	None Identified.	HPAH and LPAH.	Chevron-Willbridge Terminal (ECSI #25)–petroleum hydrocarbons Unocal Willbridge Terminal (ECSI #177)–diesel, gasoline, heavy oil, and other related constituents. Shell Oil Co.-Willbridge Plant (ECSI #160)–petroleum tank bottoms. Anderson Brothers Property (ECSI #970)–hydrocarbons Willbridge Bulk Fuel Area (ECSI #1549)–PAHs.	McCall Oil (ECSI #134)–PAHs. Chevron USA Asphalt (ECSI #1281)–PAHs.	Slightly elevated concentrations of HPAH and LPAH were detected in the in-river sediments near Outfall 22. These concentrations are attributable to known sources currently under DEQ cleanup program.
OF 48	3	Arsenic, chromium, copper, lead, and zinc.	None identified.	None identified.	McCormick and Baxter Creosoting Co. (ECSI #74)–Arsenic, chromium, and copper. Zinc is listed as a contaminant of interest in the Portland Harbor Joint Source Control Strategy Review Draft (DEQ and EPA, April 15, 2003; currently under revision). Triangle Park–North Portland Yard (ECSI #277)–Arsenic, chromium, copper, lead, and zinc.	Outfall 48 is located within the McCormick and Baxter Superfund site, which is presently undergoing remediation by EPA.
OF 50	3	Chromium, copper, lead, and zinc.	Arsenic.	None identified.	Crawford Street (ECSI #2363)–Chromium, copper, lead, and zinc.	Considerably elevated concentrations of chromium, copper, zinc, and lead were detected in the in-river sediments near Outfall 50. These constituent concentrations can be attributed to the upriver source, Crawford Street.
OF 52A	3	None identified.	HPAH, LPAH, DEHP, copper, lead, and zinc.	None identified for elevated constituents.	Mar Com (ECSI #2350)–PAHs, metals, and phthalates. Mar Com sediment results also indicate elevated copper, lead and zinc. The Mar Com site discharges via private outfalls and sheet flow and operates a dry dock immediately adjacent to City outfall.	Slightly elevated concentrations of HPAH, LPAH, DEHP, copper, lead, and zinc were detected in the in-river sediments near 52A. The sample from which slightly elevated DEHP was collected at 52A was a soil sample. River sediment samples did not show elevated DEHP above DEQ Baseline.
OF 52C	3	Chromium.	HPAH, LPAH, DEHP and lead.	None identified for elevated constituents.	Port of Portland Terminal 4 (ECSI #272)–PAHs and chromium. The Terminal 4 site discharges to private outfalls WP-177, WP-178, WP-179, WP-180, and WP-181 in the vicinity of Outfall 52C.	Considerably elevated concentrations of chromium and slightly elevated concentrations of lead, PAHs, and DEHP were detected in the in-river sediments near Outfall 52C; sources may be attributable to Terminal 4, which is currently under Early Action evaluation. The City will coordinate with appropriate parties on source control issues.
OF S-6	4	None identified.	None identified.	Not applicable.	Not applicable.	The outfall does not appear to be a significant source of contamination. None of the plotted constituents were detected at slightly elevated or considerably elevated concentrations.

TABLE 4-2
Outfall Prioritization[1]

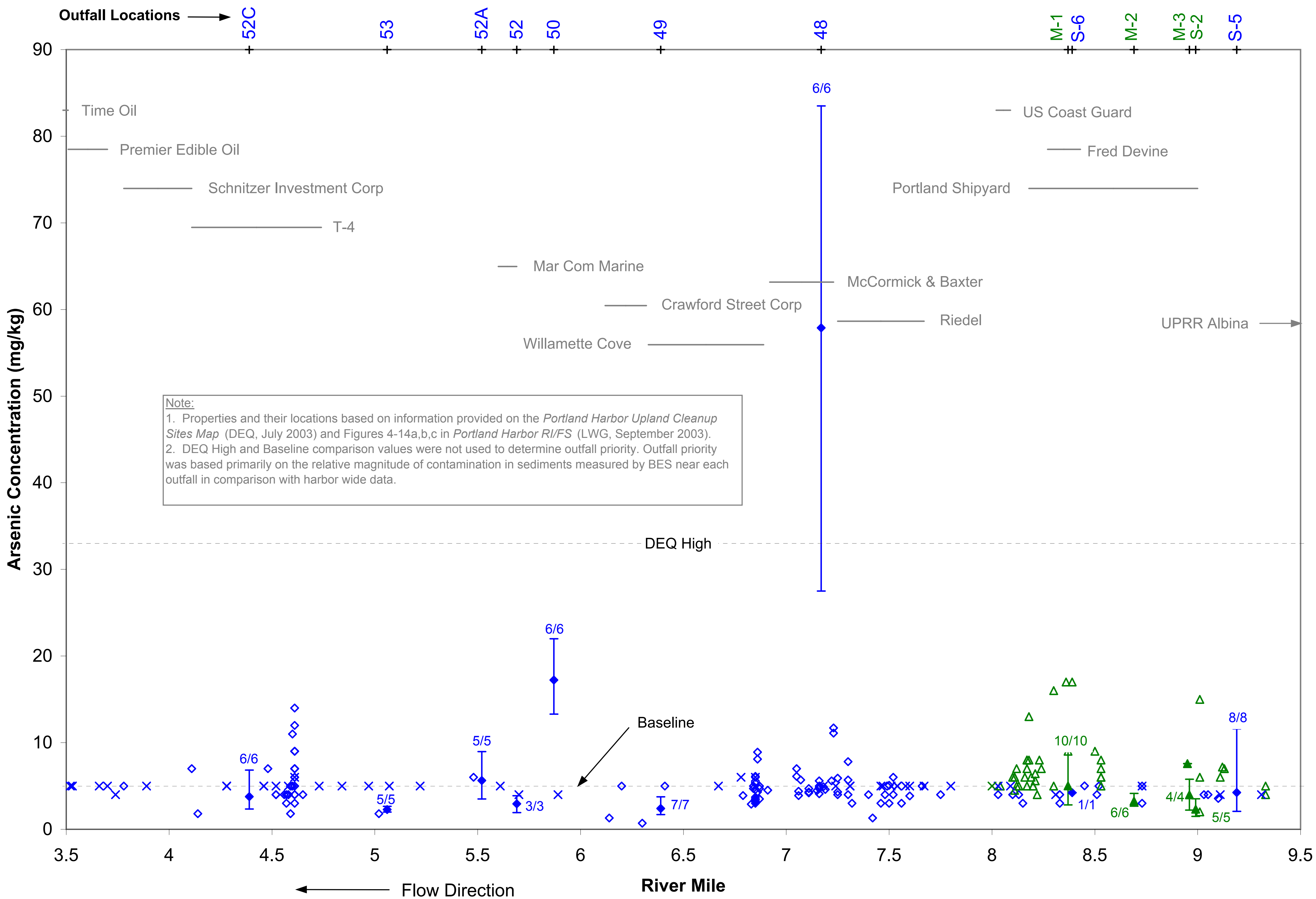
Outfall ID	Priority	Chemicals with Considerably Elevated Concentrations[2]	Chemicals with Slightly Elevated Concentrations[2]	Potential Sources in the Outfall Basin with PCOIs that Match the PCOIs that Exceed Comparison Levels[3]	Potential Sources Upstream or Near the Outfall with PCOIs that Match the PCOIs that Exceed Comparison Levels[3]	Justification for Listed Priority
OF S-1	4	No data are available for this outfall. Based on the close proximity to outfalls S-6 and S-2, this outfall has been assigned Priority 4.		Not applicable.	Not applicable.	On the basis of data collected at nearby Outfalls S-6 and S-2, the outfall does not appear to be a significant source of contamination. Additional data collected as part of the in-water CERCLA investigation may be used to reclassify the priority.
OF S-2	4	None identified.	None identified.	Not applicable.	Not applicable.	The outfall does not appear to be a significant source of contamination. None of the plotted constituents were detected at slightly elevated or considerably elevated concentrations.
OF M-2	4	None identified.	None identified.	Not applicable.	Not applicable.	The outfall does not appear to be a significant source of contamination. None of the plotted constituents were detected at slightly elevated or considerably elevated concentrations.
OF 52	4	None identified.	Mercury (in upstream sample only).	None identified.	None identified for elevated constituents.	Slightly elevated concentrations of mercury were detected in the upriver sediments near Outfall 52; sediments adjacent to and downstream of the outfall were below typical river-wide concentrations.
OF 53	4	None identified.	None identified.	Not applicable.	Not applicable.	The outfall does not appear to be a significant source of contamination. None of the plotted constituents were detected at slightly elevated or considerably elevated concentrations.

Notes:
[1] DEQ High and Baseline comparison values were not used to determine outfall priority. Outfall priority was based primarily on the relative magnitude of contamination in sediments measured by BES near each outfall in comparison with harbor-wide data.

[2]Chemicals used for prioritization are shown in Section 4.2 of the text. These chemicals were used for prioritization and do not represent the final PCOI list. The final outfall-specific PCOI lists will be determined on a basin-by-basin basis during the basin RI work.

[3]Information is primarily from DEQ's ECSI website (http://www.deq.state.or.us/wmc/ecsi/ecsiquery.htm), which is used by DEQ to track sites in Oregon with known or potential contamination from hazardous substances. The PCOIs shown are listed under the website's "Hazardous Substances/Waste Types." This table includes only ECSI sites listed with the same PCOIs as those detected in river sediments. The ECSI sites shown may have additional PCOIs associated with them. ECSI website information may be outdated, incomplete, or unconfirmed, and DEQ files should be consulted to determine current status of investigation and cleanup.

Abbreviations:
BES City of Portland Bureau of Environmental Services
DEHP Bis-2-ethyl-hexyl phthalate
DEQ Oregon Department of Environmental Quality
ECSI Environmental Cleanup Site Information
PCOI Potential Contaminant of Interest
OF Outfall
DDT dichlorodiphenyltrichloroethane
PAH high molecular weight polycyclic aromatic hydrocarbons
LPAH low molecular weight polycyclic aromatic hydrocarbons
PCB polychlorinated biphenyl



Outliers (Not Shown)

BES Data:
none

LWG Data:
none

Legend

BES Data (2002)

Observed range for sample group shown about the mean. Detect ratio indicated.

- 6/6 East Side
- 4/4 Swan Island Lagoon

LWG Data (1996-2001)

- East Side
- Swan Island Lagoon
- East ND (det. limit)
- Lagoon ND (det. limit)

Figure 4-2

Arsenic Concentration in Sediments vs. River Mile - East Side (Including Swan Island Lagoon)

Remedial Investigation Work Plan
City of Portland

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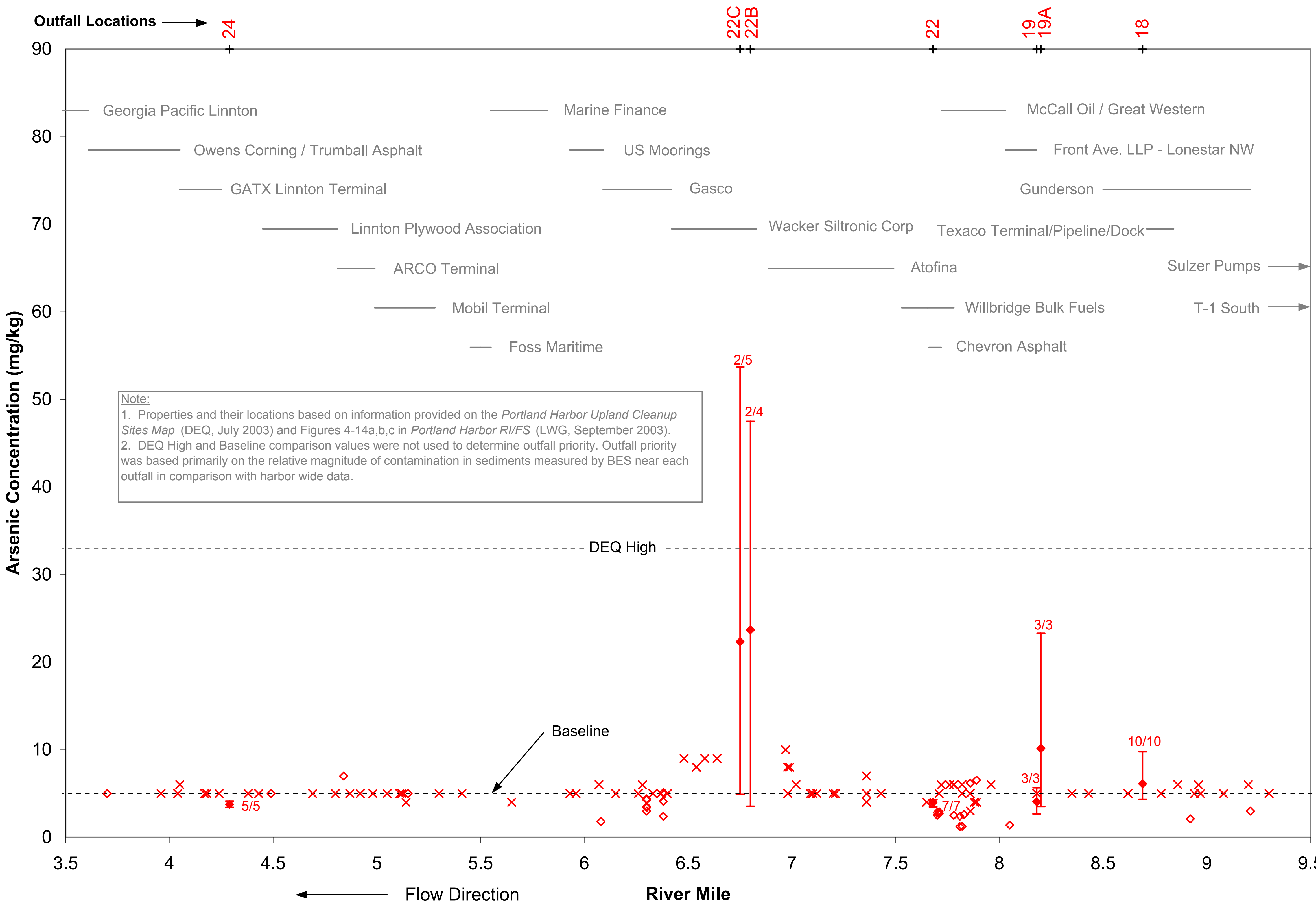

Outliers (Not Shown)

BES Data:
none

LWG Data:
none

Legend

BES Data (2002)
Observed range for sample group shown about the mean. Detect ratio indicated.

2/4 West Side

LWG Data (1996-2001)

◇ West Side

× West ND (det. limit)

Figure 4-3

Arsenic Concentration in Sediments vs. River Mile - West Side

Remedial Investigation Work Plan
City of Portland

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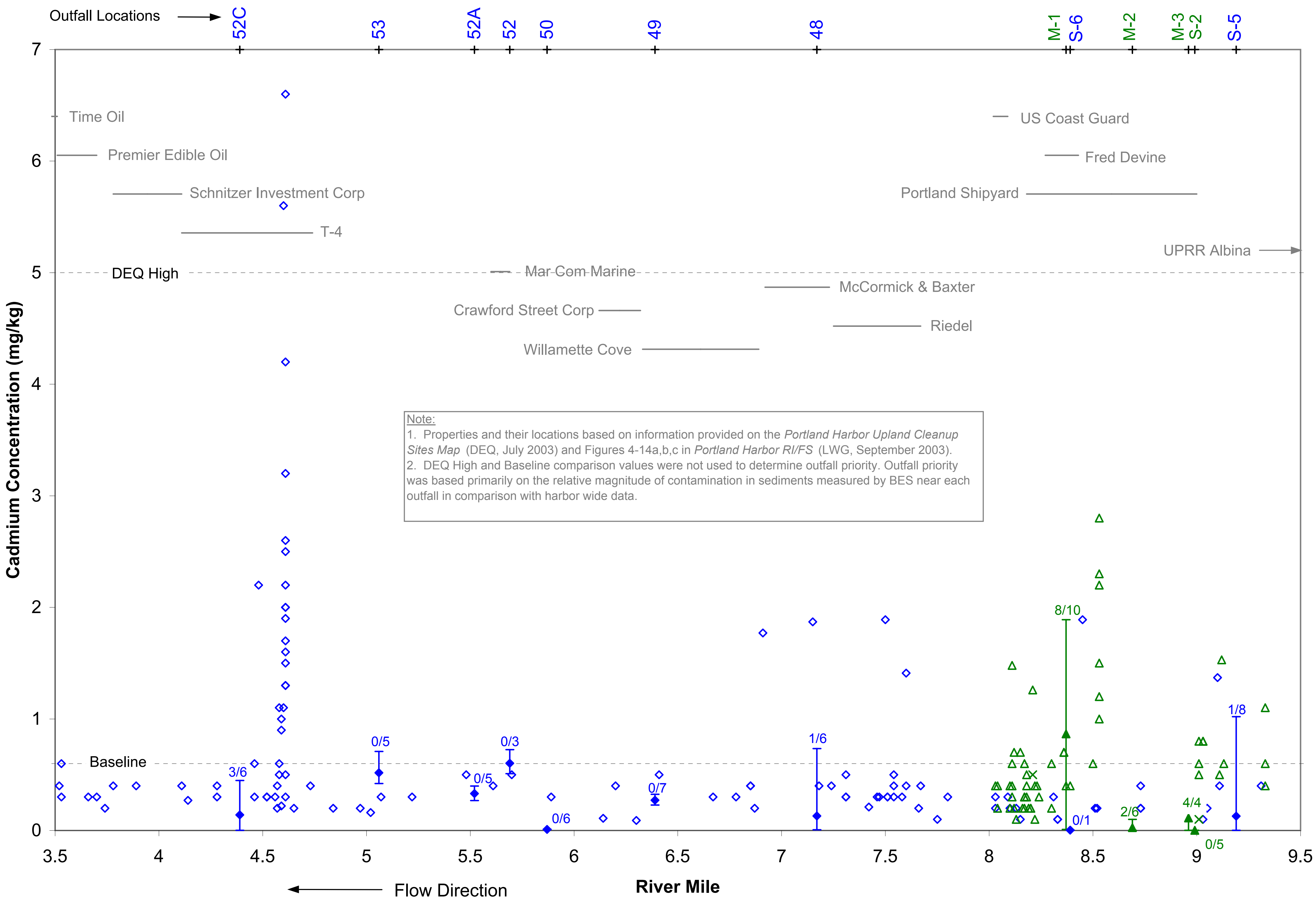

Outliers (Not Shown)

BES Data:

1 at private outfall WP-16 adjacent to M-3 (46.2 mg/kg)

LWG Data:

none

Legend

BES Data (2002)

Observed range for sample group shown about the mean. Detect ratio indicated.

3/6 East Side

2/6 Swan Island Lagoon

LWG Data (1996-2001)

◇ East Side

△ Swan Island Lagoon

× Lagoon ND (det. limit)

Figure 4-4

Cadmium Concentration in Sediments vs. River Mile - East Side (Including Swan Island Lagoon)

Remedial Investigation Work Plan
City of Portland

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Outliers (Not Shown)

BES Data:
none

LWG Data:
none

Legend

BES Data (2002)
Observed range for sample group shown about the mean. Detect ratio indicated.
4/4 West Side

LWG Data (1996-2001)
West Side
West ND (det. limit)

Figure 4-5

Cadmium Concentration in Sediments vs. River Mile - West Side

Remedial Investigation Work Plan
City of Portland

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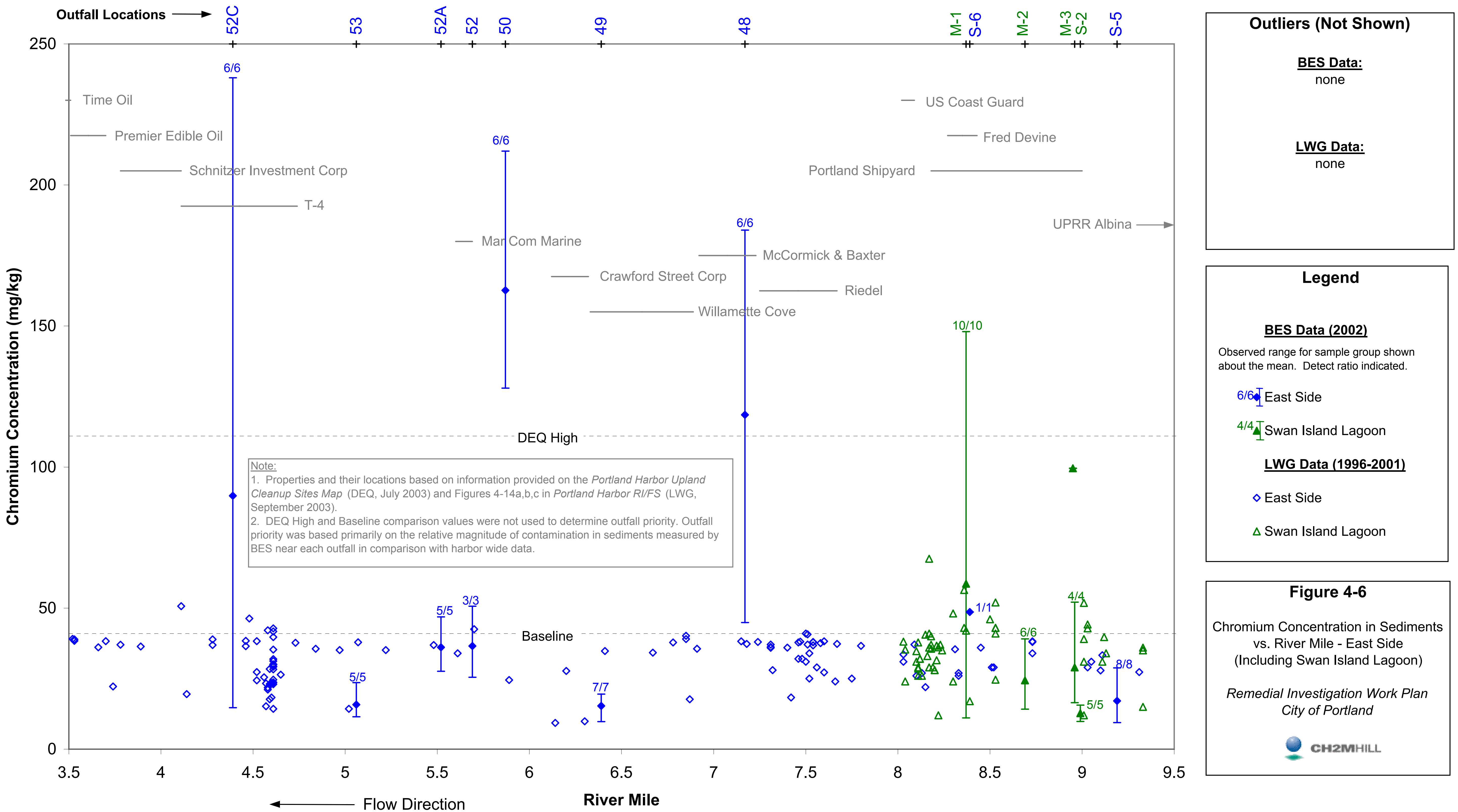

Figure 4-6

Chromium Concentration in Sediments vs. River Mile - East Side (Including Swan Island Lagoon)

Remedial Investigation Work Plan
City of Portland

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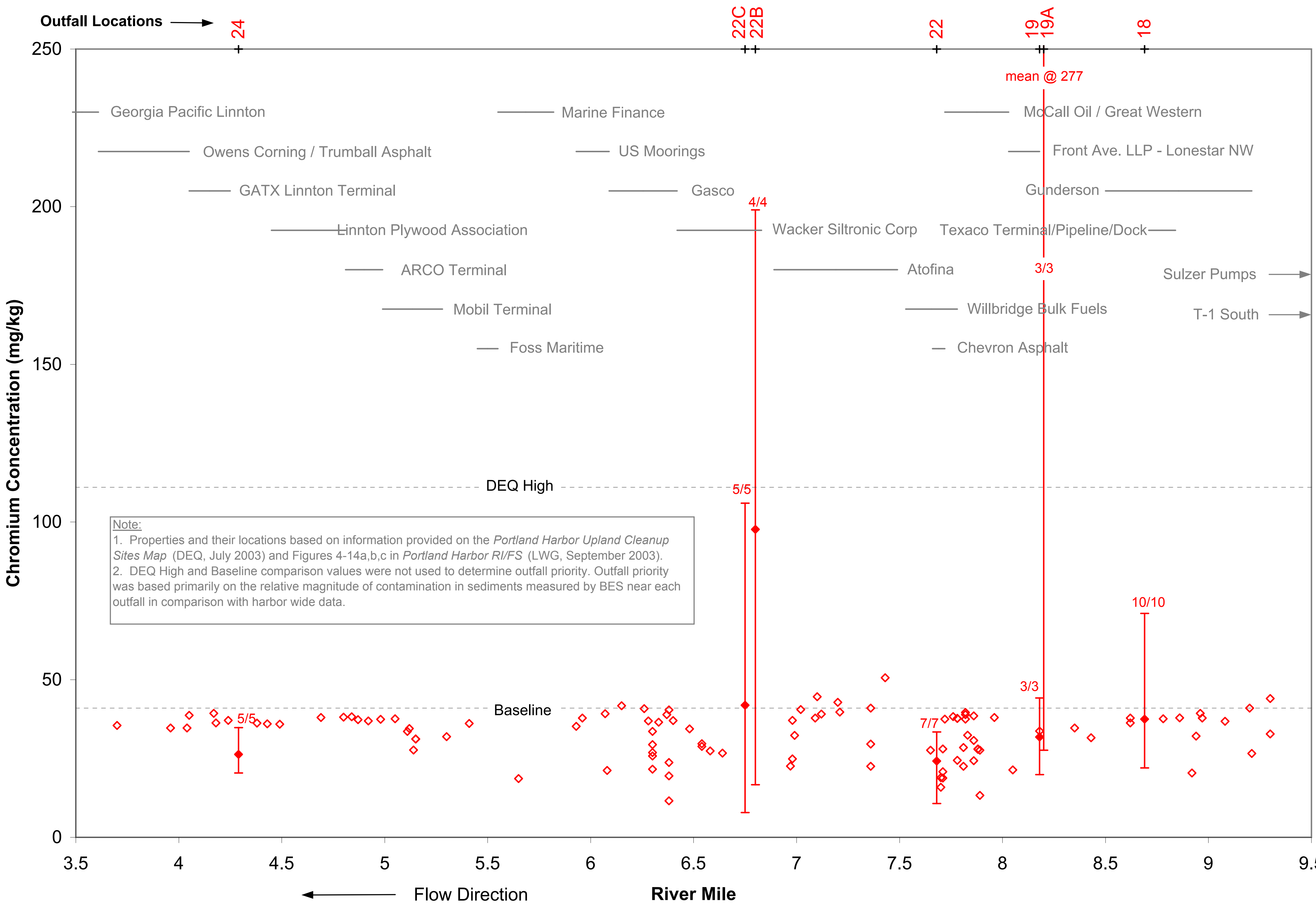

Outliers (Not Shown)

BES Data:
1 at outfall 19A (774 mg/kg)

LWG Data:
none

Legend

BES Data (2002)

Observed range for sample group shown about the mean. Detect ratio indicated.

4/4 West Side

LWG Data (1996-2001)

West Side

Figure 4-7

Chromium Concentration in Sediments vs. River Mile - West Side

Remedial Investigation Work Plan
City of Portland

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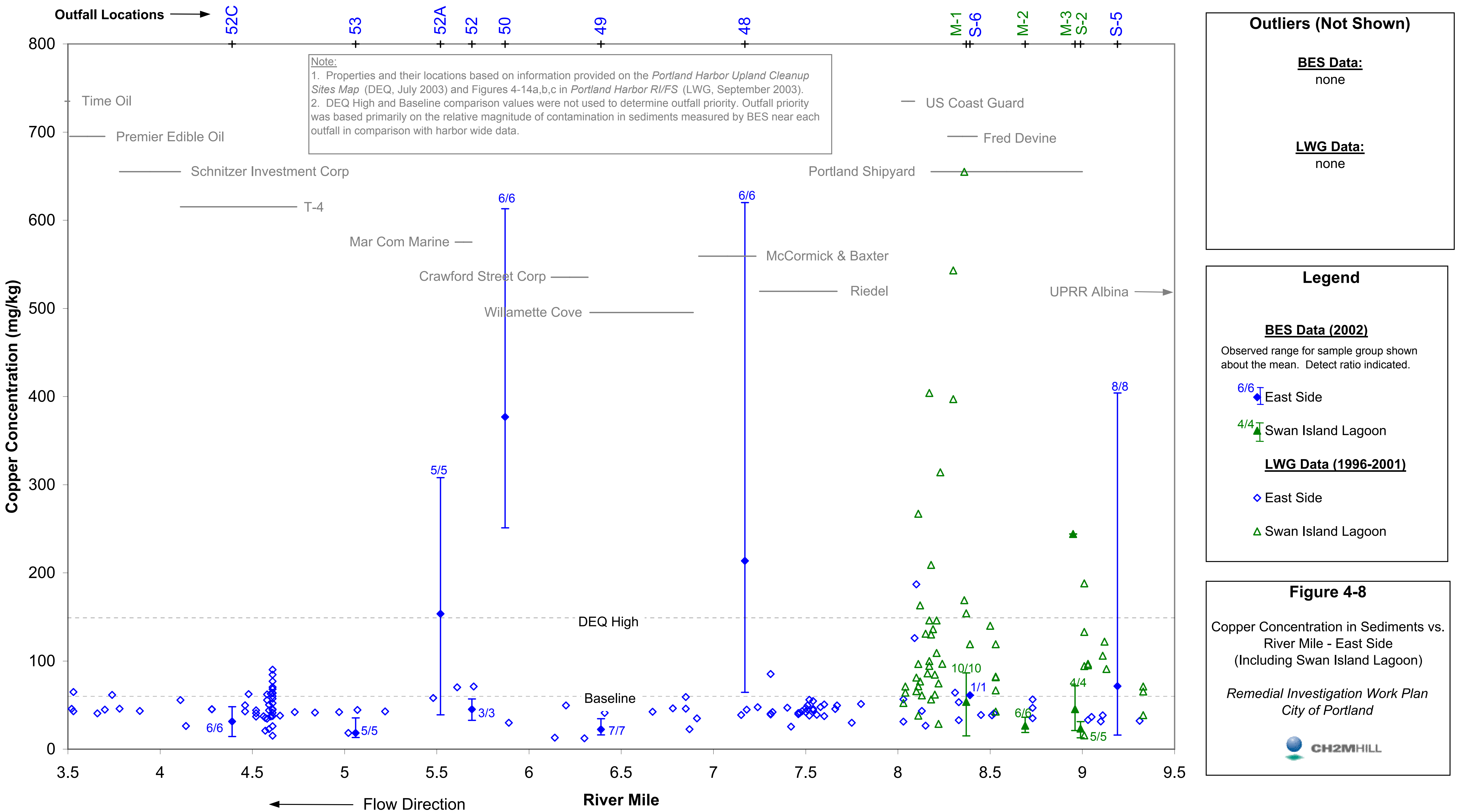

Figure 4-8

Copper Concentration in Sediments vs. River Mile - East Side (Including Swan Island Lagoon)

Remedial Investigation Work Plan
City of Portland

Outliers (Not Shown)

BES Data:
none

LWG Data:
none

Legend

BES Data (2002)

Observed range for sample group shown about the mean. Detect ratio indicated.

4/4 West Side

LWG Data (1996-2001)

West Side

West ND (det. limit)

Figure 4-9

Copper Concentration in Sediment vs. River Mile - West Side

Remedial Investigation Work Plan
City of Portland

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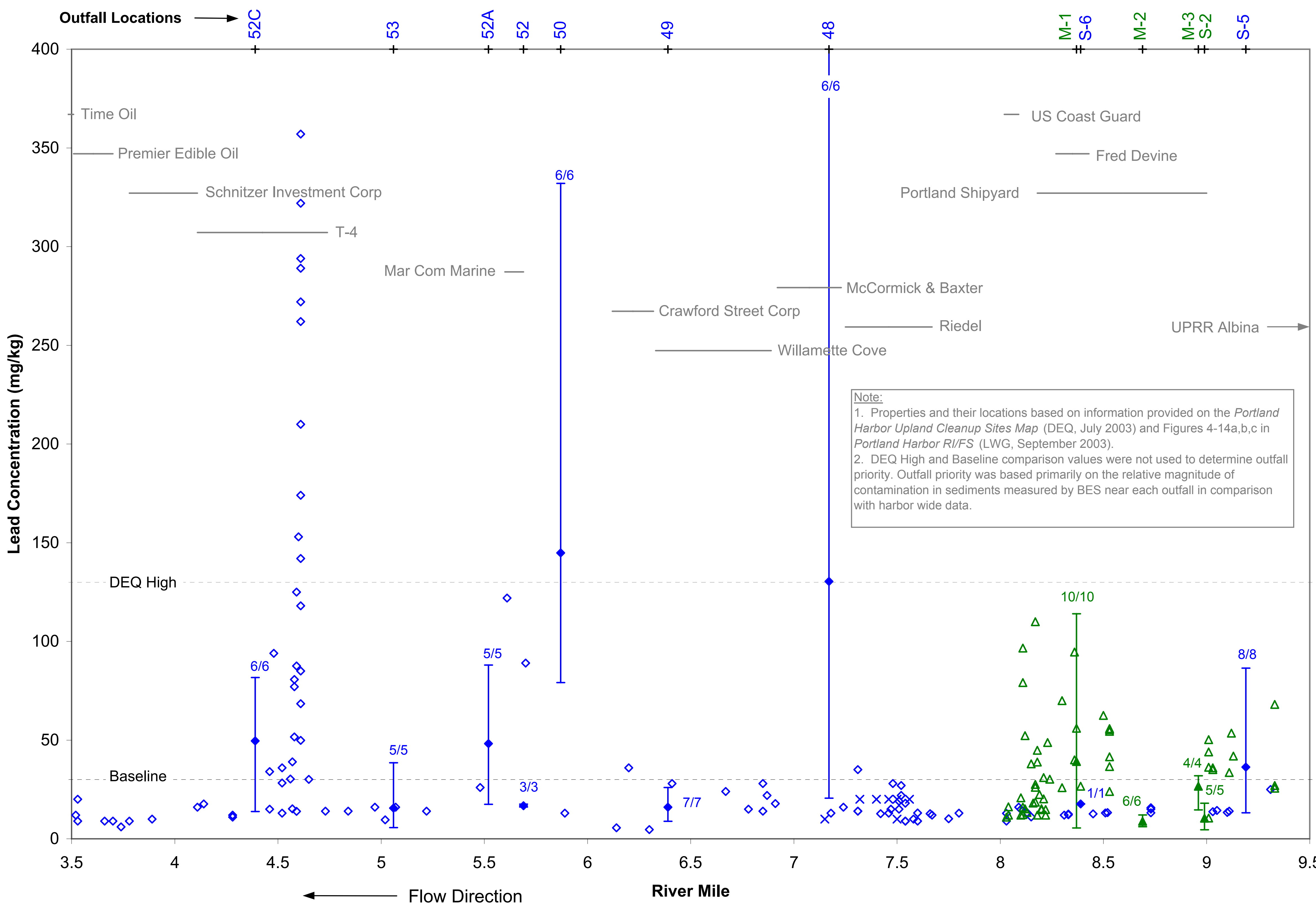

Outliers (Not Shown)

BES Data:
1 at outfall 48 (516 mg/kg);
1 at private outfall WP-16 adjacent to M-3 (936 mg/kg)

LWG Data:
1 at river mile 4.60 (1160 mg/kg);
3 at river mile 4.61 (626, 644, 837 mg/kg)

Legend

BES Data (2002)
Observed range for sample group shown about the mean. Detect ratio indicated.
6/6 East Side
4/4 Swan Island Lagoon

LWG Data (1996-2001)
East Side
Swan Island Lagoon
East ND (det. limit)

Figure 4-10

Lead Concentration in Sediments vs. River Mile - East Side (Including Swan Island Lagoon)

Remedial Investigation Work Plan
City of Portland

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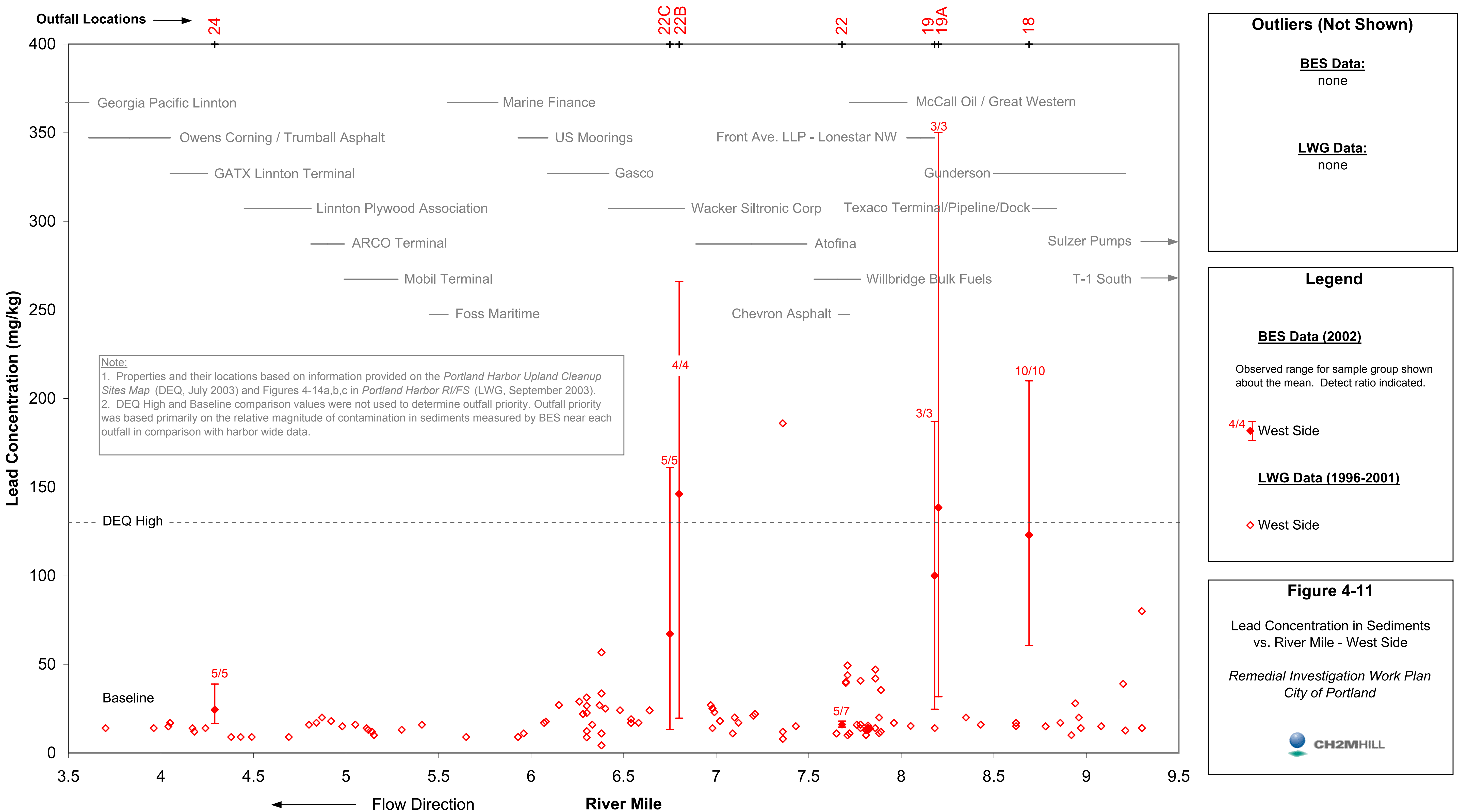

Figure 4-11

Lead Concentration in Sediments vs. River Mile - West Side

Remedial Investigation Work Plan
City of Portland

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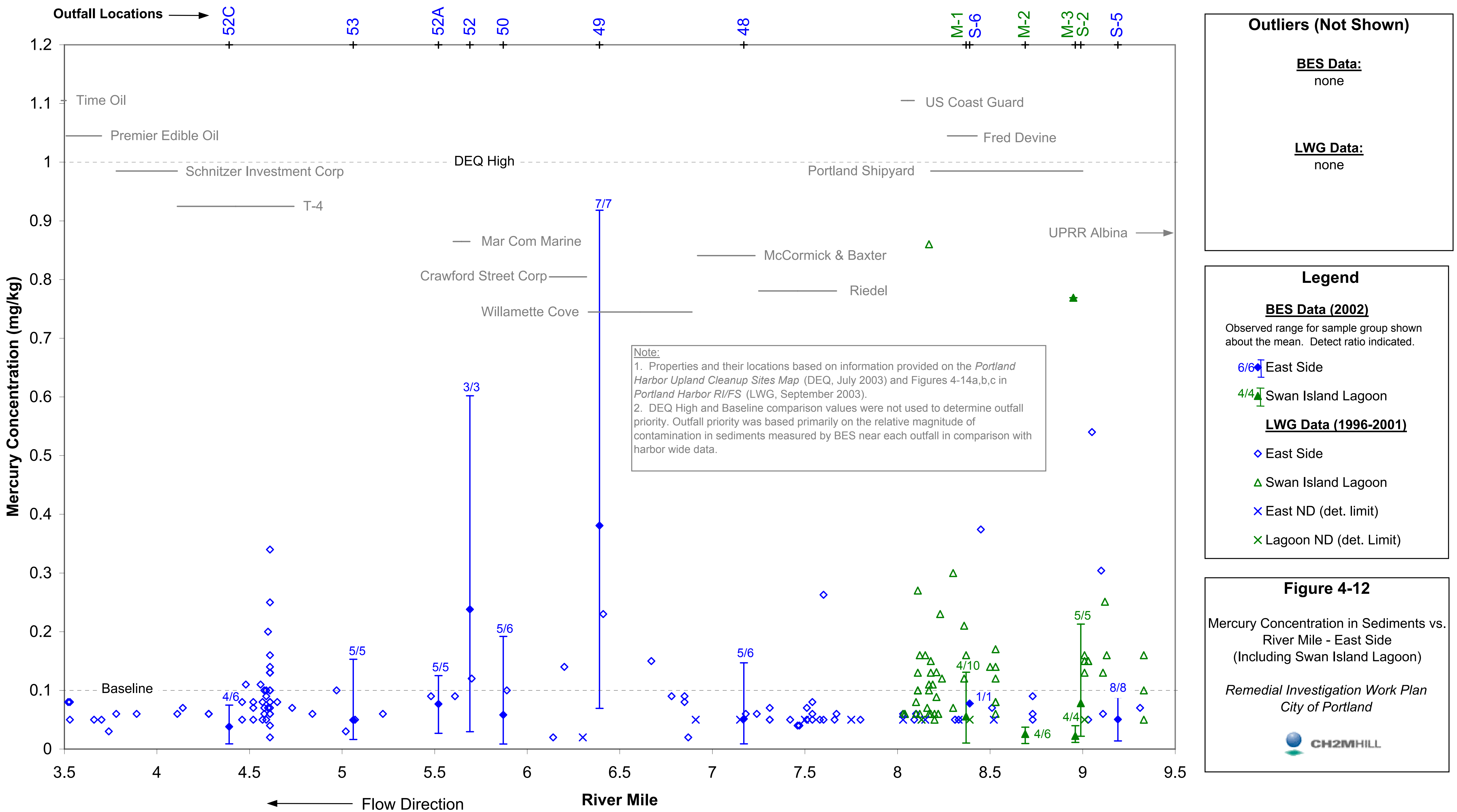

Figure 4-12

Mercury Concentration in Sediments vs. River Mile - East Side (Including Swan Island Lagoon)

Remedial Investigation Work Plan
City of Portland

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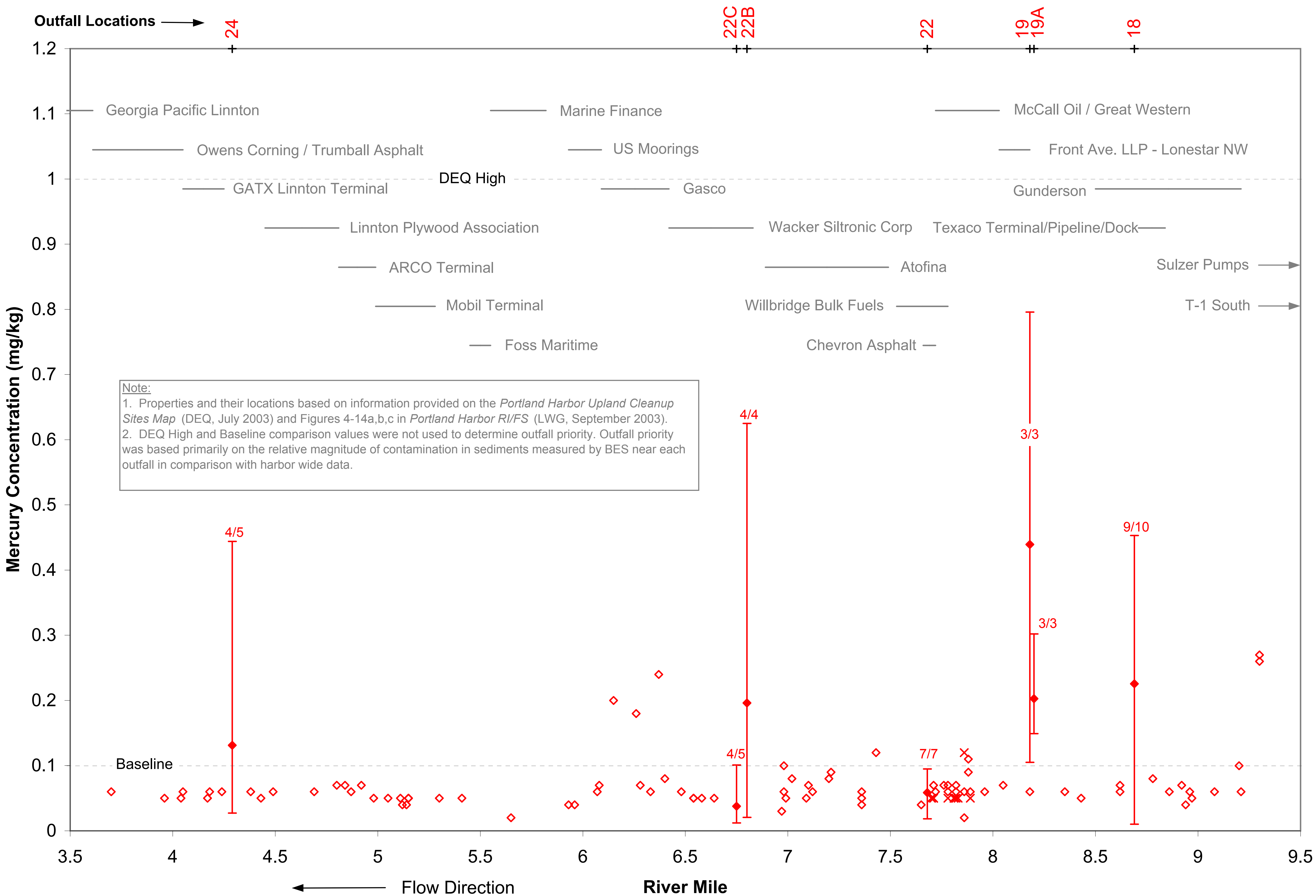

Figure 4-13

Mercury Concentration in Sediments vs. River Mile - West Side

Remedial Investigation Work Plan
City of Portland

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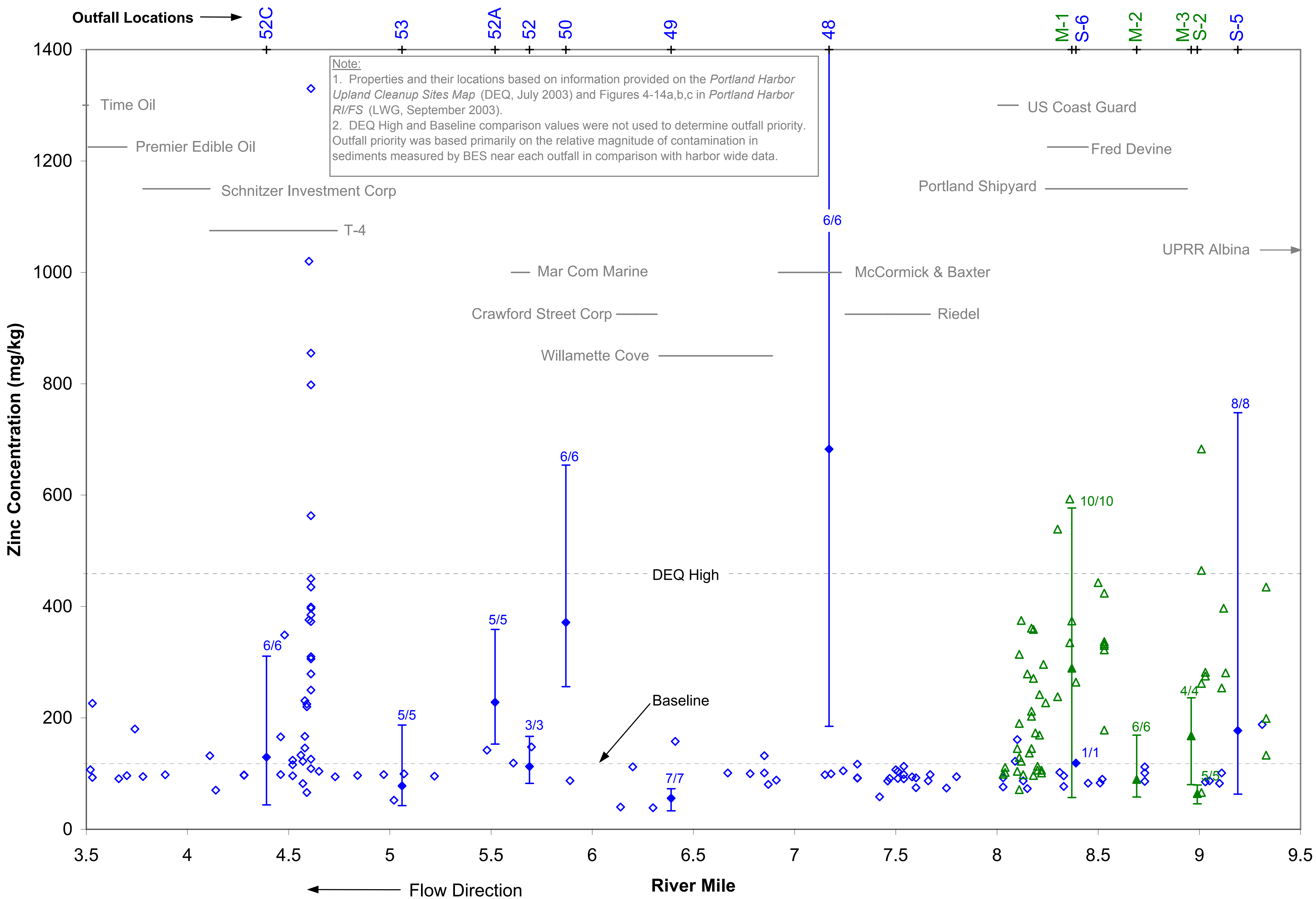

Figure 4-14

Zinc Concentration in Sediment
vs. River Mile - East Side
(Including Swan Island Lagoon)

Remedial Investigation Work Plan
City of Portland

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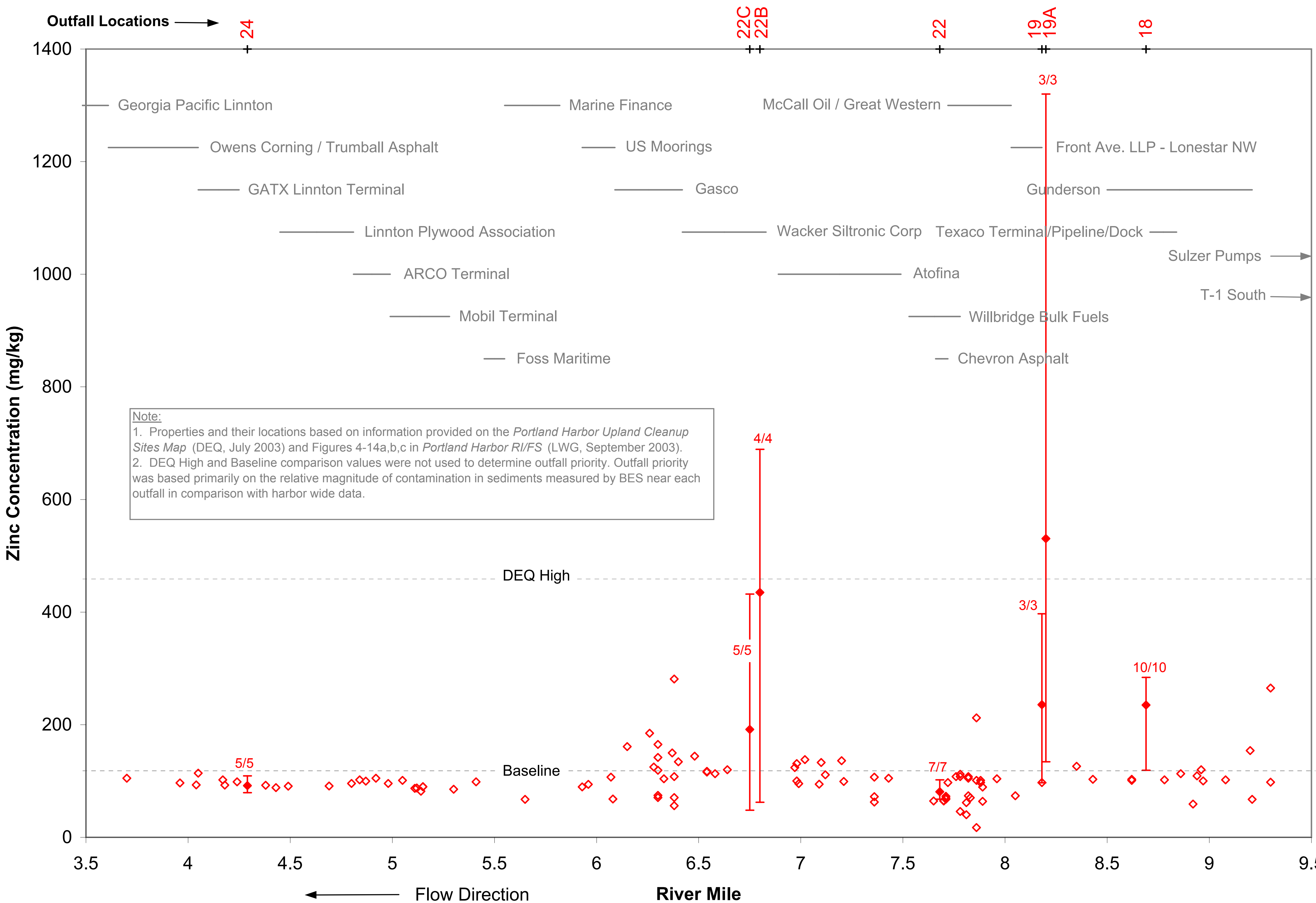

Outliers (Not Shown)

BES Data:
none

LWG Data:
none

Legend

BES Data (2002)

Observed range for sample group shown about the mean. Detect ratio indicated.

4/4 West Side

LWG Data (1996-2001)

West Side

Figure 4-15

Zinc Concentration in Sediment vs. River Mile - West Side

Remedial Investigation Work Plan
City of Portland

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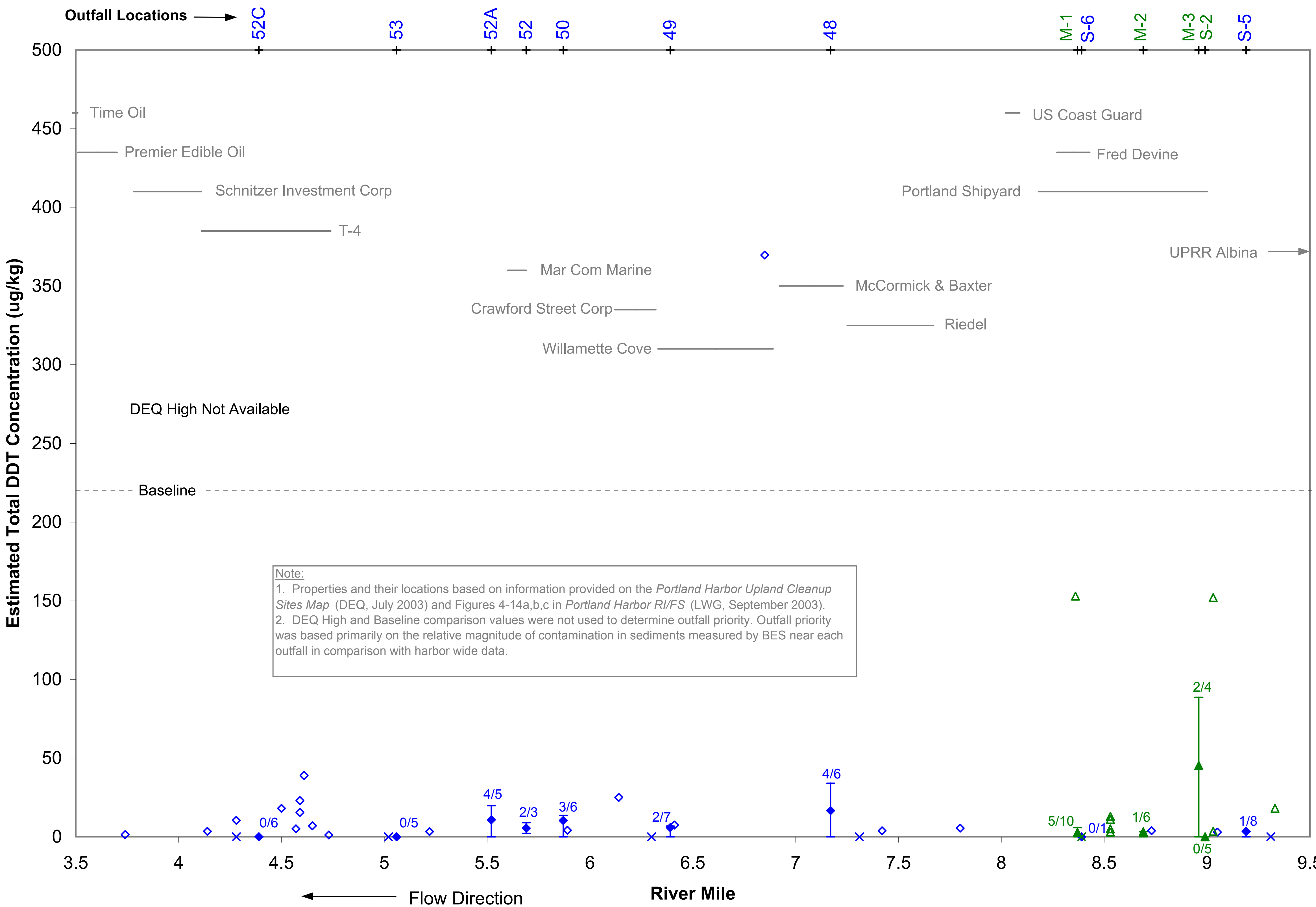

Outliers (Not Shown)

BES Data:
none

LWG Data:
none

Legend

Totals represent sum of detected parameters. Non-detects plotted as 0

BES Data (2002)

Observed range for sample group shown about the mean. Detect ratio indicated.

- 6/6 East Side
- 4/4 Swan Island Lagoon

LWG Data (1996-2001)

- East Side
- Swan Island Lagoon
- East ND
- Lagoon ND

Figure 4-16

Estimated Total DDT Concentration in Sediments vs. River Mile - East Side (Including Swan Island Lagoon)

Remedial Investigation Work Plan
City of Portland

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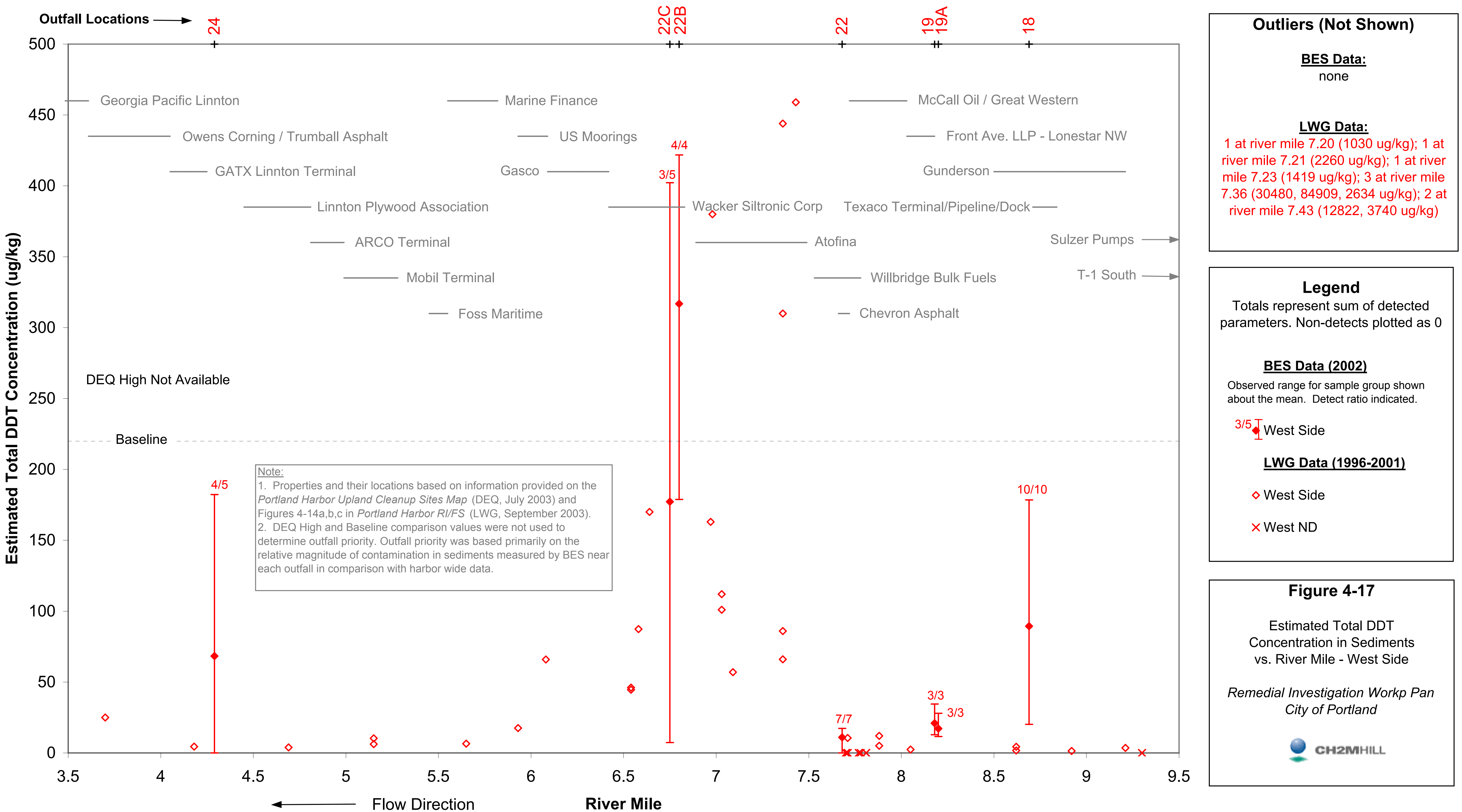
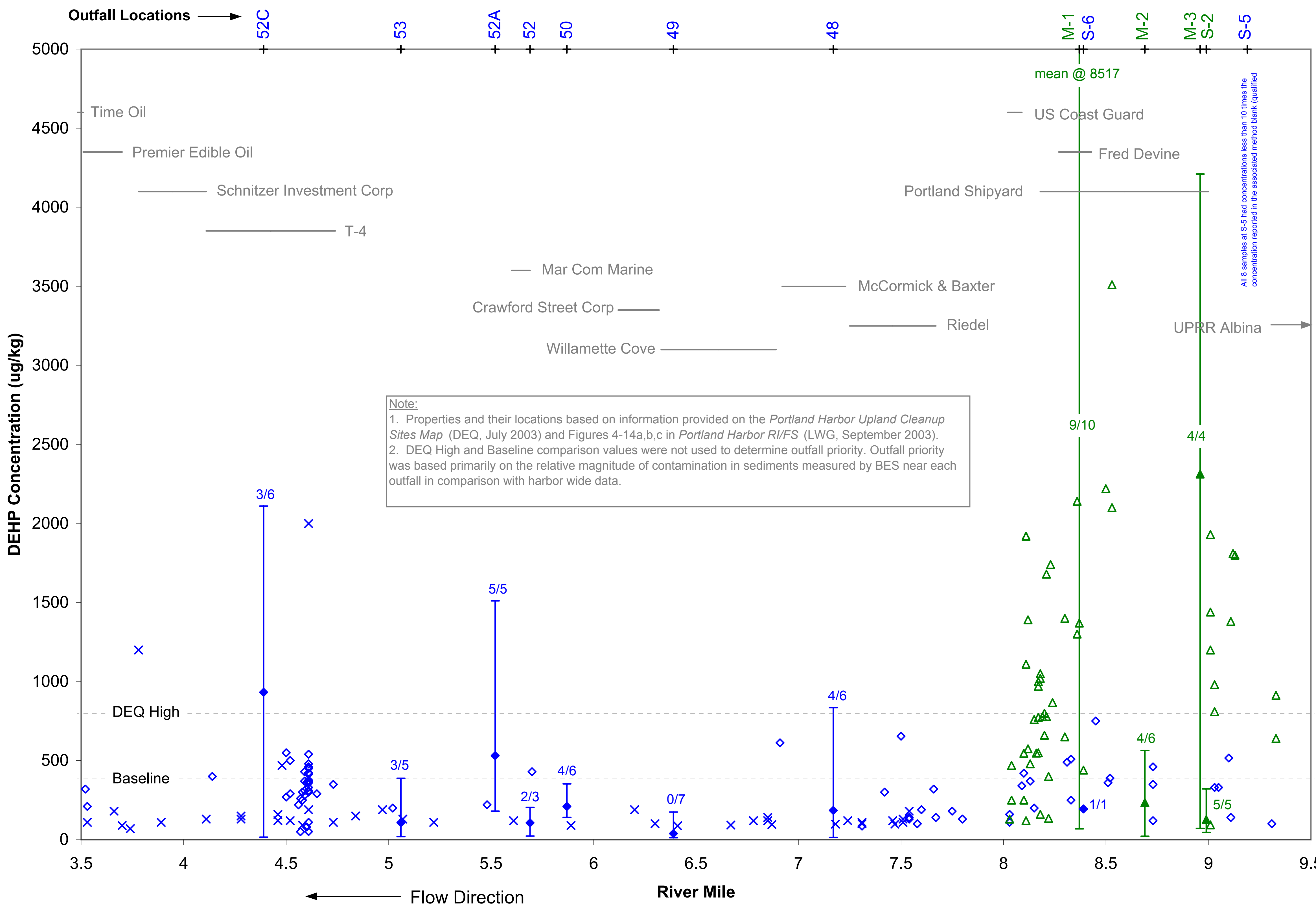


Outfall Locations
24
22C
22B
22
19
19A
18
Georgia Pacific Linnton
Owens Corning / Trumball Asphalt
GATX Linnton Terminal
Linnton Plywood Association
ARCO Terminal
Mobil Terminal
Foss Maritime
Marine Finance
US Moorings
Gasco
Wacker Siltronic Corp
Atofina
Willbridge Bulk Fuels
Chevron Asphalt
McCall Oil / Great Western
Front Ave. LLP - Lonestar NW
Gunderson
Texaco Terminal/Pipeline/Dock
Sulzer Pumps
T-1 South
DEQ High Not Available
Baseline
4/5
3/5
4/4
7/7
3/3
3/3
10/10
Note:
1. Properties and their locations based on information provided on the Portland Harbor Upland Cleanup Sites Map (DEQ, July 2003) and Figures 4-14a,b,c in Portland Harbor RI/FS (LWG, September 2003).
2. DEQ High and Baseline comparison values were not used to determine outfall priority. Outfall priority was based primarily on the relative magnitude of contamination in sediments measured by BES near each outfall in comparison with harbor wide data.
Estimated Total DDT Concentration (ug/kg)
0
50
100
150
200
250
300
350
400
450
500
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
Flow Direction
River Mile
Outliers (Not Shown)
BES Data:
none
LWG Data:
1 at river mile 7.20 (1030 ug/kg); 1 at river mile 7.21 (2260 ug/kg); 1 at river mile 7.23 (1419 ug/kg); 3 at river mile 7.36 (30480, 84909, 2634 ug/kg); 2 at river mile 7.43 (12822, 3740 ug/kg)
Legend
Totals represent sum of detected parameters. Non-detects plotted as 0
BES Data (2002)
Observed range for sample group shown about the mean. Detect ratio indicated.
3/5
West Side
LWG Data (1996-2001)
West Side
West ND
Figure 4-17
Estimated Total DDT Concentration in Sediments vs. River Mile - West Side
Remedial Investigation Workp Pan
City of Portland
CH2MHILL



Outliers (Not Shown)

BES Data:
3 at outfall M-1 (7130, 32500, 39200 ug/kg); 1 at private outfall WP-16 adjacent to M-3 (33200 ug/kg)

LWG Data:
3 at river mile 4.61 (10000U, 10000U, 20000U ug/kg); 1 at river mile 6.14 (10000 ug/kg), 1 at river mile 6.14 (5150 ug/kg); 1 at river mile 7.60 (7330 ug/kg); 4 at river mile 8.53 (11400, 11600, 6760, 7590 ug/kg); 1 at river mile 9.33 (33300 ug/kg)

Legend

BES Data (2002)
Observed range for sample group shown about the mean. Detect ratio indicated.

4/6 East Side
4/4 Swan Island Lagoon

LWG Data (1996-2001)

East Side
Swan Island Lagoon
East ND (det. limit)

Figure 4-18

DEHP Concentration in Sediments vs. River Mile - East Side (Including Swan Island Lagoon)

Remedial Investigation Work Plan
City of Portland

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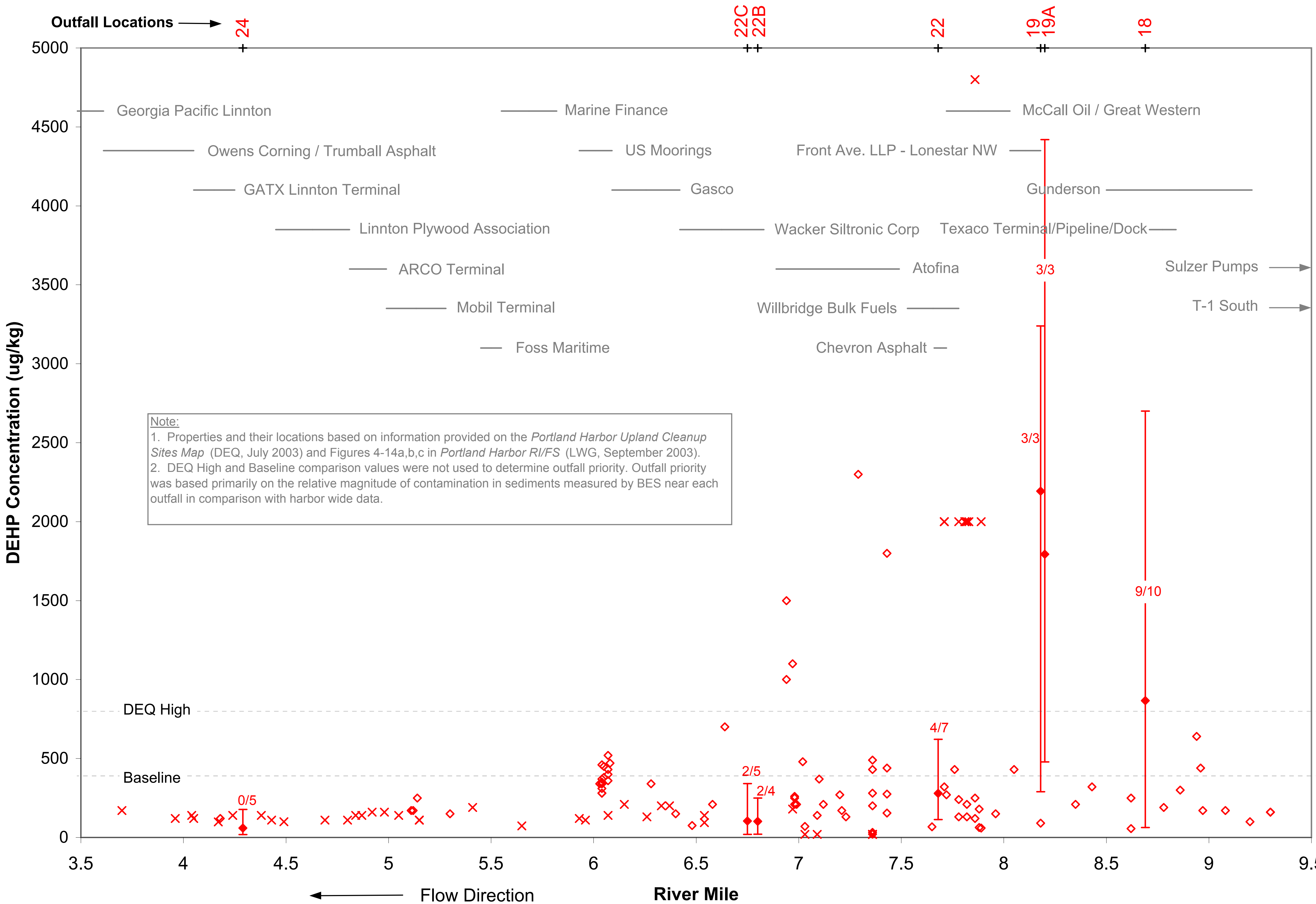

Outliers (Not Shown)

BES Data:
none

LWG Data:
none

Legend

BES Data (2002)

Observed range for sample group shown about the mean. Detect ratio indicated.

5/7 West Side

LWG Data (1996-2001)

West Side

West ND (det. limit)

Figure 4-19

DEHP Concentration in Sediments vs. River Mile - West Side

Remedial Investigation Work Plan
City of Portland

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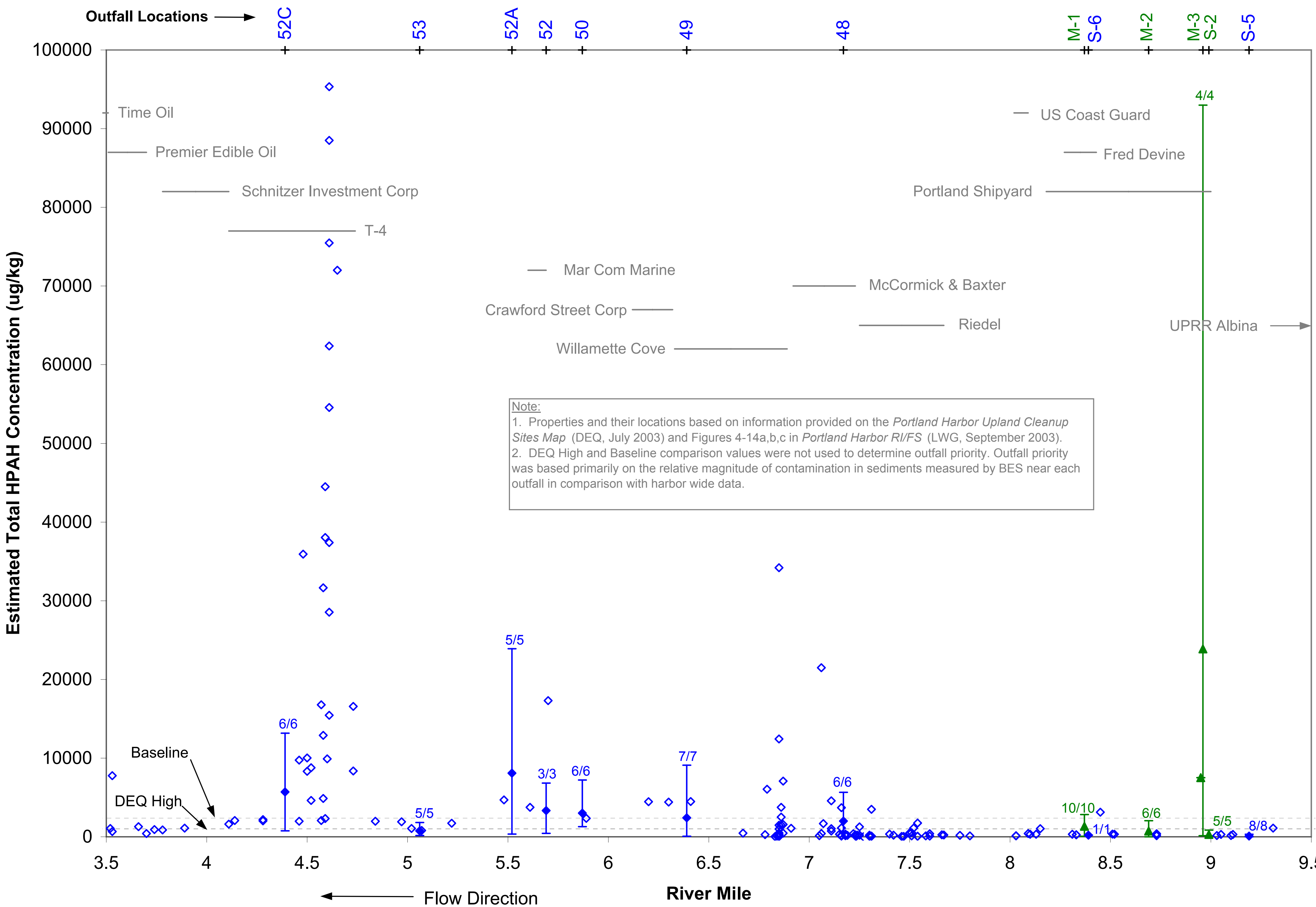


Outliers (Not Shown)

BES Data:
none
LWG Data:
1 at river mile 4.52 (120500 ug/kg); 1 at river mile 4.56 (168900 ug/kg); 1 at river mile 4.59 (158100 ug/kg); 1 at river mile 4.60 (471000 ug/kg); 12 at river mile 4.61 (333200, 427700, 111800, 121500, 122700, 690000, 134300, 291000, 106900, 677000, 754000, 765000 ug/kg); 1 at river mile 6.14 (452000 ug/kg); 1 at river mile 7.05 (102460 ug/kg)

Legend

Totals represent sum of detected parameters. Non-detects plotted as 0

BES Data (2002)

Observed range for sample group shown about the mean. Detect ratio indicated.

6/6 East Side

4/4 Swan Island Lagoon

LWG Data (1996-2001)

East Side

Swan Island Lagoon

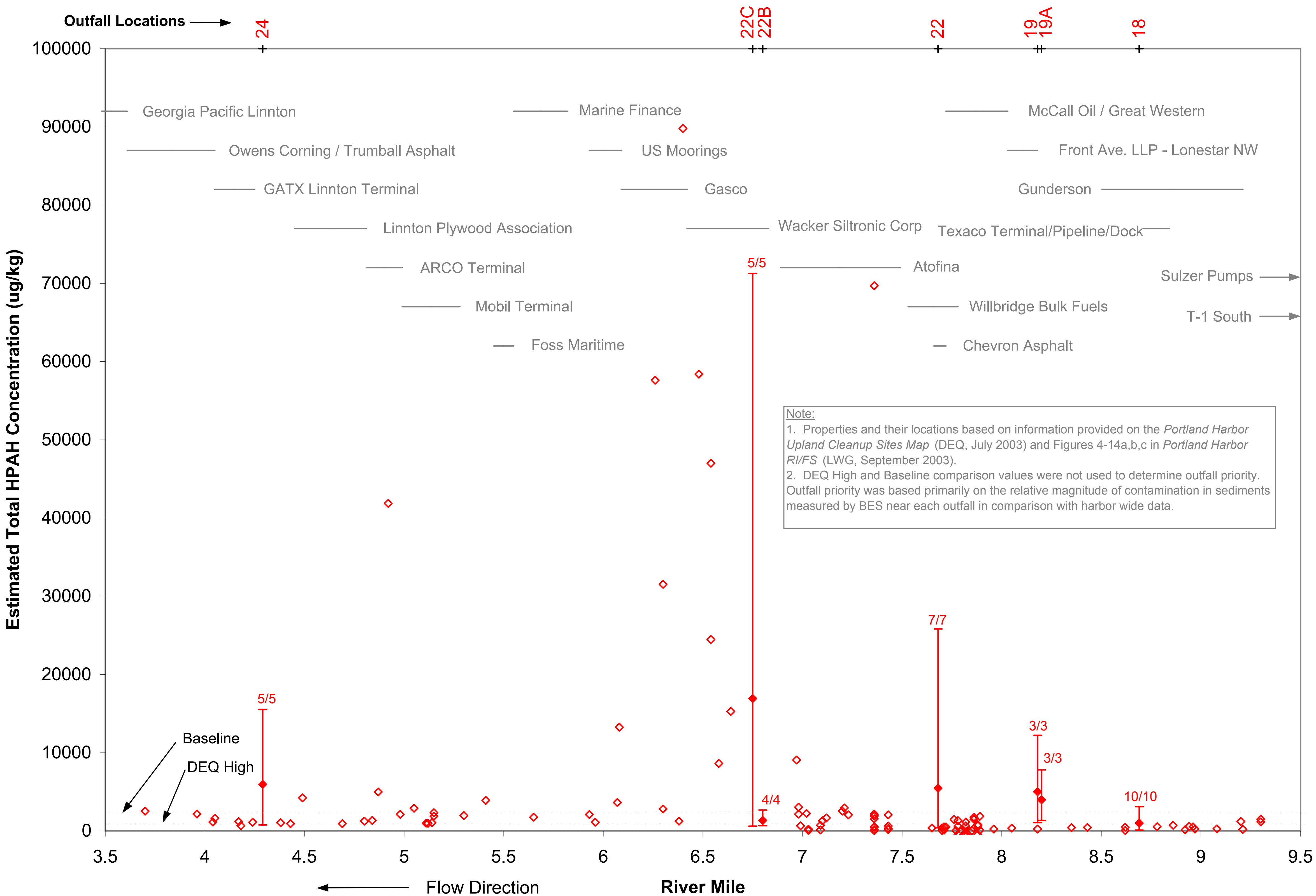
East ND

Figure 4-20

Estimated Total HPAH Concentration in Sediments vs. River Mile - East Side (Including Swan Island Lagoon)

Remedial Investigation Work Plan
City of Portland

CH2MHILL



Outliers (Not Shown)

BES Data:
none

LWG Data:
1 at river mile 6.16 (524200 ug/kg); 1 at river mile 6.28 (420200 ug/kg); 3 at river mile 6.30 (341400, 549500, 356500 ug/kg); 1 at river mile 6.33 (268800 ug/kg); 1 at river mile 6.37 (192000 ug/kg); 3 at river mile 6.38 (1057400, 396200, 180500 ug/kg)

Legend

Totals represent sum of detected parameters. Non-detects plotted as 0

BES Data (2002)

Observed range for sample group shown about the mean. Detect ratio indicated.

4/4 West Side

LWG Data (1996-2001)

West Side

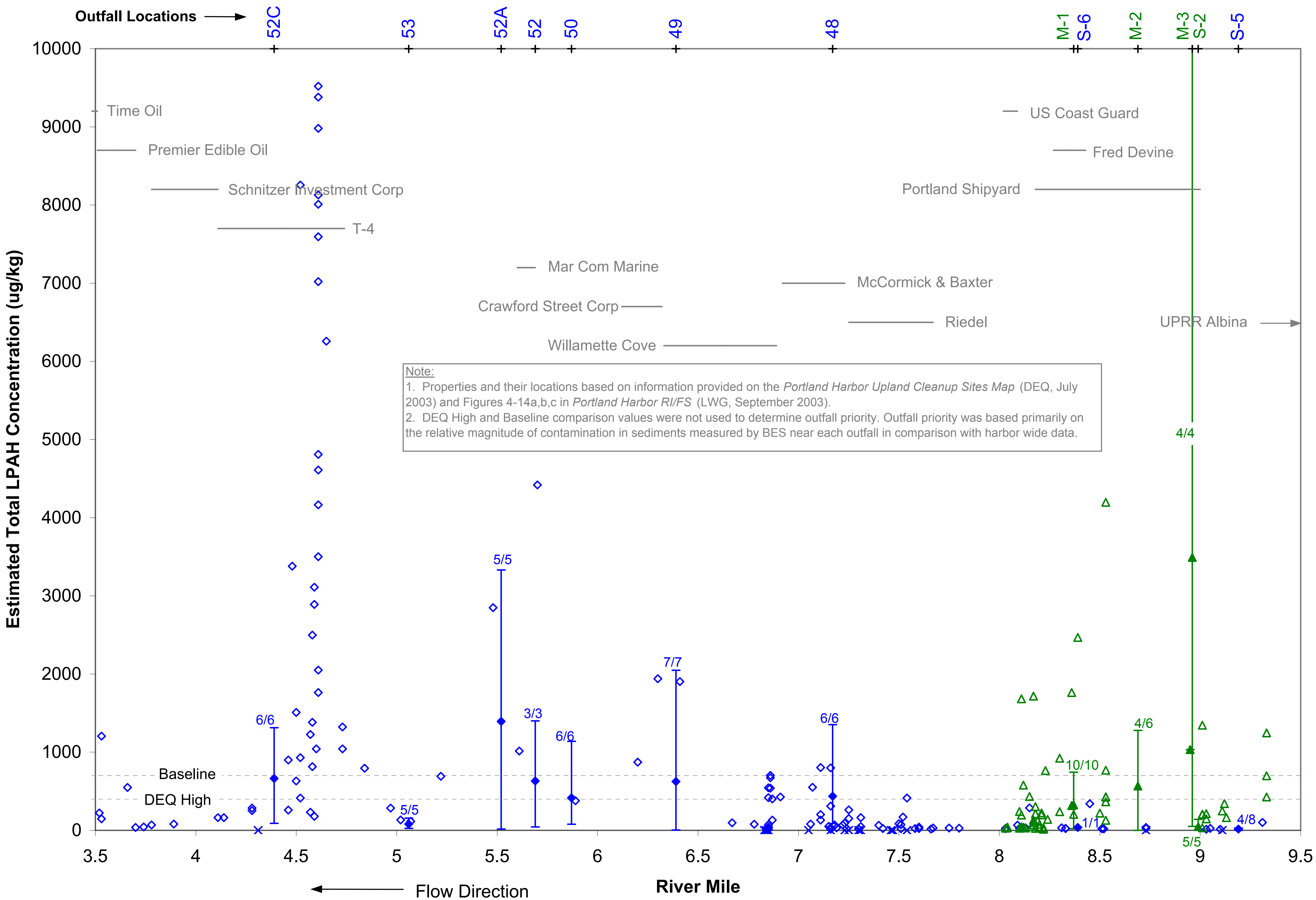
West ND

Figure 4-21

Estimated Total HPAH Concentration in Sediments vs. River Mile - West Side

Remedial Investigation Work Plan
City of Portland

CH2MHILL



Outliers (Not Shown)

BES Data :

1 at outfall M-3 (13356 ug/kg)

LWG Data:

1 at river mile 4.56 (12210 ug/kg); 1 at river mile 4.58 (12630 ug/kg); 1 at river mile 4.60 (41971 ug/kg); 7 at river mile 4.61 (31640, 29010, 10270, 16000, 57190, 114000, 49000 ug/kg); 1 at river mile 6.14 (155000 ug/kg); 1 at river mile 6.79 (10513 ug/kg); 2 at river mile 6.85 (20186, 130400 ug/kg); 1 at river mile 6.87 (18934 ug/kg); 1 at river mile 7.05 (282830 ug/kg); 1 at river mile 7.06 (14040 ug/kg)

Legend

Totals represent sum of detected parameters. Non-detects plotted as 0

BES Data (2002)

Observed range for sample group shown about the mean. Detect ratio indicated.

6/6 East Side

4/6 Swan Island Lagoon

LWG Data (1996-2001)

East Side

Swan Island Lagoon

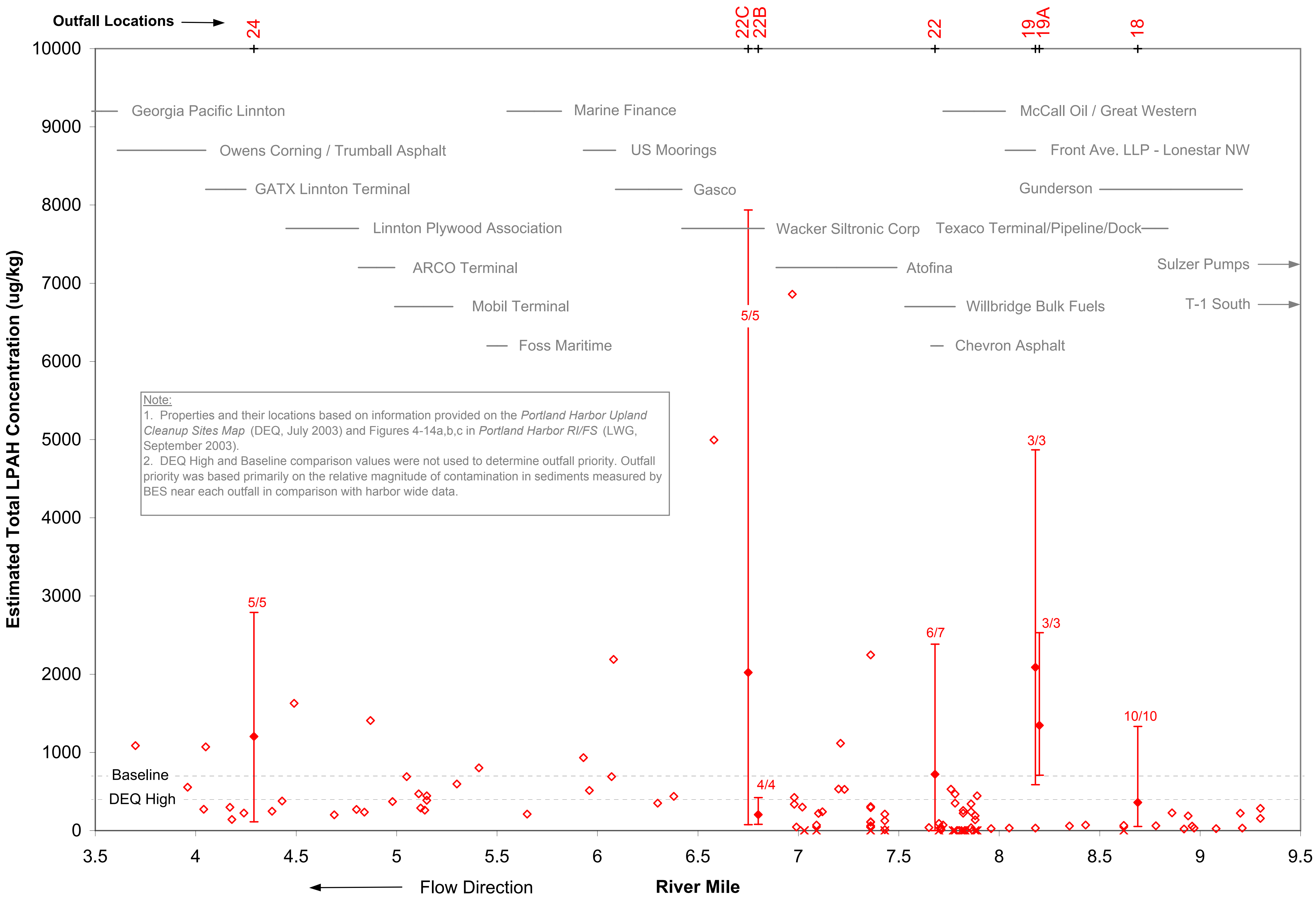
East ND

Figure 4-22

Estimated Total LPAH Concentration in Sediments vs. River Mile
East Side
(Including Swan Island Lagoon)

Remedial Investigation Work Plan
City of Portland

CH2MHILL



Outliers (Not Shown)

BES Data:
none
LWG Data:
1 at river mile 4.92 (26950 ug/kg); 1 at river mile 6.15 (211460 ug/kg); 1 at river mile 6.26 (26970 ug/kg); 1 at river mile 6.28 (402400 ug/kg); 4 at river mile 6.30 (169400, 654400, 429500, 29320 ug/kg); 1 at river mile 6.33 (165600 ug/kg), 1 at river mile 6.37 (112400 ug/kg); 3 at river mile 6.38 (771800, 223800, 52080 ug/kg); 1 at river mile 6.40 (60430 ug/kg); 1 at river mile 6.48 (65680 ug/kg); 2 at river mile 6.54 (70574, 31819 ug/kg); 1 at river mile 6.64 (13490 ug/kg)

Legend

Totals represent sum of detected parameters. Non-detects plotted as 0

BES Data (2002)

Observed range for sample group shown about the mean. Detect ratio indicated.

4/4 West Side

LWG Data (1996-2001)

West Side

West ND

Figure 4-23

Estimated Total LPAH Concentration in Sediments vs. River Mile
West Side

Remedial Investigation Work Plan
City of Portland

CH2MHILL

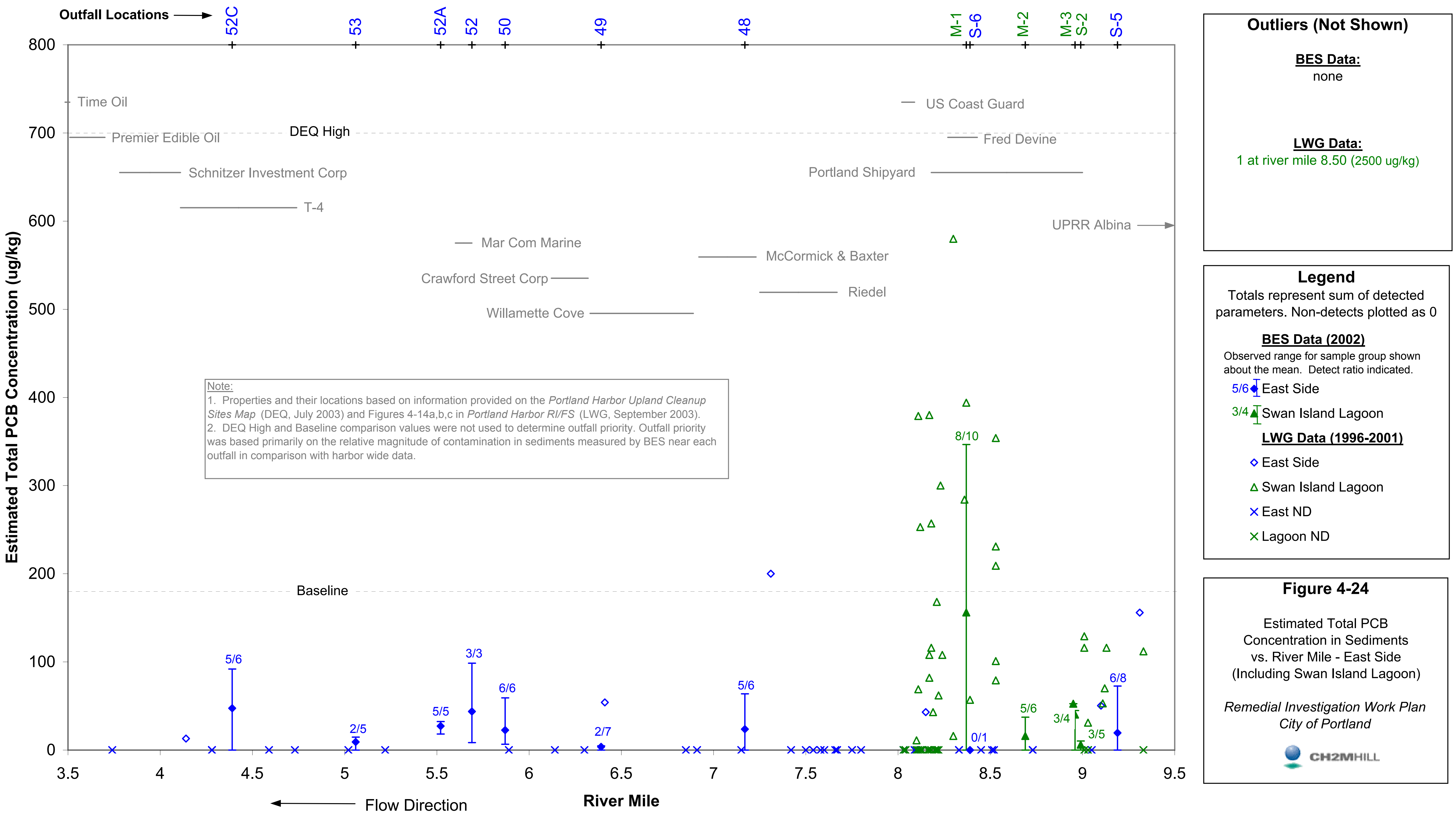


Figure 4-24

Estimated Total PCB Concentration in Sediments vs. River Mile - East Side (Including Swan Island Lagoon)

Remedial Investigation Work Plan
City of Portland

CH2MHILL

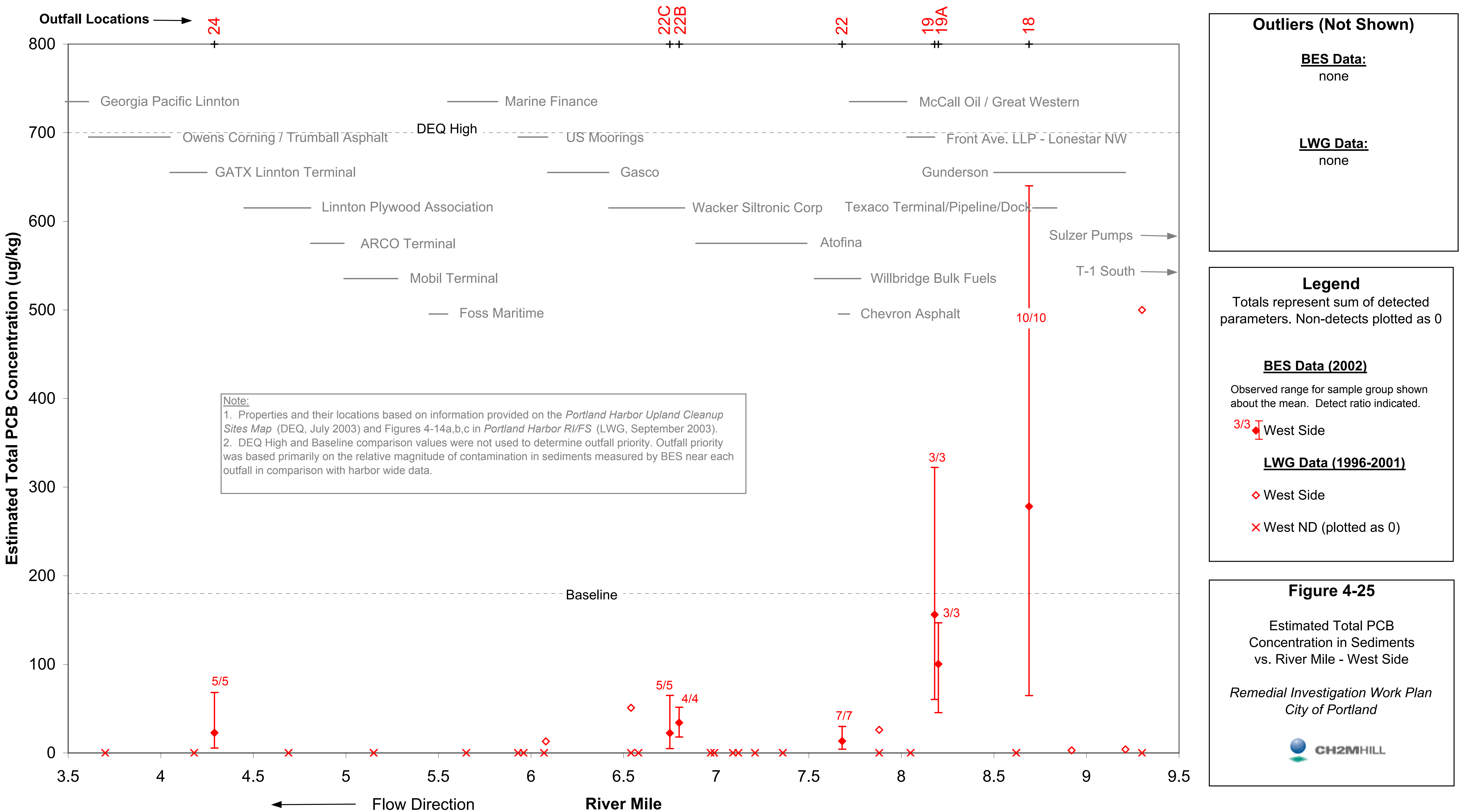


Figure 4-25

Estimated Total PCB Concentration in Sediments vs. River Mile - West Side

Remedial Investigation Work Plan
City of Portland

CH2MHILL

SECTION 5

Site Characterization Plan for Outfall Basins

The purpose of this Site Characterization Plan (SCP) is to describe the approach for identification of potential contaminant sources that may be entering the City stormwater conveyance systems and adversely affecting Willamette River sediments. The requirements of the SCP are listed in Section V(D) of the IGA.

This SCP does not present a basin-specific approach for each outfall. Basin-specific work plans will be prepared for each outfall as they are investigated in accordance with the order determined in the prioritization process described in Section 4. The specific tasks outlined in this SCP are based on current understanding of the roles and responsibilities of the City, DEQ, and EPA in carrying out the RI. As this program develops and we learn more, adjustments will be documented in individual reports.

5.1 Overview of Multistep Approach

The characterization will be performed using a multistep approach that first identifies the PCOIs for source investigation and then identifies potential upland sources of those contaminants (Steps 1 through 3). The PCOIs are the contaminants that will be used to perform preliminary evaluations of the City outfall basins. This list of contaminants is expected to change as additional information (i.e., the results of the in-water RI/FS) becomes available. The SCP also describes potential investigation tools that the City, DEQ, and EPA may use to investigate potential upland sources and to identify and evaluate appropriate source control measures (Steps 4 and 5).

The approach presented in this SCP is based partially on findings from the interagency Pilot Project, initiated by BES and DEQ in July 2002. Activities were conducted at Outfalls M-1 and 18 as outlined in the *Source Control Pilot Project for the City of Portland Outfalls Work Plan* (CH2M HILL, 2002). Information regarding site characterization continues to be gathered as part of the Pilot Project. The approach and methods for site characterization are expected to continue to evolve as new information is acquired. The Pilot Project will continue until remedial investigations for sources discharging contaminants to the City system served by Outfalls M-1 and 18 are complete and results are reported in a Pilot Project RI report.

In addition, this approach is in accordance with the "weight-of-evidence" approach presented in the *Portland Harbor Joint Source Control Strategy* for determining whether upland sites need additional source control. The site characterization process presented in this section is subject to changes in the approach included in the *Portland Harbor Joint Source Control Strategy* and other sources of new information (such as opportunities for early action or availability of in-water risk data).

5.2 Site Characterization Approach for City Stormwater Outfalls

This section describes the process for identifying PCOIs and potential upland sources for City outfall drainage basins located in the ISA. Methods to investigate those potential sources and then evaluate and initiate SCMs are also described, as are the roles and responsibilities of DEQ, EPA, and the City in implementing this plan. Although the roles and responsibilities of each entity depend on their respective authorities and agreements, these roles will be refined throughout the RI implementation.

The site characterization approach for City stormwater outfall basins can be divided into the following five main steps:

1. Identify PCOIs for each City outfall.
2. Identify and evaluate potential migration pathways.
3. Identify potential upland sources of the PCOIs.
4. Investigate the identified potential sources.
5. Identify and evaluate source control options and actions.

These steps are summarized in Figure 5-1 (located at the end of this section). The approach shown in Figure 5-1 describes the process to follow during characterization of each outfall. As the five steps are completed for each outfall, situations may arise where a decision box can be marked yes or no depending on the constituent that is being evaluated. For example, samples near some outfalls may have sediment contamination that is attributable to upriver sources for some constituents and not for others. In this case, the constituents that were associated with upriver sources would be referred to DEQ and/or EPA and the other constituents would be further evaluated in the site characterization process.

Each outfall basin will have specific conditions (such as land use, size, and facilities) that will influence the process for evaluating sources discharging to each outfall. As a result, basin-specific work plans will be prepared as each outfall is investigated under the prioritization scheme described in Section 4. The individual RI work plans for basins draining to each outfall or groups of outfalls will determine sampling analytes and locations for sampling. Appendixes C, D, and E present the overall SOPs, RI QAPP, and the safety procedures that will be referenced as individual work plans are prepared for each basin. These appendixes describe the array of potential sampling procedures, analytes, and the quality assurance and quality control procedures for solids sampling. The need to collect additional sample types might be identified in the future; specific SOPs will be developed at that time to address that work.

The characterization process is described in more detail below.

5.2.1 Step 1: Identify Potential Contaminants of Interest

The first step in the site characterization process is to identify PCOIs for the outfall basin. This includes evaluating the in-river surface sediment data that are available within the ISA. In-river samples were collected by BES in August 2002 and October 2002. Results of these investigations are included in the *Phase 1 Data Evaluation Report and Phase 2 Work Planning for City of Portland Outfall M-1*, *Phase 1 Data Evaluation Report and Phase 2 Work Planning for*

City of Portland Outfall 18, and *Source Control Sediment Investigation for the City of Portland Outfalls Data Report* (located in Appendix B of this work plan). In order to identify PCOIs, the following factors will be considered:

- Exceedance of the DEQ High and Baseline comparison values and/or other pertinent screening levels
- The factor of exceedance
- The spatial distribution of sediment near the outfall

PCOIs may be added or deleted after the EPA in-river risk assessment determines risk-based levels.

Once the PCOI list is established, nearby and/or up-river potential sources must be evaluated to determine if the sediment concentrations detected near the City outfall are attributable to those sources (residing outside the stormwater drainage basin boundary). If concentrations are attributable to up-river or nearby sites, those sites are referred to either DEQ (upland sites) or EPA (in-river). If the concentrations are not attributable to up-river or nearby sources, the site characterization proceeds to Step 2.

5.2.2 Step 2: Identify and Evaluate Potential Migration Pathways

After the PCOIs associated with each outfall basin are identified, the next step will be to identify potential migration pathways. An evaluation will be conducted in each outfall basin to determine whether there is potential for upland sources to discharge contaminated stormwater or groundwater into the City stormwater system.

The stormwater migration pathway will be evaluated by preparing/updating and reviewing a stormwater basin boundary map, facility list, and other items as necessary. Factors that will be considered for the stormwater pathway include the presence of the following:

- Connection to the City stormwater conveyance system
- Permitted discharges
- Illicit discharges

The potential for contaminated groundwater to discharge into the City stormwater conveyance system or to migrate preferentially in the system backfill will be determined using the decision matrix shown in Figure 5-2 (located at the end of this section).

5.2.3 Step 3: Identify Potential Upland Sources of the PCOIs

The next step will be to identify potential upland sources of the PCOIs. This will include evaluating information collected from Steps 1 and 2, as well as reviewing multiple databases and resources to determine whether there are known or potential (current or historical) releases to the stormwater conveyance system. Known or potential releases to the stormwater conveyance system will be identified as potential sources.

A preliminary basin assessment approach was developed in 1999 as part of the development of the Preliminary Basin Evaluation notebooks. This basin assessment approach was further refined during the Pilot Project. The tasks listed below are those tasks that were found to be the most useful during the Pilot Project. The specific tasks to be performed will be based on the basin size, primary land use type, and other identified factors. In some basins, sufficient information will be obtained after using only a few tools; in other cases, all (or nearly all) tasks will be required.

- Review the basin facility list for the outfall. Specific facility types (that is, waste processor, transportation, metal fabrication, chemical distributor, manufacturing, oil distributor, metal plater, truck washing, equipment repair, etc.) will be flagged if site activities can be associated with the identified PCOIs. In addition, facilities will be flagged if stormwater is exposed to industrial activities and can enter the conveyance system.
- Create a basin map showing upland facilities located within the outfall basin.
- Update information from the DEQ ECSI list (located in *Preliminary Evaluation of City Outfalls* Notebooks [CH2M HILL, 2000]).
- Review DEQ ECSI summaries for relevant soil, stormwater, and groundwater sampling data, historical releases, site chemicals of interest, and activities. Contact DEQ Project Managers as appropriate and conduct interviews.
- Check availability of facility-specific Stormwater Pollution Control Plans (SWPCPs) from the City and review plans to determine whether the upland facility conducts or has conducted activities that may be linked to PCOIs.
- Review NPDES permit (for example, 1200Z, 1300J) stormwater sampling results for exceedances of permit benchmarks or limits from industries discharging to the stormwater system. Contact City Permit Managers as appropriate and conduct interviews.
- Review data from the Illicit Discharge Elimination Program (IDEP) for indications of potential illicit connections or groundwater intrusion to the stormwater conveyance system.
- Review the City Spill Protection and Citizen Response records (pollution complaints), the State Fire Marshall Hazardous Material Incidents database, and DEQ's spill database for incidents within basins. Note pollution complaints and/or spills if they involve facilities within the drainage basins. Also note the frequency, type, and magnitude of the pollution complaints and/or spills.

If more screening information is needed, the following additional tools can be used:

- EPA Toxic Release Inventory List
- Hazardous Waste Generator list
- EPA's Resource Conservation and Recovery Act (RCRA) Treatment Storage and Disposal facilities list
- Confirmed Release list
- DEQ Environmental Cleanup Site Information (ECSI) files
- City Stormwater Inspection reports

- Collection of inline solids samples and/or other samples

After each basin assessment is completed, the information will be evaluated to determine whether any of the upland facilities located within the basin are potential sources. If no potential sources are identified, the assessment will be set aside until the results from the in-water remedial investigation are available. Once the in-water results are available, changes to existing state and local stormwater programs will be evaluated as necessary. If potential upland sources are identified, the site characterization will be carried forward to Step 4.

5.2.4 Step 4: Investigate Potential Migration Pathways and Potential Sources

On the basis of the basin assessment tasks discussed above, potential upland sources will be identified. These potential sources will be investigated under the authority of the City, DEQ, and EPA. Potential actions that may be conducted include the following:

- DEQ: Issue information requests under the authority of the Site Discovery/Site Assessment Program.
- City: Conduct stormwater site inspections under the authority of the City Industrial Stormwater Program to determine compliance with existing discharge requirements and BMPs.
- DEQ and City: Evaluate the need for an NPDES permit or other discharge limitations at facilities that are not currently permitted but have evidence of potential contribution to stormwater or sediment contamination. Permits are to be issued by DEQ. The City will assist DEQ on permit requirements and BMPs, as needed.
- DEQ and City: Conduct additional reviews of historical data, including land use and owner searches, interviews with DEQ project managers, and/or review of City Industrial Stormwater Program records and DEQ Water Quality files.
- DEQ: Evaluate federal facilities for the need to refer site discovery to EPA.
- DEQ: Continue upland facility investigation under the Voluntary Cleanup Program (VCP). The City will provide input on additional data to be collected under the VCP to address facility stormwater discharges into the public conveyance system.
- DEQ: Update the ECSI database and file with new information.
- City and DEQ: Perform additional sampling as needed.
- EPA: Evaluate stormwater pathway at sites under EPA cleanup authority.

The specific actions that will be used to investigate potential upland sources discharging to each outfall will be dependent on the individual characteristics of that drainage basin and may be a combination of the potential actions shown above and/or other actions that have not yet been developed.

During the Pilot Project, the two most common actions performed were Site Discovery/Site Assessments (SD/SA) and stormwater site inspections. Decision flow diagrams were prepared to further prioritize upland facilities that were subject to either or both of these actions. These diagrams are shown in Figures 5-3 and 5-4, respectively (located at the end of this section). The diagrams can be used to determine priorities for conducting DEQ SD/SA and City stormwater site inspections. Figure 5-3 prioritizes sites into Group 1 or Group 2 for DEQ site discovery. Figure 5-4 prioritizes sites into Group 1, Group 2, or Group 3 for City stormwater site inspections. For both actions, the Group 1 sites will have actions performed before the other groups. This division was done in order to best utilize existing resources.

5.2.5 Step 5: Identify and Evaluate Appropriate Source Control Action

After the potential sources and migration pathways have been evaluated, the next step is to determine whether source control is needed. If an upland site requires source control, DEQ may pursue site cleanup/source control with the potentially responsible party (PRP). The City will aid in the identification of source control options as necessary. If a current source cannot be identified, the City and DEQ will evaluate programmatic issues for source control.

DEQ will determine the appropriate source control action on the basis of information obtained from the Portland Harbor RI/FS results and information provided by the City. Source control actions will follow the *Portland Harbor Joint Source Control Strategy* with the City's input, as appropriate.

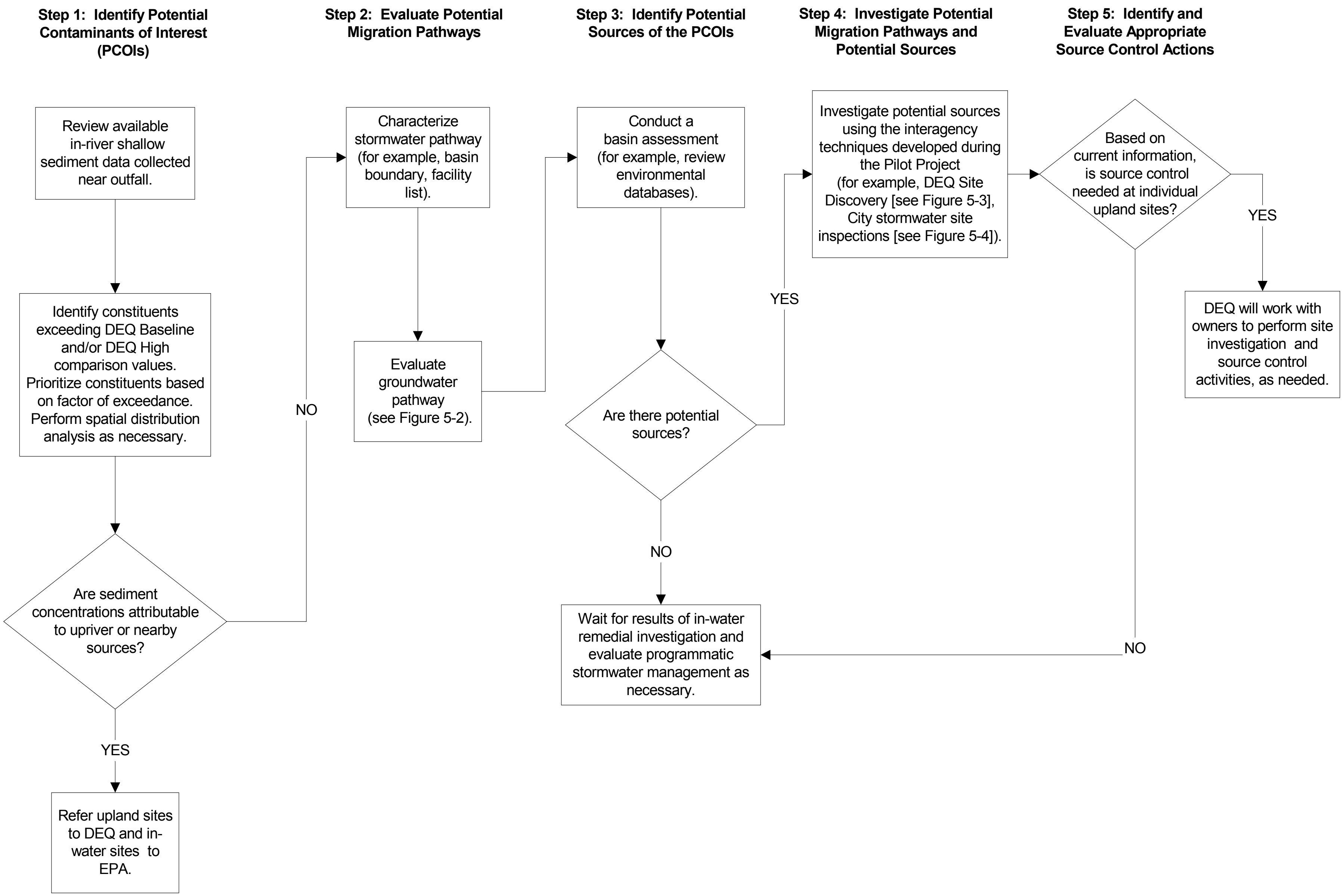


Figure 5-1
Approach for Conducting Site Characterization and Identifying Appropriate Source Control
Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project

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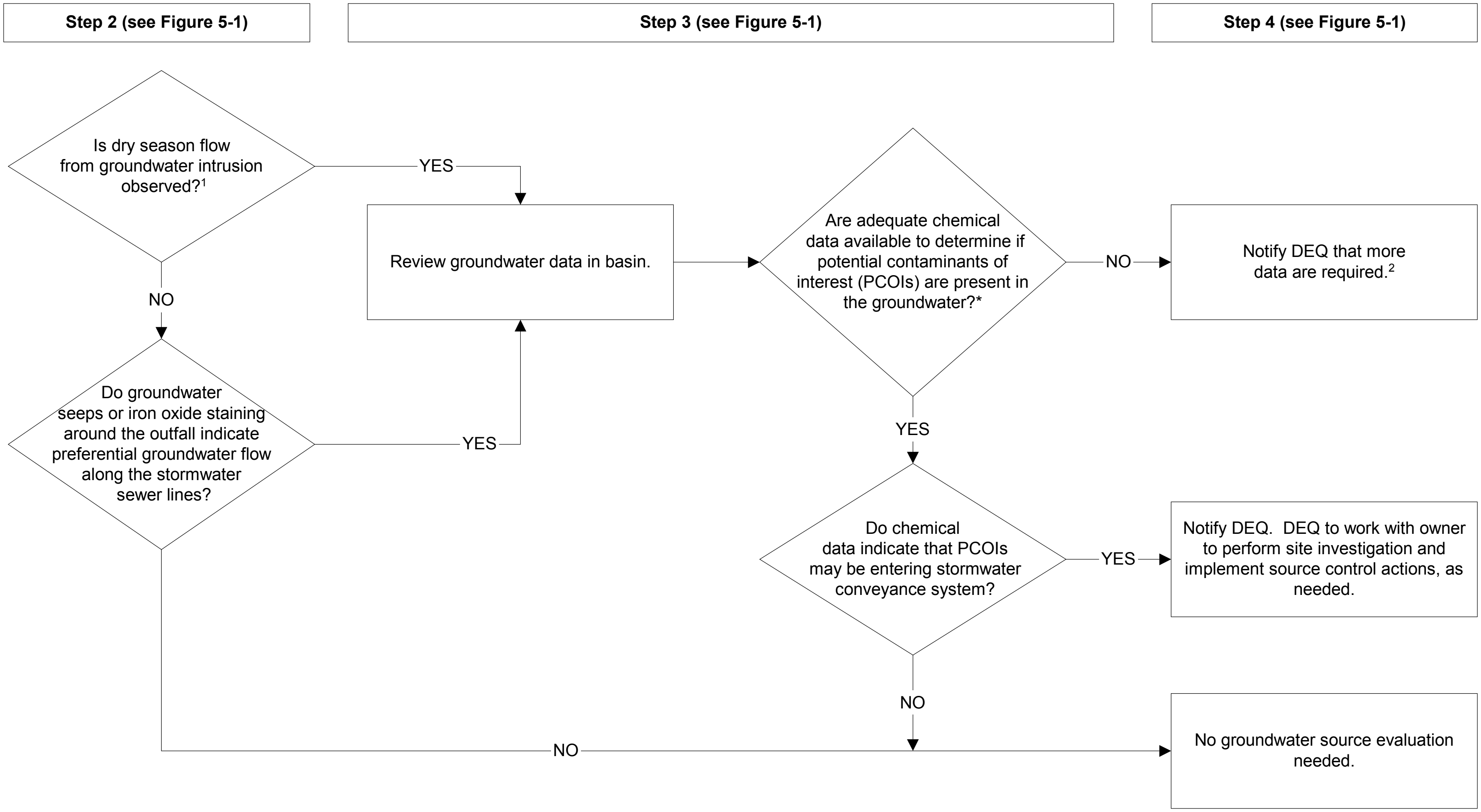

Decision criteria

1 Determined by evaluation of permitted flow and illicit discharge flow within basins where dry season flow is observed.

2 Evaluate additional data needs and under which regulatory program additional data will be collected.

***Sources to consider**

- DEQ ECSI database
- Site-specific data reports (if appropriate)
- City IDEP database

Figure 5-2
Evaluation of Groundwater Flow Pathway via the City Stormwater Conveyance System
Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project

PDX/033170006.VSD

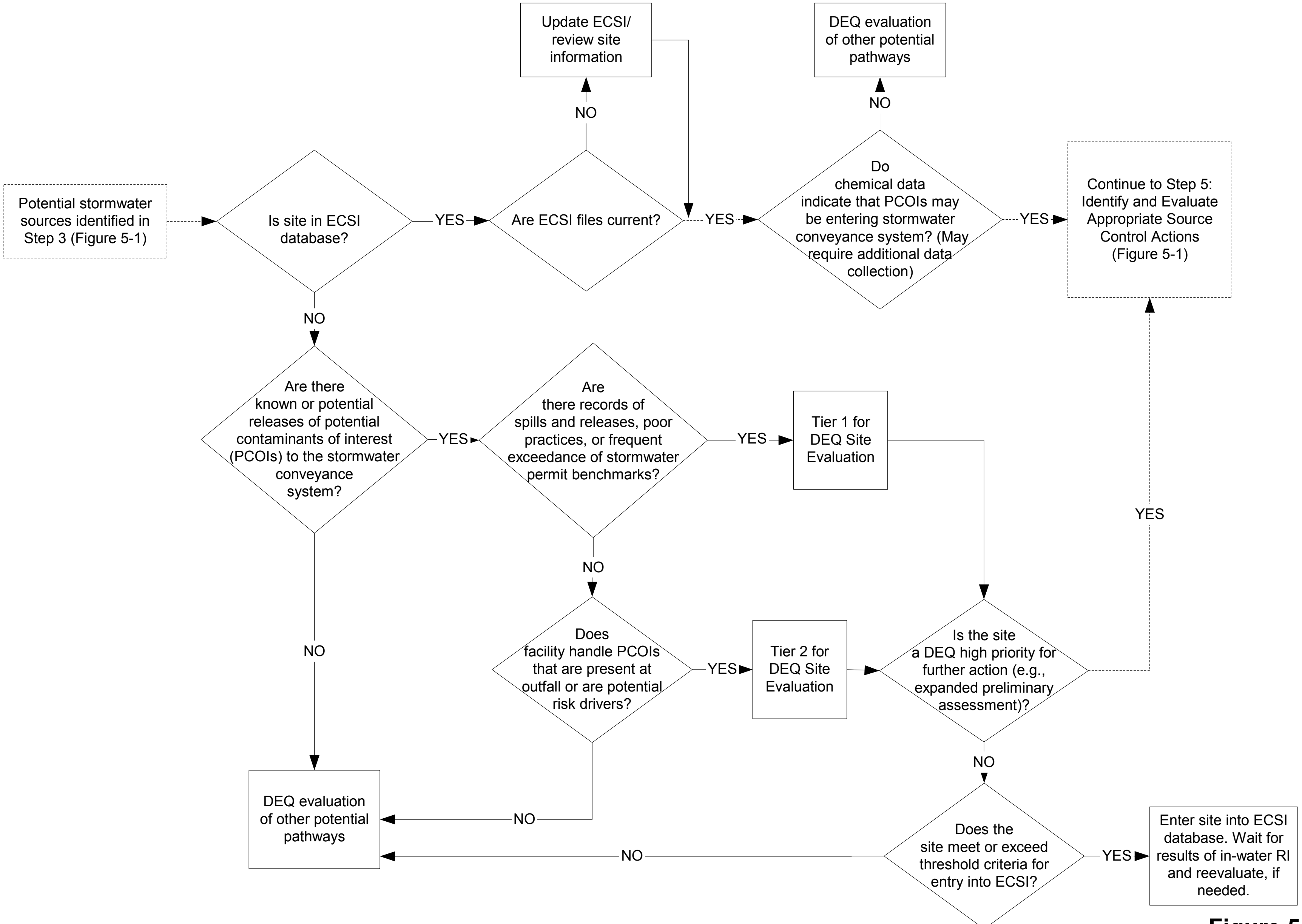

Figure 5-3

Interagency Approach to DEQ Site Discovery/Site Assessment and DEQ ECSI Updates for Upland Sites Located within City Stormwater Basins

Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project

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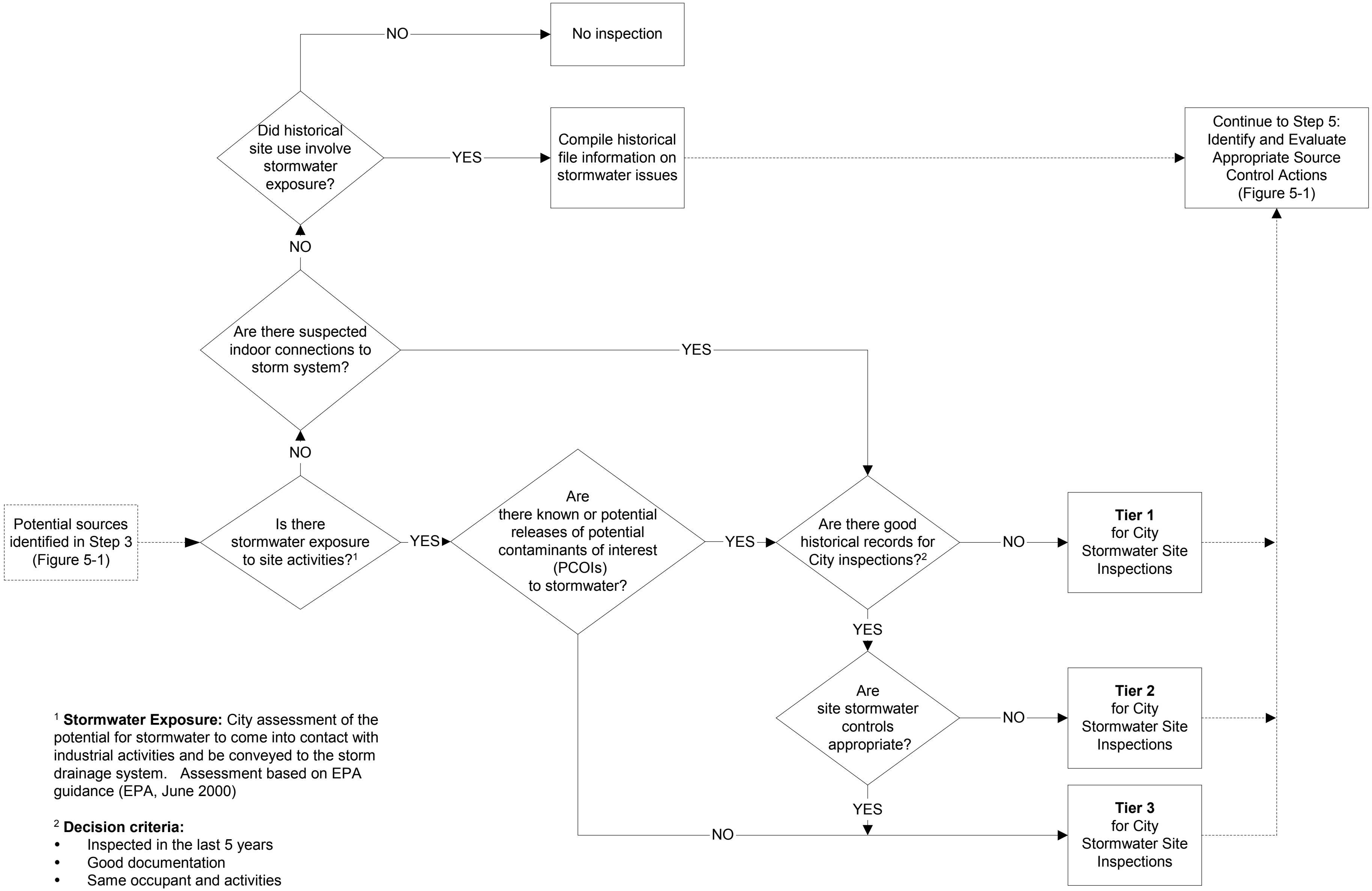

[1] **Stormwater Exposure:** City assessment of the potential for stormwater to come into contact with industrial activities and be conveyed to the storm drainage system. Assessment based on EPA guidance (EPA, June 2000)

[2] **Decision criteria:**
- Inspected in the last 5 years
- Good documentation
- Same occupant and activities
- Is activity type more likely to contribute pollutants?

Figure 5-4
City Stormwater (SW) Site Inspection Process to Support DEQ Site Discovery
Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project

PDX/033090006.VSD

SECTION 6

Sampling and Analysis Plan

Individual RI SAPs for specific basins draining to an outfall or groups of outfalls will be prepared as required to determine sampling analytes and locations for sampling. The programmatic RI SAP is provided in Appendix C and focuses on solids sampling. Standard operating procedures (SOPs) for the array of potential sampling procedures are included in this appendix. These SOPs do not address all potential types of sampling that may be required for individual basin RIs. Therefore, where the need for additional sampling methods/media is identified for basin-specific RIs, the programmatic SAP will be amended or separate SAPs will be developed to address these needs.

The Quality Assurance Project Plan template is presented in Appendix D. The QAPP template lists potential analytes and describes the analytical methods and quality assurance procedures that may be required for future basin-specific RIs. As the project progresses, analytical programs will be developed for individual basins using the QAPP template (i.e., methods/analytes will be added to or deleted from the template as appropriate) in conjunction with the basin-specific SAP development. This approach to QAPP development was selected because of the difficulty in developing a global QAPP that addresses all the stormwater basins, and the fact that such a global document would not be a useful tool to field sampling and laboratory staff.

City safety procedures for source control and the CH2M HILL health and safety plan are provided in Appendix E. Safety procedures potentially applicable to this investigation for both the City and CH2M HILL are described.

6.1 Data Quality Objectives

An important step in developing the overall project approach is identifying data needs and data quality required to successfully satisfy project objectives. Data quality objectives (DQOs) are the planning tools used to ensure that data of sufficient quantity and quality are collected and allow informed source control decisions. DQOs minimize expenditures related to data collection by eliminating unnecessary, duplicative, or overly precise data. The type, quality, and quantity of data necessary to assess the problem can be ascertained from DQOs before sampling and analysis begin. DQOs will be developed and incorporated into future basin-specific SAPs.

SECTION 7

References

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Oregon Department of Environmental Quality and U.S. Environmental Protection Agency (DEQ and EPA). 2003. *Portland Harbor Joint Source Control Strategy*. Review draft April 15, 2003 (currently under revision).

Striplin Environmental Associates. September 2003. *Portland Harbor RI/FS*.

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APPENDIX A

Regulatory Framework and City Source Control Activities

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Regulatory Framework and City Source Control Activities

Regulatory Framework

This section describes the U.S. Environmental Protection Agency (EPA), Oregon Department of Environmental Quality (DEQ), and City regulatory programs that are potentially applicable to this source control RI for the City outfalls within the ISA. The authorities and programs identified in this section provide the regulatory framework to determine which federal, state, and local programs need to be involved and consulted in implementing site discovery and source control activities. The City and DEQ will work to identify overlapping programs and understand how programs can be coordinated and sequenced for implementing and assessing the effectiveness of source control measures.

EPA Authorities and Programs

Comprehensive Response, Compensation, and Liability Act

The Comprehensive Response, Compensation, and Liability Act (CERCLA) (commonly known as Superfund) was enacted by Congress in 1980 and amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). It provides broad federal authority to respond to releases or threatened releases of hazardous substances from closed and abandoned sites that may endanger public health or the environment.

As discussed previously, the Portland Harbor site was designated a Superfund site in December 2000. In September 2001, EPA signed a negotiated Administrative Order on Consent (AOC) with nine potentially responsible parties (PRPs) to participate in the investigation and cleanup of the Portland Harbor Superfund site. This legal agreement designates DEQ as the lead agency for upland work along the banks of the river (where many of the historical contamination sources are located) and EPA as the lead agency for the in-water work on contaminated sediments. Under CERCLA, the City and DEQ will coordinate with EPA on all source control activities, including in-water and upland investigations conducted as part of the RI. Additionally, the remedial investigation (RI) and source control measures (SCMs) will be conducted in accordance with EPA remedial investigation/feasibility study (RI/FS) guidance, as applicable.

Toxic Substances Control Act/Polychlorinated Biphenyls

The Toxic Substances Control Act (TSCA), signed into law in 1976, provides EPA with broad authority to regulate chemicals and chemical substances whose manufacture, processing, distribution in commerce, use, or disposal may present an unreasonable risk of injury to human health and the environment.

Section 6 of TSCA applies to the RI and SCMs because it controls chemicals proven to present an unreasonable risk or injury to human health and the environment and whose risks outweigh their benefit to society and the economy. Examples include polychlorinated biphenyls (PCBs), asbestos, lead, chlorofluorocarbons (CFCs), and dioxin. TSCA prohibits the manufacture of PCBs, controls the phase-out of their existing uses, and is the federal authority for PCB remediation and disposal.

DEQ Authorities and Programs

DEQ and EPA recently released an initial draft *Portland Harbor Source Control Strategy* document (DEQ and EPA, April 2003) that identifies five proposed source control strategy objectives:

- Identify the universe of sources requiring control.
- Develop the regulatory and technical framework necessary for effective source control decisions and implementation.
- Facilitate the evaluation of sources of contamination.
- Define minimum data requirements for source control measures.
- Establish milestone and reporting requirements for source control activities.

According to the draft strategy document, the principal regulatory framework that DEQ will use in undertaking source control activities relies on existing cleanup authority and on the regulatory framework that currently exists for controlling stormwater and other discharges to Portland Harbor. This framework is described below.

Environmental Cleanup

DEQ performs upland site discovery, investigation, and cleanup under Oregon Revised Statute (ORS) 465 and Oregon Administrative Rule (OAR) Chapter 340 (Hazardous Substance Remedial Action Rules). These authorities apply to contaminated soil, groundwater, surface water, and sediments. The majority of upland investigations and cleanups are being performed under Voluntary Cleanup Letter Agreements, Voluntary Cleanup Agreements, Consent Orders, and Unilateral Orders funded by PRPs. In addition, DEQ has used funds from its Orphan Site Account to perform work itself at a number of cleanup sites within Portland Harbor.

Under OAR 340-122-070, DEQ has broad removal authority to expedite cleanup activities when necessary. Removals may be performed as necessary to “prevent, minimize, or mitigate damage to the public health, safety and welfare, and the environment that might result from the release or threat of release of hazardous substances.” Removals may be undertaken at any time, from the discovery of a release or threat of a release through the completion of a remedial action. Removal actions are typically performed to address emergency situations or when the removal action is not expected to be the final action at a site.

Stormwater Discharges

National Pollutant Discharge Elimination System (NPDES) Stormwater Permits. The 1987 amendments to the federal Clean Water Act (CWA) directed EPA to include nonpoint source pollution under its permitting program. Phase I of the NPDES Stormwater Program, developed in 1990, requires permit coverage for stormwater discharges from medium and large Municipal Separate Storm Sewer Systems (MS4s) located in incorporated places or counties with populations of 100,000 or more. DEQ administers and enforces NPDES regulations in Oregon.

Permits are also required for specific industry classifications (generally identified by Standard Industrial Classification [SIC] code) or if stormwater leaves a site through a point source (that is, pipes, culverts, ditches, catch basins, or any other type of channel) and reaches surface waters either directly or through storm drainage. DEQ has developed a series of five permits to address the specific industrial activities specified by EPA. These permits are grouped by activities:

- 1200-C for construction activities that disturb 5 or more acres
- 1200-CA for public agencies that are involved in construction activities that disturb 5 or more acres
- 1200-A for nonmineral mining activities
- 1200-Z for the remaining industrial activities
- 1300-J general permit has been developed for facilities with discharges from oil/water separators and other oily discharges

DEQ's authority for NPDES stormwater permitting is relevant to the RI and SCMs because facilities with these types of permits are likely to be located within or adjacent to the City outfall basins within the ISA.

NPDES for Point Sources

DEQ regulates all sources that discharge wastewater to surface water in Oregon. In addition to general stormwater permits (see above), DEQ also issues individual permits to industrial wastewater discharges to surface waters and some stormwater discharges to surface waters not otherwise covered by an NPDES general permit.

DEQ also issues general permits for certain types of industrial wastewater discharges. These permits are grouped by discharge type:

- 100—Cooling water/heat pumps
- 200—Filter backwash
- 300—Fish hatcheries
- 400—Log ponds
- 500—Boiler blowdown
- 700—Suction dredges
- 900—Seafood processing
- 1500A—Tank cleanup and treatment of groundwater
- 1700A—Washwater

- 1900—Noncontact geothermal

This regulatory program may provide NPDES monitoring data or additional site information for permitted facilities adjacent to or within the City outfall basins within the ISA.

Total Maximum Daily Load (TMDL). Under Section 303(d) of the CWA, states are required to develop lists of impaired waters that do not meet water quality standards set by the state. DEQ places water bodies that are "water quality limited" for certain parameters (that is, that do not meet designated standards and criteria) on its 303(d) list. OAR generally prohibits new or increased discharges of the specified parameters to the listed water bodies. The Willamette River is listed as a water quality limited water body.

DEQ is developing TMDLs and load allocations for the Willamette mainstem for bacteria, mercury, and temperature (stormwater transport 303(d)/TMDL parameters). DEQ is requiring TMDL waste load allocations to be addressed under NPDES municipal stormwater permits. While TMDLs may not be established for the Willamette River before the RI is completed, identification of significant sources of 303(d) parameters will be important to future source control efforts.

Spills

DEQ spill rules are included in OAR 340-108. The purpose of DEQ's spill rules is to identify the emergency response actions, reporting obligations, and follow-up actions required in response to a spill or release, or threat of spill or release, of oil or hazardous materials. DEQ is currently revising its spill rules to include new tasks and directions provided by the Oregon legislature. The proposed changes are expected to address oil spill planning, vessel fees, ballast water, and hazardous materials spill guidance.

The program is relevant to the RI and SCMs because DEQ's program may provide additional information on previous spill events. In addition, under this authority DEQ reviews spill prevention, control, and countermeasure (SPCC) plans, which may be an additional source of information collected under the City outfall basin assessments.

Hazardous Waste Program

The federal Resource Conservation and Recovery Act (RCRA), an amendment to the Solid Waste Disposal Act of 1965, was established in 1976 to protect human health and the environment from the hazards posed by waste disposal, to conserve energy and natural resources through waste recycling and recovery, to reduce or eliminate waste generation, and to ensure wastes are managed in a manner that is protective of human health and the environment. RCRA establishes three interrelated programs: solid waste (Subtitle D), hazardous waste (Subtitle C), and underground storage tanks (USTs) (Subtitle I). DEQ is authorized by EPA to regulate solid waste, hazardous waste, and USTs in Oregon.

Under this authority, DEQ administers hazardous waste regulations and implements technical assistance and outreach to industry on hazardous waste management. This program may have additional information for the Basin Assessment on facility activities and waste management practices. In addition, the technical assistance programs may be able to assist in implementing source control.

City Authorities and Programs to Promote Willamette Watershed Health

The City is currently undertaking a number of programs to promote the health of the Willamette River watershed. These programs are the associated responsibilities of the City/ BES and are described below.

City/BES Responsibilities

Many of the City's watershed activities fall under the purview of the City of Portland's Bureau of Environmental Services (BES). BES provides services related to wastewater collection, treatment, and disposal; stormwater management; source control; watershed management; and water quality protection. It is BES's responsibility to manage Portland's extensive wastewater and stormwater infrastructure. In total, the system encompasses two wastewater treatment plants, 2,250 miles of sewer pipe, 90 pump stations, 130 miles of drainage ditches, approximately 9,300 sumps, 6,000 sedimentation manholes, and 60,000 street drain inlets.

The City's wastewater, stormwater, and watershed health activities must comply with a complex set of federal, state, and local regulations, such as the federal Clean Water Act, that involve protection and restoration of the natural environment. For example, several state-mandated administrative orders and permits require the City to do the following:

- Reduce combined sewer overflows (CSOs) into the Columbia Slough and Willamette River
- Improve water quality in the Columbia Slough
- Reduce pollutants in stormwater entering the conveyance systems
- Protect groundwater

These types of regulations form the framework for BES's work and serve as the foundation of several BES programs, including the following (these programs are described in more detail later in this document):

- CSO Control Program, to reduce CSOs
- Pretreatment Program, to control discharges of harmful pollutants from industrial users
- Stormwater Management Program, to reduce pollutants in stormwater pollution
- Watershed Planning and Management, to improve water quality and restore habitat

Although BES is responsible for these particular programs, and thus much of the City's specific watershed improvement efforts, the health of the Willamette River watershed also is affected by the activities of other City bureaus, such as Water, Planning, Transportation, Parks and Recreation, and Portland Development Commission. To ensure coordinated and integrated river-related work across bureaus and groups, the City has created an internal River Renaissance Program for the revitalization of the Willamette River. The program was created to optimize the City's efforts, forge public-private partnerships, leverage resources, and mobilize the community in support of a healthy river. The program's integrated approach is designed to achieve maximum watershed benefits by ensuring that environmental protection work is done on a comprehensive, watershed-wide basis.

The programs described below are integral parts of the River Renaissance Program and the City's efforts to comply with CWA, ESA, Superfund, and other requirements.

CSO Control Program

Portland is one of many cities around the nation with a combined sewer system. When it rains, sewer pipes fill up with both stormwater runoff and sewage; they then overflow to the Willamette River through 42 outfall pipes. These overflows may contain bacteria, suspended solids, metals, and nutrients from stormwater and untreated sewage.

In August of 1991, the City of Portland signed an agreement with DEQ (amended in 1994) that established a schedule for action to do both of the following:

- Eliminate CSO discharges on the Columbia Slough by more than 99 percent by 2001
- Eliminate CSO discharges on the Willamette River by 94 percent by the end of 2011

The City is in the tenth year of its multi-faceted program to eliminate CSOs by 2011. The program has three parts:

- **Cornerstone Projects.** These projects reduce the amount of stormwater runoff that flows into the combined sewers. Projects include installing street sumps, disconnecting residential downspouts, diverting underground streams, and building separate pipes for stormwater runoff.

- **Columbia Slough Projects.** Construction of the Columbia Slough Consolidation Conduit, known as the Big Pipe, was finished in October 2000. It took BES 3 years to build this 3.5-mile, 12-foot-diameter, reinforced concrete pipeline that collects and transports combined sewage to the Columbia Boulevard Wastewater Treatment Plant. The $70 million conduit removes 99 percent of the combined sewage that once overflowed into the Columbia Slough when it rains.

- **Willamette River Projects.** These projects will control and reduce CSOs to the Willamette River. The City and a citizen task force have reviewed the original facility plan to ensure that the proposed projects are environmentally responsible and cost-effective. These projects are focused along the west and east sides of the Willamette River. Treatment of some of the separated or remaining stormwater flows is part of the predesign for CSO projects.

Although combined sewers will continue to overflow during rainstorms until the entire CSO program is finished, the frequency and volume of overflows are diminishing as the program progresses. Projects necessary to comply with CSO requirements in the Columbia Slough have been completed, and Portland has already controlled or eliminated eight Willamette River CSO outfalls. In addition, the City has removed approximately 1.8 billion gallons of stormwater from the combined system by separating drainage areas and diverting clean stream flows out of combined sewer pipes. This has reduced the amount of metals, suspended solids, and other pollutants reaching streams and the combined sewer system by directing stormwater flow to pollution reduction facilities and natural areas, where appropriate.

The estimated cost for the entire CSO program is more than $1 billion. While the City is aggressively pursuing alternative funding sources, such as state and federal grants, most of the funding will come directly from ratepayers.

Pretreatment Program

Federal laws require pretreatment programs to control discharges of harmful pollutants from industrial users. BES issues industrial wastewater discharge control permits to industries that discharge more than 25,000 gallons per day of process wastewater to the sanitary system. The City restricts the discharge of harmful substances to the sewers to protect the community's investment in the wastewater collection and treatment system. The following substances are controlled by the permits:

- Pollutants that may cause a fire or explosion hazard
- Pollutants that will corrode the sewer system
- Solid or viscous substances that cause sewer flow obstruction
- Toxic materials, such as heavy metals and toxic organic compounds, that adversely affect the City's treatment system

Nearly 200 Portland businesses pretreat industrial wastewater before it flows into the sewer system. Many industrial users have installed pretreatment systems or other control measures to eliminate or reduce pollutant discharges.

All permitted industries must submit periodic self-monitoring reports to show compliance with discharge standards. The City also collects samples and conducts annual inspections of all permitted facilities.

The City of Portland strives to keep the industrial community informed of training and educational opportunities as well as changes to the City's pretreatment program. Newsletters, mailings, treatment plant tours, and technical advisory work group activities all serve to provide technical assistance to industrial customers.

Stormwater Management Program

The City and co-permittees hold an NPDES Municipal Separate Storm Sewer System (MS4) discharge permit through DEQ. Pursuant to the permit, the City and co-permittees have developed a comprehensive stormwater management program that includes the following best management practices (BMPs):

1. Development standards/erosion control
2. Industrial/commercial controls
3. Illicit discharge controls
4. Structural controls
5. Operations and maintenance requirements
6. Planning/system preservation and development
7. Public involvement and education

The City's NPDES stormwater permit requires the implementation of BMPs to reduce the discharge of pollutants to surface waters to the maximum extent practicable. BES is active in a variety of source control efforts, as described below, including development requirements for stormwater management, permitting of stormwater discharges, illicit discharge monitoring, and spill prevention and emergency response.

Development Standards

Stormwater management development standards have been put into place to comply with the City's stormwater permit and the City's policies pertaining to a sustainable environment and the recovery of threatened or endangered species.

City Stormwater Manual. Under City Code Chapter 17.38, the City sets out policies and standards to provide for the effective management of stormwater and drainage, and to maintain and improve water quality in the watercourses and water bodies within the City of Portland. The City has developed a stormwater management manual to protect water resources and stream integrity. Some key requirements include the following:

- Removal of at least 70 percent of total suspended solids (TSS) in stormwater
- Removal of pollutants of concern in water-quality-limited bodies of water (those with total maximum daily load, or TMDL, limits)
- Infiltration of as much of the postdevelopment stormwater runoff as practicable
- Additional best management practices (BMPs) for land use activities of particular concern

The stormwater management manual provides design professionals with specific requirements for reducing the impacts of stormwater runoff (water quantity) and pollution (water quality) resulting from new development and redevelopment within the City of Portland. The manual's requirements apply to all development, whether public or private.

City Erosion Control Manual. In March of 2000, the City implemented new erosion control guidelines that require all sites of ground disturbance to comply with the "no visible or measurable" standard. The new requirements are citywide, with enhanced controls for large, sloped, and or sensitive development sites. Erosion, sediment and pollutant control plans are required for all sites needing a City permit. The new requirements specify compliance with the revised erosion control manual, which lists 37 BMPs for preventing erosion and controlling sediment. All BMPs have specific performance standards for design, installation, and maintenance.

Industrial and Commercial Controls

BES provides oversight of DEQ's series 1200 and 1300 general stormwater permits, as well as technical assistance for industrial and commercial sites.

Industrial Control. The Industrial Stormwater Program is an integral part of Portland's effort to reduce pollutants in stormwater runoff. The program is part of the BES Source Control Division, which addresses discharges to the City's sanitary and storm sewer systems from industrial and commercial properties. The industrial program began when Portland was issued its NPDES Municipal Stormwater (MS4) Permit in September 1995. As required by the permit, the City developed a program to monitor and control pollutants in stormwater runoff from industrial facilities. Industrial land use has been found to have a higher percentage of sediment, oil and grease, and metals in stormwater runoff than other land uses.[1]

To implement its program, the City developed City Code 17.39, which provides the legal authority to control discharges to the City's storm sewer system. The City also entered into a Memorandum of Agreement (MOA) with DEQ to administer the 1200 and 1300 series general stormwater permits for those facilities located within the City of Portland. These include facilities that discharge directly to the City's storm sewer system and those that discharge directly to receiving waters. As part of the MOA, the City reviews facility stormwater pollution control plans and performs site inspections to ensure compliance with the plan and permit conditions. The City also provides technical assistance to identify additional activities and BMPs to minimize pollutants in stormwater runoff.

Another aspect of the program is to inspect industrial and commercial facilities to determine whether they are required to obtain a stormwater permit. If so, an Industrial Stormwater Permit Application is submitted to the City and the permit is issued by DEQ. Regardless of permit requirements, the City provides technical assistance to address any industrial activities that may add pollution to the City's storm sewer system. These inspections may be initiated by pollution complaints or by the results of systematic evaluations based on a geographical area and/or industry type.

In conjunction with other City staff, the program also evaluates nonstormwater discharges to the storm sewer system. EPA has identified 19 nonstormwater discharges that need not be prohibited from the storm sewer system, provided that appropriate control measures are developed to minimize their impacts. These discharges include uncontaminated pumped groundwater, foundation drains, air conditioning condensate, and water line flushing.

Technical Assistance/Recognition Programs. The City has a variety of programs that offer technical assistance in preventing and controlling pollution from commercial and industrial sites. Specific efforts have been made with the automotive, dental, restaurant, and landscape contractor business sectors. The Ecological Business Program has been developed with the Portland area Pollution Prevention Outreach (P2O) Team to provide recognition for those businesses that prevent pollution.

Illicit Discharge Controls

Illicit Discharge Elimination Program. The Illicit Discharge Elimination Program, which is implemented by BES's Environmental Compliance and Industrial Source Control divisions, was developed to prevent, search for, detect, and control illicit discharges to the City's stormwater systems and surface waters. The program also addresses other discharges to the storm sewer system that may have a permit from DEQ, such as noncontact cooling water, and illicit discharges, such as certain washing activities. The program includes the following components:

- Identification and tracking of public and private outfalls, including some of the CSO outfalls
- Verification of commercial and industrial connections to the City storm system

[1] Analysis of Oregon Urban Runoff Water Quality Monitoring Data Collected from 1990 to 1996. June 1997. Prepared for the Oregon Association of Clean Water Agencies. Prepared by Woodward-Clyde, Portland, Oregon.

- Dry-weather monitoring to detect nonpermitted discharges

Spill Prevention and Response Program. The objective of BES's Spill Protection and Citizen Response (SPCR) Team is to reduce the frequency and impact of spills to the combined sewer system and the stormwater system. The SPCR team maintains a pollution complaint hotline and conducts follow-up activities on telephone calls reporting suspicious-looking substances in streets, catch basins, and local rivers and streams. The program was developed to protect the treatment plant from spills to the sewer system and was later expanded to address discharges to the storm sewer system.

Structural Controls

Structural stormwater controls include retrofitting, the creation of facilities to improve water quality, and demonstration projects with various partners to reduce stormwater quantity and improve water quality.

Pollution Reduction Facilities. NPDES regulations require that the integration of flood control and water quality issues be considered when new facilities are designed or existing facilities are improved. Historically, most stormwater facilities were designed, operated, and evaluated only on the basis of capacity. During the first permit cycle, the City completed the Public Facilities Plan (PFP) and Integrated Watershed Plans, which provide a framework for reducing pollutants in MS4 discharges. The PFP lists deficiencies in the stormwater system and recommends that all predesign include implementation or retrofitting for water quality improvements. The City retrofitted a number of stormwater management facilities and designed and constructed several pollution reduction facilities. Implementation will continue in the second cycle, using watershed planning documents (such as the Johnson Creek Predesign) and the Public Facilities Plan to identify and prioritize projects.

Demonstration Projects. As part of the City's Stormwater Management Program, the City offers incentives for technical and financial assistance for projects that control stormwater runoff from commercial, industrial, and institutional properties. BES supports demonstration stormwater management projects that show others how to retrofit existing sites. Examples include:

- Disconnecting roof downspouts and directing roof runoff to vegetated swales, planters, or other landscape features
- Removing or replacing pavement with porous materials that allow stormwater to infiltrate the ground
- Regrading some paved areas so that they drain into new or existing landscaping

Operations and Maintenance

The City is currently evaluating a wide variety of maintenance practices for City buildings, structures, parks, and other City-held properties and publicly held rights-of-way. These evaluations include consideration of product substitution, dry maintenance practices, treatment of runoff flows, and redirection of contaminated flows to the sanitary sewer.

Planning/System Preservation and Development

The protection of natural areas through incentives, policy development, code change, and acquisition improves water quality by protecting and restoring the natural functions of vegetated areas.

Environmental Zone Overlays. The City is in the process of updating its environmental overlay zone revisions. Environmental overlay zones are elements within the zoning code that protect waterways and upland natural resource areas and prevent or limit development in their vicinity. Required as part of the City's Goal 5 compliance effort, the newest revisions propose enhanced environmental overlay zone coverages adjacent to all waterways in the City.

Land Acquisition. Working alone and with Metro, the City has purchased a variety of properties during the last few years for purposes of flood storage, natural parks, and resource protection. Many of these properties are cleared of any structures and reverted or restored to vegetated states to be managed by the City or Metro.

Other City Code Changes. The City has completed a number of changes to its existing codes to enhance stormwater removal objectives. The most relevant code change, from March 2001, involved changing the parking lot vegetation and screening codes to require that stormwater in all new parking lots be managed in required site landscaping areas.

Public Involvement and Education

BES offers a wide variety of public involvement and education programs on stormwater to residential, commercial, and industrial users and the general public. For example, BES provides free education programs to schools and community groups within the City of Portland. These hands-on programs teach students about the causes and effects of water pollution and what individuals can do to protect rivers and streams. Classroom activities, field trips, and assembly programs all provide valuable information in a fun and accessible format. BES's education programs also provide community service projects, stewardship grants, and curriculum resources that can be checked out.

Watershed Planning and Management

BES is responsible for a range of watershed planning and restoration activities in the Willamette River watershed and its tributary watersheds (Johnson Creek, Tryon Creek, Fanno Creek, Columbia Slough, Balch Creek, and Stephens Creek). Focal activities include comprehensive watershed assessment and planning, implementation of projects and programs to improve water quality and restore habitat, management of a community-wide public education and stewardship program, and integration of ESA goals into BES planning efforts.

Watershed Management

BES is currently collaborating with other City bureaus to develop comprehensive watershed management plans for each of the major Portland watershed areas. These planning efforts will establish goals and objectives, characterize current and future watershed conditions and problems, and generate recommendations for projects and programs to improve watershed health. The watershed plans will advance the City's efforts to meet regulatory requirements of CWA, ESA, CERCLA, and other legislation.

BES is implementing a stormwater management program that focuses on implementation of innovative onsite pilot projects in partnership with landowners in the Willamette River watershed. These projects will improve water quality by reducing stormwater runoff and contributing to CSO control. BES is also studying the role of the tree canopy in reducing runoff to the sewer system.

BES is implementing a showcase floodplain program in the Johnson Creek watershed. The "Willing Seller Program" involves public acquisition of properties subject to flooding along Johnson Creek. The City purchases these properties from willing sellers and maintains them as functioning floodplain areas that reduce flood risk while improving water quality and habitat.

Revegetation and Restoration

BES carries out revegetation and restoration projects throughout Portland's watersheds. BES's Watershed Revegetation Program operates in partnership with City bureaus, municipal agencies, and private landowners to remove invasive plants from along Portland's rivers, streams, and uplands and to plant native trees, shrubs, grasses, and wetland plants in their place. BES also sponsors or co-sponsors water quality and restoration projects in Portland's watersheds. These projects include floodplain reconnection, wetland enhancement, culvert and bridge modifications, and the creation of stormwater bioswales. Benefits gained from these projects include riverbank and slope stabilization, fish and wildlife habitat enhancement, fish access enhancement, erosion/sedimentation control, shading, and pollutant removal.

Endangered Species Act Program

Portland organized its ESA program in March 1998. The Portland City Council has asked City bureaus and agencies to work together to proactively protect fish and their habitat and to gain compliance under the ESA. The Portland City Council wants Portland to be the first urban center that successfully restores a threatened aquatic species. The City's program is designed to be comprehensive, based on good science, and focused on action. It has the following goals:

- Be proactive, not reactive, with regard to watershed health and fish protection.
- Push past the minimum standards set by the Endangered Species Act to help attain the goal of recovering native fish.
- Meet legal obligations in a good-faith effort to reach "properly functioning conditions."
- Empower, engage, and motivate the community and City government.
- Minimize disruption of critical City services that could be caused by legal or regulatory disputes.
- Demonstrate progress to the citizens of Portland and positive leadership in the region.

- Act strategically so that the greatest overall community, economic, and environmental benefits are achieved.

The objectives of the ESA program are being integrated into watershed management plans and other City programs to meet the Portland City Council's desire to move beyond mere compliance to actually aiding in species recovery.

APPENDIX B

Data Report: Source Control Sediment Investigation for the City of Portland Outfalls (CH2M HILL, January 2004)

Data Report

Source Control Sediment Investigation for the City of Portland Outfalls

Prepared for

City of Portland
Bureau of Environmental Services

January 2004

Prepared by

CH2MHILL

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Contents

Table

(The table is presented after the figures at the end of the report.)

Figures

(Figures are presented at the end of the report.)

Acronyms and Abbreviations

BES	Bureau of Environmental Services
BTEX	benzene, toluene, ethylbenzene, and xylenes
CBWTP	Columbia Boulevard Wastewater Treatment Plant
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter(s)
COPI	contaminants of potential interest
CSO	combined sewer overflow
2,4-D	2,4-Dichlorophenoxyacetic acid
2,4-DB	2,4-Dichlorophenoxybutyric acid
2,4,5-T	2,4,5-Trichlorophenoxyacetic acid
DBR	differential beacon receiver
DCE	1,2-dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DEQ	Department of Environmental Quality
DGPS	Differential Global Positioning System
ECSI	Environmental Cleanup Site Information
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
GPS	global positioning system
HPAH	high molecular weight polynuclear aromatic hydrocarbon
ISA	initial study area
LPAH	low molecular weight polynuclear aromatic hydrocarbon
m^2	square meter(s)
mm	millimeter
MTBE	methyl tertiary-butyl ether
NAD	North American Datum
NPDES	National Pollutant Discharge Elimination System
ODOT	Oregon Department of Transportation
PAH	polynuclear aromatic hydrocarbon
PCBs	polychlorinated biphenyls
PCE	tetrachloroethane
PCP	pentachlorophenol
SVOCs	semivolatile organic compounds

TCA	1,1,1-trichloroethane
TOC	total organic carbon
TPH	total petroleum hydrocarbon
VOCs	volatile organic compounds
WP/FSP	Work Plan/Field Sampling Plan

SECTION 1

Introduction

This document presents analytical results from the Source Control Sediment Investigation for the City of Portland (City) outfalls. The purpose of this investigation is to evaluate sediment quality during dry weather conditions (July to October of 2002) in the Willamette River near the City's stormwater and combined sewer overflow (CSO) outfalls. The 18 outfall locations that were sampled in this investigation are in the initial study area (ISA) of the Portland Harbor Superfund site. These data will be used for the following purposes:

- Identifying City outfalls that may be serving as conduits for contamination from upland sources to Willamette River sediment
- Identifying potential upland sources of contaminants within the outfall basins
- Guiding source control efforts

This investigation was conducted in anticipation of data needs for evaluations of the Portland Harbor Superfund site under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Approximately 250 non-City outfalls have been identified that may discharge stormwater into the Willamette River within the ISA; the City has 20 outfalls[1] within the ISA that discharge stormwater. The non-City outfalls are believed to be owned by the Port of Portland, the state of Oregon, private owners, and other entities. Ownership or operation of an outfall is not necessarily linked to ownership of land on which the outfall is located. Citations of land and/or outfall ownership in this report may not be current or accurate.

City stormwater drainage basin boundaries were developed in 2000 as part of a preliminary evaluation of City stormwater outfalls (CH2M HILL, July 2000; December 2000). Many of these basin boundaries were re-delineated in 2003. The original delineations were digitally drawn in a small scale (zoomed out) that provided limited precision, and this resulted in a rough estimation of boundary lines. Changes in available data, such as storm system maps, plumbing records, dye testing, and downspout disconnection records, have affected the basin boundaries. Basin re-delineations were conducted under the assumption that storm system maps, plumbing records, and downspout disconnection records are correct.

The most significant changes to stormwater drainage basin boundaries occurred in the St. Johns area. Combined sewer overflow (CSO) separation projects and downspout disconnection efforts in this area have significantly changed the basin boundaries for Outfalls 48, 49, 50, 52, and 53. All five of these outfalls are historical CSOs that have been fully or partially separated as part of CSO separation projects. In addition to the CSO separation projects, the City has made a significant effort to disconnect building downspouts (roof drains) from the City stormwater system (MS4). The disconnection of

[1] Eighteen of these outfalls were sampled as part of this investigation; two additional outfalls (M-1 and 18) were sampled and reported in the Phase 1 Data Evaluation and Phase 2 Work Planning reports (CH2M HILL, January 2003) and (CH2M HILL, November 2003, currently draft), respectively.

downspouts in the St. Johns area has contributed to changes in stormwater drainage basin boundaries. A review of plumbing and downspout disconnection records showed that many properties (primarily residences) in these basins remain connected to the combined sewer system (discharging to the Columbia Boulevard Wastewater Treatment Plant [CBWTP]) or have roof drains that are disconnected from the City stormwater system (MS4 system). The assumption is that disconnected downspouts discharge to the ground, where stormwater then infiltrates to soil. It is important to note that some residences in this area may have roof drains that discharge through a curb outfall, resulting in a stormwater discharge to the street, which would then enter the combined or stormwater system. This may be evaluated more thoroughly in future investigations.

Basin drainage boundaries will continue to be revised over time as further analyses are undertaken and new data become available. For these reasons, the stormwater drainage basin boundaries should still be considered under revision. Similarly, Environmental Cleanup Site Information (ECSI) used in this assessment was compiled several years ago and may not reflect current conditions.[2] The location of ECSI sites was visually estimated based on an Oregon Department of Environmental Quality (DEQ) ECSI site data map. Information related to stormwater permits may also be dated and potentially incomplete or incorrect.

[2] This may be significant based on the number of changes that have occurred during the past few years. There were 44 ECSI sites associated with the Portland Harbor a few years ago; now there are more than 100 sites.

SECTION 2

Sediment Investigation Field Activities

This section presents a summary of field activities conducted during the investigation of sediment near City outfalls. Sampling protocols followed the procedures described in the *Work Plan – Source Control Sediment Investigation for the City of Portland* (CH2M HILL, October 2002a) and in the Work Plan Appendix *Field Sampling Plan for Source Control Sediment Investigation for the City of Portland Outfalls* (CH2M HILL, October 2002b).

2.1 Sample Collection

2.1.1 Sampling Vessels

The following vessels were used for sampling during the investigation:

- Shallow draft, 28-foot-long vessel equipped with a 5-foot-long boom and electric winch
- Shallow draft, 34-foot-long vessel equipped with a 5-foot-long boom and electric winch
- Steel frame raft, 12-foot-long vessel with wooden bottom used for collecting sediment samples with a 0.025-square-meter (m^2) van Veen sediment sampler. This vessel allowed access to areas not accessible by the larger vessels.

2.1.2 Station Positioning

A Trimble GeoExplorer 3 Differential Global Positioning System (DGPS) unit was used to record each sample location. DGPS is a refinement to the global positioning system (GPS) that uses land-based radio beacons to transmit position corrections to the GPS receiver, in which the GPS receiver is used in conjunction with a differential beacon receiver (DBR) and antenna. The use of DGPS corrections improved the receiver accuracy to within 3 to 10 feet.

Proposed sample locations were loaded into a data dictionary before the sampling event, allowing for navigation to each point. Sample locations then were adjusted, if necessary, for site conditions. After sample collection, the location was recorded in the field with the DGPS unit, stored in a data dictionary, and recorded on the field data sheets. The standard projection method used during field activities was Horizontal Datum: North American Datum of 1983 (NAD 83), State Plane Coordinate System, Oregon North Zone. To ensure accuracy, sample locations were also measured with a tape measure relative to the outfall and other sampling points. Vertical positioning of each sample was recorded using a lead line to determine the sample depth.

Post-processing of the DGPS data was completed using Trimble Pathfinder Office® software. Post-processing differential correction of the sample positions was completed using data from the Portland State University Department of Geology base station. The DGPS positioning accuracy was in the order of ± 3 to 10 feet. Locations were plotted over an aerial photograph of the outfall location and further refined on the basis of physical measurements collected in the field. All outfall locations are shown in Figure 1. Sample locations are presented in Figures 2 through 19.

2.1.3 Sampling Equipment and Methods

Surface sediment (upper 15 centimeters [cm]) grab samples were collected using standard sampling protocols and guidelines as presented in the U.S. Environmental Protection Agency (EPA) document *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analysis: Technical Manual* (EPA, 2001).

Surface sediment samples were collected in a consistent, repeatable manner. Most samples were collected with a stainless steel, 0.1-m^2, van Veen grab sampler. The sampler was attached to a winch line with a clevis to prevent twisting during deployment. The sampler was raised and lowered through the water column at a low rate to ensure the sampler did not flip over or lose material. When sampling from the smaller work boat or when bottom conditions necessitated, a smaller, hand-operated, 0.025-m^2 van Veen grab sampler was used.

After the full sampler was brought aboard, it was placed on a large, stainless steel sheet. The access doors on the top of the sampler allowed for visual characterization of the sediment surface to assess sample acceptability. Before characterization, the overlying water in the sampler was siphoned off.

Depending on the location of the outfall terminus, some samples were collected from the beach (above the high tide water level during the field sampling) and some were collected in the tidal zone (between the low tide water level and the high tide water level). A stainless steel scoop was used to collect these samples if standard protocols were not possible or appropriate.

Before the sediment was removed for chemical analyses, certain parameters and qualitative environmental observations were recorded. The following physical characteristics of sediment in each of the surface sediment grab samples were described and recorded on field data sheets:

- Sediment texture
- Sediment color
- Presence
- Type
- Strength of odors
- Grab penetration depth
- Degree of leakage or sediment surface disturbance
- Any obvious abnormalities, such as wood/shell fragments or large organisms

Field data sheets for each sample are presented in Appendix A.

Sediment material was removed from the top 15 cm of the sampling device using a stainless steel spoon. Sediment that was in contact with the sides of the sampler was not included. Large organisms (such as worms and clams) and, when possible, all debris were removed and noted on the sample log sheet. The sediment was placed into a stainless steel mixing bowl for homogenization. In some cases, additional material was required to meet the sample volume required for analysis; therefore, multiple grabs were collected with the van Veen sampler and composited. After the sample was thoroughly homogenized, aliquots were placed in each appropriate laboratory-supplied sample jar.

2.2 Summary of Sediment Sampling Locations

Sediment sample locations focused on nearshore areas in the immediate vicinity of the outfalls. Sampling patterns were developed at each outfall based on factors such as results from Phase 1 of the City of Portland Source Control Pilot Project, historical sediment sampling results, the physical setting of the outfall, and physical characteristics of the river at each outfall location.

Generally, samples were spaced 50 to 100 feet apart and distributed around the outfall. Sampling patterns were developed to collect samples within the probable discharge plume area and at least one sample upstream of the discharge point of each outfall. In some cases, such as in the Swan Island lagoon, there is no clear upstream flow direction, so historical data were considered.

At outfalls located with obvious river flow perpendicular to the outfall, the sampling grids generally consisted of the following:

- One sample at the outfall terminus
- One nearshore sample at the discharge confluence point with the river (if not the same as above)
- One nearshore upstream sample
- One or two nearshore downstream samples
- One offshore downstream sample

Nearshore samples were collected at locations approximately 5 feet offshore from the low tide watermark. If river bottom conditions (for example, rocks or riprap) inhibited sample collection, the nearshore samples were collected as close to the shoreline as possible.

The offshore sample was collected approximately 50 feet downstream of the discharge confluence with the river and approximately 50 feet perpendicular to the nearshore sample. This sample was intended to help define the extent of the presumed depositional plume and was modified in the field to achieve this goal.

At outfall locations where there was no clear flow pattern (such as in the Swan Island lagoon and in inlets), sample locations were selected to be inside the presumed depositional area.

To minimize the potential for cross-contamination between sampling locations at a given outfall, sediment sampling generally was conducted from downstream to upstream locations.

2.3 Laboratory Analysis

Sediment samples were analyzed for metals, semivolatile organics, organochlorine pesticides, heavy oil and diesel range hydrocarbons, and polychlorinated biphenyls (PCBs). Chlorinated herbicides were analyzed at one sample location per outfall, generally adjacent to or near the outfall. The field sampling coordinator selected this sample location. Additionally, chlorinated herbicide samples were collected at all four samples in the vicinity of Outfall 22B; initially one sample was analyzed and the other three were extracted and held pending results of the initial sample. Based on the detection of 2,4-dichlorophenoxybutyric acid (2,4-DB) in the first sample, chlorinated herbicides were analyzed in the other three samples as well.

Conventional parameters, such as percent moisture, sediment particle size, and total organic carbon (TOC), also were measured. Grain size is used to characterize the physical characteristics of sediments and can be used to normalize chemical concentrations according to sediment characteristics.

SECTION 3

Field Observations

Sediment samples were collected between October 14 and 23, 2002. This section presents a brief summary of any deviations from the Work Plan and Field Sampling Plan (WP/FSP), as well as general observations related to each outfall site and associated sediment samples. Outfall observations are presented in geographic order, moving downstream starting with outfalls located on the east side of the river followed by those on the west side. The complete field data sheets, field notes, and site photographs are presented in Appendixes A, B, and C, respectively.

Weather during the sampling event was generally sunny, with highs in the low 70s (Fahrenheit) and with no recorded precipitation. Figure D-1 of Appendix D presents the daily rainfall for Portland, Oregon, from January 1, 2002, through October 31, 2002.

River stage and tidal levels are potentially significant because they can determine whether samples collected at or above the apparent shoreline, or in erosional channels, were potentially affected by recent or frequent deposition of Willamette River sediments. These factors are noted in the following discussions of outfalls. The Willamette River is tidally influenced throughout Portland Harbor and can fluctuate several feet diurnally. High and low tidal stages were noted during sampling; low tide levels occurred during the day in October and were visually noted during sampling, while high tide levels were apparent from moisture and small debris markers along the shoreline. River stage is determined by Willamette River flow and water elevations in the Columbia River. River stage in October is typically at annually low levels. High river stage was assessed qualitatively by depositional zones for larger logs and debris.

3.1 Outfall S-5

3.1.1 Background

Outfall Characteristics

Stormwater Outfall S-5 (a 36-inch-diameter pipe) is located to the southeast (upstream) of the Swan Island Shipyard, on the east side of the river at river mile 9.2. At low river stage the outfall discharge is above the apparent high tide water line, and at high river stage the high tide water line is above the base of the outfall and river water can back up into the outfall. The riverbank below the outfall is generally sandy, with few large timbers or cobbles. The riverbank above the outfall is lined with riprap and scattered with large timbers. On October 15, 2002 (low river stage), the low tide water line was approximately 100 feet from the base of the outfall and the apparent high tide water line was approximately 50 feet from the base of the outfall. A deep erosional channel cut through the sandy bank from the outfall to the apparent high tide water line. The first 50 feet of the erosional channel was approximately 3 feet deep by 20 feet wide and contained large cobbles, timbers, and other debris. From the apparent high tide water level to the low tide water level, the erosional channel gradually spread out and became less defined and free of cobbles, timbers, and other debris.

Sediment trend analysis in the river directly adjacent to Outfall S-5 indicated that the general sediment trend in the area is "accretion" (that is, more fine grains are deposited along the transport path than are eroded, with the result that the sediment bed, though mobile, is accreting) (Geo Sea Consulting Ltd., 2001). The riverbank is generally straight, without large structures or obvious features that might create localized sediment shoaling or scouring in the vicinity of the outfall.

Drainage Basin Characteristics

Outfall S-5 drains approximately 39 acres of land in the Swan Island area and discharges to the Willamette River. Slightly less than half of the stormwater drainage basin lies within 120 feet of the shoreline, with the remainder located within 500 feet of the shoreline. On the basis of 2003 estimates, approximately 46 percent of the basin is zoned for industrial land use, and approximately 35 percent is zoned as an employment district. Rights–of-way are approximately 9 percent of the basin. No residences are located within this basin.

There are no DEQ ECSI sites located in the drainage basin. There is only one facility within the basin that has a National Pollutant Discharge Elimination System (NPDES) 1200-Z permit. City records show no permitted nonstormwater discharges in this basin. The businesses within the basin include a number of offices, a few restaurants, and some manufacturing and distributing facilities (CH2M HILL, 2000a).

Characteristics of Sites Adjacent to Outfall

The property immediately adjacent to Outfall S-5 is used by Freightliner for offices and parking lots. The City has not identified any non-City outfalls in close proximity to Outfall S-5; the closest upstream outfall is WP-249, more than 1,200 feet upstream (see Figure 2).

3.1.2 Site Observations

The following observations were noted at Outfall S-5 on October 21, 2002:

- There was no discharge from the outfall.
- A deep (more than 3 feet) erosional channel extended from the outfall terminus to the high tide mark of the riverbank. The bottom of the outfall pipe was wet and the pipe appeared to have discharged recently, although there was no indication of recent flow in the erosional channel.
- During the sampling effort, a moderate sheen was observed in the vicinity of the nearshore, downstream sample SI01S5050. This sheen developed after sediment in the area was disturbed. Photograph 4 (Appendix C) shows the sheen. The source of the sheen was not determined; it was unclear whether the sheen was a result of a groundwater seep or contamination contained in the sediment.
- Moderate amounts of anthropogenic debris were observed in the erosional channel; debris included a 5-gallon plastic bucket, glass bottles, and plastic cups.

Photographs 1 through 5 (Appendix C) were taken at Outfall S-5 during the sediment investigation.

3.1.3 Sample Observations

Seven sediment samples and one field duplicate were collected in the vicinity of Outfall S-5. Sample locations are presented in Figure 2. The following is a brief summary of field observations:

- SI01S5010 was collected above the apparent high tide water line in the erosional channel directly below the outfall. Moderate amounts of anthropogenic debris, including Styrofoam®, aluminum foil, white flakes (possibly paint chips), and bolt fragments, were observed in this sample.
- Two samples were collected from the tidal zone in the erosional channel. SI01S5020 was collected at the high tide water line and SI01S5030 was collected at the low tide water line.
- Four samples were collected in the river below the low tide water line. SI01S5040, SI01S5050, and SI01S5060 (upstream) were nearshore samples collected 5 feet from the low tide water line. SI01S5070 was collected 50 feet offshore from the nearshore sample SI01S5050.
- Minor amounts of anthropogenic debris, including brick fragments, paint chips, and aluminum foil, were observed in the nearshore sample SI01S5040, which was collected 50 feet downstream of the outfall terminus.
- A light oil sheen was observed on the nearshore samples SI01S5040 and SI01S5060, and on the offshore sample SI01S5070. The sheen was a light, discontinuous sheen that developed on top of the pore water during sample homogenization.
- A light oil sheen was observed on the water in the location of the nearshore sample SI01S5050. The sheen was also present on the sampler; however, no sheen was present on the sample itself.

3.1.4 Deviations from WP/FSP

Sediment samples at Outfall S-5 were collected in accordance with the WP/FSP, with the following exception:

One additional nearshore sample (SI01S5040) was collected 100 feet downstream of the outfall because an oil sheen was observed in the vicinity of the nearshore sample (SI01S5050), which was collected 50 feet downstream of the outfall.

3.2 Outfall S-6

3.2.1 Background

Outfall Characteristics

Stormwater Outfall S-6 (a 36-inch-diameter pipe) is located on the east side of the river and is below a shipyard dock that extends approximately 50 feet into the river and runs along the northwest side of the shipyard at river mile 8.4. The outfall is located approximately 550 feet from the southwest end of the dock. On October 14, 2002 (low river stage), the outfall was visible and completely above the water line. Because of the limited amount of time spent at Outfall S-6 during the sediment investigation, no further information is available on the relative height of the outfall compared with the low tide water line, high tide water line, or at high river stage.

Sediment trend analysis in the river adjacent to Outfall S-6 indicated that the general sediment trend in the area is "mixed case" (that is, the environment undergoes periodic accretion followed by periodic erosion) (Geo Sea Consulting Ltd., 2001). The riverbank beneath the shipyard dock is straight, with heavy riprap along its entire length. The dock is supported by several hundred wood pilings and is about 3,000 feet long. Several rows of timber pilings run the length of the dock, which may result in localized accretion beneath the dock. Prop wash from ship activity along the dock may have significant periodic effects on sediment transport in the area.

Drainage Basin Characteristics

Outfall S-6 drains approximately 23 acres of land in the Swan Island area and discharges to the Willamette River. Approximately one-third of the stormwater drainage basin lies within 100 feet of the shoreline, with the remainder located within 500 feet of the shoreline. On the basis of 2003 estimates, approximately 84 percent of the basin is zoned for industrial land use, and rights-of-way are approximately 16 percent of the basin. No residences are located within this basin.

Much of the property in the basin is owned by Cascade General. On the basis of current information, it is unclear which of the Cascade General tenants discharge to the City conveyance system and which tenants discharge through private outfalls. However, there are a number of facilities located within the drainage basin that discharge to the City's stormwater system. City records show a 1200-Z NPDES permit and an individual NPDES permit held by the Port of Portland/Cascade General in this drainage basin. City records show no permitted nonstormwater discharges in this basin.

There is one DEQ ECSI site located partially within the basin: Swan Island Ship Repair Yard (Cascade General) (ECSI #271). The Swan Island Ship Repair Yard is listed in DEQ's ECSI database as having known or potential contamination, including: paint, heavy metals, tributyl tin, oil/petroleum hydrocarbons, polynuclear aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), phthalates, pentachlorophenol (PCP), PCBs, and asbestos. The businesses within the basin primarily conduct ship repair activities. There are also some offices and some manufacturing and distributing facilities in the basin (CH2M HILL, 2000a).

Characteristics of Sites Adjacent to Outfall

Cascade General owns property adjacent to Outfall S-6 on which shipbuilding and repair are the primary activities. These activities include over-water operations and have the potential to release metals, PAHs, phthalates, butyl tins, and PCBs. The Swan Island Shipyard site (ECSI #271) has been cited by DEQ as having potential problems with paint, heavy metals, tributyl tin, oil/petroleum hydrocarbons, PAHs, and arsenic.

The City has not identified any non-City outfalls in close proximity to Outfall S-6. The closest outfalls are assigned to Cascade General, although various tenants may contribute to the total discharge. Designation for these adjacent owner/occupant outfalls is as follows (see Figure 3):

- WP-156: Cascade General (480 feet downstream of Outfall S-6)
- WP-157: Cascade General (350 feet downstream of Outfall S-6)
- WP-158: Cascade General (650 feet upstream of Outfall S-6)

3.2.2 Site Observations

The following observations were noted at Outfall S-6 on October 14, 2002:

- The outfall is below a shipyard dock that extends approximately 50 feet into the river and runs along the northwest side of the shipyard. The dock is supported by several hundred wood pilings.
- There was no discharge observed from the outfall terminus. The outfall was viewed from 50 feet away because access was blocked by shipyard dock pilings. The field team did not have time to view the outfall from the bank because of the early arrival of a large ship.

3.2.3 Sample Observations

One sediment sample (SI0106010) was collected in the vicinity of Outfall S-6. The sample location is presented in Figure 3. The following is a brief summary of field observations:

- The surface sediment at this location was very soft silt. The 0.025-m^2 Van Veen sampler was used to collected this sample because the weight of the 0.1-m^2 Van Veen sampler resulted in sediment extruding from the sampler's doors, which is an indication that the sampler penetrated deeper than normal and that the exact depth of the sample collection could not be determined.
- No anthropogenic debris was observed in the sample.

3.2.4 Deviations from WP/FSP

This outfall is located at the Swan Island Shipyard. The shipyard was contacted prior to the start of the field investigation. The field team was informed that a U.S. Navy ship would arrive on October 15, 2002, and be docked in front of Outfall S-6 for a minimum of 1 month. The ship arrived 1 day early on October 14, 2002, before the completion of the field investigation at Outfall S-6, and was docked for the remainder of the field investigation. The shipyard confirmed that the ship would remain docked for a minimum of 1 month.

Sediment samples at Outfall S-6 were collected in accordance with the WP/FSP with the following exceptions:

- Only one sample was collected in the vicinity of Outfall S-6.
- No photographs were taken at the outfall.
- The GPS coordinates of the outfall terminus were not collected.

3.3 Outfall S-1

3.3.1 Background

Outfall Characteristics

Stormwater Outfall S-1 (a 36-inch-diameter pipe) is located on the southwest side of the Swan Island lagoon beneath a shipyard dock. Outfall S-1 is located approximately 350 feet from the southeast end of the dock. The outfall was not visible during the sediment investigation because a large ship was docked at the shipyard pier. As a result of this limited access, further information is not currently available on the relative height of the outfall compared with high and low river stage.

Sediment trend analysis in the lagoon adjacent to Outfall S-1 indicated that the general sediment trend in the area is "total deposition I" (that is, the sediment bed is not mobile and is a zone of accretion) (Geo Sea Consulting Ltd., 2001). The riverbank beneath the shipyard dock is straight, with heavy riprap along its entire length. The dock is supported by several hundred wood pilings and is about 2,000 feet long. Several rows of timber pilings run the length of the pier, which may result in localized accretion beneath the dock. Prop wash from ship activity along the dock may have significant effects on sediment transport in the area.

Drainage Basin Characteristics

Outfall S-1 drains approximately 25 acres of land in the Swan Island area and discharges to the Swan Island lagoon. The entire stormwater drainage basin lies within 250 feet of the shoreline (lagoon side). On the basis of 2003 estimates, approximately 96 percent of the basin is zoned for industrial land use, and rights-of-way are approximately 4 percent of the basin. No residences are located within this basin.

The businesses within the basin primarily conduct shipping and transportation activities. Much of the property in the basin is owned by Cascade General. On the basis of current information, it is unclear which of the Cascade General tenants discharge to the City conveyance system and which tenants discharge through private outfalls. However, there are a number of facilities located within the drainage basin that discharge to the City's stormwater system. NPDES permits listed for this drainage basin include a 1200-Z and an individual permit, both held by Cascade General. City records show no permitted nonstormwater discharges in this basin.

There is one DEQ ECSI site located within the basin: Swan Island Ship Repair Yard (Cascade General) (ECSI #271). The Swan Island Ship Repair Yard is listed in DEQ's ECSI database as having known or potential contamination, including: paint, heavy metals, tributyl tin, oil/petroleum hydrocarbons, PAHs, VOCs, phthalates, PCP, PCBs, and asbestos.

Characteristics of Sites Adjacent to Outfall

Cascade General owns property adjacent to Outfall S-1. Shipbuilding and repair are the primary activities conducted on the property. These activities have the potential to release metals, PAHs, phthalates, butyl tins, and PCBs (CH2M HILL, 2000a).

The City has identified a number of non-City outfalls along the shoreline adjacent to Outfall S-1. These outfalls are assigned to the Port of Portland, although various tenants may contribute to the Port's total discharge. Within 200 feet of Outfall S-1 (see Figure 4), the following outfalls have been identified. Designation for these adjacent owner/occupant outfalls is noted as follows:

- WP-48: Port of Portland (190 feet northwest, toward mouth of lagoon)
- WP-47: Port of Portland (60 feet southeast, toward head of lagoon)
- WP-46: Port of Portland (140 feet southeast, toward head of lagoon)

3.3.2 Site Observations

Outfall S-1 could not be accessed because a large ship was docked directly in front of the outfall. The outfall location is shown in Figure 4.

3.3.3 Sample Observations

No samples were collected at Outfall S-1.

3.3.4 Deviations from WP/FSP

The shipyard was contacted before the field investigation began. The CH2M HILL field team did not know the exact location of Outfall S-1 but was informed that a ship may be docked in front of the outfall. During field work, the field team confirmed that Outfall S-1 could not be accessed because a large ship (*The Global Sentinel*) was docked directly in front of the apparent location of the outfall. The shipyard informed the field team that the ship would remain docked indefinitely. Deviations from the WP/FSP included:

- No samples were collected at the outfall.
- No photographs were taken at the outfall.
- The GPS coordinates of the outfall terminus were not collected.

3.4 Outfall S-2

3.4.1 Background

Outfall Characteristics

Stormwater Outfall S-2 (a 36-inch-diameter pipe) is located in the southwestern corner of the Swan Island lagoon. At low river stage the outfall is above the apparent high tide water line, and at high river stage the high tide water line is above the base of the outfall and river water may back up into the outfall. The riverbank below the outfall is generally sandy, while the riverbank above the outfall is lined with riprap, vegetated with trees, and scattered with large timbers. On October 14, 2002 (low river stage), the low tide water line was approximately 85 feet from the base of the outfall and the apparent high tide water line reached the base of the outfall terminus but was approximately 2 vertical feet below the outfall pipe. A shallow erosional channel cut through the sandy bank was evident from the base of the outfall to the low tide water line. The first 25 feet of the erosional channel was approximately 2 feet deep by 5 feet wide and lined with large cobbles, timbers, and other debris. Twenty-five feet from the outfall, the channel narrowed to approximately 2 feet wide and 1 foot deep and became free of cobbles, timbers, and other debris.

Sediment trend analysis in the lagoon adjacent to Outfall S-2 indicated that the general sediment trend in the area is "total deposition I" (that is, the sediment bed is not mobile and is a zone of accretion) (Geo Sea Consulting Ltd., 2001). Four rows of pilings are located 100 feet to the northwest of the outfall, extend approximately 50 feet into the lagoon, and run along the bank; these pilings may create localized sediment shoaling or scouring in this area.

Drainage Basin Characteristics

Outfall S-2 drains approximately 27 acres of land in the Swan Island area and discharges at the head of Swan Island lagoon. Approximately one-third of the stormwater drainage basin lies within 150 feet of the shoreline (lagoon side), with the remainder of the basin within 250 feet of the shoreline (lagoon side). On the basis of 2003 estimates, approximately 78 percent of the basin is zoned for industrial land use and rights-of-way are approximately 22 percent of the basin. No residences are located within this basin. The industries within the basin include a number of distribution facilities and a few offices, storage, transportation, and manufacturing facilities (CH2M HILL, 2000a).

Properties located within the basin but nearest to the lagoon side of Swan Island are industrial. Some of these properties discharge stormwater directly to the river. However, the majority of the commercial and industrial facilities within the basin discharge to the City's stormwater system. There were no NPDES permits listed for this drainage basin, and City records show no permitted nonstormwater discharges associated with the basin.

There are two DEQ ECSI sites located within the basin: Automatic Vending (ECSI #1430) and Crosby & Overton (ECSI #877). Automatic Vending is listed in DEQ's ECSI database as having known or potential total petroleum hydrocarbon (TPH) contamination. Crosby & Overton is listed in DEQ's ECSI database as having known or potential PCB contamination.

Characteristics of Sites Adjacent to Outfall

A reconnaissance by the City in 2000 determined that there was no tenant on the property immediately adjacent to Outfall S-2. Freightliner had recently acquired the property approximately 100 feet northwest of the outfall. The City has identified six non-City outfalls between 180 and 470 feet northwest of Outfall S-2, towards the mouth of the lagoon (see Figure 5). Designation for these adjacent owner/occupant outfalls is noted as follows:

- WP-30: Port of Portland
- WP-250: Freightliner
- WP-251: Freightliner
- WP-252: Freightliner
- WP-253: Freightliner
- WP-254: Freightliner

3.4.2 Site Observations

The following observations were noted at Outfall S-2 on October 14, 2002:

- No observations of flow were recorded during the field investigation.
- A shallow (1 foot) erosional channel extended from the outfall to the low tide mark of the riverbank (see Photograph 6 in Appendix C).
- Large amounts of anthropogenic debris and wood were observed around the outfall (see Photograph 6 in Appendix C). Debris included truck tires, large chunks of Styrofoam, and plastic bags.

3.4.3 Sample Observations

Five sediment samples were collected in the vicinity of Outfall S-2. Sample locations are presented in Figure 5. The following is a brief summary of field observations:

- Two samples were collected from the erosional channel within the tidal zone. SI01S2010 was collected below the apparent high tide water line, and SI01S2020 was collected at the low tide water line.
- SI01S2030, SI01S2040, and SI01S2050 were nearshore samples collected below the low tide water line.
- A small amount of anthropogenic debris, including a candy wrapper and plastic tie wrap, was observed in sample SI01S2050, which was collected 100 feet northeast of the outfall discharge confluence with the river.
- A small piece of duct tape was observed in sample SI01S2040, which was collected 100 feet northwest of the outfall discharge confluence with the river. This sample location was adjacent to three non-City outfalls.
- Sediment collected in the erosional channel (SI01S2010 and SI01S2020) and directly offshore of the outfall (SI01S2030) was a coarse, well-graded sand with little or no fines and varying amounts of pea-sized gravel. Sediment collected 100 feet northeast of the outfall discharge confluence with the river was a fine to medium, well-graded sand with little or no fines. Sediment collected 100 feet northwest of the outfall discharge confluence with the river was a coarse, well-graded sand with a thin silt layer on the surface.

3.4.4 Deviations from WP/FSP

Sediment samples at Outfall S-2 were collected in accordance with the WP/FSP. There were no deviations.

- The field team initially estimated the distance between SI01S2040 and SI01S2030 to be 75 feet. However, the measured distance was confirmed to be 97 feet, which is consistent with the WP/FSP.

3.5 Outfall M-3

3.5.1 Background

Outfall Characteristics

Stormwater Outfall M-3 (a 60-inch-diameter pipe) is located in the southeastern corner of the Swan Island lagoon. At low and high river stage, the outfall discharge is below the low tide water line and river water may back up into the outfall. Riprap has been placed along both sides of the outfall pipe, as shown in Photograph 8 (Appendix C). Outside of the riprap zone, the bank is generally sandy with a gentle slope. On October 15, 2002 (low river stage), the outfall was partially submerged at low tide and appeared to be ¾ submerged at the apparent high tide water line.

Sediment trend analysis in the lagoon adjacent to Outfall M-3 indicated that the general sediment trend in the area is "total deposition I" (that is, the sediment bed is not mobile and is a zone of accretion) (Geo Sea Consulting Ltd., 2001). The riverbank is generally sandy and bends at a right angle at the outfall location. There is a small public boat launch 100 feet to the south of the outfall, with a pier that extends approximately 50 feet into the lagoon. Prop wash from boat activity along the dock may have significant effects on sediment transport in the area.

Drainage Basin Characteristics

The stormwater drainage basin served by Outfall M-3 was originally estimated to be approximately 106 acres of land. This basin was re-delineated in 2003 and is now estimated to be 111 acres. A small portion of the basin lies within approximately 100 feet of the shoreline (lagoon side), with the majority of the basin more than 500 feet from the shoreline (lagoon side). On the basis of 2003 estimates, approximately 72 percent of the basin is zoned for industrial land use, and approximately 14 percent is zoned as an employment district. Rights-of-way are approximately 14 percent of the basin. No residences are located within this basin. The industries within the basin include a number of manufacturing, processing, and distribution facilities and a few offices, restaurants, gas stations, and service facilities (CH2M HILL, 2000a).

Properties located within the basin but nearest to the shoreline are a combination of vacant properties and industrial properties. In the basin, there are four facilities with 1200-Z NPDES permits and one facility with a 100-J permit (cooling water discharge). There are two DEQ ECSI sites located within the basin: Fred Meyer (ECSI #44) and Freightliner (ECSI #115). Fred Meyer is listed in DEQ's ECSI database as having known or potential contamination, including: PCBs, organic solvents, phenols, 1,2-dichlorobenzene, bis-2-ethyl-hexyl phthalate, furans, and dioxins. Freightliner is listed in DEQ's ECSI database as having known or potential contamination, including: toluene, ethylbenzene, xylene, cis-1,2-dichloroethene, vinyl chloride, and other solvent/thinner constituents.

Characteristics of Sites Adjacent to Outfall

At the time of the City's site reconnaissance (2000), there was no tenant on the property immediately adjacent to Outfall M-3. A public boat ramp and dock are located just south (approximately 100 feet) of the outfall. There is one DEQ ECSI site located directly north of

Outfall M-3: Island Holdings, Inc. (ECSI #260). Island Holdings, Inc., is listed in DEQ's ECSI database as having known or potential arsenic, chromium, PCB, 2,4-D, and other pesticide contamination. The Island Holdings site is located on property currently occupied by NW Paper Box.

The City has identified one non-City outfall approximately 100 feet north of Outfall M-3 (see Figure 6). Designation for this adjacent owner/occupant outfall is as follows:

- WP-16: NW Paper Box Manufacturing

This outfall discharges at the top of the sloped shoreline and drains overland, ultimately discharging to the Swan Island lagoon close to Outfall M-3.

3.5.2 Site Observations

The following observations were noted at Outfall M-3 on October 14, 2002:

- No evidence of discharge was observed; however, the outfall terminus was partially submerged during the entire sampling effort.
- A clear erosional channel was observed at private outfall WP-16, which is located about 100 feet up the riverbank from Outfall M-3. This channel extended from WP-16 to the apparent river high water line on the riverbank, although there was no indication of recent flow.

Photographs 8 through 10 (Appendix C) were taken at Outfall M-3 during the sediment investigation.

3.5.3 Sample Observations

Five sediment samples were collected in the vicinity of Outfall M-3. Sample locations are presented in Figure 6. The following is a brief summary of field observations:

- SI01M3010 was collected from the erosional channel directly below private outfall WP-16 above the high tide water line.
- Four samples were collected below the low tide water line. SI01M3020 was a nearshore sample collected 10 feet from the outfall. SI01M3030, SI01M3040, and SI01M3050 were offshore samples collected approximately 50 feet from the low tide water line.
- A small amount of anthropogenic debris, including glass and cigarette butts, was observed in sample SI01M3010, which was collected directly below private outfall WP-16.
- A minor sheen developed on the water surface following the collection of sample SI01M3020, which was located 10 feet from the outfall.
- A small amount of anthropogenic debris was observed in the three offshore samples—SI01M3030, SI01M3040, and SI01M3050. Debris included a cigarette butt, a 1-inch piece of clear tape, fishing line, a lead weight, a rubber worm, and a 2-inch-long metal shaving.

- Fecal matter (possibly animal waste) was observed on the surface of sample SI01M3040 (see Photograph 10 in Appendix C).

3.5.4 Deviations from WP/FSP

Sediment samples at Outfall M-3 were collected in accordance with the WP/FSP. There were no deviations.

3.6 Outfall M-2

3.6.1 Background

Outfall Characteristics

Stormwater Outfall M-2 (a 60-inch-diameter pipe) is located on the east side of the Swan Island lagoon. At low river stage, the outfall discharge is above the apparent high tide water line. At high river stage, the high tide water line is above the outfall discharge and river water may back up into the outfall. At low river stage, Outfall M-2 discharges into a large plunge pool approximately 4 feet below the outfall. On October 15, 2002 (low river stage), the low tide water line was observed to be approximately 20 feet from the outfall and the apparent high tide water line extended to the base approximately 3 vertical feet below the outfall. The riverbank, including the plunge pool, was composed of a stiff silt. At low tide the pool beneath the outfall drained to the river via a short narrow channel cut through the stiff silt riverbank.

Sediment trend analysis in the lagoon adjacent to Outfall M-2 indicated that the general sediment trend in the area is "mixed case" that is, the environment undergoes periodic accretion followed by periodic erosion) (Geo Sea Consulting Ltd., 2001). The predicted outfall discharge plume area is sheltered from flow in the main channel of the lagoon by a large pier and boat dock. The pier is located 100 feet to the southeast and extends approximately 50 feet into the lagoon to a dock that runs parallel to the shoreline for approximately 700 feet and is supported by multiple timber pilings. These pilings may create localized sediment shoaling or scouring in this area. During the sediment investigation, conduits for a large dredge were docked along the dock. Prop wash from periodic boat activity associated with the dock and dredge may locally affect sediment adjacent to the outfall.

Drainage Basin Characteristics

Outfall M-2 drains approximately 118 acres of land in the Swan Island area and discharges to the Swan Island lagoon. The stormwater drainage basin lies within 500 feet of the shoreline (lagoon side). On the basis of 2003 estimates, 83.5 percent of the basin is zoned for industrial land use, and 0.5 percent is zoned as rural open space. Rights-of-way are 16 percent of the basin. No residences are located within this basin. The industries within the basin include a number of manufacturing, distribution, and transportation facilities and a few offices, a laboratory, and retail distributors (CH2M HILL, 2000a).

Properties located within the basin but nearest to the shoreline are a combination of commercial properties, industrial properties, and rights-of-way. A few of the properties located on the southwestern edge of the basin are only partially in the basin. Some of these properties also discharge directly to the river. There are four facilities within the basin with 1200-Z NPDES permits. City records show no permitted nonstormwater discharges in the basin. In addition, site drainage goes to a dry well at one facility. There is one DEQ ECSI site located within the basin: GI Trucking (ECSI #1840). GI Trucking is listed in DEQ's ECSI database as having known or potential diesel and bunker fuel contamination.

Characteristics of Sites Adjacent to Outfall

In 1999, Eastern Oregon Fast Freight and Interior Motor Freight were located on the property adjacent to Outfall M-2. Both of these facilities were transportation companies (CH2M HILL, 2000a).

There is one DEQ ECSI site located adjacent to the southwest edge of the basin: Island Holdings Inc. (ECSI #260). Island Holdings Inc. is listed in DEQ's ECSI database as having known or potential contamination, including: chromium, arsenic, PCBs, 2,4-D, and other pesticides. The Island Holdings site is located on property currently occupied by NW Paper Box.

The City has identified five non-City outfalls within approximately 230 feet of Outfall M-2 (see Figure 7). On the basis of information compiled in 1999, the designation for these adjacent owner/occupant outfalls is as follows:

- WP-68: Eastern Oregon Fast Freight (northwest, towards mouth of lagoon)
- WP-72: Dallas & Mavis/Foster Farm (northwest, towards mouth of lagoon)
- WP-73: Dallas & Mavis/Foster Farm (northwest, towards mouth of lagoon)
- WP-74: Dallas & Mavis/Foster Farm (northwest, towards mouth of lagoon)
- WP-185: Eastern Oregon Fast Freight (southeast, towards head of lagoon)

3.6.2 Site Observations

The following observations were noted at Outfall M-2 on October 15, 2002:

- Flow from the outfall was approximately 50 gpm and was clear (see Photograph 11 in Appendix C). However, because City records show no permitted nonstormwater discharges (based on 1999 data) in the basin, the source of this dry-weather flow is unknown.

- Flow from the outfall discharged into a large plunge pool located beneath the outfall. Water in the pool was reddish brown, possibly because of iron-oxidizing bacteria. A minor sheen was observed at the edges of the pool where disturbance from the discharge was minimal (see Photographs 11 and 12 in Appendix C).

- A 1-millimeter (mm)-thick layer of reddish brown silt was observed in the outfall pipe and plunge pool beneath the outfall terminus.

- A moderate, discontinuous sheen was observed 50 feet offshore in the vicinity of sample SIM20130. The source of the sheen was undetermined, but it may have been associated with old creosote-treated pilings that supported a large dock in the area (see Figure 7). A direct correlation of the sheen to the piling could not be made; however, there was no other obvious source of the sheen in the area. Docks and moorage in this area create the potential for over-water work and releases of contaminants.

Photographs 11 through 13 (Appendix C) were taken at Outfall M-2 during the sediment investigation.

3.6.3 Sample Observations

Five sediment samples, one field duplicate, and one equipment blank were collected in the vicinity of Outfall M-2. Sample locations are presented in Figure 7. The following is a brief summary of field observations:

- One sample was collected from above the low tide water line. SI01M2010 was collected approximately 5 feet from the outfall in the plunge pool below the outfall.
- Four samples and one duplicate sample were collected in the river below the low tide water line. SI01M2020, SI01M2040, and SI01M2050 were nearshore samples collected approximately 5 feet from the low tide water line. SI01M2030 and field duplicate sample SI01M2031 were offshore samples collected approximately 50 feet from the low tide water line.
- Sediment along the shore was hard and limited penetration of the van Veen grab sampler to 5 to 10 cm.
- A small amount of anthropogenic debris, including two small pieces of rubber and a 2-inch piece of plastic (apparently from a car taillight), was observed in samples collected close to the outfall.

3.6.4 Deviations from WP/FSP

Sediment samples at Outfall M-2 were collected in accordance with the WP/FSP, with the following exceptions:

- Because of the hard sediments located at the outfall terminus and along the shoreline, penetration of the van Veen grab sampler was limited to 5 to 10 centimeters at shoreline sample locations.

3.7 Outfall M-1

This outfall was not sampled as part of this investigation. Instead, this outfall was sampled as part of the Source Control Pilot Project. Results of this investigation are included in *Phase 1 Data Evaluation Report and Phase 2 Work Planning for City of Portland Outfall M-1* (CH2M HILL, January 2003).

3.8 Outfall 48

3.8.1 Background

Outfall Characteristics

Stormwater Outfall 48 (a 30-inch-diameter pipe) is located on the east side of the river in the upstream corner of the McCormick & Baxter Creosoting cove. The outfall is approximately 500 feet from the main river channel. At low river stage the outfall discharge is above the apparent high tide water line, and at high river stage the high tide water line is above the outfall discharge and river water may back up into the outfall.

Large timbers and other debris tend to accumulate on the riverbank in this area (see Photograph 16). On October 16, 2002 (low river stage), a large amount of timbers and other debris was observed on the riverbank in the vicinity of this outfall. Additionally, sand and other debris had settled in and around the outfall pipe, indicating that at high river stage the water line is above the outfall pipe, allowing water to back into the outfall, and that significant accretion may occur in the outfall pipe and riverbank during these times. The low tide water line was approximately 120 feet from the outfall and the apparent high tide water line was approximately 70 feet from the outfall. The riverbank below the apparent river high water line is sandy and nonvegetated. Above the apparent high water line the bank is sandy and covered with small shrubs, trees, and blackberry vines.

Sediment trend analysis in the river adjacent to Outfall 48 indicated that the general sediment trend in the area is “accretion” (that is, sediment becomes finer in the direction of transport; however, more fine grains are deposited along the transport path than are eroded, with the result that the bed, though mobile, is accreting) (Geo Sea Consulting Ltd., 2001). On a smaller scale, the upstream section of the McCormick & Baxter cove is believed to be subject to back eddies from the main stem, where floating material from upstream and fine sediment within the cove are deposited. This is supported by the accumulation of woody debris in this area and the fine-grained material, as suggested by the relatively high values for total organic carbon found near the high water mark (Sample SI0148010). The probable Outfall 48 discharge plume area is sheltered by the cove from flow in the main river channel. Several rows of timber pilings extend 500 feet into the river and separate the cove from the main river channel. These pilings may create localized sediment shoaling in the area adjacent to the outfall.

Drainage Basin Characteristics

Outfall 48 is a historical CSO; the basin was fully separated in 1997 as part of the Fiske Basin Separation Project. Stormwater from the basin is treated at the Fiske stormwater treatment facility before being discharged back to the City stormwater system (MS4) above Outfall 48. The stormwater drainage basin served by this outfall was originally estimated to be 19 acres. This basin was re-delineated in September 2003 on the basis of a review of plumbing and downspout disconnection records, as discussed in Section 1 of this report. This review showed that many properties (primarily residences) within the basin either remain connected to the combined sewer system (discharging to the CBWTP) or have roof drains that are disconnected from the City stormwater system or combined system and discharge onto the ground. On the basis of this review, the basin boundary was re-delineated to include only right-of-way runoff from this area. Accordingly, the stormwater drainage basin served by this outfall is now estimated to be 6 acres, with 100 percent of the basin being right-of-way. Future analysis of individual properties within the basin could result in additional changes to the basin boundary.

Characteristics of Sites Adjacent to Outfall

Outfall 48 is located on the southern edge of the former McCormick & Baxter Creosoting Co. site and the northern edge of Triangle Park-North Portland Yard. The McCormick & Baxter site is an ECSI site and a Superfund site; the company conducted wood treating processes.

McCormick & Baxter Creosoting Co. is listed in DEQ's ECSI database (ECSI #74) as having known or potential contamination, including: PCP, creosote, copper, chromium, oil, PAHs, arsenic, and dioxins. Triangle Park (also known as Riedel Environmental Services) is an ECSI site as well; the site has been used as a historical lumber yard, electrical power generation station, petroleum pipeline, fuel storage and dispensing site, ironworks, shipbuilding and sandblasting area, transformer storage and cleaning area, and regulated hazardous waste storage area. Triangle Park-North Portland Yard is listed in DEQ's ECSI database (ECSI #277) as having known or potential contamination, including: PCBs, toxic metals (arsenic, barium, chromium, copper, lead, nickel, and zinc), PAHs, TPH, PCP, dioxins, methylene chloride, and asbestos.

There is a third DEQ ECSI site in the vicinity of the basin: a diesel release on N. Edgewater St. (ECSI #1345). The diesel release on N. Edgewater St. is listed in DEQ's ECSI database as having known or potential hydrocarbon fuel contamination.

Arsenic, chromium, and copper were detected at elevated levels in Willamette River sediments near Outfall 48. These are not contaminants that are typically expected in stormwater runoff from transportation. Elevated levels of these contaminants have been detected at McCormick & Baxter and Triangle Park-North Portland Yard.

- The City has not identified any non-City outfalls in the vicinity of Outfall 48; the closest outfall is 400 feet downstream and is the abandoned McCormick & Baxter WP-197 outfall (see Figure 8).

3.8.2 Site Observations

The following observations were noted at Outfall 48 on October 16, 2002:

- There was no discharge from the outfall.
- The outfall terminus was approximately 120 feet from the low tide water mark on the riverbank. There was no clear evidence of an erosional channel between the outfall terminus and the river, and no indication of recent discharge from the outfall.
- A large amount of driftwood was noted in the area surrounding the outfall terminus, including charred wood debris. This charred wood appeared to be from fires on the beach, not from the outfall discharge.
- A significant amount of sand had accumulated in and around the outfall (see Photograph 14), apparently from Willamette River deposition during high river stages.

Photographs 14 through 16 (Appendix C) were taken at Outfall 48 during the sediment investigation.

3.8.3 Sample Observations

Six shallow (less than 15 cm) sediment samples were collected in the vicinity of Outfall 48. Sample locations are presented in Figure 8. The following is a brief summary of field observations:

- Two samples were collected above the apparent high tide water line. SI0148010 was collected 18 feet from the outfall, and SI0148020 was collected 70 feet from the outfall.

Both samples were collected in the presumed discharge pathway, although no clear channel was present.

- Four samples were collected in the river below the low tide water line. SI0148030, SI0148040, and SI0148050 were collected nearshore approximately 5 feet from the low tide water line. SI0148060 was an offshore sample collected approximately 55 feet from the low tide water line.
- Anthropogenic debris was not observed in any of the samples collected in the vicinity of Outfall 48.
- Charred wood was observed in samples collected above the high tide water line (SI0148010 and SI0148020).

3.8.4 Deviations from WP/FSP

Sediment samples at Outfall 48 were collected in accordance with the WP/FSP, with the following exception:

- One additional sample (SI0148060) was collected 50 feet from the shoreline. This sample was collected because there was no clear indication where discharge from the outfall entered the river.

3.9 Outfall 49

3.9.1 Background

Outfall Characteristics

Stormwater Outfall 49 (an 18-inch-diameter pipe) is located on the east side of the river. At low river stage the outfall discharge is above the apparent high tide water line, and at high river stage the high tide water line is above the base of the outfall and river water may back up into the outfall. The riverbank in the vicinity of the outfall is sandy, with cobbles and gravel. On October 17, 2002 (low river stage), the low tide water line was approximately 30 feet from the outfall and the high tide water line was approximately 20 feet from the base of the outfall.

Sediment trend analysis in the river directly adjacent to Outfall 49 indicated that the general sediment trend in the area is “dynamic equilibrium” (that is, there is a grain-by-grain replacement, without accumulation, along the transport path) (Geo Sea Consulting Ltd., 2001). The riverbank is generally straight, with several rows of timber pilings running along the bank and into the river (some of the pilings are within a few feet of the outfall). The rows of pilings extend approximately 50 feet into the river and may have supported an old pier that ran along the riverbank above Outfall 49. These pilings may create localized sediment shoaling or scouring in the vicinity of the outfall.

Drainage Basin Characteristics

Outfall 49 is a historical CSO; the basin was fully separated in 1997 as part of the St. Johns Basin Separation Project. Stormwater from the basin is treated at the Richmond stormwater treatment facility before being discharged back to the City stormwater system (MS4) above

Outfall 49. The stormwater drainage basin served by this outfall was originally estimated to be 64 acres. This basin was re-delineated in September 2003 on the basis of a review of plumbing and downspout disconnection records, as discussed in Section 1 of this report. This review showed that many properties (primarily residences) within the basin either remain connected to the combined sewer system (discharging to the CBWTP) or have roof drains that are disconnected from the City stormwater system or combined system and discharge onto the ground. In addition, areas along the basin boundary that are believed to be pervious were not included in the basin. On the basis of review of individual properties near the basin boundary, the stormwater drainage basin served by this outfall is now estimated to be 45 acres. Future analysis of individual properties within the basin could result in further changes to the basin boundary.

On the basis of 2003 estimates, approximately 6 percent of the basin is zoned commercial, approximately 4 percent is zoned as an employment district, approximately 14 percent is zoned high-density residential, and approximately 34 percent is zoned low-density residential. Rights-of-way are approximately 42 percent of the basin.

Properties located within the basin but nearest the shoreline are a combination of residential properties and rights-of-way. There are no DEQ ECSI sites located within the basin. According to City records, there are no facilities with permitted stormwater or nonstormwater discharges.

Characteristics of Sites Adjacent to Outfall

Willamette Cove (ECSI #2066) is located along the shoreline upstream from stormwater drainage basin 49. The site was formerly used as a lumber mill, plywood mill, barrel manufacturer, and a shipbuilding/repair facility. Although past industrial on-site activities are believed to be likely sources of soil, groundwater and sediment contamination, it is suspected that contamination from the adjacent McCormick & Baxter site (ECSI #74) has affected sediments (and potentially groundwater) at the Willamette Cove site. The shoreline surrounding Outfall 49 is currently vacant and mostly vegetated.

The City has identified two non-City outfalls within 500 feet of Outfall 49 (see Figure 9). Designation for these adjacent owner/occupant outfalls is noted as follows:

- WP-190: Metro (approximately 450 feet upstream of Outfall 49)
- WP-189: Metro (approximately 150 feet downstream of Outfall 49)

3.9.2 Site Observations

The following observations were noted at Outfall 49 on October 17, 2002:

- There was no discharge from the outfall.
- The outfall terminus is approximately 30 feet from the low tide water mark on the riverbank. There was no clear evidence of an erosional channel between the outfall terminus and the river, and no indication of recent discharge from the outfall.

Photographs 17 through 20 (Appendix C) were taken at Outfall 49 during the sediment investigation.

3.9.3 Sample Observations

Six shallow (less than 15 cm) sediment samples, one field duplicate, and one equipment blank were collected in the vicinity of Outfall 49. Sample locations are presented in Figure 9. The following is a brief summary of field observations:

- One sample and one field duplicate were collected on the riverbank above the apparent high tide water line. SI0149010 and SI0149011 were collected 6 feet from the outfall in the predicted discharge flow path.
- Five samples were collected in the river below the low tide water line. SI0149020, SI0149030, SI0149040, and SI0149060 were nearshore samples collected approximately 5 feet from the low tide water line. SI0149060 was collected upriver of the expected discharge point to the river. SI0149050 was an offshore sample collected approximately 60 feet from the low tide water line.
- Anthropogenic debris was not observed in any of the nearshore samples, but a small piece of white plastic was observed in offshore sample SI0149050.

3.9.4 Deviations from WP/FSP

Sediment samples at Outfall 49 were collected in accordance with the WP/FSP. There were no deviations.

3.10 Outfall 50

3.10.1 Background

Outfall Characteristics

Outfall 50 (a 30-inch-diameter pipe) is located on the east side of the river just upstream of the St. Johns Bridge and adjacent to the City of Portland Water Pollution Control Lab. At low river stage the outfall discharge is above the high tide water line, and at high river stage the outfall discharge is below the high tide water line and river water may back up into the outfall. The riverbank below the outfall is gravelly sand with scattered boulders. The riverbank above the outfall is lined with riprap and sparsely vegetated with small trees and shrubs. On October 18, 2002 (low river stage), the low tide water line was approximately 60 feet from the outfall and the apparent high tide water line was approximately 20 feet from the outfall. A shallow erosional channel extended from the base of the outfall to the low tide water line.

Sediment trend analysis in the river directly adjacent to Outfall 50 indicated that the general sediment trend in the area is "mixed case" (that is, the environment undergoes periodic accretion followed by periodic erosion) (Geo Sea Consulting Ltd., 2001). The riverbank is generally straight, with several rows of timber pilings running along the bank and into the river. A small public boat dock is located approximately 300 feet downriver of the outfall, and a short sandy point protrudes into the river at the outfall discharge confluence point with the river. The rows of pilings extend approximately 50 feet into the river and may have supported an old pier that ran along the riverbank above Outfall 50. These pilings may create localized sediment shoaling or scouring in the vicinity of the outfall.

Drainage Basin Characteristics

Outfall 50 was built as a CSO-only outfall but was mostly separated in 1995 as part of the St. Johns Basin Separation Project and is now primarily a stormwater outfall. There is a potential for CSO discharges from this outfall during large storm events. However, by design parameters, there should be no CSO overflows into the river from this outfall; the City's CSO Program is conducting additional modeling to evaluate the potential for overflow. If additional control is needed, this outfall will be addressed by 2006. Stormwater from the basin is treated in a stormwater treatment pond, located upstream of the outfall at the City Water Pollution Control Lab, before it is discharged into the river.

The stormwater drainage basin served by this outfall was originally estimated to be 50 acres. This basin was re-delineated in September 2003 on the basis of a review of plumbing and downspout disconnection records, as discussed in Section 1 of this report. The review showed that many properties (primarily residences) within the basin either remain connected to the combined sewer system (discharging to the CBWTP) or have roof drains that are disconnected from the City stormwater (MS4) or combined system and discharge onto the ground. In addition, areas along the basin boundary that are believed to be pervious were not included in the basin. On the basis of the review of individual properties near the basin boundary, the stormwater drainage basin served by this outfall is now estimated to be 45 acres. Future analysis of individual properties within the basin could result in further changes to the basin boundary.

This stormwater drainage basin is located approximately 100 feet from the shoreline. On the basis of 2003 estimates, approximately 18 percent of the basin is zoned commercial, approximately 19 percent is zoned as an employment district, approximately 19 percent is zoned high-density residential, and approximately 3 percent is zoned low-density residential. Rights-of-way are approximately 41 percent of the basin.

The property nearest the shoreline is that of the City of Portland Water Pollution Control Lab. According to City records, there are no facilities with permitted stormwater or nonstormwater discharges in the basin. There are no DEQ ECSI sites located in the basin.

Characteristics of Sites Adjacent to Outfall

The City of Portland Water Pollution Control Lab is located on the property adjacent to Outfall 50. Cathedral Park and the St. Johns Bridge are located directly downstream of the outfall. The Crawford Street site (ECSI #2363) is located approximately 200 feet east (upstream) of the basin. The site was formerly used for processing lumber and as a machine shop and foundry. Currently, the site is used by Columbia Forge and Machine Works ([CFM] metal forging and stamping), Lampros Steel (steel recycling and distribution center), and TLL Steel (small forging and fabrication business). Import Black Sand (blasting grit) fill in the South Area of the Crawford Street site and along the shoreline below the site has been identified as a potential source of hazardous materials to the Willamette River (Bridgewater Group, Inc., 2000). Concentrations of PAH, chromium, copper, lead, and zinc detected in the black sand located along the shoreline and along the top of the bank above the shoreline exceeded DEQ Sediment Screening Level Values (SSLVs) (Bridgewater Group, Inc., 2002), as well as the DEQ Sediment Baseline Comparison Values.[3] The detection of the same potential contaminants of interest (PCOIs) in Willamette River sediments near the Crawford Street site and the presence of black sand near and along the shoreline suggest that releases to the river from black sand located on the site may have occurred. The City has not identified any non-City outfalls in the vicinity of Outfall 50.

3.10.2 Site Observations

The following observations were noted at Outfall 50 on October 18, 2002:

- Flow from the outfall was observed to be less than 1 gpm, clear, with no apparent odor or sheen. However, because City records show no permitted nonstormwater discharges (based on 1999 data) in the basin, the source of this dry-weather flow is unknown.
- A shallow (2 inches deep) erosion channel extended from the outfall terminus approximately 60 feet to the low tide mark of the riverbank.

Photographs 21 and 22 (Appendix C) were taken at Outfall 50 during the sediment investigation.

3.10.3 Sample Observations

Six shallow (less than 15 cm) sediment samples were collected in the vicinity of Outfall 50. Sample locations are presented in Figure 10. The following is a brief summary of field observations:

- Two samples were collected in the erosional channel above the low tide water line. SI0150010 was collected 8 feet from the outfall above the apparent high tide water line, and SI0150020 was collected 58 feet from the outfall close to the low tide water line.
- Four samples were collected in the river below the low tide water line. SI0150030 and SI0150040 were collected nearshore, downstream of the outfall area, approximately 5 feet from the low tide water line. SI0150050 was collected nearshore and upstream of the outfall discharge area. SI0150060 was an offshore sample collected approximately 65 feet from the low tide water line.
- A minor amount of anthropogenic debris, including paint chips, glass shards, a piece of brick, and a small piece of foil, was observed in three of the nearshore samples.
- A very faint oil sheen was observed on two of the downstream samples (SI0150030 and SI0150040). The sheen was a light discontinuous sheen that developed on top of the pore water during sample homogenization.

3.10.4 Deviations from WP/FSP

Sediment samples at Outfall 50 were collected in accordance with the WP/FSP, with the following exceptions:

- One additional sample was collected in the vicinity of Outfall 50. The terminus of Outfall 50 is approximately 60 feet farther up the riverbank than indicated by the aerial

[3] DEQ Sediment Baseline Comparison Values = Apparent Portland Harbor Sediment Baseline Maximum Values presented in Table 1 of *DEQ Notification Letters to Portland Harbor Property Owners* (DEQ, September 1999).

photograph and GPS coordinates; as a result, an additional sample was collected 58 feet from the outfall terminus on the riverbank.

3.11 Outfall 52

3.11.1 Background

Outfall Characteristics

Outfall 52 (a 30-inch-diameter pipe) is located on the east side of the river. The outfall is submerged and extends approximately 150 feet from the shoreline, approximately 23 feet below the water surface at low river stage.

Sediment trend analysis in the river in the vicinity of Outfall 50 indicated that the general sediment trend in the area is "mixed case" (that is, the environment undergoes periodic accretion followed by periodic erosion) (Geo Sea Consulting Ltd., 2001). The outfall is located approximately 350 feet downriver of the St. Johns Bridge and 200 feet to the southeast upstream of a small public boat launch. A boom made of wooden timbers extends from the boat launch to the base of the St. Johns Bridge at Cathedral Park, passing over the outfall area.

Drainage Basin Characteristics

Outfall 52 was built as a CSO-only outfall but was mostly separated in 1995 as part of the St. Johns Basin Separation Project. It is now primarily a stormwater outfall that drains the former (pre-1990s) Outfall 51 and Outfall 52 stormwater drainage basins. There is a potential for CSO discharges from this outfall during large storm events. However, by design parameters, there should be no CSO overflows into the river from this outfall; the City's CSO Program is conducting additional modeling to evaluate conditions. If additional control is needed, this outfall will be addressed by 2006.

The stormwater drainage basin served by this outfall was originally estimated to be 43.2 acres. This basin was re-delineated in September 2003 on the basis of a review of plumbing and downspout disconnection records, as discussed in Section 1 of this report. This review showed that many properties (primarily residences) within the basin either remain connected to the combined sewer system (discharging to the CBWTP) or have roof drains that are disconnected from the City stormwater system (MS4) or combined system and discharge onto the ground. In addition, some large areas along the basin boundary that are believed to be pervious were not included (e.g., Cathedral Park) in the basin. On the basis of the review of individual properties near the basin boundary, the stormwater drainage basin served by this outfall is now estimated to be 23 acres. Future analysis of individual properties within the basin could result in further changes to the basin boundary.

On the basis of 2003 estimates, approximately 25 percent of the basin is zoned for industrial land use, approximately 24 percent is zoned as an employment district, approximately 11 percent is zoned high-density residential, approximately 2 percent is zoned low-density residential, and approximately 6 percent is zoned rural and open space. Rights–of-way are approximately 32 percent of the basin.

The properties within the basin but nearest the shoreline are a combination of commercial properties and vacant lots. According to City records, there are no facilities with permitted stormwater or non-stormwater discharges. There are no DEQ ECSI sites located within the basin.

Characteristics of Sites Adjacent to Outfall

Cathedral Park is located on the property that surrounds Outfall 52. According to City records, Cathedral Park, which was built between 1972 and 1976, did not have significant structures on it before the park was built. It is believed that at least part of the park was used as a parking/storage area for one of the industrial sites located to the south. Until the 1970s, the Coast Veneer Box Company and the Portland Lumber Mill occupied the area south of the park (CH2M HILL, 2000a).

- The City has not identified any non-City outfalls within close proximity to the outfall, though there may be possible drainage from the deck of the St. Johns Bridge.

3.11.2 Site Observations

The following observations were noted at Outfall 52 on October 23, 2002:

- The outfall terminus is located approximately 150 feet from the shoreline and 23 feet below the surface of the water.
- Observations regarding outfall discharge were not possible because the outfall was completely submerged.
- During sampling at the outfall terminus, several attempts were made before a successful grab was obtained with the van Veen sampler. During these attempts, a large amount of debris was brought to the surface by the sampler, including plastic bags, a compact disk, metal cable, a plastic twist tie, a sock, and pieces of glass.
- A large amount of cobbles, logs, and other debris was observed prior to sampling by a diver in the vicinity of the outfall. The diver collected gravel from inside the outfall using a sample jar. Although this sample was not submitted to the laboratory, it was observed on the surface and was found to contain about 95 percent gravel. A heavy oil sheen coated the gravel (see Photograph 24 in Appendix C).
- During collection of the downriver sample, a large piece of plywood was brought to the surface on the first attempt.

Photographs 23 through 26 (Appendix C) were taken at Outfall 52 during the sediment investigation.

3.11.3 Sample Observations

Three shallow (less than 15 cm) sediment samples were collected in the vicinity of Outfall 52. Sample locations are presented in Figure 11. The following is a brief summary of field observations:

- Small amounts of anthropogenic debris were observed in downriver sample SI0152020 and upriver sample SI0152030.

- A light to moderate oil sheen was observed on downriver sample SI0152020 and upriver sample SI0152030. The sheen was discontinuous and developed on top of the pore water during sample homogenization.

3.11.4 Deviations from WP/FSP

Sediment samples at Outfall 52 were collected in accordance with the WP/FSP, with the following exceptions:

- After an unsuccessful search for Outfall 52 by the CH2M HILL field team, the City of Portland Bureau of Environmental Services (BES) was contacted. BES informed the field team that the outfall terminus may extend into the river. A diver from Fred Devine Diving and Salvage Company was hired to locate the outfall terminus. The diver located the discharge point approximately 150 feet from the shoreline in 23 feet of water and marked it with a plastic float to facilitate sampling.
- The sampling grid was modified to accommodate the submerged location of the outfall. Three samples were collected in line with the outfall terminus: one 15 feet downriver from the outfall terminus, one 65 feet downriver of the outfall terminus, and one 50 feet upriver of the outfall terminus.

3.12 Outfall 52A

3.12.1 Background

Outfall Characteristics

Outfall 52A (a 36-inch-diameter pipe) is located on the east side of the river at river mile 5.5. At low river stage, the outfall is above the high tide water line. On the basis of field observations, it is unclear whether or not the outfall is above the high tide water line at periods of high river stage. On October 17, 2002 (low river stage), the observed low tide water line was approximately 200 feet from the outfall and the apparent high tide water line was approximately 100 feet from the outfall. A drainage ditch extends from the outfall terminus to the apparent high water line. The first 50 feet of the drainage ditch below the outfall was covered with leaves and small twigs. The banks of the ditch were heavily vegetated with blackberry bushes, which had to be cut back in order to access the outfall. This section appears to be above the river high water mark. The second 50 feet of the ditch was moderately vegetated with grass and small weeds, similar to the surrounding bank. Several large timbers and wooden debris crossed the channel approximately 100 feet from the outfall at the apparent high water mark (see Photograph 30). From the apparent high water line to the edge of the river, there is a shallow erosional channel over the gradually sloping beach. The erosional channel runs adjacent to a series of old dry dock footings and discharges into a small, sheltered inlet. The final 100 feet of the channel was tidally influenced. No vegetation covered the bottom of this segment of the channel.

Sediment trend analysis in the river directly adjacent to Outfall 52A indicated that the general sediment trend in the area is "dynamic equilibrium" (that is, there is a grain-by-grain replacement, without accumulation, along the transport path) (Geo Sea Consulting Ltd., 2001). The probable outfall discharge plume area is sheltered from the main river flow by a large pier and ship dock. Over-water work and possible releases of contaminants may be associated with the pier and dry dock. The pier is located approximately 100 feet southeast (upstream) of the outfall discharge confluence point with the river and is supported by multiple timber pilings. The dry dock is located approximately 100 feet from the observed low tide water line. The dock is approximately 300 feet long and is also supported by multiple timber pilings. When a ship is docked at the pier, as was the case during the field investigation, the inlet area is further sheltered from the main flow of the river by the draft of the ship. The pier and dock may reduce the river flow and create localized eddies sufficient to result in increased shoaling behind the dry dock, at the confluence of the outfall erosional channel and the river.

Drainage Basin Characteristics

The stormwater drainage basin served by Outfall 52A was originally estimated to be 39 acres. This basin was re-delineated in September 2003 because the original boundary delineation included areas that likely drained to a combined sewer system that is not a part of the City stormwater system (MS4). Plumbing and downspout disconnection records showed that some properties along the northeastern portion of the boundary likely remain connected to this combined system. Many of the structures throughout this area may also have roof drains that are disconnected from the City stormwater (MS4) or combined system. In addition, some small areas within the basin boundary that are believed to be pervious were not included in the basin. Also removed from the 52A basin coverage was an area along the Mar Com site, including a rail line that is believed either to be pervious surface or to discharge entirely through private outfalls. Accordingly, the stormwater drainage basin served by this outfall is now estimated to be 24 acres.

A more thorough analysis of properties adjacent to the basin boundary needs to be conducted because these properties may have connections to the City stormwater system (MS4 system). Such analyses could result in additional changes to this basin boundary.

The basin is located more than 500 feet from the shoreline. On the basis of 2003 estimates, 50 percent of the basin is zoned for industrial land use, 14.8 percent is zoned as an employment district, 0.4 percent is zoned high-density residential, and 5.1 percent is zoned low-density residential. Rights-of-way are 29.7 percent of the basin.

Most of the industrial property within the basin is approximately 1,000 feet from the shoreline. A portion of the Mar Com property along N. Bradford Street is believed to discharge to the Outfall 52A conveyance system as overland flow. Mar Com is listed in DEQ's ECSI database (ECSI #2350) as having known or potential contamination, including: PAHs, metals, phthalates, and organotins. There are only a few commercial or industrial facilities discharging to the City's stormwater system. One facility within the basin has an NPDES 1200-Z permit, and City records show no permitted nonstormwater discharges associated with the basin.

Characteristics of Sites Adjacent to Outfall

Mar Com, Inc., owns property adjacent to and upstream of Outfall 52A, a portion of which is located within the Outfall 52A drainage basin. Mar Com conducts shipbuilding and repair on the property, and it has facilities to fabricate metal products and industrial machinery as well as conduct sandblasting and painting. These activities have the potential to release metals, PAHs, phthalates, butyl tins, and PCBs. There are several dock structures extending from the shoreline, including one directly offshore from Outfall 52A that supports over-water work. According to the DEQ Site Assessment Program Strategy Recommendation (July 12, 1999), the Mar Com property has been identified as a high-priority site based on DEQ's review of site information, history, and activities (CH2M HILL, 2000).

The City has identified three non-City outfalls within 350 feet southeast (upstream) and 175 feet northwest (downstream) of Outfall 52A (see Figure 12). Designation for these adjacent owner/occupant outfalls is noted as follows (however, other sites may also drain into these private outfalls):

- WP-86: Mar Com
- WP-219: Mar Com
- WP-286: Mar Com (abandoned)

Potential contaminants of interest (PCOIs) detected at elevated levels in river sediments near Outfall 52A included PAHs, copper, lead, and zinc. These constituents were detected at higher levels in sediment samples collected adjacent to the Mar Com site. On February 19, 2002, three surface sediment samples were collected adjacent to the Mar Com site.[4] Two sediment samples were collected in the immediate downstream vicinity of the two active Mar Com stormwater outfalls (Sed-1 and Sed-2). The third sample (Sed-3) was collected immediately downstream from surface water runoff in the vicinity of the active marine ways (Parametrix, 2002). The PAH, copper, lead, and zinc concentrations detected in Mar Com sediment samples exceeded the DEQ Sediment Baseline and High Comparison Values.[5] The table below compares Mar Com sediment sample results with the data collected as part of this sediment investigation. These data suggest that the upstream and/or over-water activities are the source of elevated sediment concentrations.

Comparison of BES and MarCom Sediment Data (from Downstream to Upstream)

Constituent	Units	BES Data—Vicinity of Outfall 52A[1]	BES Data—Upstream or Near Dry-Dock[2]	Mar Com Sed-3[3]	Mar Com Sed-2[3]	Mar Com Sed-1[3]
PAHs	µg/kg	358-3,814	9,752-27,226	2,454	5,759	4,287
Copper	mg/kg	39-173	126-308	118	1150	620
Lead	mg/kg	18-88	25-64	35.2	460	577
Zinc	mg/kg	175-359	153-238	225	2010	388

[1]BES samples SI0152A010, SI 0152A020, and SI 0152A030.
[2]BES samples SI 0152A040 and SI 0152A050.
[3]Parametrix, 2002.

3.12.2 Site Observations

The following observations were noted at Outfall 52A on October 17, 2002, during sample collection:

[4] Sediment was collected from the top 4 to 10 inches of sediment using a Peterson-type sediment sampler (Parametrix, 2002).
[5] DEQ Sediment Baseline Comparison Values = Apparent Portland Harbor Sediment Baseline Maximum Values presented in Table 1 of *DEQ Notification Letters to Portland Harbor Property Owners* (DEQ, September 1999).

- There was no discharge observed from the outfall.
- A deep (approximately 2 feet) erosion channel extends approximately 200 feet from the outfall to the low tide water line (see Photographs 27 through 30 in Appendix C). The high tide water line appeared to extend halfway up the erosional channel. Above the high tide water line there was no indication of recent flow in the erosional channel, as evidenced by the absence of flow patterns in channel detritus.
- The surrounding area is littered with woody debris from the remains of an old dry dock (see Photographs 28 through 30).
- During the field investigation, a large ship was docked at the facility and was apparently being prepared for resurfacing (see Photograph 28 in Appendix C).

Photographs 27 through 31 (Appendix C) were taken at Outfall 52A during the sediment investigation.

3.12.3 Sample Observations

Five shallow (less than 15 cm) sediment samples were collected in the vicinity of Outfall 52A. Sample locations are presented in Figure 12. The following is a brief summary of field observations:

- Three samples were collected from the erosional channel above the low tide water line. SI0152A010 was collected above the apparent high water line directly below the outfall terminus (see Photograph 27). SI0152A020 and SI0152A030 were collected in the lower reach of the channel in the intertidal zone.
- Two offshore samples were collected. SI0152A040 was collected approximately 100 feet from the shoreline and approximately 100 feet upstream (southeast) from the erosional channel's confluence with the river, beneath the Mar Com facility pier. SI0152A050 was collected approximately 100 feet from the shoreline and approximately 150 feet downstream (northwest) from the erosional channel's confluence with the river, adjacent to the Mar Com dry dock.
- A minor amount of anthropogenic debris was observed in three of the samples. A small metal screw was removed from SI0152A010, which was collected directly below the outfall. Small paint chips were observed in SI0152A030, which was collected from the end of the erosional channel, and SI0152A050, which was collected approximately 150 feet downriver. Larger paint chips were removed from the samples before the samples were submitted to the lab. Additionally, a 5-inch-long piece of creosote-treated wood was removed from SI0152A050. This wood was heavily stained, and it left a heavy sheen and creosote odor on the surrounding sediment.

3.12.4 Deviations from Field Sampling Plan

Sediment samples at Outfall 52A were collected in accordance with the WP/FSP, with the following exceptions:

- One additional sample was collected in the vicinity of Outfall 52A. The terminus of Outfall 52A is approximately 200 feet farther up the riverbank and 100 feet farther downriver than indicated by the aerial photograph and GPS coordinates. As a result, an additional sample was collected 126 feet from the outfall terminus on the riverbank.

- A total of five samples were collected in the vicinity of Outfall 52A: three from the erosional channel located between the outfall terminus and the river's edge, one upriver, and one downriver.

3.13 Outfall 53

3.13.1 Background

Outfall Characteristics

Outfall 53 (a 48-inch-diameter pipe) is located on the east side of the river. At low river stage the outfall is above the high tide water line, and at high river stage the outfall is below the high tide water line and river water may back up into the outfall. On October 17, 2002 (low river stage), the low tide water line was approximately 20 feet from the outfall and the high tide water line was approximately 5 feet from the outfall. The riverbank adjacent to Outfall 53 is covered with riprap and fairly steep, with the exception of a small sandy area approximately 100 feet long and 50 feet wide directly downstream of the outfall.

Sediment trend analysis in the river adjacent to Outfall 53 indicated that the general sediment trend in the area is "mixed case" (that is, the environment undergoes periodic accretion followed by periodic erosion) (Geo Sea Consulting Ltd., 2001). The predicted outfall discharge plume area is sheltered from the main river flow by two large piers located approximately 50 feet to the southeast (upstream) and 100 feet to the northwest (downstream). These piers are supported by several large pilings and extend approximately 50 feet into the river to a large dock used for unloading automobiles from large cargo ships. When a ship is docked at the pier, as was the case during the field investigation, the area is further sheltered from the main flow of the river by the draft of the ship. The pier and dock may reduce river flow and create localized eddies sufficient to result in increased shoaling in the vicinity of the outfall. Prop wash from ship movements may also affect sediment movement patterns.

Drainage Basin Characteristics

Outfall 53 was built as a CSO-only outfall but was mostly separated in 1995 as part of the St. Johns Basin Separation Project and is now primarily a stormwater outfall. There is a potential for CSO discharges from this outfall during large storm events. However, by design parameters, there should be no CSO overflows into the river from this outfall; the City's CSO Program is conducting additional modeling to evaluate the potential for overflow. If additional control is needed, this outfall will be addressed by 2006.

The stormwater drainage basin served by this outfall was originally estimated to be 46 acres. This basin was re-delineated in September 2003 on the basis of a review of plumbing and downspout disconnection records, as discussed in Section 1 of this report. This review showed that many properties (primarily residences) within the basin either remain connected to the combined sewer system (discharging to the CBWTP) or have roof drains that are disconnected from the City stormwater (MS4) or combined system and discharge onto the ground. Based on the review of individual properties near the basin boundary, the stormwater drainage basin served by this outfall is now estimated to be 39 acres. Future analysis of individual properties within the basin could result in further changes to the basin boundary.

This stormwater drainage basin is more than 1,500 feet from the shoreline. On the basis of 2003 estimates, 0.6 percent of the basin is zoned for commercial land use, 4.7 percent is zoned high-density residential, and 57.8 percent is zoned low-density residential. Rights-of-way are 36.9 percent of the basin.

The basin properties nearest the shoreline are primarily residential. According to City records, there are no facilities with permitted stormwater or nonstormwater discharges. There are no DEQ ECSI sites located within the basin.

Characteristics of Sites Adjacent to Outfall

The Port of Portland owns property adjacent to Outfall 53 and Toyota operates an automobile receiving yard at this location. There are over-water activities conducted in this area, with the potential for releases of contaminants to the river.

- The City has identified one non-City outfall in close proximity to Outfall 53; WP-167 (owned by the Port of Portland) is about 90 feet downstream of Outfall 53 (see Figure 13).

3.13.2 Site Observations

The following observations were noted at Outfall 53 on October 22, 2002:

- Flow from the outfall was less than 1 gpm, was clear, and had no apparent odor or sheen. A minor amount of white foam had accumulated on the small pools of water below the outfall, as shown in Photographs 33 and 34 (Appendix C). Because City records show no permitted nonstormwater discharges (based on 1999 data) in the basin, the source of this dry-weather flow is unknown.

- Current in front of the outfall was low and appeared to be flowing upstream. However, it was unclear whether only the surface water appeared to be moving upriver as a result of the wind. During the sampling effort, a large ship was docked at the pier in front of the outfall and may have cut off the area from the main flow of the river.

Photographs 32 through 34 (Appendix C) were taken at Outfall 53 during the sediment investigation.

3.13.3 Sample Observations

Five shallow (less than 15 cm) sediment samples were collected in the vicinity of Outfall 53. Sample locations are presented in Figure 13. The following is a brief summary of field observations:

- One sample was collected above the high tide water line. SI0153010 was collected from a small pool directly beneath the outfall, 5 feet from the apparent high tide water line.

- Four samples were collected from below the low tide water line. SI0153020, SI0153040, and SI0153050 were nearshore samples collected approximately 5 feet from the low tide water line. SI0153040 was collected upriver of the outfall. SI0153020 was an offshore sample collected approximately 50 feet from the low tide water line.
- A minor amount of anthropogenic debris was observed in three of the samples. A large paint chip (3 cm) and cellophane wrapper were observed in SI0153010, which was collected directly below the outfall. Paint chips and several small pieces of plastic were observed in SI053030, which was collected in front of the outfall 50 feet from the shoreline. A small paint chip was observed in SI0153050, which was collected 100 feet downstream of the outfall.

3.13.4 Deviations from WP/FSP

Sediment samples at Outfall 53 were collected in accordance with the WP/FSP, with the following exceptions:

- The outfall terminus is located 85 feet upriver and 50 feet closer to the river than shown in the aerial photographs and GPS coordinates. The sampling grid was modified to collect samples within the predicted discharge plume and one sample upstream of the plume. A total of five samples were collected in the vicinity of Outfall 53: one directly below the outfall, two downriver near the shoreline, one upriver near the shoreline, and one 50 feet from the shoreline in front of the outfall.

3.14 Outfall 52C

3.14.1 Background

Outfall Characteristics

Stormwater Outfall 52C (a 36-inch-diameter pipe) is located on the east side of the river at the eastern end of the Terminal 4, Slip 1. At low river stage, the base of the outfall is above the high tide water line. At high river stage, the base of the outfall is below the high tide water line and river water may back up into the outfall. On October 15, 2002 (low river stage), the low tide water line was approximately 20 feet from the outfall and the high tide water line was approximately 3 feet from the outfall. The riverbank adjacent to Outfall 53 is sandy and locally covered with riprap. The bank is lined with numerous timber pilings, most of which extend only a short distance (2 feet) above the ground surface. Discharge from the outfall flowed between the riprap and at low tide into a small pool approximately 8 feet wide and 10 feet long, which drained via a small channel between the riprap.

Sediment trend analysis in the river adjacent to Outfall 52C indicated that the general sediment trend in Slip 1 is “mixed case” (that is, the environment undergoes periodic accretion followed by periodic erosion) (Geo Sea Consulting Ltd., 2001). At the head of Slip 1, there is a row of closely spaced timber pilings that run parallel to the east riverbank. The row of timber pilings may provide a quiescent area where settling of materials from the City outfall and the five non-City outfalls could occur.

Drainage Basin Characteristics

The stormwater drainage basin served by this outfall was originally estimated to be 24 acres. However, a City review of individual property drainage in and around Basin Boundary 52C was conducted in August 2003 and resulted in a revised basin estimate of 22 acres. This re-delineation relied on visual investigations and the review of available information, such as building plans, plumbing records, inspection/file records, and database notes.

This stormwater drainage basin is more than 1,000 feet from the shoreline. On the basis of 2003 estimates, 85 percent of the basin is zoned for industrial land use, and rights-of-way are 15 percent of the basin. The properties within the basin are primarily Toyota Logistics Service, Port of Portland Marine Facility, and several manufacturing/warehouses/storage facilities.

According to City records, there are no facilities with permitted stormwater discharges and only one facility that has nonstormwater discharges. There are two DEQ ECSI sites partially within the basin: Borden Packaging and Industrial Products (ECSI #1277) and Klix Corp. (ECSI #1075). Drainage from the Borden Packaging site into the City's conveyance system is primarily from roof drainage, while drainage from the Klix site is primarily roof drainage and some parking lot drainage. Borden Packaging and Industrial Products is listed in DEQ's ECSI database as having known or potential contamination of chlorinated and alcohol-based solvents. Klix Corp. is listed in DEQ's ECSI database as having known or potential contamination of semivolatile organic compounds (SVOCs), VOCs, DDD, and dichlorodiphenyltrichloroethane (DDT).

Characteristics of Sites Adjacent to Outfall

The Port of Portland owns property adjacent to Outfall 52C. Dry bulk handling has been conducted here since before 1924 (CH2M HILL, 2000a). There is one DEQ ECSI site in the vicinity of the outfall: Port of Portland-Terminal 4 (ECSI #272). Port of Portland-Terminal 4 (Outfall 52C also runs right through this property) is listed in DEQ's ECSI database as having known or potential contamination, including: coal tar pitch, PAHs, diesel fuel, oil, metals, dichlorodiphenyldichloroethylene (DDE), dichlorodiphenyldichloroethane (DDD), solvents, and tributyl tin. Port of Portland-Terminal 4 has been identified by DEQ as a significant source of contaminants to the Willamette River and is currently under early action.

The City has identified six non-City outfalls at the head of Slip 1 (see Figure 14). Designation for these adjacent owner/occupant outfalls is as follows:

- WP-154: International Raw Materials
- WP-177: Port of Portland
- WP-178: Port of Portland
- WP-179: Port of Portland
- WP-180: Port of Portland
- WP-181: Port of Portland

3.14.2 Site Observations

The following observations were noted at Outfall 52C on October 15, 2002:

- At the beginning of the sampling effort, there was no discharge from the outfall. At 10:50 a.m., discharge from the outfall started suddenly with a flow rate of approximately 10 gpm.
- A white foam developed on surface water pooled below the outfall soon after the discharge was noted.
- Much of the surface water in the sampling area was covered with a fine layer of brown, floating particles of an unknown substance for most of the day (see Photograph 38 in Appendix C). The layer dissipated by 4:00 p.m.
- A Port of Portland employee was spraying herbicide in the area above the outfall during sampling. Upon questioning, he stated that he was applying Roundup®.

Photographs 35 through 39 (Appendix C) were taken at Outfall 52C during the sediment investigation.

3.14.3 Sample Observations

Five shallow (less than 15 cm) sediment samples, one field duplicate, and one equipment blank were collected in the vicinity of Outfall 52C. Sample locations are presented in Figure 14. The following is a brief summary of field observations:

- One sample was collected above the low tide water line. SI0152C010 was collected 11 feet from the outfall and approximately 13 feet from the low tide water line.
- Four samples were collected in the river below the low tide water line. SI0152C020, SI0152C030, and SI0152C040 were nearshore samples collected inside the row of tightly spaced pilings. SI0152C050 was an offshore sample collected outside the row of tightly spaced pilings.
- A moderate amount of anthropogenic debris was observed in sample SI0152C010, which was collected directly beneath the outfall. Debris included plastic fragments, pieces of glass, and a glass marble.

3.14.4 Deviations from WP/FSP

Sediment samples at Outfall 52C were collected in accordance with the WP/FSP. There were no deviations.

3.15 Outfall 18

This outfall was not sampled as part of this investigation. Instead, this outfall was sampled as part of the Source Control Pilot Project. Results of this investigation are included in *Phase 1 Data Evaluation Report and Phase 2 Work Planning for City of Portland Outfall 18* (CH2M HILL, November 2003).

3.16 Outfall 19A

3.16.1 Background

Outfall Characteristics

Stormwater Outfall 19A (a 36-inch-diameter pipe) was originally built as an Oregon Department of Transportation (ODOT) outfall and may not be owned by the City. It is located on the west side of the river at river mile 8.2, approximately 150 feet from Outfall 19. The outfall is located in the northwestern (downriver) corner of a cove that is used to dock tugboats and barges. At low river stage, the outfall is above the high tide water line. At high river stage, the outfall is below the high tide water line and river water may back up into the outfall. On October 15, 2002 (low river stage,) the low tide water line was approximately 10 feet from the outfall and the high tide water line was at the base of the outfall but below the bottom of the outfall pipe. Riprap was observed along the side and directly in front of the outfall. The riverbank to the southeast (upriver) was generally sandy, with a gradual slope. The riverbank to the north (downriver) was sandy up to the high tide water line, then changed to a silty material with a gradual slope.

Sediment trend analysis in the river adjacent to Outfall 19A indicated that the general sediment trend in the cove is "dynamic equilibrium" (that is, there is a grain-by-grain replacement, without accumulation, along the transport path) (Geo Sea Consulting Ltd., 2001). The predicted outfall discharge plume area is sheltered from the main river flow by several large docks for tugboats and barges, which may reduce river flow and may create localized eddies sufficient to result in increased shoaling adjacent to the outfall. The area is heavily affected by prop wash from docking ships.

Drainage Basin Characteristics

Outfall 19A drains approximately 4 acres of land and is predominantly Front Avenue right-of-way, with some industrial frontage drainage. The basin lies more than 400 feet from the shoreline. On the basis of 2003 estimates, approximately 31 percent of the basin is zoned for industrial land use, and approximately 69 percent of the basin is right-of-way.

A small portion of Lakeside Industries frontage, along Front Avenue, drains to this outfall. The remainder of this site discharges to dry wells. Lakeside Industries is an asphalt manufacturing facility. City records show no facilities with permitted stormwater discharges or nonstormwater discharges to the conveyance system.

Properties adjacent to or partially in the drainage basin include Calbag Metals (ECSI # 2454), Lakeside Industries (ECSI #2372), and Gunderson (ECSI #1155). Calbag Metals is listed in DEQ's ECSI database as having known or potential contamination for metals. Lakeside Industries is listed in DEQ's ECSI database as having known or potential contamination, including: antimony, barium, cadmium, lead, mercury, silver, zinc, 4-methylphenol, and benzoic acid. Gunderson is listed in DEQ's ECSI database as having known or potential contamination, including: VOCs, PAHs, solvents, PCBs, and metals. It has not been determined if these site significantly contribute to the conveyance system, since most of the drainage is from property frontage rather than from industrial activities.

Characteristics of Sites Adjacent to Outfall

Along the shoreline, adjacent to Outfall 19A, are three DEQ ECSI sites: Shaver Transportation Company (a tugboat and barge company), Lakeside Industries, and Front Avenue LLP (CMI Northwest and Hampton Lumber). Shaver Transportation (ECSI #2377), located adjacent to the outfall, operates a fleet of 11 tugboats and 16 barges, and over-water activities include general ship maintenance activities, such as refueling and oil changes. In June 2003, on the basis of its review of available information, DEQ determined that no further action is needed at the site.

Just upstream of Shaver Transportation and along the shore is Lakeside Industries (ECSI #2372), which is listed in DEQ's ECSI database as having known or potential contamination, including: antimony, barium, cadmium, lead, mercury, silver, zinc, 4-methylphenol, and benzoic acid.

Front Avenue LLP (ECSI #1239) is listed in DEQ's ECSI database as having known or potential contamination, including: antimony, barium, cadmium, lead, mercury, silver, thallium, zinc, 4-methylphenol, and benzoic acid.

There are no non-City outfalls adjacent to Outfall 19A. The closest non-City outfall is approximately 600 feet away (see Figure 15).

3.16.2 Site Observations

The following observations were noted at Outfall 19A on October 18, 2002:

- There was no discharge from the outfall.
- During the sampling effort, two tugboats docked along the pier adjacent to Outfalls 19A and 19. The prop wash from the tugs stirred up the sediment, creating a large sediment plume. As a result of the sediment disturbance, a faint oil sheen developed on the river surface over the entire sampling area.

Photographs 40 through 42 (Appendix C) were taken at Outfall 19A during the sediment investigation.

3.16.3 Sample Observations

Three shallow (less than 15 cm) sediment samples were collected in the vicinity of Outfall 19A. Sample locations are presented in Figure 15. The following is a brief summary of field observations:

- All three samples were collected below the low tide water line.
- A small amount of paint chips and a hydrocarbon sheen were observed on the surface of the pore water from all the samples.

3.16.4 Deviations from WP/FSP

Sediment samples at Outfall 19A were collected in accordance with the WP/FSP. There were no deviations.

3.17 Outfall 19

3.17.1 Background

Outfall Characteristics

Stormwater Outfall 19 (a 42-inch-diameter pipe) is located on the west side of the river at river mile 8.2, approximately 150 feet from Outfall 19A. The outfall is located in the western (downriver) corner of a cove that is used to dock tugboats and barges. The outfall extends into the river and discharges underwater; it is not visible above the river surface at low river stage. The exact location of this outfall was not verified during this sampling event.

Sediment trend analysis in the river adjacent to Outfall 19 indicated that the general sediment trend in the cove is "dynamic equilibrium" (that is, there is a grain-by-grain replacement along the transport path without accumulation) (Geo Sea Consulting Ltd., 2001). The probable outfall discharge plume area is sheltered from the main river flow by several large docks for tugboats and barges, which may reduce river flow and create localized eddies sufficient to result in increased shoaling adjacent to the outfall. The area is heavily affected by prop wash from docking ships.

Drainage Basin Characteristics

Outfall 19 drains approximately 498 acres of land and discharges to the Willamette River. The nearest edge of the basin lies more than 800 feet from the shoreline. On the basis of 2003 estimates, 27.4 percent of the basin is zoned for industrial land, 0.3 percent is zoned low-density residential, and 65 percent is zoned rural and open space. Rights-of-way are 7.3 percent of the basin.

There are five facilities within the basin with 1200-Z NPDES permits. City records show no permitted nonstormwater discharges in the basin. Industries within the basin include: metal finishing/painting, metal fabrication, distribution, manufacturing, offices/warehouses, equipment rental, and asphalt refining facilities (CH2M HILL, 2000b).

There are eight DEQ ECSI sites located in the basin: Anderson Brothers Property (ECSI #970), Brazil & Co. (ECSI #1026), Calbag Metals (ECSI #2454), Dura Industries (ECSI #111), Mt. Hood Chemical Corp. (ECSI #81), Mt. Hood Chemical Property (ECSI #1328), Schnitzer Investment Corp. (ECSI #2442), and PGE-Forest Park (ECSI #2406). The Anderson Brothers Property is listed in DEQ's ECSI database as having known or potential contamination, including: oil, motor oil, Stoddard solvent, paint waste, and solvent wastes. Brazil & Co. is listed in DEQ's ECSI database as having known or potential PCB contamination. Calbag Metals is listed in DEQ's ECSI database as having known or potential metals contamination. Dura Industries is listed in DEQ's ECSI database as having known or potential cadmium, chromium, and lead contamination. Mt. Hood Chemical Corp. (ECSI #81) is listed in DEQ's ECSI database as having known or potential corrosive liquids and methylene chloride contamination. Mt. Hood Chemical Property (ECSI #1328) is listed in DEQ's ECSI database as having known or potential chlorinated solvents contamination. The Schnitzer Investment Corp. is listed in DEQ's ECSI database as having known or potential contamination, including: cadmium, lead, mercury, zinc, barium, silver, and benzoic acid. PGE-Forest Park is listed in DEQ's ECSI database as having known or potential PCB contamination (CH2M HILL, 2000b).

There are three DEQ ECSI sites that are located partially in the basin: Front LP Properties (ECSI #1239), Glacier Northwest Inc. (ECSI #2378), and Unocal-Willbridge Terminal (ECSI #177). Front LP Properties is listed in DEQ's ECSI database as having known or potential contamination, including: waste oil, metals, 4-methylphenol, and benzoic acid. Glacier Northwest Inc. is listed in DEQ's ECSI database as having known or potential bis(2-ethylhexyl)phthalate contamination. The Unocal-Willbridge Terminal site is listed in DEQ's ECSI database as having known or potential contamination, including: diesel, gasoline, and heavy oil, and related constituents (CH2M HILL, 2000b).

Characteristics of Sites Adjacent to Outfall

Along the shoreline, adjacent to Outfall 19, are three DEQ ECSI sites: Shaver Transportation Company (a tugboat and barge company), Lakeside Industries, and Front Avenue LLP (CMI Northwest and Hampton Lumber). Shaver Transportation (ECSI #2377), located adjacent to the outfall, operates a fleet of 11 tugboats and 16 barges, and over-water activities include general ship maintenance activities, such as refueling and oil changes. In June 2003, on the basis of its review of available information, DEQ determined that no further action is needed at the site.

Just upstream of Shaver Transportation and along the shore is Lakeside Industries (ECSI #2372), which is listed in DEQ's ECSI database as having known or potential contamination, including: antimony, barium, cadmium, lead, mercury, silver, zinc, 4-methylphenol, and benzoic acid.

Front Avenue LLP (ECSI #1239) is listed in DEQ's ECSI database as having known or potential contamination, including: antimony, barium, cadmium, lead, mercury, silver, thallium, zinc, 4-methylphenol, and benzoic acid.

There are no non-City outfalls adjacent to Outfall 19. The closest non-City outfall is approximately 600 feet upstream (see Figure 15).

3.17.2 Site Observations

The following observations were noted at Outfall 19 on October 18, 2002:

- Outfall 19 was not located visually because it was completely submerged. Sample locations were identified with the DGPS unit. A Shaver Transportation Company employee claimed to have seen evidence of discharge (that is, bubbles) from the outfall during rain events and confirmed the general location of the outfall.
- During sampling, two tugboats docked along the pier adjacent to Outfalls 19A and 19. The prop wash from the tugs stirred up the sediment, creating a large sediment plume. As a result of the sediment disturbance, a faint oil sheen developed on the river surface over the entire sampling area.
- An oily sheen developed on the surface water of the river after the sediment was disturbed during sampling.

Photograph 43 (Appendix C) was taken at Outfall 19 during the sediment investigation.

3.17.3 Sample Observations

Three shallow (less than 15 cm) sediment samples were collected in the vicinity of Outfall 19. Sample locations are presented in Figure 15. The following is a brief summary of field observations:

- A small amount of paint chips and a hydrocarbon sheen were observed on the surface of all the samples.

3.17.4 Deviations from WP/FSP

Sediment samples at Outfall 19 were collected in accordance with the WP/FSP, with the following exceptions:

- After the large sediment plume (resulting from tugboat prop wash) was observed, the City project manager was contacted. The City project manager determined that the number of samples should be reduced to three because it was believed that a gradient from the outfall would not likely be detectable in this highly disturbed environment.

3.18 Outfall 22

3.18.1 Background

Outfall Characteristics

Stormwater Outfall 22 (a 60-inch-diameter pipe) is located on the west side of the river at river mile 7.7. The outfall is located in the southern (upriver) corner of a cove at the Willbridge Terminal. At low river stage, the outfall is above the high tide water line. At high river stage, the outfall is below the high tide water line and river water may back up into the outfall. On October 15, 2002 (low river stage), the low tide water line was approximately 40 feet from the outfall and the apparent high tide water line was approximately 20 feet from the outfall. Riprap was observed alongside and directly in front of the outfall, while the rest of the riverbank was sandy with a gradual slope. Directly above the outfall, approximately 10 feet from the outfall terminus, is a series of groundwater extraction wells. Four floating containment booms surround the outfall terminus, as shown in Photograph 47 (Appendix C).

Sediment trend analysis in the river adjacent to Outfall 22 indicated that the sediment trend in the cove is “total deposition I” (that is, the sediment bed is not mobile and is a zone of accretion) (Geo Sea Consulting Ltd., 2001). The probable outfall discharge plume area is sheltered from the main river flow by several large docks, which may reduce river flow and create localized eddies sufficient to result in increased shoaling adjacent to the outfall. The area may be heavily affected by prop wash from ships docking.

Drainage Basin Characteristics

Outfall 22 drains approximately 88 acres of land. This basin is approximately 300 feet from the shoreline. On the basis of 2003 estimates, 59.2 percent of the basin is zoned industrial, and 25.4 percent of the basin is zoned rural and open space. Rights-of-way are 15.4 percent of the basin. The properties within the basin that are nearest the shoreline are primarily industrial . A few properties along the border of the drainage basin have discharges to private outfalls. City records show there are two facilities with permitted stormwater discharges and two facilities with nonstormwater discharges.

There are four DEQ ECSI sites located in the basin: Unocal-Willbridge Terminal (ECSI #177), Chevron-Willbridge Distribution Terminal (ECSI #25), the Shell Oil Co.-Willbridge Plant (ECSI #160), and Anderson Brothers Property (ECSI #970). The Unocal-Willbridge Terminal site is currently owned by the Tosco Distribution Company. This site has documented releases of hazardous materials and is listed in DEQ's ECSI database as having known or potential contamination, including: diesel, gasoline, heavy oils, and other related constituents. The Chevron-Willbridge Distribution Terminal site is listed in DEQ's ECSI database as having known or potential petroleum hydrocarbon contamination. Petroleum-contaminated groundwater from the Willbridge Terminal uses the stormline as a conduit to the river, and oil sheens have been noted near the outfall. The Shell Oil Co.-Willbridge Plant is listed in DEQ's ECSI database as having known or potential contamination, including: DDT, chlorinated solvents, petroleum tank bottoms, VOCs, and lead.

The Anderson Brothers Property is listed in DEQ's ECSI database as having known or potential contamination, including: hydrocarbons, paint wastes, and solvents.

The Unocal-Willbridge Terminal (ECSI #177), Chevron-Willbridge Distribution Terminal (ECSI #25), and Shell Oil Co.-Willbridge Plant (ECSI #160) have all been combined into the Willbridge Bulk Fuel Area project (ECSI #1549). Ongoing remedial investigation and interim remedial actions for these sites are now addressed under the Willbridge Bulk Fuel Area. Interim actions have been conducted since 1995 to address free product in groundwater and contaminant seepage into the Willamette River. These included: (1) free-product removal from existing monitoring wells; (2) continued operation of a subsurface cutoff trench; (3) placement of containment booms around seepage areas in the Willamette River; and (4) construction of engineered cutoff walls around the City's stormwater conveyance system that acts as a migration pathway.

The properties within the basin include: chemical manufacturing and distribution facilities, a few restaurants, vehicle repair facilities, offices, storage facilities, and some residential properties (CH2M HILL, 2000b).

Characteristics of Sites Adjacent to Outfall

Outside of the basin, but adjacent to the river, the properties are all industrial. Tosco Distribution Company, a bulk petroleum distribution company, owns property adjacent to Outfall 22.

There are two DEQ ECSI sites outside of the basin within the vicinity of Outfall 22 (within approximately 500 feet of the outfall): McCall Oil (ECSI #134) and Chevron USA Asphalt (ECSI #1281). The McCall Oil site is located just upstream of the outfall and is listed in DEQ's ECSI database as having known or potential contamination, including: petroleum, VOCs, aluminum, barium, cadmium, cobalt, lead, mercury, zinc, 4-methylphenol, butylbenzylphthalate, di-n-octylphthalate, dibenzofuran, LPAHs, and HPAHs. The Chevron USA Asphalt site is located just downstream of the outfall and is listed in DEQ's ECSI database as having known or potential contamination, including: gasoline; benzene, toluene, ethylbenzene, and xylenes (BTEX); PAHs; and phenolic compounds.

The City has identified three non-City outfalls adjacent to or just upstream of Outfall 22 (see Figure 16). Designation for these adjacent owner/occupant outfalls is as follows:

- WP-11: Great Western Chemical (200 feet upstream –two outfall pipes at this location)
- WP-12: Tosco (adjacent)

3.18.2 Site Observations

The following observations were noted at Outfall 22 on October 18, 2002:

- Flow from the outfall was approximately 5 gpm.
- A thick layer of brown foam accumulated in the pool at the outfall terminus (see Photograph 46 in Appendix C).
- A moderate hydrocarbon-like sheen was observed seeping from the riverbank below the outfall terminus (see Photograph 48 in Appendix C).
- Three private outfalls were observed within 225 feet of the outfall. A deep erosional channel was observed in the riverbank approximately 250 feet southeast at the discharge point of two adjacent owner/occupant outfalls. The channel is approximately 3 feet deep and 4 feet wide and extends to the apparent high tide water line.

Photographs 44 through 49 (Appendix C) were taken at Outfall 22 during the sediment investigation.

3.18.3 Sample Observations

Six shallow (less than 15 cm) sediment samples, one field duplicate, and one equipment blank were collected in the vicinity of Outfall 22. Sample locations are presented in Figure 16. The following is a brief summary of field observations:

- All six samples and the field duplicate were collected below the low tide water line.
- A small amount of paint chips and a hydrocarbon sheen were observed on the surface of all the samples.

3.18.4 Deviations from WP/FSP

Sediment samples at Outfall 22 were collected in accordance with the WP/FSP. There were no deviations.

3.19 Outfall 22B

3.19.1 Background

Outfall Characteristics

Stormwater Outfall 22B (a 48-inch-diameter pipe) is located on the west side of the river at river mile 6.8, just upstream of the railroad bridge. At low and high river stage, the outfall is located above the apparent high tide water line. On October 16, 2002, the low tide water line was approximately 250 feet from the outfall and the high tide water line was not recorded.

A shallow erosional channel extended from the outfall terminus to the low tide water line. The upper 50 feet of the channel below the outfall was approximately 0.5 foot deep, 2 feet wide, and lined with a thin (2 cm) silt layer, gravel, small cobbles, and woody debris. The lower 200 feet of the channel was approximately 1 foot wide and 0.5 foot deep and lined with a thin (2 cm) layer of silt, which ended at the apparent high tide water line.

Sediment trend analysis in the river adjacent to Outfall 22B indicated that the general sediment trend in the area is "dynamic equilibrium" (that is, there is a grain-by-grain replacement along the transport path, with no accumulation). (Geo Sea Consulting Ltd., 2001). With the exception of footings from the railroad bridge, the bank is generally straight, without large structures or obvious features that may create localized sediment shoaling or scouring in the vicinity of the outfall.

Drainage Basin Characteristics

Outfall 22B provides drainage for industrial sites and NW Front Avenue. This outfall may also provide overflow drainage for the Gould Battery Superfund site. The drainage basin served by Outfall 22B is approximately 37 acres and is approximately 300 feet from the shoreline. On the basis of 2003 estimates, 81 percent of the basin is zoned industrial, and rights-of-way are 19 percent of the basin.

The properties within the basin include: chemical and industrial gas manufacturing facilities, a solid waste transfer station, and a sanitary pump station (CH2M HILL, 2000b). There are three facilities within the basin with permitted stormwater discharges to the City's conveyance system. City records show no facilities with permitted nonstormwater discharges in the basin.

Historically, much of the area currently drained by Outfall 22B was composed by Doane Lake, a shallow lake and wetland in the floodplain of the Willamette River. The following information about this area is from the DEQ ECSI (#36) Web site. Early in this century, the lake was split into three sections by an elevated railroad line. From the 1920s to the 1940s, heavy industries set up along the shores, filling in most of the remnants of Doane Lake. Northwest of the railroad line, 30,000 cubic yards of coal tar were laid down from a coal gasification plant [this area is now in City Basin 22C]. Southeast of the railroad line, a company engaged in battery "breaking" and lead smelting [Gould – ECSI #49] buried 80,000 tons of lead-bearing material, and discharged 6.5 million gallons of sulfuric acid into the lake. An adjacent agricultural chemical production facility [Rhone-Poulenc Inc.- ECSI #155] discharged wastewaters containing chlorinated phenolic and aromatic compounds, as well as herbicides and insecticides. In addition, highly alkaline calcium hydroxide and mildly radioactive zirconium sands have been landfilled in the area. In 1983, NL/Gould (the "battery breaking" site) was placed on the National Priorities List (NPL). The RI/FS for NL/Gould was completed in 1988. Upon completion of the Doane Lake Study (ECSI #36) in 1990, DEQ decided it would be more efficient to investigate and clean up the sites in the study area individually, rather than attempt a cleanup of the study area as a whole. The Doane Lake Study Area is listed in DEQ's ECSI database as having known or potential contamination, including: chlorophenols, coal tar, creosote, PAHs, herbicides, insecticides, radioactive casting sands, lead, calcium hydroxide sludge, volatile organics, sulfuric acid, and asbestos.

Other DEQ ECSI sites located within the basin include: Gould Inc./NL Industries Inc. (ECSI #49), Schnitzer Investment - Doane Lake (ECSI #395), and Metro Central Transfer Station (ECSI #1398). Gould Inc./NL Industries Inc. is listed in DEQ's ECSI database as having known or potential contamination, including: lead, cadmium, sulfuric acid, zinc, and antimony. Schnitzer Investment - Doane Lake is listed in DEQ's ECSI database as having known or potential contamination, including: calcium hydroxide, lead, arsenic, petroleum hydrocarbons, PCB, chlorinated solvents. Metro Central Transfer Station is listed in DEQ's ECSI database as having known or potential contamination, including: pesticides, herbicides, benzene, and heavy metals.

There is one DEQ ECSI site located partially within the basin: Elf Atochem North America (ATOFINA Chemicals) (ECSI #398). ATOFINA Chemicals is listed in DEQ's ECSI database as having known or potential contamination, including: chlorine, hydrochloric acid, ammonia, sodium hydroxide, asbestos, sodium metabisulfite, sodium bichromate, sulfuric acid monochlorobenzene, and DDT. Some drainage from this site along Front Avenue may enter the City's conveyance system, although most site drainage is served by private outfalls.

Characteristics of Sites Adjacent to Outfall

ATOFINA Chemicals Inc., a chemical manufacturer, occupies the property adjacent to Outfall 22B (ECSI #398). Just downstream of the outfall are the Burlington Northern Railroad and bridge. Wacker Siltronic Corp. (ECSI #183), a semiconductor manufacturer, occupies the property just downstream of the outfall.

Other DEQ ECSI sites that are located outside the basin but in the vicinity of Outfall 22B (within approximately 200 feet of the basin) are: Rhone-Poulenc—East Doane Lake (ECSI #155) and ESCO Corp.-Willbridge Landfill (ECSI #397). Rhone-Poulenc is listed in DEQ's ECSI database as having known or potential contamination, including: 2,4-Dichlorophenoxyacetic acid (2,4-D), 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T), dioxins and furans, isomers of dichlorobenzene, phenolic compounds, creosols, trichloroethene, BTEX, lead, and arsenic. ESCO Corp is listed in DEQ's ECSI database as having known or potential contamination, including: foundry sand, slag, demolition debris, dust, and foundry yard debris (including zirconium sand).

The City has identified two non-City outfalls within close proximity to Outfall 22B. Designation for these adjacent owner/occupant outfalls is as follows:

- WP-06: Rhone-Poulenc
- WP-213: Culvert under Front Avenue

Ownership of WP-213 is unknown; it drains an undeveloped area between the railroad tracks and Front Avenue. Non-City outfall WP-06 is an underwater discharge just offshore from Outfall 22B and conveys site remediation wastewater from the Rhone-Poulenc (RPAC) site.

3.19.2 Site Observations

The following observations were noted at Outfall 22B on October 16, 2002:

- Flow from the outfall was constant and estimated to be between 10 and 25 gpm. However, because City records show no permitted nonstormwater discharges in the basin (based on 1999 data), the source of this dry-weather flow is unknown.
- A thick layer of brown and white foam was observed on the pooled water below the outfall (see Photograph 51 in Appendix C).
- A minor sheen was observed on the pooled water below the outfall.
- An odor similar to bleach was noted in the area around the outfall, but it was not determined whether the odor was coming from the outfall.
- A shallow (6 inches) erosional channel extended from the outfall to the low tide mark of the riverbank. The channel was covered with a 1-cm-thick layer of orange/brown silt from the outfall to the high tide mark on the riverbank (see Photographs 53 and 54 in Appendix C).

Photographs 50 through 57 (Appendix C) were taken at Outfall 22B during the sediment investigation.

3.19.3 Sample Observations

Four shallow (less than 15 cm) sediment samples were collected in the vicinity of Outfall 22B. Sample locations are presented in Figure 17. The following is a brief summary of field observations:

- Two samples were collected above the low tide water line in the erosion channel. SI0122B040 was collected 52.5 feet from the outfall above the high tide water line. SI0122B030 was collected 125 feet from the outfall below the high tide water line.
- Two samples were collected from the river below the low tide water line. SI0122B010 and SI0122B020 were collected approximately 5 feet from the low tide water line. Sample SI0122B020 was collected upriver of the observed discharge of Outfall 22B.
- No anthropogenic debris was observed in the samples.

3.19.4 Deviations from WP/FSP

Sediment samples at Outfall 22B were collected in accordance with the WP/FSP, with the following deviation:

- Sample SI0122B020 was collected 100 feet upstream of SI0122B010 in order to collect a sample upstream of the predicted discharge plume.

3.20 Outfall 22C

3.20.1 Background

Outfall Characteristics

Stormwater Outfall 22C (an 84-inch-diameter pipe) is located on the west side of the river at river mile 6.75, just downstream of the railroad bridge. At low and high river stage, the outfall is located above the apparent high tide water line. On October 17, 2002, the low tide water line was approximately 250 feet from the outfall and the high tide water line was not recorded. The outfall discharged into a large plunge pool, which drained via a shallow erosional channel from the outfall terminus to the low tide water line. The channel was approximately 1 foot wide and 0.5 foot deep and lined with a thin layer of silt, which ended at the apparent high tide water line.

Sediment trend analysis in the river adjacent to Outfall 22C indicated that the general sediment trend in the area is "dynamic equilibrium" (that is, there is a grain-by-grain replacement along the transport path; the bed is neither accreting nor eroding) (Geo Sea Consulting Ltd., 2001). With the exception of footings from the railroad bridge, the bank is generally straight, without large structures or obvious features that may create localized sediment shoaling or scouring in the vicinity of the outfall.

Drainage Basin Characteristics

Outfall 22C provides drainage for upland wetlands, remnants of Doane Lake (see discussion under Outfall 22B), Forest Park streams, and a few industrial sites. The drainage basin served by Outfall 22C is approximately 1,009 acres. On the basis of 2003 estimates, approximately 5 percent of the basin is zoned industrial, and 88 percent of the basin is zoned rural and open space. Rights-of-way are approximately 7 percent of the basin.

The properties located within the basin but nearest the shoreline are primarily industrial. The properties within the basin include: metal fabrication facilities, equipment repair and vehicle salvage facilities, bulk organic chemical manufacturing facilities, and transportation facilities (CH2M HILL, 2000b). City records show two facilities with permitted stormwater discharges and one facility with nonstormwater discharges.

There are two DEQ ECSI sites located within the basin: Koppers Industries Inc. (ECSI #2348) and Santa Fe Pacific Pipeline Co. (ECSI #2104). The DEQ ECSI database says that the Koppers Industries Inc. site evaluation is included in the Strategy Recommendation for Wacker Siltronic Corp. (refer to ECSI #183). Wacker Siltronic Corp. is discussed in the following paragraph. Santa Fe Pacific Pipeline Co. is listed in DEQ's ECSI database as having known or potential contamination, including: 2-methylnaphthalene, carbazole, LPAHs, HPAHs, 2,4-D, and 2,4-DB.

There is one DEQ ECSI site located partially within the basin: Wacker Siltronic Corp. (ECSI #183). Wacker Siltronic Corp. is the site of a historical coal tar gasification plant and is listed in DEQ's ECSI database as having known or potential contamination, including: PAHs, BTEX, phenols, 2,4-D, metals, 2-methylnaphthalene, bis(2-ethylhexyl) phthalate, carbazole, PCP, di-n-butylphthalate, dibenzofuran, DDTs, 2,4-D, and 2,4-DB.

Characteristics of Sites Adjacent to Outfall

Wacker Siltronic Corp., a semiconductor manufacturer, occupies the property adjacent to Outfall 22C (ECSI #183). Just upstream of the outfall are the Burlington Northern Railroad and bridge. ATOFINA Chemicals Inc. (ECSI #398) occupies the property upstream (south) of the outfall.

The City has identified two non-City outfalls upstream and within close proximity to Outfall 22C. Designation for these adjacent owner/occupant outfalls is noted as follows:

- WP-06: Rhone-Poulenc
- WP-213: Culvert under Front Avenue

Ownership of WP-213 is unknown; it drains an undeveloped area between the railroad tracks and Front Avenue. Private outfall WP-06 is an underwater discharge just offshore from City Outfall 22B and conveys site remediation wastewater from the Rhone-Poulenc (RPAC) site.

3.20.2 Site Observations

The following observations were noted at Outfall 22C on October 17, 2002:

- Flow from the outfall was constant and estimated to be between 10 and 25 gpm (see Photograph 59 in Appendix C).
- Flow from the outfall discharged into a large plunge pool located beneath the outfall. Water in the pool was reddish brown because of a large amount of suspended soils, and it had a minor sheen and a thin film layer on top (see Photograph 59 in Appendix C).
- A shallow (approximately 6 inches) erosional channel extended from the plunge pool to the low tide mark of the riverbank. The channel was covered with a 1- to 4-cm-thick layer of reddish brown silt from the outfall to the high tide mark on the riverbank (see Photographs 61, 62, and 63 in Appendix C).

Photographs 58 through 63 (Appendix C) were taken at Outfall 22C during the sampling event.

3.20.3 Sample Observations

Four shallow (less than 15 cm) sediment samples were collected in the vicinity of Outfall 22C. Sample locations are presented in Figure 17. The following is a brief summary of field observations:

- Two samples were collected in the erosional channel above the high tide water line. SI0122C040 was collected 20 feet from the outfall, and SI0122C030 was collected 110 feet from the outfall.
- Two samples were collected in the river below the low tide water line. SI0122C030 was a nearshore sample collected 5 feet from the low tide water line. SI0122C040 was a nearshore sample collected 50 feet from the low tide water line because there was riprap along the shoreline.
- No anthropogenic debris was observed in the samples.

3.20.4 Deviations from WP/FSP

Sediment samples at Outfall 22C were collected in accordance with the WP/FSP. There were no deviations.

3.21 Outfall 23

3.21.1 Background

Outfall Characteristics

Outfall 23 (a 27-inch-diameter pipe) is a historical CSO outfall located on the west side of the river at river mile 5; all flow from this outfall was diverted to the Linnton sanitary sewer interceptor in 1945, and the outfall was plugged in 1992. No stormwater can discharge through this outfall.

Drainage Basin Characteristics

No stormwater discharges from Outfall 23. Some stormwater in the area adjacent to this outfall is captured by the combined system and sent to the CBWTP. Most hillside runoff in this area discharges through non-City outfalls. A review of individual property drainage in and around the basin boundary found that very few properties, if any, have stormwater connections to the combined system. The “stormwater” drainage basin (that discharges to the CBWTP) is shown as a few small “patches” of drainage. It is, in fact, possible that there is actually fewer than 1.8 acres of stormwater captured in this area. Additional research is needed to clarify the nature, extent, and direction of the collection system in this area, as some of the mapping information used may not be current. This may result in additional changes to the “stormwater” drainage basin boundary.

Characteristics of Sites Adjacent to Outfall

Mobil Oil Terminal (ECSI #137) occupies the property adjacent to Outfall 23. This facility conducts bulk petroleum distribution and transportation, some of which takes place at the Mobil Oil dock. Mobil Oil Terminal is listed in DEQ’s ECSI database as having known or potential petroleum contamination. There are documented petroleum releases associated with this site.

The City has not identified any non-City outfalls in close proximity to Outfall 23 (see Figure 18). The closest upstream outfall is WP-209 (Mobil Oil) located approximately 270 feet upstream. Site Observations

The location of the outfall could not be confirmed. The approximate outfall location is shown in Figure 18.

3.21.2 Sample Observations

No samples were collected at the outfall.

3.21.3 Deviations from WP/FSP

Outfall 23 was located according to the aerial photograph and GPS coordinates for the outfall. However, just upstream the field team noted another outfall that was labeled on the map as a private outfall but had a CSO sign next to it. The project manager was contacted and it was decided to forgo sampling at this outfall until more information could be obtained about its status.

At the time that the WP/FSP was developed and implemented, it was not known that Outfall 23 had been plugged and had not discharged for more than 10 years.

3.22 Outfall 24

3.22.1 Background

Outfall Characteristics

Outfall 24 (a 12-inch diameter pipe)is a historical CSO outfall located on the west side of the river at river mile 4.3. In 2000, all flows were diverted to the Linnton sanitary sewer interceptor, and stormwater can no longer discharges through this outfall. In case of a large storm event or pump station failure, combined sewage could discharge through this outfall, but no CSO events have been observed since diversion.

At low and high river stage, the outfall is above the apparent high tide water line. On October 22, 2002, the low tide water line was 230 feet from the outfall and 130 feet from the apparent high tide water line. The outfall is located on the top of a steep, rocky, and heavily vegetated riverbank that extends approximately 30 feet from the outfall. The bank then becomes flat, with a large tidally influenced area.

Sediment trend analysis in the river adjacent to Outfall 24 indicated that the general sediment trend in the area is "mixed case" (that is, the environment undergoes periodic accretion followed by periodic erosion) (Geo Sea Consulting Ltd., 2001). The riverbank is generally straight, without large structures or obvious features that may create localized sediment shoaling or scouring in the vicinity of the outfall.

Drainage Basin Characteristics

The stormwater drainage basin served by this outfall was originally estimated to be 79 acres. After review of the NW 110th CSO Separation Project as-builts, this estimate was revised to 32.7 acres. This basin area represents the acreage of stormwater that is captured and sent to the Columbia Boulevard Water Treatment Plant via the combined system. Hillside runoff that was included in the original estimate for Outfall 24 was determined to be actually discharging through non-City outfalls. The basin boundary was also revised to remove properties that have no obvious connection to the combined system. This includes large portions of land that are undeveloped. Additional research may be required to evaluate whether any hillside stormwater drainage is entering the combined system.

Characteristics of Sites Adjacent to Outfall

At the time of the site reconnaissance (2000), there was no tenant at the property immediately adjacent to Outfall 24. There are a number of ECSI sites along the shoreline and upriver to Outfall 24 that could affect sediment in the vicinity of the outfall. These include (from upstream to downstream): ARCO Bulk Terminal (ECSI #1528), Columbia River Sand & Gravel Inc. (ECSI #2351), Linnton Plywood Association (ECSI #2373), and Babcock Land Company (ECSI #2361). The ARCO Bulk Terminal (also known as BP Atlantic Richfield) site is listed in DEQ's ECSI database as having known or potential petroleum contamination. Columbia River Sand & Gravel is located on the south part of the Linnton Plywood property and the site investigation was included in the Linnton Plywood DEQ ECSI. The

Linnton Plywood Association and Babcock Land Company are shown in DEQ's ECSI database as not having enough information to list the sites on the Confirmed Release List.

- The City has not identified any non-City outfalls in close proximity to Outfall 24 (see Figure 19). The closest upstream outfall is WP-126 (Linnton Plywood), located more than 750 feet upstream.

3.22.2 Site Observations

The following observations were noted at Outfall 24 on October 22, 2002:

- There was no discharge from the outfall.
- The outfall was located 230 feet from the low water mark in a heavily vegetated area with a steep slope.
- A large amount of anthropogenic debris (including steel cans, aluminum cans, glass bottles, car tires, wire, and plastic pieces) was located around the outfall.
- Several small waxy sheens accumulated on the beach as the tide receded. The sheens fragmented when touched, did not feel oily, and had no apparent odor. Digging below the sheen did not reveal any deposits or increase the intensity of the sheen. These sheens appeared to be naturally occurring.

Photographs 64 through 66 (Appendix C) were taken at Outfall 24 during the sampling event.

3.22.3 Sample Observations

Five shallow (less than 15 cm) sediment samples and one equipment blank were collected in the vicinity of Outfall 24. Sample locations are presented in Figure 19. The following is a brief summary of field observations:

- Five samples were collected above the low tide water line. SI0124010 was collected 30 feet from the presumed discharge flow channel above the apparent high tide water line. SI0124020 was collected in the presumed discharge flow path below the high tide water line. SI0124030, SI0124040, and SI0124050 were collected approximately 20 feet above the low tide water line. SI0124030 was collected upriver of the presumed discharge flow path.
- Significant anthropogenic debris, including cloth and a perfume bottle, was removed from SI0124010, which was collected 30 feet below the outfall.
- A light oil sheen was observed and petroleum odor was noted in SI0124050, which was collected 100 feet downstream of the outfall.

3.22.4 Deviations from WP/FSP

Sediment samples at Outfall 24 were collected in accordance with the WP/FSP. There were no deviations. At the time that the WP/FSP was developed and implemented, it was not known that this outfall did not discharge to the river.

SECTION 4

Analytical Results

Analytical results for all sediment samples collected during the Source Control Sediment Investigation for the City of Portland Outfalls are presented in Table 1. Laboratory data sheets and a data validation report are presented in Appendixes E and F, respectively.

SECTION 5

References

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Table

TABLE 1

Outfall Sediment Analytical Data

Class	Analyte	Units*	DEQ Screening Level (High)	DEQ Screening Level (Baseline)	Outfall S-5: SI01S5010 10/21/2002 Normal		SI01S5020 10/21/2002 Normal		SI01S5030 10/21/2002 Normal		SI01S5031 10/21/2002 Duplicate		SI01S5040 10/21/2002 Normal		SI01S5050 10/21/2002 Normal		SI01S5060 10/21/2002 Normal		SI01S5070 10/21/2002 Normal		Outfall S-6: SI01S6010 10/14/2002 Normal		Outfall S-2: SI01S2010 10/14/2002 Normal		SI01S2020 10/14/2002 Normal		SI01S2030 10/14/2002 Normal		SI01S2040 10/14/2002 Normal		SI01S2050 10/14/2002 Normal	
Semivolatile Organics:	1,2,4-Trichlorobenzene	ug/kg	9200	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	1,2-Dichlorobenzene	ug/kg	1700	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	1,3-Dichlorobenzene	ug/kg	300	--	**1320**	**UJ**	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	1,4-Dichlorobenzene	ug/kg	300	--	**1320**	**UJ**	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	2,3,4,6-Tetrachlorophenol	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	2,3,5,6-Tetrachlorophenol	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	2,4,5-Trichlorophenol	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	2,4,6-Trichlorophenol	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	2,4-Dichlorophenol	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	2,4-Dimethylphenol	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	2,4-Dinitrophenol	ug/kg	--	--	6610	UJ	134	UJ	80.4	UJ	77.3	UJ	73.6	UJ	79.7	UJ	840	UJ	79.2	UJ	120	U	84.7	U	76.4	U	81.5	U	83.4	U	81	U
	2,4-Dinitrotoluene	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	2,6-Dinitrotoluene	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	2-Chloronaphthalene	ug/kg	--	--	132	UJ	2.68	UJ	1.61	UJ	1.55	UJ	1.47	UJ	1.59	UJ	16.8	UJ	1.58	UJ	2.4	U	1.69	U	1.53	U	1.63	U	1.67	U	1.62	U
	2-Chlorophenol	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	2-Methylnaphthalene	ug/kg	200	150	132	UJ	2.68	UJ	1.61	UJ	1.55	UJ	1.47	UJ	1.59	UJ	16.8	UJ	1.58	UJ	4.1	J	1.69	U	1.53	U	1.63	U	3.81		1.62	U
	2-Methylphenol	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	2-Nitroaniline	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	2-Nitrophenol	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	3,3'-Dichlorobenzidine	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	3-Nitroaniline	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	4,6-Dinitro-2-Methylphenol	ug/kg	--	--	6610	UJ	134	UJ	80.4	UJ	77.3	UJ	73.6	UJ	79.7	UJ	840	UJ	79.2	UJ	120	U	84.7	U	76.4	U	81.5	U	83.4	U	81	U
	4-Bromophenyl Phenyl Ether	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	4-Chloro-3-Methylphenol	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	4-Chloroaniline	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	4-Chlorophenyl Phenyl Ether	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	4-Methylphenol	ug/kg	--	680	*2640*	*UJ*	53.6	UJ	32.2	UJ	30.9	UJ	29.4	UJ	31.9	UJ	336	UJ	31.7	UJ	47.9	U	33.9	U	30.6	U	32.6	U	33.4	U	32.4	U
	4-Nitroaniline	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	4-Nitrophenol	ug/kg	--	--	6610	UJ	134	UJ	80.4	UJ	77.3	UJ	73.6	UJ	79.7	UJ	840	UJ	79.2	UJ	120	U	84.7	U	76.4	U	81.5	U	83.4	U	81	U
	Acenaphthene	ug/kg	300	180	132	UJ	2.68	UJ	1.61	UJ	1.55	UJ	1.47	UJ	2.79	J	16.8	UJ	2.48	J	4.31	J	2.82	J	1.53	U	6.23		8.75		2.11	J
	Acenaphthylene	ug/kg	200	60	*132*	*UJ*	2.68	UJ	1.61	UJ	1.55	UJ	1.47	UJ	1.59	UJ	16.8	UJ	1.67	J	2.4	U	1.69	U	1.53	U	1.63	U	7.81		1.62	U
	Aniline	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Anthracene	ug/kg	800	150	132	UJ	2.68	UJ	1.61	UJ	1.55	UJ	2.49	J	1.59	UJ	16.8	UJ	4.14	J	4.91		7.68		1.53	U	3.23	J	16		3.89	
	Benzo (a) anthracene	ug/kg	1000	360	132	UJ	2.9	J	1.61	UJ	3.01	J	6.53	J	1.59	UJ	16.8	UJ	1.58	UJ	15.9		15		5.28		13.3		66.6		10.7	
	Benzo (a) pyrene	ug/kg	1500	500	132	UJ	2.68	UJ	1.61	UJ	4.67	J	6.79	J	1.59	UJ	16.8	UJ	11.1	J	26.1		16.9		7.88		14.1		78		12.2	
	Benzo [g,h,i] perylene	ug/kg	300	250	160	J	7.26	J	1.61	UJ	6.69	J	9.41	J	1.59	UJ	16.8	UJ	18.3	J	21.3		22.2		9.92		9.91		62		11.4	
	Benzofluoranthenes	ug/kg	--	--	264	UJ	5.36	UJ	3.22	UJ	10.9	J	13.1	J	3.7	J	33.6	UJ	27.1	J	46.8		47.7		23.7		36		139		25.2	
	Benzoic Acid	ug/kg	--	200	*6610*	*UJ*	134	UJ	80.4	UJ	77.3	UJ	73.6	UJ	79.7	UJ	*840*	*UJ*	79.2	UJ	164	J	372		76.4	U	81.5	U	123	J	81	U
	Benzyl Alcohol	ug/kg	--	20	*1320*	*UJ*	*26.8*	*UJ*	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	*168*	*UJ*	15.8	UJ	*24*	*U*	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Bis(2-Chloroethoxy) Methane	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Bis(2-Chloroethyl) Ether	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Bis(2-Chloroisopropyl) Ether	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Bis(2-Ethylhexyl) Phthalate	ug/kg	800	390	4230	B1 J	30.8	J B1	16.3	J B1	19.3	J B1	20.5	J B1	22.3	J B1	284	J B1	81.3	B1 J	194		321		66.7		94		108		45.7	
	Butyl Benzyl Phthalate	ug/kg	--	20	*1320*	*UJ*	*26.8*	*UJ*	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	*168*	*UJ*	15.8	UJ	28.4	J	118		25	J	16.3	U	21.8	J	16.2	U
	Carbazole	ug/kg	1600	100	*1320*	*UJ*	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	*168*	*UJ*	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Chrysene	ug/kg	1300	425	132	UJ	4.33	J	1.61	UJ	3.76	J	7.58	J	1.59	UJ	16.8	UJ	9.95	J	22.2		32.7		11.2		19.5		86.2		17	
	Di-n-Butyl Phthalate	ug/kg	100	20	***1320***	***UJ***	*26.8*	*UJ*	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	***168***	***UJ***	15.8	UJ	*24*	*U*	46.3		15.3	U	16.3	U	18.9	J	16.2	U
	Di-n-Octyl Phthalate	ug/kg	--	20	*1320*	*UJ*	*26.8*	*UJ*	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	*168*	*UJ*	15.8	UJ	*24*	*U*	165		32.9		53.3		60.1		16.2	U
	Dibenzo (a,h) anthracene	ug/kg	1300	125	*132*	*UJ*	2.68	UJ	1.61	UJ	1.55	UJ	1.47	UJ	1.59	UJ	16.8	UJ	1.58	UJ	2.4	U	1.69	U	1.53	U	1.63	U	37.1		1.62	U
	Dibenzofuran	ug/kg	5100	100	*1320*	*UJ*	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	*168*	*UJ*	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Diethyl Phthalate	ug/kg	600	--	**1320**	**UJ**	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Dimethyl Phthalate	ug/kg	--	20	*1320*	*UJ*	*26.8*	*UJ*	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	*168*	*UJ*	15.8	UJ	*24*	*U*	56.3		15.3	U	16.3	U	23.4	J	16.2	U
	Fluoranthene	ug/kg	2200	600	132	UJ	3.73	J	1.61	UJ	4.7	J	8.17	J	1.59	UJ	54.7	J	20.2	J	29.7		54.7		15.8		24.7		157		26.6	
	Fluorene	ug/kg	600	125	*132*	*UJ*	2.68	UJ	1.61	UJ	1.55	UJ	1.47	UJ	1.59	UJ	16.8	UJ	1.58	UJ	2.88	J	4.31		1.53	U	6.95		8.67		1.92	J
	Hexachlorobenzene	ug/kg	100	--	**1320**	**UJ**	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	**168**	**UJ**	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Hexachlorobutadiene	ug/kg	600	--	**1320**	**UJ**	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Hexachlorocyclopentadiene	ug/kg	400	--	**1320**	**UJ**	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Hexachloroethane	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Indeno (1,2,3-cd) pyrene	ug/kg	100	225	**132**	**UJ**	2.68	UJ	1.61	UJ	3.55	J	9.45	J	1.59	UJ	16.8	UJ	16.8	J	12.5		17.4		12.6		12.5		52.9		9.04	
	Isophorone	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	n-Nitrosodi-n-Propylamine	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	n-Nitrosodimethylamine	ug/kg	--	--	6610	UJ	134	UJ	80.4	UJ	77.3	UJ	73.6	UJ	79.7	UJ	840	UJ	79.2	UJ	120	U	84.7	U	76.4	U	81.5	U	83.4	U	81	U
	n-Nitrosodiphenylamine	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Naphthalene	ug/kg	600	200	132	UJ	2.68	UJ	1.61	UJ	1.55	UJ	1.47	UJ	1.59	UJ	16.8	UJ	1.58	UJ	9.84		3.52		1.53	U	1.63	U	5.48		1.73	J
	Nitrobenzene	ug/kg	--	--	1320	UJ	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	168	UJ	15.8	UJ	24	U	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Pentachlorophenol	ug/kg	1000	97	*1320*	*UJ*	26.8	UJ	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	*168*	*UJ*	15.8	UJ	35.3	J	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Phenanthrene	ug/kg	1200	700	132	UJ	2.68	UJ	1.61	UJ	1.55	UJ	9.86	J	1.59	UJ	30.7	J	11.4	J	11.3		24.8		5.8		7.72		88.9		13.4	
	Phenol	ug/kg	50	20	***1320***	***UJ***	*26.8*	*UJ*	16.1	UJ	15.5	UJ	14.7	UJ	15.9	UJ	***168***	***UJ***	15.8	UJ	*24*	*U*	16.9	U	15.3	U	16.3	U	16.7	U	16.2	U
	Pyrene	ug/kg	1500	700	159	J	5.4	J	3.02	J	6.24	J	15.9	J	5.51	J	106	J	21.9	J	31		59.1		19.1		32		161		28.8	
	Estimated Total LPAHs[1,2]	ug/kg	400	700	--		--		--		--		12		3		31		20		37		43		6		24		139		23	
	Estimated Total HPAHs[1,3]	ug/kg	1000	2400	319		24		3		44		77		9		161		125		206		266		105		162		840		141	
	Estimated Total PAHs[1,4]	ug/kg	23000	--	319		24		3		44		89		12		191		145		243		309		111		186		979		164	
General Chemistry:	Total Organic Carbon	mg/kg	--	20000	14300		43.3	U	709		153	J	882		759		1810		3250		19800		5270		423		811		1050		604	
Chlorinated Herbicides:	2,4,5-T	ug/kg	--	--	2.94	U	NA		NA		NA		NA		NA		NA		NA		5.93	U	4.01	U	NA		NA		NA		NA	
	2,4,5-TP	ug/kg	--	--	2.4	U	NA		NA		NA		NA		NA		NA		NA		4.85	U	3.28	U	NA		NA		NA		NA	
	2,4-D	ug/kg	--	3.3	2.49	U	NA		NA		NA		NA		NA		NA		NA		*5.03*	*U*	*3.41*	*U*	NA		NA		NA		NA	
	2,4-Db	ug/kg	--	5	1.8	U	NA		NA		NA		NA		NA		NA		NA		3.63	U	2.46	U	NA		NA		NA		NA	
	4-Nitrophenol	ug/kg	--	--	1.43	U	NA		NA		NA		NA		NA		NA		NA		2.89	U	1.95	U	NA		NA		NA		NA	
	Dalapon	ug/kg	--	--	1.44	U	NA		NA		NA		NA		NA		NA		NA		2.91	U	1.97	U	NA		NA		NA		NA	
	Dicamba	ug/kg	--	--	1.47	U	NA		NA		NA		NA		NA		NA		NA		2.97	U	2.01	U	NA		NA		NA		NA	
	Dichloroprop	ug/kg	--	--	2.37	U	NA		NA		NA		NA		NA		NA		NA		4.79	U	3.24	U	NA		NA		NA		NA	
	DinosEquip Blank	ug/kg	--	--	2.06	U	NA		NA		NA		NA		NA		NA		NA		4.15	U	2.81	U	NA		NA		NA		NA	
	Mcpa	ug/kg	--	--	2.81	U	NA		NA		NA		NA		NA		NA		NA		5.68	U	3.84	U	NA		NA		NA		NA	
	Mcpp	ug/kg	--	--	1.25	U	NA		NA		NA		NA		NA		NA		NA		2.53	U	1.71	U	NA		NA		NA		NA	
	Pentachlorophenol	ug/kg	1000	97	1.84	U	NA		NA		NA		NA		NA		NA		NA		3.71	U	2.51	U	NA		NA		NA		NA	

TABLE 1

Outfall Sediment Analytical Data

Class	Analyte	Units*	DEQ Screening Level (High)	DEQ Screening Level (Baseline)	Outfall S-5: SI01S5010 10/21/2002 Normal		SI01S5020 10/21/2002 Normal		SI01S5030 10/21/2002 Normal		SI01S5031 10/21/2002 Duplicate		SI01S5040 10/21/2002 Normal		SI01S5050 10/21/2002 Normal		SI01S5060 10/21/2002 Normal		SI01S5070 10/21/2002 Normal	
Total Metals:	Aluminum	mg/kg	--	42800	7370		14500		6160		4240		12700		6390		6590		7900	
	Antimony	mg/kg	64	5	4.56		0.432	J	0.202	J	0.235	J	0.375	J	0.631	J	0.235	J	0.267	J
	Arsenic	mg/kg	33	5	11.6		4.92		2.22		2.15		3.08		5.5		2.08		2.43	
	Cadmium	mg/kg	5	0.6	1.02		0.00286	U	0.00184	U	0.0016	U	0.00163	U	0.00159	U	0.0019	U	0.00189	U
	Chromium	mg/kg	111	41	28.8		21.9		11.1		9.43		18.2		11.2		19.5		16.8	
	Copper	mg/kg	149	60	404	B2	34.5	B2	28.2	B2	16	B2	24.9	B2	23.8	B2	18.5	B2	21.6	B2
	Lead	mg/kg	130	30	86.5	B2	32.1	B2	15.9	B2	26.5	B2	40	B2	23.2	B2	53.3	B2	13.2	B2
	Mercury	mg/kg	1	0.1	0.0785		0.0224	J	0.0139	J	0.0664		0.0729		0.0146	J	0.0879		0.0466	
	Nickel	mg/kg	49	32	17.9	B2	24.8	B2	12.3	B2	10.9	B2	13.8	B2	13	B2	14.6	B2	16.5	B2
	Selenium	mg/kg	5	15	0.0796	U	0.155	U	0.0994	U	0.0865	U	0.0885	U	0.0862	U	0.103	U	0.102	U
	Silver	mg/kg	5	1.4	0.569	B2	0.194	J B2	0.098	J B1	0.122	B2	0.21	B2	0.0984	J B2	0.123	J B2	0.149	B2
	Zinc	mg/kg	459	118	748	B2	155	B2	81.3	B2	103	B2	77.2	B2	122	B2	68.4	B2	63.2	B2
PCBs as Congeners:	PCB-008	ug/kg	--	--	0.28	U	0.45	U	0.32	U	0.31	U	0.34	U	0.35	JP	0.33	U	0.37	U
	PCB-018	ug/kg	--	--	0.28	U	0.44	U	0.31	U	0.3	U	0.33	U	0.3	U	0.33	U	0.37	U
	PCB-028	ug/kg	--	--	0.18	U	0.28	U	0.3	J	0.19	U	0.5	PJ	0.19	U	0.64	J	0.41	J
	PCB-044	ug/kg	--	--	0.54	P	0.25	U	0.18	U	0.17	U	0.19	U	0.17	U	0.19	U	0.21	U
	PCB-052	ug/kg	--	--	16.2		0.4	U	0.28	U	0.27	U	0.3	U	0.27	U	0.57	JP	0.33	U
	PCB-066	ug/kg	--	--	1.35		0.23	U	0.6		0.16	U	0.79		0.32		0.61	P	0.19	U
	PCB-101	ug/kg	--	--	0.87		0.32	U	0.26	J	0.22	U	0.34	J	0.22	U	0.4		0.27	U
	PCB-105	ug/kg	--	--	0.12	U	0.19	U	0.14	U	0.13	U	0.15	U	0.13	U	0.14	U	0.16	U
	PCB-118	ug/kg	--	--	0.52	JP	0.24	U	0.17	U	0.16	U	0.18	U	0.16	U	0.25	JP	0.2	U
	PCB-128	ug/kg	--	--	1.55	P	0.2	U	0.14	U	0.14	U	0.35	J	0.23	JP	0.41	J	0.17	U
	PCB-138	ug/kg	--	--	1.99	P	0.22	U	0.18	JP	0.15	U	0.64	J	0.15	U	0.87		0.23	J
	PCB-153	ug/kg	--	--	4.32		0.28	U	0.62		0.19	U	0.59	P	0.19	U	1.7		0.32	JP
	PCB-170	ug/kg	--	--	3.08		0.22	U	0.16	U	0.15	U	0.2	JP	0.15	U	0.26	JP	0.19	U
	PCB-180	ug/kg	--	--	3.22	P	0.2	U	0.14	U	0.13	U	0.53	J	0.25	J	0.66	J	0.26	JP
	PCB-187	ug/kg	--	--	2.51	P	0.24	U	0.17	U	0.17	U	0.49	P	0.2	JP	1.78		0.27	JP
	Estimated Total PCBs[1,5]	ug/kg	700	180	72.6		--		5.9		--		10.7		4.7		18.0		5.0	
Pesticides:	2,4'-DDD	ug/kg	--	--	2.29	UJ	3.79	UJ	2.59	UJ	2.15	UJ	2.34	UJ	2.17	UJ	2.51	UJ	2.9	UJ
	2,4'-DDE	ug/kg	--	--	2.29	UJ	3.79	UJ	2.59	UJ	2.15	UJ	2.34	UJ	2.17	UJ	2.51	UJ	2.9	UJ
	2,4'-DDT	ug/kg	--	--	2.29	UJ	3.79	UJ	2.59	UJ	2.15	UJ	2.34	UJ	2.17	UJ	2.51	UJ	2.9	UJ
	4,4'-DDD	ug/kg	30	--	0.445	UJ	0.737	UJ	0.504	UJ	0.419	UJ	0.455	UJ	0.423	UJ	0.487	UJ	0.564	UJ
	4,4'-DDE	ug/kg	30	--	0.527	UJ	0.872	UJ	0.597	UJ	0.496	UJ	0.538	UJ	0.5	UJ	0.577	UJ	0.668	UJ
	4,4'-DDT	ug/kg	60	--	3.48	J C1	0.981	UJ	0.672	UJ	0.558	UJ	0.606	UJ	0.563	UJ	0.649	UJ	0.752	UJ
	Estimated Total DDTs[1,6]	ug/kg	--	220	3.48		--		--		--		--		--		--		--	
	4,4'-Methoxychlor	ug/kg	--	--	3.15	UJ	5.22	UJ	3.57	UJ	2.97	UJ	3.22	UJ	2.99	UJ	3.45	UJ	4	UJ
	Aldrin	ug/kg	40	--	0.988	UJ	1.63	UJ	1.12	UJ	0.929	UJ	1.01	UJ	0.938	UJ	1.08	UJ	1.25	UJ
	Alpha-BHC	ug/kg	--	--	0.712	UJ	1.18	UJ	0.806	UJ	0.669	UJ	0.726	UJ	0.676	UJ	0.779	UJ	0.901	UJ
	beta-BHC	ug/kg	--	--	0.97	UJ	1.6	UJ	1.1	UJ	0.911	UJ	0.989	UJ	0.92	UJ	1.06	UJ	1.23	UJ
	Beta-Chlordane	ug/kg	--	--	0.93	UJ	1.54	UJ	1.05	UJ	0.874	UJ	0.949	UJ	0.883	UJ	1.02	UJ	1.18	UJ
	Chlordane	ug/kg	20	--	3.23	UJ	5.33	UJ	3.65	UJ	3.03	UJ	3.29	UJ	3.06	UJ	3.53	UJ	4.08	UJ
	cis-Chlordane	ug/kg	--	--	0.911	UJ	1.51	UJ	1.03	UJ	0.856	UJ	0.929	UJ	0.864	UJ	0.996	UJ	1.15	UJ
	cis-Nonachlor	ug/kg	--	--	2.29	UJ	3.79	UJ	2.59	UJ	2.15	UJ	2.34	UJ	2.17	UJ	2.51	UJ	2.9	UJ
	delta-BHC	ug/kg	--	--	1.37	J C1	1.45	UJ	0.996	UJ	0.827	UJ	0.897	UJ	0.835	UJ	0.962	UJ	1.11	UJ
	Dieldrin	ug/kg	60	--	0.751	UJ	1.24	UJ	0.851	UJ	0.706	UJ	0.767	UJ	0.713	UJ	0.822	UJ	0.952	UJ
	Endosulfan I	ug/kg	--	--	0.975	UJ	1.61	UJ	1.1	UJ	0.917	UJ	0.995	UJ	0.926	UJ	1.07	UJ	1.24	UJ
	Endosulfan II	ug/kg	--	--	0.885	UJ	1.46	UJ	1	UJ	0.832	UJ	0.903	UJ	0.84	UJ	0.969	UJ	1.12	UJ
	Endosulfan Sulfate	ug/kg	--	--	0.833	UJ	1.38	UJ	0.944	UJ	0.784	UJ	0.85	UJ	0.791	UJ	0.912	UJ	1.06	UJ
	Endrin	ug/kg	200	--	0.827	UJ	1.37	UJ	0.936	UJ	0.777	UJ	0.843	UJ	0.785	UJ	0.904	UJ	1.05	UJ
	Endrin Aldehyde	ug/kg	--	--	0.934	UJ	1.54	UJ	1.06	UJ	0.878	UJ	0.953	UJ	0.886	UJ	1.02	UJ	1.18	UJ
	Endrin Ketone	ug/kg	--	--	0.644	UJ	1.06	UJ	0.729	UJ	0.605	UJ	0.657	UJ	0.611	UJ	0.704	UJ	0.815	UJ
	Heptachlor	ug/kg	10	--	0.789	UJ	1.3	UJ	0.893	UJ	0.741	UJ	0.805	UJ	0.749	UJ	0.863	UJ	0.999	UJ
	Heptachlor Epoxide	ug/kg	20	--	0.837	UJ	1.38	UJ	0.948	UJ	0.787	UJ	0.854	UJ	0.794	UJ	0.916	UJ	1.06	UJ
	Hexachlorobenzene	ug/kg	100	--	1.94	J C1	1.89	UJ	1.3	UJ	1.08	UJ	1.17	UJ	1.09	UJ	4.35	C2 J	1.45	UJ
	Hexachlorobutadiene	ug/kg	600	--	1.15	UJ	1.89	UJ	1.3	UJ	1.08	UJ	1.17	UJ	1.09	UJ	1.25	UJ	1.45	UJ
	Hexachloroethane	ug/kg	--	--	1.15	UJ	1.93	J C2	1.3	UJ	1.08	UJ	1.17	UJ	1.09	UJ	1.25	UJ	1.45	UJ
	Lindane	ug/kg	5	--	0.876	UJ	1.45	UJ	0.991	UJ	0.823	UJ	0.893	UJ	0.831	UJ	0.958	UJ	1.11	UJ
	Oxychlordane	ug/kg	--	--	2.29	UJ	3.79	UJ	2.59	UJ	2.15	UJ	2.34	UJ	2.17	UJ	2.51	UJ	2.9	UJ
	Toxaphene	ug/kg	--	--	14.4	UJ	23.7	UJ	16.3	UJ	13.5	UJ	14.6	UJ	13.6	UJ	15.7	UJ	18.2	UJ
	Trans-Nonachlor	ug/kg	--	--	2.29	UJ	3.79	UJ	2.59	UJ	2.15	UJ	2.34	UJ	2.17	UJ	2.51	UJ	2.9	UJ
TPH:	Diesel	mg/kg	--	--	92.2		16.8		4.96	J	3.93	J	24.2		8.74	J	48.7		22.7	
	Lube Oil - NWTPH	mg/kg	--	--	501		64.1		31.9	J	27.9	J	95.8		35.5	J	136		106	

Analyte	Outfall S-6: SI01S6010 10/14/2002 Normal		Outfall S-2: SI01S2010 10/14/2002 Normal		SI01S2020 10/14/2002 Normal		SI01S2030 10/14/2002 Normal		SI01S2040 10/14/2002 Normal		SI01S2050 10/14/2002 Normal	
Aluminum	23300		8060		5840		8410		9130		6120	
Antimony	1.6		0.315		0.699		0.277		0.332		0.188	
Arsenic	4.23		1.49		1.97		3.52		2.19		2.41	
Cadmium	0.00245	U	0.00194	U	0.00161	U	0.00168	U	0.00177	U	0.0017	U
Chromium	48.6		15.6		11.9		12.6		13.9		9.79	
Copper	61.1		21.5		26.7		24.5		31.2		12.8	
Lead	17.7		12.2		8.76		8.46		18		4.59	
Mercury	0.0776		0.0873		0.0218	J	0.0376		0.213		0.0313	
Nickel	29.4		16.8		14		12.6		13.4		9.95	
Selenium	0.133	U	0.105	U	0.087	U	0.0908	U	0.0958	U	0.092	U
Silver	0.49		0.4		14.8		1.43		1.18		0.281	
Zinc	119		65.2		63.5		66.5		79.7		45.6	
PCB-008	0.49	U	0.31	U	0.31	U	0.31	U	0.32	U	0.31	U
PCB-018	0.48	U	0.3	U	0.3	U	0.31	U	0.31	U	0.3	U
PCB-028	0.3	U	0.19	U	0.19	U	0.2	U	0.2	U	0.2	U
PCB-044	0.27	U	0.17	U	0.17	U	0.17	U	0.18	U	0.17	U
PCB-052	0.43	U	0.27	U	0.27	U	1.57	P	0.28	U	0.27	U
PCB-066	0.25	U	0.16	U	0.16	U	0.9		0.23	J	0.16	U
PCB-101	0.35	U	0.22	U	0.22	U	0.69		0.23	U	0.22	U
PCB-105	0.21	U	0.13	U	0.13	U	0.14	U	0.14	U	0.13	U
PCB-118	0.26	U	0.16	U	0.16	U	0.17	U	0.17	U	0.17	U
PCB-128	0.22	U	0.14	U	0.14	U	0.14	U	0.14	U	0.14	U
PCB-138	0.24	U	0.52	JP	0.15	U	0.52	JP	0.16	U	0.15	U
PCB-153	0.3	U	0.63	P	0.19	U	0.56		0.29	J	0.19	U
PCB-170	0.24	U	0.15	U	0.15	U	0.15	U	0.16	U	0.15	U
PCB-180	0.21	U	0.13	U	0.13	U	0.14	U	0.21	J	0.14	U
PCB-187	0.26	U	0.16	U	0.16	U	0.17	U	0.17	U	0.17	U
Estimated Total PCBs[1,5]	--		4.3		--		10.4		3.5		--	
2,4'-DDD	3.59	U	2.56	U	2.49	U	2.13	U	2.65	UJ	2.3	UJ
2,4'-DDE	3.59	U	2.56	U	2.49	U	2.13	U	2.65	UJ	2.3	UJ
2,4'-DDT	3.59	U	2.56	U	2.49	U	2.13	U	2.65	UJ	2.3	UJ
4,4'-DDD	0.698	U	0.498	U	0.485	U	0.415	U	0.515	UJ	0.447	UJ
4,4'-DDE	0.826	U	0.59	U	0.574	U	0.491	U	0.609	UJ	0.529	UJ
4,4'-DDT	0.93	U	0.664	U	0.646	U	0.552	U	0.686	UJ	0.595	UJ
Estimated Total DDTs[1,6]	--		--		--		--		--		--	
4,4'-Methoxychlor	4.94	U	3.53	U	3.43	U	2.94	U	3.65	UJ	3.16	UJ
Aldrin	1.55	U	1.11	U	1.08	U	0.92	U	1.14	UJ	0.991	UJ
Alpha-BHC	1.12	U	0.796	U	0.774	U	0.662	U	0.823	UJ	0.714	UJ
beta-BHC	1.52	U	1.08	U	1.05	U	0.902	U	1.12	UJ	0.972	UJ
Beta-Chlordane	1.46	U	1.04	U	1.01	U	0.865	U	1.08	UJ	0.933	UJ
Chlordane	5.05	U	3.61	U	3.51	U	3	U	3.73	UJ	3.23	UJ
cis-Chlordane	1.43	U	1.02	U	0.991	U	0.847	U	1.05	UJ	0.913	UJ
cis-Nonachlor	3.59	U	2.56	U	2.49	U	2.13	U	2.65	UJ	2.3	UJ
delta-BHC	1.38	U	0.984	U	0.956	U	0.818	U	1.02	UJ	0.882	UJ
Dieldrin	1.18	U	0.841	U	0.817	U	0.699	U	0.869	UJ	0.754	UJ
Endosulfan I	1.53	U	1.09	U	1.06	U	0.908	U	1.13	UJ	0.978	UJ
Endosulfan II	1.39	U	0.99	U	0.963	U	0.824	U	1.02	UJ	0.888	UJ
Endosulfan Sulfate	1.31	U	0.932	U	0.907	U	0.776	U	0.963	UJ	0.836	UJ
Endrin	1.3	U	0.925	U	0.899	U	0.769	U	0.955	UJ	0.829	UJ
Endrin Aldehyde	1.46	U	1.04	U	1.02	U	0.869	U	1.08	UJ	0.937	UJ
Endrin Ketone	1.01	U	0.72	U	0.7	U	0.599	U	0.744	UJ	0.646	UJ
Heptachlor	1.24	U	0.882	U	0.858	U	0.734	U	0.912	UJ	0.791	UJ
Heptachlor Epoxide	1.31	U	0.936	U	0.91	U	0.779	U	0.967	UJ	0.839	UJ
Hexachlorobenzene	1.8	U	1.28	U	1.25	U	1.07	U	1.32	UJ	1.15	UJ
Hexachlorobutadiene	1.8	U	1.28	U	1.25	U	1.07	U	1.32	UJ	1.15	UJ
Hexachloroethane	1.8	U	1.28	U	1.25	U	1.07	U	1.32	UJ	1.15	UJ
Lindane	1.37	U	0.979	U	0.952	U	0.815	U	1.01	UJ	0.878	UJ
Oxychlordane	3.59	U	2.56	U	2.49	U	2.13	U	2.65	UJ	2.3	UJ
Toxaphene	22.5	U	16.1	U	15.6	U	13.4	U	16.6	UJ	14.4	UJ
Trans-Nonachlor	3.59	U	2.56	U	2.49	U	2.13	U	2.65	UJ	2.3	UJ
Diesel	35.8		19.3		16.3		10.5		22.9		5.61	
Lube Oil - NWTPH	78.7		114		31.2		28.8		45.6		15.2	

Notes:

DEQ baseline and high values are used here for screening purposes only. Additional evaluation is needed to develop site-specific risk and/or cleanup concentrations.

*Equipment blank samples reported in liters, not kilograms.

bold The method detection limit exceeds DEQ High Screening Value.

border The reported value exceeds DEQ High Screening Value.

italic The method detection limit exceeds Portland Harbor Baseline Screening Value.

shaded The reported value exceeds Portland Harbor Baseline Screening Value.

[1] Total parameters (i.e., LPAHs, HPAHs, PAHs, PCBs, and DDTs) were calculated based on detections only. Qualifiers are not included on total parameters as it is implied that these are estimated quantities.

[2] Total LPAHs: Includes naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, and 2-methylnaphthalene.

[3] Total HPAHs: Includes fluoranthene, pyrene, benz[a]anthracene, chrysene, benzofluoranthenes, benzo[a]pyrene, indeno[1,2,3-cd]pyrene, dibenz[a,h]anthracene, and benzo[ghi]perylene.

[4] Total PAHs: Represents the sum of Total LPAHs and HPAHs.

[5] Total PCBs: The list of PCB congeners is based on EPA recommendations provided in *QA/QC Guidance for Sampling and Analysis of Sediment, Water, and Tissues for Dredged Material Evaluations,* EPA 823-B-95-001 (April 1995). This list can be used to estimate total PCBs in accordance with the NOAA method provided in NOAA Technical Memorandum NOA OMA 49 (August 1989). Calculations follow the Battelle method: Total PCB = 1.95 (Σ congeners listed) + 2.1.

[6] Total DDTs: Sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.

Qualifiers:

- B1 This analyte was detected in the associated method blank. The concentration was determined not to be significantly higher than the associated method blank (less than 10 times the concentration reported in the blank).
- B2 This analyte was detected in the associated method blank. The analyte concentration in the sample was determined to be significantly higher than the method blank (greater than 10 times the concentration reported in the blank).
- C1 Second column confirmation was performed. The relative percent difference value (RPD) between the results on the two columns was evaluated and determined to be < 40%.
- C2 Second column confirmation was performed. The RPD between the results on the two columns was evaluated and determined to be > 40%. The higher result was reported unless anomalies were noted.
- D5 The analyte exceeded the linear calibration range and the sample was diluted and reanalyzed. The reported result for the analyte has been flagged with "D" and a number representing the additional dilution required to bring the analyte within the calibration range.
- D10 The analyte exceeded the linear calibration range and the sample was diluted and reanalyzed. The reported result for the analyte has been flagged with "D" and a number representing the additional dilution required to bring the analyte within the calibration range.
- J The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.
- U The analyte was not detected above the reported method detection limit.
- UJ The analyte was not detected above the reported method detection limit. However, the reported method detection limit is approximate and may or may not represent the actual method detection limit necessary to accurately and precisely measure the analyte in the sample.
- P The difference between the analyte detected in the front and back column is greater than 40%.

Abbreviations/Definitions:

- -- Not available or applicable
- HPAH high molecular weight polycyclic aromatic hydrocarbons
- LPAH low molecular weight polycyclic aromatic hydrocarbons
- ug/kg micrograms per kilogram
- mg/kg milligrams per kilogram
- NA Not analyzed
- NOAA National Oceanographic and Atmospheric Administration
- PAH polycyclic aromatic hydrocarbon
- PCB polychlorinated biphenyl
- TPH total petroleum hydrocarbon

TABLE 1

Outfall Sediment Analytical Data

Class	Analyte	Units*	DEQ Screening Level (High)	DEQ Screening Level (Baseline)	Outfall M-3										Outfall M-2														Outfall 48											
					SI01M3010 10/14/2002 Normal		SI01M3020 10/14/2002 Normal		SI01M3030 10/14/2002 Normal		SI01M3040 10/15/2002 Normal		SI01M3050 10/15/2002 Normal		SI01M2010 10/15/2002 Normal		SI01M2020 10/15/2002 Normal		SI01M2030 10/15/2002 Normal		SI01M2031 10/15/2002 Duplicate		SI01M2040 10/15/2002 Normal		SI01M2042 10/15/2002 Equip Blank		SI01M2050 10/16/2002 Normal		SI0148010 10/16/2002 Normal		SI0148020 10/16/2002 Normal		SI0148030 10/16/2002 Normal		SI0148040 10/16/2002 Normal		SI0148050 10/16/2002 Normal		SI0148060 10/16/2002 Normal	
Semivolatile Organics:	1,2,4-Trichlorobenzene	ug/kg	9200	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	1,2-Dichlorobenzene	ug/kg	1700	--	**2150**	**UJ**	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	1,3-Dichlorobenzene	ug/kg	300	--	**2150**	**UJ**	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	1,4-Dichlorobenzene	ug/kg	300	--	**2150**	**UJ**	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	2,3,4,6-Tetrachlorophenol	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	NA		20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	2,3,5,6-Tetrachlorophenol	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	NA		20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	28	
	2,4,5-Trichlorophenol	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	2,4,6-Trichlorophenol	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	2,4-Dichlorophenol	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	2,4-Dimethylphenol	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	2,4-Dinitrophenol	ug/kg	--	--	10800	UJ	89.4	U	949	U	949	U	892	U	768	U	861	U	81.3	U	79.1	U	107	U	4.67	U	104	U	944	UJ	66.2	U	78.2	U	78.6	U	83.5	U	139	U
	2,4-Dinitrotoluene	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	2,6-Dinitrotoluene	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	2-Chloronaphthalene	ug/kg	--	--	215	UJ	1.79	U	19	U	19	U	17.8	U	15.4	U	17.2	U	1.63	U	1.58	U	2.15	U	0.0935	U	2.08	U	18.9	UJ	1.32	U	1.56	U	1.57	U	1.67	U	2.78	U
	2-Chlorophenol	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	2-Methylnaphthalene	ug/kg	200	150	309	J	2.86	J	19	U	27.9	J	19.6	J	15.4	U	17.2	U	89.4		5.41		2.15	U	0.234	U	2.08	U	108	J	3.4		13.5		7.45		1.67	U	6.91	
	2-Methylphenol	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	2-Nitroaniline	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	2-Nitrophenol	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	3,3'-Dichlorobenzidine	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	3-Nitroaniline	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	4,6-Dinitro-2-Methylphenol	ug/kg	--	--	10800	UJ	89.4	U	949	U	949	U	892	U	768	U	861	U	81.3	U	79.1	U	107	U	4.67	U	104	U	944	UJ	66.2	U	78.2	U	78.6	U	83.5	U	139	U
	4-Bromophenyl Phenyl Ether	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	4-Chloro-3-Methylphenol	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	4-Chloroaniline	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	4-Chlorophenyl Phenyl Ether	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	4-Methylphenol	ug/kg	--	680	*4310*	*UJ*	35.8	U	380	U	380	U	357	U	307	U	345	U	32.5	U	31.7	U	42.9	U	1.87	U	41.7	U	377	UJ	26.5	U	31.3	U	31.4	U	33.4	U	55.5	U
	4-Nitroaniline	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	4-Nitrophenol	ug/kg	--	--	10800	UJ	89.4	U	949	U	949	U	892	U	768	U	861	U	81.3	U	79.1	U	107	U	4.67	U	104	U	944	UJ	66.2	U	78.2	U	78.6	U	83.5	U	139	U
	Acenaphthene	ug/kg	300	180	*215*	*UJ*	14.2		19	U	147		23.2	J	16.1	J	17.2	U	114		59.6		2.15	U	0.0935	U	2.08	U	104	J	4.98		63.9		21.3		5.7		14.7	
	Acenaphthylene	ug/kg	200	60	503	J	2.82	J	28.5	J	123		34.5	J	15.4	U	17.2	U	19.1		14.1		2.15	U	0.0935	U	2.08	U	139	J	11.3		46.6		34.3		12.4		50.1	
	Aniline	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	NA		20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	Anthracene	ug/kg	800	150	*215*	*UJ*	3.41	J	43		1360		60.5		15.4	U	17.2	U	43.3		55.9		2.15	U	0.0935	U	2.08	U	302	J	29.6		136		77.2		39.9		129	
	Benzo (a) anthracene	ug/kg	1000	360	215	UJ	13.8		89		5570	D10	111		25.8	J	17.6	J	78.7		58.4		2.15	U	0.0935	U	2.08	U	386	J	62.8		149		110		85		174	
	Benzo (a) pyrene	ug/kg	1500	500	215	UJ	13.1		85.7		2600		101		15.4	U	17.2	U	40.5		32.3		2.15	U	0.0935	U	2.08	U	533	J	53		129		83.7		43.6		154	
	Benzo [g,h,i] perylene	ug/kg	300	250	215	UJ	8.71		19	U	854		124		50.7		60.5		25		26.9		2.15	U	0.0935	U	2.08	U	492	J	37.6		87.8		60.1		23.5		101	
	Benzofluoranthenes	ug/kg	--	--	3450	J	24.2		168		4470		204		72.4		93.9		125		76.8		4.29	U	0.187	U	4.17	U	1190	J	118		346		230		124		460	
	Benzoic Acid	ug/kg	--	200	*10800*	*UJ*	89.4	U	*949*	*U*	*949*	*U*	*892*	*U*	*768*	*U*	*861*	*U*	81.3	U	79.1	U	107	U	4.67	U	104	U	*944*	*UJ*	66.2	U	78.2	U	78.6	U	83.5	U	139	U
	Benzyl Alcohol	ug/kg	--	20	*2150*	*UJ*	17.9	U	*190*	*U*	*190*	*U*	*178*	*U*	*154*	*U*	*172*	*U*	16.3	U	15.8	U	*21.5*	*U*	0.935	U	*20.8*	*U*	*189*	*UJ*	13.2	U	15.6	U	15.7	U	16.7	U	*27.8*	*U*
	Bis(2-Chloroethoxy) Methane	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	Bis(2-Chloroethyl) Ether	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	Bis(2-Chloroisopropyl) Ether	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	Bis(2-Ethylhexyl) Phthalate	ug/kg	800	390	33200	J	71.4		1940		3030		4210		565		468		169		147		31.8	JU	4.28	B1	21.2	JU	835	J	13.2	U	40		45.8		17.8	JU	159	
	Butyl Benzyl Phthalate	ug/kg	--	20	*2150*	*UJ*	20.4	J	*190*	*U*	250	J	215	J	*154*	*U*	*172*	*U*	19.2	J	19	J	*21.5*	*U*	0.935	U	*20.8*	*U*	*189*	*UJ*	13.2	U	15.6	U	15.7	U	16.7	U	*27.8*	*U*
	Carbazole	ug/kg	1600	100	**2150**	**UJ**	17.9	U	*190*	*U*	*190*	*U*	*178*	*U*	*154*	*U*	*172*	*U*	16.3	U	15.8	U	21.5	U	NA		20.8	U	213	J	13.2	U	50.3		32		16.7	U	66.3	
	Chrysene	ug/kg	1300	425	215	UJ	16.5		86.6		11100	D10	174		48		51.6		101		83.4		3.14	J	0.0935	U	2.08	U	808	J	75.6		265		152		93.2		308	
	Di-n-Butyl Phthalate	ug/kg	100	20	3790	J	17.9	U	**190**	**U**	359	J	**178**	**U**	**154**	**U**	**172**	**U**	16.3	U	15.8	U	*21.5*	*U*	0.935	U	*20.8*	*U*	**189**	**UJ**	13.2	U	15.6	U	15.7	U	16.7	U	*27.8*	*U*
	Di-n-Octyl Phthalate	ug/kg	--	20	12000	J	17.9	U	*190*	*U*	574		*178*	*U*	1340		302	J	62.6		49.7		*21.5*	*U*	0.935	U	*20.8*	*U*	*189*	*UJ*	13.2	U	15.6	U	15.7	U	16.7	U	*27.8*	*U*
	Dibenzo (a,h) anthracene	ug/kg	1300	125	*215*	*UJ*	1.79	U	19	U	667		17.8	U	15.4	U	17.2	U	1.63	U	1.58	U	2.15	U	0.0935	U	2.08	U	382	J	22.9		50.9		32.2		1.67	U	86	
	Dibenzofuran	ug/kg	5100	100	*2150*	*UJ*	17.9	U	*190*	*U*	*190*	*U*	*178*	*U*	*154*	*U*	*172*	*U*	52.9		15.8	U	21.5	U	0.935	U	20.8	U	*189*	*UJ*	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	Diethyl Phthalate	ug/kg	600	--	**2150**	**UJ**	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	Dimethyl Phthalate	ug/kg	--	20	*2150*	*UJ*	17.9	U	*190*	*U*	*190*	*U*	*178*	*U*	*154*	*U*	*172*	*U*	16.3	U	15.8	U	*21.5*	*U*	0.935	U	*20.8*	*U*	*189*	*UJ*	13.2	U	15.6	U	15.7	U	16.7	U	*27.8*	*U*
	Fluoranthene	ug/kg	2200	600	1750	J	27.1		222		37400	D10	319		102		102		929	D10	638	D10	3.71	J	0.102	J	3.2	J	811	J	104		374		218		94.4		399	
	Fluorene	ug/kg	600	125	*215*	*UJ*	7.99		22	J	367		30.7	J	15.4	U	20.8	J	80.8		54.8		2.15	U	0.0935	U	2.08	U	127	J	6.3		67		29.2		10.8		37.9	
	Hexachlorobenzene	ug/kg	100	--	**2150**	**UJ**	17.9	U	**190**	**U**	**190**	**U**	**178**	**U**	**154**	**U**	**172**	**U**	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	**189**	**UJ**	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	Hexachlorobutadiene	ug/kg	600	--	**2150**	**UJ**	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	Hexachlorocyclopentadiene	ug/kg	400	--	**2150**	**UJ**	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	Hexachloroethane	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	Indeno (1,2,3-cd) pyrene	ug/kg	100	225	**215**	**UJ**	9.72		19	U	739		75.6		26.4	J	17.2	U	26.3		19.3		2.15	U	0.0935	U	2.08	U	381	J	28.5		68.8		51.5		17.9		84.7	
	Isophorone	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	n-Nitrosodi-n-Propylamine	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	n-Nitrosodimethylamine	ug/kg	--	--	10800	UJ	89.4	U	949	U	949	U	892	U	768	U	861	U	81.3	U	79.1	U	107	U	NA		104	U	944	UJ	66.2	U	78.2	U	78.6	U	83.5	U	139	U
	n-Nitrosodiphenylamine	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	Naphthalene	ug/kg	600	200	222	J	2.13	J	19	U	31	J	29.7	J	15.4	U	17.2	U	33.2		5.85		2.15	U	0.234	U	2.08	U	156	J	7.34		26.4		17.6		1.68	J	12.1	
	Nitrobenzene	ug/kg	--	--	2150	UJ	17.9	U	190	U	190	U	178	U	154	U	172	U	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	189	UJ	13.2	U	15.6	U	15.7	U	16.7	U	27.8	U
	Pentachlorophenol	ug/kg	1000	97	***2150***	***UJ***	17.9	U	*190*	*U*	*190*	*U*	*178*	*U*	*154*	*U*	*172*	*U*	16.3	U	15.8	U	21.5	U	0.935	U	20.8	U	799	J	37.3		798	D10	324		36.1		430	
	Phenanthrene	ug/kg	1200	700	215	UJ	17.2		107		11300	D10	158		58.4		56.1		898	D10	640	D10	2.15	U	0.0935	U	2.08	U	416	J	42.1		146		68.5		15.7		74	
	Phenol	ug/kg	50	20	***2150***	***UJ***	17.9	U	***190***	***U***	***190***	***U***	***178***	***U***	***154***	***U***	***172***	***U***	16.3	U	15.8	U	*21.5*	*U*	0.935	U	*20.8*	*U*	***189***	***UJ***	13.2	U	15.6	U	15.7	U	16.7	U	*27.8*	*U*
	Pyrene	ug/kg	1500	700	2310	J	28.3		226		29600	D10	411		125		138		723	D10	525	D10	5.25		0.115	J	3.53	J	680	J	132		378		223		96.1		375	
	Estimated Total LPAHs[1,2]	ug/kg	400	700	1034		51		201		13356		356		75		77		1278		836		--		--		--		1352		105		499		256		86		325	
	Estimated Total HPAHs[1,3]	ug/kg	1000	2400	7510		141		877		93000		1520		450		464		2049		1460		12		0		7		5663		634		1849		1161		578		2142	
	Estimated Total PAHs[1,4]	ug/kg	23000	--	8544		192		1078		106356		1876		525		541		3326		2296		12		0		7		7015		739		2348		1416		664		2466	
General Chemistry:	Total Organic Carbon	mg/kg	--	20000	189000		767		27000		40200		9540		9750		4720		1490		3190		4310		4.22		2970		24500		445		1490		3850		469		34700	
Chlorinated Herbicides:	2,4,5-T	ug/kg	--	--	NA		4.11	U	NA		NA		NA		15.8		NA		NA		NA		NA		0.0491	U	NA		4.08	U	NA		NA		NA		NA		NA	
	2,4,5-TP	ug/kg	--	--	NA		3.36	U	NA		NA		NA		2.95	U	NA		NA		NA		NA		0.0165	U	NA		3.33	U	NA		NA		NA		NA		NA	
	2,4-D	ug/kg	--	3.3	NA		*3.49*	*U*	NA		NA		NA		3.07	U	NA		NA		NA		NA		0.0386	U	NA		*3.46*	*U*	NA		NA		NA		NA		NA	
	2,4-Db	ug/kg	--	5	NA		2.52	U	NA		NA		NA		2.21	U	NA		NA		NA		NA		0.0445	U	NA		2.5	U	NA		NA		NA		NA		NA	
	4-Nitrophenol	ug/kg	--	--	NA		2	U	NA		NA		NA		1.76	U	NA		NA		NA		NA		0.0382	U	NA		1.99	U	NA		NA		NA		NA		NA	
	Dalapon	ug/kg	--	--	NA		2.02	U	NA		NA		NA		1.77	U	NA		NA		NA		NA		0.0485	U	NA		2	U	NA		NA		NA		NA		NA	
	Dicamba	ug/kg	--	--	NA		2.06	U	NA		NA		NA		1.81	U	NA		NA		NA		NA		0.04	U	NA		2.05	U	NA		NA		NA		NA		NA	
	Dichloroprop	ug/kg	--	--	NA		3.32	U	NA		NA		NA		2.92	U	NA		NA		NA		NA		0.0165	U	NA		3.3	U	NA		NA		NA		NA		NA	
	DinosEquip Blank	ug/kg	--	--	NA		2.88	U	NA		NA		NA		2.53	U	NA		NA		NA		NA		0.0474	U	NA		2.86	U	NA		NA		NA		NA		NA	
	Mcpa	ug/kg	--	--	NA		3.94	U	NA		NA		NA		3.46	U	NA		NA		NA		NA		0.0227	U	NA		3.91	U	NA		NA		NA		NA		NA	
	Mcpp	ug/kg	--	--	NA		1.76	U	NA		NA		NA		1.54	U	NA		NA		NA		NA		0.0303	U	NA		1.74	U	NA		NA		NA		NA		NA	
	Pentachlorophenol	ug/kg	1000	97	NA		2.57	U	NA		NA		NA		2.26	U	NA		NA		NA		NA		0.0239	U	NA		312		NA		NA		NA		NA		NA	

TABLE 1
Outfall Sediment Analytical Data

Class	Analyte	Units*	DEQ Screening Level (High)	DEQ Screening Level (Baseline)	Outfall M-3									
					SI01M3010 10/14/2002 Normal		SI01M3020 10/14/2002 Normal		SI01M3030 10/14/2002 Normal		SI01M3040 10/15/2002 Normal		SI01M3050 10/15/2002 Normal	
Total Metals:	Aluminum	mg/kg	--	42800	10800		9210		12000		9930		10400	
	Antimony	mg/kg	64	5	4.92		0.613		1.49		0.908		0.782	
	Arsenic	mg/kg	33	5	7.57		2.21		4.04		5.78	B2	3.87	B2
	Cadmium	mg/kg	5	0.6	46.2		0.00172	U	0.0883	J	0.167	J	0.195	J
	Chromium	mg/kg	111	41	99.6		16.5		22.1		25.2		52.1	
	Copper	mg/kg	149	60	244		21.2		72		43.3	B2	44.6	B2
	Lead	mg/kg	130	30	936		14.6		31.9		31	B2	29	B2
	Mercury	mg/kg	1	0.1	0.769		0.0225	J	0.0398		0.0112	U	0.0162	J
	Nickel	mg/kg	49	32	61.9		19.1		17.8		18.9		23.6	
	Selenium	mg/kg	5	15	0.112	U	0.0933	U	0.0988	U	0.101	U	0.0978	U
	Silver	mg/kg	5	1.4	0.799		0.107		0.216		0.274	B2	0.207	B2
	Zinc	mg/kg	459	118	2850		80.1		236		179	B2	176	B2
PCBs as Congeners:	PCB-008	ug/kg	--	--	0.45	U	0.31	U	0.34	U	0.76	JP	0.35	U
	PCB-018	ug/kg	--	--	2.85	P	0.3	U	0.33	U	0.37	U	0.35	U
	PCB-028	ug/kg	--	--	1.38	P	0.19	U	0.48		0.46	P	0.22	U
	PCB-044	ug/kg	--	--	4.11		0.17	U	0.59	P	0.21	U	0.2	U
	PCB-052	ug/kg	--	--	0.4	U	0.27	U	3.99	P	4.71	P	4.79	P
	PCB-066	ug/kg	--	--	5.98		0.16	U	0.86	P	1.25	P	1.2	P
	PCB-101	ug/kg	--	--	6.16	P	0.22	U	1.3		1.3		1.6	
	PCB-105	ug/kg	--	--	0.2	U	0.13	U	0.15	U	0.16	U	1.75	P
	PCB-118	ug/kg	--	--	0.24	U	0.16	U	1.05		0.75	JP	1.17	P
	PCB-128	ug/kg	--	--	0.21	U	0.14	U	0.38	J	0.76	JP	0.99	P
	PCB-138	ug/kg	--	--	5.4	P	0.15	U	2.76		2.55		3.78	
	PCB-153	ug/kg	--	--	0.28	U	0.19	U	2.18	P	2.06	P	0.22	U
	PCB-170	ug/kg	--	--	0.23	U	0.15	U	1.09	P	0.19	U	1.75	P
	PCB-180	ug/kg	--	--	0.2	U	0.13	U	2.85		1.72		3.43	
	PCB-187	ug/kg	--	--	0.24	U	0.16	U	1.36		1.67		1.44	
	Estimated Total PCBs[1,5]	ug/kg	700	180	52.6		--		38.9		37.2		44.8	
Pesticides:	2,4'-DDD	ug/kg	--	--	61.8	UJ	2.53	U	25.9	UJ	3.82	J C1	2.7	U
	2,4'-DDE	ug/kg	--	--	61.8	UJ	2.53	U	25.9	UJ	2.94	U	2.7	U
	2,4'-DDT	ug/kg	--	--	61.8	UJ	2.53	U	25.9	UJ	2.94	U	2.7	U
	4,4'-DDD	ug/kg	30	--	40.6	J C2	0.492	U	5.04	UJ	1.85	J C2	0.524	U
	4,4'-DDE	ug/kg	30	--	14.2	UJ	0.583	U	5.97	UJ	0.676	U	0.62	U
	4,4'-DDT	ug/kg	60	--	48	J C2	0.656	U	6.72	UJ	0.761	U	0.698	U
	Estimated Total DDTs[1,6]	ug/kg	--	220	88.60		--		--		1.85		--	
	4,4'-Methoxychlor	ug/kg	--	--	85	UJ	3.49	U	35.7	UJ	4.04	U	3.71	U
	Aldrin	ug/kg	40	--	26.6	UJ	1.09	U	11.2	UJ	1.27	U	1.16	U
	Alpha-BHC	ug/kg	--	--	19.2	UJ	0.786	U	8.06	UJ	0.913	U	0.837	U
	beta-BHC	ug/kg	--	--	26.1	UJ	1.07	U	11	UJ	1.24	U	1.14	U
	Beta-Chlordane	ug/kg	--	--	25.1	UJ	1.03	U	10.5	UJ	1.19	U	1.09	U
	Chlordane	ug/kg	20	--	**86.9**	**UJ**	3.56	U	**36.5**	**UJ**	4.14	U	3.8	U
	cis-Chlordane	ug/kg	--	--	24.5	UJ	1.01	U	10.3	UJ	1.17	U	1.07	U
	cis-Nonachlor	ug/kg	--	--	61.8	UJ	2.53	U	25.9	UJ	2.94	U	2.7	U
	delta-BHC	ug/kg	--	--	23.7	UJ	0.971	U	9.96	UJ	1.13	U	1.03	U
	Dieldrin	ug/kg	60	--	20.3	UJ	0.83	U	8.51	UJ	0.963	U	0.884	U
	Endosulfan I	ug/kg	--	--	26.3	UJ	1.08	U	11	UJ	1.25	U	1.15	U
	Endosulfan II	ug/kg	--	--	23.9	UJ	0.978	U	10	UJ	1.14	U	1.04	U
	Endosulfan Sulfate	ug/kg	--	--	22.5	UJ	0.921	U	9.44	UJ	6.91	C1	0.981	U
	Endrin	ug/kg	200	--	22.3	UJ	0.913	U	9.36	UJ	1.06	U	0.973	U
	Endrin Aldehyde	ug/kg	--	--	25.2	UJ	1.03	U	10.6	UJ	1.2	U	1.1	U
	Endrin Ketone	ug/kg	--	--	17.4	UJ	0.711	U	7.29	UJ	0.825	U	0.757	U
	Heptachlor	ug/kg	10	--	**21.3**	**UJ**	0.871	U	8.93	UJ	1.01	U	0.928	U
	Heptachlor Epoxide	ug/kg	20	--	**22.6**	**UJ**	0.925	U	9.48	UJ	2.63	J C1	0.985	U
	Hexachlorobenzene	ug/kg	100	--	30.9	UJ	1.27	U	13	UJ	1.47	U	1.35	U
	Hexachlorobutadiene	ug/kg	600	--	30.9	UJ	1.27	U	13	UJ	1.47	U	1.35	U
	Hexachloroethane	ug/kg	--	--	30.9	UJ	1.27	U	13	UJ	1.47	U	1.35	U
	Lindane	ug/kg	5	--	**23.6**	**UJ**	0.967	U	**9.91**	**UJ**	1.12	U	1.03	U
	Oxychlordane	ug/kg	--	--	61.8	UJ	2.53	U	25.9	UJ	2.94	U	2.7	U
	Toxaphene	ug/kg	--	--	387	UJ	15.9	U	163	UJ	18.4	U	16.9	U
	Trans-Nonachlor	ug/kg	--	--	100	J C2	2.53	U	25.9	UJ	4.14	J C2	2.7	U
TPH:	Diesel	mg/kg	--	--	2310		10.4		83.2		82	J	106	J
	Lube Oil - NWTPH	mg/kg	--	--	9420		17.8		274		263		261	

Analyte	Outfall M-2													
	SI01M2010 10/15/2002 Normal		SI01M2020 10/15/2002 Normal		SI01M2030 10/15/2002 Normal		SI01M2031 10/15/2002 Duplicate		SI01M2040 10/15/2002 Normal		SI01M2042 10/15/2002 Equip Blank		SI01M2050 10/16/2002 Normal	
Aluminum	6770		8180		6580		8320		18700		0.0376	J	25100	
Antimony	0.57	J	0.31	J	0.236	J	0.278	J	0.346	J	0.000377	J B1	0.254	J
Arsenic	4.11	B2	4.15	B2	2.68	B2	2.9	B2	2.79	B2	0.00219		2.93	
Cadmium	0.0989	J	0.0441	J	0.00171	U	0.00176	U	0.00226	U	0.0000071	U	0.00203	U
Chromium	14.9		26.3		14.2		14.4		37.5		0.00795		39.1	
Copper	27.3	B2	22	B2	18.9	B2	21.5	B2	36.2	B2	0.000524	B1 J	34.2	B2
Lead	12.1	B2	8.73	B2	9.26	B2	9.3	B2	7.88	B2	0.0147	B2	6.11	B2
Mercury	0.00978	U	0.00943	U	0.0373		0.0263		0.0363		***9.61***	***U***	0.0355	
Nickel	11.1		16.6		17.8		15.7		25.8		0.00351		26.7	B2
Selenium	0.0885	U	0.0839	U	0.0926	U	0.0954	U	0.123	U	0.00079		0.11	U
Silver	3.6	B2	0.8	B2	0.355	B2	0.472	B2	0.264	B2	0.000143	J B1	0.219	
Zinc	169	B2	89.7	B2	80.6	B2	79.7	B2	59.9	B2	0.013	B2	58	B2
PCB-008	0.94	J	0.53	J	0.27	U	0.29	U	0.38	U	0.00072	U	0.39	U
PCB-018	0.35	UJ	0.33	U	0.26	U	0.29	U	0.38	U	0.00058	U	0.38	U
PCB-028	0.44	PJ	0.21	U	0.19	JP	0.18	U	0.24	U	0.0013	U	0.25	U
PCB-044	0.2	UJ	0.43	P	0.15	U	0.17	U	0.22	U	0.021	U	0.22	U
PCB-052	3.13	PJ	1.36	P	0.28	JP	0.74	P	0.34	U	0.002	U	0.34	U
PCB-066	0.84	J	0.4	P	0.4		0.18	JP	0.2	U	0.00039	U	0.2	U
PCB-101	0.39	PJ	0.56		0.19	U	0.21	U	0.28	U	0.0017	U	0.28	U
PCB-105	0.16	UJ	0.15	U	0.12	U	0.13	U	0.17	U	0.00026	U	0.17	U
PCB-118	0.23	JP	1.01	P	0.14	U	0.35	JP	0.21	U	0.00036	U	0.21	U
PCB-128	0.84	PJ	0.45	JP	0.12	U	0.62	P	0.28	JP	0.00029	U	0.18	U
PCB-138	1.7	PJ	1.1	P	0.17	JP	0.64	P	0.24	JP	0.0003	U	0.19	U
PCB-153	1.36	PJ	2.15		0.34		0.18	U	0.24	U	0.00034	U	0.24	U
PCB-170	0.92	PJ	0.33	JP	0.13	U	0.31	JP	0.29	JP	0.0015	U	0.19	U
PCB-180	3.04	J	1.1	P	0.24	J	1.2		0.43	J	0.00027	U	0.17	U
PCB-187	4.23	J	0.82	P	0.14	U	0.59	P	0.21	U	0.00037	U	0.21	U
Estimated Total PCBs[1,5]	37.3		22.1		5.3		11.1		4.5		--		--	
2,4'-DDD	4.72	U	2.47	U	2.22	U	2.44	U	2.39	U	0.00806	U	3.14	U
2,4'-DDE	4.72	U	2.47	U	2.22	U	2.44	U	2.39	U	0.00806	U	3.14	U
2,4'-DDT	4.72	U	2.47	U	2.22	U	2.44	U	2.39	U	0.00806	U	3.14	U
4,4'-DDD	4.72	U	0.481	U	3.22	J C1	0.475	U	0.465	U	0.0038	U	0.61	U
4,4'-DDE	4.72	U	0.569	U	0.512	U	0.562	U	0.55	U	0.00315	U	0.722	U
4,4'-DDT	4.72	U	0.641	U	0.576	U	0.633	U	0.62	U	0.00403	U	0.813	U
Estimated Total DDTs[1,6]	--		--		3.22		--		--		--		--	
4,4'-Methoxychlor	23.6	U	3.41	U	3.06	U	3.36	U	3.29	U	0.00433	U	4.32	U
Aldrin	2.36	U	1.07	U	0.96	U	1.05	U	1.03	U	0.000924	U	1.35	U
Alpha-BHC	2.36	U	0.768	U	0.691	U	0.759	U	0.743	U	0.00297	U	0.975	U
beta-BHC	2.36	U	1.05	U	0.941	U	1.03	U	1.01	U	0.00344	U	1.33	U
Beta-Chlordane	2.36	U	1	U	0.903	U	0.992	U	0.971	U	0.00386	U	1.27	U
Chlordane	**23.6**	**U**	3.48	U	3.13	U	3.44	U	3.37	U	0.0258	U	4.42	U
cis-Chlordane	2.36	U	0.983	U	0.884	U	0.971	U	0.951	U	0.00284	U	1.25	U
cis-Nonachlor	4.72	U	2.47	U	2.22	U	2.44	U	2.39	U	0.00806	U	3.14	U
delta-BHC	2.36	U	0.949	U	0.854	U	0.938	U	0.918	U	0.0102	C1	1.2	U
Dieldrin	22.3	C1	0.811	U	0.73	U	0.801	U	0.784	U	0.00243	U	1.03	U
Endosulfan I	2.36	U	1.05	U	0.947	U	1.04	U	1.02	U	0.00402	U	1.34	U
Endosulfan II	4.72	U	0.956	U	0.86	U	0.944	U	0.924	U	0.00305	U	1.21	U
Endosulfan Sulfate	4.72	U	0.9	U	0.809	U	0.889	U	0.87	U	0.00433	U	1.14	U
Endrin	4.72	U	0.892	U	1.34	J C2	0.882	U	0.863	U	0.0025	U	1.13	U
Endrin Aldehyde	4.72	U	1.01	U	0.907	U	0.996	U	0.975	U	0.00785	U	1.28	U
Endrin Ketone	4.72	U	0.695	U	0.625	U	0.686	U	0.672	U	0.00278	U	0.882	U
Heptachlor	2.36	U	0.852	U	0.766	U	0.841	U	0.823	U	0.00608	U	1.08	U
Heptachlor Epoxide	2.36	U	0.904	U	0.812	U	0.892	U	0.874	U	0.00302	U	1.15	U
Hexachlorobenzene	2.36	U	1.24	U	1.11	U	1.22	U	1.2	U	0.00403	U	1.57	U
Hexachlorobutadiene	2.36	U	1.24	U	1.11	U	1.22	U	1.2	U	0.00403	U	1.57	U
Hexachloroethane	2.36	U	1.24	U	2.22	C2	1.22	U	1.2	U	0.00403	U	1.57	U
Lindane	2.36	U	0.945	U	0.85	U	0.934	U	0.914	U	0.0058	U	1.2	U
Oxychlordane	4.72	U	2.47	U	2.22	U	2.44	U	2.39	U	0.00806	U	3.14	U
Toxaphene	236	U	15.5	U	13.9	U	15.3	U	15	U	0.0941	U	19.7	U
Trans-Nonachlor	4.72	U	2.47	U	2.22	U	2.44	U	2.39	U	0.00806	U	3.14	U
Diesel	59		36.1		14.7		16.9		6.62		0.056		3.92	
Lube Oil - NWTPH	237		157		64.5		65.9		25.6		0.098		19.3	

Analyte	Outfall 48											
	SI0148010 10/16/2002 Normal		SI0148020 10/16/2002 Normal		SI0148030 10/16/2002 Normal		SI0148040 10/16/2002 Normal		SI0148050 10/16/2002 Normal		SI0148060 10/16/2002 Normal	
Aluminum	17900		4920		6890		5240		4600		13900	
Antimony	12.4		1.03	J	1.97	J	1.3	J	0.711	J	3.35	J
Arsenic	54.8		51.9		75.6		83.5		27.5		54	
Cadmium	0.735		0.00694	U	0.00878	U	0.00791	U	0.00803	U	0.0132	U
Chromium	184		52.2		92.1		165		44.9		173	
Copper	620	B2	74.6	B2	130	B2	78.2	B2	64.5	B2	314	B2
Lead	516	B2	20.6	B2	73.9	B2	40.4	B2	27.4	B2	104	B2
Mercury	0.147		0.0113	J	0.0201	J	0.0097	J	0.00887	U	0.112	
Nickel	179	B2	53.6	B2	58.3	B2	44.6	B2	44.6	B2	98.2	B2
Selenium	0.559	U	0.376	U	0.476	U	0.428	U	0.435	U	0.713	U
Silver	2.22		0.272	J	0.536	J	0.399	J	0.276	J	1.63	
Zinc	2650	B2	202	B2	286	B2	281	B2	185	B2	492	B2
PCB-008	0.31	U	0.25	U	0.31	U	0.42	J	0.3	U	0.49	U
PCB-018	0.31	U	0.24	U	0.31	U	0.29	U	0.3	U	1.46	
PCB-028	0.53		0.16	U	0.2	U	0.45		0.19	U	1.53	
PCB-044	0.71		0.14	U	0.18	U	0.22	J	0.17	U	3.33	
PCB-052	2.03		0.22	U	0.28	U	0.26	U	0.27	U	3.14	P
PCB-066	2.82		0.13	U	0.16	U	0.63		0.16	U	2.18	P
PCB-101	2.64		0.18	U	0.23	U	0.21	U	0.22	U	1.56	P
PCB-105	0.14	U	0.11	U	0.14	U	0.13	U	0.13	U	0.21	U
PCB-118	1.32		0.13	U	0.17	U	0.16	U	0.16	U	1.33	P
PCB-128	0.63	J	0.11	U	0.14	U	0.17	J	0.14	U	0.86	JP
PCB-138	3.21		0.12	U	0.15	U	0.15	U	0.15	U	4.77	
PCB-153	3.44		0.15	U	0.2	U	0.19	U	0.19	U	4.08	
PCB-170	0.86		0.22	J	0.29	J	0.26	J	0.15	U	1.77	
PCB-180	1.61		0.13	J	0.14	U	0.13	U	0.13	U	1.97	P
PCB-187	1.08		0.13	U	0.17	U	0.16	U	0.16	U	3.67	
Estimated Total PCBs[1,5]	42.8		2.8		2.7		6.3		--		63.8	
2,4'-DDD	2.95	U	2.05	U	2.64	U	2.47	U	2.51	U	5.26	J C1
2,4'-DDE	3.34	J C2	2.05	U	2.64	U	2.47	U	2.51	U	4.34	U
2,4'-DDT	2.95	U	2.05	U	2.64	U	2.47	U	2.51	U	4.34	U
4,4'-DDD	0.573	U	0.398	U	0.513	U	3.37	J C1	0.488	U	12.8	C1
4,4'-DDE	0.679	U	0.471	U	0.608	U	0.568	U	0.578	U	0.999	U
4,4'-DDT	25.8	C1	3.36	J C1	0.684	U	0.639	U	0.65	U	21.2	C1
Estimated Total DDTs[1,6]	25.80		3.36		--		3.37		--		34.00	
4,4'-Methoxychlor	4.06	U	2.82	U	3.64	U	3.4	U	3.46	U	23.6	J C1
Aldrin	1.27	U	0.883	U	1.14	U	1.06	U	1.08	U	1.87	U
Alpha-BHC	2.06	J C2	0.636	U	0.82	U	0.766	U	0.78	U	1.35	U
beta-BHC	1.25	U	0.866	U	1.12	U	1.04	U	1.06	U	1.84	U
Beta-Chlordane	7.66	C2	0.831	U	1.07	U	1	U	1.02	U	1.76	U
Chlordane	4.15	U	2.88	U	3.72	U	3.47	U	3.53	U	6.11	U
cis-Chlordane	6.04	C2	0.814	U	1.05	U	0.98	U	0.997	U	1.73	U
cis-Nonachlor	2.95	U	2.05	U	2.64	U	2.47	U	2.51	U	4.34	U
delta-BHC	3.99	C2	0.786	U	1.01	U	0.946	U	0.963	U	1.67	U
Dieldrin	0.967	U	0.672	U	0.866	U	0.809	U	0.823	U	1.42	U
Endosulfan I	1.26	U	0.872	U	1.12	U	1.05	U	1.07	U	1.85	U
Endosulfan II	1.14	U	0.791	U	1.02	U	0.953	U	0.97	U	1.68	U
Endosulfan Sulfate	1.07	U	0.745	U	0.961	U	0.897	U	0.913	U	5.64	J C1
Endrin	8.03	C2	0.739	U	0.953	U	0.89	U	0.905	U	1.57	U
Endrin Aldehyde	3.05	J C2	0.835	U	1.08	U	1.01	U	1.02	U	1.77	U
Endrin Ketone	4.48	J C2	0.575	U	0.742	U	0.693	U	0.705	U	1.22	U
Heptachlor	1.4	J C1	0.705	U	0.909	U	0.849	U	0.864	U	1.49	U
Heptachlor Epoxide	1.08	U	0.748	U	0.965	U	0.901	U	0.917	U	1.59	U
Hexachlorobenzene	4.53	C1	1.02	U	1.32	U	1.23	U	1.25	U	2.17	U
Hexachlorobutadiene	1.47	U	1.02	U	1.32	U	1.23	U	1.25	U	2.97	J C1
Hexachloroethane	1.47	U	1.02	U	1.32	U	1.23	U	1.25	U	2.17	U
Lindane	1.13	U	0.782	U	1.01	U	0.943	U	0.959	U	1.66	U
Oxychlordane	2.95	U	2.05	U	2.64	U	2.47	U	2.51	U	4.34	U
Toxaphene	18.5	U	12.8	U	16.5	U	15.5	U	15.7	U	27.2	U
Trans-Nonachlor	13.9	C1	2.05	U	2.64	U	2.47	U	2.51	U	4.34	U
Diesel	76.6		12.6		11.9		5.56		14.3		81.9	
Lube Oil - NWTPH	406		59.3		41		23.4		31.2		253	

Notes:

DEQ baseline and high values are used here for screening purposes only. Additional evaluation is needed to develop site-specific risk and/or cleanup concentrations.

*Equipment blank samples reported in liters, not kilograms.

bold The method detection limit exceeds DEQ High Screening Value.
border The reported value exceeds DEQ High Screening Value.
italic The method detection limit exceeds Portland Harbor Baseline Screening Value.
shaded The reported value exceeds Portland Harbor Baseline Screening Value.

[1] Total parameters (i.e., LPAHs, HPAHs, PAHs, PCBs, and DDTs) were calculated based on detections only. Qualifiers are not included on total parameters as it is implied that these are estimated quantities.
[2] Total LPAHs: Includes naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, and 2-methylnaphthalene.
[3] Total HPAHs: Includes fluoranthene, pyrene, benz[a]anthracene, chrysene, benzofluoranthenes, benzo[a]pyrene, indeno[1,2,3-cd]pyrene, dibenz[a,h]anthracene, and benzo[ghi]perylene.
[4] Total PAHs: Represents the sum of Total LPAHs and HPAHs.
[5] Total PCBs: The list of PCB congeners is based on EPA recommendations provided in *QA/QC Guidance for Sampling and Analysis of Sediment, Water, and Tissues for Dredged Material Evaluations,* EPA 823-B-95-001 (April 1995).
This list can be used to estimate total PCBs in accordance with the NOAA method provided in NOAA Technical Memorandum NOA OMA 49 (August 1989). Calculations follow the Battelle method: Total PCB = 1.95 (Σ congeners listed) + 2.1.
[6] Total DDTs: Sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.

Qualifiers:

B1 This analyte was detected in the associated method blank. The concentration was determined not to be significantly higher than the associated method blank (less than 10 times the concentration reported in the blank).
B2 This analyte was detected in the associated method blank. The analyte concentration in the sample was determined to be significantly higher than the method blank (greater than 10 times the concentration reported in the blank).
C1 Second column confirmation was performed. The relative percent difference value (RPD) between the results on the two columns was evaluated and determined to be < 40%.
C2 Second column confirmation was performed. The RPD between the results on the two columns was evaluated and determined to be > 40%. The higher result was reported unless anomalies were noted.
D5 The analyte exceeded the linear calibration range and the sample was diluted and reanalyzed. The reported result for the analyte has been flagged with "D" and a number representing the additional dilution required to bring the analyte within the calibration range.
D10 The analyte exceeded the linear calibration range and the sample was diluted and reanalyzed. The reported result for the analyte has been flagged with "D" and a number representing the additional dilution required to bring the analyte within the calibration range.
J The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.
U The analyte was not detected above the reported method detection limit.
UJ The analyte was not detected above the reported method detection limit. However, the reported method detection limit is approximate and may or may not represent the actual method detection limit necessary to accurately and precisely measure the analyte in the sample.
P The difference between the analyte detected in the front and back column is greater than 40%.

Abbreviations/Definitions:

-- Not available or applicable
HPAH high molecular weight polycyclic aromatic hydrocarbons
LPAH low molecular weight polycyclic aromatic hydrocarbons
ug/kg micrograms per kilogram
mg/kg milligrams per kilogram
NA Not analyzed
NOAA National Oceanographic and Atmospheric Administration
PAH polycyclic aromatic hydrocarbon
PCB polychlorinated biphenyl
TPH total petroleum hydrocarbon

TABLE 1
Outfall Sediment Analytical Data

Class	Analyte	Units*	DEQ Screening Level (High)	DEQ Screening Level (Baseline)	Outfall 49																Outfall 50												Outfall 52					
					SI0149010 10/17/2002 Normal		SI0149011 10/17/2002 Duplicate		SI0149020 10/17/2002 Normal		SI0149022 10/17/2002 Equip Blank		SI0149030 10/17/2002 Normal		SI0149040 10/17/2002 Normal		SI0149050 10/17/2002 Normal		SI0149060 10/17/2002 Normal		SI0150010 10/18/2002 Normal		SI0150020 10/18/2002 Normal		SI0150030 10/18/2002 Normal		SI0150040 10/18/2002 Normal		SI0150050 10/18/2002 Normal		SI0150060 10/18/2002 Normal		SI0152010 10/23/2002 Normal		SI0152020 10/23/2002 Normal		SI0152030 10/23/2002 Normal	
Semivolatile Organics:	1,2,4-Trichlorobenzene	ug/kg	9200	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	1,2-Dichlorobenzene	ug/kg	1700	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	1,3-Dichlorobenzene	ug/kg	300	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	1,4-Dichlorobenzene	ug/kg	300	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	2,3,4,6-Tetrachlorophenol	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	2,3,5,6-Tetrachlorophenol	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	2,4,5-Trichlorophenol	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	2,4,6-Trichlorophenol	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	2,4-Dichlorophenol	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	2,4-Dimethylphenol	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	2,4-Dinitrophenol	ug/kg	--	--	62	U	64.7	U	81.5	U	4	UJ	89.3	U	85.4	U	876	U	81.4	U	77.3	U	83.6	UJ	1120	U	902	U	823	UJ	940	U	86.9	U	98.1	U	116	U
	2,4-Dinitrotoluene	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	2,6-Dinitrotoluene	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	2-Chloronaphthalene	ug/kg	--	--	1.24	U	1.29	U	1.63	U	0.08	UJ	1.79	U	1.71	U	17.5	U	1.63	U	1.55	U	1.67	UJ	22.3	U	18	U	16.5	UJ	18.8	U	1.74	U	1.96	U	2.33	U
	2-Chlorophenol	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	2-Methylnaphthalene	ug/kg	200	150	7.78		5.78		19.2		0.2	UJ	322		8.35		341		1.63	U	1.55	U	2.43	J	34.2	J	18	U	16.5	UJ	28.4	J	2.85	J	58		14.1	
	2-Methylphenol	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	2-Nitroaniline	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	2-Nitrophenol	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	3,3'-Dichlorobenzidine	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	3-Nitroaniline	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	4,6-Dinitro-2-Methylphenol	ug/kg	--	--	62	U	64.7	U	81.5	U	4	UJ	89.3	U	85.4	U	876	U	81.4	U	77.3	U	83.6	UJ	1120	U	902	U	823	UJ	940	U	86.9	U	98.1	U	116	U
	4-Bromophenyl Phenyl Ether	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	4-Chloro-3-Methylphenol	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	4-Chloroaniline	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	4-Chlorophenyl Phenyl Ether	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	4-Methylphenol	ug/kg	--	680	24.8	U	25.9	U	32.6	U	1.6	UJ	35.7	U	34.2	U	350	U	32.6	U	30.9	U	33.4	UJ	838	J	361	U	329	UJ	376	U	34.8	U	45.4	J	46.6	U
	4-Nitroaniline	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	4-Nitrophenol	ug/kg	--	--	62	U	64.7	U	81.5	U	4	UJ	89.3	U	85.4	U	876	U	81.4	U	77.3	U	83.6	UJ	1120	U	902	U	823	UJ	940	U	86.9	U	98.1	U	116	U
	Acenaphthene	ug/kg	300	180	1.24	U	1.29	U	10.4		0.08	UJ	20.7		3.96		35.1		1.63	U	31.5		16.5	J	132		29.8	J	16.5	UJ	41.4		11.1		124		33.2	
	Acenaphthylene	ug/kg	200	60	14.8		9.51		56.9		0.08	UJ	268		18.7		516		3.1	J	3.96		6.39	J	48.9		21.2	J	16.5	UJ	31.6	J	3.87		67.8		50.5	
	Aniline	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Anthracene	ug/kg	800	150	9.39		6.25		41.2		0.08	UJ	221		12.3		287		1.63	U	12.5		40.7	J	140		32.1	J	19.5	J	68.1		5.39		152		70.5	
	Benzo (a) anthracene	ug/kg	1000	360	24		13.8		123		0.08	UJ	497	D10	24		987		6.21		205		351	J	698		159		101	J	252		43.3		494	D10	243	
	Benzo (a) pyrene	ug/kg	1500	500	36.8		24.4		183		0.08	UJ	618	D10	43.6		1010		6.63		154		328	J	856		195		116	J	309		46.1		545	D10	284	
	Benzo [g,h,i] perylene	ug/kg	300	250	41.3		32		181		0.08	UJ	435		45.9		819		14		101		279	J	653		196		79.4	J	262		60.7		597	D10	249	
	Benzofluoranthenes	ug/kg	--	--	48.7		33.3		224		0.16	UJ	561		51.3		1150		3.26	U	197		549	J	1360		366		212	J	516		67.6		813		368	
	Benzoic Acid	ug/kg	--	200	62	U	64.7	U	81.5	U	4	UJ	89.3	U	85.4	U	876	U	81.4	U	77.3	U	83.6	UJ	1120	U	902	U	823	UJ	940	U	86.9	U	98.1	U	116	U
	Benzyl Alcohol	ug/kg	--	20	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Bis(2-Chloroethoxy) Methane	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Bis(2-Chloroethyl) Ether	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Bis(2-Chloroisopropyl) Ether	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Bis(2-Ethylhexyl) Phthalate	ug/kg	800	390	12.4	U	12.9	U	16.3	U	4.29	B1 J	19.5	JU	17.1	U	175	U	16.3	U	204		141	J	353	J	180	U	198	J	188	U	205		90.9		23.3	U
	Butyl Benzyl Phthalate	ug/kg	--	20	12.4	U	12.9	U	16.3	U	1.46	J	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Carbazole	ug/kg	1600	100	12.4	U	12.9	U	16.3	U	0.8	UJ	41.6		17.1	U	175	U	16.3	U	15.5	U	49.7	J	223	U	180	U	165	UJ	188	U	17.4	U	22.1	J	25.2	J
	Chrysene	ug/kg	1300	425	32.7		22.2		165		0.08	UJ	681	D10	37.2		1440		8.76		200		398	J	695		207		194	J	312		35.6		590	D10	307	
	Di-n-Butyl Phthalate	ug/kg	100	20	12.4	U	12.9	U	16.3	U	0.854	J B1	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Di-n-Octyl Phthalate	ug/kg	--	20	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Dibenzo (a,h) anthracene	ug/kg	1300	125	5.53		4.72		24		0.08	UJ	103		12.5		175		1.63	U	17.5		44.8	J	143		48.5		22.3	J	51		14		89.6		41.2	
	Dibenzofuran	ug/kg	5100	100	12.4	U	12.9	U	16.3	U	0.8	UJ	18.1	J	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Diethyl Phthalate	ug/kg	600	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.9	J	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Dimethyl Phthalate	ug/kg	--	20	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Fluoranthene	ug/kg	2200	600	34		22.4		187		0.08	UJ	652	D10	50.2		974		9.08		122		439	D5 J	1090		314		493	J	466		51.5		1410	D10	456	
	Fluorene	ug/kg	600	125	3.18		1.29	U	12.2		0.08	UJ	71.5		4.08		87.9		1.63	U	1.55	U	14	J	88.3		18	U	16.5	UJ	26.2	J	4.37		91.1		23.2	
	Hexachlorobenzene	ug/kg	100	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Hexachlorobutadiene	ug/kg	600	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Hexachlorocyclopentadiene	ug/kg	400	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Hexachloroethane	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Indeno (1,2,3-cd) pyrene	ug/kg	100	225	27.8		20.1		124		0.08	UJ	305		29.3		496		8.58		101		227	J	546		171		94.9	J	220		52.4		425		181	
	Isophorone	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	n-Nitrosodi-n-Propylamine	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	n-Nitrosodimethylamine	ug/kg	--	--	62	U	64.7	U	81.5	U	4	UJ	89.3	U	85.4	U	876	U	81.4	U	77.3	U	83.6	UJ	1120	U	902	U	823	UJ	940	U	86.9	U	98.1	U	116	U
	n-Nitrosodiphenylamine	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Naphthalene	ug/kg	600	200	10.3		8.5		31.2		0.2	UJ	573	D10	12.9		426		1.63	U	4.48		3.93	J	98.1		28.3	J	16.5	UJ	77.4		3.63		182		29.4	
	Nitrobenzene	ug/kg	--	--	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Pentachlorophenol	ug/kg	1000	97	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	29.2	J	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	44.7		23.3	U
	Phenanthrene	ug/kg	1200	700	23.6		10.6		99.2		0.08	UJ	373		30.6		354		1.73	J	25.8		224	J	598		162		167	J	230		12.4		726	D10	229	
	Phenol	ug/kg	50	20	12.4	U	12.9	U	16.3	U	0.8	UJ	17.9	U	17.1	U	175	U	16.3	U	15.5	U	16.7	UJ	223	U	180	U	165	UJ	188	U	17.4	U	19.6	U	23.3	U
	Pyrene	ug/kg	1500	700	52		33.5		282		0.08	UJ	1570	D10	79.7		2050		14.1		180		436	D5 J	1180		326		392	J	499		66.8		1870	D10	563	
	Estimated Total LPAHs[1,2]	ug/kg	400	700	69		41		270		--		1849		91		2047		5		78		308		1140		273		187		503		44		1401		450	
	Estimated Total HPAHs[1,3]	ug/kg	1000	2400	303		206		1493		--		5422		374		9101		67		1278		3052		7221		1983		1705		2887		438		6834		2692	
	Estimated Total PAHs[1,4]	ug/kg	23000	--	372		247		1763		--		7271		465		11148		72		1356		3360		8361		2256		1891		3390		482		8235		3142	
General Chemistry:	Total Organic Carbon	mg/kg	--	20000	664		555		572		0.98		3270		1020		3220		268		4940		648		19100		4280		704		8340		1530		4340		12500	
Chlorinated Herbicides:	2,4,5-T	ug/kg	--	--	2.89	U	2.66	U	NA		0.0479	U	NA		NA		NA		NA		2.53	U	NA		NA		NA		NA		NA		3.19	U	NA		NA	
	2,4,5-TP	ug/kg	--	--	2.36	U	2.18	U	NA		0.0161	U	NA		NA		NA		NA		2.07	U	NA		NA		NA		NA		NA		2.61	U	NA		NA	
	2,4-D	ug/kg	--	3.3	2.45	U	2.26	U	NA		0.0377	U	NA		NA		NA		NA		2.15	U	NA		NA		NA		NA		NA		2.71	U	NA		NA	
	2,4-Db	ug/kg	--	5	1.77	U	1.63	U	NA		0.0434	U	NA		NA		NA		NA		1.55	U	NA		NA		NA		NA		NA		1.95	U	NA		NA	
	4-Nitrophenol	ug/kg	--	--	1.4	U	1.3	U	NA		0.0373	U	NA		NA		NA		NA		1.23	U	NA		NA		NA		NA		NA		1.55	U	NA		NA	
	Dalapon	ug/kg	--	--	1.41	U	1.31	U	NA		0.0474	U	NA		NA		NA		NA		1.24	U	NA		NA		NA		NA		NA		1.56	U	NA		NA	
	Dicamba	ug/kg	--	--	1.45	U	1.33	U	NA		0.039	U	NA		NA		NA		NA		1.27	U	NA		NA		NA		NA		NA		1.6	U	NA		NA	
	Dichloroprop	ug/kg	--	--	2.33	U	2.15	U	NA		0.0161	U	NA		NA		NA		NA		2.05	U	NA		NA		NA		NA		NA		2.58	U	NA		NA	
	DinosEquip Blank	ug/kg	--	--	2.02	U	1.87	U	NA		0.0463	U	NA		NA		NA		NA		1.78	U	NA		NA		NA		NA		NA		2.24	U	NA		NA	
	Mcpa	ug/kg	--	--	2.76	U	2.55	U	NA		0.0221	U	NA		NA		NA		NA		2.43	U	NA		NA		NA		NA		NA		3.06	U	NA		NA	
	Mcpp	ug/kg	--	--	1.23	U	1.14	U	NA		0.0296	U	NA		NA		NA		NA		1.08	U	NA		NA		NA		NA		NA		1.36	U	NA		NA	
	Pentachlorophenol	ug/kg	1000	97	1.81	U	1.67	U	NA		0.0233	U	NA		NA		NA		NA		24.9		NA		NA		NA		NA		NA		2	U	NA		NA	

TABLE 1
Outfall Sediment Analytical Data

Class	Analyte	Units*	DEQ Screening Level (High)	DEQ Screening Level (Baseline)	Outfall 49																Outfall 50												Outfall 52					
					SI0149010 10/17/2002 Normal		SI0149011 10/17/2002 Duplicate		SI0149020 10/17/2002 Normal		SI0149022 10/17/2002 Equip Blank		SI0149030 10/17/2002 Normal		SI0149040 10/17/2002 Normal		SI0149050 10/17/2002 Normal		SI0149060 10/17/2002 Normal		SI0150010 10/18/2002 Normal		SI0150020 10/18/2002 Normal		SI0150030 10/18/2002 Normal		SI0150040 10/18/2002 Normal		SI0150050 10/18/2002 Normal		SI0150060 10/18/2002 Normal		SI0152010 10/23/2002 Normal		SI0152020 10/23/2002 Normal		SI0152030 10/23/2002 Normal	
Total Metals:	Aluminum	mg/kg	--	42800	6630		6520		5810		0.0573	J	7960		5700		9720		3230		5920		7210		13700		9180		5300		8490		6180		11900		16200	
	Antimony	mg/kg	64	5	0.159		0.207		0.228		0.00136	B2	0.326		0.225		0.491		0.182		2.78	J	2.68	J	3.41	J	2.07	J	1.46	J	2.02	J	0.353	B2	0.347	B2	0.495	B2
	Arsenic	mg/kg	33	5	2.2		2.23		2.4		0.000918		2.62		1.95		3.74		1.7		22		16.9		21.5		15.1		13.3		14.6		1.92		3.01		3.88	
	Cadmium	mg/kg	5	0.6	0.228	U	0.246	U	0.265	U	0.000017	J	0.324	U	0.272	U	0.293	U	0.27	U	0.00798	U	0.0085	U	0.0111	U	0.0101	U	0.00777	U	0.00959	U	0.51	U	0.573	U	*0.725*	*U*
	Chromium	mg/kg	111	41	13.9		15		12		0.00793		19.3		17.7		19.5		9.75		147		212		188		137		164		128		50.7	B2	25.5	B2	33.5	B2
	Copper	mg/kg	149	60	18.2		19.2		16.2		0.0269	B2	34.5		17.7		34.6		17		613	B2	475	B2	384	B2	251	B2	279	B2	259	B2	56.9	B2	32.6	B2	46.3	B2
	Lead	mg/kg	130	30	8.92	B2	12.5	B2	13.1	B2	0.00161	B2	26	B2	15	B2	24.9	B2	11.4	B2	79.1	B2	132	B2	332	B2	109	B2	107	B2	110	B2	16.1	B2	16.4	B2	17.6	B2
	Mercury	mg/kg	1	0.1	0.0759		0.0979		0.162		***9.61***	***U***	0.918		0.45		0.893		0.0694		0.0085	J	0.01	J	0.192		0.0503		0.00887	U	0.0794		0.0296		0.0822		0.602	
	Nickel	mg/kg	49	32	16.4		18.6		15.8		0.0234		21.9		19.9		22.4		13.8		107	B2	107	B2	119	B2	116	B2	81.6	B2	96.7	B2	21.4	B2	20.8	B2	26.5	B2
	Selenium	mg/kg	5	15	0.381	U	0.409	U	0.442	U	0.000385	U	0.541	U	0.454	U	0.489	U	0.451	U	0.432	U	0.46	U	0.604	U	0.545	U	0.421	U	0.52	U	0.51	U	0.573	U	0.725	U
	Silver	mg/kg	5	1.4	0.427		0.086		0.0824		0.000559	B2	0.161		0.086		0.224		0.0836		0.758		0.842		1.38		0.791		0.634		0.815		3.2	B2	0.394	B2	0.307	B2
	Zinc	mg/kg	459	118	54.2		54.2		53.2		0.0398	B2	72.9		52.4		69.3		33.2		315	B2	330	B2	654	B2	335	B2	256	B2	338	B2	167	B2	82.4	B2	88.5	B2
PCBs as Congeners:	PCB-008	ug/kg	--	--	0.25	U	0.25	U	0.31	U	0.00065	U	0.35	U	0.32	U	0.37	U	0.31	U	0.29	U	0.32	U	0.44	U	0.34	U	0.31	U	0.34	U	0.3	U	0.35	U	0.42	U
	PCB-018	ug/kg	--	--	0.25	U	0.24	U	0.31	U	0.00053	U	0.34	U	0.31	U	0.36	U	0.31	U	0.29	U	0.32	U	0.43	U	0.33	U	0.3	U	0.34	U	0.29	U	0.34	U	0.41	U
	PCB-028	ug/kg	--	--	0.21	J	0.16	U	0.2	U	0.0011	U	0.22	U	0.2	U	0.23	U	0.2	U	0.26	JP	0.38	P	0.28	U	0.21	U	0.19	U	0.44		0.62	P	0.37	P	0.26	U
	PCB-044	ug/kg	--	--	0.14	U	0.14	U	0.18	U	0.019	U	0.19	U	0.18	U	0.21	U	0.18	U	0.47	P	0.27	J	0.25	U	0.19	U	0.17	U	1.42		0.17	PU	0.19	PU	0.23	U
	PCB-052	ug/kg	--	--	0.22	U	0.22	U	0.27	U	0.0018	U	0.3	U	0.28	U	0.33	U	0.28	U	0.57	JP	0.28	U	0.39	U	0.3	U	0.27	U	2.39	P	0.26	U	0.31	U	0.37	U
	PCB-066	ug/kg	--	--	0.13	U	0.13	U	0.16	U	0.00035	U	0.18	U	0.17	U	0.19	U	0.16	U	0.9		1.62		0.6		0.38	P	0.16	U	2.54	P	2		0.61	P	0.22	U
	PCB-101	ug/kg	--	--	0.18	U	0.18	U	0.22	U	0.0015	U	0.25	U	0.23	U	0.27	U	0.23	U	0.54		0.51	P	0.31	U	0.24	U	0.22	U	3.51		2.88		0.25	U	0.3	U
	PCB-105	ug/kg	--	--	0.11	U	0.11	U	0.14	U	0.00023	U	0.15	U	0.14	U	0.16	U	0.14	U	0.13	U	0.14	U	0.19	U	0.15	U	0.13	U	0.15	U	0.13	U	0.15	U	0.18	U
	PCB-118	ug/kg	--	--	0.13	U	0.13	U	0.17	U	0.00032	U	0.18	U	0.17	U	0.2	U	0.17	U	0.16	U	0.43	JP	0.23	U	0.18	U	0.16	U	2.82	P	0.81	P	0.19	U	0.22	U
	PCB-128	ug/kg	--	--	0.11	U	0.11	U	0.14	U	0.00027	U	0.16	U	0.14	U	0.17	U	0.14	U	0.13	U	0.27	JP	0.25	JP	0.15	U	0.14	U	0.83	P	0.98	P	0.44	JP	0.22	JP
	PCB-138	ug/kg	--	--	0.12	U	0.12	U	0.15	U	0.00027	U	0.42	JP	0.16	U	0.18	U	0.15	U	1.09	P	1.72	P	1.17		1.1		0.28	JP	6.28		7.88	P	1.37	P	0.86	
	PCB-153	ug/kg	--	--	0.16	U	0.15	U	0.19	U	0.00031	U	0.68	P	0.2	U	0.23	U	0.2	U	3.14		2.24	P	1.32	P	1.97		1.19		4.2	P	15		2.41		1.02	P
	PCB-170	ug/kg	--	--	0.12	U	0.12	U	0.16	U	0.0014	U	0.17	U	0.16	U	0.18	U	0.16	U	0.49	J	0.65	JP	0.43	J	0.39	JP	0.25	J	1.25		4.12	P	1.17	P	0.21	U
	PCB-180	ug/kg	--	--	0.11	U	0.11	U	0.14	U	0.00025	U	0.28	JP	0.14	U	0.16	U	0.14	U	1.05		1.77		1.02		1.42		0.63		2.26		10.7		2.95		0.56	J
	PCB-187	ug/kg	--	--	0.13	U	0.13	U	0.17	U	0.00034	U	0.19	U	0.17	U	0.2	U	0.17	U	0.65	P	1.07		0.61		1		0.17	U	1.35		4.51	P	2.07		0.58	P
	Estimated Total PCBs[1,5]	ug/kg	700	180	2.5		--		--		--		4.8		--		--		--		20.0		23.4		12.6		14.3		6.7		59.2		98.6		24.3		8.4	
Pesticides:	2,4'-DDD	ug/kg	--	--	1.94	U	1.97	U	2.16	U	0.008	U	2.42	U	2.31	U	2.56	U	1.97	U	2.29	UJ	2.16	UJ	3.07	UJ	2.35	UJ	2.38	UJ	2.84	UJ	2.13	U	3.88	J C1	3.08	U
	2,4'-DDE	ug/kg	--	--	1.94	U	1.97	U	2.16	U	0.008	U	2.42	U	2.31	U	2.56	U	1.97	U	2.29	UJ	2.16	UJ	3.07	UJ	2.35	UJ	2.38	UJ	2.84	UJ	2.13	U	2.8	U	3.08	U
	2,4'-DDT	ug/kg	--	--	1.94	U	1.97	U	2.16	U	0.008	U	2.42	U	2.31	U	2.56	U	1.97	U	2.29	UJ	2.16	UJ	3.07	UJ	2.35	UJ	2.38	UJ	2.84	UJ	2.13	U	2.8	U	3.08	U
	4,4'-DDD	ug/kg	30	--	0.377	U	0.383	U	0.421	U	0.00377	U	2.74	J C1	0.448	U	0.498	U	0.383	U	0.445	UJ	0.42	UJ	5.56	J C1	3.72	J C1	0.463	UJ	6.09	C1 J	0.414	U	6.91	C1	0.598	U
	4,4'-DDE	ug/kg	30	--	0.447	U	0.453	U	0.498	U	0.00312	U	0.558	U	0.531	U	0.589	U	0.453	U	0.527	UJ	0.498	UJ	4.97	J C1	0.541	UJ	0.548	UJ	3.79	J C2	0.49	U	2.06	J C2	2.14	J C2
	4,4'-DDT	ug/kg	60	--	0.503	U	0.51	U	0.561	U	0.004	U	4.04	J C2	0.597	U	4.95	J C2	0.51	U	0.593	UJ	0.56	UJ	3.02	J C1	3.96	J C2	0.617	UJ	0.735	UJ	0.551	U	0.726	U	0.797	U
	Estimated Total DDTs[1,6]	ug/kg	--	220	--		--		--		--		6.78		--		4.95		--		--		--		13.55		7.68		--		9.88		--		8.97		2.14	
	4,4'-Methoxychlor	ug/kg	--	--	2.67	U	2.71	U	2.98	U	0.0043	U	3.34	U	3.17	U	3.52	U	2.71	U	3.15	UJ	2.98	UJ	4.23	UJ	3.24	UJ	3.28	UJ	3.91	UJ	2.93	U	3.86	U	4.24	U
	Aldrin	ug/kg	40	--	0.837	U	0.849	U	0.934	U	0.000916	U	1.05	U	0.995	U	1.1	U	0.849	U	0.987	UJ	0.933	UJ	1.33	UJ	1.01	UJ	1.03	UJ	1.22	UJ	0.918	U	1.21	U	1.33	U
	Alpha-BHC	ug/kg	--	--	0.603	U	0.611	U	0.672	U	0.00294	U	0.753	U	0.716	U	0.795	U	0.612	U	0.711	UJ	0.672	UJ	0.955	UJ	0.731	UJ	0.74	UJ	0.882	UJ	0.661	U	0.871	U	0.956	U
	beta-BHC	ug/kg	--	--	0.821	U	0.833	U	0.916	U	0.00342	U	1.03	U	0.976	U	1.08	U	0.833	U	0.968	UJ	0.915	UJ	1.3	UJ	0.995	UJ	1.01	UJ	1.2	UJ	0.9	U	1.19	U	1.3	U
	Beta-Chlordane	ug/kg	--	--	0.788	U	0.799	U	0.879	U	0.00383	U	0.983	U	0.936	U	1.04	U	0.799	U	0.929	UJ	0.878	UJ	1.25	UJ	0.955	UJ	0.967	UJ	1.15	UJ	0.864	U	3.21	C2	1.25	U
	Chlordane	ug/kg	20	--	2.73	U	2.77	U	3.05	U	0.0256	U	3.41	U	3.25	U	3.6	U	2.77	U	3.22	UJ	3.04	UJ	4.33	UJ	3.31	UJ	3.35	UJ	4	UJ	3	U	3.95	U	4.33	U
	cis-Chlordane	ug/kg	--	--	0.772	U	0.782	U	0.86	U	0.00282	U	0.963	U	0.916	U	1.02	U	0.783	U	0.909	UJ	0.86	UJ	1.22	UJ	0.935	UJ	0.946	UJ	1.13	UJ	0.846	U	1.11	U	1.22	U
	cis-Nonachlor	ug/kg	--	--	1.94	U	1.97	U	2.16	U	0.008	U	2.42	U	2.31	U	2.56	U	1.97	U	2.29	UJ	2.16	UJ	3.07	UJ	2.35	UJ	2.38	UJ	2.84	UJ	7.74	C2	2.8	U	3.08	U
	delta-BHC	ug/kg	--	--	0.745	U	0.755	U	0.83	U	0.00188	U	0.93	U	0.885	U	0.982	U	0.756	U	0.878	UJ	0.83	UJ	1.18	UJ	0.903	UJ	0.914	UJ	1.09	UJ	0.816	U	1.08	U	1.18	U
	Dieldrin	ug/kg	60	--	0.637	U	0.646	U	0.71	U	0.00241	U	0.795	U	0.756	U	0.839	U	0.646	U	0.75	UJ	0.709	UJ	1.01	UJ	0.771	UJ	0.781	UJ	0.931	UJ	1.69	J C2	0.92	U	1.01	U
	Endosulfan I	ug/kg	--	--	0.826	U	0.838	U	0.921	U	0.00399	U	1.03	U	0.982	U	1.09	U	0.838	U	0.974	UJ	0.921	UJ	1.31	UJ	1	UJ	1.01	UJ	1.21	UJ	0.906	U	1.19	U	1.31	U
	Endosulfan II	ug/kg	--	--	0.75	U	0.761	U	0.836	U	0.00303	U	0.936	U	0.891	U	0.989	U	0.761	U	0.884	UJ	0.836	UJ	1.19	UJ	0.909	UJ	0.92	UJ	1.1	UJ	0.822	U	1.08	U	1.19	U
	Endosulfan Sulfate	ug/kg	--	--	0.706	U	0.716	U	0.787	U	0.0043	U	0.881	U	0.839	U	0.931	U	0.716	U	0.832	UJ	0.787	UJ	1.12	UJ	0.856	UJ	0.866	UJ	1.03	UJ	0.774	U	1.92	J C2	1.12	U
	Endrin	ug/kg	200	--	0.7	U	0.71	U	0.781	U	0.00248	U	0.874	U	0.832	U	0.923	U	0.71	U	0.826	UJ	0.78	UJ	1.11	UJ	0.849	UJ	0.859	UJ	1.02	UJ	0.768	U	1.01	U	1.11	U
	Endrin Aldehyde	ug/kg	--	--	0.791	U	0.802	U	0.882	U	0.00779	U	0.988	U	0.94	U	1.04	U	0.803	U	0.933	UJ	0.882	UJ	1.25	UJ	0.959	UJ	0.971	UJ	1.16	UJ	2.66	J C2	1.14	U	1.25	U
	Endrin Ketone	ug/kg	--	--	0.545	U	0.553	U	0.608	U	0.00276	U	0.681	U	0.648	U	0.719	U	0.553	U	0.643	UJ	0.608	UJ	0.864	UJ	0.661	UJ	0.669	UJ	0.798	UJ	0.598	U	0.788	U	0.865	U
	Heptachlor	ug/kg	10	--	0.668	U	0.678	U	0.745	U	0.00603	U	0.834	U	0.794	U	0.881	U	0.678	U	0.788	UJ	0.745	UJ	1.06	UJ	0.81	UJ	0.82	UJ	0.977	UJ	0.732	U	0.965	U	1.06	U
	Heptachlor Epoxide	ug/kg	20	--	0.709	U	0.719	U	0.79	U	0.00299	U	0.885	U	0.842	U	0.935	U	0.719	U	0.836	UJ	0.79	UJ	1.12	UJ	0.859	UJ	0.87	UJ	1.04	UJ	0.777	U	1.02	U	1.12	U
	Hexachlorobenzene	ug/kg	100	--	0.97	U	0.984	U	1.08	U	0.004	U	1.21	U	1.15	U	1.28	U	0.984	U	1.14	UJ	1.08	UJ	1.54	UJ	1.18	UJ	1.19	UJ	1.42	UJ	1.06	U	1.4	U	1.54	U
	Hexachlorobutadiene	ug/kg	600	--	0.97	U	0.984	U	1.08	U	0.004	U	1.21	U	1.15	U	1.28	U	0.984	U	1.14	UJ	1.08	UJ	1.54	UJ	1.18	UJ	1.19	UJ	1.42	UJ	1.06	U	1.4	U	1.54	U
	Hexachloroethane	ug/kg	--	--	0.97	U	0.984	U	1.08	U	0.004	U	1.21	U	1.15	U	1.28	U	0.984	U	1.14	UJ	1.08	UJ	1.54	UJ	1.18	UJ	1.19	UJ	1.42	UJ	4.08	C2	1.75	J C2	1.54	U
	Lindane	ug/kg	5	--	0.742	U	0.752	U	0.827	U	0.00576	U	0.926	U	0.881	U	0.978	U	0.752	U	0.874	UJ	0.826	UJ	1.17	UJ	0.899	UJ	0.91	UJ	1.08	UJ	2	J C1	1.07	U	1.18	U
	Oxychlordane	ug/kg	--	--	1.94	U	1.97	U	2.16	U	0.008	U	2.42	U	2.31	U	2.56	U	1.97	U	2.29	UJ	2.16	UJ	3.07	UJ	2.35	UJ	2.38	UJ	2.84	UJ	2.13	U	2.8	U	3.08	U
	Toxaphene	ug/kg	--	--	12.2	U	12.3	U	13.6	U	0.0933	U	15.2	U	14.4	U	16	U	12.3	U	14.3	UJ	13.6	UJ	19.3	UJ	14.7	UJ	14.9	UJ	17.8	UJ	13.3	U	17.6	U	19.3	U
	Trans-Nonachlor	ug/kg	--	--	1.94	U	1.97	U	2.16	U	0.008	U	2.42	U	2.31	U	2.56	U	1.97	U	2.29	UJ	2.16	UJ	3.07	UJ	2.35	UJ	2.38	UJ	2.84	UJ	2.13	U	2.8	U	3.08	U
TPH:	Diesel	mg/kg	--	--	4.39	J	2.36	J	11.4		0.08	J	12.8		8.65		19.5		3.07		23.1		10.6		59		4.92		7.23		26		47.3		41		19.9	
	Lube Oil - NWTPH	mg/kg	--	--	22.1		11.3		17.9		0.083		38		27.1		53		7.96		162		74.7		226		20.6		74.2		117		269		78.4		60.6	

Notes:

DEQ baseline and high values are used here for screening purposes only. Additional evaluation is needed to develop site-specific risk and/or cleanup concentrations.

*Equipment blank samples reported in liters, not kilograms.

bold The method detection limit exceeds DEQ High Screening Value.

border The reported value exceeds DEQ High Screening Value.

italic The method detection limit exceeds Portland Harbor Baseline Screening Value.

shaded The reported value exceeds Portland Harbor Baseline Screening Value.

[1] Total parameters (i.e., LPAHs, HPAHs, PAHs, PCBs, and DDTs) were calculated based on detections only. Qualifiers are not included on total parameters as it is implied that these are estimated quantities.

[2] Total LPAHs: Includes naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, and 2-methylnaphthalene.

[3] Total HPAHs: Includes fluoranthene, pyrene, benz[a]anthracene, chrysene, benzofluoranthenes, benzo[a]pyrene, indeno[1,2,3-cd]pyrene, dibenz[a,h]anthracene, and benzo[ghi]perylene.

[4] Total PAHs: Represents the sum of Total LPAHs and HPAHs.

[5] Total PCBs: The list of PCB congeners is based on EPA recommendations provided in *QA/QC Guidance for Sampling and Analysis of Sediment, Water, and Tissues for Dredged Material Evaluations,* EPA 823-B-95-001 (April 1995). This list can be used to estimate total PCBs in accordance with the NOAA method provided in NOAA Technical Memorandum NOA OMA 49 (August 1989). Calculations follow the Battelle method: Total PCB = 1.95 (Σ congeners listed) + 2.1.

[6] Total DDTs: Sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.

Qualifiers:

B1	This analyte was detected in the associated method blank. The concentration was determined not to be significantly higher than the associated method blank (less than 10 times the concentration reported in the blank).
B2	This analyte was detected in the associated method blank. The analyte concentration in the sample was determined to be significantly higher than the method blank (greater than 10 times the concentration reported in the blank).
C1	Second column confirmation was performed. The relative percent difference value (RPD) between the results on the two columns was evaluated and determined to be < 40%.
C2	Second column confirmation was performed. The RPD between the results on the two columns was evaluated and determined to be > 40%. The higher result was reported unless anomalies were noted.
D5	The analyte exceeded the linear calibration range and the sample was diluted and reanalyzed. The reported result for the analyte has been flagged with "D" and a number representing the additional dilution required to bring the analyte within the calibration range.
D10	The analyte exceeded the linear calibration range and the sample was diluted and reanalyzed. The reported result for the analyte has been flagged with "D" and a number representing the additional dilution required to bring the analyte within the calibration range.
J	The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.
U	The analyte was not detected above the reported method detection limit.
UJ	The analyte was not detected above the reported method detection limit. However, the reported method detection limit is approximate and may or may not represent the actual method detection limit necessary to accurately and precisely measure the analyte in the sample.
P	The difference between the analyte detected in the front and back column is greater than 40%.

Abbreviations/Definitions:

--	Not available or applicable
HPAH	high molecular weight polycyclic aromatic hydrocarbons
LPAH	low molecular weight polycyclic aromatic hydrocarbons
ug/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
NA	Not analyzed
NOAA	National Oceanographic and Atmospheric Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
TPH	total petroleum hydrocarbon

TABLE 1
Outfall Sediment Analytical Data

Class	Analyte	Units*	DEQ Screening Level (High)	DEQ Screening Level (Baseline)	Outfall 52A										Outfall 53										Outfall 52C											
					SI0152A010 10/17/2002 Normal		SI0152A020 10/17/2002 Normal		SI0152A030 10/17/2002 Normal		SI0152A040 10/17/2002 Normal		SI0152A050 10/17/2002 Normal		SI0153010 10/22/2002 Normal		SI0153020 10/22/2002 Normal		SI0153030 10/22/2002 Normal		SI0153040 10/22/2002 Normal		SI0153050 10/22/2002 Normal		SI0152C010 10/15/2002 Normal		SI0152C020 10/15/2002 Normal		SI0152C030 10/15/2002 Normal		SI0152C040 10/15/2002 Normal		SI0152C050 10/15/2002 Normal		SI0152C051 10/15/2002 Duplicate	
Semivolatile	1,2,4-Trichlorobenzene	ug/kg	9200	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
Organics:	1,2-Dichlorobenzene	ug/kg	1700	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	1,3-Dichlorobenzene	ug/kg	300	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	1,4-Dichlorobenzene	ug/kg	300	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	2,3,4,6-Tetrachlorophenol	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	2,3,5,6-Tetrachlorophenol	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	2,4,5-Trichlorophenol	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	2,4,6-Trichlorophenol	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	2,4-Dichlorophenol	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	2,4-Dimethylphenol	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	2,4-Dinitrophenol	ug/kg	--	--	797	UJ	1040	U	98.4	U	105	UJ	958	U	1150	U	78.2	UJ	88.2	UJ	87.1	U	83.7	UJ	7900	UJ	80.4	U	88.4	U	80.4	U	8150	UJ	8020	UJ
	2,4-Dinitrotoluene	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	2,6-Dinitrotoluene	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	2-Chloronaphthalene	ug/kg	--	--	15.9	UJ	20.9	U	1.97	U	2.09	UJ	19.2	U	22.9	U	1.56	UJ	1.76	UJ	1.74	U	1.67	UJ	158	UJ	1.61	U	1.77	U	1.61	U	163	UJ	160	UJ
	2-Chlorophenol	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	2-Methylnaphthalene	ug/kg	200	150	15.9	UJ	20.9	U	40.2		34.3	J	144		22.9	U	3.43	J	2.49	J	5.62		1.67	UJ	158	UJ	2.46	J	3.79		4.11		163	UJ	160	UJ
	2-Methylphenol	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	2-Nitroaniline	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	2-Nitrophenol	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	3,3'-Dichlorobenzidine	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	3-Nitroaniline	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	4,6-Dinitro-2-Methylphenol	ug/kg	--	--	797	UJ	1040	U	98.4	U	105	UJ	958	U	1150	U	78.2	UJ	88.2	UJ	87.1	U	83.7	UJ	7900	UJ	80.4	U	88.4	U	80.4	U	8150	UJ	8020	UJ
	4-Bromophenyl Phenyl Ether	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	4-Chloro-3-Methylphenol	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	4-Chloroaniline	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	4-Chlorophenyl Phenyl Ether	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	4-Methylphenol	ug/kg	--	680	319	UJ	417	U	41.6	J	41.9	UJ	383	U	459	U	31.3	UJ	35.3	UJ	34.9	U	33.5	UJ	3160	UJ	32.2	U	35.4	U	32.1	U	3260	UJ	3210	UJ
	4-Nitroaniline	ug/kg	--	--	159	UJ	209	U	39	J	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	4-Nitrophenol	ug/kg	--	--	797	UJ	1040	U	98.4	U	105	UJ	958	U	1150	U	78.2	UJ	88.2	UJ	87.1	U	83.7	UJ	7900	UJ	80.4	U	88.4	U	80.4	U	8150	UJ	8020	UJ
	Acenaphthene	ug/kg	300	180	15.9	UJ	31.9	J	63.3		193	J	268		22.9	U	4.23	J	7.42	J	13		1.67	UJ	293	J	7.67		18.6		9.08		269	J	180	J
	Acenaphthylene	ug/kg	200	60	15.9	UJ	20.9	U	32.5		42.7	J	139		22.9	U	1.56	UJ	5.09	J	12.2		5.71	J	158	UJ	4.11		29.6		30.3		163	UJ	160	UJ
	Aniline	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Anthracene	ug/kg	800	150	15.9	UJ	46		151		247	J	426		26.4	J	2.91	J	6.81	J	31		6.14	J	256	J	14.3		38.3		82.8		238	J	160	UJ
	Benzo (a) anthracene	ug/kg	1000	360	17.7	J	241		315	D5	863	D10 J	2600		168		12.8	J	37.2	J	90.1		30.4	J	714	J	64.4		134		103		1180	J	682	J
	Benzo (a) pyrene	ug/kg	1500	500	38.3	J	246		411		972	D10 J	2520		196		16.4	J	52.6	J	108		34.4	J	1010	J	80		155		85.3		1570	J	1520	J
	Benzo [g,h,i] perylene	ug/kg	300	250	39.3	J	222		337		551	D10 J	1940		200		22.7	J	42.9	J	84.2		31.3	J	158	UJ	60.2		99.6		59.2		1470	J	1210	J
	Benzofluoranthenes	ug/kg	--	--	105	J	508		564		2030	D10 J	4130		340		29.7	J	91.5	J	251		82.6	J	1770	J	146		230		148		2800	J	2910	J
	Benzoic Acid	ug/kg	--	200	797	UJ	1040	U	98.4	U	105	UJ	958	U	1150	U	78.2	UJ	88.2	UJ	87.1	U	83.7	UJ	7900	UJ	80.4	U	88.4	U	80.4	U	8150	UJ	8020	UJ
	Benzyl Alcohol	ug/kg	--	20	159	UJ	209	U	21.6	J	85.4	J	244	J	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Bis(2-Chloroethoxy) Methane	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Bis(2-Chloroethyl) Ether	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Bis(2-Chloroisopropyl) Ether	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Bis(2-Ethylhexyl) Phthalate	ug/kg	800	390	1510	J	485		206		180	J	277	J	388	J	19.1	JU	50.1	J	46.1		31.2	JU	1580	UJ	84.6		21.4	JU	16.1	U	1780	J	2110	J
	Butyl Benzyl Phthalate	ug/kg	--	20	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Carbazole	ug/kg	1600	100	159	UJ	209	U	64.9		171	J	219	J	229	U	15.6	UJ	17.6	UJ	19.2	J	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Chrysene	ug/kg	1300	425	36.5	J	244		372	D5	931	D10 J	2540		158		12.5	J	52	J	114		44.9	J	703	J	83.1		136		114		1360	J	968	J
	Di-n-Butyl Phthalate	ug/kg	100	20	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Di-n-Octyl Phthalate	ug/kg	--	20	159	UJ	209	U	212		64.5	J	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Dibenzo (a,h) anthracene	ug/kg	1300	125	15.9	UJ	72.9		75.9		141	J	456		47.1		1.56	UJ	13.3	J	30		6.73	J	158	UJ	30.1		63.3		38.6		163	UJ	160	UJ
	Dibenzofuran	ug/kg	5100	100	159	UJ	209	U	46		94.1	J	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Diethyl Phthalate	ug/kg	600	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Dimethyl Phthalate	ug/kg	--	20	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Fluoranthene	ug/kg	2200	600	31.9	J	434		762	D5	1980	D10 J	3530		229		19.1	J	79.3	J	136		41.9	J	1130	J	119		251		215		1820	J	1230	J
	Fluorene	ug/kg	600	125	15.9	UJ	25.6	J	65.8		173	J	215		22.9	U	2.66	J	5.4	J	10.8		2.69	J	158	UJ	5.97		12.4		10.5		163	UJ	160	UJ
	Hexachlorobenzene	ug/kg	100	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Hexachlorobutadiene	ug/kg	600	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Hexachlorocyclopentadiene	ug/kg	400	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Hexachloroethane	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Indeno (1,2,3-cd) pyrene	ug/kg	100	225	33	J	232		254		484	J	2120		224		20.2	J	34.5	J	80		25.4	J	158	UJ	56.3		96.2		56.6		1070	J	1060	J
	Isophorone	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	n-Nitrosodi-n-Propylamine	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	n-Nitrosodimethylamine	ug/kg	--	--	797	UJ	1040	U	98.4	U	105	UJ	958	U	1150	U	78.2	UJ	88.2	UJ	87.1	U	83.7	UJ	7900	UJ	80.4	U	88.4	U	80.4	U	8150	UJ	8020	UJ
	n-Nitrosodiphenylamine	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Naphthalene	ug/kg	600	200	15.9	UJ	24.4	J	69.7		42.3	J	318		22.9	U	3.26	J	3.67	J	8.79		3.83	J	158	UJ	3.61		8.27		5.51		163	UJ	160	UJ
	Nitrobenzene	ug/kg	--	--	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Pentachlorophenol	ug/kg	1000	97	159	UJ	209	U	19.7	U	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	8410	J	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Phenanthrene	ug/kg	1200	700	17.2	J	203		550	D5	1580	D10 J	1820		99.5		9.67	J	36.9	J	73.7		10.6	J	743	J	51.5		92.5		172		806	J	594	J
	Phenol	ug/kg	50	20	159	UJ	209	U	21.9	UJ	20.9	UJ	192	U	229	U	15.6	UJ	17.6	UJ	17.4	U	16.7	UJ	1580	UJ	16.1	U	17.7	U	16.1	U	1630	UJ	1600	UJ
	Pyrene	ug/kg	1500	700	39.4	J	455		723	D5	1800	D10 J	4060		249		22.5	J	81.8	J	135		51.7	J	1620	J	129		259		298		1900	J	1250	J
	Estimated Total LPAHs[1,2]	ug/kg	400	700	17		331		973		2312		3330		126		26		68		155		29		1292		90		203		314		1313		774	
	Estimated Total HPAHs[1,3]	ug/kg	1000	2400	341		2655		3814		9752		23896		1811		156		485		1028		349		6947		768		1424		1118		13170		10830	
	Estimated Total PAHs[1,4]	ug/kg	23000	--	358		2986		4786		12064		27226		1937		182		553		1183		378		8239		858		1628		1432		14483		11604	
General Chemistry:	Total Organic Carbon	mg/kg	--	20000	7490		48700		22700		20500		15400		10100		2840		1940		2380		1820		12300		2360		1420		71.5	J	28000		18700	
Chlorinated	2,4,5-T	ug/kg	--	--	3.51	U	NA		NA		NA		NA		4.1	U	NA		NA		NA		NA		3.51	U	NA		NA		NA		NA		NA	
Herbicides:	2,4,5-TP	ug/kg	--	--	2.87	U	NA		NA		NA		NA		3.35	U	NA		NA		NA		NA		2.86	U	NA		NA		NA		NA		NA	
	2,4-D	ug/kg	--	3.3	2.98	U	NA		NA		NA		NA		3.48	U	NA		NA		NA		NA		2.98	U	NA		NA		NA		NA		NA	
	2,4-Db	ug/kg	--	5	2.15	U	NA		NA		NA		NA		2.51	U	NA		NA		NA		NA		2.15	U	NA		NA		NA		NA		NA	
	4-Nitrophenol	ug/kg	--	--	1.71	U	NA		NA		NA		NA		2	U	NA		NA		NA		NA		1.71	U	NA		NA		NA		NA		NA	
	Dalapon	ug/kg	--	--	1.72	U	NA		NA		NA		NA		2.01	U	NA		NA		NA		NA		1.72	U	NA		NA		NA		NA		NA	
	Dicamba	ug/kg	--	--	1.76	U	NA		NA		NA		NA		2.06	U	NA		NA		NA		NA		1.76	U	NA		NA		NA		NA		NA	
	Dichloroprop	ug/kg	--	--	2.84	U	NA		NA		NA		NA		3.31	U	NA		NA		NA		NA		2.83	U	NA		NA		NA		NA		NA	
	DinosEquip Blank	ug/kg	--	--	2.46	U	NA		NA		NA		NA		2.87	U	NA		NA		NA		NA		2.46	U	NA		NA		NA		NA		NA	
	Mcpa	ug/kg	--	--	3.36	U	NA		NA		NA		NA		3.93	U	NA		NA		NA		NA		3.36	U	NA		NA		NA		NA		NA	
	Mcpp	ug/kg	--	--	1.5	U	NA		NA		NA		NA		1.75	U	NA		NA		NA		NA		1.5	U	NA		NA		NA		NA		NA	
	Pentachlorophenol	ug/kg	1000	97	11.5		NA		NA		NA		NA		46.5		NA		NA		NA		NA		26.8		NA		NA		NA		NA		NA	

TABLE 1
Outfall Sediment Analytical Data

Class	Analyte	Units*	DEQ Screening Level (High)	DEQ Screening Level (Baseline)	Outfall 52A									
					SI0152A010 10/17/2002 Normal		SI0152A020 10/17/2002 Normal		SI0152A030 10/17/2002 Normal		SI0152A040 10/17/2002 Normal		SI0152A050 10/17/2002 Normal	
Total Metals:	Aluminum	mg/kg	--	42800	13100		9350		12700		18200		8500	
	Antimony	mg/kg	64	5	0.499		1.41		2.53		0.969		0.678	
	Arsenic	mg/kg	33	5	3.49		5.26		8.96		4.93		5.52	
	Cadmium	mg/kg	5	0.6	0.268	U	0.334	U	0.333	U	0.398	U	0.318	U
	Chromium	mg/kg	111	41	27.6		28.5		43.8		46.9		33.7	
	Copper	mg/kg	149	60	39		122		173		126		308	
	Lead	mg/kg	130	30	17.5	B2	47.1	B2	88	B2	63.8	B2	24.5	B2
	Mercury	mg/kg	1	0.1	0.0269		0.0483		0.0842		0.125		0.0998	
	Nickel	mg/kg	49	32	21.4		20.1		26.3		30.8		22.7	
	Selenium	mg/kg	5	15	0.447	U	0.556	U	0.556	U	0.664	U	0.531	U
	Silver	mg/kg	5	1.4	0.167		3.93		0.408		0.476		0.226	
	Zinc	mg/kg	459	118	175		215		359		153		238	
PCBs as Congeners:	PCB-008	ug/kg	--	--	0.3	U	0.77	JP	0.65	JP	0.98	J	0.39	U
	PCB-018	ug/kg	--	--	0.3	U	0.4	U	0.39	U	0.48	U	0.38	U
	PCB-028	ug/kg	--	--	1.13		0.83	P	0.8	P	0.32	JP	0.37	JP
	PCB-044	ug/kg	--	--	0.81	P	0.75	P	0.96	P	1.31		0.91	
	PCB-052	ug/kg	--	--	1.57	P	3.98	P	2.51	P	0.48	JP	0.68	JP
	PCB-066	ug/kg	--	--	2.11		1.54	P	2.79		1.5		1.37	
	PCB-101	ug/kg	--	--	0.53		1.04		0.68	P	0.35	U	1.34	
	PCB-105	ug/kg	--	--	0.13	U	0.22	JP	0.17	U	0.21	U	0.17	U
	PCB-118	ug/kg	--	--	0.37	JP	0.81	JP	0.71	JP	0.4	JP	0.46	JP
	PCB-128	ug/kg	--	--	0.14	U	0.41	JP	0.4	JP	0.55	JP	0.29	JP
	PCB-138	ug/kg	--	--	0.58	J	1.44		1.56		1.33	P	1.52	P
	PCB-153	ug/kg	--	--	0.91		1.07	P	1.84		2.77		4.43	
	PCB-170	ug/kg	--	--	0.15	U	0.27	JP	0.25	JP	0.35	JP	0.49	JP
	PCB-180	ug/kg	--	--	0.29	J	0.77	J	0.75	J	1.27		1.66	P
	PCB-187	ug/kg	--	--	0.16	U	0.43		0.25	JP	1	P	2.04	
	Estimated Total PCBs[1,5]	ug/kg	700	180	18.3		30.0		29.7		26.0		32.4	
Pesticides:	2,4'-DDD	ug/kg	--	--	2.07	U	4.45	J C1	5.67	U	3.26	U	8.49	C2 J
	2,4'-DDE	ug/kg	--	--	2.07	U	2.58	U	5.67	U	3.26	U	2.58	UJ
	2,4'-DDT	ug/kg	--	--	2.07	U	2.58	U	5.67	U	3.26	U	2.58	UJ
	4,4'-DDD	ug/kg	30	--	0.403	U	0.501	U	5.67	U	3.77	J C1	12.4	C2 J
	4,4'-DDE	ug/kg	30	--	0.477	U	0.593	U	5.67	U	2.76	J C2	3.74	J C1
	4,4'-DDT	ug/kg	60	--	0.537	U	2.79	J C1	7.67	C2	6.69	C1	3.6	J C1
	Estimated Total DDTs[1,6]	ug/kg	--	220	--		2.79		7.67		13.22		19.74	
	4,4'-Methoxychlor	ug/kg	--	--	2.86	U	3.55	U	28.3	U	4.49	U	3.55	UJ
	Aldrin	ug/kg	40	--	1.01	J C2	1.11	U	2.83	U	1.41	U	1.11	UJ
	Alpha-BHC	ug/kg	--	--	0.644	U	0.8	U	2.83	U	1.01	U	0.8	UJ
	beta-BHC	ug/kg	--	--	0.878	U	1.09	U	2.83	U	1.38	U	1.09	UJ
	Beta-Chlordane	ug/kg	--	--	0.842	U	1.05	U	2.83	U	14.8	C2	3.93	C2 J
	Chlordane	ug/kg	20	--	2.92	U	3.63	U	**28.3**	**U**	4.59	U	3.63	UJ
	cis-Chlordane	ug/kg	--	--	0.824	U	1.02	U	2.83	U	1.3	U	1.02	UJ
	cis-Nonachlor	ug/kg	--	--	2.07	U	2.58	U	10.3	C2	3.71	J C2	6.19	C1 J
	delta-BHC	ug/kg	--	--	0.796	U	0.988	U	2.83	U	1.25	U	0.989	UJ
	Dieldrin	ug/kg	60	--	0.68	U	0.845	U	5.67	U	1.07	U	3.67	J C1
	Endosulfan I	ug/kg	--	--	0.883	U	1.1	U	2.83	U	4.11	C2	1.1	UJ
	Endosulfan II	ug/kg	--	--	0.802	U	0.995	U	5.67	U	1.26	U	0.995	UJ
	Endosulfan Sulfate	ug/kg	--	--	0.755	U	0.937	U	5.85	C1	1.19	U	4.44	J C2
	Endrin	ug/kg	200	--	0.748	U	0.929	U	5.67	U	1.18	U	0.929	UJ
	Endrin Aldehyde	ug/kg	--	--	0.846	U	1.05	U	5.67	U	1.33	U	1.05	UJ
	Endrin Ketone	ug/kg	--	--	0.583	U	0.724	U	5.67	U	0.916	U	0.724	UJ
	Heptachlor	ug/kg	10	--	0.714	U	0.887	U	2.83	U	1.12	U	0.887	UJ
	Heptachlor Epoxide	ug/kg	20	--	0.758	U	0.941	U	2.83	U	1.19	U	0.941	UJ
	Hexachlorobenzene	ug/kg	100	--	1.04	U	1.29	U	2.83	U	1.77	J C2	1.31	J C1
	Hexachlorobutadiene	ug/kg	600	--	1.04	U	1.29	U	2.83	U	1.63	U	1.29	UJ
	Hexachloroethane	ug/kg	--	--	1.04	U	1.29	U	2.83	U	1.63	U	1.29	UJ
	Lindane	ug/kg	5	--	0.793	U	0.984	U	2.83	U	1.25	U	0.984	UJ
	Oxychlordane	ug/kg	--	--	2.07	U	2.58	U	5.67	U	3.26	U	2.58	UJ
	Toxaphene	ug/kg	--	--	13	U	16.1	U	283	U	20.4	U	16.1	UJ
	Trans-Nonachlor	ug/kg	--	--	2.07	U	2.58	U	5.67	U	3.26	U	2.58	UJ
TPH:	Diesel	mg/kg	--	--	25.3		82.7		73.8		75.7		185	
	Lube Oil - NWTPH	mg/kg	--	--	129		377		322		277		406	

Analyte	Outfall 53									
	SI0153010 10/22/2002 Normal		SI0153020 10/22/2002 Normal		SI0153030 10/22/2002 Normal		SI0153040 10/22/2002 Normal		SI0153050 10/22/2002 Normal	
Aluminum	6440		6150		6270		7660		5920	
Antimony	0.434	B2	0.127	B2	0.161	B2	0.168	B2	0.124	B2
Arsenic	2.56		1.98		2.22		2.65		1.99	
Cadmium	*0.709*	*U*	0.421	U	0.507	U	0.482	U	0.464	U
Chromium	23.6	B2	11.5	B2	13.1	B2	16.1	B2	14.5	B2
Copper	35.5	B2	13.4	B2	14.1	B2	15.9	B2	13.2	B2
Lead	38.5	B2	8.84	B2	9.42	B2	15.2	B2	5.64	B2
Mercury	0.153		0.0163	J	0.0307		0.0255	J	0.0212	J
Nickel	20.3	B2	12.9	B2	12.6	B2	16	B2	15	B2
Selenium	0.709	U	0.421	U	0.507	U	0.482	U	0.464	U
Silver	0.876	B2	0.0959	B2	0.187	B2	0.143	B2	0.0943	B2
Zinc	187	B2	42.5	B2	54	B2	62.9	B2	42.8	B2
PCB-008	0.47	PU	0.32	U	0.34	U	0.35	U	0.35	U
PCB-018	0.46	U	0.31	U	0.34	U	0.34	U	0.34	U
PCB-028	0.72	P	0.2	U	0.22	U	0.22	U	0.22	U
PCB-044	0.26	PU	0.18	JPU	0.19	JPU	0.2	JPU	0.2	JPU
PCB-052	0.41	U	0.28	U	0.3	U	0.31	U	0.31	U
PCB-066	1.92		0.16	U	0.18	U	0.18	U	0.18	U
PCB-101	0.49	P	0.23	U	0.25	U	0.25	U	0.25	U
PCB-105	0.2	U	0.14	U	0.15	U	0.15	U	0.15	U
PCB-118	0.25	U	0.17	U	0.18	U	0.19	U	0.19	U
PCB-128	0.39	JP	0.14	U	0.16	U	0.23	JP	0.16	U
PCB-138	0.92	J	0.16	U	0.17	U	0.17	U	0.17	U
PCB-153	0.64	P	0.2	U	0.21	U	0.33	JP	0.22	U
PCB-170	0.28	JP	0.16	U	0.17	U	0.17	U	0.17	U
PCB-180	0.55	JP	0.14	U	0.15	U	0.2	JP	0.15	U
PCB-187	0.57	P	0.17	U	0.18	U	0.19	U	0.19	U
Estimated Total PCBs[1,5]	14.7		--		--		3.6		--	
2,4'-DDD	3.11	UJ	2.17	UJ	2.57	UJ	2.69	UJ	2.61	UJ
2,4'-DDE	3.11	UJ	2.17	UJ	2.57	UJ	2.69	UJ	2.61	UJ
2,4'-DDT	3.11	UJ	2.17	UJ	2.57	UJ	2.69	UJ	2.61	UJ
4,4'-DDD	0.605	UJ	0.421	UJ	0.499	UJ	0.524	UJ	0.508	UJ
4,4'-DDE	0.716	UJ	0.498	UJ	0.591	UJ	0.62	UJ	0.601	UJ
4,4'-DDT	0.806	UJ	0.561	UJ	0.665	UJ	0.698	UJ	0.677	UJ
Estimated Total DDTs[1,6]	--		--		--		--		--	
4,4'-Methoxychlor	4.29	UJ	2.98	UJ	3.53	UJ	3.71	UJ	3.6	UJ
Aldrin	1.34	UJ	0.935	UJ	1.11	UJ	1.16	UJ	1.13	UJ
Alpha-BHC	1.78	J C2	0.673	UJ	0.797	UJ	0.837	UJ	0.812	UJ
beta-BHC	1.32	UJ	0.917	UJ	1.09	UJ	1.14	UJ	1.11	UJ
Beta-Chlordane	6.24	C2 J	0.879	UJ	1.04	UJ	1.09	UJ	1.06	UJ
Chlordane	4.38	UJ	3.05	UJ	3.61	UJ	3.79	UJ	3.68	UJ
cis-Chlordane	1.24	UJ	0.861	UJ	1.02	UJ	1.07	UJ	1.04	UJ
cis-Nonachlor	3.11	UJ	2.17	UJ	2.57	UJ	2.69	UJ	2.61	UJ
delta-BHC	2.23	J C2	0.831	UJ	0.985	UJ	1.03	UJ	1	UJ
Dieldrin	1.02	UJ	0.71	UJ	0.842	UJ	0.884	UJ	0.857	UJ
Endosulfan I	1.33	UJ	0.922	UJ	1.09	UJ	1.15	UJ	1.11	UJ
Endosulfan II	1.2	UJ	0.837	UJ	0.992	UJ	1.04	UJ	1.01	UJ
Endosulfan Sulfate	1.13	UJ	0.788	UJ	0.933	UJ	0.98	UJ	0.95	UJ
Endrin	1.12	UJ	0.782	UJ	0.926	UJ	0.972	UJ	0.943	UJ
Endrin Aldehyde	1.27	UJ	0.883	UJ	1.05	UJ	1.1	UJ	1.06	UJ
Endrin Ketone	0.874	UJ	0.609	UJ	0.721	UJ	0.757	UJ	0.734	UJ
Heptachlor	1.07	UJ	0.746	UJ	0.883	UJ	0.928	UJ	0.899	UJ
Heptachlor Epoxide	1.14	UJ	0.791	UJ	0.937	UJ	0.984	UJ	0.954	UJ
Hexachlorobenzene	2.88	J C2	1.08	UJ	1.28	UJ	1.35	UJ	1.31	UJ
Hexachlorobutadiene	1.56	UJ	1.08	UJ	1.28	UJ	1.35	UJ	1.31	UJ
Hexachloroethane	1.56	UJ	1.08	UJ	1.28	UJ	1.35	UJ	1.31	UJ
Lindane	1.19	UJ	0.828	UJ	0.981	UJ	1.03	UJ	0.998	UJ
Oxychlordane	3.11	UJ	2.17	UJ	2.57	UJ	2.69	UJ	2.61	UJ
Toxaphene	19.5	UJ	13.6	UJ	16.1	UJ	16.9	UJ	16.4	UJ
Trans-Nonachlor	3.11	UJ	2.17	UJ	2.57	UJ	2.69	UJ	2.61	UJ
Diesel	47.9		5.38		11.1		7.5		9.31	
Lube Oil - NWTPH	267		30.4		60		58.2		74.3	

Analyte	Outfall 52C											
	SI0152C010 10/15/2002 Normal		SI0152C020 10/15/2002 Normal		SI0152C030 10/15/2002 Normal		SI0152C040 10/15/2002 Normal		SI0152C050 10/15/2002 Normal		SI0152C051 10/15/2002 Duplicate	
Aluminum	4870		5810		7190		7580		10500		8610	
Antimony	10.9		0.606	J	0.322	J	0.264	J	0.89		0.903	
Arsenic	2.34	B2	2.96	B2	6.84	B2	2.9	B2	4.05	B2	3.52	B2
Cadmium	0.449		0.00168	U	0.00182	U	0.00167	U	0.122	J	0.265	
Chromium	238		138		16.2		14.7		57		75.1	
Copper	47.7	B2	22.3	B2	18	B2	14.3	B2	48.1	B2	38.5	B2
Lead	61.4	B2	27.1	B2	44.5	B2	13.8	B2	68.9	B2	81.7	B2
Mercury	0.0486		0.00894	U	0.0222	J	0.00917	U	0.0656		0.0747	
Nickel	30.5		14.8		15.3		16.4		22.5		19.1	
Selenium	0.0819	U	0.0909	U	0.0988	U	0.0905	U	0.0976	U	0.0985	U
Silver	0.175	B2	0.119	B2	0.164	B2	0.127	B2	0.262	B2	0.213	B2
Zinc	311	B2	72.5	B2	68.7	B2	43.7	B2	146	B2	135	B2
PCB-008	1.36	P	0.3	U	0.3	U	0.31	U	0.37	U	0.63	JP
PCB-018	3.74		0.3	U	0.3	U	0.3	U	0.67	JP	3.75	
PCB-028	9.2		0.54	P	0.19	U	0.2	U	4.46		5.64	
PCB-044	3.13		0.62		0.17	U	0.17	U	2.38		2.93	
PCB-052	4.2	P	0.76	P	0.27	U	0.27	U	6.44	P	6.94	P
PCB-066	3.3		0.49	P	0.35		0.16	U	2.36	P	4.08	
PCB-101	1.56		0.26	JP	0.22	U	0.22	U	2.3		2.72	
PCB-105	0.22	JP	0.13	U	0.19	JP	0.13	U	0.46	JP	0.47	JP
PCB-118	1.24	P	0.16	U	0.16	U	0.17	U	2.53		2.11	P
PCB-128	0.4	JP	0.14	U	0.14	U	0.14	U	0.52	JP	1.32	P
PCB-138	2		0.15	U	0.15	U	0.15	U	3.65		4.73	
PCB-153	1.38	P	0.19	U	0.19	U	0.19	U	2.33	P	4.2	
PCB-170	0.5	JP	0.15	U	0.15	U	0.15	U	0.87	P	0.76	P
PCB-180	1.37		0.27	J	0.13	U	0.14	U	2.25		2.45	
PCB-187	0.57	P	0.16	U	0.16	U	0.17	U	1.12		3.33	
Estimated Total PCBs[1,5]	68.7		7.8		3.2		--		65.2		91.9	
2,4'-DDD	23.2	U	2.48	U	2.49	U	2.41	U	23.1	U	24.6	U
2,4'-DDE	23.2	U	2.48	U	2.49	U	2.41	U	23.1	U	24.6	U
2,4'-DDT	23.2	U	2.48	U	2.49	U	2.41	U	23.1	U	24.6	U
4,4'-DDD	4.51	U	0.483	U	0.485	U	0.469	U	4.49	U	4.79	U
4,4'-DDE	5.33	U	0.571	U	0.574	U	0.555	U	5.31	U	5.67	U
4,4'-DDT	6	U	0.643	U	0.646	U	0.625	U	5.98	U	6.38	U
Estimated Total DDTs[1,6]	--		--		--		--		--		--	
4,4'-Methoxychlor	31.9	U	3.42	U	3.43	U	3.32	U	31.8	U	33.9	U
Aldrin	10	U	1.07	U	1.08	U	1.04	U	9.96	U	10.6	U
Alpha-BHC	7.2	U	0.771	U	0.775	U	0.749	U	7.17	U	7.65	U
beta-BHC	9.81	U	1.05	U	1.06	U	1.02	U	9.77	U	10.4	U
Beta-Chlordane	9.41	U	1.01	U	1.01	U	0.979	U	9.37	U	10	U
Chlordane	**32.6**	**U**	3.5	U	3.51	U	3.4	U	**32.5**	**U**	**34.7**	**U**
cis-Chlordane	9.21	U	0.987	U	0.992	U	0.959	U	9.17	U	9.79	U
cis-Nonachlor	23.2	U	2.48	U	2.49	U	2.41	U	23.1	U	24.6	U
delta-BHC	8.9	U	0.953	U	0.957	U	0.926	U	8.86	U	9.45	U
Dieldrin	7.6	U	0.814	U	0.818	U	0.791	U	7.57	U	8.08	U
Endosulfan I	9.87	U	1.06	U	1.06	U	1.03	U	9.83	U	10.5	U
Endosulfan II	8.96	U	0.96	U	0.964	U	0.932	U	8.92	U	9.52	U
Endosulfan Sulfate	8.43	U	0.903	U	0.908	U	0.877	U	8.4	U	8.96	U
Endrin	8.36	U	0.896	U	0.9	U	0.87	U	8.33	U	8.89	U
Endrin Aldehyde	9.45	U	1.01	U	1.02	U	0.983	U	9.41	U	10	U
Endrin Ketone	6.51	U	0.698	U	0.701	U	0.678	U	6.48	U	6.92	U
Heptachlor	7.98	U	0.855	U	0.859	U	0.83	U	7.95	U	8.48	U
Heptachlor Epoxide	8.47	U	0.907	U	0.911	U	0.881	U	8.43	U	9	U
Hexachlorobenzene	11.6	U	1.24	U	1.25	U	1.21	U	11.5	U	12.3	U
Hexachlorobutadiene	11.6	U	1.24	U	1.25	U	1.21	U	11.5	U	12.3	U
Hexachloroethane	34.1	C2	1.24	U	1.25	U	1.21	U	11.5	U	12.3	U
Lindane	**8.86**	**U**	0.949	U	0.953	U	0.922	U	**8.82**	**U**	**9.41**	**U**
Oxychlordane	23.2	U	2.48	U	2.49	U	2.41	U	23.1	U	24.6	U
Toxaphene	145	U	15.6	U	15.6	U	15.1	U	145	U	154	U
Trans-Nonachlor	23.2	U	2.48	U	2.49	U	2.41	U	23.1	U	24.6	U
Diesel	37.6	J	11.4	J	10.5		6.55		76.5	J	97.8	
Lube Oil - NWTPH	302		68.3		147		1.03	U	316		484	

Notes:

DEQ baseline and high values are used here for screening purposes only. Additional evaluation is needed to develop site-specific risk and/or cleanup concentrations.

*Equipment blank samples reported in liters, not kilograms.

bold	The method detection limit exceeds DEQ High Screening Value.
border	The reported value exceeds DEQ High Screening Value.
italic	The method detection limit exceeds Portland Harbor Baseline Screening Value.
shaded	The reported value exceeds Portland Harbor Baseline Screening Value.

[1] Total parameters (i.e., LPAHs, HPAHs, PAHs, PCBs, and DDTs) were calculated based on detections only. Qualifiers are not included on total parameters as it is implied that these are estimated quantities.

[2] Total LPAHs: Includes naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, and 2-methylnaphthalene.

[3] Total HPAHs: Includes fluoranthene, pyrene, benz[a]anthracene, chrysene, benzofluoranthenes, benzo[a]pyrene, indeno[1,2,3-cd]pyrene, dibenz[a,h]anthracene, and benzo[ghi]perylene.

[4] Total PAHs: Represents the sum of Total LPAHs and HPAHs.

[5] Total PCBs: The list of PCB congeners is based on EPA recommendations provided in *QA/QC Guidance for Sampling and Analysis of Sediment, Water, and Tissues for Dredged Material Evaluations,* EPA 823-B-95-001 (April 1995).
This list can be used to estimate total PCBs in accordance with the NOAA method provided in NOAA Technical Memorandum NOA OMA 49 (August 1989). Calculations follow the Battelle method: Total PCB = 1.95 (Σ congeners listed) + 2.1.

[6] Total DDTs: Sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.

Qualifiers:

B1	This analyte was detected in the associated method blank. The concentration was determined not to be significantly higher than the associated method blank (less than 10 times the concentration reported in the blank).
B2	This analyte was detected in the associated method blank. The analyte concentration in the sample was determined to be significantly higher than the method blank (greater than 10 times the concentration reported in the blank).
C1	Second column confirmation was performed. The relative percent difference value (RPD) between the results on the two columns was evaluated and determined to be < 40%.
C2	Second column confirmation was performed. The RPD between the results on the two columns was evaluated and determined to be > 40%. The higher result was reported unless anomalies were noted.
D5	The analyte exceeded the linear calibration range and the sample was diluted and reanalyzed. The reported result for the analyte has been flagged with "D" and a number representing the additional dilution required to bring the analyte within the calibration range.
D10	The analyte exceeded the linear calibration range and the sample was diluted and reanalyzed. The reported result for the analyte has been flagged with "D" and a number representing the additional dilution required to bring the analyte within the calibration range.
J	The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.
U	The analyte was not detected above the reported method detection limit.
UJ	The analyte was not detected above the reported method detection limit. However, the reported method detection limit is approximate and may or may not represent the actual method detection limit necessary to accurately and precisely measure the analyte in the sample.
P	The difference between the analyte detected in the front and back column is greater than 40%.

Abbreviations/Definitions:

--	Not available or applicable
HPAH	high molecular weight polycyclic aromatic hydrocarbons
LPAH	low molecular weight polycyclic aromatic hydrocarbons
ug/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
NA	Not analyzed
NOAA	National Oceanographic and Atmospheric Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
TPH	total petroleum hydrocarbon

TABLE 1
Outfall Sediment Analytical Data

Class	Analyte	Units*	DEQ Screening Level (High)	DEQ Screening Level (Baseline)	Outfall 19A						Outfall 19						Outfall 22															
					SI0119A010 10/18/2002 Normal		SI0119A020 10/18/2002 Normal		SI0119A030 10/18/2002 Normal		SI0119010 10/18/2002 Normal		SI0119020 10/18/2002 Normal		SI0119030 10/18/2002 Normal		SI0122010 10/21/2002 Normal		SI0122020 10/21/2002 Normal		SI0122030 10/21/2002 Normal		SI0122031 10/21/2002 Duplicate		SI0122040 10/21/2002 Normal		SI0122050 10/21/2002 Normal		SI0122060 10/21/2002 Normal		SI0122062 10/21/2002 Equip Blank	
Semivolatile Organics:	1,2,4-Trichlorobenzene	ug/kg	9200	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	1,2-Dichlorobenzene	ug/kg	1700	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	1,3-Dichlorobenzene	ug/kg	300	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	1,4-Dichlorobenzene	ug/kg	300	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	2,3,4,6-Tetrachlorophenol	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	2,3,5,6-Tetrachlorophenol	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	2,4,5-Trichlorophenol	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	2,4,6-Trichlorophenol	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	2,4-Dichlorophenol	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	2,4-Dimethylphenol	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	2,4-Dinitrophenol	ug/kg	--	--	1010	UJ	1150	U	1070	U	910	UJ	1110	UJ	1080	U	820	U	101	UJ	1030	U	927	UJ	1390	U	1290	U	1220	UJ	4.17	U
	2,4-Dinitrotoluene	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	2,6-Dinitrotoluene	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	2-Chloronaphthalene	ug/kg	--	--	20.2	UJ	23.1	U	21.4	U	18.2	UJ	22.3	UJ	21.7	U	16.4	U	2.03	UJ	20.6	U	18.5	UJ	27.9	U	25.9	U	24.5	UJ	0.0833	U
	2-Chlorophenol	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	2-Methylnaphthalene	ug/kg	200	150	182	J	75		76.5		60.3	J	314	J	44.2		16.4	U	22.6	J	89.2		18.5	UJ	27.9	U	25.9	U	24.5	UJ	0.208	U
	2-Methylphenol	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	2-Nitroaniline	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	2-Nitrophenol	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	3,3'-Dichlorobenzidine	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	3-Nitroaniline	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	4,6-Dinitro-2-Methylphenol	ug/kg	--	--	1010	UJ	1150	U	1070	U	910	UJ	1110	UJ	1080	U	820	U	101	UJ	1030	U	927	UJ	1390	U	1290	U	1220	UJ	4.17	U
	4-Bromophenyl Phenyl Ether	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	4-Chloro-3-Methylphenol	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	4-Chloroaniline	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	4-Chlorophenyl Phenyl Ether	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	4-Methylphenol	ug/kg	--	680	404	UJ	462	U	427	U	364	UJ	563	J	434	U	328	U	79.7	J	413	U	371	UJ	557	U	518	U	489	UJ	1.67	U
	4-Nitroaniline	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	4-Nitrophenol	ug/kg	--	--	1010	UJ	1150	U	1070	U	910	UJ	1110	UJ	1080	U	820	U	101	UJ	1030	U	927	UJ	1390	U	1290	U	1220	UJ	4.17	U
	Acenaphthene	ug/kg	300	180	251	J	58		60.3		72	J	508	J	40.1	J	16.4	U	36.4	J	20.6	U	18.5	UJ	27.9	U	38.8	J	33.9	J	0.232	
	Acenaphthylene	ug/kg	200	60	197	J	73		31	J	34.6	J	22.3	UJ	30.4	J	16.4	U	50.7	J	354		18.5	UJ	35.7	J	48.8	J	24.5	UJ	0.0833	U
	Aniline	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Anthracene	ug/kg	800	150	357	J	99.7		77.3		97.2	J	892	J	105		16.4	U	184	J	677		33.8	J	50.5	J	84.2		37.5	J	0.0833	U
	Benzo (a) anthracene	ug/kg	1000	360	850	J	271		117		147	J	1210	J	108		23.6	J	148	J	3350		111	J	106		550		92.7	J	0.0833	U
	Benzo (a) pyrene	ug/kg	1500	500	735	J	257		99.3		108	J	905	J	77.7		32.8		107	J	2470		144	J	129		356		109	J	0.0833	U
	Benzo [g,h,i] perylene	ug/kg	300	250	554	J	182		76.4		86	J	666	J	104		47.6		89	J	1340		154	J	132		248		81.3	J	0.0833	U
	Benzofluoranthenes	ug/kg	--	--	1140	J	417		186		233	J	1450	J	100		67.2		176	J	3380		271	J	241		778		183	J	0.167	U
	Benzoic Acid	ug/kg	--	200	1010	UJ	1150	U	1070	U	910	UJ	1110	UJ	1080	U	820	U	101	UJ	1030	U	927	UJ	1390	U	1290	U	1220	UJ	4.17	U
	Benzyl Alcohol	ug/kg	--	20	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Bis(2-Chloroethoxy) Methane	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Bis(2-Chloroethyl) Ether	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Bis(2-Chloroisopropyl) Ether	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Bis(2-Ethylhexyl) Phthalate	ug/kg	800	390	4420	J	479		483		3050	J	3240	J	290	J	164	U	113	J	622		234	J	279	U	263	J	369	J B1	1.28	J
	Butyl Benzyl Phthalate	ug/kg	--	20	231	J	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Carbazole	ug/kg	1600	100	202	UJ	231	U	214	U	182	UJ	350	J	217	U	164	U	50.8	J	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Chrysene	ug/kg	1300	425	870	J	274		150		225	J	1290	J	93.4		44.2		193	J	3500		162	J	199		762		265	J	0.0833	U
	Di-n-Butyl Phthalate	ug/kg	100	20	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Di-n-Octyl Phthalate	ug/kg	--	20	612	J	231	U	214	U	182	UJ	437	J	217	U	164	U	40.3	J	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Dibenzo (a,h) anthracene	ug/kg	1300	125	166	J	52.1		21.4	U	18.2	UJ	221	J	21.7	U	16.4	U	21.7	J	345		48.1	J	27.9	U	62.1		33.6	J	0.0833	U
	Dibenzofuran	ug/kg	5100	100	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	21.6	J	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Diethyl Phthalate	ug/kg	600	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Dimethyl Phthalate	ug/kg	--	20	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	31	J	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Fluoranthene	ug/kg	2200	600	1340	J	523		304		419	J	2980	J	245		34.8		403	J	3580		241	J	280		1480		250	J	0.0833	U
	Fluorene	ug/kg	600	125	215	J	76.1		52.8		79.1	J	766	J	40.7	J	16.4	U	54.1	J	20.6	U	18.5	UJ	28.8	J	40.9	J	26.4	J	0.0833	U
	Hexachlorobenzene	ug/kg	100	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Hexachlorobutadiene	ug/kg	600	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Hexachlorocyclopentadiene	ug/kg	400	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Hexachloroethane	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Indeno (1,2,3-cd) pyrene	ug/kg	100	225	466	J	178		67.2		70.8	J	620	J	67.1		33.4		76.3	J	1130		125	J	119		216		70	J	0.0833	U
	Isophorone	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	n-Nitrosodi-n-Propylamine	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	n-Nitrosodimethylamine	ug/kg	--	--	1010	UJ	1150	U	1070	U	910	UJ	1110	UJ	1080	U	820	U	101	UJ	1030	U	927	UJ	1390	U	1290	U	1220	UJ	4.17	U
	n-Nitrosodiphenylamine	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Naphthalene	ug/kg	600	200	269	J	113		146		78.6	J	220	J	108		16.4	U	26.8	J	154		18.5	UJ	29.1	J	34.9	J	24.5	UJ	0.208	U
	Nitrobenzene	ug/kg	--	--	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Pentachlorophenol	ug/kg	1000	97	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Phenanthrene	ug/kg	1200	700	1060	J	304		265		386	J	2170	J	218		16.4	U	286	J	1110		122	J	193		276		164	J	0.0833	U
	Phenol	ug/kg	50	20	202	UJ	231	U	214	U	182	UJ	223	UJ	217	U	164	U	20.3	UJ	206	U	185	UJ	279	U	259	U	245	UJ	0.833	U
	Pyrene	ug/kg	1500	700	1680	J	591		340		413	J	2870	J	261		101		503	J	6730	D5	303	J	343		1420		234	J	0.0833	U
	Estimated Total LPAHs[1,2]	ug/kg	400	700	2531		799		709		808		4870		586		--		661		2384		156		337		524		262		0	
	Estimated Total HPAHs[1,3]	ug/kg	1000	2400	7801		2745		1340		1702		12212		1056		385		1717		25825		1559		1549		5872		1319		--	
	Estimated Total PAHs[1,4]	ug/kg	23000	--	10332		3544		2049		2510		17082		1643		385		2378		28209		1715		1886		6396		1580		0	
General Chemistry:	Total Organic Carbon	mg/kg	--	20000	29900		24300		23300		16600		36900		13000		576		15400		9530		55300		17500		21800		20000		37.4	
Chlorinated Herbicides:	2,4,5-T	ug/kg	--	--	3.3	U	NA		NA		3.21	U	NA		NA		2.95	U	NA		NA		NA		NA		NA		NA		0.0479	U
	2,4,5-TP	ug/kg	--	--	2.7	U	NA		NA		2.62	U	NA		NA		2.41	U	NA		NA		NA		NA		NA		NA		0.0161	U
	2,4-D	ug/kg	--	3.3	2.8	U	NA		NA		2.72	U	NA		NA		2.5	U	NA		NA		NA		NA		NA		NA		0.0377	U
	2,4-Db	ug/kg	--	5	2.02	U	NA		NA		1.96	U	NA		NA		1.81	U	NA		NA		NA		NA		NA		NA		0.0434	U
	4-Nitrophenol	ug/kg	--	--	1.61	U	NA		NA		1.56	U	NA		NA		1.44	U	NA		NA		NA		NA		NA		NA		0.0373	U
	Dalapon	ug/kg	--	--	1.62	U	NA		NA		1.57	U	NA		NA		1.45	U	NA		NA		NA		NA		NA		NA		0.0474	U
	Dicamba	ug/kg	--	--	1.65	U	NA		NA		1.61	U	NA		NA		1.48	U	NA		NA		NA		NA		NA		NA		0.039	U
	Dichloroprop	ug/kg	--	--	2.67	U	NA		NA		2.59	U	NA		NA		2.38	U	NA		NA		NA		NA		NA		NA		0.0161	U
	DinosEquip Blank	ug/kg	--	--	2.31	U	NA		NA		2.25	U	NA		NA		2.07	U	NA		NA		NA		NA		NA		NA		0.0463	U
	Mcpa	ug/kg	--	--	3.16	U	NA		NA		3.07	U	NA		NA		2.83	U	NA		NA		NA		NA		NA		NA		0.0221	U
	Mcpp	ug/kg	--	--	1.41	U	NA		NA		1.37	U	NA		NA		1.26	U	NA		NA		NA		NA		NA		NA		0.0296	U
	Pentachlorophenol	ug/kg	1000	97	15.1		NA		NA		2.01	U	NA		NA		1.85	U	NA		NA		NA		NA		NA		NA		0.0233	U

TABLE 1
Outfall Sediment Analytical Data

Class	Analyte	Units*	DEQ Screening Level (High)	DEQ Screening Level (Baseline)	Outfall 19A						Outfall 19						Outfall 22															
					SI0119A010 10/18/2002 Normal		SI0119A020 10/18/2002 Normal		SI0119A030 10/18/2002 Normal		SI0119010 10/18/2002 Normal		SI0119020 10/18/2002 Normal		SI0119030 10/18/2002 Normal		SI0122010 10/21/2002 Normal		SI0122020 10/21/2002 Normal		SI0122030 10/21/2002 Normal		SI0122031 10/21/2002 Duplicate		SI0122040 10/21/2002 Normal		SI0122050 10/21/2002 Normal		SI0122060 10/21/2002 Normal		SI0122062 10/21/2002 Equip Blank	
Total Metals:	Aluminum	mg/kg	--	42800	15400		13600		13500		21500		16300		12000		5530		15800		9560		9310		19500		14900		13300		0.0179	J
	Antimony	mg/kg	64	5	13		0.571	J	0.683	J	1.32		4.33		0.525	J	0.266	J	0.335	J	0.279	J	0.29	J	0.375	J	0.362	J	0.294	J	0.000498	J B1
	Arsenic	mg/kg	33	5	23.3		3.51		3.67		3.88		5.65		2.67		3.47		4.27		3.8		3.91		4.26		4.29		3.88		0.00101	
	Cadmium	mg/kg	5	0.6	2.82		0.0608	J	0.331		0.395		1.35		0.00228	U	0.00177	U	0.0156	J	0.00199	U	0.00182	U	0.00292	U	0.00262	U	0.00266	U	0.0000071	U
	Chromium	mg/kg	111	41	774		27.6		28.1		31.4		44.2		19.9		10.7		33.4		19.1		21.3		31.9		27.5		25.4		0.00646	
	Copper	mg/kg	149	60	772	B2	48.3	B2	61.5	B2	102	B2	266	B2	62.3	B2	14.4	B2	61.9	B2	20	B2	21.5	B2	39.1	B2	39.8	B2	33.3	B2	0.000495	J B1
	Lead	mg/kg	130	30	350	B2	31.7	B2	33.7	B2	88.5	B2	187	B2	24.7	B2	17.6	B2	18	B2	15.9	B2	14.6	B2	16	B2	15.3	B2	15.1	B2	0.000322	J B2
	Mercury	mg/kg	1	0.1	0.302		0.157		0.149		0.796		0.417		0.105		0.0184	J	0.0457		0.0949		0.0413		0.0803		0.0582		0.0719		***9.61***	***U***
	Nickel	mg/kg	49	32	153	B2	21.1	B2	21.1	B2	23.2	B2	45	B2	15.3	B2	12.6	B2	21.3	B2	17.6	B2	16.9	B2	21.7	B2	20.1	B2	18	B2	0.000583	
	Selenium	mg/kg	5	15	0.534	U	0.131	U	0.138	U	0.119	U	0.139	U	0.124	U	0.0959	U	0.123	U	0.108	U	0.0984	U	0.158	U	0.142	U	0.144	U	0.00046	J
	Silver	mg/kg	5	1.4	3.73		0.386	B2	0.449	B2	0.445	B2	0.695	B2	0.936	B2	0.0967	J B1	0.213	B2	0.133	J B2	0.136	B2	0.333	B2	0.288	B2	0.254	B2	0.000325	J B2
	Zinc	mg/kg	459	118	1320	B2	134	B2	138	B2	213	B2	397	B2	96.8	B2	102	B2	78.4	B2	72.7	B2	67.8	B2	87.3	B2	83	B2	74.4	B2	0.0359	B2
PCBs as Congeners:	PCB-008	ug/kg	--	--	0.4	U	0.43	U	0.55	JP	0.41	PU	10.1		0.37	PU	0.66	J	0.41	U	0.34	U	0.36	U	0.55	U	0.34	U	0.53	U	0.00083	U
	PCB-018	ug/kg	--	--	1.4	P	0.42	U	0.99	P	0.55	JP	17.5	P	1.83		0.38	U	0.4	U	0.34	U	0.35	U	0.54	U	0.33	U	0.52	U	0.00067	U
	PCB-028	ug/kg	--	--	3.52		1.27	P	2.95		4.35		27.2		2.22		0.24	U	0.28	JP	0.23	JP	0.22	U	0.34	U	0.27	JP	0.35	JP	0.0015	U
	PCB-044	ug/kg	--	--	3.15		0.75	P	2.75		2.41		14.9		1.9		0.22	U	0.75		0.31	JP	0.39	P	0.31	U	0.59		1.03		0.025	U
	PCB-052	ug/kg	--	--	10	P	2.29	P	0.35	U	3.48		20.4		2.73	P	0.34	U	0.99	P	0.3	U	0.86	P	0.48	U	0.3	U	0.47	U	0.0068	P
	PCB-066	ug/kg	--	--	10.1		3.32		3.45	P	4.05	P	30.9	P	2.12	P	0.2	U	1.11	P	0.55	P	0.93	P	0.47	JP	0.31	JP	0.53	J	0.00045	U
	PCB-101	ug/kg	--	--	8.48		2.41	P	4.91		4.48		4.64	P	2.02		0.28	U	0.94		0.25	U	0.39	P	0.39	U	0.24	U	0.38	U	0.0019	U
	PCB-105	ug/kg	--	--	0.17	U	0.18	U	0.17	U	0.18	U	0.18	U	0.16	U	0.17	U	0.18	U	0.15	U	0.16	U	0.24	U	0.15	U	0.23	U	0.0003	U
	PCB-118	ug/kg	--	--	6.57		1.17	P	2.04	P	3.31		0.22	U	0.96	P	0.21	U	0.51	JP	0.18	U	0.27	JP	0.29	U	0.18	U	0.28	U	0.0015	P
	PCB-128	ug/kg	--	--	1.21	P	0.4	JP	1.5		1.02		6.68	P	0.72	J	0.21	JP	0.73	JP	0.56	JP	0.54	JP	0.25	U	0.15	U	0.24	U	0.00034	U
	PCB-138	ug/kg	--	--	10.1		3.22		5.1	P	3.34	P	31.9	P	3.32		0.19	U	1.29	P	0.64	JP	0.18	U	13.8	P	0.17	U	0.29	JP	0.00035	U
	PCB-153	ug/kg	--	--	8.46	P	3.16	P	12.6		6.44	P	0.26	U	5.19		0.24	U	2.07		0.59	P	0.95	P	0.34	U	0.25	JP	0.33	U	0.00039	U
	PCB-170	ug/kg	--	--	1.76	P	0.63	JP	4.26		1.54	P	0.2	U	1.57		0.19	U	0.25	JP	0.17	U	0.25	JP	0.27	U	0.17	U	0.26	U	0.0018	U
	PCB-180	ug/kg	--	--	4.87		1.59		7.32		3.93		0.18	U	2.7		0.17	U	0.39	JP	0.53	J	1.01	P	0.24	U	0.18	J	0.4	J	0.00032	U
	PCB-187	ug/kg	--	--	4.61		2.04		6.16		3.96		0.22	U	2.62		0.24	JP	1.08		0.27	JP	0.45	P	0.29	U	0.28	J	0.54	P	0.00043	U
	Estimated Total PCBs[1,5]	ug/kg	700	180	146.8		45.5		108.5		85.7		322.3		60.4		4.3		22.4		9.3		13.9		29.9		5.8		8.2		2.1	
Pesticides:	2,4'-DDD	ug/kg	--	--	23.6	C1 J	2.95	UJ	3.28	UJ	3.78	J C2	42.5	C1 J	6.17	C2 J	2.47	UJ	2.84	UJ	2.88	UJ	2.87	UJ	4.01	UJ	4.14	UJ	3.76	UJ	0.00847	UJ
	2,4'-DDE	ug/kg	--	--	4.88	J C2	2.95	UJ	3.28	UJ	3.24	UJ	7.87	C2 J	2.99	UJ	2.47	UJ	2.84	UJ	2.88	UJ	2.87	UJ	4.01	UJ	4.14	UJ	3.76	UJ	0.00847	UJ
	2,4'-DDT	ug/kg	--	--	2.65	UJ	2.95	UJ	3.28	UJ	3.24	UJ	7.22	UJ	2.99	UJ	2.47	UJ	2.84	UJ	2.88	UJ	3.64	J C1	4.01	UJ	4.14	UJ	3.76	UJ	0.00847	UJ
	4,4'-DDD	ug/kg	30	--	0.515	UJ	5.69	J C1	6.07	J C1	5.3	J C2	7.22	UJ	6.38	C1 J	0.481	UJ	4.43	J C1	8.51	C1 J	6.01	C1 J	0.779	UJ	5.69	J C1	3.59	J C1	0.00399	UJ
	4,4'-DDE	ug/kg	30	--	10.7	C2 J	5.94	C2 J	6.03	J C1	7.54	C1 J	24	C1 J	4.2	J C2	0.57	UJ	1.75	J C2	3.17	J C2	1.64	J C2	0.922	UJ	3.93	J C2	0.865	UJ	0.00331	UJ
	4,4'-DDT	ug/kg	60	--	17.3	C1 J	0.764	UJ	0.851	UJ	0.838	UJ	10.5	C1 J	4.97	J C2	0.641	UJ	3.18	J C2	3.42	J C1	9.68	C1 J	1.04	UJ	1.07	UJ	0.973	UJ	0.00423	UJ
	Estimated Total DDTs[1,6]	ug/kg	--	220	28.00		11.63		12.10		12.84		34.50		15.55		--		9.36		15.10		17.33		--		9.62		3.59		--	
	4,4'-Methoxychlor	ug/kg	--	--	3.65	UJ	4.06	UJ	4.52	UJ	4.46	UJ	36.1	UJ	4.12	UJ	3.41	UJ	3.91	UJ	3.97	UJ	3.95	UJ	5.52	UJ	5.7	UJ	5.17	UJ	0.00455	UJ
	Aldrin	ug/kg	40	--	1.14	UJ	1.27	UJ	1.42	UJ	1.4	UJ	3.61	UJ	1.29	UJ	1.07	UJ	1.23	UJ	1.24	UJ	1.24	UJ	1.73	UJ	1.79	UJ	1.62	UJ	0.000971	UJ
	Alpha-BHC	ug/kg	--	--	0.823	UJ	0.917	UJ	1.02	UJ	1.01	UJ	3.61	UJ	0.929	UJ	0.769	UJ	0.883	UJ	0.896	UJ	0.892	UJ	1.25	UJ	1.29	UJ	1.17	UJ	0.00312	UJ
	beta-BHC	ug/kg	--	--	1.12	UJ	1.25	UJ	1.39	UJ	1.37	UJ	3.61	UJ	1.27	UJ	1.05	UJ	1.2	UJ	1.22	UJ	1.21	UJ	1.7	UJ	1.75	UJ	1.59	UJ	0.00362	UJ
	Beta-Chlordane	ug/kg	--	--	1.08	UJ	1.2	UJ	1.33	UJ	1.31	UJ	4.21	C2 J	1.21	UJ	1	UJ	1.15	UJ	1.17	UJ	1.17	UJ	1.63	UJ	1.68	UJ	1.53	UJ	0.00406	UJ
	Chlordane	ug/kg	20	--	3.73	UJ	4.15	UJ	4.62	UJ	4.55	UJ	**36.1**	**UJ**	4.21	UJ	3.48	UJ	4	UJ	4.06	UJ	4.04	UJ	5.64	UJ	5.83	UJ	5.29	UJ	0.0271	UJ
	cis-Chlordane	ug/kg	--	--	1.05	UJ	1.17	UJ	1.31	UJ	1.29	UJ	3.61	UJ	1.19	UJ	0.984	UJ	1.13	UJ	1.15	UJ	1.14	UJ	1.59	UJ	1.65	UJ	1.49	UJ	0.00298	UJ
	cis-Nonachlor	ug/kg	--	--	2.65	UJ	7.96	C1 J	3.28	UJ	8.24	C1 J	60.1	C1 J	10.2	C1 J	2.47	UJ	2.84	UJ	2.88	UJ	2.87	UJ	4.01	UJ	4.14	UJ	3.76	UJ	0.00847	UJ
	delta-BHC	ug/kg	--	--	1.02	UJ	1.13	UJ	1.26	UJ	1.24	UJ	3.61	UJ	1.15	UJ	0.95	UJ	1.09	UJ	1.11	UJ	1.1	UJ	1.54	UJ	1.59	UJ	1.44	UJ	0.00199	UJ
	Dieldrin	ug/kg	60	--	0.869	UJ	1.52	J C2	1.08	UJ	1.72	J C2	27.8	C1 J	2.8	J C2	0.812	UJ	0.932	UJ	0.946	UJ	0.942	UJ	1.31	UJ	1.36	UJ	1.23	UJ	0.00256	UJ
	Endosulfan I	ug/kg	--	--	1.13	UJ	1.26	UJ	1.4	UJ	1.38	UJ	6.53	C2 J	1.27	UJ	1.05	UJ	1.21	UJ	1.23	UJ	1.22	UJ	1.71	UJ	1.76	UJ	1.6	UJ	0.00423	UJ
	Endosulfan II	ug/kg	--	--	1.02	UJ	1.14	UJ	1.27	UJ	1.25	UJ	7.22	UJ	1.16	UJ	0.956	UJ	1.1	UJ	1.11	UJ	1.11	UJ	1.55	UJ	1.6	UJ	1.45	UJ	0.00321	UJ
	Endosulfan Sulfate	ug/kg	--	--	0.964	UJ	1.07	UJ	1.19	UJ	1.18	UJ	7.22	UJ	1.09	UJ	0.9	UJ	1.03	UJ	1.05	UJ	1.04	UJ	1.46	UJ	1.51	UJ	1.37	UJ	0.00455	UJ
	Endrin	ug/kg	200	--	0.956	UJ	1.06	UJ	1.19	UJ	1.17	UJ	14.7	C1 J	1.08	UJ	0.893	UJ	1.03	UJ	1.04	UJ	1.04	UJ	1.45	UJ	1.49	UJ	1.36	UJ	0.00262	UJ
	Endrin Aldehyde	ug/kg	--	--	1.08	UJ	1.2	UJ	1.34	UJ	1.32	UJ	7.22	UJ	1.22	UJ	1.01	UJ	1.16	UJ	1.18	UJ	1.17	UJ	1.63	UJ	1.69	UJ	1.53	UJ	0.00825	UJ
	Endrin Ketone	ug/kg	--	--	0.745	UJ	0.829	UJ	0.923	UJ	0.909	UJ	7.22	UJ	0.84	UJ	0.695	UJ	0.798	UJ	0.81	UJ	0.807	UJ	1.13	UJ	1.16	UJ	1.06	UJ	0.00292	UJ
	Heptachlor	ug/kg	10	--	1.08	J C1	1.02	UJ	1.13	UJ	1.11	UJ	3.61	UJ	1.03	UJ	0.852	UJ	0.978	UJ	0.993	UJ	0.988	UJ	1.38	UJ	1.43	UJ	1.29	UJ	0.00638	UJ
	Heptachlor Epoxide	ug/kg	20	--	1.77	J C2	1.08	UJ	1.2	UJ	1.18	UJ	4.53	C2 J	1.09	UJ	0.904	UJ	1.04	UJ	1.05	UJ	1.05	UJ	1.46	UJ	1.51	UJ	1.37	UJ	0.00317	UJ
	Hexachlorobenzene	ug/kg	100	--	1.38	J C2	1.48	UJ	1.64	UJ	1.62	UJ	3.61	UJ	1.5	UJ	1.24	UJ	1.42	UJ	1.44	UJ	1.44	UJ	2	UJ	2.07	UJ	1.88	UJ	0.00424	UJ
	Hexachlorobutadiene	ug/kg	600	--	1.33	UJ	1.48	UJ	1.64	UJ	1.62	UJ	3.61	UJ	1.5	UJ	1.24	UJ	1.42	UJ	1.44	UJ	1.44	UJ	2	UJ	2.07	UJ	1.88	UJ	0.00424	UJ
	Hexachloroethane	ug/kg	--	--	1.33	UJ	1.48	UJ	1.64	UJ	1.62	UJ	3.61	UJ	1.5	UJ	1.24	UJ	1.42	UJ	1.44	UJ	1.44	UJ	2	UJ	2.07	UJ	1.88	UJ	0.00424	UJ
	Lindane	ug/kg	5	--	1.01	UJ	1.13	UJ	1.26	UJ	1.24	UJ	3.61	UJ	1.14	UJ	0.946	UJ	1.09	UJ	1.1	UJ	1.1	UJ	1.53	UJ	1.58	UJ	1.44	UJ	0.0061	UJ
	Oxychlordane	ug/kg	--	--	2.65	UJ	2.95	UJ	3.28	UJ	3.24	UJ	7.22	UJ	2.99	UJ	2.47	UJ	2.84	UJ	2.88	UJ	2.87	UJ	4.01	UJ	4.14	UJ	3.76	UJ	0.00847	UJ
	Toxaphene	ug/kg	--	--	16.6	UJ	18.5	UJ	20.6	UJ	20.3	UJ	361	UJ	18.7	UJ	15.5	UJ	17.8	UJ	18.1	UJ	18	UJ	25.1	UJ	25.9	UJ	23.5	UJ	0.0989	UJ
	Trans-Nonachlor	ug/kg	--	--	2.65	UJ	2.95	UJ	3.28	UJ	3.24	UJ	7.22	UJ	2.99	UJ	2.47	UJ	2.84	UJ	2.88	UJ	2.87	UJ	4.01	UJ	4.14	UJ	3.76	UJ	0.00847	UJ
TPH:	Diesel	mg/kg	--	--	342		119		127		426		3790		46.2		501		242		320		488		238		124		246		0.058	
	Lube Oil - NWTPH	mg/kg	--	--	1290		339		345		922		2310		116		125		210		203		366		350		191		365		0.082	

Notes:

DEQ baseline and high values are used here for screening purposes only. Additional evaluation is needed to develop site-specific risk and/or cleanup concentrations.

*Equipment blank samples reported in liters, not kilograms.

bold The method detection limit exceeds DEQ High Screening Value.

border The reported value exceeds DEQ High Screening Value.

italic The method detection limit exceeds Portland Harbor Baseline Screening Value.

shaded The reported value exceeds Portland Harbor Baseline Screening Value.

[1] Total parameters (i.e., LPAHs, HPAHs, PAHs, PCBs, and DDTs) were calculated based on detections only. Qualifiers are not included on total parameters as it is implied that these are estimated quantities.

[2] Total LPAHs: Includes naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, and 2-methylnaphthalene.

[3] Total HPAHs: Includes fluoranthene, pyrene, benz[a]anthracene, chrysene, benzofluoranthenes, benzo[a]pyrene, indeno[1,2,3-cd]pyrene, dibenz[a,h]anthracene, and benzo[ghi]perylene.

[4] Total PAHs: Represents the sum of Total LPAHs and HPAHs.

[5] Total PCBs: The list of PCB congeners is based on EPA recommendations provided in *QA/QC Guidance for Sampling and Analysis of Sediment, Water, and Tissues for Dredged Material Evaluations,* EPA 823-B-95-001 (April 1995).
This list can be used to estimate total PCBs in accordance with the NOAA method provided in NOAA Technical Memorandum NOA OMA 49 (August 1989). Calculations follow the Battelle method: Total PCB = 1.95 (Σ congeners listed) + 2.1.

[6] Total DDTs: Sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.

Qualifiers:

- B1 This analyte was detected in the associated method blank. The concentration was determined not to be significantly higher than the associated method blank (less than 10 times the concentration reported in the blank).
- B2 This analyte was detected in the associated method blank. The analyte concentration in the sample was determined to be significantly higher than the method blank (greater than 10 times the concentration reported in the blank).
- C1 Second column confirmation was performed. The relative percent difference value (RPD) between the results on the two columns was evaluated and determined to be < 40%.
- C2 Second column confirmation was performed. The RPD between the results on the two columns was evaluated and determined to be > 40%. The higher result was reported unless anomalies were noted.
- D5 The analyte exceeded the linear calibration range and the sample was diluted and reanalyzed. The reported result for the analyte has been flagged with "D" and a number representing the additional dilution required to bring the analyte within the calibration range.
- D10 The analyte exceeded the linear calibration range and the sample was diluted and reanalyzed. The reported result for the analyte has been flagged with "D" and a number representing the additional dilution required to bring the analyte within the calibration range.
- J The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.
- U The analyte was not detected above the reported method detection limit.
- UJ The analyte was not detected above the reported method detection limit. However, the reported method detection limit is approximate and may or may not represent the actual method detection limit necessary to accurately and precisely measure the analyte in the sample.
- P The difference between the analyte detected in the front and back column is greater than 40%.

Abbreviations/Definitions:

- -- Not available or applicable
- HPAH high molecular weight polycyclic aromatic hydrocarbons
- LPAH low molecular weight polycyclic aromatic hydrocarbons
- ug/kg micrograms per kilogram
- mg/kg milligrams per kilogram
- NA Not analyzed
- NOAA National Oceanographic and Atmospheric Administration
- PAH polycyclic aromatic hydrocarbon
- PCB polychlorinated biphenyl
- TPH total petroleum hydrocarbon

TABLE 1
Outfall Sediment Analytical Data

Class	Analyte	Units*	DEQ Screening Level (High)	DEQ Screening Level (Baseline)	Outfall 22B SI0122B010 10/16/2002 Normal		SI0122B020 10/16/2002 Normal		SI0122B030 10/16/2002 Normal		SI0122B040 10/16/2002 Normal		Outfall 22C SI0122C010 10/16/2002 Normal		SI0122C020 10/16/2002 Normal		SI0122C030 10/17/2002 Normal		SI0122C031 10/17/2002 Duplicate		SI0122C040 10/17/2002 Normal		Outfall 24 SI0124010 10/22/2002 Normal		SI0124020 10/22/2002 Normal		SI0124030 10/22/2002 Normal		SI0124040 10/22/2002 Normal		SI0124050 10/22/2002 Normal		SI0124052 10/22/2002 Equip Blank	
Semivolatile Organics:	1,2,4-Trichlorobenzene	ug/kg	9200	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	1,2-Dichlorobenzene	ug/kg	1700	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	1,3-Dichlorobenzene	ug/kg	300	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	1,4-Dichlorobenzene	ug/kg	300	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	2,3,4,6-Tetrachlorophenol	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	2,3,5,6-Tetrachlorophenol	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	2,4,5-Trichlorophenol	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	2,4,6-Trichlorophenol	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	2,4-Dichlorophenol	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	2,4-Dimethylphenol	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	2,4-Dinitrophenol	ug/kg	--	--	84.3	U	90.9	U	121	U	96.1	U	1700	U	76.6	UJ	80.8	U	76.5	U	325	UJ	67.5	U	887	U	98.7	U	91.8	U	106	U	4	U
	2,4-Dinitrotoluene	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	2,6-Dinitrotoluene	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	2-Chloronaphthalene	ug/kg	--	--	1.69	U	1.82	U	2.43	U	1.92	U	34.1	U	1.53	UJ	1.62	U	1.53	U	6.5	UJ	1.35	U	17.7	U	1.97	U	1.84	U	2.11	U	0.08	U
	2-Chlorophenol	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	2-Methylnaphthalene	ug/kg	200	150	4.14		13.3		24.8		8.61		136		17.5	J	9.95		11.2		6.5	UJ	5.48		213		43.7		23.7		98.8		0.2	U
	2-Methylphenol	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	179	J	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	2-Nitroaniline	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	2-Nitrophenol	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	3,3'-Dichlorobenzidine	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	3-Nitroaniline	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	4,6-Dinitro-2-Methylphenol	ug/kg	--	--	84.3	U	90.9	U	121	U	96.1	U	1700	U	76.6	UJ	80.8	U	76.5	U	325	UJ	67.5	U	887	U	98.7	U	91.8	U	106	U	4	U
	4-Bromophenyl Phenyl Ether	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	4-Chloro-3-Methylphenol	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	4-Chloroaniline	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	4-Chlorophenyl Phenyl Ether	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	4-Methylphenol	ug/kg	--	680	33.7	U	36.3	U	48.5	U	38.4	U	681	U	30.6	UJ	32.3	U	30.6	U	130	UJ	27	U	355	U	39.5	U	36.7	U	139		1.6	U
	4-Nitroaniline	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	4-Nitrophenol	ug/kg	--	--	84.3	U	90.9	U	121	U	96.1	U	1700	U	76.6	UJ	80.8	U	76.5	U	325	UJ	67.5	U	887	U	98.7	U	91.8	U	106	U	4	U
	Acenaphthene	ug/kg	300	180	6.18		18.5		17.3		12		1380		119	J	95.8		57.2		12.8	J	8.85		220		92.9		34.6		168		0.08	U
	Acenaphthylene	ug/kg	200	60	17.4		22		143		10.8		201		71.2	J	37.8		40.1		7	J	17.5		446		207		103		178		0.08	U
	Aniline	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Anthracene	ug/kg	800	150	13.8		20.9		85.4		17.6		1150		250	D10 J	131		77.1		12.8	J	18.7		229		130		54.4		133		0.08	U
	Benzo (a) anthracene	ug/kg	1000	360	59.2		95.9		189		61.2		7050		283	J	611	D10	321	D10	30	J	64.3		1370		495		218		432		0.08	U
	Benzo (a) pyrene	ug/kg	1500	500	78.4		157		404		67.1		8220	D10	294	J	635	D10	355	D10	64.2	J	80.1		2120		777	D5	401		773	D5	0.08	U
	Benzo [g,h,i] perylene	ug/kg	300	250	71.1		129		400		61.8		6390		195	J	639	D10	381		59.6	J	81.6		1960		788	D5	370		898	D5	0.08	U
	Benzofluoranthenes	ug/kg	--	--	116		213		443		108		13300		400	J	1220	D10	756		127	J	146		2330		747		436		755		0.16	U
	Benzoic Acid	ug/kg	--	200	84.3	U	90.9	U	121	U	96.1	U	1700	U	76.6	UJ	80.8	U	76.5	U	325	UJ	67.5	U	887	U	98.7	U	91.8	U	106	U	4	U
	Benzyl Alcohol	ug/kg	--	20	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Bis(2-Chloroethoxy) Methane	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Bis(2-Chloroethyl) Ether	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Bis(2-Chloroisopropyl) Ether	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Bis(2-Ethylhexyl) Phthalate	ug/kg	800	390	20.9	JU	114		24.3	U	250		341	U	19.9	JU	49.1		48.6		65	UJ	26.1	JU	177	U	34.7	JU	18.4	U	41.5	JU	0.8	U
	Butyl Benzyl Phthalate	ug/kg	--	20	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Carbazole	ug/kg	1600	100	16.9	U	18.2	U	24.3	U	19.2	U	952		54.5	J	73.3		50.3		65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Chrysene	ug/kg	1300	425	94.3		92.1		339		77.2		7140		297	J	584	D10	349	D10	59.1	J	82.9		1580		479	D5	239		525	D5	0.08	U
	Di-n-Butyl Phthalate	ug/kg	100	20	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Di-n-Octyl Phthalate	ug/kg	--	20	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Dibenzo (a,h) anthracene	ug/kg	1300	125	21.3		24.5		91.3		29.5		2850		65.7	J	109		77.6		17	J	16.8		236		86.5		49.1		75.4		0.08	U
	Dibenzofuran	ug/kg	5100	100	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	18.4	J	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Diethyl Phthalate	ug/kg	600	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	102	J	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Dimethyl Phthalate	ug/kg	--	20	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Fluoranthene	ug/kg	2200	600	92.7		199		176		93.7		10400	D10	499	D10 J	837	D10	548	D10	89.4	J	100		1670		433		254		753	D5	0.08	U
	Fluorene	ug/kg	600	125	5.74		11.2		22.6		8.18		501		38.3	J	40		30.9		6.5	UJ	6.29		133		51.8		18.3		110		0.08	U
	Hexachlorobenzene	ug/kg	100	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Hexachlorobutadiene	ug/kg	600	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Hexachlorocyclopentadiene	ug/kg	400	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Hexachloroethane	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Indeno (1,2,3-cd) pyrene	ug/kg	100	225	48.7		89.6		248		46.4		5120		148	J	629	D10	338		53.4	J	66.9		1760		444		261		462		0.08	U
	Isophorone	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	n-Nitrosodi-n-Propylamine	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	n-Nitrosodimethylamine	ug/kg	--	--	84.3	U	90.9	U	121	U	96.1	U	1700	U	76.6	UJ	80.8	U	76.5	U	325	UJ	67.5	U	887	U	98.7	U	91.8	U	106	U	4	U
	n-Nitrosodiphenylamine	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Naphthalene	ug/kg	600	200	14.1		43.4		60.1		10.4		268		29.5	J	23.4		13.6		14.4	J	9.23		459		98.9		53.3		219		0.2	U
	Nitrobenzene	ug/kg	--	--	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Pentachlorophenol	ug/kg	1000	97	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	19.4	J	21.1	U	0.8	U
	Phenanthrene	ug/kg	1200	700	18.1		86.2		68		35.7		4300		283	J	411	D10	309		28.8	J	45.8		1090		331		146		822	D5	0.08	U
	Phenol	ug/kg	50	20	16.9	U	18.2	U	24.3	U	19.2	U	341	U	15.3	UJ	16.2	U	15.3	U	65	UJ	13.5	U	177	U	19.7	U	18.4	U	21.1	U	0.8	U
	Pyrene	ug/kg	1500	700	129		253		362		113		10800	D10	596	D10 J	962	D10	635	D10	95.9	J	118		2490		704	D5	380		1150	D5	0.08	U
	Estimated Total LPAHs[1,2]	ug/kg	400	700	79		216		421		103		7936		809		749		539		76		112		2790		955		433		1729		--	
	Estimated Total HPAHs[1,3]	ug/kg	1000	2400	711		1253		2652		658		71270		2778		6226		3761		596		757		15516		4954		2608		5823		--	
	Estimated Total PAHs[1,4]	ug/kg	23000	--	790		1469		3074		761		79206		3586		6975		4300		671		868		18306		5909		3041		7552		--	
General Chemistry:	Total Organic Carbon	mg/kg	--	20000	770		4180		20100		15500		84200		910		3040		3140		7320		2920		4880		4680		10700		6500		0.98	
Chlorinated Herbicides:	2,4,5-T	ug/kg	--	--	3.91	U	3.83	U	4.92	U	3.82	U	NA		NA		NA		NA		10.5	UJ	2.97	U	NA		NA		NA		NA		0.0479	UJ
	2,4,5-TP	ug/kg	--	--	3.19	U	3.13	U	4.02	U	3.12	U	NA		NA		NA		NA		8.6	UJ	2.43	U	NA		NA		NA		NA		0.0161	UJ
	2,4-D	ug/kg	--	3.3	3.32	U	3.25	U	4.18	U	3.24	U	NA		NA		NA		NA		8.93	UJ	2.52	U	NA		NA		NA		NA		0.0377	UJ
	2,4-Db	ug/kg	--	5	18.7		2.34	U	3.01	U	2.34	U	NA		NA		NA		NA		6.44	UJ	1.82	U	NA		NA		NA		NA		0.0434	UJ
	4-Nitrophenol	ug/kg	--	--	1.9	U	1.86	U	2.4	U	1.86	U	NA		NA		NA		NA		5.12	UJ	1.45	U	NA		NA		NA		NA		0.0373	UJ
	Dalapon	ug/kg	--	--	1.91	U	1.88	U	2.41	U	1.87	U	NA		NA		NA		NA		5.16	UJ	1.46	U	NA		NA		NA		NA		0.0474	UJ
	Dicamba	ug/kg	--	--	1.96	U	1.92	U	2.47	U	1.91	U	NA		NA		NA		NA		5.27	UJ	1.49	U	NA		NA		NA		NA		0.039	UJ
	Dichloroprop	ug/kg	--	--	3.15	U	3.09	U	3.97	U	3.08	U	NA		NA		NA		NA		8.5	UJ	2.4	U	NA		NA		NA		NA		0.0161	UJ
	DinosEquip Blank	ug/kg	--	--	2.74	U	2.68	U	3.45	U	2.68	U	NA		NA		NA		NA		7.37	UJ	2.08	U	NA		NA		NA		NA		0.0463	UJ
	Mcpa	ug/kg	--	--	3.74	U	3.67	U	4.71	U	3.66	U	NA		NA		NA		NA		10.1	UJ	2.84	U	NA		NA		NA		NA		0.0221	UJ
	Mcpp	ug/kg	--	--	1.67	U	1.63	U	2.1	U	1.63	U	NA		NA		NA		NA		4.49	UJ	1.27	U	NA		NA		NA		NA		0.0296	UJ
	Pentachlorophenol	ug/kg	1000	97	2.44	U	2.4	U	9.66	J	2.39	U	NA		NA		NA		NA		6.59	UJ	9.06		NA		NA		NA		NA		0.0233	UJ

TABLE 1
Outfall Sediment Analytical Data

Class	Analyte	Units*	DEQ Screening Level (High)	DEQ Screening Level (Baseline)	Outfall 22B								Outfall 22C										Outfall 24											
					SI0122B010 10/16/2002 Normal		SI0122B020 10/16/2002 Normal		SI0122B030 10/16/2002 Normal		SI0122B040 10/16/2002 Normal		SI0122C010 10/16/2002 Normal		SI0122C020 10/16/2002 Normal		SI0122C030 10/17/2002 Normal		SI0122C031 10/17/2002 Duplicate		SI0122C040 10/17/2002 Normal		SI0124010 10/22/2002 Normal		SI0124020 10/22/2002 Normal		SI0124030 10/22/2002 Normal		SI0124040 10/22/2002 Normal		SI0124050 10/22/2002 Normal		SI0124052 10/22/2002 Equip Blank	
Total Metals:	Aluminum	mg/kg	--	42800	9170		8860		23600		5700		12200		9730		10100		8740		1630		10100		9180		14700		10200		17700		0.0114	J
	Antimony	mg/kg	64	5	0.623	J	1.45	J	4.47	J	32.1		4	J	1.6	J	0.261		0.292		0.579		0.768	B2	1.26	B2	0.465	B2	0.447	B2	1.03	B2	0.000298	J B1
	Arsenic	mg/kg	33	5	3.55		20.8		22.9		47.5		27.7		19.7		5.6		4.92		53.7		4.14		3.58		3.57		3.43		4.04		0.000109	U
	Cadmium	mg/kg	5	0.6	0.00189	U	0.0088	U	0.0131	U	0.78		0.0174	U	0.0085	U	0.272	U	0.266	U	*1.1*	*U*	0.431	U	0.482	U	0.516	U	0.543	U	*0.611*	*U*	0.0000071	U
	Chromium	mg/kg	111	41	16.7		101		199		74		106		67.2		15.4		13.1		7.84		20.4	B2	21.5	B2	29.6	B2	25.1	B2	34.8	B2	0.00689	
	Copper	mg/kg	149	60	17.2	B2	82.6	B2	271	B2	116	B2	168	B2	123	B2	22.6		19		18.3		56.5	B2	21.6	B2	32.1	B2	31.5	B2	37.5	B2	0.00244	B2
	Lead	mg/kg	130	30	19.6	B2	102	B2	197	B2	266	B2	161	B2	122	B2	18.9	B2	20.7	B2	13.3	B2	23.2	B2	38.9	B2	20	B2	16.6	B2	23.1	B2	0.000136	J B1 U
	Mercury	mg/kg	1	0.1	0.0207	J	0.0409		0.625		0.098		0.101		0.012	J	0.0205	J	0.0181	J	0.0372	U	0.0273		0.053		0.0692		0.444		0.062		**9.61**	***U***
	Nickel	mg/kg	49	32	16.6	B2	91.9	B2	138	B2	101	B2	83.2	B2	75.5	B2	15		12.2		7.03		18.3	B2	20.2	B2	23.5	B2	19.9	B2	28.2	B2	0.000519	
	Selenium	mg/kg	5	15	0.102	U	0.477	U	0.712	U	9.42		0.941	U	0.46	U	0.453	U	0.444	U	1.83	U	0.431	U	0.482	U	0.516	U	0.543	U	0.611	U	0.000385	U
	Silver	mg/kg	5	1.4	0.136		0.701		4.24		0.932		1.3		0.744		0.141		6.14		0.573		0.178	B2	0.219	B2	0.263	B2	0.302	B2	0.376	B2	0.000167	J B1 U
	Zinc	mg/kg	459	118	62.4	B2	322	B2	666	B2	689	B2	432	B2	319	B2	87.3		71		48		86.3	B2	109	B2	81.6	B2	79.3	B2	102	B2	0.00795	B2 U
PCBs as Congeners:	PCB-008	ug/kg	--	--	1.21	P	0.39	JP	0.45	U	3.69	P	2.34		0.54	J	0.52	JP	1.04		1.26	U	0.26	U	0.35	U	0.38	U	0.42	U	0.39	U	0.00068	UJ
	PCB-018	ug/kg	--	--	0.32	U	0.35	U	0.44	U	0.61	JP	0.82	J	0.31	U	0.33	U	0.34	U	1.23	U	0.26	U	0.35	U	0.37	U	0.41	U	0.38	U	0.00055	UJ
	PCB-028	ug/kg	--	--	0.22	JP	0.24	JP	0.28	U	2.65	P	2.82		0.22	J	0.31	JP	0.52	P	1.44	P	0.17	U	0.65		0.43	P	0.27	U	0.43	P	0.0012	UJ
	PCB-044	ug/kg	--	--	0.44	P	1.21	P	0.25	U	1.56	P	0.41	U	0.26	J	0.19	U	0.28	JP	0.71	U	0.15	JPU	0.2	U	0.21	PU	0.24	U	0.22	PU	0.02	UJ
	PCB-052	ug/kg	--	--	0.41	JP	0.86	P	0.4	U	6.11		4.48		0.48	J	0.65	J	0.81	P	1.11	U	0.23	U	0.46	JP	0.5	JP	0.37	U	0.34	U	0.0019	UJ
	PCB-066	ug/kg	--	--	0.72	P	0.18	U	2.88		1.27	P	4.72		0.76		0.56	P	1.54		0.65	U	0.14	U	0.18	U	1.69	P	1.86		0.91	P	0.00063	JP
	PCB-101	ug/kg	--	--	0.76		0.25	U	0.98		1.12		0.52	U	0.22	U	0.24	U	0.25	U	0.9	U	0.19	U	0.33	JP	0.46	P	1.37		0.28	U	0.0016	UJ
	PCB-105	ug/kg	--	--	0.14	U	0.15	U	0.2	U	0.25	U	0.32	U	0.14	U	0.15	U	0.15	U	0.55	U	0.11	U	0.15	U	0.16	U	0.18	U	0.17	U	0.00024	UJ
	PCB-118	ug/kg	--	--	0.17	U	0.19	U	0.24	U	0.3	U	0.67	J	0.17	U	0.18	U	0.24	JP	0.67	U	0.14	U	0.19	U	0.2	U	0.23	U	0.21	U	0.00034	UJ
	PCB-128	ug/kg	--	--	0.15	U	0.2	JP	0.53	JP	0.34	JP	0.7	J	0.14	U	0.27	JP	0.28	JP	0.57	U	0.18	JP	0.35	JP	0.21	JP	0.3	JP	0.24	JP	0.00028	UJ
	PCB-138	ug/kg	--	--	1.42	P	0.17	U	3.2		0.99	JP	3.1		0.53	J	0.79	P	0.95	P	0.62	U	0.37	J	30.7	P	0.25	JP	0.97	P	0.25	JP	0.00028	UJ
	PCB-153	ug/kg	--	--	2.8		2.12		5.41		2.24		6.51		1.09		1.18	P	2.12		0.79	U	0.76		1.42		0.52	P	2.65		0.29	JP	0.00032	UJ
	PCB-170	ug/kg	--	--	0.68	P	0.73	P	2.31	P	0.28	U	0.98	J	0.26	J	0.17	U	0.32	J	0.62	U	0.13	U	0.18	U	0.19	U	0.41	JP	0.19	U	0.0014	UJ
	PCB-180	ug/kg	--	--	1.45		1.7		5.71		0.69	J	3.17		0.14	U	0.32	JP	0.71		0.55	U	0.18	JP	0.15	U	0.26	JP	0.99	P	0.19	JP	0.00026	UJ
	PCB-187	ug/kg	--	--	0.58		0.72		4.36		0.31	U	1.88		0.17	U	0.34	JP	0.66		0.68	U	0.25	JP	0.19	U	0.2	U	1.32	P	0.82	P	0.00035	UJ
	Estimated Total PCBs[1,5]	ug/kg	700	180	22.9		18.0		51.6		43.6		64.9		10.2		11.7		20.6		4.9		5.5		68.2		10.5		21.3		8.2		2.1	
Pesticides:	2,4'-DDD	ug/kg	--	--	154	C1	73.4	C1	115	C1	117	C1	162	C1	12.9	C1	20.6	C1	31.6	C1	8.62	U	2	UJ	8.38	C1 J	6.54	C1 J	6.26	C1 J	14.3	C1 J	0.0082	UJ
	2,4'-DDE	ug/kg	--	--	17.8	C2	11.5	C2	15.3	C2	22.6	C2	23.8	C2	3.51	J C2	4.45	J C2	9.31	C2	8.62	U	2	UJ	2.71	UJ	2.92	UJ	2.25	UJ	2.98	UJ	0.0082	UJ
	2,4'-DDT	ug/kg	--	--	33.5	C1	9.8	C1	11.5	C1	39.6	C1	25.2	C1	22.4	C1	7.88	C1	88.4	C1	8.62	U	2	UJ	2.71	UJ	2.92	UJ	2.25	UJ	2.98	UJ	0.0082	UJ
	4,4'-DDD	ug/kg	30	--	315	C1	121	C1	250	C1	195	C1	296	C1	19.4	C1	22.6	C1	45.7	C1	7.34	J C1	0.389	UJ	17.8	C1 J	26.8	C1 J	14.2	C1 J	43.8	C1 J	0.00386	UJ
	4,4'-DDE	ug/kg	30	--	52.2	C1	21.2	C1	19.5	C1	67.9	C1	58	C1	20.3	C1	18.9	C1	37	C1	1.98	U	0.46	UJ	1.95	J C2	4.49	J C2	2.76	J C1	10.4	C2 J	0.0032	UJ
	4,4'-DDT	ug/kg	60	--	54.6	C1	36.6	C1	58.8	C1	75.4	C2	48.2	C1	22.9	C1	31.5	C1	258	C1	2.23	U	0.518	UJ	0.703	UJ	151	C1 J	0.584	UJ	0.771	UJ	0.00409	UJ
	Estimated Total DDTs[1,6]	ug/kg	--	220	421.80		178.80		328.30		338.30		402.20		62.60		73.00		340.70		7.34		--		19.75		182.29		16.96		54.20		--	
	4,4'-Methoxychlor	ug/kg	--	--	3.44	U	3.99	U	5.15	U	17.3	J C1	24.3	J C1	3.48	U	3.24	U	2.94	U	11.9	U	2.75	UJ	3.74	UJ	4.03	UJ	3.1	UJ	4.1	UJ	0.0044	UJ
	Aldrin	ug/kg	40	--	1.08	U	1.25	U	1.61	U	1.28	U	2.28	U	1.09	U	1.01	U	0.923	U	3.72	U	0.863	UJ	1.17	UJ	1.26	UJ	0.972	UJ	1.28	UJ	0.000939	UJ
	Alpha-BHC	ug/kg	--	--	0.777	U	0.9	U	1.16	U	1.52	J C2	1.64	U	0.784	U	0.731	U	0.664	U	2.68	U	0.621	UJ	0.843	UJ	0.908	UJ	0.7	UJ	0.925	UJ	0.00302	UJ
	beta-BHC	ug/kg	--	--	1.06	U	15.2	C1	1.58	U	1.25	U	2.24	U	1.07	U	0.995	U	0.905	U	3.65	U	0.846	UJ	1.15	UJ	1.24	UJ	0.953	UJ	1.26	UJ	0.0035	UJ
	Beta-Chlordane	ug/kg	--	--	2.13	J C2	1.18	U	8.87	C2	8.55	C2	2.15	U	1.02	U	0.955	U	0.868	U	3.5	U	0.812	UJ	1.1	UJ	1.19	UJ	0.915	UJ	1.21	UJ	0.00393	UJ
	Chlordane	ug/kg	20	--	3.52	U	4.08	U	5.27	U	4.17	U	7.44	U	3.55	U	3.31	U	3.01	U	12.1	U	2.82	UJ	3.82	UJ	4.12	UJ	3.17	UJ	4.19	UJ	0.0263	UJ
	cis-Chlordane	ug/kg	--	--	0.994	U	1.15	U	1.49	U	16.4	C1	2.1	U	1	U	0.935	U	0.85	U	3.43	U	0.795	UJ	1.08	UJ	1.16	UJ	0.895	UJ	1.18	UJ	0.00289	UJ
	cis-Nonachlor	ug/kg	--	--	2.5	U	2.9	U	3.74	U	21.1	C1	5.29	U	2.52	U	2.35	U	2.14	U	8.62	U	2	UJ	2.71	UJ	2.92	UJ	2.25	UJ	2.98	UJ	0.0082	UJ
	delta-BHC	ug/kg	--	--	0.96	U	1.11	U	1.44	U	5.33	C2	2.03	U	0.969	U	0.903	U	0.821	U	3.31	U	0.767	UJ	1.04	UJ	1.12	UJ	0.865	UJ	1.14	UJ	0.00192	UJ
	Dieldrin	ug/kg	60	--	0.82	U	0.95	U	1.23	U	2.78	J C1	1.73	U	0.828	U	0.771	U	0.701	U	2.83	U	0.656	UJ	0.89	UJ	0.959	UJ	0.739	UJ	0.977	UJ	0.00247	UJ
	Endosulfan I	ug/kg	--	--	1.06	U	1.23	U	1.59	U	1.26	U	2.25	U	1.07	U	1	U	0.91	U	3.67	U	0.851	UJ	1.16	UJ	1.24	UJ	0.959	UJ	1.27	UJ	0.00409	UJ
	Endosulfan II	ug/kg	--	--	0.967	U	1.12	U	1.45	U	1.14	U	2.04	U	0.975	U	0.909	U	0.826	U	3.33	U	0.773	UJ	1.05	UJ	1.13	UJ	0.871	UJ	1.15	UJ	0.0031	UJ
	Endosulfan Sulfate	ug/kg	--	--	0.91	U	1.05	U	1.36	U	1.08	U	1.92	U	0.918	U	0.856	U	0.778	U	3.14	U	0.728	UJ	0.988	UJ	1.06	UJ	1.27	J C2	1.84	J C2	0.00441	UJ
	Endrin	ug/kg	200	--	0.902	U	1.05	U	1.35	U	1.07	U	1.91	U	0.911	U	0.849	U	0.772	U	3.11	U	0.722	UJ	0.979	UJ	1.06	UJ	0.813	UJ	1.07	UJ	0.00254	UJ
	Endrin Aldehyde	ug/kg	--	--	1.02	U	1.18	U	1.53	U	1.21	U	6.59	J C2	1.03	U	0.959	U	0.872	U	3.52	U	0.815	UJ	1.11	UJ	1.19	UJ	0.918	UJ	1.21	UJ	0.00798	UJ
	Endrin Ketone	ug/kg	--	--	0.703	U	0.814	U	1.05	U	0.831	U	4.39	J C2	0.709	U	0.661	U	0.601	U	2.42	U	0.562	UJ	0.763	UJ	0.822	UJ	0.633	UJ	0.837	UJ	0.00283	UJ
	Heptachlor	ug/kg	10	--	0.861	U	0.997	U	1.29	U	1.02	U	4.1	J C2	0.869	U	0.81	U	0.736	U	2.97	U	0.688	UJ	0.935	UJ	1.01	UJ	0.776	UJ	1.03	UJ	0.00618	UJ
	Heptachlor Epoxide	ug/kg	20	--	0.914	U	1.06	U	8.9	C2	14	C1	1.93	U	0.922	U	0.859	U	0.781	U	3.15	U	0.73	UJ	0.992	UJ	1.07	UJ	0.823	UJ	1.09	UJ	0.00307	UJ
	Hexachlorobenzene	ug/kg	100	--	1.25	U	1.45	U	5.94	C2	2.59	J C2	6.91	C1	1.26	U	1.18	U	1.07	U	4.31	U	1	UJ	1.36	UJ	1.46	UJ	1.13	UJ	1.72	J C2	0.0041	UJ
	Hexachlorobutadiene	ug/kg	600	--	1.25	U	1.45	U	1.87	U	1.48	U	3.37	J C2	1.26	U	1.18	U	1.07	U	4.31	U	1	UJ	1.36	UJ	1.46	UJ	1.13	UJ	1.49	UJ	0.0041	UJ
	Hexachloroethane	ug/kg	--	--	1.25	U	3.52	C2	1.87	U	2.53	J C2	2.64	U	1.26	U	1.18	U	1.07	U	4.31	U	1	UJ	1.36	UJ	1.46	UJ	1.13	UJ	1.63	J C2	0.0041	UJ
	Lindane	ug/kg	5	--	0.956	U	1.11	U	1.43	U	1.13	U	2.02	U	0.965	U	0.899	U	0.817	U	3.3	U	0.764	UJ	1.04	UJ	1.12	UJ	0.861	UJ	1.14	UJ	0.0059	UJ
	Oxychlordane	ug/kg	--	--	2.5	U	2.9	U	3.74	U	10.7	C2	5.29	U	2.52	U	2.35	U	2.14	U	8.62	U	2	UJ	2.71	UJ	2.92	UJ	2.25	UJ	2.98	UJ	0.0082	UJ
	Toxaphene	ug/kg	--	--	15.7	U	18.2	U	23.4	U	18.5	U	33.1	U	15.8	U	14.7	U	13.4	U	54	U	12.5	UJ	17	UJ	18.3	UJ	14.1	UJ	18.7	UJ	0.0956	UJ
	Trans-Nonachlor	ug/kg	--	--	2.5	U	2.9	U	3.74	U	2.96	U	5.29	U	2.52	U	2.35	U	2.14	U	8.62	U	2	UJ	2.71	UJ	2.92	UJ	2.25	UJ	2.98	UJ	0.0082	UJ
TPH:	Diesel	mg/kg	--	--	27.2		24.8		159		77.9		53.5		11.2		32.3		32.7		38.4		7.25		43.1		23.6		78.1		33.9		0.017	J
	Lube Oil - NWTPH	mg/kg	--	--	297		114		482		357		200		64.9		331		108		226		38.6		97.9		68.2		113		76.3		0.0073	U

Notes:

DEQ baseline and high values are used here for screening purposes only. Additional evaluation is needed to develop site-specific risk and/or cleanup concentrations.

*Equipment blank samples reported in liters, not kilograms.

bold	The method detection limit exceeds DEQ High Screening Value.
border	The reported value exceeds DEQ High Screening Value.
italic	The method detection limit exceeds Portland Harbor Baseline Screening Value.
shaded	The reported value exceeds Portland Harbor Baseline Screening Value.

[1] Total parameters (i.e., LPAHs, HPAHs, PAHs, PCBs, and DDTs) were calculated based on detections only. Qualifiers are not included on total parameters as it is implied that these are estimated quantities.

[2] Total LPAHs: Includes naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, and 2-methylnaphthalene.

[3] Total HPAHs: Includes fluoranthene, pyrene, benz[a]anthracene, chrysene, benzofluoranthenes, benzo[a]pyrene, indeno[1,2,3-cd]pyrene, dibenz[a,h]anthracene, and benzo[ghi]perylene.

[4] Total PAHs: Represents the sum of Total LPAHs and HPAHs.

[5] Total PCBs: The list of PCB congeners is based on EPA recommendations provided in *QA/QC Guidance for Sampling and Analysis of Sediment, Water, and Tissues for Dredged Material Evaluations,* EPA 823-B-95-001 (April 1995).
This list can be used to estimate total PCBs in accordance with the NOAA method provided in NOAA Technical Memorandum NOA OMA 49 (August 1989). Calculations follow the Battelle method: Total PCB = 1.95 (Σ congeners listed) + 2.1.

[6] Total DDTs: Sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.

Qualifiers:

B1	This analyte was detected in the associated method blank. The concentration was determined not to be significantly higher than the associated method blank (less than 10 times the concentration reported in the blank).
B2	This analyte was detected in the associated method blank. The analyte concentration in the sample was determined to be significantly higher than the method blank (greater than 10 times the concentration reported in the blank).
C1	Second column confirmation was performed. The relative percent difference value (RPD) between the results on the two columns was evaluated and determined to be < 40%.
C2	Second column confirmation was performed. The RPD between the results on the two columns was evaluated and determined to be > 40%. The higher result was reported unless anomalies were noted.
D5	The analyte exceeded the linear calibration range and the sample was diluted and reanalyzed. The reported result for the analyte has been flagged with "D" and a number representing the additional dilution required to bring the analyte within the calibration range.
D10	The analyte exceeded the linear calibration range and the sample was diluted and reanalyzed. The reported result for the analyte has been flagged with "D" and a number representing the additional dilution required to bring the analyte within the calibration range.
J	The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity.
U	The analyte was not detected above the reported method detection limit.
UJ	The analyte was not detected above the reported method detection limit. However, the reported method detection limit is approximate and may or may not represent the actual method detection limit necessary to accurately and precisely measure the analyte in the sample.
P	The difference between the analyte detected in the front and back column is greater than 40%.

Abbreviations/Definitions:

--	Not available or applicable
HPAH	high molecular weight polycyclic aromatic hydrocarbons
LPAH	low molecular weight polycyclic aromatic hydrocarbons
ug/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
NA	Not analyzed
NOAA	National Oceanographic and Atmospheric Administration
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
TPH	total petroleum hydrocarbon

Figures

Source (for all figures): David Evans and Associates, Metro DRC, City of Portland BES
Aerial photo flight date September 20, 1997

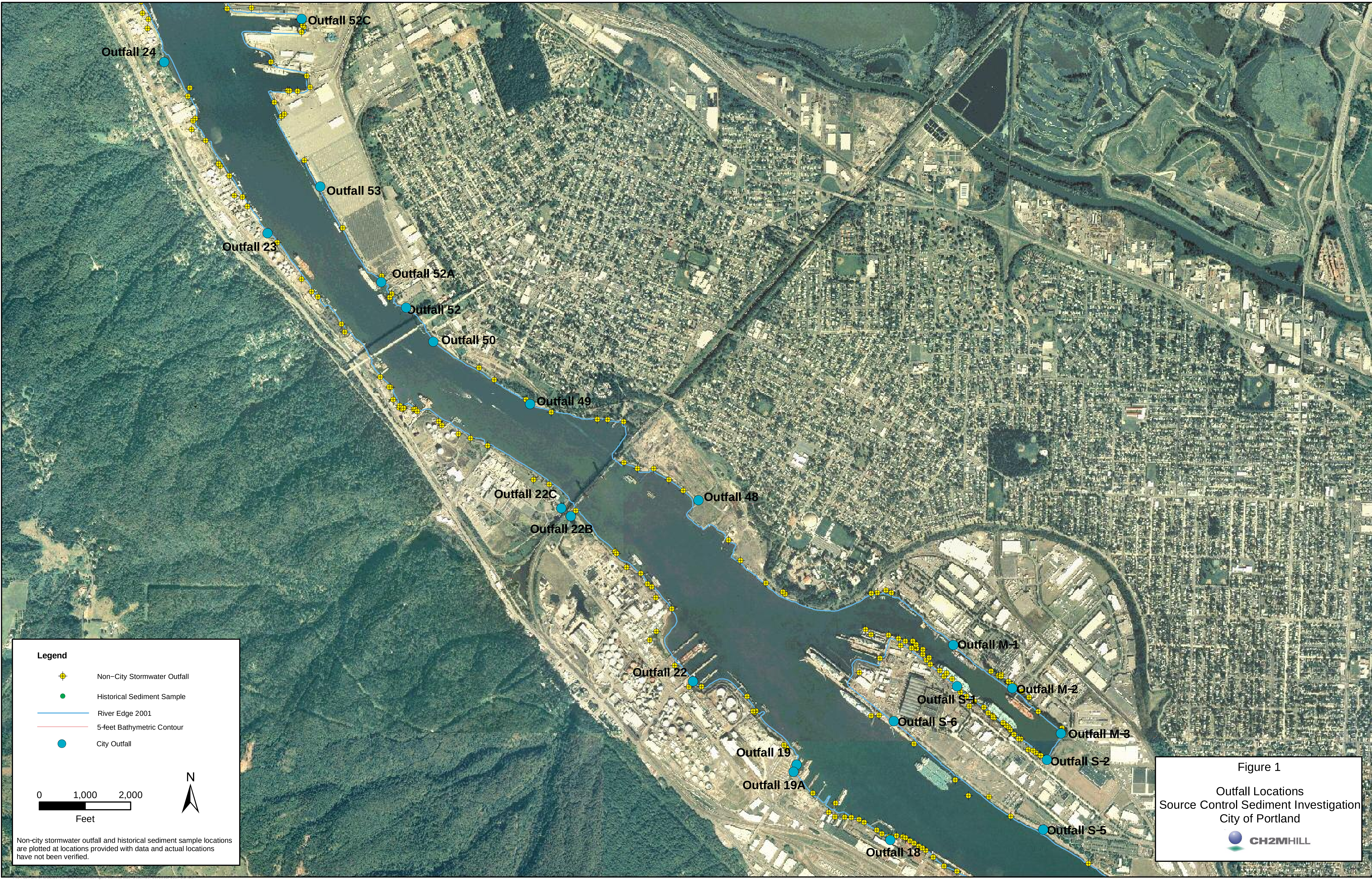

Figure 1

Outfall Locations
Source Control Sediment Investigation
City of Portland

Figure 2

Outfall S-5 −Sample Locations
Source Control Sediment Investigation
City of Portland

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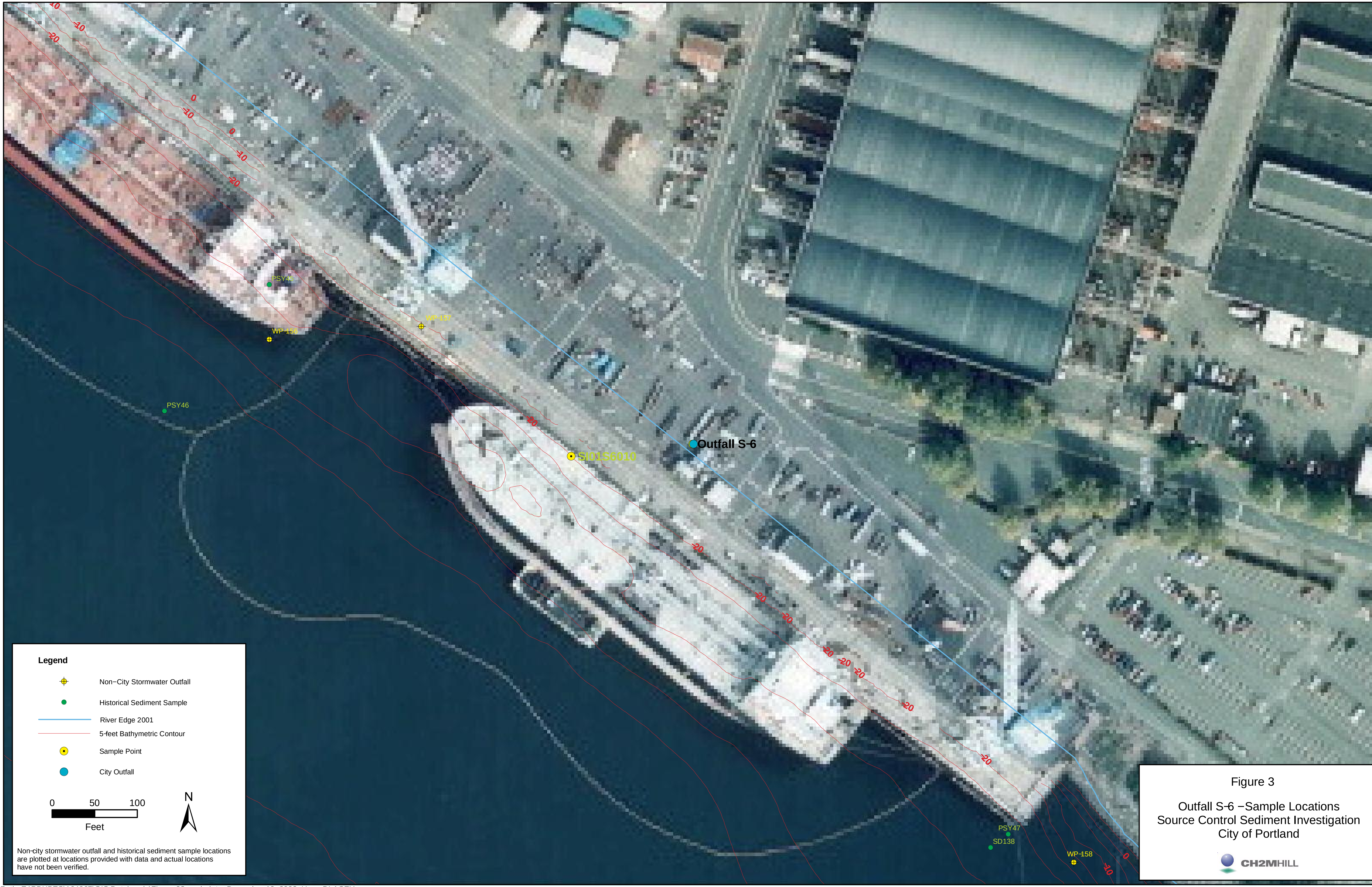

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Figure 5

Outfall S-2 −Sample Locations
Source Control Sediment Investigation
City of Portland

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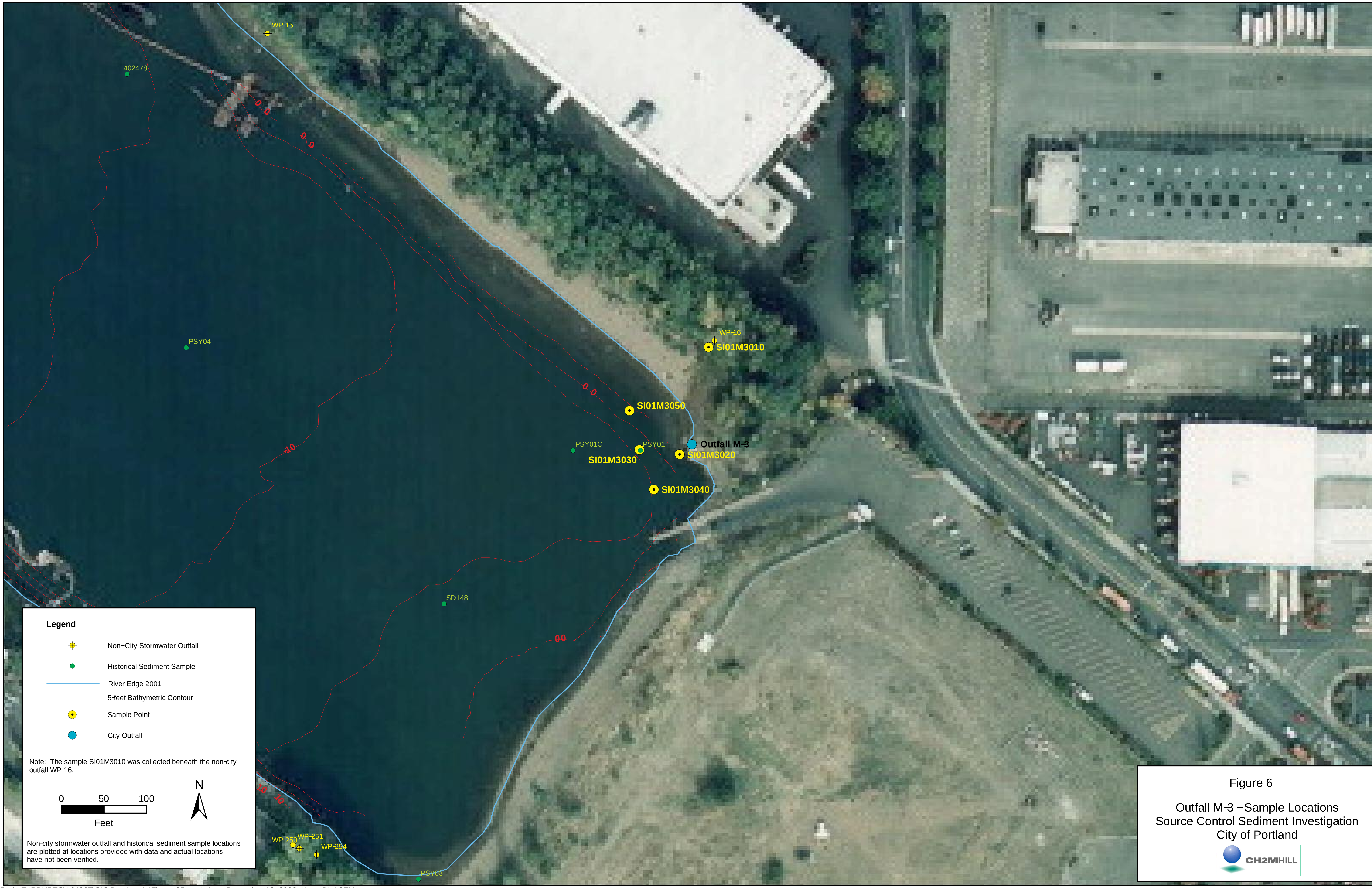

Figure 6

Outfall M-3 – Sample Locations
Source Control Sediment Investigation
City of Portland

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Figure 7

Outfall M-2 – Sample Locations
Source Control Sediment Investigation
City of Portland

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Figure 8

Outfall 48 −Sample Locations
Source Control Sediment Investigation
City of Portland

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Figure 9

Outfall 49 −Sample Locations
Source Control Sediment Investigation
City of Portland

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Figure 10

Outfall 50 −Sample Locations
Source Control Sediment Investigation
City of Portland

CH2MHILL

Figure 11

Outfall 52 −Sample Locations
Source Control Sediment Investigation
City of Portland

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Figure 12

Outfall 52A −Sample Locations
Source Control Sediment Investigation
City of Portland

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Figure 13

Outfall 53 −Sample Locations
Source Control Sediment Investigation
City of Portland

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Figure 14

Outfall 52C −Sample Locations
Source Control Sediment Investigation
City of Portland

File Path: E:\PDXBES\164067\GIS Data\mxds\Figure 13.mxd, date: December 10, 2002, User: DLACEY

Figure 15

Outfall 19 and 19A −Sample Locations
Source Control Sediment Investigation
City of Portland

CH2MHILL

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Figure 16

Outfall 22 −Sample Locations
Source Control Sediment Investigation
City of Portland

File Path: E:\PDXBES\164067\GIS Data\mxds\Figure 15.mxd, date: December 10, 2002, User: DLACEY

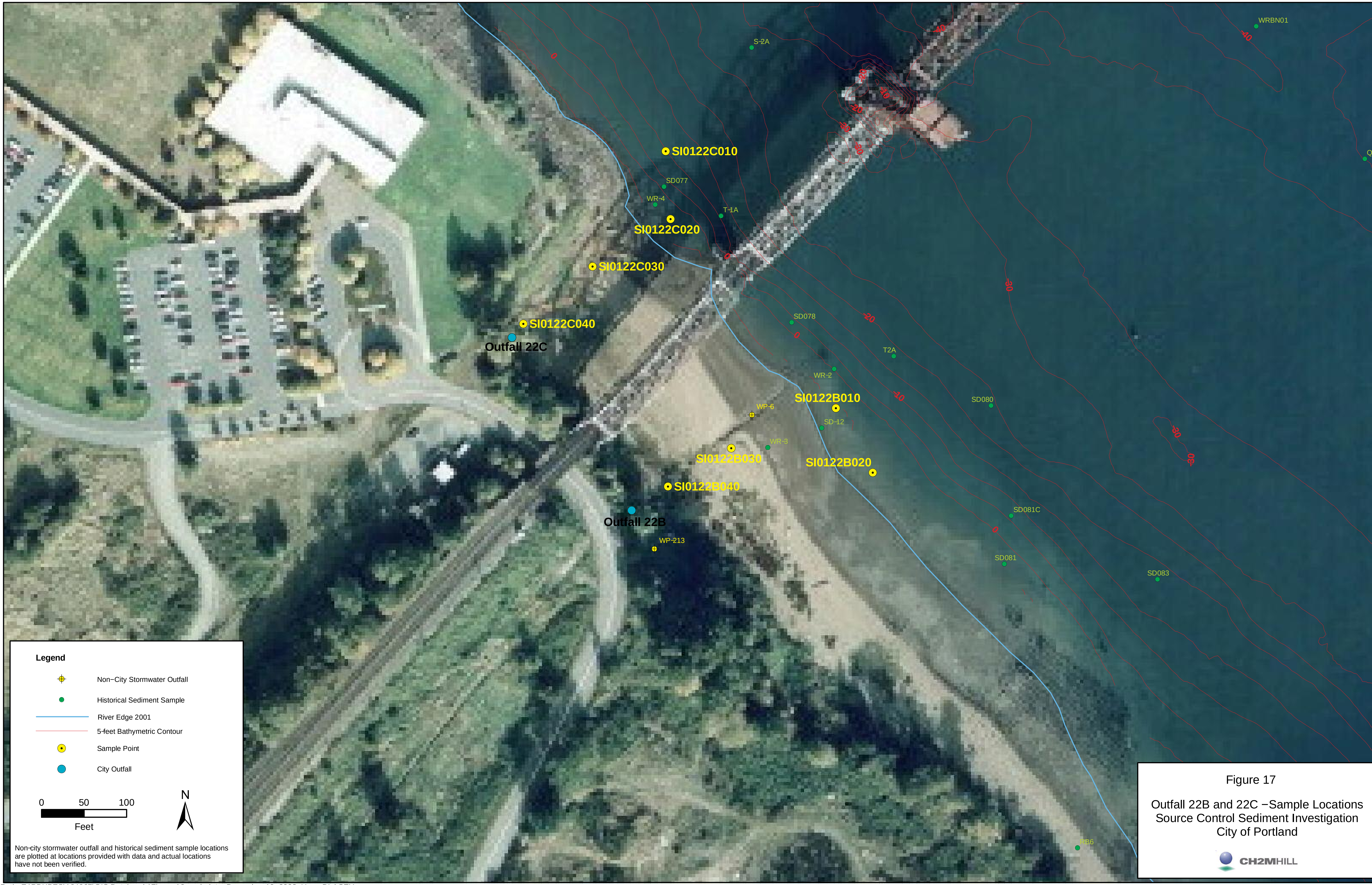

Figure 17

Outfall 22B and 22C −Sample Locations
Source Control Sediment Investigation
City of Portland

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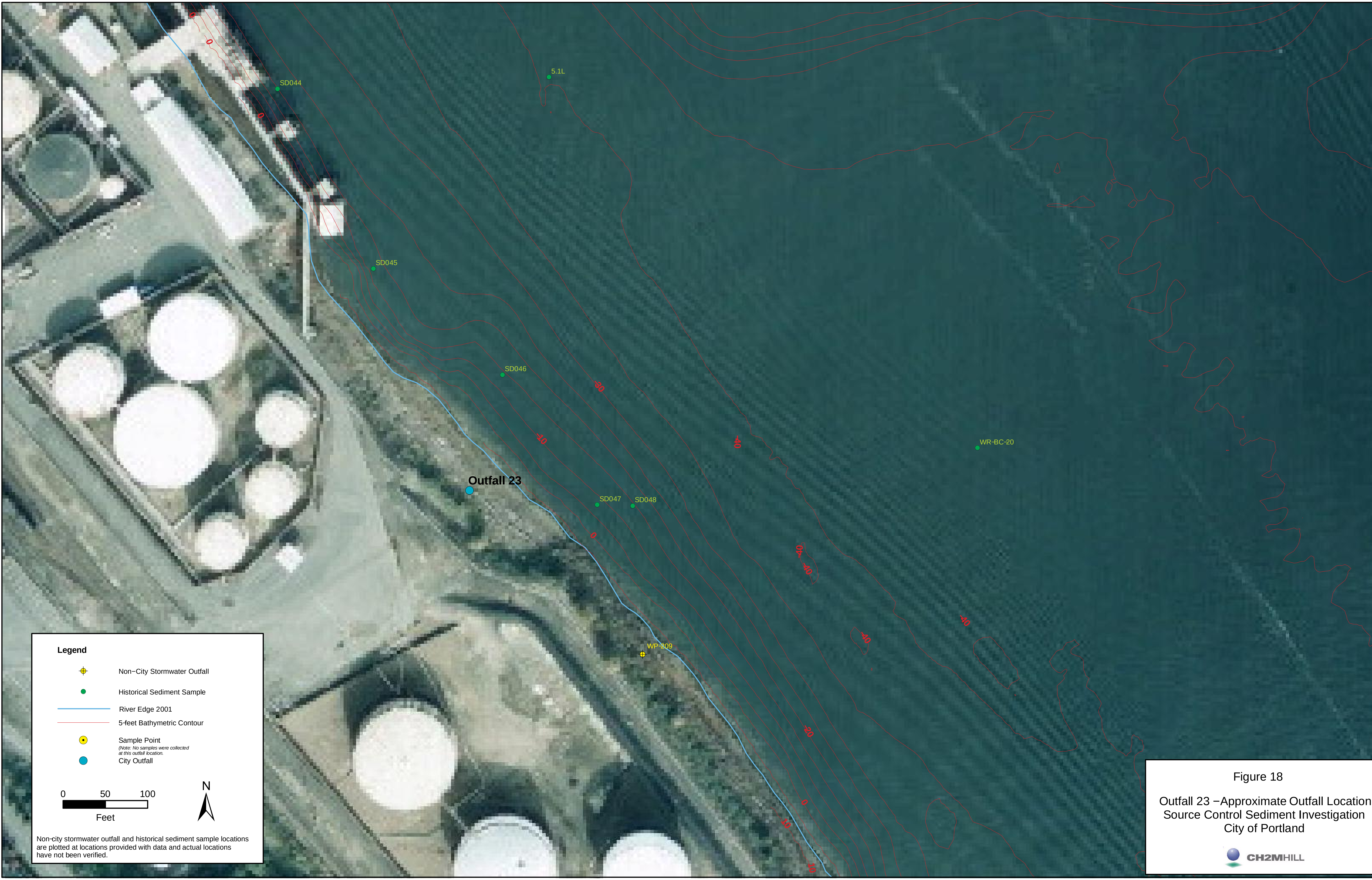

Figure 18

Outfall 23 −Approximate Outfall Location
Source Control Sediment Investigation
City of Portland

File Path: E:\PDXBES\164067\GIS Data\mxds\Figure 17.mxd, date: December 10, 2002, User: DLACEY

Figure 19

Outfall 24 −Sample Locations
Source Control Sediment Investigation
City of Portland

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Appendixes A through F

Appendixes A through F are provided in CD format.

Appendixes

A Field Data Sheets
B Field Notes
C Site Photographs
D Daily Precipitation Log Portland, Oregon
E Laboratory Data Sheets
F Data Validation Report

APPENDIX C

Programmatic Remedial Investigation Sampling and Analysis Plan

This RI sampling and analysis plan consists of a compilation of the standard operating procedures (SOPs) that have been developed by BES and that may be pertinent to the collection of solids samples (i.e., sediment and soils). Some of these SOPS may be incorporated into sampling and analysis plans for future individual outfall RIs where appropriate. The SOPs contained in this appendix include the following:

- Guidance for Sampling of Catch Basin Solids (CH2M HILL, 2003)
- Sampling of Soil and Sediment (BES SOP No. 5.01a)
- Field Quality Control Sample Collection (BES SOP No. 7.01c)
- Draft Decontamination of Sampling Equipment (BES SOP 7.01a)

Standard Operating Procedures

Guidance for Sampling of Catch Basin Solids

Prepared for

City of Portland

March 2004

Prepared by

CH2MHILL

VERSION 1.0
USR/031550010.DOC

Printed on Recycled and Recyclable Paper

Contents

Standard Operating Procedures—Guidance for Sampling of Catch Basin Solids

1.0 Purpose

This document describes Standard Operating Procedures (SOPs), developed for the City, for the collection of environmental solids samples from stormwater catch basins. It provides procedures to be used for assessing potential pathways of contamination from upland sources via stormwater conveyances to receiving waters and sediments. Sampling for environmental investigations requires different methods than those that may be used for determining waste profiles for catch basin solids disposal.

The procedures described here are intended to provide representative samples of catch basin contents. These procedures may be modified for other purposes, such as assessing characteristics of older or newer solids, or because of space or access limitations. All deviations from these SOPs should be noted in field logs and reports.

1.1 Background

Catch basins are typically designed to prevent debris, gravels, and soils from fouling storm drain lines, and generally remove larger particles (greater than approximately 1 millimeter in diameter). Unlike specially designed stormwater treatment vaults, catch basins are not intended to remove fine particles or soluble pollutants, and they may only marginally reduce concentrations of contaminants or suspended solids. Catch basin retention efficiencies for suspended solids may be highly variable as functions of basin design, stormwater flow rates, accumulated solids in the sump (a function of cleaning frequency), and solids particle characteristics. Finer particle fractions may be suspended in moving water and carried beyond the catch basin. Because these finer particles are often correlated with organic and inorganic contaminants, special care needs to be taken while collecting catch basin solids samples to ensure that the finer particle fraction is sampled.

2.0 Scope and Applicability

The methodologies discussed in these SOPs are intended to provide procedures for collecting representative environmental samples of solids in stormwater catch basins. These SOPs describe specific steps that can be used to ensure representative and comparable data.

Residual material in catch basins is inherently variable. Factors that can affect variability include the characteristics of catch basin structures, the sources of particles, water flow rates and stormwater quality, and the depth and pattern of accumulated solids. In addition, the characteristics of catch basin solids can vary from slurry-like to dry solids. Although variability may be unavoidable, standard methods of collecting and handling samples can improve data quality.

3.0 Equipment and Materials

The following equipment should be available for collecting solids samples from catch basins:

- Sampler (generally one type will be selected per catch basin)
  - Stainless steel scoop, trowel, or spoon
  - Bucket (hand) auger
  - Hand corer
  - Petite Ponar® dredge/Van Veen® dredge (0.025 square meter [m^2])
- Sampling Equipment List
  - Site Sampling and Analysis Plan and/or site files detailing sampling locations, sample collection, and site information
  - Large stainless steel bowl
  - Stainless steel mixing spoon
  - Latex gloves
  - Metal or wooden rod
  - Field data sheets or other documentation
  - Laboratory-supplied sample containers
  - Cooler and ice/chilled blue ice
  - Tape measure
  - Ziploc® bags
  - Field notebook
  - Permanent marking pens
  - Sample labels
  - Chain-of-custody seals
  - Personal Protective Equipment (PPE)

4.0 Procedures

4.1 Documentation

Regardless of the equipment to be used, the following general procedures apply:

- Confirm any active catch basin best management practices such as sweeping and cleaning, frequency of activity, etc., if known.
- Document design flow rates (base flow, storm flow) for catch basins, if known.
- Record weather conditions at the time of sampling and last known rainfall event(s).
- Record the location of the catch basin. Include potential solids or contaminant sources such as construction activities, erosion, equipment storage or use, waste or material storage, vehicles, exhaust vents, onsite processes, etc. Site features, distances, flow directions, and gradients should be noted or sketched on a site map.

- Record dimensions of catch basin. Diagram inlet/outlet pipes in the catch basin. The source of inlet flows and destination of outlet flows should be noted, if known.
- Note the presence of water, visible flows, signs of flooding, clogging, debris in or around the catch basin, blocked inlets/outlets, staining, etc.
- Note any apparent evidence of contamination in the catch basin, such as odor, sheen, discoloration, etc., of water or solids.
- Measure the depth of solids in the catch basin and the total depth of the catch basin or sump. Use a decontaminated metal rod or disposable wooden dowel to probe the total depth of the catch basin.
- When recovering samples, record visual observations of:
  - Color
  - Texture, estimates of particle size fractions (as soil classification)
  - Amount and type of debris (Note: any large debris observed in the sample, including sticks, leaves, beverage containers, miscellaneous pieces of plastic and metal, stones and gravel, etc., should be removed, but paint chips and small organic matter should be left in the sample)
- Prepare a diagram of sampling locations within the catch basin, noting any special features such as sumps, inlets and outlets, etc.
- Decontaminate all sampling equipment using documented procedures before and after any sampling activities. Record the decontamination procedures in the field notes.
- Record any deviations from the specified sampling procedures or any obstacles encountered.
- Complete a chain-of-custody form for all samples.

4.2 Selection of Sampling Method

Sampling equipment should be matched with the presence and depth of water, solids water content, and catch basin depth. Figure 1 presents a flow chart for determining the appropriate sampling device. Detailed descriptions of each sampling method are presented in Section 4.3.

4.2.1 Decontamination of Equipment

Non-disposable equipment that contacts solids samples should be thoroughly cleaned and decontaminated before each set of samples is collected. Decontamination should be done in accordance with City of Portland SOP 7.01a[1] or comparable standard. Decontamination solutions should be selected on the basis of the type of analysis being conducted on samples.

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[1] Bureau of Environmental Services, Environmental Investigations Division, SOP No. 7.01a Draft or subsequent revisions, Decontamination of Sampling Equipment.

4.3 Sample Collection

This guidance for sampling catch basins is intended to assess individual catch basins as potential sources of past, present, or future conduits of contamination to Willamette River sediments. Sample collection should therefore incorporate material representative of the total depth and area unless specific alternative sampling objectives are otherwise noted and approved. In some cases, sample collection from discrete depths may be desired based on knowledge of catch basin maintenance and time since last cleaning, activities conducted within the drainage area, spills or releases, and related information.

Standing water in the catch basin, if present, may be pumped off to simplify sample collection. If this procedure is conducted, care must be taken to:

- Pump water from the surface only
- Leave a thin layer of water so that fine materials in the solids are not disturbed
- Pump water slowly so that fine materials are not disturbed
- Dispose of pumped water in the sanitary sewer (pumped water may not be released into the storm system)
- Document all steps taken, the depth and volume of water removed, the point of water disposal, water remaining before sampling, and other relevant factors

4.3.1 Sampling Firm Solids in Catch Basins without Standing Water

Firm solids above the water line are most easily collected using simple soil sampling tools (that is, stainless steel spoon or trowel, or bucket auger). When sampling with a spoon or auger, solids may be moist or wet but should retain their form and structure when handled. (Note: If the sample has a high water content [water drips from solids], another sampling method should be considered to minimize the loss of fine particles in liquid drainage.)

4.3.1.1 Stainless Steel Spoon, Scoop, or Trowel

If necessary, the spoon, scoop, or trowel may be attached to an extension pole in order to reach the bottom of the catch basin, provided a representative sample can be retained on the spoon and recovered intact.

The following procedure defines steps to be taken when sampling dry or moist solids with a stainless steel spoon, scoop, or trowel:

1. Collect the necessary equipment. Clean and decontaminate the equipment, using procedures appropriate for the analytical parameters to be measured.
2. Arrange the appropriate sampling containers.
3. Don a new pair of nitrile or latex gloves.
4. Using a decontaminated stainless steel spoon, scoop, or trowel, collect an equal amount of material from five locations: each corner (or, if round, each compass point) and the center. Material recovered at each point should be a composite of the total depth of accumulated material, unless otherwise specified in the sampling plan.

5. Place sampled solids into a decontaminated stainless steel bowl or tray. Repeat step 4 as necessary in order to obtain the required volume, and mix to homogenize thoroughly using a decontaminated or disposable stainless steel spoon.

6. Collect a suitable portion of the mixed solids with a decontaminated or disposable stainless steel spoon and place into each appropriate sample container.

7. Check that a Teflon® liner is present in caps, if required. Secure the caps tightly. Label sample containers clearly with all appropriate sample information.

8. Place samples in cooler for transport. Refrigeration to 4° Celsius (C) is usually required. Transport time to the laboratory should be as short as possible and must be documented with a chain-of-custody form.

9. Ensure that appropriate field notes, as detailed in the Field Documentation, Section 4.1, have been collected.

10. Complete the chain-of-custody documents.

4.3.1.2 Stainless Steel Bucket Auger (Hand Auger)

Bucket augers are applicable to the same situations and materials as the spoon, scoop, and trowel method described above. Most bucket augers have long handles (> 4 feet), and some can be fitted with extension handles that will allow the collection of solids from deeper catch basins.

The following procedure defines steps to be taken when sampling dry or moist solids with a stainless steel bucket auger:

1. Collect the necessary equipment. Clean and decontaminate the equipment, using procedures appropriate for the analytical parameters to be measured.

2. Arrange the appropriate sampling containers.

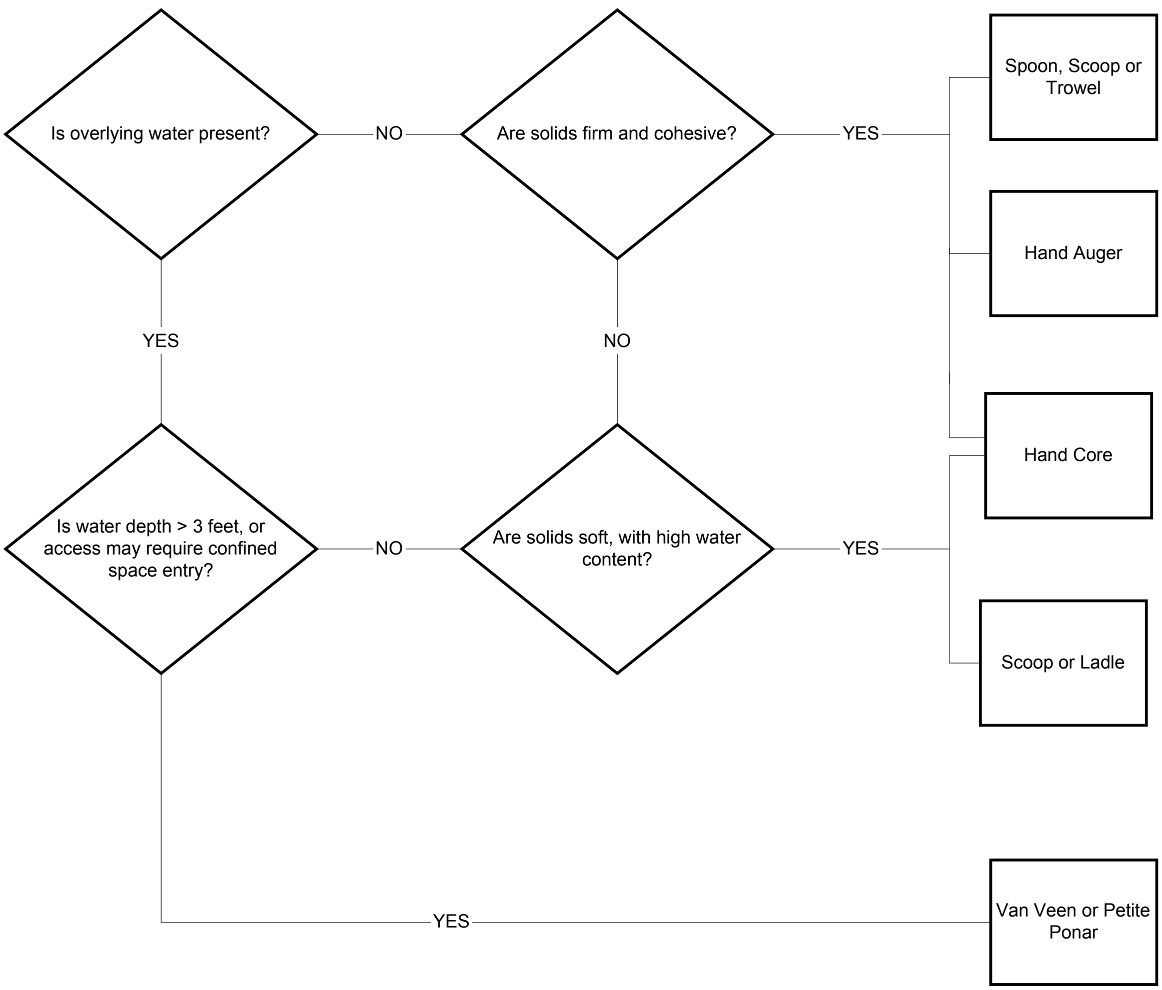
3. Don a new pair of nitrile or latex gloves.

4. Advance a thoroughly cleaned and decontaminated bucket auger into catch basin solids in each corner (or, if round, each compass point) and the center of the catch basin. Material recovered at each point should be a composite of the total depth of accumulated material, unless otherwise specified in the sampling plan.

5. Empty the auger into a stainless steel bowl or tray. Repeat step 4 as necessary in order to obtain the required volume and mix to homogenize thoroughly, using a decontaminated or disposable stainless steel spoon.

6. Collect a suitable portion of the mixed solids with a decontaminated or disposable stainless steel spoon and place the sample into each appropriate sample container.

Figure 1. Flow Chart for Selecting the Appropriate Catch Basin Solids Sampler



7. Check that a Teflon® liner is present in caps, if required. Secure the caps tightly. Label sample containers clearly with all appropriate sample information.
8. Place samples in cooler for transport. Refrigeration to 4° Celsius (C) is usually required. Transport time to the laboratory should be as short as possible and must be documented with a chain-of-custody form.
9. Ensure that appropriate field notes, as detailed in the Field Documentation, Section 4.1, have been collected.
10. Complete the chain-of-custody documents.

4.3.2 Sampling Solids in Catch Basins with Standing Water

Hand corers or dredge samplers should be used when standing water is present in catch basins to prevent washout of sample material when the sampler is retrieved through the water column. Corers may also be used for dry and moist solids. Some hand corers can be fitted with extension handles that will allow the collection of samples in deeper basins.

4.3.2.1 Hand Corers

The following procedure defines steps to be taken when sampling saturated solids with a stainless steel hand corer:

1. Collect the necessary equipment. Clean and decontaminate the equipment, using procedures appropriate for the analytical parameters to be measured.
2. Arrange the appropriate sampling containers.
3. Don a new pair of nitrile or latex gloves.
4. Using a thoroughly cleaned and decontaminated corer, advance the sampler into catch basin solids with a smooth, continuous motion, twist corer, and then withdraw it in a single motion.
5. Remove the nosepiece and withdraw the sample into a stainless steel bowl or tray.
6. Repeat steps 4 and 5 in each corner (or, if round, each compass point) and the center of the catch basin. Material recovered at each point should be a composite of the total depth of accumulated material, unless otherwise specified in the sampling plan.
7. Mix to homogenize thoroughly, using a decontaminated or disposable stainless steel spoon.
8. Collect a suitable portion of the mixed solids with the decontaminated or disposable stainless steel spoon and place into each appropriate sample container.
9. Check that a Teflon® liner is present in caps, if required. Secure the caps tightly. Label sample containers clearly with all appropriate sample information.
10. Place samples in cooler for transport. Refrigeration to 4° Celsius (C) is usually required. Transport time to the laboratory should be as short as possible and must be documented with a chain-of-custody form.

11. Ensure that appropriate field notes, as detailed in Section 4.1, Documentation, have been collected.

12. Complete the chain-of-custody documents.

4.3.2.2 Clamshell-Type Dredge Samplers

Clamshell-type dredge samplers like the Petite Poner® and Van Veen® 0.025-m² dredge sampler are capable of sampling moist and wet solids, including those below standing water. However, penetration depths usually will not exceed several inches, so it may not be possible to collect a representative sample if the solids layer is greater than several inches. The sampling action of these devices causes agitation currents that may temporarily resuspend some settled solids. This disturbance can be minimized by lowering the sampler slowly and by allowing slow contact with the solids.

Samples collected with clamshell-type dredge samplers should meet the following acceptability criteria in order to ensure that representative samples have been collected (EPA, 2001):

- Solids do not extrude from the upper surface of the sampler.
- Overlying water is present in the sampler (indicating minimal leakage).
- Overlying water is clear and not excessively turbid.
- Desired depth of penetration has been achieved.
- The solids-water interface is intact and relatively flat, with no sign of channeling or sample washout.
- There is no evidence of sample loss.

The following procedure defines steps to be taken when sampling moist, wet, or submerged solids with a dredge sampler:

1. Collect the necessary equipment. Clean and decontaminate the equipment, using procedures appropriate for the analytical parameters to be measured.
2. Arrange the appropriate sampling containers.
3. Don a new pair of nitrile or latex gloves.
4. Using a thoroughly cleaned and decontaminated dredge-type sampler and working on a clean, decontaminated surface, arrange the sampler in the open position, setting the trip bar so that the sampler remains open when lifted from the top.
5. Slowly lower the sampler to a point just above the solids surface.
6. Drop the sampler sharply into the solids, then pull sharply on the line, thus releasing the trip bar and closing the dredge.
7. Raise the sampler and place on a clean surface. Slowly decant or siphon any free liquid through the top of the sampler. Take care to ensure that fines are not lost in the process; if necessary, allow the sampler to sit and the fine particles to settle before decanting or siphoning free liquid.

8. Open the dredge and transfer the solids into a large stainless steel bowl or tray of sufficient size to receive three sample loads.
9. Repeat steps 4 through 8 in diagonal corners (or, if round, two opposite compass points) and the center of the catch basin. Material recovered at each point should be representative of the total depth of solids in the sampling device. If necessary, modify sampling points to correspond to catch basin size or dimensions. Record any deviations in the field notes.
10. Mix to homogenize thoroughly, using a decontaminated or disposable stainless steel spoon.
11. Collect a suitable portion of the mixed solids with a decontaminated or disposable stainless steel spoon and place into each appropriate sample container.
12. Check that a Teflon® liner is present in caps, if required. Secure the caps tightly. Label sample containers clearly with all appropriate sample information.
13. Place samples in cooler for transport. Refrigeration to 4° Celsius (C) is usually required. Transport time to the laboratory should be as short as possible and must be documented with a chain-of-custody form.
14. Ensure that appropriate field notes, as detailed in the Field Documentation, Section 4.1, have been collected.
15. Complete the chain-of-custody documents.

5.0 Sample Acceptability

Only solids that are collected correctly with grab or core sampling devices should be used for subsequent physicochemical testing. Acceptability of grabs can be ascertained by noting that the samplers are closed when retrieved, are relatively full of solids (but not overfilled), and do not appear to have lost surficial fines. Core samples are acceptable if the core was inserted vertically in the solids and an adequate depth was sampled without significant loss out the mouth of the corer.

6.0 Quality Assurance and Quality Control

A rinsate sample may be appropriate or required when non-disposable sampling equipment is used. The equipment rinsate should be collected between sampling locations and after the device has been decontaminated. The rinsate sample should be analyzed for the same parameters analyzed for in solids.

7.0 Resources

1. ASTM. September 1994. Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediment for Toxicological Testing. American Society for Testing and Materials (E 1391-94). West Conshohocken, Pennsylvania.

2. EPA. 1987. A Compendium of Superfund Field Operations Methods, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response (EPA/540/P-87/001), Washington, D.C.

3. EPA. 2001. Methods for Collection, Storage, and Manipulation of Sediment for Chemical and Toxicological Analyses: Technical Manual. U.S. Environmental Protection Agency, Office of Water (EPA-823-B-01-002). Washington, D.C. October 2001.

FIELD OPERATIONS
STANDARD OPERATING PROCEDURE

SAMPLING OF SOIL AND SEDIMENT

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the procedures for collecting soil and sediment samples using non-mechanical sampling devices. The samples generated using these procedures may be submitted for laboratory analysis as grab samples or may be composited, as needed.

2.0 SCOPE AND APPLICABILITY

The methodologies discussed in this SOP are applicable to the sampling of fine to coarse-grained surface and subsurface soils, and for sediments beneath flowing and standing water.

3.0 EQUIPMENT AND MATERIALS

The following is a list of required equipment for collecting soil and sediment samples:

Bucket Auger(Hand Auger)
Ponar dredge/Ekman dredge
Shovel
Stainless steel scoop
Large stainless steel bowl
Stainless steel or plastic bucket
Site files detailing sampling locations, site information, and past site visits
Latex gloves
Chain of custody, field data sheets or other documentation
Laboratory-supplied sampler containers
Cooler and chilled blue ice
Stainless steel spoon
Tape measure

4.0 PROCEDURE

The following procedures explain how to collect surface soil samples with a trowel or scoop, subsurface soil samples with a bucket auger, and sediment samples beneath an aqueous layer using both an Ekman dredge and a Ponar dredge.

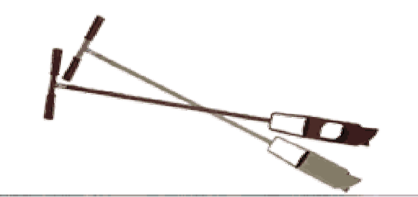
All sampling devices used in this SOP should be decontaminated prior to any sampling activities. Proper decontamination procedures are described in SOP 7.01a, *Decontamination of Sampling Equipment*.

4.1 Sampling Surface Soils with a Trowel or Scoop

Common types of scoops or trowels used to sample surface soils.

The following procedure defines step to be taken when sampling dry or moist soils with a trowel or scoop
1. Locate the desired sampling point and assemble the appropriate sampling containers.
2. Using a decontaminated stainless steel scoop, remove the desired thickness of soil from the sampling area.
3. Transfer the sample to the appropriate sample container or homogenization container.
4. Label sample container and place sample in cooler for transport.
5. Record sampling date, time and a description of sampling location on field data sheet and chain of custody sheet.

4.2 Sampling Subsurface Soils Using a Bucket Auger



Common types of bucket augers(hand augers)

The following procedures define steps to be taken when using a bucket auger to collect a subsurface soil sample. If necessary and appropriate, call the Utility Locate one-number at (503)246-6699 at least 72-hours prior to sampling to ensure that all utility lines in the area are marked. Upon arrival at the site make an inspection to determine if the utilities have been marked, and if any utilities occur at pre-designated sampling locations. No core sampling should occur within 18-inches of a marked utility line.

1. Don gloves and drive bucket auger into the ground using a clockwise twisting motion being sure to keep auger aligned vertically. When auger is full remove from the ground and empty soil into stainless steel bowl.

2. If notes and observations are to be made of the soils at discrete locations within the hole, those should be completed now. Observations may include soil type, depth below ground from where soil is extracted, any discoloration or odors.
3. Repeat Steps 1 and 2 as necessary to the appropriate depth.
4. Upon advancement of the auger to the appropriate sampling depth, withdraw sampler from the hole and rinse with deionized water. Place sampler in the hole and advance as before, using a twisting motion. Withdraw auger from the hole.
5. With as little agitation as possible, place soil sample in the appropriate lab-supplied sample container and place into chilled cooler for delivery to the laboratory. Use chain of custody documentation to track collected samples.
6. If collecting a composite sample, use auger to collect subsamples from desired location, as provided in Step 5 and place into a stainless steel bowl. Use a stainless steel spoon to homogenize the portions of the sample, and transfer into sample containers.
7. When core sampling is completed, place soil cuttings back into the hole.
8. Record sampling date, time and a description of sampling location on field data sheet and chain of custody sheet.
9. If proceeding to another sampling location, decontaminate core sampler per *SOP 7.01a "Decontamination of Sampling Equipment"*.

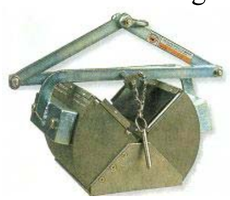
4.3 Sampling Surface Sediments From Beneath an Aqueous Layer Using an Ekman Dredge

The Ekman dredge is useful for sampling benthic communities inhabiting soft bottomed aquatic environments and the associated sediments. As the dredge is lowered, the hinged upper doors swing open, allowing water to pass through and minimize the shock wave. When the dredge reaches the bottom, a messenger is sent down the line which trips the spring-loaded jaws. The jaws snap shut, preventing washout of the sample.

1. Thread a sturdy nylon rope through the bracket.
2. Lower the sampler to a point just above the sediment surface.
3. Trigger the jaw release mechanism by lowering the messenger down the line.
4. Raise the sampler and slowly decant any free liquid through the top of the sampler. Be careful to retain any fine sediments.
5. Open the dredge and transfer the sediment into a stainless steel or plastic bucket. Collect additional sediment until sufficient sediment has been secured.
6. Transfer the sample to the appropriate sample container. Label sample container and place sample in cooler for transport.
7. Record sampling date, time and a description of sampling location on field data sheet and chain of custody sheet.

4.4 Sampling Surface Sediments From Beneath an Aqueous Layer Using an Ponar Dredge

The Ponar Dredge is widely used for sampling sand, gravel clays, and the associated benthic macro organisms. The self-tripping sampler features center hinged jaws and a spring loaded pin that releases when the sampler makes impact with the bottom. Features include an underlip attachment that cleans gravel from the jaws that would normally prevent closing and removable side plates that prevent lateral loss of sample. The top is covered with a stainless steel screen with neoprene rubber flaps which allows water to flow through for a controlled descent and less interference with the sample.



Thread a sturdy nylon rope through the bracket.

1. Arrange the Ponar dredge in the open position, setting the trip bar so that the sampler remains open when lifted from the top.
2. Lower the sampler to a point just above the sediment surface.
3. Drop the sampler sharply into the sediment, then pull sharply on the line, thus releasing the trip bar and closing the dredge.
4. Raise the sampler and slowly decant any free liquid through the top of the sampler. Be careful to retain any fine sediments.
5. Open the dredge and transfer the sediment into a stainless steel or plastic bucket. Collect additional sediment until sufficient sediment has been secured.
6. Transfer the sample to the appropriate sample container. Label sample container and place sample in cooler for transport.
7. Record sampling date, time and a description of sampling location on field data sheet and chain of custody sheet.

5.0 POTENTIAL PROBLEMS

When collecting subsurface soil samples it will be impossible to drive core sampler through asphalt or concrete surfaces. If the sampling location is at such a location, arrangements will need to be made with a concrete cutter to core through those surfaces. In addition, core samplers are not able to penetrate layers of large cobbles or rock. Alternative sampling processes may need to be considered if samples cannot be obtained using hand methods. If refusal is encountered, attempt another boring within five feet of the original location.

Since contaminants can be preferentially concentrated in fine grain layers, care must be taken to select sampling locations that will best comply with the project requirements. The technician should take careful notes to document any conditions that may differ from those expected.

When collecting sediment samples using the dredges a common problem is failure of the dredge to close completely due to debris interfering with the device. This will result in the sediment to fall out of the dredge as it is raised to the surface. If this occurs, re-attempt until the dredge closes properly.

6.0 QUALITY ASSURANCE & QUALITY CONTROL

A rinsate sample may be requested at a site where sampling will occur at more than one sampling location. The rinsate should be collected between sampling locations and after the device has been decontaminated.

If collect volatile organic compounds (VOCs) samples first. Never collect VOC samples from a composite sample.

7.0 RESOURCES

1. EPA, *Compendium of ERT Surface Water and Sediment sampling Procedures*, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response (EPA/540/P-91/005), Washington D.C., 1991.

City of Portland
Bureau of Environmental Services
Environmental Investigations Division

SOP No.: 7.01c
Revision No.: 1
Date: 1/30/02
Author: JBB

FIELD OPERATIONS
STANDARD OPERATING PROCEDURE

FIELD QUALITY CONTROL SAMPLE COLLECTION

1.0 PURPOSE

This Standard Operating Procedure (SOP) details procedures for taking field Quality Control (QC) samples in conjunction with the extraction of environmental monitoring samples. The intended sampling media pertains to surface water, stormwater, wastewater, sediment/soils, and groundwater. Furthermore, the development of the QC sampling procedure will follow the directives of the sampling project of concern and will be designed accordingly. The types of QC samples discussed are trip blanks, duplicates, and rinsates.

2.0 SCOPE AND APPLICABILITY

Field Quality Control samples are intended for the evaluation of the sampling operation and the quantification and documentation of bias that can occur in the field. QC samples offer sampling crews the ability to assess the accuracy of the data they produce and a means for quantifying sampling bias and limiting it to acceptable levels. By incorporating QC procedures into a sampling and monitoring plan, confidence in standard practices related to sample collection, preservation, and storage can be assured. Sampling crews must understand the purpose of the sampling operation and how the data from the QC samples will be utilized. When collecting QC samples it is important to develop an understanding of the analytical requirements involved and to employ good field practices. Sampling activities may require “Clean” techniques (e.g., “Clean Hands/Dirty Hands”) and low level sampling methods.

The following table lists the types of QC samples utilized. Project specific objectives will determine the level of the QC sampling procedure.

QC Sample Type	Purpose/Information Provided
Trip Blanks	Sample handling and transport bias Sample cross-contamination
Duplicates	Sampling and measurement precision Consistency in sampling methodology Equipment contamination Requirement for post sampling laboratory checks Measurement of variability
Rinsates Rinsates (cont'd)	Equipment contamination Proper/improper field practices Check of the decontamination procedure Carryover of contaminants between sites

SOP No.: **7.01c**
Revision No.: **1**
Date: **1/30/02**
Author: **JBB**

This SOP is applicable to the extraction of field QC samples as dictated by the sampling and analysis plan of concern and the media involved. The use of necessary sampling equipment will be referenced in this document; however, more detailed instructions pertaining to sampling equipment operation will be outlined in the appropriate SOP (e.g., *SOP 2.02a Grab Sample with Stainless Steel Bailer*). Only those QC samples taken in the field will be covered. QC samples that are specific to laboratory practices, for instance, those used to verify analytical methodology or instrument detection limits, will not be covered in this document. Laboratory specific samples can be referenced in the *Water Pollution Control Laboratory Quality Assurance Plan.*

3.0 EQUIPMENT AND MATERIALS

Sampling equipment required for the collection of QC samples will be consistent with those used during the sampling operation. The QC sampling procedures described in this document pertain to a variety of sampling media and will require the operation of many different types of sampling and monitoring equipment. Equipment checklists should be formulated in response to the needs of the sampling operation and associated procedures. In addition to the project specific equipment checklist, QC sampling may require the following:

- Ample supply of ultrapure, deionized water
- Analyte-specific sample containers, bottles, and/or jars for the additional QC samples
- Extra supply of latex or vinyl gloves (as appropriate)
- Additional cooler with ice for sample storage

4.0 PROCEDURE

Consult the necessary sampling protocol prior to QC sampling for specific instructions. Since QC samples are used to evaluate the sampling procedure, sampling activities performed in the field must reflect the needs and objectives of the project of concern. Reference all necessary project information and related SOPs prior to the collection of QC samples.

4.1 Collection of Duplicate Samples

1. Prepare to collect duplicate samples following the procedure outlined by the project of concern. Reference analytical requirements, proper sampling methodology, sampling site location, and sampling apparatus decontamination. Special attention should be applied to differences in protocol concerning composite and grab samples.
2. Fill the duplicate sample bottles along side the sample bottles in a corresponding manner related to analysis (e.g., grab metals bottle with duplicate grab metals bottle). When a representative flow stream is accessible for direct collection, fill the duplicate and sample bottles simultaneously or as close to as possible. If sampling requires the use of a sampling device, such as a dredge or water column sampler; an aggregate of the sample should be compiled and then partitioned into the duplicate and sampling bottles in an alternating fashion until all bottles are filled.
3. Deliver duplicate bottles with the grab samples to the laboratory along with all field and sample documentation for analysis following specified sample storage requirements.

4.2 Rinsate Sample Collection

Rinsate samples are collected at a sampling location in the same manner and using the same equipment as the environmental sample. There are two types of rinsate samples: the cleaning rinsate and the carryover rinsate. The method of sampling will determine which type of rinsate sample is collected. If the project requires site specific, pre-cleaned sampling devices, a cleaning rinsate sample shall be taken. If a project involves using the same equipment at multiple sites without decontamination occurring between sites, a carryover rinsate sample is collected.

4.2.1 Cleaning Rinsate

1. Perform the necessary decontamination duties for the sampling equipment to be used prior to the collection of the samples. Sampling devices should be stored in clean carrying cases and wrapped in plastic bags or aluminum foil (as appropriate) to avoid contamination while in transit to the sampling location(s).
2. Refer to the applicable field/sampling documentation for necessary instruction as to when to take the rinsate sample. The rinsate sample maybe designated to a specific sampling site and/or analyte specific. For routine sampling projects that occur within a predetermined schedule (e.g., monthly), it is recommended that the site location at which the rinsate sample is collected at alternate monitoring locations each sample event.
3. While wearing a clean pair of vinyl or latex gloves, fill the previously decontaminated sampling equipment with ultrapure, deionized water and empty to rinse. While pouring the ultrapure water into the sampling device, make sure to rinse the interior of the device thoroughly. Repeat.
4. Fill the sampling apparatus once again with ultra-pure, deionized water and fill the required rinsate sample bottles. Perform a ¼ bottle rinse of the rinsate sample bottles with the rinsate water from the sampling apparatus before the rinsate bottles are filled and capped.
5. Record the time and date that the sample was collected on the chain-of-custody as well as on any other form of appropriate field documentation. Ensure that the applicable sample site point code has been accurately designated on the field/sampling documentation, corresponding to where the rinsate sample was collected.
6. Proceed with the collection of the environmental sample for that site.
7. Deliver rinsate bottles along with the other sample bottles to the laboratory, accompanied by all field and sample documentation for analysis. Follow the necessary sample storage requirements.

4.2.2 Carryover Rinsate

1. Perform the necessary decontamination for the sampling equipment as required by that project.
2. Refer to the applicable field/sampling documentation for necessary instruction as to when to take the rinsate sample. The rinsate sample maybe designated to a specific sampling site and/or analyte specific. For routine sampling projects that occur within a predetermined schedule (e.g., monthly), it is recommended that the site location at which the rinsate sample is collected at alternate monitoring locations each sample event.
3. Collect the environmental sample at the site where the rinsate sample will be collected.
4. Don a clean pair of vinyl or latex gloves, fill the previously used sampling equipment with ultrapure, deionized water and empty to rinse. While pouring the ultrapure water into the sampling device, make sure to rinse the interior of the device thoroughly. Repeat.
5. Fill the sampling apparatus once again with ultra-pure, deionized water and fill the required rinsate sample bottles. Perform a ¼ bottle rinse of the rinsate sample bottles with the rinsate water from the sampling apparatus before the rinsate bottles are filled and capped.
6. Record the time and date that the sample was collected on the chain-of-custody as well as on any other form of appropriate field documentation. Ensure that the applicable sample site point code has been accurately designated on the field/sampling documentation, corresponding to where the rinsate sample was collected.

7. Deliver rinsate bottles along with the other sample bottles to the laboratory, accompanied by all field and sample documentation for analysis. Follow the necessary sample storage requirements.

4.3 Trip Blank Sample Collection

Note: The collection and use of trip blank samples is required when collecting volatile organic compounds (VOC) samples.

1. Prior to conducting the sampling operation, acquire an unfilled VOC vial.
2. Without overfilling to avoid washout of preservative, fill the VOC vial to zero headspace with ultrapure, deionized water by creating a convex meniscus and then capping. To achieve the convex meniscus without allowing the washout of added preservative, the vial cap can be filled with the deionized water and used to drip small amounts of water into the vial at a time. If air bubbles are noted in the vial, additional water should be added to force out the bubbles. However if preservative is lost during this part of the procedure, the vial should be discarded and a new vial used in its place.
3. Scribe the date and time on the vial and place it into the cooler adjacent to the VOC grab sample vials. The trip blank sample should be stored in this manner from the time the sampling crews leaves the lab, during the sampling operation, and until the samples are relinquished to the lab. Record the date and time, as well as any additional sampling information, on the appropriate field documentation and chain-of-custody forms.
4. Deliver the trip blank sample to the laboratory with the VOC grab samples and all field and sample documentation for analysis.

5.0 POTENTIAL PROBLEMS

Careful attention should be employed while conducting QC sampling procedures to avoid possible contamination and to secure accurate representation. By not following specified requirements pertaining to decontamination, clean sampling technique, and proper sampling methodology; the accuracy of the sampling procedure can be jeopardized. Contamination of the sample(s) may occur through the use of unclean sampling equipment that will introduce foreign material (e.g., dust, dirt, and organic material) into the sample container and/or the sampling area. Improper activity in or around the sample site will also negatively affect the representation of the sample and must be avoided before and during the collection of the samples. The operation of equipment in or around the sample site that may compromise the representation of the samples must also be avoided.

All procedures related to proper decontamination and sample handling must be followed accordingly to safeguard sample integrity. Special consideration concerning sample preservation and sterile sampling methods also pertain directly to the desired analysis and should be noted prior to the sampling operation as well. Sample bottles that contain a preservative must not be filled by the direct collection method to avoid dilution of the preservative concentration and may require the use of additional sampling devices (e.g., bailers, water bottle samplers). Refer to the appropriate SOP for the operation procedures of those sampling devices.

Sampling documentation must be reviewed before conducting the sampling operation to verify analytical requirements and to ensure effective communication to the laboratory regarding the processing of the QC samples in accordance to the needs of the sampling project. Before sampling occurs, past sampling and/or field documentation can be referenced for information related to monitoring site characteristics and required sampling protocol. Activities conducted in the field must also reinforce adherence to BES safety procedures and guidelines.

6.0 QUALITY ASSURANCE AND QUALITY CONTROL

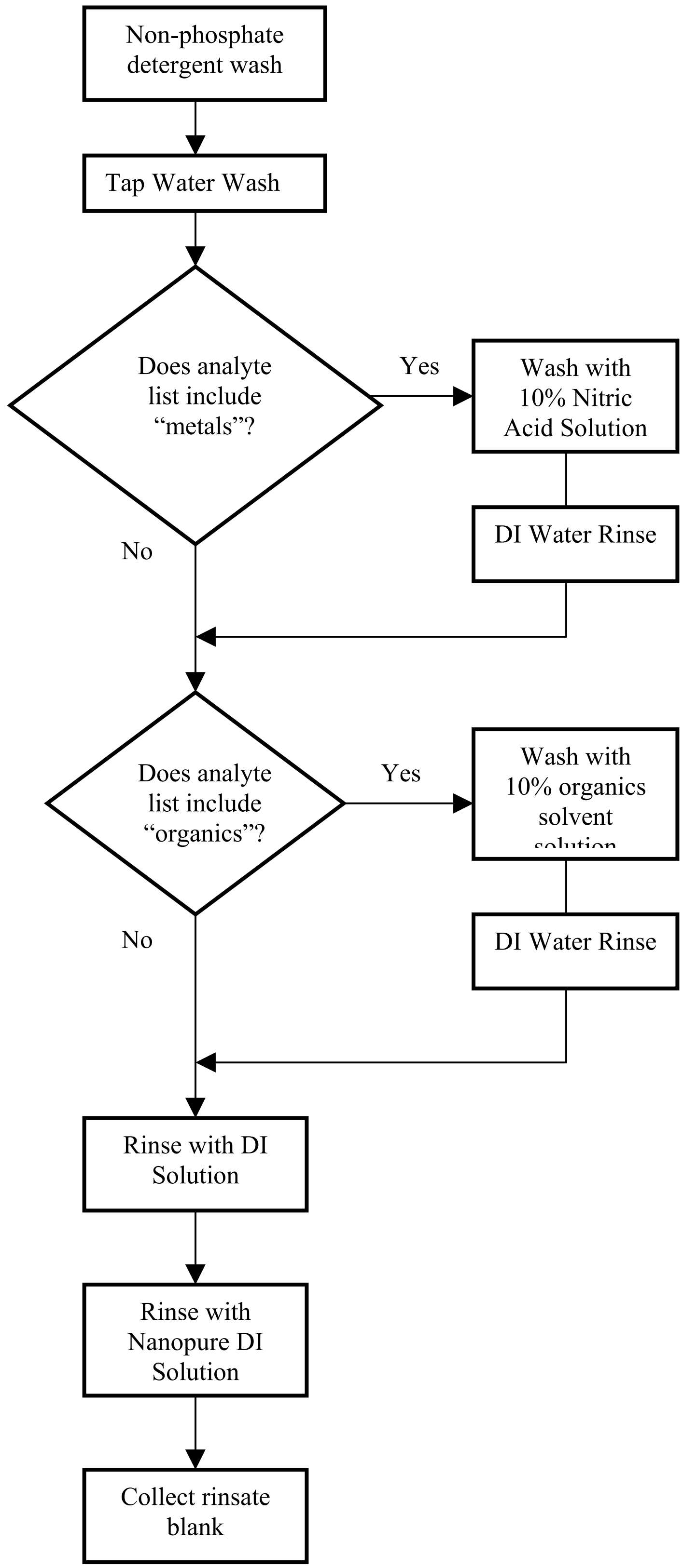
Field quality control samples identify, quantify, and document bias and variability in data resulting from the collection and handling of samples by field personnel. The development of a sound quality assurance and quality control plan demand accurate QC sampling procedures. The number and type of QC samples utilized depends upon the objectives of the monitoring project and the sampling media involved. Sampling crews should conduct a thorough review of the sampling and monitoring plan prior to performing the sampling operation. In the field, all sampling documentation and field data should be checked for accuracy and completeness before the samples are shipped to the laboratory. Collect all field QC samples on the same day the environmental samples are collected, using the same equipment utilized during collection of the environmental samples.

7.0 RESOURCES

The following publications were utilized in the development of this Standard Operating Procedure:

(1) *EPA Guidance for Quality Assurance Project Plans,* U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC, 1998.
(2) *National Field Manual for the Collection of Water-Quality Data,* U.S. Department of the Interior, U.S. Geological Survey, United States Government Printing Office: 1998-99.
(3) *Guidelines and Specifications for Preparing Quality Assurance Project Plans,* Washington State Department of Ecology, May 1991.
(4) *U.S. Geological Survey, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations*, book 9, chaps. A1-A9, 2 v., variously paged. [Chapters were published from 1997-1999; updates and revisions are ongoing and can be viewed at: http://water.usgs.gov/owq/FieldManual/mastererrata.html]

Decontamination Flow Chart



FIELD OPERATIONS
STANDARD OPERATING PROCEDURE

DECONTAMINATION OF SAMPLING EQUIPMENT

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes decontamination procedures for soil and water sampling equipment, including tubing, bailers, augers and sampling spoons and any other equipment that may come into contact with the material to be collected. This SOP is applicable to samples to be analyzed for organic constituents, metals, nutrients/general chemistry and microbiological constituents.

The general approach to equipment decontamination is stated by EPA: "*The method of cleaning should be adapted to both the substances that are to be removed, and the determination to be performed*"[1]. This principle has been adapted to develop this set of procedures to produce clean, uncontaminated equipment. Following correct decontamination procedures will protect sample integrity, increase data quality and reliability, minimize contaminant spread and reduce potential for worker exposure. This SOP is a vital link in the integrity of the sampling process and will help ensure that equipment used during the sampling process is free from contaminants that could bias analytical results.

2.0 SCOPE AND APPLICABILITY

The procedures set forth in this SOP are applicable for the decontamination of sampling equipment when collecting soils, sediments, groundwater, and surface water for the analysis of organic, metals, nutrients/general chemistry and microbiological constituents. This SOP describes the correct procedures to decontaminate equipment that comes into contact with the sample matrix including sampling spoons, bowls, augers, bailers, dredges, composite containers, column samplers, and sample tubing. This practice is applicable to most conventional sampling equipment constructed of metallic and synthetic materials. The manufacturer of a specific sampling apparatus should be contacted if there is concern regarding the reactivity of a decontamination rinsing agent with the equipment.

These procedures do not apply to any project using ultra clean techniques. Please refer to the specific project file for decontamination procedures for that project. These procedures do not apply to pre-cleaned or disposable equipment intended for single use.

3.0 EQUIPMENT AND MATERIALS

Latex, vinyl or nitrile gloves
Splash apron/visor/goggles

SOP No.: 7.01a
Revision No.: 2
Date: 02/10/02
Author: MJH

Decontamination solvents:

Particulate Wash	-Alconox, Liquinox,
Inorganic solvent	-reagent grade nitric acid or hydrochloric acid
Organics solvent	-methanol, isopropanol, acetone, or hexane

Deionized water
Ultra-pure deionized water
Tap water
5-gallon buckets, clean, designated for "decon" only
Peristaltic pump (if necessary)
Plastic scrub brushes
Aluminum foil/clean plastic bags

4.0 PROCEDURE

4.1 Determination of Decontamination Sequence

Equipment decontamination is dependent upon the equipment to be cleaned and the analysis to be performed. Prior to starting decontamination procedures it is vital to review these two issues in order to determine the correct decontamination procedure.

1. To determine the correct decontamination sequence, locate the analysis to be performed on the *"Analyte Classification List*" in Appendix A. For each analysis to be performed on the sample, note whether each analysis is listed in the "organics" "metals", "nutrients", or "general chem." section.

2. Review sampling equipment to be used. Note if there is any metal sampling equipment.

3. Next, use Table 1, "Stepwise Decontamination Procedure", on the next page, to determine the correct decontamination sequence. Follow the procedure as shown, answering the questions and moving on to the next steps. Highlight, or write down the steps to be followed.

TABLE 1
STEPWISE DECONTAMINATION PROCEDURE
SOP 7.01A – DECONTAMINATION OF SAMPLING EQUIPMENT

Use the following steps to determine the correct decontamination process. First, determine what items are to be decontaminated. Then, starting at Step 1 answer the questions and proceed to the next Step indicated. Check the appropriate boxes in the right column. The resulting checked boxes indicate the optimal decontamination sequence.

Project Name: ____________________
Project Number: ____________________
Date: ____________________

Description of item to be decontaminated:________________________________

Step Number	Decontamination Process	Check boxes below as necessary
Step 1	Wash with non-phosphate detergent solution, proceed to Step 2	☐Non-Phosphate wash
Step 2	Rinse with tap water, proceed to Step 3	☐ Tap water rinse
Step 3	Is sample to be analyzed for metals? Yes – Does equipment have metal parts? Yes – Skip this step. Proceed to Step 5 No – Wash with 10% nitric acid solution, Proceed to Step 4 No – Proceed to Step 5	☐ 10% nitric acid wash
Step 4	Rinse with DI water, proceed to step 5	☐ DI water rinse
Step 5	Is sample to be analyzed for organics? Yes – Does analyte list include TOC, DOC, SOC analytes? Yes – Omit this step, proceed to Step 7 No – Does analyte list include PCBs? Yes – Wash with acetone, proceed to Step 6 No – Wash with 10% methanol/isopropyl alcohol solution, proceed to Step 6 No – Proceed to Step 6	☐ Acetone Wash ☐ 10% methanol wash
Step 6	Rinse with DI, proceed to Step 7	☐ DI water rinse
Step 7	Rinse with ultrapure DI water, proceed to Step 8.	☐ Ultrapure DI water rinse
Step 8	Collect rinsate blank if needed, wrap sampling equipment in foil or clean plastic bags for later use.	

4.2 Decontamination Process

1) Prepare a contaminant free space for cleaning and drying the sampling equipment. When possible, the decontamination area should be clean and free from contaminants and blowing dust, and be large enough to accommodate decontamination activities. The "mud room" adjacent to the staging area is an ideal location for decontamination activities to be performed at the WPCL. This location provides a sheltered environment, an ample supply of water, sinks and other amenities.
2) Place clean plastic sheeting over the work surface.
3) Put on coveralls, protective clothing and gloves.
4) Assemble equipment to be decontaminated in one area. Inspect equipment for stains, cuts, or abrasions. Replace parts as needed. Do not use tubing that is moldy, mildewed or discolored, or if imbedded sediment cannot be removed.
5) Assemble decontamination solutions using the following steps.
   a) Non-phosphate detergent wash: Fill a clean five gallon bucket with a solution of one part detergent and nine parts tap water.
   b) Tap water wash: Fill a clean five gallon bucket with cold municipal tap water.
   c) 10% nitric acid solution wash: If the sample to be collected is to be analyzed for metals then a nitric acid solution wash is required. Fill a clean five-gallon bucket with a solution of one part reagent grade nitric acid and nine parts DI water.
   d) Organic solvent wash. Fill a clean five-gallon bucket with a solution of one part organics solvent and nine parts DI water. In general use methanol as the organic solvent. If methanol is not available isopropyl alcohol is also acceptable. If samples are to be analyzed for PCB, then only acetone must be used as the organic solvent. If collecting TOC, DOC or SOC samples, omit this step. Do not use any of the above organic solvents on equipment used to collect TOC, DOC or SOC samples.
   e) DI water rinse. Fill a clean five-gallon bucket with deionized water from supply taps.
   f) Ultrapure DI water rinse. Fill a clean five-gallon bucket with ultrapure DI water polishing stations
6) Decontamination Wash Procedures.
   a) Assemble decontamination solutions as required
   b) Using soapy water, scrub equipment surfaces with a firm sponge or soft brush to remove any adhering material such as oil and grease, sediment, algae or chemical deposits. Pay particular attention to grooves, crevices or other places where material may become trapped. If decontaminating tubing, pump solution through tubing.
   c) Using the tap water, rinse equipment thoroughly to remove detergent residue. Equipment rinsing is complete when no soap bubbles appear after agitating the rinse water. If decontaminating tubing, pump tap water through tubing.
   d) If analyzing for metals: Soak equipment in nitric acid solution. If decontaminating tubing, pump nitric solution through tubing.
   e) If analyzing for organics, change to gloves that are chemically resistant to the solvent being used. Rinse equipment exterior with a minimum amount of the appropriate organic solvent. If decontaminating tubing pump organic solvent solution through tubing.
   f) Place equipment in bucket of ultrapure deionized water. If decontaminating tubing, pump ultra-pure deionized water through tubing.
   g) Collect any rinsate samples at this time.
   h) Allow equipment to air dry. Wrap equipment in inert material (aluminum foil or plastic wrap) if equipment is to be stored.

5.0 POTENTIAL PROBLEMS

The following potential problems could effect the decontamination process or could compromise the integrity of the samples to be collected using equipment decontaminated using this process.

- Be sure to review the analytes, so that the correct decontamination procedures are followed.
- Refrain from handling dirty or other equipment during the decontamination process. Replace gloves when needed.
- Anticipate having an assistant available when handling cumbersome equipment or tubing.
- Do not let equipment or tubing touch the ground or any other surfaces or objects during or after the decontamination process. If this occurs, re-start the decontamination process from the beginning.

Note concerning nutrient analyses: Field Operations conducted a test to determine whether using nitric acid rinse as a decontamination solution would bias analyses on samples to be run for nutrients. The results of the test showed that the rinsate procedures in this SOP are sufficient to purge any nitric acid from the equipment being cleaned and will there fore not bias any nutrient analyses.

6.0 QUALITY ASSURANCE & QUALITY CONTROL

Whenever possible conduct equipment decontamination in the lab or in an enclosed, clean environment.

Typically, individual projects will specify the types of quality assurance/quality control samples to be collected from a specific project. If it is important to document the effectiveness of the decontamination process, a rinsate sample should be collected from the equipment or tubing at the conclusion of the decontamination procedure.

For complete QA/QC documentation of the effectiveness of a specific decontamination procedure the following steps should be taken:

- Collect a rinse sample from the equipment prior to any decontamination activities. This will establish a baseline level of contamination residing on the equipment.
- Collect a final rinsate sample from the equipment after decontamination has been completed.

7.0 RESOURCES

(4) *Standard Practice for Decontamination of Field Equipment used at Non-radioactive Waste Sites,* American Society for testing and Materials, Philadelphia, PA, 1990.

(5) *National Field Manual for the Collection of Water Quality Data* Techniques of Water Resources Investigations Book 9 Handbooks for Water-Resources Investigations, Unites States Geological Survey.

(6) *Standard Practices for Sampling Water,* ASTM Method D 3370-82

(7) *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA –600/4-79-019, March 1979

(8) *City of Portland WPCL Analyte List,* City of Portland Water Pollution Control laboratory, 2002

(9) *Sampling Equipment Decontamination, SOP #2006,* Environmental Protection Agency, 1994

APPENDIX D

Quality Assurance Project Plan

Contents

Section **Page**

Tables

City of Portland Outfalls RI – Inline Solids Screening Program Programmatic QUALITY ASSURANCE PROJECT PLAN (QAPP)

APPROVED:

CH2M HILL Project Chemist	Date
CH2M HILL Field Team Leader	Date
City of Portland BES Sampling Coordinator	Date
CH2M HILL Project Manager	Date
City of Portland BES Program Manager	Date

QAPP Distribution List

Dawn Sanders/City of Portland BES (Program Manager)
Ken Trotman/CH2M HILL-PDX (Project Manager)
Mark Boedigheimer/CH2M HILL-CVO (CH2M HILL Project Chemist)
Dave Lacey/CH2M HILL-PDX (CH2M HILL Field Team Leader)
Peter Abrams/City of Portland BES (Sampling Coordinator)
Tina Rice/CH2M HILL-PDX (CH2M HILL Data Manager)
Dennis Shelton/CH2M HILL-CVO (CH2M HILL Toxicologist)
Laboratory Project Managers (PDX WPCL, ASL, NCA)

Data Distribution List

Tina Rice/CH2M HILL-PDX Hardcopy Data, EDD

Abbreviations and Acronyms

ACGs	analytical concentration goals
ASL	CH2M HILL Applied Sciences Laboratory
ASTM	American Society for Testing and Materials
BES	Bureau of Environmental Services
bgs	below the ground surface
CAS	Chemical Abstracts Service
CLP	Contract Laboratory Program
cm^2	square centimeter(s)
COC	chain of custody
COE	U.S. Army Corps of Engineers
CRDL	contract-required detection limit
CV	coefficient of variation
%D	percent difference
DEQ	Oregon Department of Environmental Quality
DI	deionized
DOT	U.S. Department of Transportation
DQOs	data quality objectives
Eh	oxidation/reduction potential
EPA	U.S. Environmental Protection Agency
ESRI	Environmental Systems Research Institute
ft	foot or feet
FTL	field team leader
GIS	geographic information system
gpm	gallons per minute
HASP	Health and Safety Plan
HCID	hydrocarbon identification
ID	identification
IDL	instrument detection limit
IGA	intergovernmental agreement
LCS	laboratory control samples
MDL	method detection limit
µg/L	microgram(s) per liter
mg/kg	milligram(s) per kilogram

mg/L	milligram(s) per liter
mL	milliliter(s)
MRL	method reporting limit
MS/MSD	matrix spike/matrix spike duplicate
NAD	North American Datum
NCA	North Creek Analytical
NELAP	National Environmental Laboratory Accreditation Program
NGVD	National Geodetic Vertical Datum
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NTU	nephelometric turbidity unit
OSHA	Occupational Safety and Health Act
% RSD	percent relative standard deviation
PAHs	polynuclear aromatic hydrocarbons
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
PCBs	polychlorinated biphenyls
PPE	personal protective equipment
ppm	part(s) per million
PQL	practical quantitation limit
PSEP	Puget Sound Estuary Program
psi	pounds per square inch
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QASP	Quality Assurance Sampling Plan
RCRA	Resource Conservation and Recovery Act
RF	response factor
RI/FS	remedial investigation/feasibility study
RPD	relative percent difference
RPM	[EPA] Remedial Project Manager
RSD	relative standard deviation
RT	retention time
SAP	Sampling and Analysis Plan
SDG	sample delivery group
SIM	selected ion monitoring
SIP	Site Inspection Prioritization
SOPs	standard operating procedures
SOW	Statement of Work

SRM	standard reference material
SVOCs	semivolatile organic compounds
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TDS	total dissolved solids
TIC	tentatively identified compound
TLC	Teflon-lined cap
TLS	Teflon-lined septum
TOC	total organic carbon
TPH	total petroleum hydrocarbons
TSS	total suspended solids
VOCs	volatile organic compounds
WPCL	City of Portland Water Pollution Control Laboratory

Programmatic Quality Assurance Project Plan

1.0 Purpose

The purpose of this programmatic document is to ensure that the data quality objectives (DQOs) described in future stormwater inline solids work plans are met and to present the quality assurance (QA), quality control (QC) requirements for performing the sampling and analysis portion of the work. This Quality Assurance Project Plan (QAPP) was written in accordance with *EPA Guidance for Quality Assurance Project Plans* (EPA, 1998) and uses the alpha-numeric coding for each QAPP required element. The sampling and analysis work is to be performed by CH2M HILL or the City of Portland Bureau of Environmental Services (BES).

QA involves all those planned and systematic actions necessary to ensure that field and analytical activities are performed satisfactorily and safely. The goal of QA is to verify that activities are planned and performed according to accepted standards and practices to ensure that the resulting data are valid and usable for the project decision making process, and that safety requirements are met. QC is an integral part of the overall QA function and comprises all those actions necessary to control quality and verify that project activities and the resulting data meet established requirements.

The requirements of this document apply to CH2M HILL, the City of Portland BES, and subcontractors. Deviations from these procedures will be documented and included in the final report.

2.0 Project Management/Data Quality Objectives (A)

2.1 Project/Task Organization (A4)

Project roles and responsibilities, along with Quality Assurance and Quality Control responsibilities, are presented in Tables 2-1 and 2-2.

TABLE 2-1
Project Personnel and Responsibilities

Title	Responsibility	Name	Phone
CH2M HILL Project Manager	Responsible for the coordination and execution of all work items associated with project planning and implementation. Liaison between program-level managers and project-level team members. Identifies team members and project assignments. Manages and tracks schedule and budget. Ensures that all tasks are completed by assigned team members within schedule and budget constraints.	Ken Trotman 825 NE Multnomah, Suite 1300 Portland, OR 97232 ktrotman@ch2m.com	(503) 235-5022 ext. 4728
BES Program Manager, City of Portland Outfalls Project	Manages City tasks related to Portland Harbor City Outfalls Project. Coordinates with DEQ and EPA on state and federal tasks.	Dawn Sanders 1120 SW 5th, Suite 1000 Portland, OR 97204 Dawns@bes.ci.portland.or.us	(503) 823-7263
Field Team Leader and Site Safety Coordinator (FTL/SSC)	Responsible for sample collection, sample handling, maintaining and documenting the sample chain-of-custody (COC), delivering the samples to the laboratory, and delivering the field notes, field measurements, and chains-of-custody to the DM. As SSC, will implement the Health and Safety Plan in the field.	Dave Lacey 825 NE Multnomah, Suite 1300 Portland, OR 97232 dlacey@ch2m.com	(503) 235-5002 ext. 4228
City of Portland BES Sampling Coordinator	Point of contact for the laboratory. The PC communicates the sampling schedule, analytical methods, turnaround time, laboratory QA/QC, and reporting requirements.	Peter Abrams Water Pollution Control Lab 6543 N. Burlington Ave Portland, OR 97203	(503) 823-5533
CH2M HILL Data Manager (DM)	Point of contact for all issues concerning laboratory data, database maintenance, data loading, verifying data, and communicating with the laboratory and project team regarding database and data content issues.	Tina Rice 825 NE Multnomah, Suite 1300 Portland, OR 97232-2146 trice@ch2m.com	(503) 235-5000 ext. 4513
CH2M HILL Project Chemist (PC)	The PC is responsible for validating the data and providing data validation flags and their meanings to the DM The PC is responsible for validating the data according to the requirements of the Quality Assurance Project Plan and identifying and resolving any issues affecting completeness, accuracy, or usability.	Mark Boedigheimer 2300 NW Walnut Blvd. Corvallis, OR 97330 mboedigh@ch2m.com	(541) 752-4271 ext. 3125
CH2M HILL Project Scientist (PS)	The PS is responsible for reviewing the data to identify potential issues that may affect data evaluation or usability with respect to the project requirements.	Emily Keene 825 NE Multnomah, Suite 1300 Portland, OR 97232 ekeene@ch2m.com	(503) 235-5000 x 4218
City of Portland Water Pollution Control Laboratory – Director	Point of contact for the laboratory.	Charles Lytle 6543 N. Burlington Ave Portland, OR 97203 charlesl@bes.ci.portland.or.us	(503) 823-5568

TABLE 2-1
Project Personnel and Responsibilities

Title	Responsibility	Name	Phone
CH2M HILL Applied Sciences Laboratory – Lab Project Manager	Point of contact for the laboratory.	Kathy McKinley 2300 NW Walnut Blvd. Corvallis, OR 97330 kmckinle@ch2m.com	(541) 758-0235 ext. 3144
North Creek Analytical Laboratory – Lab Project Manager	Point of contact for the laboratory.	Lisa Domenighini 9405 SW Nimbus Avenue Beaverton, OR 97008 ldomenighini@ncalabs.com	(503) 906-9200

TABLE 2-2
Quality Assessment Responsibilities

Assessment Need	Purpose	Performed By
Review of QAPP	Confirm that the proposed sampling and analysis plan meets DQO needs	CH2M HILL and City of Portland Project Team
Review of Lab Data	Bench/Lab level review to ensure data meets method requirements	Analytical Laboratory
Review of field data, sampling logs	Verifies correct samples taken, procedures followed by field team	CH2M HILL Field Team and City of Portland BES Sampling Coordinator
E-data/Hardcopy Data Review	Verifies e-data and hardcopy data match	CH2M HILL Data Manager
Data Usability	Determines whether data meets QA/QC requirements; assesses usability	CH2M HILL Project Chemist and Project Scientist
Reconciliation with DQOs	Determines whether data meet DQOs for project	CH2M HILL Project Team

2.2 Problem Definition/Background (A5)

The City of Portland is investigating the nature and extent of environmental contamination that may enter the City's storm water conveyance system and discharge into the Willamette River, resulting in contamination of river sediments. This work is being conducted in accordance with an intergovernmental agreement (IGA) between BES and the Oregon Department of Environmental Quality (DEQ). Upland source data may be used in conjunction with data from river sediments and storm water lines to determine what, if any, additional actions may be needed by the City, DEQ, owners or operators, and others to protect river functions.

The primary purposes of the City of Portland Outfalls RI Inline Solids Investigation is to:

1. Identify potential up-pipe sources of contaminants of interest (COI) and other constituents (TBD) and physical characteristics of inline solids that may pose a long-term impact on the harbor and river. ODEQ baseline values for Harbor COI are currently

proposed as the benchmark to establish analytical detection limits associated with inline solids.

2. Identify potential sources of inline solids that may need to be investigated further under DEQ's Source Control program so that the potential for recontamination of Harbor sediments is minimized.

2.3 Project/Task Description and Schedule (A6)

This section provides general information on the Outfalls study area and summarizes the work to be performed within the area.

2.3.1 Project Description

Sampling of drainage basin inline solids will be conducted following the sampling design described in future stormwater inline solids work plans. Because of the investigative nature of this work, the exact number of samples to be collected at each Outfall and the analyses to be performed will be determined in the field. The number of samples collected will be such that they are chemically, physically and spatially representative of the residue present (based on visual examination during sampling). The SAP for each drainage basin to be sampled identifies the study area and probable sampling locations.

Analysis of the inline solids will be performed in accordance with the schedule of analyses presented in future stormwater inline solids work plans. Section 3 and Table 3-3 of this QAPP provide the principal list of analyses (Harbor COI) that will in all likelihood be performed at each sample location. Because of the investigative nature of this work, the exact analyses to be performed may be different from one drainage basin to the next. When observation, conditions, and the data quality objectives dictate, additional parameters will in all probability be added and specified as part of the SAP.

Collection of inline solids samples, which can be spatially representative of large portions of a drainage basin, is often limited by stormwater system access. Therefore, the inline solids and COI mass data obtained during this investigation will be that of screening level variety. The use of this screening data is for the purpose of determining whether additional actions by the City, DEQ, owners/operators, or others are needed.

2.3.2 Summary of Work

Briefly, the planned work involves:

- Collection of inline solids samples in accordance with the approved SAPs.
- Chemical and physical analysis of the residual material to identify potential up-pipe sources of contaminants of interest (COI), along with other constituents (TBD) and other physical characteristics (TBD) of interest that may be influencing the buildup of inline solids.
- Collection of sufficient characterization data to assess potential sources of inline solids.
- Evaluation of the data to establish spatial trends and probable sources of inline solids and Harbor COI.

2.3.3 Project Schedule

The general project schedule will be presented in the Work Plan and detailed as part of each SAP. Samples will be processed for shipping, chain-of-custody (COC) forms completed, and shipped immediately upon each day's sampling event to the participating laboratories using overnight shipping. For the full range of analyses that may be required, it is anticipated that several laboratories will be needed. At this time the laboratories include, but are not necessarily limited to: City of Portland WPCL, CH2M HILL Applied Sciences Laboratory, and North Creek Analytical.

Analytical turnaround time and holding time are shown in Table 3-2. For conventional chemical and physical parameters the times shown are those prescribed by EPA. In the case of non-conventional analyses the analytical turnaround and holding time are those determined to be appropriate for this investigation.

Data validation will be performed by the project chemist, or by a third party, in a timely fashion to meet project delivery schedules. Data review will then be performed by the project scientist to uncover potential issues or the need for additional analyses to complete the evaluation.

2.4 Quality Objectives and Criteria for Measurement Data (A7)

This section summarizes the levels of data quality that will be required for future stormwater inline solids work plans. This section also provides the quantitative quality objectives and measurement performance criteria for the analytical data.

2.4.1 Data Quality Objectives

Data quality objectives (DQOs) are both qualitative and quantitative statements that define the type, quality, and quantity of data necessary to support project decisions. The project team will apply EPA's seven-step DQO process, as described *in Guidance for the Data Quality Objectives Process, EPA QA/G-4* (USEPA, 2000), to future stormwater inline solids work plans to identify project-specific DQOs.

For purposes of the QAPP, there are two DQOs.

The DQOs and the decisions that are to be made from the data collected are:

- DQO 1—Identify potential up-pipe sources of contaminants of interest (COI) and other indicator parameters (TBD) to outfalls that may pose a long-term impact on the river.
  - Decision 1.1: What are the identities and concentrations of COI and other indicator constituents (TBD) present in the inline solids?
- DQO 2—Determine the potential source of inline solids and associated contaminants.
  - Decision 2.1: Can potential sources be identified either from the concentration of COIs, the physical/chemical character of other indicator parameters, and/or from data trends and the relationship to known upland sources?

The analyses and evaluation criteria that will be used to support decisionmaking for these DQOs are listed in Table 2-3.

TABLE 2-3
Sampling Objectives

Sample Location	Sample Type	Parameters	Number of Field Samples	Purpose	Comparison Value
Physical Analysis of Inline Solids					
Drainage basin and subbasin outfall pipes	Bulk residue material	Grain size/texture, % moisture, macro-scale photography, micro-scale photography, SEM photography	Specified in SAP	To characterize, record, and document the bulk properties of the solids	Not applicable
Trace Chemical Analysis of Inline Solids					
Drainage basin and subbasin outfall pipes	Bulk residue material	SEM/EDS, electron microprobe, TPH-DRO, TPH-RRO, TOC, Metals, Hg, CN, SVOC, Organochlorine Pesticides, PCBs, chlorinated herbicides	Specified in SAP	To characterize, record, and document the chemical composition of the solids	DEQ Harbor Baseline Value when applicable

The intended final use of the residue chemical concentration and physical data will be the assessment of potential sources that could represent potential recontamination of river sediments. From the DQOs specified above, analytical measurement quality objectives (MQOs) have been developed. Analytical MQOs for the Outfall inline solids are shown in Table 2-4.

TABLE 2-4
Analytical Measurement Quality Objectives for COI Parameters

Analytical Data Quality Objectives	Measurement	Metals	PCBs/Pesticides SVOCs/TPH/PAHs/ alkyl PAH Phenols/ Phthalates/Herbicides	TOC/Other Inorganics Conventionals
Sediment				
Accuracy	Field and Method Blanks	< MQL	< MQL	< MQL
Accuracy	Second Source Calibration Checks	90% - 110%	80% - 120%	90%-110%
Accuracy	Continuing Calibration Checks	ICPOES/ICPMS 90% - 110% GFAA/CVAA 80%-120%	PCBs/Pesticides/ Herbicides 85%-115% SVOCs/PAHs 80%-120%	90%-110%
Accuracy	Target Compound Blank Spikes (carried through procedure)	75%-125%	50%-150%	80%-120% when applicable to test
Accuracy	Surrogate Spikes	Not applicable	Lab In-house Limits (must be between 20% and 150%)	Not applicable

TABLE 2-4
Analytical Measurement Quality Objectives for COI Parameters

Analytical Data Quality Objectives	Measurement	Metals	PCBs/Pesticides SVOCs/TPH/PAHs/ alkyl PAH Phenols/ Phthalates/Herbicides	TOC/Other Inorganics Conventionals
Sediment				
Accuracy	Target Compound Sample Matrix Spikes	75%-125%	50%-150%	80%-120% when applicable to test
Precision	Laboratory Duplicates	± 20%	± 20%	± 20%
Precision	Field Duplicates	± 35%	± 35%	± 35%

2.4.2 Measurement Quality Objectives

Analytical method quality objectives (MQOs) are expressed in terms of precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS). Summarized below are definitions for each PARCCS parameter. Table 2-4 summarizes the level of accuracy and precision required for the analyses of inline solids samples.

2.5 Precision

Precision is the measure of the scatter of a group of measurements, made under identical conditions, about their mean value. The overall precision of the measurement system is a combination of sampling precision and analytical precision. Sampling, or field duplicate precision, can be assessed by collecting and analyzing duplicate field samples. Analytical (laboratory) precision is derived from the analysis of a duplicate created in the laboratory from one or more of the investigative samples. Sampling precision is defined as the combination of sampling and analytical precision and is represented by the difference between field duplicate measurements. Precision is typically measured by analyzing field duplicate and laboratory duplicate samples (sample duplicate, matrix spike duplicate, check standard duplicate, and/or laboratory blank duplicate). Precision is most frequently expressed as standard deviation(s), percent relative standard deviation (%RSD), coefficient of variation (CV), or relative percent difference (RPD). Table 2-4 shows the numeric target QC limits for precision.

As shown in Table 3-1 (located at the end of Section 3.0), field duplicate samples are currently scheduled at a frequency of 10 percent. However, depending on the amount of solids encountered at a sample location, it may not be possible to collect field duplicates at this frequency. In some cases, replicate samples may be more suitable than duplicates. Site-specific conditions will be evaluated to determine if field duplicates or replicate samples can or should be collected. This situation will be addressed in the SAPs. By its very nature collection of samples of inline solids with precision is problematic, made so by limited access and ever-changing temporal and hydraulic conditions within the drainage system. Because of these inherent features, we consider the analytical results and data quality consistent with that of screening level.

The precision of a duplicate (or replicate) determination can be expressed as the relative percent difference (RPD), as calculated as:

$$RPD = \{(|X_1 - X_2|)/(X_1 + X_2)/2\} \times 100 = \left\{ \frac{|X_1 - X_2|}{\frac{(X_1 + X_2)}{2}} \right\} x\,100$$

X_1 = native sample
X_2 = duplicate sample

2.5.1 Accuracy

Accuracy is the measure of agreement between an analytical result (or the mean of several results) and its true or accepted value. Deviations from a standard value represent the cumulative errors in the measurement system. Potential sources of error include (but are not limited to) sample collection, sample preservation, sample handling, matrix effects, sample analysis, and data reduction. Sampling and field sample handling accuracy is normally assessed by collecting field blanks and analyzing them for the parameters of interest. A field blank should report no targeted parameter at a concentration greater than the practical quantitation limit (PQL) or minimum reporting limit (MRL). If these limits are exceeded, the source of contamination will be investigated and corrective action taken. Analytical laboratory accuracy is determined by comparing results from the analysis of matrix spikes, surrogates, or check standard samples with the known values. Accuracy, defined as percent recovery (P), is calculated as

$$P = \left[\frac{(SSR - SR)}{SA} \right] x\ 100$$

SSR = spiked sample result
SR = sample result (native)
SA = the spike concentration added to the spiked sample

Table 2-4 shows numeric QC limit objectives for accuracy.

2.5.2 Representativeness

Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness is a subjective parameter and is used to evaluate the efficacy of the sampling plan design. Representativeness will be demonstrated by providing full descriptions of the sampling techniques and the rationale used for selecting sampling locations in the project planning documents.

By its very nature collection of representative inline solids is problematic, made so by limited access and ever changing temporal and hydraulic conditions within the drainage system. Because of these inherent features, we consider the analytical results and data quality consistent with that of screening level.

Representativeness is a qualitative parameter that will be controlled by the proper design and management of the sampling project. Good representativeness will be achieved through the following requirements:

- To the extent possible and with care, informed selection of sampling sites.
- Selection of testing parameters and methods that adequately define and characterize the inline solids samples.
- Proper gathering and handling of samples so as to avoid interferences and prevent contamination and loss.

2.5.3 Completeness

Completeness is defined as the percentage of measurements that are judged valid compared to the total number of measurements made for a specific sample matrix and analysis. Completeness is calculated using the following formula:

$$\text{Completeness} = \frac{\text{Valid Measurements}}{\text{Total Measurements}} \times 100$$

Completeness is defined as the percentage of measurements that are judged valid measurements. Factors that negatively affect completeness include the following:

- Missing scheduled sampling events
- Submitting improper quantity of sample
- Sample leakage or breakage in transit or during handling
- Exceeding holding times
- Losing sample during laboratory analysis through accident or improper handling
- Improper documentation such that traceability is compromised
- Reported field and analytical data that is of insufficient sensitivity

The completeness requirement is based on the number of samples required by the sampling plan. A completeness objective of at least 90 percent of the data is the goal established for this project.

2.5.4 Comparability

Comparability is another qualitative measure designed to express the confidence with which one data set may be compared with another. Sample collection and handling techniques, sample matrix type, and analytical method all affect comparability. Comparability is limited by the other PARCCS (precision, accuracy, representativeness, comparability, completeness, and sensitivity) parameters because data sets can be compared with confidence only when precision and accuracy are known. Data from one phase of an investigation can be compared with others when similar methods are used and similar data packages are obtained.

2.5.5 Sensitivity

Sensitivity is the measure of the concentration at which an analytical method can positively identify and report analytical results. The sensitivity of a given method is commonly referred to as the detection limit. Although there is no single definition of this term, the following terms commonly used to measure sensitivity are defined below.

Instrument detection limit (IDL) is the minimum concentration that can be measured from instrument background noise and is normally only measured for metals parameters.

Method detection limit (MDL) is a statistically determined concentration. It is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero as determined in the same or a similar matrix. Because of the lack of information on analytical precision at this level, sample results greater than the MDL but less than the MQL will be laboratory qualified as "estimated."

Method Quantitation Limit (MQL) is the sample volume or dry weight adjusted concentration of the target analyte that the laboratory has demonstrated the ability to measure within specified limits of precision and accuracy during routine laboratory operating conditions. This value is variable and highly matrix-dependent. This is the minimum concentration that will be reported as "unqualified" by the laboratory. For organics analysis and inorganic ions, this usually corresponds to the lowest calibration standard used. It is also the inflection point in quantitation where the precision and accuracy in the data falls below the project's MQOs.

The target method quantitation limits (TMQL) are shown in Table 3-3. These TMQLs are the minimum required from the participating laboratories.

2.6 Special Training Requirements/Certification (A8)

2.6.1 Safety and Safety Planning

All project staff working on the site must be health and safety trained and must follow the requirements specified in the project Health and Safety Plan (HASP). The HASP will be developed by the Field Team Leader and approved by the Regional Health and Safety Project Officer prior to field sampling. The HASP is applicable to CH2M HILL project field staff and subcontractors.

As a minimum, field personnel must be enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SSC" have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones.

2.6.2 Laboratory Accreditation

All of the commercial laboratories participating in this investigation will be National Environmental Laboratory Accreditation Program (NELAP) accredited in the State of Oregon for parameters which they are under contract to analyze. Other participating laboratories, such as the City of Portland Water Pollution Control Laboratory (WPCL) and Oregon State University Microprobe Laboratory, will adhere to good laboratory practices. In instances where properties of materials analyses (grain size, etc.) are required, ASTM procedures will be employed by laboratories having demonstrated proficiency for each specific test procedure.

2.7 Documentation and Records (A9)

This section defines which records are critical to the project and what information needs to be included in reports, as well as the data reporting format and the document control procedures to be used.

Project activities must be properly documented and those records stored and maintained. The CH2M HILL project manager will be responsible for organizing, storing, and cataloging all project information. Individual project team members may maintain separate notebooks for individual tasks; these notebooks will be transferred to the project manager during project closeout.

2.7.1 Field Operation Records

The information contained in these records documents overall field operations and generally consists of the following:

- **Sample collection records.** Field personnel will use a project notebook to record all pertinent information and to describe sampling procedures. The SAPs will summarize the required detailed field documentation. After completion of the sampling activities, the field notebooks will be in the custody of the project manager. Each notebook will be identified by a project-specific document number, and each page will be numbered. Personnel will update the project notebooks daily during field activities. At a minimum, this documentation should include:
  - Names of the persons conducting the activity
  - Subcontractor personnel
  - Time of arrival and departure at the site
  - Health and safety monitoring records
  - Sample number and sample collection points
  - Maps and diagrams
  - Equipment methods used
  - Climatic conditions
  - Any unusual observations

  All original data recorded in field logbooks, sample labels, and chain-of-custody (COC) forms will be written with waterproof, indelible ink. If an error is made, the individual should make all corrections simply by crossing a line through the error, initialing and dating the correction, and entering the correct information.

- **Chain-of-custody records.** COC records document the progression of samples as they travel from the original sampling location to the laboratory.

- **QC sample records.** These records document the generation for QC samples, such as field, trip, and equipment rinsate blanks and duplicate samples. They also include documentation for sample integrity and preservation and include calibration and standards traceability documentation capable of providing a reproducible reference point. QC sample records should contain information on the frequency, conditions, level of standards, and instrument calibration history.

- **Corrective action reports.** Corrective action reports show what methods were used in cases where general field practices or other standard procedures were deviated from, and they include the methods used to resolve noncompliance.

2.7.2 Laboratory Records

Data report packages for conventional organic and inorganic analyses from the laboratories will contain the same documentation controls and be in a similar format as those required for Contract Laboratory Program (CLP) organics and inorganic work. Data packages for special analyses (material analyses, physical properties, etc.) from the laboratories will contain documentation of sufficient detail as to be evident that sample control was maintained, data were generated in accordance with the test procedure, and quality control was followed and achieved. The following paragraphs describe some of the laboratory-specific records that will be compiled and reported by the laboratories:

- **Sample Data.** These records contain the times that samples were analyzed to verify that they met the holding times prescribed in the analytical methods. Included should be the overall number of samples, sample location information, any deviations from standard operating procedures (SOPs), time of day, and date. Corrective action procedures to replace samples violating the protocol also should be noted.
- **Sample Management Records.** Sample management records document sample receipt, handling and storage, and scheduling of analyses. The records verify that the COC and proper preservation were maintained, reflect any anomalies in the samples (such as receipt of damaged samples), note proper log-in of samples into the laboratory, and address procedures used to ensure that holding time requirements were met.
- **Test Methods.** Unless analyses are performed exactly as prescribed by SOPs, this documentation will describe how the analyses were carried out in the laboratory. This includes sample preparation and analysis, instrument standardization, detection and reporting limits, and test-specific QC criteria. Documentation demonstrating laboratory proficiency with each method used could be included.
- **QA/QC Reports**. These reports include the general QC records, such as initial demonstration of capability, instrument calibration, routine monitoring of analytical performance, calibration verification, etc. Project-specific information from the QA/QC checks, such as blanks (field, reagent, rinsate, and method), spikes (matrix, matrix spike replicate, analysis matrix spike, and surrogate spike), calibration check samples (zero check, span check, and mid-range check), replicates, splits, and so on should be included in these reports to facilitate data quality analysis.

2.7.3 Data Handling Records

Data handling records document protocols used in data reduction, verification, and validation. Data reduction addresses data transformation operations such as converting raw data into reportable quantities and units, use of significant figures, recording of extreme values, blank corrections, etc. Data verification ensures the accuracy of data transcription and calculations, if necessary, by manually checking a set of computer calculations. Data validation ensures that QC criteria have been met.

2.7.4 Data Reporting Package Format and Documentation Control

The format of all data reporting packages for conventional organic and inorganic analyses will be consistent with the requirements and procedures used for data validation and data assessment described in Section 5 of this QAPP. All individual records that represent action taken to achieve the objective of the data operation and the performance of specific QA functions are potential components of the final data-reporting package. Data report formats will be consistent with the content of the EPA CLP Program.

The data reporting packages will be described in more detail in a set of project instructions (contractual statement of work) to the laboratories.

3.0 Measurement/Data Acquisition (B)

3.1 Sampling Process Design (Experimental Design) (B1)

SAPs for each drainage basin to be sampled provide information on the sampling process design. Table 3-1 of this QAPP lists the number of samples and the numbers of associated QA samples. As indicated in Table 3-1, the actual number of samples to be collected is to be determined (TBD) and will be specified in the SAPs. As previously mentioned (Section 2.5), the number of field duplicates collected will be a matter of conditions encountered.

TABLE 3-1
Sample Numbers

Parameter	Analytical Method	Number of Samples	Frequency				Total Samples
			Field Duplicates	MS	MSD	Equip. Rinsate Blanks	
Grain size	ASTM D-422/PSEP	TBD	10%	NA	NA	NA	TBD
Percent moisture/Total Solids	ASTM D-2216	TBD	10%	NA	NA	NA	TBD
Total organic carbon	Combustion	TBD	10%	5%	5%	1 per event	TBD
Metals	SW6010B	TBD	10%	5%	5%	1 per event	TBD
Mercury	SW7471A	TBD	10%	5%	5%	1 per event	TBD
TPH-Diesel range	NWTPH-D	TBD	10%	5%	5%	1 per event	TBD
TPH-oil range	NWTPH-oil	TBD	10%	5%	5%	1 per event	TBD
PCBs as Aroclors	SW8082	TBD	10%	5%	5%	1 per event	TBD
PCBs as Congeners	SW8082	TBD	10%	5%	5%	1 per event	TBD
Chlorinated Pesticides	SW8081A	TBD	10%	5%	5%	1 per event	TBD
Chlorinated Herbicides	SW8151A	TBD	10%	5%	5%	1 per event	TBD
SVOCs/TICs	SW8270C	TBD	10%	5%	5%	1 per event	TBD
PAHs	SW8270C SIM	TBD	10%	5%	5%	1 per event	TBD
Alkylated PAHs	SW8270C SIM	TBD	10%	5%	5%	1 per event	TBD
Phenols	SW8270C	TBD	10%	5%	5%	1 per event	TBD
Phthalates	SW8270C	TBD	10%	5%	5%	1 per event	TBD
SEM/EDS	In-house	TBD	NA	NA	NA	NA	TBD
Electron microprobe	In-house	TBD	NA	NA	NA	NA	TBD

TBD = to be determined based on site conditions.
NA = not applicable for this parameter.

3.2 Sampling Method Requirement (B2)

The inline solids samples will be obtained following the City of Portland BES sampling protocols 5.01a, *Sampling of Soil and Sediment*, 7.01a *Decontamination of Sampling Equipment* and 7.01c *QC Sample Collection*. Copies of these sampling protocols are included in Appendix C.

3.2.1 Sample Containers, Preservatives, and Holding Times

The field team leader (FTL) and sampling coordinator is responsible for ensuring proper sampling, labeling of samples, preservation, and shipment of samples to the laboratory to meet required holding times. The required sample containers, preservative requirements, and maximum holding times are shown in Table 3-2.

TABLE 3-2
Parameters, Methods, Bottles, Preservation and Hold Time by Matrix

Parameter	Method	Bottle	Preservation	Hold Time	Purpose
Inline Solids					
Archive Sample	**Extra sample collected and archived by lab**	16 oz. glass	4°C	6 months	Physical characterization Chemical characterization
Grain size	ASTM D-422/PSEP	16 oz. glass	4°C	6 months	Physical characterization
Particle Shape and Texture	ASTM D2488				
Particle Identification	Scanning Electron Microscope/Energy Dispersive Spectroscopy			Not applicable	Physical characterization Chemical characterization
Total Solids	ASTM D2216			6 months	Physical characterization
Metals	SW6010	4 oz. glass	4°C	6 months	Chemical characterization
Mercury	SW7471A			28 days	
SVOCs/TICs PAHs/alkyl PAH	SW8270C	8 oz. glass	4°C	14 days[a]/40[b]	
Organochlorine Pesticides	SW8081A				
Chlorinated Herbicides	SW8151A				
Phenols	SW8270C				
Phthalates	SW8270C				
TPH-Diesel and Oil	NWTPH-D,O				
PCBs as Aroclors	SW8082				
PCBs as Congeners	SW8082				
Total Organic Carbon	ASTM E777-81	2 oz. glass	4°C	14 days	
Water and Equipment Blanks					
Metals	SW6010	250-mL poly	pH< 2, HNO_3, 4°C	6 months	Chemical characterization—Field and lab QC
Mercury	SW7470A			28 days	
SVOCs/TICs PAHs/alkyl PAHs	SW8270C	1-L amber glass	4°C	7 days[a]/40[b]	
Organochlorine Pesticides	SW8081A	1-L amber glass	4°C	7 days[a]/40[b]	

TABLE 3-2
Parameters, Methods, Bottles, Preservation and Hold Time by Matrix

Parameter	Method	Bottle	Preservation	Hold Time	Purpose
Herbicides	SW8151A	1-L amber glass	4°C	7 days[a]/40[b]	
TPH-Diesel and Oil	NWTPH-D,O	1-L amber glass	4°C	7 days[a]/40[b]	
PCBs as Aroclors	SW8082	1-L amber glass	4°C	7 days[a]/40[b]	
PCBs as Congeners	SW8082	1-L amber glass	4°C	7 days[a]/40[b]	
Total Organic Carbon	ASTM E777-81	3 x 40-mL VOC vials	pH < 2, H_2SO_4, 4°C	28 days	

Pre-cleaned and certified sample containers will be purchased and shipped to the field site before sample collection. The laboratory will add all preservatives before bottles are shipped to the field. The laboratory will retain all certificates of analysis for the pre-cleaned containers and note the lot numbers of bottles shipped for this project in the laboratory project file.

3.3 Sample Custody Requirements (B3)

Components of sample custody procedures include the use of field logbooks, sample labels, custody seals, and COC forms. Each person involved with sample handling will be trained in COC procedures before the start of the field program. The COC form will accompany the samples during shipment from the field to the laboratory.

The procedures described below will be used when transferring the samples for shipment.

3.3.1 Field Custody

The following procedures will be used to document, establish, and maintain custody of field samples:

- Sample labels will be completed for each sample with waterproof ink, making sure that the labels are legible and affixed firmly on the sample container.
- All sample-related information will be recorded in the project logbook.
- The field sampler will retain custody of the samples until they are transferred or properly dispatched.
- To simplify the COC record and minimize potential problems, as few people as possible should handle the samples. For this reason, one individual from the field sampling team will be designated as the responsible individual for all sample transfer activities. This field investigator will be responsible for the care and custody of the samples until they are properly transferred to another person or facility.
- A COC form will accompany all samples. This form documents transfer of sample custody from the field sampler to the laboratory. When transferring the possession of

samples, the individuals relinquishing and receiving will sign, date, and note the time on the form.

- Samples will be properly packaged for shipment and sent to the appropriate laboratory for analysis with a separate signed COC form, enclosed in a plastic bag, and taped inside the cover of each sample box or cooler. The original record will accompany the shipment, and the FTL will retain a copy. When samples are relinquished to shipping companies for transport, the tracking number will be recorded on the COC form.
- The COC must be signed when relinquished by field personnel and be signed by the laboratory receiving the samples.
- Custody seals will be used on the shipping containers when samples are shipped to the laboratory to inhibit sample tampering during transportation.

3.3.2 Laboratory Sample Custody

Each laboratory receiving samples for this project must comply with the laboratory sample custody requirements outlined in its Quality Assurance Plan (QAP). The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples and for maintaining all associated records documenting that custody. In addition:

- The laboratory will check to see that there has been no tampering with the custody seals on the coolers.
- Upon receipt of the samples, the custodian will check the original COC and request-for-analysis documents and compare them with the labeled contents of each sample container for corrections and traceability. The sample custodian will sign the COC and record the date and time received in the “Received by Laboratory” box.
- The sample custodian also will assign a unique laboratory sample number to each sample.
- Cooler temperature will be checked and recorded.
- Care will be exercised to annotate any labeling or descriptive errors. If discrepancies occur in the documentation, the laboratory will immediately contact the sample tracking coordinator and project chemist as part of the corrective action process. A qualitative assessment of each sample container will be performed to note anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming COC procedure.
- Samples will be stored in a secured area and at a temperature of 4° ± 2°C, if necessary, until analyses are to begin.
- Copies of the COC and request-for-analysis forms will accompany the samples.

3.3.3 Sample Packing and Shipping

During the field effort, the CH2M HILL project chemist will notify the participating laboratories about sample shipments to the lab. The FTL or sampling coordinator should fax copies of the COC to the laboratory(s) project manager each day of sampling.

Hard plastic ice chests or coolers with similar durability will be used for shipping samples. The coolers must be able to withstand a 4-foot drop onto solid concrete in the position most likely to cause damage. Sample bottles will be bagged in Ziploc™ bags, grouped by sample set. Styrofoam or bubble wrap will be used as packing material to protect the samples from leakage during shipment.

A volume of ice approximately equal to sample volume should be present in each cooler. Blue ice will not be used. After packing is complete, the cooler will be taped securely, with custody seals affixed across the top and bottom joints.

Cooler Shipment Notes:

1. Include absorbent material in the cooler to absorb any ice melt.
2. Record the airbill on each COC.
3. Use custody seals on the cooler.
4. Notify the laboratory that samples have been shipped and fax them a copy of the COC.

Please Note:

The laboratory must be informed in advance if a Saturday shipment will be required.

Samples will be shipped priority overnight FedEx to the laboratory.

Laboratory Contacts and Addresses: Laboratory selection, laboratory coordination, and sample distribution will be handled by the project chemist and field team leader. Samples for conventional organic and inorganic analyses will be sent to one of the following laboratories:

City of Portland Water Pollution Control Laboratory
6543 N. Burlington Ave.
Portland, OR 97203
Phone: 503/823-5600
Attn: Charles Lytle

CH2M HILL Applied Sciences Laboratory
2300 NW Walnut Blvd.
Corvallis, OR 97330
Phone: 541/758-0235 ext. 3144
Fax: 541/752-0276
Attn: Dayna Kaumanns
Sample Custodian

North Creek Analytical Laboratory
9405 SW Nimbus Avenue
Beaverton, OR 97008-7132
Phone: 503/906-9200
Attn: Sample Custodian

Laboratory selection for non-routine analyses will be based on the specific tests needed. Laboratory selection and coordination will be performed by the project chemist.

3.4 Analytical Method Requirements (B4)

The analytical methods for conventional organic and inorganic parameters were chosen on the basis of SW-846 guidance so that it was reasonable to expect that the required reporting limit could be met for each parameter. For non-conventional parameters the most appropriate analytical method for solid/sediment analyses has been selected. Analytical methods and the associated TMQLs for the inline solids analytes are listed in Table 3-3.

TABLE 3-3
Required Target Method Quantitation Limits (TMQLs) and Methodology

Analyte	Analytical Method	TMQL[1]	CAS No.
Conventionals			
Particle Size	ASTM D422-63/PSEP	0.01%	NA
Particle Shape and Texture	ASTM D2488	NA	NA
Percent moisture/Total Solids	ASTM D-2216	0.01%	NA
Total Organic Carbon (TOC)	ASTM E777-81/combustion	500 mg/kg	NA
Non-conventionals			
Material Characterization	Light Microscopy, Electron Microscopy	Micro-photograph	NA
Material Characterization	SEM/EDS	Micro-photograph, 1.0%	NA
Elemental Composition	Microprobe X-ray	1.0%	NA
SVOC Tentatively Identified Compounds (TICs)	SW846-8270C	Estimated Conc.	NA
Metals		**mg/kg dry weight (ppm)**	
Silver – Ag	SW846-6010B ICP-AES	1	7782-49-2
Aluminum – Al	SW846-6010B ICP-AES	1	7429-90-5
Arsenic –As	SW846-6010B ICP-AES	1	7440-66-6
Cadmium – Cd	SW846-6010B ICP-AES	0.6	7440-43-9
Chromium – Cr	SW846-6010B ICP-AES	1	7440-47-3
Copper – Cu	SW846-6010B ICP-AES	1	7440-50-8
Mercury – Hg	SW846-7471A CVAA	0.002	7439-97-6
Nickel – Ni	SW846-6010B ICP-AES	1	7440-50-8
Lead – Pb	SW846-6010B ICP-AES	1	7439-92-1
Antimony – Sb	SW846-6010B ICP-AES	1	7440-36-0
Selenium – Se	SW846-6010B ICP-AES	1	7782-49-2
Zinc – Zn	SW846-6010B ICP-AES	1	7440-66-6
Petroleum Hydrocarbons		**mg/kg dw (ppm)**	
Diesel Range Organics	NWTPH-Dx	10	NA
Oil Range Organics	NWTPH-Dx	20	NA
PCBs as Aroclors		**μg/kg dw (ppb)**	
Aroclor 1016	SW846-8082	10	12674-11-2
Aroclor 1221	SW846-8082	10	11104-28-2
Aroclor 1232	SW846-8082	10	11141-16-5

TABLE 3-3
Required Target Method Quantitation Limits (TMQLs) and Methodology

Analyte	Analytical Method	TMQL[1]	CAS No.
Aroclor 1242	SW846-8082	10	53469-21-9
Aroclor 1248	SW846-8082	10	12672-29-6
Aroclor 1254	SW846-8082	10	11097-69-1
Aroclor 1260	SW846-8082	10	11096-82-5
Aroclor 1262	SW846-8082	10	37324-23-5
PCB Congeners[1]		**μg/kg dw (ppb)**	
BZ(note 2)-8	SW846-8082	0.5	34883-43-7
BZ-18	SW846-8082	0.5	37680-65-2
BZ-28	SW846-8082	0.5	7012-37-5
BZ-44	SW846-8082	0.5	41464-39-5
BZ-52	SW846-8082	0.5	35693-99-3
BZ-66	SW846-8082	0.5	32598-10-0
BZ-101	SW846-8082	0.5	37680-73-2
BZ-105	SW846-8082	0.5	32598-14-4
BZ-118	SW846-8082	0.5	31508-00-6
BZ-128	SW846-8082	0.5	38380-07-3
BZ-138	SW846-8082	0.5	35065-28-2
BZ-153	SW846-8082	0.5	35065-27-1
BZ-170	SW846-8082	0.5	35065-30-6
BZ-180	SW846-8082	0.5	35065-29-3
BZ-187	SW846-8082	0.5	52663-68-0
Organochlorine Pesticides		**μg/kg dw (ppb)**	
a – BHC	SW846-8081A	1.0	319-84-6
b – BHC	SW846-8081A	0.5	319-85-7
g – BHC (Lindane)	SW846-8081A	0.5	58-89-9
d – BHC	SW846-8081A	1.0	319-86-8
Heptachlor	SW846-8081A	0.5	76-44-8
Aldrin	SW846-8081A	0.5	309-00-2
Heptachlor epoxide	SW846-8081A	1.0	1024-57-3
beta – Chlordane (trans-Chlordane)	SW846-8081A	1.0	5103-74-2
alpha – Chlordane (cis-Chlordane)	SW846-8081A	1.0	5103-71-9
Endosulfan I	SW846-8081A	1.0	959-98-8
4,4'-DDE	SW846-8081A	2.0	72-55-9
Dieldrin	SW846-8081A	0.5	60-57-1
Endrin	SW846-8081A	0.5	72-20-8
Endosulfan II	SW846-8081A	2.0	33213-65-9
4,4'-DDD	SW846-8081A	2.0	72-54-8
Endrin aldehyde	SW846-8081A	2.0	7421-93-4
4,4'-DDT	SW846-8081A	2.0	50-29-3
Endosulfan sulfate	SW846-8081A	2.0	1031-07-8

TABLE 3-3
Required Target Method Quantitation Limits (TMQLs) and Methodology

Analyte	Analytical Method	TMQL[1]	CAS No.
Endrin ketone	SW846-8081A	2.0	53494-70-5
Methoxychlor	SW846-8081A	5.0	72-43-5
Hexachlorobenzene	SW846-8081A	1.0	118-74-1
Toxaphene	SW846-8081A	100	8001-35-2
Hexachlorobutadiene	SW846-8081A	1.0	87-68-3
Hexachloroethane	SW846-8081A	1.0	67-72-1
Oxychlordane	SW846-8081A	1.0	26880-48-8
cis – Nonachlor	SW846-8081A	1.0	5103-73-1
trans –Nonachlor	SW846-8081A	1.0	39765-80-5
Chlorinated Herbicides		**μg/kg dw (ppb)**	
Dalapon	SW846-8151A	45	75-99-0
Dicamba	SW846-8151A	20	1918-00-9
MCPA	SW846-8151A	10000	94-74-6
Dichloroprop	SW846-8151A	33	120-36-5
2,4-D	SW846-8151A	3.3	94-75-7
2,4,5-TP (Silvex)	SW846-8151A	1.7	93-72-1
2,4,5-T	SW846-8151A	3.4	93-76-5
2,4-DB	SW846-8151A	5.0	94-82-6
Dinoseb	SW846-8151A	17	88-85-7
MCPP	SW846-8151A	5.0	93-65-2
Pentachlorophenol (also on SVOC list)	SW846-8151A	3.5	87-86-5
Semivolatile Organic Compounds		**μg/kg dw (ppb)**	
1,2,4-Trichlorobenzene	SW846-8270C	330	120-82-1
1,2-Dichlorobenzene	SW846-8270C	330	95-50-1
1,3-Dichlorobenzene	SW846-8270C	330	541-73-1
1,4-Dichlorobenzene	SW846-8270C	330	106-46-7
2,2'-oxybis(1-chloropropane)	SW846-8270C	330	108-60-1
2,4-Dinitrotoluene	SW846-8270C	330	121-14-2
2,6-Dinitrotoluene	SW846-8270C	330	606-20-2
2-Chloronaphthalene	SW846-8270C	330	91-58-7
2-Nitroaniline	SW846-8270C	1670	88-74-4
3,3’-Dichlorobenzidine	SW846-8270C	660	91-94-1
3-Nitroaniline	SW846-8270C	1670	99-09-2
4-bromophenyl-phenyl ether	SW846-8270C	330	101-55-3
4-Chloroaniline	SW846-8270C	660	106-47-8
4-Chlorophenyl-phenyl ether	SW846-8270C	330	7005-72-3
4-Nitroaniline	SW846-8270C	1670	100-01-6
Aniline	SW846-8270C	330	62-53-3
Benzoic Acid	SW846-8270C	200	65-85-0
Benzyl Alcohol	SW846-8270C	20	100-51-6

TABLE 3-3
Required Target Method Quantitation Limits (TMQLs) and Methodology

Analyte	Analytical Method	TMQL[1]	CAS No.
Bis-(2-chloroethoxy) methane	SW846-8270C	330	111-91-1
Bis-(2-chloroethyl) ether	SW846-8270C	330	111-44-4
Hexachlorobenzene	SW846-8270C	330	118-74-1
Hexachlorobutadiene	SW846-8270C	330	87-68-3
Hexachlorocyclopentadiene	SW846-8270C	330	77-47-4
Hexachloroethane	SW846-8270C	330	67-72-1
Isophorone	SW846-8270C	330	78-59-1
Nitrobenzene	SW846-8270C	330	98-95-3
n-Nitrosodimethylamine	SW846-8270C	330	62-75-9
n-Nitroso-di-n-propylamine	SW846-8270C	330	621-64-7
n-Nitrosodiphenylamine	SW846-8270C	330	86-30-6
PAHs		**μg/kg dw (ppb)**	
2-Methylnaphthalene	SW846-8270C SIM	10	91-57-6
1-Methylnaphthalene	SW846-8270C SIM	10	90-12-0
Acenaphthene	SW846-8270C SIM	10	83-32-9
Acenaphthylene	SW846-8270C SIM	10	208-96-8
Anthracene	SW846-8270C SIM	10	120-12-7
Benzo(a)anthracene	SW846-8270C SIM	10	56-55-3
Benzo(a)pyrene	SW846-8270C SIM	10	50-32-8
Benzo(b)fluoranthene	SW846-8270C SIM	10	205-99-2
Benzo(ghi)perylene	SW846-8270C SIM	10	191-24-2
Benzo(k)fluoranthene	SW846-8270C SIM	10	207-08-9
Carbazole	SW846-8270C SIM	10	86-74-8
Chrysene	SW846-8270C SIM	10	218-01-9
Dibenzofuran	SW846-8270C SIM	10	132-64-9
Dibenz(a,h)anthracene	SW846-8270C SIM	10	53-70-3
Fluoranthene	SW846-8270C SIM	10	206-44-0
Fluorene	SW846-8270C SIM	10	86-73-7
Indeno(1,2,3-cd)pyrene	SW846-8270C SIM	10	193-39-5
Naphthalene	SW846-8270C SIM	10	91-20-3
Phenanthrene	SW846-8270C SIM	10	85-01-8
Pyrene	SW846-8270C SIM	10	129-00-0
Alkylated PAHs		**μg/kg dw (ppb)**	
c1-napthalene	SW846-8270C SIM	10	
c2-napthalene	SW846-8270C SIM	10	
c3-napthalene	SW846-8270C SIM	10	
c4-napthalene	SW846-8270C SIM	10	
Dibenzothiophene	SW846-8270C SIM	10	132-65-0
c1-dibenzothiophene	SW846-8270C SIM	10	
c2-dibenzothiophene	SW846-8270C SIM	10	

TABLE 3-3
Required Target Method Quantitation Limits (TMQLs) and Methodology

Analyte	Analytical Method	TMQL[1]	CAS No.
c3-dibenzothiophene	SW846-8270C SIM	10	
c4-dibenzothiophene	SW846-8270C SIM	10	
c1-fluorene	SW846-8270C SIM	10	
c2-fluorene	SW846-8270C SIM	10	
c3-fluorene	SW846-8270C SIM	10	
c4-fluorene	SW846-8270C SIM	10	
c1-phenanthrene/anthracene	SW846-8270C SIM	10	
c2-phenanthrene/anthracene	SW846-8270C SIM	10	
c3-phenanthrene/anthracene	SW846-8270C SIM	10	
c4-phenanthrene/anthracene	SW846-8270C SIM	10	
c1-fluoranthene/pyrene	SW846-8270C SIM	10	
c1-chrysene	SW846-8270C SIM	10	
c2-chrysene	SW846-8270C SIM	10	
c3-chrysene	SW846-8270C SIM	10	
c4-chrysene	SW846-8270C SIM	10	
Phenols		**μg/kg dw (ppb)**	
2,3,4,6-Tetrachlorophenol	SW846-8270C	330	58-90-2
2,3,5,6-Tetrachlorophenol	SW846-8270C	330	935-95-5
2,4,5-trichlorophenol	SW846-8270C	1670	95-95-4
2,4,6-trichlorophenol	SW846-8270C	330	88-06-2
2,4-Dichlorophenol	SW846-8270C	330	120-83-2
2,4-Dimethylphenol	SW846-8270C	330	105-67-9
2,4-Dinitrophenol	SW846-8270C	1670	51-28-5
2-Chlorophenol	SW846-8270C	330	95-57-8
2-Methylphenol	SW846-8270C	330	95-48-7
2-Nitrophenol	SW846-8270C	330	88-75-5
4,6-Dinitro-2-Methylphenol	SW846-8270C	1670	534-52-1
4-Chloro-3-methylphenol	SW846-8270C	660	59-50-7
4-Methylphenol	SW846-8270C	330	106-44-5
4-Nitrophenol	SW846-8270C	1670	100-02-7
Pentachlorophenol	SW846-8270C	97 (3)	87-86-5
Phenol	SW846-8270C	20 (3)	108-95-2
Tetrachlorophenol, sum of 3 isomers (as TIC compound)	SW846-8270C	330	25167-83-3
Phthalates		**μg/kg dw (ppb)**	
bis(2-Ethylhexyl) phthalate	SW846-8270C	20 (3)	117-81-7
Butylbenzylphthalate	SW846-8270C	20 (3)	85-68-7
Diethylphthlalate	SW846-8270C	20 (3)	84-66-2
Dimethylphthalate	SW846-8270C	20 (3)	131-11-3
Di-n-butylphthalate	SW846-8270C	20 (3)	84-74-2

TABLE 3-3
Required Target Method Quantitation Limits (TMQLs) and Methodology

Analyte	Analytical Method	TMQL[1]	CAS No.
Di-n-octylphthalate	SW846-8270C	20 (3)	117-84-0

1. TMQLs are the expected method quantitation limits for clean samples.
2. BZ = Ballschmitter and Zell (Fresenius Anal. Chem. 302:20-31, 1980) congener identifications.
3. If laboratory reporting limit is not ≤ TMQL, then the laboratory MDL must be ≤ the TMQL for this compound.

NA = Not applicable.

3.4.1 Grain Size (ASTM D422-sieve/hydrometer)

Grain size (particle size) will be determined using ASTM D422 following the modifications as described in the Puget Sound Estuary Program (PSEP) protocols. Seven class fractions will be determined not employing the peroxide oxidation option.

Results will be expressed by class percentage (reportable to 0.01%) in the following fractions:

- Coarse Gravel
- Fine Gravel
- Coarse Sand
- Medium Sand
- Fine Sand
- Silt
- Clay

Results will also be presented as curves on semi-log graphs by plotting percent fines by weight versus particle size.

3.4.2 Particle Shape/Texture (ASTM D2488)

The particle shape and texture will be described following the guidance of method ASTM D2488 in conjunction with the grain size determination.

3.4.3 Percent Moisture/Total Solids (ASTM D2216)

Percent moisture will be determined by placing a known aliquot of a well-mixed sample in a weighed aluminum pan or ceramic crucible and the water evaporated in an oven at 103°C to 105°C. The difference in weight of sample before drying and after drying represents the total solids.

The percent solids are calculated as:

- Percent solids = 100* (total solids remaining)/(wet sample weight)

When expressed in terms of the water lost on drying this value the percent moisture is calculated as:

- Percent moisture = 100* (total water lost)/(wet sample weight)

3.4.4 Total Organic Carbon (combustion)

Total organic carbon (TOC) will be determined using guidance from the Inland Testing manual (ITM, EPA 823-B-98-004, *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual*).

The solid sample will be combusted after addition of HCl to remove carbonates. The resulting CO_2 will be measured by infrared spectroscopy and related to the organic carbon concentration in the sample.

3.4.5 Metals (SW3051/6010B)

Metals will be digested following method SW3051 and the digestate analyzed following method SW6010 (ICP-AES).

3.4.6 Mercury (SW7471A)

Mercury will be analyzed following method SW7471A. Mercury is reduced to its elemental state and its concentration measured using cold-vapor atomic absorption (CVAA).

3.4.7 Total Petroleum Hydrocarbons (TPH) - Diesel Range and Oil Range Organics

The samples will be analyzed for diesel range and oil range TPH following the NWTPH-Dx method. The laboratory may need to use the silica gel cleanup option to remove expected biogenic interferences from the extract before analysis. The project chemist must be consulted if the laboratory does not plan to use the silica gel cleanup.

3.4.8 PCBs as Aroclors (SW3350B or SW3540C/SW8082)

Samples will be extracted using the sonication (SW3550B) or Soxhlet (SW3540C) extraction methods (SW3540C). Column cleanup of the samples using Florisil™, alumina, silica gel, or acid cleanup (H_2SO_4) is required. Removal of sulfur using chemical methods (SW3660B or similar) may also be required to achieve the required reporting limits. Dual column confirmation is required and the QA/QC limits must be met on both columns used for analysis.

3.4.9 PCBs as Congeners (SW3350B or SW3540C/SW8082)

The list of PCB congeners selected is a subset of those recommended by EPA (*QA/QC Guidance for Sampling and Analysis of Sediment, Water, and Tissues for Dredged Material Evaluations*, EPA 823-B-95-001) .

The list includes congeners that are prevalent in the Aroclor commercial mixtures. Congeners BZ-77, BZ-126 and BZ-169 are not included in the analysis list (though they are part of the NOAA summation) as they have low relative abundance in technical mixtures and separate methods are usually used to determine their concentrations. They are usually found at much lower concentrations in sediment samples than the 15 congeners listed.

Samples will be extracted using the sonication (SW3550B) or Soxhlet (SW3540C) extraction methods (SW3540C). Column cleanup of the samples using Florisil™, alumina, silica gel, or acid cleanup (H_2SO_4) is required. Removal of sulfur using chemical methods (SW3660B or similar) may also be required to achieve the required reporting limits. Dual-column confirmation is required, and the QA/QC limits must be met on both columns used for analysis.

The laboratory will run each of the Aroclor standards along with the initial calibration so this information will be available if Aroclor pattern determination is required in the future.

3.4.10 Organochlorine Pesticides (SW3350B or SW3540C/SW8081A)

Samples will be extracted using the sonication (SW3550B) or Soxhlet (SW3540C) extraction methods (SW3540C). Column cleanup of the samples using Florisil™, alumina, or silica gel is required. Removal of sulfur using gel permeation chromatography (GPC) or chemical methods (SW3660B or similar) may also be required to achieve the required reporting limits. Dual-column confirmation is required, and the QA/QC limits must be met on both columns used for analysis.

3.4.11 Chlorinated Herbicides (SW8151A)

Acid herbicides will be extracted from samples and derivatized prior to analysis by GC/ECD following method SW 8151A. Dual-column confirmation by GC/ECD or single-column confirmation by GC/MS should be used to confirm compound identities.

3.4.12 Semivolatile Organics (SW3350B or SW3540C/ SW8270C) and TICs

Samples will be extracted using the sonication (SW3550B) or Soxhlet (SW3540C) extraction methods (SW3540C). The use of GPC cleanup may be necessary on each sample to remove biogenic macromolecules from the sediment samples. Sample extracts are analyzed to determine the identities and concentrations of target analytes using gas chromatography-mass spectrometry.

The laboratory must take extra care to ensure that phthalate contamination is not a problem during analysis. Steps taken may include extra rinses of glassware with solvent before use, segregation of glassware used for high- and low-level samples, and ensuring that plastic materials such as gloves do not come in contact with the samples.

When tentatively identified compounds (TICs) are requested, the laboratory will quantify and report all TICs which are greater than 10 percent of the nearest internal standard. The response factor of the nearest internal standard will be used to estimate TIC concentration.

3.4.13 Polynuclear Aromatic Hydrocarbons (PAHs)

Samples will be extracted using the sonication (SW3550B) or Soxhlet (SW3540C) extraction methods (SW3540C). The use of GPC cleanup may be necessary on each sample to remove biogenic macromolecules from the sediment samples. Sample extracts are analyzed to determine the identities and concentrations of target analytes using gas chromatography-mass spectrometry with the MS detector operated in the selected ion-monitoring mode to reduce the reporting limits.

3.4.14 Alkylated Polynuclear Aromatic Hydrocarbons (Alk- PAHs)

Samples will be extracted using the sonication (SW3550B) or Soxhlet (SW3540C) extraction methods (SW3540C). The use of GPC cleanup may be necessary on each sample to remove biogenic macromolecules from the sediment samples. Sample extracts are analyzed to determine the identities and concentrations of target analytes using gas chromatography-mass spectrometry with the MS detector operated in the selected ion-monitoring mode to reduce the reporting limits. The concentrations of the alkylated PAHs are determined using the response factor for the parent compound (e.g., fluorene for c1-fluorene, c2-fluorene) and summing the peak response area for all ions with the same mass as the quantitation ion that elute within a retention time window defined using an oil standard. Peak identity is confirmed by examination of the quantitation ion to qualitative ion response ratios.

3.4.15 Phenols

Samples will be extracted using the sonication (SW3550B) or Soxhlet (SW3540C) extraction methods (SW3540C). The use of GPC cleanup may be necessary on each sample to remove biogenic macromolecules from the sediment samples. Sample extracts are analyzed to determine the identities and concentrations of target analytes using gas chromatography-mass spectrometry.

3.4.16 Phthalates

Samples will be extracted using the sonication (SW3550B) or Soxhlet (SW3540C) extraction methods (SW3540C). The use of GPC cleanup may be necessary on each sample to remove biogenic macromolecules from the sediment samples. Sample extracts are analyzed to determine the identities and concentrations of target analytes using gas chromatography-mass spectrometry.

The laboratory must take extra care to ensure that phthalate contamination from laboratory sources is not a problem during analysis. Steps taken may include extra rinses of glassware with solvent before use, segregation of glassware used for high- and low-level samples, and ensuring that plastic materials such as gloves do not come in contact with the samples.

3.4.17 Scanning Electron Microscopy—Energy Dispersive Spectroscopy (SEM/EDS)

In-pipe solids will be examined by SEM and particles of interest chemically identified using energy dispersive spectroscopy. This technique is useful for elements heavier than carbon. Scanning Electron Microscopy/Energy Dispersive Spectroscopy (SEM/EDS) will be used to assist in the characterization of particles found in the residue. Both the chemical composition and micro-photographs of the particles are obtained. This analytical technique is available at Oregon State University Microprobe Laboratory.

3.4.18 Electron Microprobe/Wavelength Dispersive Spectroscopy

In-pipe solids will be chemically analyzed by electron micropobe. An electron beam is focused on the sample, exciting X-rays in the sample and allowing chemical information to be obtained. Quantitative analysis can be performed on individual particles and is most is useful for particles > 5 microns in size. All elements with atomic weights greater than beryllium can be identified and detection limits are typically 1 percent. This analytical technique is available at Oregon State University Microprobe Laboratory.

3.5 Quality Control Requirements (B5)

3.5.1 Project Quality Control Checks

Field duplicates, temperature blanks, and trip blanks will be submitted to the laboratory as part of the field QA/QC program. A brief description of the types and frequency of the QC samples are included in Table 3-4. Laboratory QA/QC procedures (including method blanks, laboratory blank spikes, surrogate spikes, and calibration check samples) are also described in Table 3-4.

TABLE 3-4
QA/QC Procedures and Frequency

QC Check	Information Provided	Description
Blanks		
Cooler temperature	Verify cooler temperature is maintained	Each cooler checked by use of IR temperature gun immediately upon receipt by laboratory or by use of a temperature blank sample included with the shipment
Equipment rinse field blank	Contamination from total sampling procedure	Samples of reagent grade, analyte-free water passed through and over the surface of decontaminated sampling equipment. Equipment rinse blanks (ERBs) are used to monitor the effectiveness of the decontamination process. The rinse water is collected in sample bottles, preserved, and handled in the same manner as the samples. Field ERB will be collected at approximately 5% of the sample locations and submitted for analysis for all parameters except grain size.
Laboratory method blank	Contamination from laboratory procedure	Samples of reagent water processed through the analytical procedure to monitor lab contamination. 1 per analytical batch
Spikes		
Matrix spike/spike duplicate	Analytical bias due to matrix and method	Laboratory QC samples designed to monitor the effect of the sample matrix on the accuracy and precision of analytical results. 5% of samples (minimum 1 pair per matrix) for applicable methods
Laboratory blank spike	Analytical bias due to method	Laboratory QC samples designed to monitor the effect of the method on the accuracy and precision of analytical results. 1 per analytical batch of 20 field samples or less, for applicable methods
Surrogate spike	Analytical method bias	Compounds added to each semi-volatile organics sample to assess bias of the analytical procedure. Added to every organic sample (semivolatile organic compounds [SVOCs])
Calibration Check Samples		
Calibration blank check	Carryover, memory effects	Analytical system blank
Continuing calibration check	Calibration drift	Assesses calibration accuracy on day of analysis Daily, per method requirements
Secondary source calibration check	Calibration accuracy	Independent check of calibration accuracy Each type initial calibration is performed

TABLE 3-4
QA/QC Procedures and Frequency

QC Check	Information Provided	Description
Duplicates		
Field duplicates	Precision of all steps after sample is taken	"Blind" to the laboratory, collected to monitor the precision of the field sampling process. The field team leader will choose at least 5 percent of the total number of sample locations known or suspected to contain moderate contamination as the duplicate field samples. The identity of the duplicate field samples will be recorded in the field sampling logbook, and this information will be forwarded to the data quality evaluation team to aid in review and evaluation of the data. 5% of samples (or 1 duplicate per 20 samples)
Laboratory replicates	Analytical precision	Analytical precision is assessed through the use of blank spiked samples and blank spiked duplicate samples.

3.5.2 Field Corrective Action

Any problems encountered in the field should be documented. If general field practices or other standard procedures were deviated from, a corrective action report should be completed, including any measures undertaken to resolve the issue(s). Corrective actions may include:

- Correcting COC forms
- Changing procedures to correct problems in sample collection, packing, and shipping
- Evaluating and amending sampling procedures
- Re-sampling

3.5.3 Laboratory Corrective Action

Details of laboratory corrective actions are described in the laboratory QAP of the participating laboratories.

3.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements (B6)

Equipment and instruments used during sampling activities will be cleaned and properly stored upon return from the field, as detailed in the SAPs. Malfunctions will be repaired or reported to the designated equipment specialist as soon as possible. All field instruments and sampling equipment will be stored in a manner to maintain their proficiency. Field personnel will routinely clean, calibrate, check batteries, and saturate field probes or meters to ensure their reliability for field sampling. Instruction and maintenance logs and records of repair for all field equipment will be noted in the field logbook.

Preventive maintenance is performed according to the procedures delineated in the manufacturers' instrument manuals, including lubrication, source cleaning, detector cleaning, and the frequency of such maintenance.

Precision and accuracy data are examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance will be performed when an instrument begins to degrade, as evidenced by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or another of the QC criteria.

3.7 Instrument Calibration and Frequency (B7)

Field instrument calibration and frequency shall be in accordance with manufacturers' specifications. Laboratory instrument calibration will be in accordance with methods described in Section 3.6, above.

3.8 Data Acquisition Requirements (Non-direct Measurements) (B9)

Non-direct data for this project include historical sediment results for determining analyses list. Before use, historical data will be examined to determine how their representativeness, bias, and precision affect any conclusions.

3.9 Data Management (B10)

3.9.1 Data Management System and Workflow

The data associated with the Outfall RI Inline Solids Investigation will be managed using CH2M HILL's Quest© system. Quest© uses an MS Access relational database to manage, process, and report data associated with environmental activities. Quest© is paired with Environmental Systems Research Institute's (ESRI's) ArcView to report and analyze data spatially.

Quest© facilitates a data management workflow that allows users to manage data efficiently; identify potential data discrepancies, redundancies, or gaps; and maintain an audit trail from the final result back to its hard-copy lab report. In addition to chemical data, Quest© manages sample location, field measurement, and construction data.

3.9.2 Analytical Data

Laboratory analytical samples will be collected and recorded on the COC forms provided by the laboratory. Upon receipt, the data manager enters the samples and analytical methods into Quest© using the Sample Management module. Descriptive data such as the sample media, depth, sampling method, sampling location, laboratory name, turnaround time, and sample type are entered at this time from the completed field forms. The result is an inventory of samples and which analytical methods the laboratory should deliver.

The laboratory delivers data to the data manager in electronic and hard-copy format. The laboratory uses Quest©-specific table structures and valid values to ensure efficient data loading into Quest©. Upon receipt of both the hard-copy and electronic data, the data manager creates a printout of the electronic data and verifies 100 percent of the data against the hard copy. Any discrepancies or omissions are discussed and resolved with the laboratory. The data manager makes changes to the electronic deliverable only when directed in writing by the laboratory. If significant errors or omissions exist, the data manager will request redelivery of the data.

After the data are verified and error free, Quest© runs a set of 30 diagnostics on the electronic data. The diagnostics check the data against the inventory of samples in Quest© created from the COCs. In addition, all valid value fields are checked against the valid value tables in Quest©, and several logic checks are performed to identify potential errors, omissions, or redundancies in the electronic data. Any discrepancies or omissions are discussed and resolved with the laboratory. The data manager makes changes to the electronic deliverable only when directed in writing by the laboratory. If significant errors or omissions exist, the data manager will request redelivery of the data. Once the data are error free, they are uploaded into the project database.

This process continues until all of the sample data expected have been uploaded and are error free.

3.9.3 Data Validation

The CH2M HILL project chemist is given the original hard-copy report from the laboratory. Validation is performed on the hard-copy data in accordance with the QAPP (Section 5). Validation flags (if required) are made in red pen directly on the laboratory report. As the data are validated, the project chemist initials and dates each page of the report. The completed data package is delivered to the data manager. The data manager then uses the Quest© Data Validation module to call up each result that requires a change. The change is added to the database manually. When the data manager finishes updating validation flags for a laboratory report, he or she prints out a Validation Changes report and verifies 100 percent of the changes against the hard copy. Any errors or omissions are corrected.

3.9.4 Spatial Data

Sample coordinates will be delivered electronically to the data manager. The data manager will verify that the coordinate system and datum correspond to the requirements in the work plan. The data manager will load the coordinates into Quest© and will make a simple plot of the locations. The field team leader (FTL) will verify the map to identify any mislabeled or missing locations. The data manager will use Quest's© Sample Locations module to verify that coordinates have been delivered for every sample location. The FTL will resolve any discrepancies, omissions, or redundancies.

A base map will be compiled in ArcView using the existing data available to the Lower Willamette Group. Any additional spatial data layers or features added by CH2M HILL will be documented in the project data dictionary to record the source, data loaded, name of the person who loaded the data, and description of the feature.

3.9.5 Data Reduction and Reporting

When all the sample data have been received, tested, loaded, and validated, the data manager uses Quest's© Data Reduction module to reduce and report the results. Data reduction is a process used to identify the most representative result when redundancy is encountered. Redundancy exists when there are field duplicates, re-analyses, replicates, or dilutions. Units are standardized; redundancies are reduced; and a flag identifies which result to report. The data manager then generates a series of data reports and summary tables for the project team. The geographic information system (GIS) analyst links the tabular data to the site map and generates a series of maps to represent the data spatially.

3.9.6 Data Handling

The COC records, field forms, field notebooks, and laboratory reports are maintained in a secure location in CH2M HILL's Portland office. Access to the files is limited to the project staff, and check-out cards are used to keep track of any files removed from the project files. The Quest© database records the unique COC and laboratory filing numbers associated with each sample analysis. The project database and base map are backed up nightly and monthly. Monthly backup tapes are stored in a secure, offsite location.

4.0 Assessment/Review (C)

4.1 Assessment and Response Actions (C1)

The project manager and the review team will monitor and audit the performance of the QA procedures. When necessary, the review team will conduct field audits. Audits may be scheduled to evaluate the execution of sample identification, sample control, COC procedures, field notebooks, sampling procedures, and field measurements.

The laboratories will be audited as necessary. If necessary, external onsite laboratory audits will be carried out to cover analytical methodology QC procedures.

Verification of computer models and software will be conducted periodically by the entry of known data sets or programs by a computer expert not assigned to the project. Electronic and paper-based data sets will be verified by double entry, cross-checking, and range-checking against the known programs and models to check for correctness, reasonableness, and user competence. Verification of model and software performance will be documented in the QA/QC portion of the specific reports.

If QC audits result in detection of unacceptable conditions or data, the project manager will be responsible for initiating corrective action. Corrective actions may include the following:

- Re-analyzing samples if holding time criteria permit
- Re-sampling and analyzing
- Evaluating and amending sampling and analytical procedures
- Accepting data but acknowledging level of uncertainty

4.2 Reporting (C2)

An Outfalls RI Report will be prepared. The report will present an evaluation of the inline solids data and recommendations for additional work, as appropriate. Additional details regarding the content of the report are found in the project Work Plan.

QA reports will be submitted in accordance with the project Work Plan. QA reports document implementation of the QAPP and the results of the site-specific QA/QC audits. A final data quality report will be submitted as part of the project's final report. The topics to be covered are outlined in the project Work Plan, but the data quality report will include at least the following information:

- Identification of non-conformances that required corrective action, and resolution of the nonconformance
- Data quality assessment in terms of precision and accuracy and how they affect the usability of the analytical results
- Limitations of the qualified results and a discussion of rejected results
- Discussion of the field and laboratory QA/QC sample results
- Results of external laboratory audits (if performed)
- Results of field sampling audits (if performed)

5.0 Data Validation and Usability (D)

5.1 Data Review, Validation, and Verification Requirements (D1)

Data review and validation are processes whereby data generated in support of this project are reviewed against the QA/QC requirements. The conventional approach to data validation involves EPA's laboratory data validation functional guidelines (listed below). The data will be evaluated for precision, accuracy, and completeness against the analytical protocol requirements and the QC requirements specified in Section 3 of this QAPP. Non-conformances or deficiencies that could affect the usability of data will be identified.

5.2 Validation and Verification Methods (D2)

Data will be reviewed following the process outlined in the following EPA guidance documents for evaluating data:

- Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA, 1999)
- Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA, 2002)
- The entire data set will be reviewed for trends, such as blank contamination or unacceptable spike recoveries, which would indicate that the data did not meet the project-specific quality objectives.

5.3 Reconciliation with User Requirements (D3)

Following validation, the project team will assess the data. The assessment will include incorporation of the data validation findings into the database by entering data qualifiers. The assessment will also include review of quantitative MQOs (accuracy, precision, completeness, detection limits) and the preparation of a summary report to present the data results. The final Outfalls Report (see Section 4.2) will include an evaluation of the overall adequacy of the total measurement systems with regard to the DQOs (Section 2.4) and MQOs (Section 3) for the data generated.

6.0 References

Lower Willamette Group. June 2002. *Portland Harbor RI/FS Round 1 QAPP*, Draft.

Metro (King County) Environmental Laboratory. April 1997. Puget Sound Estuary Program: *Recommended Protocols for Measuring Metals in Marine Water, Sediment and Tissue Samples*.

Metro (King County) Environmental Laboratory. April 1997. Puget Sound Estuary Program: *Recommended Protocols for Measuring Organic Compounds in Puget Sound Water, Sediment and Tissue Samples*.

Metro (King County) Environmental Laboratory. April 1997. Puget Sound Estuary Program: *Recommended Quality Control Guidelines for the Collection of Environmental Data in Puget Sound.*

National Oceanic and Atmospheric Administration (NOAA). August 1989. NOAA Technical Memorandum NOA OMA 49

Tetra Tech. April 1997. Puget Sound Estuary Program: *Recommended Protocols for Conventional Sediment Variables*.

U.S. Environmental Protection Agency (EPA). April 1995. *QA/QC Guidance for Sampling and Analysis of Sediment, Water, and Tissues for Dredged Material Evaluations*, EPA 823-B-95-001.

U.S. Environmental Protection Agency (EPA). 1998. *Test Methods for Evaluating Solid Wastes.* EPA SW-846, Revision 5.

U.S. Environmental Protection Agency (EPA). December 2002. *EPA Guidance for Quality Assurance Project Plans.* EPA/240/R-02/009.

U.S. Environmental Protection Agency (EPA). October 2001. *Methods for Collection, Storage and Manipulation of Sediments for Chemical Toxicological Analysis: Technical Manual.* EPA 823-B-01-00.

Attachments

1. City of Portland, Bureau of Environmental Services, Protocol 5.01a, Sampling of Soils and Sediments.
2. City of Portland, Bureau of Environmental Services, Protocol 7.01a, Decontamination of Sampling Equipment.
3. City of Portland, Bureau of Environmental Services, Protocol 7.01c, QC Sample Collection.

APPENDIX E

City Safety Procedures for Source Control and CH2M HILL Health and Safety Plan

APPENDIX E

City Safety Procedures for Source Control and CH2M HILL Health and Safety Plan

The health and safety plans and procedures for the City of Portland Bureau of Environmental Services and CH2M HILL are presented in Appendix E. Appendix E contains the following documents:

- *City of Portland Bureau of Environmental Services, Personal Protective Equipment (PPE) Policy and Procedures*, City of Portland, June 2001.
- *Bureau of Environmental Services Wastewater Group General Safety Rules and Guidelines*, City of Portland, January 2002.
- *City of Portland Bureau of Environmental Services, Hazard Communication Policy and Procedure*, City of Portland, December 2001.
- City of Portland Bureau of Environmental Services, Confined Space Entry Policy and Procedures, City of Portland, September 2001.
- CH2M HILL Health and Safety Plan for Source Control Remedial Investigation, City of Portland Outfalls Project, CH2M HILL, October 2003.

City of Portland Safety Procedures

CH2M HILL Health and Safety Plan

City of Portland City Safety Procedures

CITY OF PORTLAND
BUREAU OF ENVIRONMENTAL SERVICES

PERSONAL PROTECTIVE EQUIPMENT (PPE)

POLICY & PROCEDURES

Revised June 2001

City of Portland, Bureau of Environmental Services
Risk Services
5001 N. Columbia Blvd.
Portland, OR 97203
Phone: (503) 823-2400

TABLE OF CONTENTS

BUREAU OF ENVIRONMENTAL SERVICES

PERSONAL PROTECTION EQUIPMENT

POLICY & PROCEDURE

I. OBJECTIVES

To establish safe standard operating procedures for Bureau employees who engage in work that requires protective clothing or equipment. Personal Protective Equipment (PPE) includes shields, barriers, restraints, and equipment for protection of any part of the body.

This policy sets guidelines that minimize or eliminate exposure to hazards, when processes or engineering controls cannot ensure those hazards will be fully controlled.

The bureau will meet or exceed OSHA PPE requirements which state: "Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition, wherever it is necessary, by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact." OR-OSHA 1910.132

II. SCOPE

This policy contains the necessary PPE procedures, precautions and controls to protect Bureau employees from hazards while accomplishing their work. It is essential to follow the general guidelines contained within this document for assessing foot, eye, head, body, face and hand hazard situations and to match the proper PPE to each situation.

It is the responsibility of the Group/ Division/ Project Managers with support from BES Risk Services, to ensure that such hazards are evaluated and protection controls are in place prior to performing work/tasks. Each task assessment (Attachment A) will be completed as necessary and a copy will be forwarded to BES Risk Services (inter-office address B310). As duties and equipment change, these assessments shall be updated and the old form deleted from the system.

III. STANDARDS AND REGULATIONS

1. OAR Chapter 437, Division 2/I, (29CFR1910)
   OR OSHA 1910.132, Sub Division I 437-002-0120 - 140.1910.140 and
   Safeguards for Personnel Protection.
   (www.orosha.org)

2. City of Portland Code 5.08.060 (Safety Glasses Use and Purchase)

3. ANSI Z87.1-1989 (www.ansi.org)

IV. DEFINITIONS

ANSI: (American National Standards Institute) - A coordinating body of trade, technical and professional and consumer groups who develop voluntary standards including standards for PPE clothing and equipment. PPSI standards are so identified by the manufacturer. NSI, 1430 Broadway, New York, NY 10018 (212-354-3300), www.ANSI.org)

Caustic: Capable of destroying or eating away by chemical action; corrosive.

Chemical: (OSHA) - Any element, chemical compound or moisture of elements and /or compounds.

Chronic: A human health problem whose symptoms develop slowly over a long period or frequently occur. Chronic effects are the result of long-term exposure and are long lasting.

Earplugs: Foam or other molded plugs that fit into the ear canal.

Engineering Controls: Mechanical and/or structural procedures such as exhaust ventilation, machine guards and noise reduction, separate from PPE and safe work practices, that help protect against workplace hazards.

Face Shield - A device worn in front of the eyes and a portion of, or all of, the face to supplement protection afforded by a primary protective device. Often used when exposed to chemical, heat or glare hazards

Fall Arrest: Limiting the effects of the fall after it has occurred, with the use of a full body harness and lanyard system.

Fall Protection : Fall protection is a concept that describes behaviors, systems, processes, procedures, equipment, and rules intended to protect workers from fall hazards. All employees shall be protected from fall hazards when working on unguarded surfaces more than 6 feet above a lower level or at any height above dangerous equipment. (437-002-0125 Oregon Rules for Fall Protection.)

Fall restraint: Prevents a fall from occurring through the use of a positioning belt.

Foot Protection: The employer shall ensure that each affected employee use appropriate, protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where such employee's feet are exposed to electrical hazards. (*437-002-0137,* §1910.136 Oregon Rules for Foot Protection.)

Fumes: Solid particles generated by condensation from the gaseous state, generally after volitalization from molten metals.

Gloves - Hand protection relied upon to prevent abrasions, cuts, burns, and skin contact with chemicals that are capable of causing local or systemic effects following dermal exposure. There are no known gloves that provide protection against all potential hazards, so appropriate selection of the type of glove to match the task. (437-002-0123 Additional Oregon General Requirements for Protective Equipment)

Types: Latex regular and heavy duty - for chemical work.
Nitril - heavier protection for lab and wet field work
Vinyl - wet, chemical (w/flock lining)
Leather - fieldwork, sharps, moderate heat, chips, sparks, rough objects.
Cotton - dirt, slippery objects. (w/dots for better gripping)
Cotton w/rubber coating - wet, dirty areas, benign chemicals

Goggles - Are impact resistant glasses that provide a secure shield around the entire eye area to protect against hazards coming from different directions.

NOTE: Goggles will have to be worn over prescription glasses do not contain Safety Glass (ANSI).

Hard Hat / Helmet: Protective headgear with a durable outer shell and impact - absorbing, suspension headband or strap.

Head Protection: Used to prevent head injury. Usually made of slow-burning, water-resistant materials.

IDHL: Immediately Dangerous to Life and Health.

Ingest: To take in, swallowed, as for digestion (ingestion)

Leggings: Protective coverings that cover the leg from ankle to knee.

Penetration: A chemical or other substance passage through an opening in a protective material.

Permeation: The passage of a chemical through a piece of clothing on a molecular level, even if the material has no visible holes.

Plano Safety Glasses - Like normal glasses, but are designed to protect against flying particles. Glasses have lenses that are impact resistant and frames that are stronger than regular eyeglasses. All Safety glasses must meet the standards of ANSI.

PPE: (Personal Protection Equipment) - Protective equipment includes shields, barriers, restraints, and equipment for protection of any part of the body. (OR OSHA , 437-002-0123 Additional Oregon General Requirements for Protective Equipment)

Prescription (RX) Safety Glasses -Person(s) whose vision requires the use of corrective lenses for optical correction. These and all safety glasses must meet ANSI standards..

Side Shield - A device of metal, plastic, or other material hinged or fixed firmly to the glasses to protect the eye from side exposure.

Welding Helmet - Protects against intense light from welding, sparks, and splashes of molten metal.

V. RESPONSIBILITIES

A. SENIOR MANAGEMENT (DIRECTOR & GROUP MANAGERS)

1. Provide commitment, leadership, staffing and financial resources necessary to enable adherence to the requirements of this policy.

2. Establish performance criteria holding all managers accountable for the compliance of this policy.

3. Continue to promote and reinforce individual responsibility and accountability as it relates to Occupational Safety and Health.

B. MIDDLE MANAGEMENT (DIVISION MANAGERS, PUBLIC WORKS MANAGERS AND PROGRAM MANAGERS)

1. Ensure that all personnel are educated as to the contents of this policy and that an ongoing system of inspection and maintenance of PPE is carried out.

2. Ensure that all employees, including those newly assigned are adequately trained and that training records are properly maintained according to City Records Management policy.

3. Ensure that personal protective equipment (PPE) is included in budgetary planning.

4. Ensure all appropriate safety equipment is available and used appropriately during the workday.

5. Ensure that affected employees and their authorized representatives are consulted on the development and implementation of all aspects of PPE.

6. Establish communication procedures to inform employees and employee representatives of Hazard analysis and identification changes in all work areas of the plant.

C. PROJECT MANAGERS

Coordinate the activities of Contractors/outside personnel who will be working in or near an identified hazard area where PPE is required. Inform contractor of any specific PPE requirements in their work area.

D. RISK SERVICES

1. Review the effectiveness of this policy and procedure annually, using task descriptions and safety reports throughout the year to evaluate the identified hazard areas, and revise the program to correct deficiencies, if necessary.

2. Provide training to all BES employees and managers.

E. EMPLOYEES & STAFF

All employees:

1. Shall follow the appropriate PPE policies and procedures according to task assignment and exposure possibilities, and ensure that all equipment is used properly;

2. Shall be held responsible and accountable for the personal safety of themselves and each other;

3. Will inspect their PPE equipment for any defects prior to each use.

D. CONTRACTORS – OUTSIDE PERSONNEL

Contractors and other outside vendors are required to provide OR-OSHA compliant PPE for their employees and ensure that it is used appropriately at all times. The City shall not provide any City-owned PPE to contractors.

VI. PPE REQUIREMENTS

A. WORK AREAS

1. In any industrial or laboratory site appropriate footwear, eye protection and head cover, gloves, rubber boots or other specified apparel shall be worn. Each manager or lead shall know these requirements before assigning staff to work in them. Each employee is responsible to know and understand PPE requirements before going into a work area.

2. Mandatory PPE for BES personnel on construction sites shall include hard hats, boots that meet the requirements of Part VI. Section E (Class 6) of this policy, and work clothing that meets the requirements of VI. Section B. Personnel on construction sites must also have in their possession standard eye protection (safety glasses) and hearing protection (plugs or muffs) and must use these items when needed. Appropriate PPE will be used as required, when exposed to specific hazards and when directed to do so by competent persons.

NOTE: To distinguish themselves, all Inspection Staff on BES construction sites are required to wear bright colored, reflectorized vests that are in like-new condition and meet OR OSHA requirements, and hardhats, regardless of hazard exposure conditions. Inspectors should consult their inspection manual for additional details on PPE.

3. PPE shall not be altered in any manner. Ant altered equipment shall be tagged, taken out of service, repaired or destroyed.

NOTE: *See separate policies on Respirator Use and Hearing Conservation.

B. WORK CLOTHING (437-002-0127 Oregon Rules for Work Clothing.)

1. Clothing shall be worn which is appropriate to the work performed and conditions encountered as identified on the Hazard Assessment Form. (Attachment A)

2. Loose sleeves, ties, lapels, cuffs, or other loose clothing shall not be worn near moving machinery.

NOTE: Application of this rule is not intended to negate requirements for guarding power-driven machinery.

3. Clothing saturated or impregnated with flammable liquids, corrosive or toxic substances, irritants, or oxidizing agents shall be removed immediately and not worn again until properly cleaned.

4. Full length pants without excessive length or flared bottoms shall be required. Shirts shall cover the entire mid-section and the sleeves shall cover the entire shoulder. In all work industrial-type work areas, fully enclosed shoes with leather uppers and rubber soles will be worn.

5. Employees exposed to hazards caused by moving vehicles must wear brightly colored, retro reflectorized vests, *at all times.* The colors must contrast sufficiently with other equipment, safety and marking colors in the area to make the worker highly visible, .

6. Reflective Clothing - During hours of darkness or semi-darkness, the garments must also have retro-reflective material on *all visible sides*. Retro-reflective materials will reflect back to any light source cast on it.

7. PPE that makes contact with the wearer's skin or hair and which has been worn or used previously shall not be reissued to another employee until the article has been cleaned and sanitized.

C. FALL PROTECTION - PERSONAL PROTECTION EQUIPMENT

(Oregon Rules for Fall Protection 1910.132 / 437-002-0125)

1. All BES employees shall be protected from fall hazards when working on unguarded surfaces more than 6 feet (General Industry). Exceptions to the 6 foot rule can be granted through Risk Services after a hazard analysis has been conducted.

2. Construction employees shall be protected from fall hazards when working on unguarded surfaces more than 6 feet above a lower level or at any height above dangerous equipment. Lifelines, harnesses and lanyards shall be used only for employee safeguarding.

3. Any lifeline, harness or lanyard actually subjected to a fall arrest incident, shall be immediately removed from service and shall not be used again.

4. Body belts shall be used for positioning only. They shall not be used for fall arrest.

5. The point of attachment for lifelines shall be capable of supporting a minimum dead weight of 5,000 pounds.

6. Personal fall arrest systems shall be rigged so that an employee can neither free-fall more than six feet, nor contact any lower level.

7. Personal fall restraint systems shall be rigged so that an employee cannot free-fall more than two feet.

8. All body belts/harnesses and lanyard hardware shall be drop forged or pressed steel, cadmium plated in accordance with type 1, Class B plating specified in Federal Specification QQ-P-416. Surface shall be smooth and free of sharp edges.

9. All body belts/harnesses and lanyard hardware, except rivets, shall be capable of withstanding a tensile loading of 4,000 pounds without cracking, breaking, or taking a permanent deformation. Belts are to be used for fall restraint or positioning only, not as an arrest system.

10. Body belts/harnesses and lanyards shall be a minimum of ½-inch nylon or equivalent, with a maximum length to provide for a fall of no greater than 6 feet. The rope shall have a nominal breaking strength of 5,000 pounds.
11. The supervisor in charge shall periodically inspect all lifelines, lanyards, and body belts/harnesses. Employees shall inspect their body belts/ harnesses and lifelines prior to each use. Any defective body belts/ harnesses or lifelines shall be discarded or repaired before use.

NOTE: Additional requirements for use of body belts/ harness systems are contained in other divisions of the Oregon Occupational Safety and Health Code and the American National Standard A10.14-1991, Requirements for Safety Belts, Harnesses, Lanyards and Lifelines for Construction and Demolition Use.

D. HAND PROTECTION (Oregon Rules for Hand Protection 1910.138 / 437-002-0136)

1. Requirements

   a. Managers, supervisors and leads shall require employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from:

      - skin absorption of harmful substances;
      - severe cuts or lacerations;
      - severe abrasions; punctures;
      - chemical burns;
      - thermal burns; and
      - harmful temperature extremes.

   b. Employees shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards and potential hazards identified.

   c. Persons whose hands are exposed to moving parts in which they could be caught shall not wear gloves.

   d. Gloves will be self-inspected for wear and tear before each use, to ensure they are not cracked, torn or damaged in any way.

   e. Appropriate hand protection for employees will be provided by the City and are available through Stores at CBWTP and laboratories.

E. FOOT PROTECTION (Oregon Rules for Foot Protection (1910.136 / 437-002-0137)

1. Requirements

   a. Safety-toe footwear for employees shall meet the requirements and specifications in American National Standards for Safety-Toe Footwear, Z41.1-1967.

   b. Persons exposed to hot substances or dangerous chemical spills shall wear leggings or high boots of leather, rubber, or other suitable material.

c. Wastewater Group employees are required to wear safety footwear, per the following Specifications (Section 2 below) at all times while in the work place.

d. Footwear requirements are separated into six (6) classes. Each class identifies specific jobs or hazardous occurrences. Any incumbent of a job class not specifically identified must contact his/her supervisor to determine the class of footwear required by the job.

e. Employees with medical conditions who require special footwear must: a) notify their supervisors; and b) provide adequate medical documentation specifying any necessary accommodations

2. Footwear Specifications

Footwear requirements are detailed as follows:

NOTE: When hazards, weather and other conditions dictate, employees may wear steel-toed rubber boots, waders or heavy insulated boots. Employees are encouraged to contact their supervisors for guidance when selecting footwear for unusual conditions.

CLASS 1

Millwrights (1803)
Wastewater Mechanic Trainee (1809)
Painter (1443)

<u>DUTIES</u>	<u>SHOE CHARACTERISTICS</u>
1. Working around rotating equipment	1. Non-slip, rubber sole
2. Subject to oils and grease	2. 6" - 8" ankle support
3. Climbing ladders	3. Steel toes/Class III rating. (Impact = 75 lbs.; compression 2500 lbs.)
5. Operating forklift/hoisting equipment	
4. Moving/lifting heavy objects	4. 1/2" heel or more
	5. Leather upper construction

<u>CLASS 2</u>

Electrician (1453)
Supervising Electrician (1457)
Instrument Tech (3260)
Lead Instrument Tech (3261)

<u>DUTIES</u>	<u>SHOE CHARACTERISTICS</u>
1. Working with or in contact with electrical equipment	1. No metal in shoe soles
2. Working around rotating equipment	2. Non-slip, rubber sole.
3. Climbing ladders	3. 5" - 8" ankle support
4. Moving/lifting heavy objects	4. Steel toes/Class III rating (Impact - 75 lbs.; compression 2500 lbs.)
	5. ½" or greater heels
	6. Leather upper construction

CLASS 3

Operator I (1810) & II (1811)
Stores -S/AS I, II, III (Storekeeper)
Wastewater Operations Supervisor (1816)
Automotive Equipment Operator (1313)
Wastewater Operations Specialist (1815)
Wastewater Maintenance Supervisor (1817)

DUTIES
1. Working around rotating equipment
2. Subject to oils and grease
3. Climbing ladders
4. Moving/lifting heavy objects
5. Walking distances
6. Operating forklift/hoisting equipment

SHOE CHARACTERISTICS
1. Non-slip, rubber sole
2. 8" or less ankle support
3. Steel toes/Class III rating (Impact = 75 lbs.; compression 2500 lbs.)
4. ½" heel or more
5. Leather upper construction
6. Light weight design

CLASS 4

Water Lab Tech (3280)
Water Lab Lead Tech (3281)
Water Lab Supervisor (3283)

DUTIES
1. Climbing ladders
2. Moving/lifting objects
3. Walking distances
4. Standing long periods

SHOE CHARACTERISTICS
1. Leather upper construction
2. 1/12" heel or more.
3. Steel toes/Class III rating (Impact = 75 lbs.; compression 2500 lbs.)
4. Light weight design

CLASS 5 *Safety Shoes are optional for the following job classes:

Director Wastewater Operations (1829)
Administrative Assistant I (0819)
Management Analyst (0827)
Office Support Spec I, II, III
Wastewater Operations Superintendent (1828)
Training Officer (0650)
Wastewater Maintenance Superintendent (1827)
Public Works Manager

DUTIES
1. Moving/lifting objects
2. Walking distances
3. Standing
4. Bike riding

SHOE CHARACTERISTICS
1. Leather upper construction
2. 1/12" heel or more.
3. Steel toes/Class III rating (Impact = 75 lbs.; compression 2500 lbs.)

CLASS 6 Employees on BES construction sites.

DUTIES
1. Moving/lifting objects
2. Walking distances
3. Standing long periods
4. Moving/lifting objects

SHOE CHARACTERISTICS
1. Non-slip rubber sole
2. 6" - 8" ankle support
3. 1/2" heel or more
4. Leather upper construction

5. Walking on slick, muddy and uneven surfaces.

5. Steel Toes/Class III rating (Impact = 75 lbs.; compression 2500 lbs.)

F. HEAD PROTECTION (Oregon Rules for Head Protection 1910.135 / 437-002-0135)

1. Requirements

Managers, Supervisors and Leads shall ensure that each employee wears a protective helmet when working in areas where there is a potential for injury to the head from falling objects. (OAR 1910.135)

The employer shall ensure that a protective helmet designed to reduce electrical shock hazard is worn by each such affected employee when near exposed electrical conductors which could contact the head. (OAR 1910.135)

a. All visitors, contractors, vendors, City employees, etc., must comply with this policy concerning head protection.
b. Anyone working in areas where there is possible danger of head injury from impact, or from flying or falling objects, or from electrical shock and burns shall be protected by protective helmets. (Hardhats).

c. Hard Hats shall meet the specifications contained in current American Standards Institute (ANSI).

d. Anyone exposed to power driven machinery and/or to sources of ignition shall wear caps or other head covering which completely covers the hair.

2. Work Situations or Locations Descriptions

The following work locations require protective hard hats.

These are representative *examples* of equipment and situations for your reference. Any similar overhead hazard requires hard hat protection.

a. Mechanical Lifting Equipment Areas

(1) Any Crane/Hoist/Diffuser arm hoist

(2) Any overhead lifting device

(3) Power Driven Machinery (except lab carts) examples:

(a) Forklifts

(b) Tractor

(c) Scissor Jacks

b. Confined Spaces

As required by Confined Entry Policy and Procedures

c. All High Voltage Areas (must be non-conductive)

d. Low Clearance Areas

(1) Work areas with less than 6 feet head clearance

(2) Areas labeled/marked/padded (red or orange I.D.)

e. Other Areas

(1) Traffic controlled work sites

(2) Work with a suspended load overhead; and

(3) Working in any area where there is possible danger of head injury from impact, of falling or flying objects.

f. Columbia Blvd and Tryon Creek Wastewater Treatment Plants:

Inside or Below Grade

(a) Primary settling tanks

(b) Aeration Basins

(c) Final Clarifiers

(d) Digesters

(e) Thickeners

(f) Secondary aerators

(g) Chemical unloading areas

G. EYE AND FACE PROTECTION

(Oregon Rules for Face Protection 1910.133 / 437-002-0130)

Managers, Supervisors and Leads shall ensure that each employee uses appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation. (Oregon Work Rules 437-002-0128, 1910.133)

1. Requirements

a. Use of protective eye and face equipment shall be required where there is a reasonable probability of injury that can be prevented by such equipment. BES shall make conveniently available a type of protector suitable for the work to be performed and employees shall use such protectors.

b. Suitable eye protectors shall be provided where machines or operations present the hazard of flying objects, glare, liquids, injurious radiation, chemical or a combination of these hazards.

c. Procurement and wear of all safety equipment shall be that which meets current ANSI standards, or until such time that older standard equipment is depleted, as long as it meets all safety requirements.

d. Protectors shall meet the following requirements:

   (1) Shall provide adequate protection against the particular hazards for which they are designed.

   (2) Shall be reasonably comfortable when worn under the designated conditions.

   (3) Shall fit snugly and not unduly interfere with the movements of the wearer.

   (4) Shall be durable.

e. Goggles or spectacles of the following types shall protect employees whose vision requires the use of corrective lenses in spectacles, when required to wear eye protection:

   (1) Spectacles with protective lenses which provide optical correction.

   (2) Goggles or face shields that can be worn over corrective spectacles.

   (3) Goggles that incorporate corrective lenses mounted behind the protective lenses.

f. Employees whose assignment requires exposure to laser beams shall be furnished laser safety goggles as required by OSHA regulations which will protect for the specific wavelength of the laser and be of optical density (O.D.) adequate for the energy involved.

g. Tasks which involve: grinding, sawing, chipping, welding, cutting, brazing, machining, pressure hosing, chemical handling and/or other tasks where there is probable risk of injury. (See <u>Selection Guide</u> for appropriate types of protection)

h. Designated and posted process areas: "EYE PROTECTION REQUIRED IN THIS AREA". This will include all areas where the above tasks are routinely performed and thus risk injury to others present in the area and other areas where Risk Services and Safety Committee has determined that there is a probable risk of eye injury.

i. It is also the policy that in order to satisfy the requirements of City Code (5.08.060), BES will assist employees in the purchase of prescription safety eyewear in a manner approved by the City Council.

2. Procedures

It is recommended that suitable protective eyewear be worn at all times. It is required that eye protection (plano or prescription) glasses be worn in the following circumstances:

a. All designated and posted process areas including:

(1) Plant and process laboratories.

(2) While performing tasks, in any areas that involve: grinding, sawing, chipping, welding, cutting, brazing, machining, pressure hosing, chemical handling and/or other tasks where there is a probable risk of injury.

(3) As recommended or required per Material Safety Data Sheet (MSDS).

(4) As mandated by a manager, supervisor or lead.

(5) Any other areas so posted.

b. Employees shall ensure that face and eye protection equipment is kept clean and in good repair. The use of this type of equipment with structural or optical defects shall be prohibited.

c. BES shall ensure that clean water, in ample quantities, is immediately available where materials are handled that are caustic or corrosive to the eyes.

d. Plano and/or safety goggles

Plano or safety goggles will be issued to all new industrial employees.

e. Prescription Safety Eyewear

(1) Requests for special prescription may be made through managers and supervisors.

(2) Prescription safety glasses, per Article 28.2 of the current Labor Agreement, are available on a partial reimbursement basis, to any represented employee with ninety (90) days of service. The reimbursement will not exceed the annual reimbursement dollar value that is in effect for either DCTU or COPPEA employees. If the employee elects to use the entire reimbursement on prescription safety glasses, it is understood that no additional funds will be available that current year for safety shoes, insulated clothing or other articles of protective clothing as stipulated in Article 28.2.

(3) Authorization may be granted by the WG Director, on a case by case basis, for prescription ground helmet lenses for welding helmets. This authorization will only be considered if the employee's position description warrants frequent and recurring use of the helmet and if the employee would otherwise be unable to wear prescription eyeglasses under the helmet. Subject authorization, if any,

does not preclude the employee from reimbursement for protective clothing available per Article 28.2, above.

3. Selection Guide For Eyewear

PROTECTION TYPE	IDENTIFICATION
Goggles	1
Plano or prescription w/side shield	**2**
Face Shield	3
Welding Goggles (tinted)	4
Welding Helmet	5

4. Application Guide for Eyewear

OPERATION	**HAZARD**	**PROTECTION**
Machining	Flying Particles	1 or 2 & 3*
Dust/Mist/Aerosol Areas	Flying Particles/Splash/ Irritation	1 or 2
Chemical Handling	Splash/Burns/Irritation	1 & 3
Grinding/Sawing/Chipping	Flying Particles	1 or 2 & 3*
Laboratory	Chemical Splash/Glass Irritation	1, 2 & 3*
Welding (arc)	Sparks/Intense Rays/Molten Metal	5
Burning/Cutting/Brazing	Sparks/Molten Metal/Intense Rays	4 & 3 *

NOTE: *after a number denotes additional protection may be necessary in a particular operation.

5. Eyewash Station Locations for Wastewater Group (See Appendix 1, Page 20)

VII. HAZARD IDENTIFICATION AND ANALYSIS

A. CRITERIA

It is essential to follow the general guidelines of assessing foot, head, eye, body, face and hand hazard situations that exist at all bureau work sites and to match proper PPE to each particular hazard. It is the responsibility of Group/Division/Project managers to ensure that such hazards are evaluated and recommendations are made as to the appropriate PPE to use.

B. HAZARD ASSESSMENT

1. Conduct initial hazard assessment survey(s). Identify and evaluate potential sources of hazards to employees. Consideration shall be given to the basic hazard categories: (See PPE Task Assessment form - Attachment A)

   a. Impact
   b. Penetration
   c. Compression
   d. Chemical
   e. Heat
   f. Harmful Dust / Mists / Vapors / Fumes
   g. Light Radiation
   h. Sources of harmful noise levels
   i. Falls
   j. Immersion
   k. Other

2. Observe and evaluate the following:

   a. Source of motion: Machinery or process where movement of tools, machine elements or particles could exist, or movement of personnel could result in a collision with a stationary object, pinch points, etc.

   b. Sources of high temperatures that could result in eye injury, ignition or burns.

   c. Chemical exposures.

d. Sources of harmful dust, mists, vapors, and/or atmospheres.

e. Sources of light radiation such as welding, brazing, cutting, heat treating, or high intensity lights (laser beams)

f. Sources of falling objects, or potential for dropping objects.

g. Sources of sharp objects that could pierce feet or cut hands.

h. Sources of rolling or pinching objects that could crush feet.

i. Sources of electric hazards

j. Sources of hazardous noise levels

k. Immersion into hazardous liquids (i.e. raw sewage)

l. Any other hazards at a particular work site.

3. Following a hazard assessment survey, the Group/Division/Project managers shall ensure:

a. Information and data is organized and used to address deficiencies.

b. Proper PPE is selected based on the analysis of the identified hazards.

c. An estimate of the potential injuries be made.

4. It is the responsibility of the Group/Division/Project managers, with the assistance of the Risk Services staff, to reassess the hazards, and revise as necessary, when exposures change. This is done by identifying and evaluating new equipment and process, reviewing safety records and re-evaluating the suitability of previous selected PPE.

5. The hazard assessment shall be documented and contain the following:

(See Attachment A for PPE Hazard Assessment Form)

a. Work site evaluated.

b. Hazards identified

c. Type of PPE recommended.

d. Name of certifying individual

e. Date of the hazard assessment

f. Evaluation of new equipment and processes.

g. Safety records/review

h. Re-evaluation of current PPE usage.

VIII. TRAINING REQUIREMENTS

1. Risk Services will provide training to each employee who is required to use PPE. Each employee will be trained to know at least the following information:

   a. When PPE is necessary

   b. What PPE is necessary

   c. How to properly don, remove adjust and wear PPE

   d. The limitations of the PPE

   e. The proper care and maintenance of the PPE and

   f. The useful life span and disposal of the PPE.

2. Each affected employee shall demonstrate an understanding of the PPE and the proper use of it before being allowed to perform work requiring its use.

3. Retraining will occur when:

   a. Changes in the workplace render previous training obsolete

   b. There are changes in the types or brands of PPE

   c. Inadequacies in an affected employee's knowledge or use of assigned PPE indicating that retraining is necessary.

4. The bureau will verify that each employee has received and understands the required training through a written certification that contains the name of each employee, the date(s) of training and the subject of the certification. Training records will be maintained in accordance with OR OSHA requirements.

Appendix 1

FIRST AID/EYE WASH LOCATIONS

First Aid – (Check MSDS if possible) Immediately flush eye for a minimum 15 minutes, notify supervisor and seek medical attention.

Blower Building (BLOW)
Process Lab, east wall

Chlorine Containment Building (CHLO)
Northwest corner, outside
Southwest corner, outside
East side, outside

Composter (COMP)
Southeast door

Digester Control (DICO)
East Compressor room, NE corner
Boiler room, east wall
West Compressor room, NW corner

Digester Pumphouse (DICO)
CL2 side on north wall

Dodd Building (DODD)
Paint Shop, paint storage area
Paint Shop, paint booth area
Inside Mechanical Clean Room at the east double door
Outside Mechanical Clean Room, Northwest corner of building
Oil and Grease Supply Room
Welding Shop
Stores on south wall. *This unit is to be checked and not activated (portable unit)

Dry Weather/Odor Control (DWOC)
Basement hallway btwn chemical storage rooms
West door of Chemical Pump Room
Inside door of Scrubber Room

Effluent Pumphouse (EFPU)
Gas room, west wall

Hayden Island De-chlorination Facility (HIDC)
Chem. Storage building at the bottom of stairs and between the 2 chem. tanks.
Mix Box building – In the Mechanical Room next to sink.

Headwork's (HEAD)
Northeast corner of Scrubber tower #1
South side of Scrubber tower #1
Northwest corner of Scrubber tower #3
South side of Scrubber #3
South side of Scrubber #4
South side of Scrubber #2
South entrance to the Chemical storage/pumping room
West side of the Chemical Storage room
South side of the Chemical Pumping room
North side of the Chemical Pumping room
Outside the north end of the Chemical
Pumping room (hallway to PISTA Pump room)

Sludge Processing (SLPR)
Outside Control Room at the sink
Northeast corner by chemical barrel storage, w/shower
Basement, northeast corner, w/shower

Steel Building #3 (Parks) (ST03) West door

Tryon Creek Treatment Plant
Laboratory at the southeast door (ADMI)
Hypochlorite tank site (HYPO)
Maint. Shop, east center of shop (MAIN)
Sludge Processing, Eye Wash only (SLPR)

Tunnel 08 (TU08)
Behind the boilers at the door leading to the tunnel

Tunnel Blue (TUBL)
South end

PERSONAL PROTECTION EQUIPMENT POLICY – June 2001

Revised By: ____________________________ Date: ____________

Paul Schuberg, BES Safety Manager

Reviewed By: ____________________________ Date: ____________

Mike Reiner, BES, Risk Services Manager

Approved By: ____________________________ Date: ____________

Dean Marriott, BES, Bureau Director

Edited by: (DJ) Brandy Bowers, BES WG - June 2001

MS Outlook Public Folders – BES\Safety\ PPE Policy 2001

Attachment A

BES - PPE Task Assessment Worksheet

Assessment conducted by:___________________________________ ____________________**Date:**

Task: ____ ____________________

Department:

Summary of Possible Task Hazards and PPE Required

Impact by: materials equipment objects co-worker other (describe)
PPE required: (head, eye, foot, etc.) ____

Contact with: stationary object moving object sharp object other (describe)
PPE required: (foot, head, etc.)____

Fall: from elevation to surface slipping tripping other (describe)
PPE required: (fall, restraint systems)____

Caught in, under, between: running or meshing objects moving object stationary object rolling vehicle collapsing materials/cave-in other (describe)
PPE required: (hand, foot, etc.)____

Overexposure: noise heat cold temperature variation radiation. List dBA Temp F.
PPE required: (hearing, respiratory, clothing, eye, etc.)_____________________________________

Inhalation of: hot cold dust mists vapors smoke gases fibers biohazards other (describe)
PPE required: (respiratory, face, etc.)____

Ingestion of: hot cold acids bases caustics poisons dust mists vapors smoke gases radiation fibers other (describe)
PPE required: (respiratory, face, etc.)____

Absorption of: acids bases caustics poisons hazardous chemicals other (describe)
PPE required: (hand, face, eye, clothing, etc.)____

Skin contact with: hot liquid molten metal sparks acids bases caustics poison other (describe)
PPE required: (hand, foot, face, eye, clothing, etc.)____

Reference the associated MSDS for each hazardous chemical used and list the recommended PPE.

Chemical:__________________________________ ______________________________PPE:

__________________________________ __________________________________

__________________________________ __________________________________

__________________________________ __________________________________

__________________________________ __________________________________

Certification: ____________________________________ ______________________
Signature Date

BUREAU OF ENVIRONMENTAL SERVICES

WASTEWATER GROUP

GENERAL SAFETY RULES & GUIDELINES

I. RULES:

A. General

1. Comply with all general and specific rules governing safe work practices. Know and follow established work procedures as set forth by the Bureau and Group. When in doubt, contact your manager or BES Risk Services.

2. Comply with all applicable Federal and State OSHA Standards.

3. Participate in safety training, instructions, and drills as instructed by your manager.

4. Promptly report every injury, regardless of its nature or extent, to your manager. Complete an 801 or Near Hit/Non-Medical Report.

5. The use or possession of intoxicants or a controlled substance on the job is prohibited (City Code 1401 .03.G.31 and Wastewater Group Work Rules).

6. Report the use of drugs and medication prescribed by a physician for medical purposes that may effect your work performance.

7. Smoke in designated areas only. Do not deposit cigarettes, pipe ashes, cigars, or matches in wastebaskets. Do not place flammable materials in smoking receptacles.

B. Work Practices

1. Maintain good housekeeping in all work/process areas. Do not block aisles, passageways, corridors, escape-ways, electrical panels or exits. Clean up scrap or spilled materials promptly and completely after the job is finished.

2. Do not use substitute methods, shortcuts or improvised equipment or tools without authorization.

3. Inspect all ladders and scaffolding and fall protection equipment before each use.

4. Do not place flammable materials near any equipment that could cause fire because of heat or open flame.

5. Operate machines with guards in place and operational unless mechanical repair work does not allow you to do so.

6. Do not enter any confined space unless all required safety precautions are reviewed the CSE Supervisor or Attendant, and the Confined Space Entry Permit has been properly filled out and signed.
7. Wear a hair net or other confining garment if there is risk of injury from hair entanglement (hair

or beard) in moving parts of machinery or from fire.

8. Do not wear jewelry, rings, loose sleeves, ties, lapels, cuffs, tags, or other loose objects that can be tangled in rotating machinery while working around such machinery.

9. Do not use compressed air or gas for cleaning clothing or any part of the body or for any other purpose than that for which it is provided.

10. Do not engage in horseplay, fighting, harassment or distractions of fellow workers.

C. Safety Devices

1. Thoroughly inspect all safety devices/equipment prior to each use.

2. Do not disconnect or alter alarms, warning devices, emergency equipment or similar devices, unless authorized by your manager.

3. Notify all affected plant personnel whenever you disconnect or alter alarms, warning devices, emergency equipment or similar devices.

4. Do not alter or attempt to repair any safety device or equipment, unless you are authorized to do so.

5. Do not remove, alter, damage, destroy or carry off any safety device, safeguard, or notice of warning, unless approved by your manager.

D. Personal Protective Devices

1. Wear head, hand, eye, foot protection, protective clothing, respirators, and other safety equipment in process areas where specified by the Group Policy or OR-OSHA Safety and Health Codes. Under certain circumstances, management or BES Risk Services representatives may mandate additional personal protection.

2. Do not engage in operations that could, or do, require the use of respirator SCBA, full and half masks unless you have gone through a baseline medical examination with follow-up exams as indicated by a physician or otherwise needed.

3. Do not wear respirators if hair growth on the face is of sufficient length to affect the positive seal required by such respiratory equipment.

E. Driving

1. Defensive driving techniques must be applied at all times while operating a City vehicle. All appropriate safety equipment, seat belts, etc. must be used while operating or riding in a City vehicle.

2. Drive slowly when backing-up a vehicle and use extra caution when in close quarters or with blind spots.

3. Observe all traffic rules and obey warnings displayed on emergency vehicles. Speeding or other driving violations on City time will not be tolerated.

F. Equipment and Tools

1. Use hand tools in a safe manner and only for the purpose for which they are designed. Maintain them in good repair and store them in designated areas.
2. Do not load equipment beyond the prescribed capacity for its use.
3. Do not ride in or on equipment not designed for transporting people.
4. Do not use defective equipment or tools. Report all defective equipment and tools immediately to your manager or lead.
5. Do not leave a piece of equipment or apparatus in an unsafe (or broken) condition.
6. Do not use electrically powered tools in areas where flammable liquids or gas is stored.
7. Do not use extension cords that are frayed, cut or taped. On a temporary basis only (less than 90 days), use approved GFCI extension cords.

G. Chemicals

1. Do not use chemicals that are not accompanied by a MSDS.
2. Report to your manager any chemical containers that are unlabeled or if the labels are illegible.
3. Review the Material Safety Data Sheet (MSDS) prior to use of any chemical you are not familiar with.
4. Contact your manager or BES Risk Services if you have doubt about using a chemical or hazardous material.
5. Containers of volatile materials shall be closed when not in use and stored according to the manufacturer's guidelines
6. Do not use unapproved containers, such as drinking cups, bottled or canned food containers, or glass jars, to hold waste oils, industrial chemicals or solvents.

H. Electrical Work

1. Do not perform electric work unless you are a trained and certified electrician.
2. Deenergize, lockout, and tag-out an electrical source prior to performing electrical work. Review all hot work safety precautions with your manager prior to starting the job.
3. Do not perform hot work at 5% LEL (lower Explosive Level).

II. <u>GUIDELINES</u>:

A. Personal hygiene

1. Wash hands often, using warm water and disinfecting soap.
2. Avoid touching the face when hands may be contaminated.
3. Eating and food storage shall be allowed only in office or lunchroom areas.
4. Wear hand protection as much as practically possible when handling wastewater or sludge.
5. Immediately wash and disinfect abrasions and lacerations. Protect all wounds from contamination.
6. Shower and change clothes and shoes prior to leaving work each day.

B. Work Practices

1. Know the location of the fire extinguisher in your process area and how to use it. If unsure on how to use the extinguisher, contact your manager or BES Risk Services.

2. Observe good weight lifting techniques as taught in "Save a Back" classes. Do not attempt to lift anything that may be too heavy or bulky for your physical capabilities. If in doubt, get help and/or use mechanical aides.

3. Use established aisles and walkways. Walk up or down stairs one at a time and use the handrails.

4. Firmly ground straight ladders and stepladders. Tie off the top of straight ladders to a stationery point.

5. Do not attempt to carry heavy objects up a ladder and do not assume an unsafe position.

6. Do not work or stand under a suspended load.

C. Office safety:

1. Store sharp objects separately in your desk.

2. When refilling staplers, make sure hands are clear from the staple punching area. Unplug electric staplers before refilling staples.

3. Keep hands well away from the slice path of paper cutters. Attach guard when work is complete.

4. Do not stack papers, notebooks, and binders on top of filing cabinets.

5. Do not use a chair as a ladder or lean back on non-swivel chairs.

6. Use ergonomic and engineering controls at all work stations.

BES WASTEWATER GROUP
GENERAL SAFETY RULES & GUIDELINES
Revised January 2002

Stephen Behrndt	Wastewater Group Director	Date
Daniel Clark	Treatment Plant Operations and Maintenance Superintendent	Date
Michael Reiner	BES Risk Services Manager	Date

Linda Dartsch	Collections Systems Division Manager	Date
Lynn Sandretzky	Support Services Manger	Date

CITY OF PORTLAND

BUREAU OF ENVIRONMENTAL SERVICES

HAZARD COMMUNICATION

POLICY & PROCEDURE

MSDS

Updated December 2001
Revised February 2000

City of Portland, Bureau of Environmental Services
Risk Services
5001 N. Columbia Blvd.
Portland, OR 97203
Phone: (503) 823-2400

HAZMAT Communication
Revisions Tracking Sheet

Rev. Date	Type of Revision: Add	Type of Revision: Change	Location (Pg/Para/Line)	Original Text	Revised Text
Dec 2001	X		Pg11 / 6/ New Paragraph	NA	If an unknown substance/chemical is discovered on any BES facility that cannot be traced to a contractor/ vendor, the HAZMAT Officer shall be immediately notified and will take action to obtain a sample for the BES lab to identify and make proper handling and disposal protocol. Once the lab has performed a thorough analysis of the material, they will report back to the HAZMAT Officer and Risk Services, and arrangements will be made for disposal, pending the results of their report. Employees shall not take it upon themselves to handle or dispose of unknown chemicals they encounter. Such a discovery shall be reported to the HAZMAT Officer.
May 2002		X	Pg 11 VI 7 A 1	Location – Operations Bldg -	Location - Operations Building - Master Book

BUREAU OF ENVIRONMENTAL SERVICES
HAZARD COMMUNICATIONS POLICY & PROCEDURE

I. PURPOSE

The purpose of the Hazard Communication Program is to insure that the City of Portland, Bureau of Environmental Services (BES) complies with OAR 437, Division 2, Sub-Division Z, 1910.1200. * Reference: 29 CFR 1910.1200 Hazard Communication, OAR 437, Division 2, Sub-Division Z, 1910.1200 Hazard Communication

II. SCOPE

All BES work groups are included in this program. This Hazard Communication Program has been written for and is available to any BES employee. It can be found in the Microsoft Outlook application under BES Public Folders (Folder: Safety, File: Hazard Communication).

III. POLICY

When a person is employed by City of Portland, Bureau of Environmental Services, (BES) he or she has a right to expect a proper place in which to work, free from over-exposure to hazardous materials and toxic substances. It is our desire to provide a safe environment and to encourage safe methods and practices.

The success of this hazard communication program depends upon the cooperation, participation, and effort we all put into it. No job is so important that we cannot take time to do it safely.

Under no circumstances will new chemicals be brought into a BES work site without prior evaluation of the **Material Safety Data Sheets** (MSDS) and approval from the Risk Services Division. (Contact Paul Schuberg, Safety Manager- 823-5509)

IV. DEFINITIONS

- Acute Effect: An adverse effect on a human or animal body caused by exposure to a chemical or physical agent, with symptoms developing rapidly. Also see "chronic."
- ACGIH: American Conference of Governmental Industrial Hygienists. An organization of professional personnel in governmental agencies or educational institutions engaged in occupational safety and health programs. ACGIH develops and publishes recommended occupational exposure limits for hundreds of chemical substances and physical agents.
- ANSI: American National Standards Institute. A privately funded, voluntary membership organization that identifies industrial and public needs for national consensus standards and coordinates development of such standards. Many ANSI standards relate to safe design/performance of equipment and safe practices and procedures.
- Asphyxiat: A vapor or gas, which can cause unconsciousness or death by suffocation. Asphyxiates are harmful to the body when they become so concentrated that they reduce the oxygen content in the air to dangerous levels or prevent the body from utilizing the oxygen breathed. Asphyxiation is one of the principal potential hazards of working in confined spaces.

- Boiling Point: The temperature at which a liquid changes to a vapor state. For mixtures the initial boiling point or the boiling range may be given. Flammable materials with low boiling points generally present extreme fire hazards.
- "C" or Ceiling: The maximum allowable human exposure limit for an airborne substance, not to be exceeded. Also see "PEL" and "TLV."
- Carcinogen: A substance or agent capable of causing or producing cancer.
- CAS: Chemical Abstracts Service. A Columbus, Ohio organization, which indexes information published in "Chemical Abstracts" by the American Chemical Society, and provides index guides by which information about particular substances may be located in the "Abstracts" when needed. "CAS Numbers" identify specific chemicals.
- cc: Cubic centimeter
- CHEMTREC: Chemical Transportation Emergency Center. A national center established by the Chemical Manufacturers Assn. (CMA) in Washington, D.C. in 1970, to relay pertinent emergency information concerning specific chemicals on request. CHEMTREC has a 24-hour toll-free telephone number (1-800-424-9300) intended primarily for use by those who respond to chemical transportation emergencies.
- Chronic Effect: An adverse effect on a human or animal body, with symptoms, which develop slowly over a long period of time of exposure to a chemical or physical agent. Also see "acute."
- CO: Carbon monoxide, a colorless, odorless, flammable and toxic gas produced by the incomplete combustion of carbon; also a by-product of many chemical processes; an Asphyxiant.
- CO2: Carbon dioxide, a heavy, colorless gas produced by combustion and decomposition of organic substances, and as a by-product of many chemical processes. CO2 will not burn and is relatively non-toxic.
- Combustible: A term used by the National Fire Protection Assn., DOT*, and others to classify certain liquids that will burn, on the basis of flash-points. In the hazard communication rules, a combustible liquid has a flash point* at or above 100 degrees F, but below 200 degrees F.
- Concentration: The relative amount of a substance when combined or mixed with other substances.
- Corrosive: A corrosive material is a liquid, solid or gas (vaporous) that causes destruction or irreversible alterations in human skin tissue at the site of contact, or; in the case of leakage from its packaging, a liquid that has a severe corrosion rate on steel.
- Decomposition: Breakdown of a material or substance into parts, elements, or simpler compounds.
- Dermal: Used on or applied to the skin.
- Dermal Toxicity: Adverse effects resulting from skin exposure to a substance. Ordinarily used to denote effects in experimental animals.
- DOT: US Department of Transportation. Regulates transportation of chemicals and other substances for the protection of the public, law enforcement, and emergency response personnel, particularly when transportation incidents occur involving hazardous materials. Detailed DOT classification lists specify appropriate warning labels which must be used for various substances during transport.
- EPA: US Environmental Protection Agency. Federal agency with environmental regulatory and enforcement authority. Administers Clean Air Act, Clean Water Act, RCRA, TSCA, CERCLA, and other federal environmental laws.
- Epidemiology: The science that deals with the study of disease in a general population. Determination of the incidence and distribution of a particular disease may provide information about the causes of the disease.
- FDA: The US Food and Drug Administration. Under the provisions of the Federal Food, Drug and Cosmetic Act the FDA establishes requirements for the labeling of foods and drugs to protect consumers from misbranded, unwholesome, ineffective, and hazardous products.
- Flash point: The temperature at which a liquid will give off enough flammable vapors to ignite. There are several flash-point test methods, and flash points may vary for the same material depending on the method used, so the test method is indicated when the flash point is given.
- Flammable: NFPA and DOT define A "flammable liquid" as a liquid with a flash point below 100 degrees F. Solids that will ignite readily or are liable to cause fires under ordinary conditions of transportation through friction or retained heat from manufacturing or processing, and which burn so vigorously and persistently as to create a serious transportation hazard, are classified by DOT as "flammable solids."
- General Exhaust: A system for exhausting air containing contaminants from a general work area. Also see "local exhaust."
- g: Gram; a metric unit of weight.

- g/kg: Grams per kilogram.
- Hazardous Chemical: Any chemical that is a physical or health hazard.
- Ignitable: Capable of being set afire.
- Incompatible: Materials that could cause dangerous reactions from direct contact with one another.
- Inhalation: Breathing a substance in the form of a gas, vapor, fume, mist or dust.
- Inhibitor: A chemical that is added to another substance to prevent a chemical changes from occurring.
- Irritant: A substance that, by contact in sufficient concentration* for a sufficient period of time, will cause an inflammatory response or reaction of the eye, skin or respiratory system. The contact may be a single exposure or multiple exposures.
- kg: Kilogram; a metric unit of weight.
- L: Liter; a metric unit of volume.
- LC: Lethal concentration; a concentration of a substance being tested which will kill a test animal.
- LC50: Lethal concentration 50; the concentration of a material which, on the basis of laboratory tests, is expected to kill 50 percent of a group of test animals when administered as a single exposure.
- LD: Lethal dose; a concentration of substance being tested which will kill a test animal.
- LD50: Lethal dose; a single dose of a material which, on the basis of laboratory tests, is expected to kill 50 percent of a group of test animals.
- LEL or LFL: Lower explosive limit or lower flammable limit of a vapor or gas; the lowest concentration that will produce a flash of fire when an ignition source is present. At concentrations lower than the LEL, the mixture is too lean to burn.
- Local Exhaust: A system for capturing and exhausting contaminants from the air at the point where the contaminants are produced. Also see "general exhaust."
- m^3: Cubic meter
- Melting Point: The temperature at which a solid substance changes to a liquid state. For mixtures, the melting range may be given.
- Mechanical Exhaust: A powered device, such as a motor-driven fan or air/stream venturi tube, for exhausting contaminants from a workplace, vessel, or enclosure.
- mg: Milligrams.
- mg/kg: Milligrams per kilogram.
- mg/m^3: Milligrams per cubic meter; a unit for measuring concentrations of gases, vapor, or particulates in air.
- ml: Milliliter; a metric unit of capacity. There are 1,000 milliliters in one liter.
- mmHg: Millimeters of mercury.
- MSHA: The Mining Safety and Health Administration of the US Department of the Interior. Federal agency with safety and health regulatory and enforcement authorities for the mining industry. Also see "OSHA."
- Mutagen: A substance or agent capable of altering the genetic material in a living cell.
- NaOH: Sodium hydroxide, or caustic soda.
- N2: Nitrogen; a colorless, odorless, and tasteless gas that will not burn and will not support combustion. The earth's atmosphere is about 78 percent nitrogen; at higher concentrations, nitrogen can displace oxygen and become a lethal asphyxiate.
- NFPA: National Fire Protection Assn. An international voluntary membership organization to promote/improve fire protection and prevention, and establish safeguards against loss of life and property by fire. Best known on the industrial scene for the National Fire Codes. Among these codes is the code for showing hazards of materials using the familiar diamond-shaped label or placard with appropriate numbers or symbols. The brief explanation below illustrates the NFPA principle of using scales of 0 to 4 (low to high) to classify material hazards.

- **Fire Hazard (Red)**
- 0 - will not burn
- 1 - will ignite if preheated
- 2 - will ignite if moderately heated
- 3 - will ignite at most ambient conditions
- 4 - burns readily at ambient conditions

- **Health Hazard (Blue)**
- 0 - ordinary combustible* hazards in a fire
- 1 - slightly hazardous
- 2 - hazardous
- 3 - extreme danger
- 4 - deadly

- **Reactivity (Yellow)**
- 0 - stable and not reactive with water
- 1 - unstable if heated
- 2 - violent chemical change
- 3 - shock and heat may detonate
- 4 - may detonate

- NIOSH: National Institute for Occupational Safety and Health of the Public Health Services, US Department of Health and Human Services (DHHS). Federal agency which, among other activities, tests and certifies respiratory protective devices and air sampling detector tubes; recommends occupational exposure limits for various substances and assists OSHA and MSHA in occupational safety and health investigations and research.

- Olfactory: Relating to the sense of smell.
- Oral: Used in or taken into the body through the mouth.
- Oral Toxicity: Adverse effects resulting from taking a substance into the body via ingestion. Ordinarily used to denote effects in experimental animals.
- OSHA: Occupational Safety and Health Administration of the US Department of Labor. Federal agency with safety and health regulatory and enforcement authorities for most US industry and business. Also see "MSHA." The Oregon Occupational Safety and Health Division operates the federal OSHA program in Oregon.
- Oxidation: In a literal sense, oxidation is a reaction in which a substance combines with oxygen. In a broader sense, based on modern atomic theory, science today defines oxidation as a reaction brought about by an oxidizing agent in which atoms, molecules, or ions lose electrons. In this broader sense, an oxidation reaction may occur even when oxygen is not present.
- PEL: Permissible Exposure Limit; an exposure limit established by OR-OSHA/federal OSHA regulatory authorities. May be a time-weighted average (TWA) limit or a maximum concentration exposure limit. Also see "skin."
- ppm: Parts per million.
- ppb: Parts per billion.
- psi: Pounds per square inch.
- Reaction: A chemical transformation or change; the interaction of two or more substances to form a new substance.
- Reducing Agent: In a reduction reaction the reducing agent is the chemical or substance which (1) combines with oxygen or (2) loses electrons in the reaction. See "oxidation."
- Respiratory System: The body's breathing system; includes the lungs and air passages and the associated nervous and circulatory supply.

- RCRA: Resource Conservation and Recovery Act. Federal environmental legislation, administered by EPA, aimed at controlling the generation, treating, storage, transportation, and disposal of hazardous wastes.
- Sensitizer: A substance which on first exposure causes little or no reaction in human or test animals, but which on repeated exposure may cause a marked response not necessarily limited to the contact site. Skin sensitization is the most common form of sensitization although respiratory sensitization to a few chemicals is also known to occur.
- Skin Sensitizer/Skin Toxicity: See "Dermal Toxicity."
- Specific Gravity: The weight of the material compared to the weight of an equal volume of water; an expression of the density of the material. Insoluble materials with specific gravity of less than 1.0 will float in or on water. Most flammable liquids have specific gravities less than 1.0 and if not soluble, will float on water; an important consideration for fire suppression and spill clean up.
- Stability: An expression of the ability of a material to remain unchanged. For MSDS purposes, a material is stable if it remains in the same form under expected and reasonable conditions of storage or use.
- STEL: Short Term Exposure Limit; ACGIH terminology. See "TLV-STEL."
- Teratogen: A substance to which exposure can result in malformations to the fetus.
- TLV: Threshold Limit Value; a term used by ACGIH to express the airborne concentration of a material to which nearly all persons can be exposed day after day, without adverse effects. ACGIH expresses TLVs in three ways:
  - TLV-TWA: The allowable Time Weighted Average concentration for a normal 8-hour workday or 40-hour workweek.
  - TLV-STEL: The short-term Exposure Limit, or maximum concentration for a continuous 15-minute exposure period.
  - TLV-C: The Ceiling* exposure limit; the concentration that should not be exceeded even instantaneously.
- Toxicity: The sum of adverse effects resulting from exposure to a material.
- TSCA: Toxic Substances Control Act.
- TWA: Time Weighted Average exposure; the airborne concentration of a material to which a person is exposed, averaged over the total exposure time-generally the total workday. Also see "TLV."
- UEL or UFL: Upper explosive limit or upper flammable limit of a vapor or gas; the highest concentration that will produce a flash of fire when an ignition source is present. At higher concentrations, the mixture is too "rich" to burn. Also see "LEL."
- Unstable: Tending toward decomposition* or other chemical change during normal handling or storage.
- USDA: US Department of Agriculture.
- Vapor Density: The weight of a vapor or gas compared to the weight of an equal volume of air; an expression of the density of the vapor or gas. Materials that are lighter than air having vapor densities less than 1.0. Materials heavier than air have vapor densities greater than 1.0. Heavier vapors and gases are likely to concentrate in low places where they may create fire or health hazards.
- Vapor Pressure: The pressure exerted by the vaporization of a liquid in a closed container.
- Ventilation: See "general exhaust," "local exhaust," and "mechanical exhaust."

V. RESPONSIBILITIES

1. WORK GROUP MANAGER / SUPERVISOR / LEAD

A. Provides Hazard Communication training on new hazardous chemicals.

B. Assures employees have completed Basic Hazard Communications Training.

C. Assures MSDS's are available for each hazardous chemical in his/her work group.

D. Audits and performs an inventory of hazardous chemicals annually for compliance with the requirements of this program.

E. Seeks assistance from Risk Services Division when necessary.

F. Assures that old MSDS's of hazardous chemicals no longer used or outdated are forwarded to MSDS administrator for archival.

2. PROJECT MANAGER

A. Informs contractors on the hazardous chemicals to which they may be exposed while on any BES job site, and the procedure for obtaining MSDS.

1) CBWTP / TCWTP - Contractors will be informed about the Chlorine hazard and will sign the Contractor's Chlorine Safety and Emergency Response for measuring that all contractor employees are notified of this information.

B. Identifies and obtains MSDS's for chemicals the contractor is bringing into the BES workplace.

C. Assures contractors take the necessary precautions to lessen the possibility of exposure by using appropriate protective measures

D. Assures contractors comply with the Vendor Policy/Conditions for Product . Acceptance and Sign the Vendor Agreement for Conditions of Acceptance. (See Appendix - A)

3. RISK SERVICES DIVISION

A. Updates and disseminates the written Hazard Communication Program.

B. Assists work group managers and supervisors in implementing the Hazard Communication Program.

C. Coordinates Basic Hazard Communication training.

4. STORES SYSTEMS

A. Assures that incoming hazardous chemical containers have appropriate manufacturer labels and an accompanying MSDS, if it is a new product.

B. Forwards any new/updated MSDS to the MSDS Administrator, where it is re-evaluated if necessary, and summary information is placed on the front page. The MSDS is then distributed to the appropriate work group(s) and Stores.

C. Verifies that new products have been approved through Risk Services Division evaluation process, by checking the approved Evaluation Sheet from the employee.

D. Verifies that hazardous chemicals received:

1. Are clearly labeled.

2. Have appropriate hazard warning.

3. Have the name of the manufacturer.

5. EMPLOYEES

A. Use only manufacturer labeled containers.

B. Insure that all secondary containers have proper HMIS label.

C. Adhere to the manufacturer's safety recommendations listed on the MSDS.

D. Notify their supervisor of any new hazardous material products

E. Inform their work group managers of any discrepancy found in the MSDS or label.

F. Check the MSDS against actual product for verification of information.

VI. PROCEDURES

The written Hazard Communication Program is available to any BES employee via *Microsoft Outlook* (email) application under BES Public Folders:
(Folder: Safety\ File: Hazard Communication).

1. EMPLOYEE TRAINING AND INFORMATION

A. All BES employees will receive Hazard Communication orientation by their section manager or workgroup MSDS POC before beginning work. This training will include the following information:

1. Know the safety rules and procedures that apply to the work being done. Determine the potential hazards (i.e. physical, chemical, biological) and appropriate precautions before beginning any new operation.

2. The use of engineering controls, work practices, and personal protective equipment to minimize exposure.

3. An overview of the requirements contained in the Hazard Communication Rules, OAR 437, Division 2, Sub-Division Z, 1910.1200.

4. Categories/Chemicals present in their workplace.

5. Location and availability of the written Hazard Communication Program.

6. Physical and health effects of hazardous chemicals.

7. Methods and observation techniques used to determine the presence or release of hazardous chemicals in the work area.

8. Emergency safety procedures to follow if they are exposed to these chemicals.

9. How to read labels and review MSDS to obtain the appropriate hazard information.

10. Further information about MSDS and other HAZCOM subjects can be found on several Internet Web sites. Examples of these are:

    a) //www.osha.gov (Federal OSHA)

    b) //www.cbs.state.or.us/osha (State of Oregon OSHA)

c) //www.ehs.cornell.edu/lrs/internet_msds.html (Cornell University)

d) //hazard.com/msds/index.html

e) //siri.uvm.edu (University of Vermont)

f) //www.ilpi.com/msds/index.html (manufacturers listing)

h) or conduct a new search using the "msds" or "hazcom" keywords

B. Continued employee training will be documented, and competency verified, through the BES Safety and Tailgate Programs.

2. HAZARDOUS NON-ROUTINE TASKS

Periodically employees may perform hazardous non-routine tasks. Before starting work on such projects employees will be given information by their work group Manager or lead, about the hazardous chemicals to which they may be exposed during such activity. This information includes:

A. Engineering contracts

B. Personal protective equipment

C. Specific procedures.

3. CHEMICALS IN PIPES

Work activities are often performed in areas where chemicals are transferred through pipes. Prior to starting work in these areas, employees will contact the group manager/division manager/supervisor or another lead for information regarding:

A. The chemical in the pipes or insulation material around the pipe. (Note: All pipes must be labeled as to their contents every 20 feet.)

B. Potential hazards

C. Safety precautions to be taken.

4. FIRST AID & EMERGENCIES

A. Anticipated emergencies are:

1. Thermal and chemical burns;

2. Cuts and puncture wounds from glass or metal, including possible chemical contamination;

3. Skin irritation by chemicals;

4. Poisoning by ingestion, inhalation or skin absorption;

5. Asphyxiation (chemical or electrical); and

6. Injuries to the eyes from splashed chemical.

B. Accident Reporting

1. Medical Treatment – Read MSDS Immediately
   Do not hesitate to call 911 if you feel it is necessary

   a) Notify supervisor; and

   b) Fill out 801

2. Non-medical: (First Aid Only)

   a) Notify supervisor; and

   b) Fill out non-medical form

5. LABELING SYSTEM

A. Labeling

Every hazardous chemical must have a label. The manufacturer's label is required on original containers. The label must contain the <u>name, identification of the substance</u>, <u>the name and address of the manufacturer or distributor</u>, and any appropriate <u>hazard information</u>.

B. Secondary Labeling - HMIS (Hazardous Material Identification System) Labeling System

All Secondary containers shall be labeled with the name and identification of substance with the appropriate HMIS codes.

C. Employees who receive a chemical shall ensure that paragraphs “A” & “B” are adhered to at all times.

6. IDENTIFICATION OF UNKNOWN SUBSTANCES

If an unknown substance/chemical is discovered on any BES facility that cannot be traced to a contractor/ vendor, the HAZMAT Officer shall be immediately notified and will take action to obtain a sample for the BES lab to identify and make proper handling and disposal protocol. Once the lab has performed a thorough analysis of the material, they will report back to the HAZMAT Officer and Risk Services, and arrangements will be made for disposal, pending the results of their report. Employees shall not take it upon themselves to handle or dispose of unknown chemicals they encounter. Such a discovery shall be reported to the HAZMAT Officer.

7. MATERIAL SAFETY DATA SHEETS

MSDS sheets will be available to employees for review during each work shift. If MSDS sheets are not available, or new chemicals do not have an MSDS, contact your work group manager, workgroup MSDS POC and/or supervisor immediately.

Copies of MSDS’s and a list of all known hazardous chemicals will be kept in designated work areas where chemicals might be used. Chemicals will not be used until an MSDS is available and employees have received training.

A. MSDS Location

Each BES work location will maintain a master copy of all MSDS’s at their identified office locations.

1. Columbia Blvd. Wastewater Treatment Plant
    a. Operations Building – Master Book

    b. Stores – Receiving Area – Stock Items

2. Materials Testing Lab – Reception Desk

3. Water Pollution Control Lab – Reception Desk

4. PUMA – Office / Computer Area

5. Tryon Creek WTP – Lab & Manager’s Office

B. MSDS Procedures

1. Wastewater Group – CBWTP, TCWTP and PUMA

a) All Hazardous Chemicals:

1) Used by BES employees will have a representative MSDS available in their work area.

2) Will be understood and their uses familiar to all employees before use.

3) Will be evaluated, using the MSDS Evaluation Form, by qualified individuals, before it is used anywhere on WG's facilities.

b) WG MSDS Product Evaluation and Control Program

1) Each MSDS will be maintained, in legible form, by each work group using the product, and in a Master Book maintained by the WG Administrative support.

2) Chemicals and the MSDS Book for each work group, and the Master List, will be audited and compared each August to insure that they agree. Any missing MSDS will be requested through the manufacturer.

3) All obsolete MSDS will be dated and sent to the MSDS Administrator for proper archival. These sheets will be maintained for 30 years.

4) A Master list of all chemicals will be maintained in an Access database by the administration support staff. This will also be audited in September of each year.

c) New Chemicals:

1) All new chemicals to be purchased for use on WG facilities will be evaluated by the BES Safety Manager and reviewed by the BES Lab Manager.

2) The requesting workgroup MSDS Point of Contact will insure that the MSDS is evaluated, using the Evaluation Request Form, before the time of order, and absolutely *before* the product is used.

3) Stores personnel may receive an updated MSDS from the manufacturer with a product. This will be sent to the MSDS Administrator, who will insure that it is properly processed through the Safety Manager. If the item is to be stocked in the warehouse Stores will fill out the MSDS Evaluation Form and forward it to the Safety Manager. (They will notify the Safety Manager if this is a RUSH situation.)

4) The Safety Manager (Paul Schuberg) will evaluate the MSDS for its hazard levels health implications and proper use instructions.

5) The WPCL Lab Manager will then review this evaluation.

6) The Safety Manager will receive the Evaluation Form back from the Lab Manager within 5 working days.

7) The Safety Manager will forward the completed MSDS Evaluation Form to:

   a) The MSDS Administrative support for proper filing and distribution, IF the new product is approved.

   b) The requestor IF the new product is *not* approved.

8) If the product is approved, the MSDS Administrator will:

   a) Add any necessary information to the MSDS;

   b) Distribute copies to the requestor and/or Stores accompanied by the Evaluation Form;

   c) Enter the new data to the MSDS Master List; and

   d) File the original in the WG Master MSDS Book at CCB, accompanied by the Evaluation Form.

2. Annex A - Water Pollution Control Laboratory

The Chemical Hygiene Plan for BES Laboratories is located in Outlook, in the BES Public Folders.

3. Annex B - Material Testing Laboratory

The Chemical Hygiene Plan for BES laboratories is located in Outlook, in the BES Public Folders.

HAZARD COMMUNICATION PROGRAM -2000

Revised By: ______________________________ Date: _________
Paul Schuberg, BES Safety Manager

Reviewed By: ______________________________ Date: __________
Charles Lytle, BES Laboratory Manager / Safety Officer

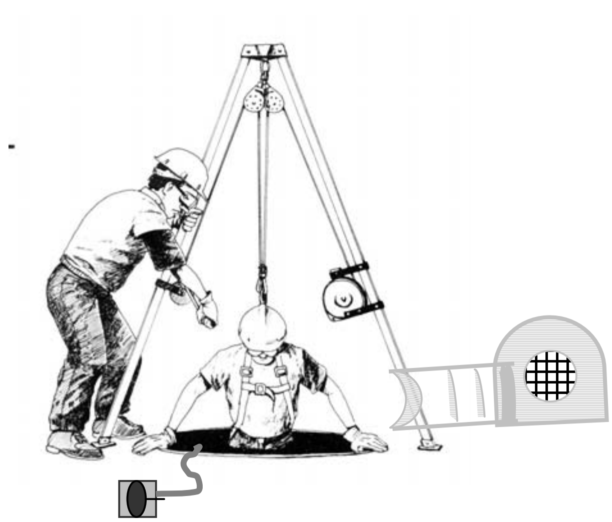
Reviewed By: ______________________________ Date: __________
Mike Reiner, Bureau Risk Services Manager

Approved By: ______________________________ Date: _________
Dean Marriott, Bureau Director

CITY OF PORTLAND
BUREAU OF ENVIRONMENTAL SERVICES

CONFINED SPACE ENTRY

POLICY & PROCEDURES



* SEE GLOSSARY

Revised March 2000
Updated August, 2000
Updated April, 2001
Updated September, 2001

City of Portland, Bureau of Environmental Services
Risk Services
5001 N. Columbia Blvd.
Portland, OR 97203
Phone: (503) 823-24

Confined Space Entry Policy

Revisions Tracking Sheet

Rev. Date	Type of Revision Add	Change	Location (Pg/Para /Line)	Original Text	Revised Text
September 2001		x	Whole Policy	**Reorganized paragraphs and verbiage throughout the policy.	
	x		Pg. 6 Para 2b		Give copy to Entry Supervisor
			Pg 6 Para E 1 a		Shall have a trained person as their attendant.
	x		Pg 11, Para 2		Eliminate all ignition sources, and use only tools that will not emit sparks, such as power drills, to open the cover.
	x		Pg 13, Para 12		If any alarms occur, or the supervisor determines that a source of fresh air is needed,
		x	Pg 15 Para 5	Since Non-Permit entries do not require an Attendant, the	Non-Permit entries do not require an Attendant, therefore
	x		Pg 15 Para 1		and there is no chance for engulfment.

Rev. Date	Type of Revision Add	Change	Location (Pg/Para /Line)	Original Text	Revised Text
April 2001		x	Pg. 2, IV,	... has been sufficiently trained as an Authorized Entrant, Attendant and/or Entry Supervisor	... has been sufficiently trained as an Authorized Entrant, Attendant and Entry Supervisor
		x	Pg. 3, Attendant	...one or more permit spaces who monitors the authorized entrant(s) and who performs all attendant's duties assigned in the Bureau's permit space program.	...outside a permit space who monitors the authorized entrant(s) and who performs all attendant's duties assigned in the Bureau's permit space program. An entry attendant can also serve as a supervisor.
		x	Pg. 3, Entry Supervisor	...that person is trained and equipped as required by this section , for each role he or she fills	...person is trained and equipped as required, for each role he or she fills
	x		Pg. 8 VII, E, 4, i	None	i.) May simultaneously serve as and entry supervisor.
	x		Pg. 9, E, 5, h.	None	h.) May simultaneously serve as and entry attendant

Rev. Date	Type of Revision Add Change	Location (Pg/Para /Line)	Original Text	Revised Text
	x	Pg. 9, A 5.	**None**	When an entry supervisor and attendant duties are combined, he/she must ensure that that all entrants are trained and certified to enter the confined space.
	x	Pg. 11, VIII, B, 5	None	Note: If duties are transferred to new personnel, the new entry supervisor/ attendant shall completely re-evaluate the hazard potential of the confined space.
June 2002	x	Pg 15 VIII, B, 9 Fall Protection	None	"for Fall protection." All equipment used in confined spaces shall be consistent with manufacturers specifications.

BUREAU OF ENVIRONMENTAL SERVICES

CONFINED SPACE ENTRY

POLICY & PROCEDURE

I. OBJECTIVE

To establish safe standard operating procedures for Bureau employees who engage in Confined Space Entry* work (Non-Permit or Permit). Entering a Confined Space* presents numerous occupational risks/hazards, therefore every precaution shall be taken. The Bureau is committed to a safe and healthy workplace and will provide the necessary resources to protect its employees.

A. USING THIS DOCUMENT

This document contains technical information with very specific language. The important terms have been placed in the Definitions Section and marked with an asterisk (*) throughout the document. Each person reading this Policy is responsible for reading these definitions as well as the document itself.

II. POLICY STATEMENT

It shall be the policy of the Bureau of Environmental Services that all Confined Space Entry work be approved by a management representative and/or designee, and that all entries into Permit Required Confined Spaces (PRCS) be assessed and authorized by the Entry Supervisor*

It is every Bureau employee's responsibility to perform work in a safe and thoughtful manner. Failure to comply with this policy could result in injury, illness or death. Additionally, non-compliance with this policy is a violation of OAR 437, Division 2/J, Permit-Required Confined Spaces (1910.146), which could result in regulatory fines by OR-OSHA.

III. SCOPE

This policy contains the necessary procedures and precautions to protect Bureau employees from hazards while working in Permit Required Confined Spaces and Non-Permit Confined Spaces. Any unusual confined entry or circumstance not covered under the procedural guidelines shall be discussed with Middle Management (see Responsibility Section) and the Risk Services before work begins.

IV. TRAINING

Under no circumstances shall Bureau employees be allowed to work in Confined Spaces, until they have been *sufficiently trained* as an Authorized Entrant*, Attendant* and Entry Supervisor*. The Bureau shall certify that each employee who works in Confined Spaces has the essential knowledge, skills and abilities to identify, evaluate and control Confined Space hazards.

Sufficient training shall include a curriculum which reviews OR-OSHA Standards and Regulations, and identification of hazards typically encountered in BES confined spaces: Physical; atmospheric; and abatement techniques; in addition to a basic knowledge of monitoring instruments, shall be included. A portion of the required training shall include "hands-on" instruction when actual entries are performed / observed by participants. An exam shall be given by the instructor, which requires a minimum passing grade of 75% before a certificate of completion is issued.

V. STANDARDS AND REGULATIONS

1. OAR 437, Division 2/J
2. OR OSHA 1910.146 Permit Required Confined Space

VI. DEFINITIONS

Attendant - an individual stationed outside a permit space who monitors the authorized entrant(s) and who performs all attendant's duties assigned in the Bureau's permit space program. An entry attendant can also serve as a supervisor.

Authorized Entrant - an employee who is authorized by the Bureau to enter a permit space.

Confined Space – A space that is large enough and so configured that an employee can bodily enter and perform assigned work; and

- Has limited or restricted means for entry or exit (example: tanks, sewers, wells, pipelines, vaults and pits)
- Is not designed for continuous employee occupancy.

Emergency – Any occurrence (including any failure of hazard control or monitoring equipment) of event internal or external to the permit space that could endanger entrants.

Engulfment – The surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling the respiratory system or that can exert enough force on the body to cause death by suffocation, constriction or drowning.

Entry - The action by which a person passes through an opening into a permit-required confined space. Entry includes work activities in that space and is considered to have occurred as soon as *any* part of the entrant's body breaks the plane of the opening into the space.

Entry Permit – The written or printed document that is provided by the employer to allow controlled entry into a permit space

Entry Supervisor - The person responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required.

Note: An entry supervisor may also serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required, for each role he or she fills. Also, duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

Hazardous Atmosphere – An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is escape unaided from a permit space), injury, or acute illness.

Hot Work – The employer's written authorization to perform operations (for example riveting, welding, cutting, burning and heating) capable of providing a source of ignition.

Immediately Dangerous to Life or Health (IDLH) – Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse effects or that would interfere with an individual's ability to escape unaided from a permit space.

Inerting – The displacement of the atmosphere in a permit space by noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible. Note – This procedure produces an IDLH oxygen-deficient atmosphere.

Isolation – The process by which a permit space is removed from service and completely protected against release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, piping or ducts; a double lock and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

LEL - lower explosive level.

Line Breaking – The intentional opening of a pipe, line or a duct that is or has been carrying flammable, corrosive or toxic material, an inert gas, or any fluid at a volume, pressure or temperature capable of causing injury.

Non-Permit Confined Space – A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

Outside Personnel – Any persons working at BES facilities, including, but not limited to employees of vendors, contractors, and of other City of Portland Bureaus.

Oxygen deficient atmosphere – An atmosphere containing less than 19.5 percent oxygen by volume.

Oxygen enriched atmosphere - An atmosphere containing more than 23.5 percent oxygen by volume.

Permit Required Confined Space – (permit space) A confined space that has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere;
2. Contains a material that has the potential for engulfing an entrant;
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
4. Contains any other recognized serious safety or health hazard.

Permit Required Confined Space Program - The employer's overall program for controlling and where appropriate, protecting employees from permit space hazards, and for regulating employee entry into permit spaces.

Permit System – The employer's written procedure for preparing and issuing permits for entry and for returning permit space to service following entry.

Prohibited condition – Any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

Rescue Service – The personnel or outside agency designated to rescue employees from permit spaces.

Retrieval system – The equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

Testing – The means by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

Note: testing enables employers both to devise and implement adequate control measures for the protection of entrants.

VII. RESPONSIBILITIES

A. SENIOR MANAGEMENT (DIRECTOR & GROUP MANAGERS)

1. Provide commitment, leadership, staffing and financial resources necessary to enable adherence to the requirements of this policy.

2. Establish performance criteria holding Middle Managers accountable for the compliance of this policy.

3. Continue to promote and reinforce individual responsibility and accountability as it relates to Occupational Safety and Health.

B. MIDDLE MANAGEMENT (DIVISION MANAGERS, PUBLIC WORKS MANAGERS AND PROGRAM MANAGERS)

1. Ensure that all personnel who perform Confined Space Entry work are educated as to the contents of this policy.

2. Ensure that all employees, including those newly-assigned to work in confined spaces, (Entrants, Attendants and Entry Supervisors) are adequately trained and certified to perform Confined Space Entry work, and that training records are properly maintained according to City Records Management policy.

3. Ensure that proper pre-entry protocols are completed prior to entry and maintained during entry. A designated employee (Entry Supervisor) may be assigned the responsibility of seeing that all Confined Space Entries are made in compliance with BES policies and procedures.

4. Ensure that Confined Space Entry equipment and personal protective equipment (PPE) are included in budgetary planning.

5. Ensure all appropriate safety equipment is available and used during Confined Space Entries.

6. Ensure that affected employees and their authorized representatives are consulted on the development and implementation of all aspects of Confined Space Entry Policy and Procedure.

7. Establish communication procedures to inform employees and employee representatives of pre-entry air monitoring results, certification of safe entry, and any hazard identified while working in Confined Spaces (e.g., atmospheric alarm).

8. Coordinate the activities of Contractors/outside personnel who will be working in or near PRCS spaces.

9. Review the effectiveness of this policy and procedure annually, using the cancelled permits to evaluate the confined space work done throughout the year, and revise the program to correct deficiencies if necessary.

C. PROJECT MANAGERS

1. Project managers shall include in their scope of services and/or bid specifications, provisions for compliance with the approved confined space procedures.

Note: All Confined Spaces are to be considered Permit-Required until the Entry Supervisor has researched and verified the historical data to down-grade the PRCS to Non-Permit.

2. Coordinate the activities of Contractors and/or outside personnel who will be working in or near PRCS spaces and ensure their compliance with OAR 437 Division 2/J, Permit-Required Confined Spaces (1910.146). Complete authorization form (Attachment A) of this document. After the Authorization Form has been completed and reviewed with the Contractor, the Project Manager and/or designee shall:

   a. Give a copy to the outside personnel;
   b. Give a copy to the Entry Supervisor
   c. File a copy in the Project file; and
   d. Forward a copy to BES Risk Services, B310.

Note: No entry shall occur until the Entry Authorization form has been completed.

3. Inform the outside personnel* that the work they are performing requires entry into a Confined Space and that they are responsible for the safety and health of their employees and must comply with OAR 437 Division 2/J, Permit-Required Confined Spaces (1910.146).

4. Inform the outside personnel of any hazards the Bureau has identified and past experience with that particular space:

Note: Authorization Form (Attachment A) can be used as a guide for Potential Hazard and the Safety Precaution/Personal Safety.

5. Inform the outside personnel of any precautions or procedures that the Bureau has taken to protect its employees.

6. Coordinate entry operations with the outside personnel if Bureau employees will also be entering the space. When an entry is made by both bureau and contract employees working together, procedures must be documented and BES Risk Services notified.

7. Debrief the outside personnel to determine if any problems were encountered requiring a change in procedure.

8. Review outside personnel's work periodically and issue a stop work order if safety procedures are not followed.

9. If Hot Work is performed, ensure that outside personnel follow those procedures.

D. OUTSIDE PERSONNEL

Outside Personnel\Contractors Shall

1. In addition to complying with permit space requirements, all outside personnel shall:

a.) Obtain all information regarding confined space hazards and entry operations from the Bureau's Project Manager; and

b.) If Bureau employees are entering the same confined space then the Contractor shall coordinate entry operations with those employees.

c.) Employers of outside personnel shall provide all equipment necessary to comply with safety standards.

d.) Employers of outside personnel shall be responsible for all training of their employees.

Note: Additionally, the prime contractor shall coordinate entries of contractor's vendors and/or subcontractors.

2. The contractor shall submit their procedures for entering confined space to the Bureau's Project Manager for approval.

E. ENTRY PERSONNEL & STAFF

1. All Personnel

a.) Shall have a trained person as their attendant.

b.) Shall follow the appropriate Confined Space Entry Procedures (confined space & Non-Permit) and ensure that equipment is used properly.

c.) Be held responsible and accountable for personal safety.

2. Entrant(s) Duties (Permit space only)

a.) Knows the hazards that may be faced (e.g., possible LEL conditions) during entry, including information on the mode, signs or symptoms, and consequences that might occur due to lack of oxygen or exposure to toxic air contaminants.

b.) Properly use of all safety equipment provided for the job.

c.) Communicates frequently with Attendant to enable Attendant to monitor Entrant(s) status.

d.) Alerts Attendant immediately when a hazardous condition or problem develops, or when leaving the space.

e.) Exits the space immediately if ordered to by the Attendant, or if a prohibited condition or hazardous situation develops (e.g., atmospheric alarm).

3. Entrants Shall: (Non-Permit)

a.) Know the hazards that may be faced (e.g., possible LEL conditions) during entry, including information on the mode, signs or symptoms, and consequences that might occur due to lack of oxygen or exposure to toxic air contaminants.

b.) Ensure that the only hazard posed by the Confined Space is a potential for hazardous atmosphere* and that ventilation alone can be sufficient to maintain the space safe for entry.

c.) Test atmosphere prior to entry and record results. Continuously monitor the atmosphere during entry.

d.) Ensure barriers or other guards are in place around the space opening.

e.) Exit immediately from the space upon any atmospheric alarm.

f.) Adhere to the duty requirements of the Entry Supervisor.

Note: An employee shall meet the training requirements of an Entrant and Entry Supervisor to perform Non-Permit Entries.

4. Attendants Shall: (Permit space only)

a.) Be First Aid and CPR certified.

b.) May simultaneously serve as and entry supervisor.

c.) Know the hazards that may be faced (e.g., possible LEL conditions) during entry, including information on the mode, signs or symptoms, and consequences that might occur due to lack of oxygen or exposure to toxic air contaminants

d.) Remain outside the permit space during the full operation.

e.) Monitor activities inside and outside the space for safety.

f.) Maintain active communication with Entrant.

g.) Maintain a correct count of authorized Entrants, if there is more than one.

h.) Keep unauthorized persons from entering the space.

i.) Perform no duties that might interfere with Attendant's primary duty. (i.e. flagging and miscellaneous distractions)

j.) Order Entrant to evacuate if a dangerous situation develops.

k.) Perform non-entry rescue* only.

l.) Summon rescue and other emergency* services if Entrant needs assistance to escape in an emergency.

Note: The Bureau has the authority to designate any Bureau employee (non-represented or represented) to be the Entry Supervisor, provided the training and certification requirements have been met.

5. Entry Supervisor Duties

a.) May simultaneously serve as and entry attendant.

b.) Have received *current* CSE training.

c.) Know the hazards that may be faced (e.g., possible LEL conditions) during entry, including information on the mode, signs or symptoms, and consequences that might occur due to lack of oxygen or exposure to toxic air contaminants.

d.) Evaluate Confined Space hazards and ensure controls are in place.

e.) Determine the responsibility for permit requirements, hazard controls and permit sign-off.

f.) Terminate the entry and cancel the permit.

g.) Verify that rescue procedures are in place and rescue services are available.

h.) Remove unauthorized individuals who enter or attempt to enter.

i.) Review Confined Space work in progress to ensure that acceptable entry conditions are maintained and workers are following the procedure.

VIII. PROCEDURES

A. PRE-ENTRY EVALUATION

The Entry Supervisor Shall:

1. Evaluate whether the Confined Space must be entered. Explore whether other controls/procedures could be used to prevent someone from entering the Confined Space. Explore every possible alternative to prevent the initial entry.

2. Conduct a visual survey of the Confined Space to identify any potential hazards (e.g., hazardous atmosphere, physical hazards, history and location of the space, etc).

Note: The Entry Supervisor must determine what safety equipment, including personal protective equipment is needed for the job, and ensure that the gas monitor has been calibrated, and fresh air checked.

3. If the Entry Supervisor is unclear whether a Confined Space is PRCS or non-permit, then the Pre-Entry Checklist (Attachment C) must be completed. The Entry Supervisor's determination is based on the identified hazards, and evaluation of those hazards eliminated and/or control measures to ensure safe entry. See Section B & C for specific Non-Permit and Permit procedures.

Note: All Confined Spaces are to be considered Permit-Required until the Entry Supervisor has researched and verified the historical data to downgrade the PRCS to Non-Permit.

4. Review work to be done in the Confined Space to evaluate its potential to create a hazardous atmosphere or other hazard.

5. After the Confined Space determination has been made, the Entry Supervisor must ensure that the Entrant and Attendant are trained and certified to enter the Confined Space. When an entry supervisor and attendant duties are combined, he/she must ensure that that all entrants are trained and certified to enter the confined space.

B. PERMIT-REQUIRED SPACE PROCEDURE

Note: All Confined Spaces* are to be considered Permit-Required until the Entry Supervisor determines otherwise.

1. Pre-Entry — The Entry Supervisor shall conduct the pre-entry procedure and determine if the Confined Space is to be Permit-Required.

   a. The Entry Supervisor shall ensure that the Attendant has current CPR/First Aid certification.

   b. Entry Supervisors, Entrants and Attendants shall have received current CSE training.

c. Anytime "Hot Work" is being performed in a confined space; the Bureau of Environmental Services Wastewater Group's Hot Work Permit Policy shall be utilized and implemented in addition to the Confined Space Entry Permit.

2. Inspection

The Entry Supervisor* shall ensure that all safety equipment is visually inspected prior to each use or entry, and is in a "ready state." Equipment includes, but is not limited to:

- Ladders (where applicable)
- Tripods *and winches*
- Safety Harness/Life Lines/Lanyards
- Gas Monitors (calibrated, properly zeroed, field-checked and/or bump tested)
- Communication Systems

Explosion-proof equipment if needed

3. External

The perimeter of the Confined Space shall be barricaded or roped off to prevent unauthorized personnel from entering the space. Additionally, if entrance covers are removed, the opening shall be *promptly* guarded by a railing or temporary cover, until work in the confined space resumes.

Manholes may be guarded or blocked by the van or an Attendant. One person at all times is responsible for keeping people away.

4. Environmental Survey

The Entry Supervisor and other on-site personnel shall survey the surrounding work environment to ensure that:

- all external controls are in place (traffic control, barricades);
- all physical hazards have been eliminated or controlled;
- the Confined Space opening is guarded by a railing or temporary barrier;
- all isolating devices are in place (lockout, blanking lines, etc.); and
- all ventilating equipment is operating.

5. Air Testing

Air test the Confined Space for oxygen, flammability (LEL), hydrogen sulfide (H_2S), carbon monoxide (CO), and any other possible contaminants based on pre-entry survey. The test shall occur:

- prior to entry
- during entry/continuous
- prior to reentering the space after work is suspended for any reason

Note: **Air contaminants might be introduced into the space during work activities, additional air testing for these air contaminants will be needed during entry.**

Entry is prohibited until initial testing of the atmosphere is done from outside

* SEE DEFINITIONS

the space and determined to be safe. Under no circumstances shall entries occur if the meter detects (by alarming) a hazardous atmosphere, or if there is other information that indicates a hazardous atmosphere may exist.

If the pre-entry survey indicates the potential for flammable atmosphere, an initial test must be taken through the small holes in the manhole cover prior to removal. For manholes that are solid the testing will be done after cracking open the cover. Eliminate all ignition sources, and use only tools that will *not emit* sparks, such as power drills, to open the cover.

If the alarm sounds while working in the space, all Entrants must exit from the space immediately!

Note: **Training and certification in atmospheric testing for all Confined Spaced personnel must include the ability to correctly interpret gas monitor readings.**

6. Personal

Personal protective equipment required for entry includes, but is not limited to:

- **Protection**
- Hard hats
- Eye wear (glasses or goggles depending on the hazard)
- Gloves
- Protective clothing (coveralls, raingear, chemical suits)

Each Entrant or his authorized representative must be provided the opportunity to observe and obtain results of pre-entry monitoring or other testing of a PRCS. If a request is made by an employee to reevaluate the Confined Space, then the Entry Supervisor will comply with that request before proceeding with the entry.

7. Entry Permit*

The Entry Supervisor shall obtain an "Entry Permit" and complete each section prior to entry (See Attachment B). The following rules apply:

a.) Permits shall be completed at the Confined Space location

b.) Permits are only valid for the duration of work.

1.) If Entrants exit from the space for short period*s* (breaks, lunches, etc.) a new permit does not have to be issued provided that the Entry Supervisor conducts atmospheric testing prior to re-entry, documents the readings on the permit, and double checks that all potential hazards are controlled.

c.) The Entry Supervisor terminates permits when:
- work is temporarily postponed,
- work is completed, or
- a hazardous condition develops during entry

d.) All terminated permits shall be forwarded to WG Records

e.) Permits shall be kept for one year.

f.) Permits shall be posted at the job site.

g.) If duties are transferred to new personnel, the new entry supervisor/ attendant shall completely re-evaluate the hazard potential of the confined space.

8. Respiratory Protection

The Entry Supervisor shall consider potential inhalation exposures (ammonia, sewage mists/vapors etc.) prior to each entry and determine the need for respiratory protection. The supervisor shall also define the specific respirator protection for the entry. Half-face respirators equipped with organic vapor cartridges in conjunction with *N 100* particulate filters will protect against low level organic solvents and particulate mists from sewage. (Reference BES Respirator policy)

Note: **Air contaminants might be introduced into the space during work activities, additional air testing for these air contaminants will be needed during entry.**

Under no circumstances shall entries be made with an SCBA or airline respirator with auxiliary escape bottle, unless alternative procedures are discussed between the Entry Supervisor and the BES Risk Services Staff prior to entry.

9. Fall Protection

The Entry Supervisor shall ensure that Entrant uses fall protection when working from any unguarded surface greater than 6 feet elevation. Under some circumstances retrieval systems may be used for Fall Protection. All equipment used in confined spaces shall be consistent with manufacturers specifications.

10. Communication

The Attendant must remain in continuous contact with the Entrant(s) and be prepared to retrieve the Entrant(s) whenever a prohibited condition occurs (i.e., Entrant exhibits behavior changes, gas monitor alarms, etc.). If visual contact can not be maintained, portable radios or some other reliable, pre-approved means must maintain effective communication.

11. Rescue

The Entry Supervisor shall ensure that rescue procedures are discussed with the Entrant and Attendant prior to each entry. At a minimum, the following rescue rules shall apply on all entries:

a.) The entrant shall wear a full-body harness.

b.) A mechanical lifting device shall be available at the job site to remove personnel from any vertical space more than 5 feet deep. When feasible the entrant will be attached by lifeline to a mechanical lifting device.

Note: If a lifeline is <u>not</u> feasible, then prior arrangements need to be made with the Risk Services Division

c.) All rescue attempts shall occur from outside the Confined Space.

d.) Under no circumstances shall the Attendant enter the Confined Space to perform a rescue.

e.) The Attendant will have a two-way radio or cellular phone to notify dispatch or 911.

f.) Outside rescue service (i.e. Portland Fire Bureau) shall assume full authority during the rescue procedure. The attendant shall remain at the entry point until relieved of this duty.

12. Ventilation

If any alarms occur, or the supervisor determines that a source of fresh air is needed, the ventilation shall be used to provide adequate levels of oxygen, to dilute toxic and flammable gases, and to improve general air quality. Ventilation equipment shall be explosion proof and be set at 100% outside air. To increase air circulation open additional manholes and other sources of fresh air on the upside/downside of the Confined Space.

All "closed" Confined Spaces (vaults, wet/dry wells, manholes, etc.) may require the use of forced, mechanical ventilation, if fixed ventilation systems are not present. The Entrant will determine the need for ventilation. Natural ventilation should be sufficient in all "open" Confined Spaces (clarifiers). However, if there is any doubt about the air quality, then mechanical ventilation shall be used.

If ventilation is needed:

- Introduce fresh air near the bottom of the immediate area where the Entrant will be present; and
- Position the fresh air intake in a clean air zone away from all combustion sources (i.e. vehicle exhaust).
- Retest Air

13. Electric

The Entry Supervisor must ensure that only double insulated electric tools or tools on a ground fault circuit interrupter system are used and all portable lights and tools are explosion proof where a potential flammable atmosphere exists.

14. Lockout — The Entry Supervisor and the Entrant shall ensure that all Potential Energy Sources have been adequately disconnected/ isolated from power source and locked out, and stored energy sources are controlled, prior to entry. This includes blocking lines and locking out valves. Refer to the Bureau's Energy Lockout/Tagout Policy for specific instructions.

15. Traffic — The Entry Supervisor shall ensure that employees working in roadways/walkways have the proper controls for traffic and access to manholes. All necessary barriers and traffic control devices shall be used. This includes ensuring that employees handling traffic are trained in flagging and traffic control.

16. Records — At completion of the entry, the Entrant shall forward the checklist *and written certification of air testing* to Records: B310.

C. NON-PERMIT SPACE PROCEDURE

A Non-Permit Space does not contain (with respect to atmospheric hazards), or have the potential to contain, any hazard capable of causing death or physical harm. The space has sufficient ventilation (forced or natural) to maintain a safe entry and all physical hazards, (e.g., mechanical equipment) can be controlled from outside the space prior to entry, and there is no chance for engulfment.

Note: Work activities shall not introduce a hazardous atmosphere into the space.

1. Training — Entrant must be trained to the Entry Supervisor level to enter the Confined Space.

Note: Training and certification in atmospheric testing for all Confined Spaced personnel must include the ability to correctly interpret gas monitor readings.

2. Pre-Entry — If Entrant completes the Pre-Entry Checklist, the checklist must be posted outside the entry portal or another visible location at the entry site. The Pre-Entry Checklist can not extend beyond the initial job purpose, or one shift, whichever is of the shortest duration

3. External Controls — The Entrant shall survey the surrounding work environment to ensure that all external controls are in place (traffic control, barricades) and that all physical hazards have been eliminated or controlled. The Entrant shall guard the Confined Space opening by a railing, or temporary barrier and will double check to ensure that all isolating devices are in place (lockout/tagout, blanking lines, etc). Industrial sampling manholes may be guarded or blocked by the van or an Attendant. One person at all times is responsible for keeping people away.

4. Inspection — Entrant shall inspect and ensure that all safety equipment is in good condition. If the job requires travel to a satellite work location, proper safety equipment must be in the vehicle. Use the Entry Permit as a checklist. (Attachment B)

5. Entrant — Non-Permit entries do not require an Attendant, therefore the Entrant must notify their manager/supervisor/lead person prior to entering a space and when the entry is complete.

6. Air Testing — Prior to entry, the Entrant shall conduct atmospheric readings for oxygen, flammability, carbon monoxide and hydrogen sulfide, and any other possible contaminants based on pre-entry survey. If initial pre-planning identifies the potential for a flammable atmosphere (methane), then the under-side of the Confined Space cover shall be "sniffed" prior to opening. If all atmospheric tests indicate the atmosphere is safe then proceed with the entry.

Note: Gas Meter Chart - Appendix B

Note: Training and certification in atmospheric testing for all Confined Spaced personnel must include the ability to correctly interpret gas monitor readings.

Any employee who enters the space, or that employee's authorized representative, shall be provided an opportunity to observe the pre-entry testing. Test results must be documented by a written certification before entry takes place.

7. Continuous Monitoring — All entries must be monitored continuously. The gas monitor shall be attached to the Entrant during entry and if, at any time, the meter goes into alarm mode, the Entrant shall exit from the space immediately.

The Non-Permit Confined Space will then be reclassified into a PRCS and no entry shall occur until the atmospheric hazard has been eliminated.

Note: In special circumstances (especially at the Wastewater Treatment Plant), this section can be waived with prior approval of the Risk Services Division.

8. Ventilation — All "closed" Confined Spaces (vaults, wet/dry wells, manholes, etc.) may require the use of forced, mechanical ventilation, if fixed ventilation systems are not present. The Entrant will determine the need for ventilation. Natural ventilation should be sufficient in all "open" Confined Spaces (clarifiers). However, if there is any doubt about the air quality, then mechanical ventilation shall be used.

If ventilation is needed:

- Introduce fresh air near the bottom of the immediate area where the Entrant will be present; and
- Position the fresh air intake in a clean air zone away from all combustion sources (i.e. vehicle exhaust).
- Retest Air

9. Respiratory Protection — The Entrant should consider potential inhalation exposures (only at a nuisance level, e.g., sewage mists/vapors etc.) prior to each entry and may decide to use respiratory protection. The filtering respirators shall eliminate most odors and filter out particulate mists.

10. Electric — The Entrant must ensure that only double insulated electric tools or tools on a ground fault circuit interrupter system are used and all portable lights and tools are explosion proof where a potential flammable atmosphere exists

11. Records — At completion of the entry, the Entrant shall forward the checklist *and written certification of air testing* to Records: B310.

D. HOT WORK PROCEDURE:

Hot Work* is work involving: electric or gas welding; cutting; heating; soldering; brazing; or similar flame and spark producing operations.

Note: Anytime "Hot Work" is being performed in a confined space; the Bureau of Environmental Services Wastewater Group's Hot Work Permit Policy shall be utilized and implemented in addition to the Confined Space Entry Permit.

1. The permit is to ensure that the proper planning and precautions are taken prior to work being performed.

2. A management representative or designee (Lead), and the Entry Supervisor shall approve all "Hot Work", as specified in the Hot Work policy.

3. The Entry Supervisor and/or Attendant shall fulfill the duties of the Designated Fire Watch as specified in the Hot Work Policy.

4. The Entry Supervisor shall obtain and complete the "Hot Work" permit on the job site and make sure all the signatures have been obtained.

5. The Entry Supervisor shall identify any special fire hazards and implement precautions to control those hazards.

6. The Entry Supervisor and crew shall ensure that the Confined Space has been adequately purged and specify methods for flushing and ventilating the space as needed.

7. Compressed gas cylinders will not be allowed inside the Confined Space. Turn valves off when gases are not in use.

* SEE DEFINITIONS

8. The Entry Supervisor and crew shall ensure that isolation controls are in place (lockout, blanking, etc.)

9. Continuous atmospheric monitoring shall occur before and during entry to ensure acceptable environmental conditions.

10. The Entry Supervisor shall ensure that personal protective equipment is used (respiratory protection, eye protection, body protection, etc.)

11. The Entry Supervisor shall fulfill the duties of the Process Area Operator as described in the Hot Work policy for areas where there is no clearly defined Process Area Operator.

12. Upon completion of Hot Work the Designated Fire Watch shall forward the "Hot Work" Permit to Records; B310.

Note: See Attachment D, Bureau of Environmental Services -Wastewater Group's Hot Work Permit Policy.

CONFINED SPACE ENTRY POLICY - March 2000

Revised By: ______________________________ Date: _____________
Paul Schuberg, Bureau Safety Manager

Reviewed By: ______________________________ Date: ______________
Mike Reiner, Bureau Risk Services Manager

Approved By: ______________________________ Date: _____________
Dean Marriott, Bureau Director

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GAS METER CHART

	Oxygen	Methane	Hydrogen Sulfide	Carbon Monoxide
METER READING	**% O_2**	**LEL CH_4**	**ppm H_2S**	**ppm CO**
Safe Level	Normal = 20.9% Minimum = 19.5% Maximum = 23.5%	< 10% of LEL	< 10 ppm	< 35 ppm
Hazard / Health Effects	**16% - fast breathing, drowsiness, nausea** 12% - unconscious 6% - death	**Explosive**	50 ppm – eye irritation, headache, fatigue 100 ppm – deadens sense of smell in 3 min.; coughing, burning eyes & respiratory tract. 500 ppm – respiratory disturbances in 2-15 min.; strong irritation of eyes; dizziness, collapse 1000 ppm - immediate unconsciousness after 1 breath, death in 3-5 minutes	50 ppm – increases risk of heart attack esp. in people working hard 500-1000 ppm – Headache, rapid breathing, nausea, weakness, dizziness, mental confusion 4000 ppm - coma

Attachment A – Example of Multiple copy Form – Do not Use

BUREAU OF ENVIRONMENTAL SERVICES
CONFINED SPACE ENTRY AUTHORIZATION

Date:_________________ Permit Duration: From __________ to __________ Project #

____

PROJECT MANAGER: ___________________________ PROJECT INSPECTOR: ___________________________

Contractor Name: ________________________________ Contractor Rep:

____

Space Location:

____

Brief Description of Work:

____

____

_____

____

_____

CHECKLIST OF SAFEGUARDS: *(Check ☐ those that are applicable.)*

POTENTIAL HAZARDS FOR THIS PROJECT

☐ Biohazard	☐ Engulfment	☐ Industrial Area	*Other Hazards/Exposures*
☐ Toxic (H_2S,CO)	☐ Stored Energy	☐ Falls	☐ ________________
☐ Corrosive/Chemicals	☐ Electrical Hazards	☐ Noise	☐ ________________
☐ Flammable (LEL)	☐ Mechanical Hazards	☐ Traffic	☐ ________________
☐ Oxygen Levels	☐ Structural Hazards	☐ Hot Work	☐ ________________
☐ Radioactive			

SAFETY PRECAUTIONS/PERSONAL SAFETY

Procedures	*Personal Safety Equip.*	*Energy Isolation*	*Fire Safety*
☐ Bureau Procedure	☐ Hard Hat	☐ Tag and Lockout	☐ Fire Hose Laid Out
☐ Communication	☐ Eye Protection	☐ Lines/Valves Blocked	☐ Extinguisher Available
☐ Entry Coordination	☐ Hearing Protection	☐ Public Access	
☐ Contractor Debrief	☐ Foot Protection		*Other Precautions*
☐ Permit Posted	☐ Hand Protection		☐ ________________
☐ Atmosphere Tests	☐ Protective Clothing	*Electrical Safety*	☐ ________________
☐ Ventilation	☐ SCBA	☐ Explosion Proof	☐ ________________
☐ Traffic Control	☐ Respirator	☐ Sparkless Tools	☐ ________________
☐ Pedestrian Safety	☐ Tripod/Harness	☐ Welding Protection	☐ ________________
☐ Rescue Plan	☐ Lighting	☐ G.F.C.I.	☐ ________________

NOTE: There may be additional hazards associated with this confined space not covered by this checklist. This document is advisory only! The contractor shall be responsible for the safety of his/her employees and must comply with OR-OSHA 1910.146 Confined Space Entry Standards.

NOTES:____

____

____

____

____

____

____

Signatures: ________________________________ ________________________________
(Project Manager) (Contractor)

COPIES: White: Project Manager Yellow: Contractor Pink: Mike Reiner B310

Attachment B - Example of Multiple copy Form – Do not Use

BUREAU OF ENVIRONMENTAL SERVICES

CONFINED SPACE ENTRY PERMIT

Entry Notifications:

Date:__________________ ☐ Operations ☐ Maintenance ☐ Contractor ☐ Other

Time:________________ am / pm

Description of Work Area and Work to be Performed ________________________________

Work Group/Division ________________________________

POTENTIAL HAZARDS FOR THIS ENTRY

☐ Biohazard	☐ Engulfment	☐ Industrial Area	*Other Hazards/Exposures*
☐ Toxic (H_2S,CO)	☐ Stored Energy	☐ Falls	☐ ____________
☐ Corrosive/Chemicals	☐ Electrical Hazards	☐ Noise	☐ ____________
☐ Flammable (LEL)	☐ Mechanical Hazards	☐ Traffic	☐ ____________
☐ Radioactive	☐ Structural Hazards	☐ Hot Work	☐ ____________

SAFETY PRECAUTIONS/PERSONAL SAFETY

Procedures	*Personal Safety Equip.*	*Energy Isolation*	*Fire Safety*
☐ Emergency Rescue Plan	☐ Hard Hat	☐ Tag and Lockout	☐ Fire Hose Laid Out
☐ Communication	☐ Eye Protection	☐ Blanking/Bleeding	☐ Extinguisher Available
☐ Entry Coordination	☐ Hearing Protection	☐ Disconnecting	
☐ Attendant	☐ Foot Protection	☐ Pumping	*Other Precautions*
☐ Permit Posted	☐ Hand Protection		☐ Traffic Control
☐ Atmosphere Tests	☐ Protective Clothing	*Electrical Safety*	☐ Public Access
☐ Ventilation	☐ Respirator	☐ Explosion Proof	☐ Barricades/Cones
☐ Traffic Control	Type:____________	☐ Sparkless Tools	☐ Opening Guarded
☐ Pedestrian Safety	☐ Fall Protection/Block	☐ Welding Protection	☐ Radio/Cellular Phone available
☐ Training	☐ Tripod	☐ G.F.C.I.	
☐ CPR/First Aid	☐ Harness/Lifeline		
☐ Hot Work			

CONFINED SPACE ATMOSPHERE ANALYSIS

METER #:___________ EXPIRATION DATE:________________ CHECK FOR ANY ALARM:_______

PARAMETER		TEST LOCATIONS				EXPOSURE		METER	ALARMS
		Sniff	Top	Middle	Bottom	Dose	Peak	Alarm Pts.	YES/NO
Oxygen	(%)	_____	_____	_____	_____	______	______	(+)or(-)19.5%	__________
Explosivity	(LEL)	_____	_____	_____	_____	______	______	(>)or(=)10%LEL	______
Carbon Monoxide	(ppm)	_____	_____	_____	_____	______	______	(>)or(=)35ppm	________
Hydrogen Sulfide	(ppm)	_____	_____	_____	_____	______	______	(>)or(=)10ppm	________

ENTRY SUPERVISOR: (Print) Name/Title____________________________________ Date____________

ENTRANTS: Name(s)____

ATTENDANTS: Name(s)____

ENTRY SUPERVISOR SIGNATURE:____

EMERGENCY NOTIFICATION:

- ☐ Call 911
- ☐ Division Mgr. Ph.#_________________
- ☐ Safety/Loss Control Ph# 823-5509
- ☐ Source Control Duty Officer Ph.# 823-7180

***COPIES**: **White**: Post at job site **Yellow**: Submit to Daily Lead **Pink**: Submit to Records/B310*

Attachment C

Pre-Entry Checklist

Date & Time of Entry: Location of Entry:

CHECKLIST	Y	N	N/A
1. Has the gas monitor been calibrated within the last 30 days?			
2. Did you fresh air calibrate the monitor prior to conducting atmospheric tests?			
3. When monitored, was the atmosphere acceptable (no alarms given)? Please note levels. _______O_2 Level _______LEL Level _______H_2S Level _______CO Level			
4. Will the atmosphere be continuously monitored while space is occupied?			
5. Is there sufficient ventilation to keep the atmospheric conditions safe?			
6. Could the atmosphere change based on the nature of the work being conducted in the space (hot work, painting, coatings, etc.)?			
7. Are openings adequately guarded against accidental falls into the space?			
8. Are there barriers around the opening to prevent unauthorized entry?			
9. Have all energy sources been locked and tagged?			
10. Are pumps, valves, and lines disconnected, bled, or blocked?			
11. Have attendants/entrants/entry supervisor been trained and understand their duties/responsibilities?			
12. Is the appropriate safety equipment being used? (PPE, lighting, safety block, etc.)			

13. Have communication procedures been reviewed and understood by everyone?			
14. Have rescue procedures been reviewed and understood by everyone?			
15. Are adequate traffic control measures being taken?			
16. Is access/egress into the confined space **less** than 20 ft. in height?			
17. Has a review of the history for the confined space revealed a potential for sudden changes that could lead to sudden unexpected hazardous conditions?			
18. Can all the identified hazards be controlled?			

NOTE: If you checked any shaded area of the checklist, the space is automatically Permit-Required.

☐ Non-Permit **Print Name:**____

☐ Permit-Required **Signature:** ____ **(Entry Supervisor)**

PERMIT-REQUIRED: Complete Entry Permit as outlined in Procedures.
NON-PERMIT: Post Checklist at Job site. If entering space without an attendant contact your supervisor prior to entry and inform them when you should be out of the space. When entry is complete, contact your supervisor and forward checklist to Admin, Front Office at B31

ATTACHMENT D EXAMPLE OF MULTIPLE COPY FORM DO NOT USE

PERMIT #:_______

HOT WORK PERMIT

TO BE USED WHEN ANY FIRE, SPARKK, OR FLAME PRODUCING OPERATION IS BEING PERFORMED

Important Note about Confined Space Entry:

Any time Hot Work is being performed in a confined space the Bureau of Environmental Services Confined Space Entry procedure must be followed.

______________________________ ____

Department Issuing the Permit Location of Work

____

Nature of Job Being Done

____

Special Fire

NOTE FOR CONSTRUCTION ACTIVITIES: IF AN ENTRY IS MADE IN AN AREA WHERE CONTRACT PERSONNEL OR MEMBERS OF THE PUBLIC COULD IMPACT THE SAFETY OF ENTRANTS AN ATTENDANT MUST BE PRESENT. REVISED AUG 2000

Type of Hot Work to be Performed: (Welding/Cutting/Open Flame)

CHECKLIST OF SPECIAL REQUIREMENTS

- ☐ **Fire Watch(s) present with adequate Fire extinguisher equipment ready for immediate use.**
- ☐ **All equipment being worked on has been adequately locked out, isolated, purged, and atmosphere tested as needed.**
- ☐ **Hot Work Notice Tag has been posted at the site where work will be performed.**
- ☐ **If welding on walls, partitions, ceilings, they have been inspected, and all combustible coverings or building materials have been moved or shielded.**
- ☐ **Objects to be welded do not transmit heat to unobserved combustibles.**
- ☐ **Area has been inspected and all combustibles within 35 feet have been moved or shielded.**
- ☐ **Equipment is in good working condition and proper personal safety equipment is being used.**
- ☐ **Fire Watch will remain at the site for at least ½ hour after Hot work is complete**

Date/Time Started: ________________________ Fire Watch(s):____________________________________

Persons Performing Hot Work: ____

____

Lead Authorizing: _________________________ Process Area Operator: ___________________________

FIRE WATCH SIGN OFF: ____

Original (White) - Manager **Duplicate Copy (Yellow) – Process Area Operator**

Revised December 2001
Revised February 2000
Prepared by: (D.J.) Brandy Bowers, BES WG
Master File Location: *BES\grp345\S:\policy\safety\HAZCOM-MSDS.doc*

APPENDIX – A

VENDOR POLICY / CONDITIONS FOR PRODUCT ACCEPTANCE

1. Any vendor wishing to enter into a business relationship (involving the leaving sample hazardous chemicals) with BES must be willing to sign a copy of the Vendor Agreement for Conditions of Acceptance.

2. Further, no product requiring a MSDS, under OAR 437, 2/Z, 1910.1200 Hazard Communication, shall be accepted as a sample, whether purchased or left as a complimentary sample product without also being accompanied by its most current MSDS. Should any such product prove unsatisfactory to our needs the vendor shall take responsibility from removing the product from the premises upon written or verbal notice from the Stores Systems Manager or designee.

VENDOR AGREEMENT FOR CONDITIONS OF ACCEPTANCE

I/we hereby acknowledge and accept the terms and policy herein outlined for vendor activity with the Bureau of Environmental Services, Wastewater Group.

No product requiring a Material Safety Data Sheet (MSDS) under OAR 437, 2/Z, 1910.1200 Hazard Communication shall be left as a sample whether purchased or left as a complimentary sample product, without also being accompanied by its most current MSDS.

Further, it is understood that, should the sample product prove unsatisfactory to our needs, the vendor shall remove the product from our premises within 48 hours of written or verbal notification from this office.

_________________________Date__________________(Authorized Representative)
BES Stores Manager Signature

_________________________Date__________________(Vendor)
Vendor – Authorized Representative Signature

CH2M HILL Health and Safety Plan for Source Control Remedial Investigation, City of Portland Outfalls Project

This Health and Safety Plan (HSP) will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Site Safety Coordinator (SSC) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment 1.

Project Information and Description

PROJECT NO: 182032.WP.25

CLIENT: City of Portland

PROJECT/SITE NAME: Source Control Remedial Investigation, City of Portland Outfalls Project

SITE ADDRESS: Various

CH2M HILL PROJECT MANAGER: David Livesay/PDX

DATE HEALTH AND SAFETY PLAN PREPARED: October 2003

DATE(S) OF SITE WORK: 2003 through 2004. Plan will be updated annually as work continues

SITE ACCESS: In-line, effluent sampling: various storm-water sewer lines. River Sampling: Boat launch

SITE SIZE: Individual storm-water basins, out-falls, and river locations within the 5.7 mile Initial Study Area of the Portland Harbor Superfund Site

SITE TOPOGRAPHY: Roadways, river level.

SITE DESCRIPTION AND HISTORY: Portland Harbor Initial Study Area represents a 5.7-mile stretch of the Lower Willamette River in which the Oregon Department of Environmental Quality (DEQ) and the U.S. Environmental Protection Agency (EPA) performed a sediment study in September and October 1997. This area is between the upstream ends of Sauvie Island (River Mile (RM) 3.5) and Swan Island (RM 9.2). Although EPA has adopted an "Initial Study Area" concept which focuses on this 5.7 mile stretch for implementation of the Portland Harbor RI/FS, the boundaries of the site may expand or contract as the investigation proceeds. The final boundaries of the site will not be established until a Record of Decision (ROD) is issued for the Portland Harbor Superfund site based on the results of the RI/FS.

EPA placed Portland Harbor on the National Priorities List on December 1, 2000. With the Superfund listing, EPA became the lead agency for the RI/FS and future cleanup decisions. EPA and DEQ have entered into a cooperative agreement that delineates the roles and responsibilities of each agency.

Although both agencies will be involved in investigation and cleanup activities within the Portland Harbor Superfund Site, EPA will take the lead for in-water work while DEQ will be responsible for upland cleanup and source control.

Numerous city and non-city outfalls, including storm drains and combined sewer overflows (CSOs), are located along both shores of the LWR in the metropolitan area. The City of Portland (the City) has about 18 stormwater outfalls and four CSO outfalls within the Portland Harbor ISA. The City's outfalls serve as a conduit for stormwater from rights-of-way, industrial, commercial, residential and vacant lands. Available sediment data indicate some sediment contamination may be associated with City outfalls. Source control is defined as those efforts taken to identify and reduce the release of contaminants to Portland Harbor, to the extent needed to be protective of human health and the environment.

Field sampling activities for the Remedial Investigation of the City of Portland Outfalls will commence in 2003 and continue into 2004.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED: Possible tasks include: observations of sediment sampling from City owned storm sewers and outfalls, observations of stormwater effluent sampling, and sediment sampling from boats.

Site Map

Figure 1 shows the locations of the City-owned outfalls. Refer to Field Sampling and Analysis Plans for the individual outfalls for specific site and sampling locations.


Outfall 12C
Outfall 24
Outfall 53
Outfall 22
Outfall 52
Outfall 50
Outfall 49
Outfall 48
Outfall 22C
Outfall 22B
Outfall M-1
Outfall M-2
Outfall M-3
Outfall S-6
Outfall S-2
Outfall S-5
Outfall 19
Outfall 19A
Outfall 18
Legend
River Edge 2001
Outfalls within Initial Study Area
Source Control Remedial Investigation Work Plan, City of Portland

Figure 1

Tasks to Be Performed Under this Plan

Description of Tasks

(Reference Field Project Start-up Form)

Refer to project documents (i.e., Field Sampling and Analysis Plan) for detailed task information. A health and safety risk analysis (Section 1.2) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Section 8.2 for procedures related to "clean" tasks that do not involve hazardous waste operations and emergency response (Hazwoper).

Hazwoper-Regulated Tasks

- Sediment sampling from a boat
- Sediment sampling from shore
- Logging sediment samples collected from city stormwater sewer.
- Logging stormwater effluent samples collected from City stormwater sewers

Non-Hazwoper-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-Hazwoper-trained personnel. **Prior approval from the Health and Safety Manager (HSM) is required before these tasks are conducted on regulated hazardous waste sites.**

Tasks	Controls
None	Brief on hazards, limits of access, and emergency procedures Post-contaminant areas as appropriate (refer to Section 8.2 for details) Sample and monitor as appropriate (refer to Section 5.0)

Task Hazard Analysis
(Refer to Section 2 for hazard controls)

POTENTIAL HAZARDS	TASKS		
	Sediment Sampling from a Boat	Sediment Sampling from Shore	Sediment Logging from City Street
Flying debris/objects	X	X	X
Noise > 85 dBA	X		X
Electrical	X		X
Suspended loads	X		
Slip, trip, fall	X	X	X
Back injury	X	X	X
Visible lightning	X	X	X

Task Hazard Analysis
(Refer to Section 2 for hazard controls)

POTENTIAL HAZARDS	TASKS		
	Sediment Sampling from a Boat	Sediment Sampling from Shore	Sediment Logging from City Street
Elevated work surfaces		X	X
Fire	X	X	X
Heavy equipment	X		
Working near water	X	X	X
Traffic			X
Working from boat	X		

Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the SSC for clarification.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 6. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Project-specific frequency for completing self-assessments: **Prior to riding in a boat or engaging in work in traffic-ways..**

Project-Specific Hazards

Boat

- Safe means of boarding or leaving the boat or platform must be provided to prevent slipping and falling.
- Boat must be operated according to U.S. Coast Guard regulations (speed, lightning, right-of-way, etc.).
- Staff should be instructed on safe use and operation of boat prior to use.
- Work requiring the use of a boat will not take place at night or during inclement weather.
- Shut off engine before refueling.

- Do not smoke while refueling.

Working In, Above, or Near Water

- Fall protection should be provided to prevent personnel from falling into water. Where fall protection systems are not provided and the danger of drowning exists, U.S. Coast Guard-approved personal flotation devices (PFDs), or life jacket, shall be worn.
- Inspect PFDs prior to use. Do not use defective PFDs.
- A minimum of one ring buoy with 90 feet of 3/8-inch solid-braid polypropylene (or equal) rope must be provided for emergency rescue.
- Use sampling and other equipment according to the manufacturer's instructions.

Exposure to Public Vehicular Traffic

(Reference CH2M HILL SOP HSE-24, *Traffic Control*)

The following precautions must be taken when working around traffic, and in or near an area where traffic controls have been established by a contractor or client.

- Exercise caution when exiting traveled way or parking along street – avoid sudden stops, use flashers, etc.
- Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier.
- All staff working adjacent to traveled way or within work area must wear reflective/high-visibility safety vests.
- Eye protection should be worn to protect from flying debris.
- Remain aware of factors that influence traffic related hazards and required controls – sun glare, rain, wind, flash flooding, limited sight-distance, hills, curves, guardrails, width of shoulder (i.e., breakdown lane), etc.
- Always remain aware of an escape route—behind an established barrier, parked vehicle, guardrail, etc.
- Always pay attention to moving traffic—never assume drivers are looking out for you.
- Work as far from traveled way as possible to avoid creating confusion for drivers.
- When workers must face away from traffic, a "buddy system" should be used, where one worker is looking towards traffic.
- When working on highway projects, obtain a copy of the contractor's traffic control plan.
- Work area should be protected by a physical barrier – such as a K-rail or Jersey barrier.
- Review traffic control devices to ensure that they are adequate to protect your work area. Traffic control devices should: 1) convey a clear meaning, 2) command respect of road users, and 3) give adequate time for proper traffic response. The adequacy of these devices are dependent on limited sight distance, proximity to ramps or intersections, restrictive width, duration of job, and traffic volume, speed, and proximity.

Arsenic

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Avoid skin and eye contact with liquid and particulate arsenic or arsenic trichloride.
- Arsenic is considered a "Confirmed Human Carcinogen."
- Arsenic particulates (inorganic metal dust) are odorless. Vapor and gaseous odor varies depending upon specific organic arsenic compound.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.

Cadmium

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Cadmium is considered a "Suspected Human Carcinogen."
- Cadmium particulates (fumes and dust) are odorless.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.
- Employees who work in percent levels of cadmium or where there is a potential exposure above the action level of 0.0025 mg/m^3 are required to read the Cadmium Fact Sheet found in attachment 5 of this Health and Safety Plan.

Lead

(Reference CH2M HILL SOP HSE-57, Lead)

The following requirements pertain to lead contaminated soils:

- Work shall progress in a sequence from less contaminated to more contaminated areas.
- Water should be added to soils prior to and during excavation, air rotary drilling, and other activities that create or have the potential to create airborne lead contaminated dust. For air rotary drilling operations, water can be added to the boring to reduce dust generation from the cyclone. Depending upon soil type, watering of soil may be required several days prior to commencing ground intrusive activities.
- Personnel working in the vicinity of lead contaminated soil shall wear disposable coveralls or equal and exercise enhanced personal hygiene (i.e., frequent hand washing prior to eating, drinking, and smoking; separation of work and street clothing/footwear, etc.).
- Employees who work in areas where there is a potential exposure to lead above the action level of 30 $\mu g/m^3$ are required to read the Lead Fact Sheet found in attachment 5 of this Health and Safety Plan.

General Hazards

General Practices and Housekeeping

(Reference CH2M HILL SOP HS-20, *General Practices*)

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness require enough illumination intensity to read a newspaper without difficulty.
- Good housekeeping must be maintained on the boat all times.
- Keep access to aisles around the boat free from obstructions.
- Boat is to be equipped with adequate slip-resistant surfaces.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

Hazard Communication

(Reference CH2M HILL SOP HS-05, *Hazard Communication)*

The SSC is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using Attachment 2.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Request or confirm the locations of Material Safety Data Sheets (MSDSs) from the client and/or contractor for chemicals to which CH2M Hill employees could be potentially exposed.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific HAZCOM training using Attachment 3.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

Shipping and Transportation of Chemical Products

(Reference CH2M HILL's Procedures for Shipping and Transporting Dangerous Goods)

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

Lifting

(Reference CH2M HILL SOP HS-29, *Lifting*)

Proper lifting techniques must be used when lifting any object.

- Plan storage and staging to minimize lifting or carrying distances.
- Split heavy loads into smaller loads.
- Use mechanical lifting aids whenever possible.
- Have someone assist with the lift—especially for heavy or awkward loads.
- Make sure the path of travel is clear prior to the lift.

Fire Prevention

(Reference CH2M HILL SOP HS-22, *Fire Prevention*)

- The boat shall be equipped with fire extinguishers.
- Extinguishers must:
  - be maintained in a fully charged and operable condition,
  - be visually inspected each month, and
  - undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

Heat Stress

(Reference CH2M HILL SOP HS-09, *Heat and Cold Stress*)

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SSC/DSC to avoid progression of heat-related illness.

Biological/Environmental Hazards and Controls

Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

Bloodborne Pathogens

(Reference CH2M HILL SOP HS-36, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-36, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

Sunburn

Sunburn is a condition resulting from an over exposure of the skin to Ultraviolet (UV) rays found in sunlight. Redness, pain, swelling, and even blistering can occur from this over exposure. Peeling usually follows several days later. The pain of sunburn is usually greatest between 6 and 48 hours after exposure.

Sunburn Prevention

- Try to avoid the sun between 10 a.m. and 3 p.m. when its rays are strongest
- Use a sunscreen with SPF of 15 or greater at all times. Use a waterproof product if swimming/exercising.
- Beware of cloudy days, you can still burn then
- Be informed about any medications you are taking and their side effects. Some antibiotics such as Tetracycline and Sulfa produce an allergic-type rash on body parts exposed to sun.

Sunburn Treatment

- Use cool wet compresses for first 48 hours. Do not use ice.
- May use aloe in first 48 hours
- NO lotions or petroleum jelly in the first 48 hours!! These hold in the heat!
- Apply moisturizing lotions after 48 hours
- Aspirin taken as directed on the label may help ease pain

Note: Seek medical attention if fever, fluid-filled blisters, dizziness or visual disturbances are present!

Long Term Effects

The sun weakens the skin's elasticity leading to premature aging, such as early wrinkles and a tough, leathery look. Over exposure also leads to the development of flat, scaly, reddish patches called Solar Keratoses, which sometimes are pre-cancerous. The most serious consequence of over exposure to the sun is skin cancer. Over 700,000 new cases of this most common form of cancer occur each year. No tan is a safe tan.

Contaminants of Concern (Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Arsenic	**SS**: ***Potential***	0.01 mg/m³	5 Ca	Ulceration of nasal septum, respiratory irritation, dermatitis, gastrointestinal disturbances, peripheral neuropathy, hyperpigmentation	NA
Cadmium	**SS**: ***Potential***	0.005 mg/m³	9 Ca	Pulmonary edema, coughing, chest tightness/pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, difficulty breathing, loss of sense of smell, emphysema, mild anemia	NA
Lead	**SS**: ***Potential***	0.05 mg/m³	100	Weakness lassitude, facial pallor, pal eye, weight loss, malnutrition, abdominal pain, constipation, anemia, gingival lead line, tremors, paralysis of wrist and ankles, encephalopathy, kidney disease, irritated eyes, hypertension	NA
PCBs (Limits as Aroclor 1254)	**SS**: ***Potential***	0.5 mg/m³	5 Ca	Eye and skin irritation, acne-form dermatitis, liver damage, reproductive effects	UK
PAHs Napthalene Acenaphthylene Acenaphthene Fluorene Phenanthrene Anthracene Fluoranthene Pyrene Chrysene Benz(a)anthracene Benzo(k)fluoranthene Benzo(b)fluoranthene Benzo(a)pyrene Indeno(1,2,3cd)pyrene Dibenzo(a,h)anthracene Benzo(g,h,I)perylene	**SS**: ***Potential***	0.2 mg/m³	80 Ca	Carcinogen in animals and possibly to humans. Dermatitis and bronchitis	UK

Footnotes:

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), SS (Sediment Sample), SL (Sludge), SW (Surface Water).

[b] Appropriate value of PEL, REL, or TLV listed.

[c] IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.

[d] PIP = photoionization potential; NA = not applicable; UK = unknown.

Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.	**Other:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

Project Organization and Personnel

CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HS-01, Medical Surveillance, and HS-02, Health and Safety Training)

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SSC" have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL's SOP HS-04, *Reproduction Protection*, including obtaining a physician's statement of the employee's ability to perform hazardous activities before being assigned fieldwork.

Employee Name	Office	Responsibility	SSC/FA-CPR
Brad Paulson	SEA	Field Team Leader	Level C SC-HW/FA-CPR
David Lacey	PDX	Field Team Leader	Level C SC-HW/FA-CPR
Justin Iverson	PDX	Field Team Member	Level C SC-HW/FA-CPR
Lyndsey Maxwell	PDX	Field Team Member	Level C SC-HW/FA-CPR
Jim Crawford	SEA	Field Team Member	Level C SC-HW/FA-CPR
Emily Keene	PDX	Field Team Member	Level C SC-HW/FA-CPR

Field Team Chain of Command and Communication Procedures

Client

Contact Name: **Rick Applegate, City of Portland**

Phone: **(503) 823-7094**

CH2M HILL

Project Manager: **David Livesay/CVO**

Health and Safety Manager: **Steve Beck/MKE**

Field Team Leader: **David Lacey/PDX**

Site Safety Coordinator: **David Lacey/PDX**

The SSC is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact the client. The Health and Safety Manager should be contacted as appropriate.

Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HS-07, Personal Protective Equipment, HS-08, Respiratory Protection)

PPE Specifications [a]				
Task	**Level**	**Body**	**Head**	**Respirator [b]**
Transport in boat	D	Work clothes; leather work boots; personal flotation device (PFD).	None	None required
Sediment sampling (boat)	Modified D	Personal flotation device (PFD). Uncoated Tyvek® or cotton coveralls; **Boots:** Leather work boots with outer rubber boot covers. **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Safety glasses	None required
Sediment sampling (shore) and no danger of drowning exists.	Modified D	Uncoated Tyvek ® or cotton coveralls **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Safety glasses	None required
Sediment logging from city storm sewer locations	Modified D	Work cloths; orange reflective vest. **Boots:** Steel-toe, leather work boots. **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Safety glasses	None required

Reasons for Upgrading or Downgrading Level of Protection	
Upgrade[f]	**Downgrade**
Request from individual performing tasks. Change in work tasks that will increase contact or potential contact with hazardous materials. Occurrence or likely occurrence of gas or vapor emission. Known or suspected presence of dermal hazards. Instrument action levels (Section 5) exceeded.	New information indicating that situation is less hazardous than originally thought. Change in site conditions that decreases the hazard. Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.

Air Monitoring/Sampling

None required for this field event based on suspect constituents and media type.

Decontamination

(Reference CH2M HILL SOP HS-13, *Decontamination*)

The SSC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SSC. The SSC must ensure that procedures are established for disposing of materials generated on the site.

Decontamination Specifications

Personnel	Sample Equipment	Boat
Boot wash/rinse Glove wash/rinse Outer-glove removal Body-suit removal Inner-glove removal Hand wash/rinse Face wash/rinse Shower ASAP Dispose of PPE in municipal trash, or contain for disposal Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal	Wash/rinse equipment Solvent-rinse equipment Contain solvent waste for offsite disposal	Wash as necessary Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

Diagram of Personnel-Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SSC should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones. Work zones are to be modified by the SSC to accommodate task-specific requirements.

Site-Control Plan

Site-Control Procedures

(Reference CH2M HILL SOP HS-11, *Site Control)*

- The SSC will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of Health and Safety Plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.
- The SSC records attendance at safety briefings in a logbook and documents the topics discussed.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the "buddy system."
- Initial air monitoring is conducted by the SCC is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2 and 3. Deficiencies are to be noted, reported to the HSM, and corrected.
- SSC in appropriate level of protection.

Emergency Response Plan

(Reference CH2M HILL, SOP HS-12, *Emergency Response*)

Pre-Emergency Planning

The SSC performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate.

- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Keep areas near extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.

- Designate one vehicle as the emergency vehicle; place hospital directions and map inside during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, fires, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The SSC will evaluate emergency response actions and initiate appropriate follow-up actions.

Emergency Equipment and Supplies

The SSC should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20 lb (or two 10-lb) fire extinguisher (A, B, and C classes)	Boat/Field vehicle
First aid kit	Boat/Field vehicle
Eye wash	Boat/Field vehicle
Potable water	Boat/Field vehicle
Bloodborne-pathogen kit	Boat/Field vehicle
Additional equipment (specify): Cell phone	With SSC

Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Section 8.4 (e.g., 911).
- The SCC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.

- Report incident as outlined in Section 8.4.

Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- Notify and submit reports to client as required in contract.

Approval

This site-specific Health and Safety Plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

Original Plan

Written By: David Lacey/SEA **Date: September 20, 2002**

Approved By: Steve Beck/MKE **Date: September 20, 2002**

Revisions

Revisions Made By: John Culley/SEA **Date: October 2003**

Revisions to Plan:

- **Addition of sediment logging from city storm sewers to Hazwoper Regulated Tasks**
- **Inclusion of sediment logging from city storm sewer to Task Hazard Analysis**
- **Inclusion of traffic control to project specific hazards**
- **Update of PPE table**
- **Inclusion of Traffic Control "Self-Assessment" Checklist** **Attachment 7**

Revisions Approved By: John Culley/SEA **Date: October 21, 2003**

Attachments

Attachment 1: Employee Signoff Form – Field Safety Instructions

Attachment 2: Project-Specific Chemical Product Hazard Communication Form

Attachment 3: Chemical-Specific Training Form

Attachment 4: Emergency Contacts

Attachment 5: Project H&S Forms/Permits

Attachment 6: Applicable Material Safety Data Sheets

Attachment 7: Self-Assessment Checklists

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 1

EMPLOYEE SIGNOFF FORM

CH2MHILL

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

- The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: Source Control Remedial Investigation, City of Portland Outfalls Project

Project Number: 182032.WP.25

EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 2

Project -Specific Chemical Product Hazard Communication Form

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: Source Control Remedial Investigation, City of Portland Outfalls Project

Project Number: 182032.WP.25

MSDSs will be maintained at the following location(s): Boat

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard
Nitric acid	< 500 ml	Support Zone/ sample bottles			
Methanol	< 1 gallon	Support/Decon Zones			
Alconox/Liquinox	< 1 liter	Support/Decon Zones			
Hexane	< 1 liter	Support/Decon Zones			
Ethanol	<1 liter	Support/Decon Zones			
Acetone	<1 liter	Support/Decon Zones			

Refer to SOP HS-05 *Hazard Communication* for more detailed information.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 3

Chemical-Specific Training Form

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project # : 182032.WP.25
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

- ☐ Physical and health hazards
- ☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)
- ☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 4

Emergency Contacts

Emergency Contacts

24-hour CH2M HILL Emergency Beeper – (888) 444-1226	
Medical Emergency – 911	**CH2M HILL Medical Consultant** Dr. Jerry H. Berke, M.D., M.P.H. 600 West Cummings Park, Suite 3400 Woburn, MA 01801-6350 1-781-938-4653 or 1-800-350-4511 (After hours calls will be returned within 20 minutes)
Fire Emergency – 911	**Corporate Director Health and Safety** Name: Dave Waite/SEA Phone: 425/453-5000 24-hour emergency beeper: 888-444-1226
Police – 911	**Health and Safety Manager (HSM)** Name: John Culley/SEA Phone: 425/453-5000 ext. 5288
Safety Coordinator (SC) Name: Brad Paulson/SEA Phone: 425-453-5000 ext. 5572	**Regional Human Resources Department** Name: Holly Michel/SEA Phone: 425/453-5000
Project Manager Name: David Livesay/CVO Phone: 541-752-4271ext. 3538	**Corporate Human Resources Department** Name: Pete Hannon/COR Phone: 303/771-0900
Federal Express Dangerous Goods Shipping Phone: 800/238-5355 **CH2M HILL Emergency Number for Shipping Dangerous Goods** Phone: 800/255-3924	**Worker's Compensation** Contact Regional Human Resources Department to have an Incident Report Form (IRF) completed. After hours call ***Julie Zimmerman @ 303/664-3304.*** **Auto Claims** Rental: Carol Dietz/COR 303/713-2757 CH2M Hill Owned: Zurich Insurance Company 1-800/987-3373

Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

Alarms: Blast of car/boat horn (3x) **Evacuation Assembly Area(s):** Field vehicle

Facility/Site Evacuation Route(s): N/A

Hospital

Hospital Name/Address: Good Samaritan Hospital & Medical Center
1015 NW 22nd Ave
Portland, OR 97210

Hospital Phone #: 503-413-7711
Fax #: 503-415-5771

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 5

Project H&S Forms and Permits

Lead Fact Sheet

Uses and Occurrences

Lead can be found in the following: construction materials for tank linings and piping; component of lead-acid storage batteries; lead solder; plastics; steel; and pigments for paints. Lead can also be found in waste rock associated with mining activities, wood debris or stock used for electrical co-generation activities, and soil and waste associated with manufacturing activities. Elevated levels of naturally occurring lead may also be found in the soil in certain parts of this country.

Physical Characteristics

Appearance:	Bluish-white, slivery, gray metal. Very soft and easily malleable
Odor:	None
Flammable:	Noncombustible
Flash Point:	Not Applicable
Flammable Range:	Not Applicable
Specific gravity:	11.35
Stability:	very stable
Incompatibilities:	hot nitric acid, boiling concentrated hydrochloric and sulfuric acids
Melting Point:	327^{o}C

Signs and Symptoms of Exposure

Skin and Eye: Irritation

Ingestion and Inhalation (Acute Overexposure): Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise that develops quickly to seizures, coma, and death from cardio-respiratory arrest. A short-term dose of lead can lead to acute encephalopathy. Short-term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however, arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects that take longer to acquire. Lead adversely affects numerous body systems, and causes forms of health impairment and disease that arise after periods of exposure as short as days or as long as several years.

Ingestion and Inhalation (Chronic Overexposure): Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic, there may be severe abdominal pain.

Modes of Exposure

Inhalation:	Dusts and fumes
Skin Absorption:	None
Ingestion:	Dusts and solids

Exposure Limits

Action level	0.03 mg/m^3
PEL	0.05 mg/m^3
STEL	None
PEL-C	None
TLV	0.05 mg/m^3

Exposure Level vs. Regulatory Requirements

EXPOSURE LEVEL (EL)	REGULATORY REQUIREMENTS
EL < AL	Maintain exposure as low as reasonably achievable
AL > EL, EL < PEL	Implement portions of the OSHA Lead Standard (i.e., initial medical monitoring) and Training
EL > PEL	Implement all portions of the OSHA Lead Standard including training, medical surveillance, engineering controls, establishment of work areas, etc.

PPE

Eye:	Safety Glasses
Skin:	Coveralls or disposable coveralls to keep lead off clothing and to prevent the spread of lead contamination.
Respiratory:	Air purifying respirators and supplied air respirators, depending on the exposure.

First Aid

Inhalation:	Move to fresh air, contact a physician
Skin:	Wash with water
Eyes	Flush with water
Ingestion:	Contact a physician

Cadmium Fact Sheet

Uses and Occurrences

Coatings on metals; nickel-cadmium storage batteries; power transmission wire; pigments in ceramic glazes, enamels, and fungicides; corrosion-resistant coatings on marine, aircraft, and motor vehicles; manufacture of nuclear reactor rods; and welding electrodes and solder.

Physical Characteristics

Appearance:	Soft, blue-white, malleable, lustrous metal or grayish-white powder; some compounds may appear as a brown, yellow, or red powdery substance.
Odor:	None.
Flammable:	Noncombustible.
Flash Point:	Not Applicable.
Flammable Range:	Not Applicable.
Specific gravity:	8.64 (metal dust).
Stability:	Very stable.
Incompatibilities:	Nitric acid, boiling concentrated hydrochloric and sulfuric acids; contact of cadmium metal dust with strong oxidizers or with elemental sulfur, selenium, and tellurium may cause fires and explosion.
Melting Point:	321°C (metal dust).

Signs and Symptoms of Exposure

Short Term (Acute):	Dust and Fume: Irritation of nose and throat; inhalation may cause a delayed onset of cough, chest pain, sweating, chills, shortness of breath, and weakness. Death may occur. Dust: Ingestion may cause nausea, vomiting, diarrhea, and abdominal cramps.
Long Term (Chronic):	Dust and Fume: Repeated or prolonged exposure may cause loss of sense of smell, ulceration of the nose, shortness of breath (emphysema), kidney damage, and mild anemia. Exposure to cadmium has been reported to cause an increase incidence of cancer of the prostate in men.

Modes of Exposure

Inhalation:	Dusts and fumes.
Absorption:	None.
Ingestion:	Dusts and solids.

Exposure Limits

Action level	2.5 µg/m^3.
PEL	5.0 µg/m^3 .
STEL	None.
PEL-C	None.
TLV	10.0 µg/m^3 ; 2.0 µg/m^3 (respirable fraction).

Exposure Level vs. Regulatory Requirements

EXPOSURE LEVEL (EL)	REGULATORY REQUIREMENTS
EL < AL	Maintain exposure as low as reasonable achievable
AL > EL, EL < PEL	Implement portions of the OSHA Cadmium Standard and training
EL > PEL	Implement all portions of the OSHA Cadmium Standard including training, medical surveillance, engineering controls, establishment of work areas, etc.

PPE

Eye:	Splash proof or dust resistant goggles; face shield.
Skin:	Protective coveralls, gloves, and footwear.
Respiratory:	Air purifying respirators and supplied air respirators, depending on the exposure.

First Aid

Inhalation:	Move to fresh air; seek medical attention immediately.
Skin:	Remove clothing and shoes; wash with soap or mild detergent and large amounts of water.
Eyes	Flush with water immediately, lifting the upper and lower eyelids; seek medical attention immediately.
Ingestion:	Under no circumstances should therapeutic chelation be administered; seek medical attention immediately.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 6

Applicable Material Safety Data Sheets

Note: copies of applicable MSDS will be included prior to the commencement of field sampling activities.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 7

Self-Assessment Checklists

CH2MHILL

H&S Self-Assessment Checklist – TRAFFIC CONTROL

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP.

This checklist is to be used at locations where: 1) CH2M HILL employees are exposed to traffic hazards and/or 2) CH2M HILL provides oversight of subcontractor personnel who are exposed to traffic hazards.

SSC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of traffic control operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies, and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the HS&E Staff for review.

Project Name: ____ Project No.: ______________________

Location: ____ PM: __________________________________

Auditor: ____________________________________ Title: _________________________________ Date: _____________

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposure to traffic hazards.
☐ Evaluate a CH2M HILL subcontractor's compliance with traffic control requirements.
Subcontractor's Name: ____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-24.

SECTION 1

SAFE WORK PRACTICES (3.1)

	Item	Yes	No	N/A	N/O
1.	Personnel working on/adjacent to active roadways or in control zones are wearing safety vests.	☐	☐	☐	☐
2.	Traffic control plan (TCP) is consistent with roadway, traffic, and working conditions.	☐	☐	☐	☐
3.	TCP has been approved by regulatory or contractual authority prior to work.	☐	☐	☐	☐
4.	TCP considers all factors that may influence traffic related hazards and controls.	☐	☐	☐	☐
5.	Work areas are protected by rigid barriers.	☐	☐	☐	☐
6.	Lookouts are used when applicable.	☐	☐	☐	☐
7.	Vehicles are parked 40 feet away from work zone or are equipped with hazard beacon/strobe.	☐	☐	☐	☐
8.	TMCC or TMA vehicle is used where appropriate.	☐	☐	☐	☐
9.	All CH2M HILL traffic control devices conform to MUTCD standards.	☐	☐	☐	☐
10.	Traffic control devices are inspected continuously.	☐	☐	☐	☐
11.	Flagging is only used when other means of traffic control are inadequate.	☐	☐	☐	☐
12.	Additional traffic control zone controls have been implemented.	☐	☐	☐	☐
13.	Cranes do not swing loads/booms over nor do workers enter/cross live roadways (as defined).	☐	☐	☐	☐

CH2MHILL

H&S Self-Assessment Checklist – TRAFFIC CONTROL

SECTION 2 — Yes No | N/A N/O

GENERAL (3.2.1)

14. Lane closings are performed when required by this SOP. ☐ ☐ ☐ ☐
15. Traffic control configurations are based on an engineering study of the location. ☐ ☐ ☐ ☐
16. If no study, traffic control is performed with approval of the authority having jurisdiction. ☐ ☐ ☐ ☐
17. TCP has been prepared and understood by all responsible parties prior to work. ☐ ☐ ☐ ☐
18. Special preparation/coordination with external parties has been conducted where applicable. ☐ ☐ ☐ ☐
19. All contractor traffic control devices conform to MUTCD standards. ☐ ☐ ☐ ☐
20. Traffic movement and flow are inhibited or disrupted as little as possible. ☐ ☐ ☐ ☐
21. Supplemental equipment and activities do not interfere with traffic. ☐ ☐ ☐ ☐
22. Drivers and pedestrians are considered when entering and traversing traffic control zone. ☐ ☐ ☐ ☐

TRAFFIC CONTROL ZONES (3.2.2)

23. Traffic control zones are divided into the necessary five areas. ☐ ☐ ☐ ☐
24. Advance warning area is designed based on conditions of speed, roadways, and driver needs. ☐ ☐ ☐ ☐
25. Advance warning signage is spaced according to roadway type and conditions. ☐ ☐ ☐ ☐
26. Transition areas are used to channelize traffic around the work area. ☐ ☐ ☐ ☐
27. Buffer areas are used to provide a margin of safety for traffic and workers. ☐ ☐ ☐ ☐
28. The buffer area is free of equipment, workers, materials, and worker vehicles. ☐ ☐ ☐ ☐
29. The length of the buffer area is two times the posted speed limit in feet. ☐ ☐ ☐ ☐
30. All work is contained in the work area and is closed to all traffic. ☐ ☐ ☐ ☐
31. A termination area is used to provide traffic to return to normal lanes. ☐ ☐ ☐ ☐
32. A downstream taper is installed in the termination area. ☐ ☐ ☐ ☐

DEVICE INSTALLATION AND REMOVAL (3.2.3)

33. All vehicles involved with device installation/removal have hazard beacons/strobes. ☐ ☐ ☐ ☐
34. Devices are installed according to the order established by this SOP. ☐ ☐ ☐ ☐
35. Devices are removed in the opposite order of installation. ☐ ☐ ☐ ☐
36. Tapers are used to move traffic out of its normal path. ☐ ☐ ☐ ☐
37. Tapers are created using channelizing devices. ☐ ☐ ☐ ☐
38. The length of taper is determined by posted speed and width of lane to be closed (see formula). ☐ ☐ ☐ ☐
39. Local police or highway patrol assist during taper installation and removal. ☐ ☐ ☐ ☐
40. TMCC/ TMA vehicles are used to protect personnel during installation and removal of devices. ☐ ☐ ☐ ☐
41. Cone trucks are equipped with platforms and railings. ☐ ☐ ☐ ☐
42. Cones are the appropriate height for the specific roadway and are reflectorized. ☐ ☐ ☐ ☐
43. Temporary sign supports are secured using sandbags to prevent movement. ☐ ☐ ☐ ☐
44. Arrow panels are used on lane closures where required. ☐ ☐ ☐ ☐
45. Concrete barriers are used where required. ☐ ☐ ☐ ☐
46. Barrels, crash cushions, or energy absorbing terminals are used to protect traffic as required. ☐ ☐ ☐ ☐
47. Changeable message signs (CMS) are used as required. ☐ ☐ ☐ ☐
48. CMS are not used to replace required signage. ☐ ☐ ☐ ☐
49. No more than two message panels are used in any message cycle on CMS. ☐ ☐ ☐ ☐

FLAGGING (3.2.4)

50. Flagging is used only when other traffic control methods are inadequate. ☐ ☐ ☐ ☐
51. Only approved personnel with current certification are allowed to be used as flaggers. ☐ ☐ ☐ ☐
52. Flaggers are located off the traveled portion of the roadway. ☐ ☐ ☐ ☐
53. A communication system is established when more than one flagger is used. ☐ ☐ ☐ ☐
54. Hand signaling by flaggers is by means of red flags, sign paddles, or red lights. ☐ ☐ ☐ ☐
55. Flaggers are alert, positioned close enough to warn work crews, and easily identified from crew. ☐ ☐ ☐ ☐
56. An escape plan is established by crew and flaggers prior to traffic control set up. ☐ ☐ ☐ ☐
57. Signs indicating a flagger is present are used and removed as required. ☐ ☐ ☐ ☐

CH2MHILL

H&S Self-Assessment Checklist – TRAFFIC CONTROL

SECTION 2	Yes	No	N/A	N/O
INSPECTION AND MAINTENANCE (3.2.5)				
58. Traffic control zones are monitored to determine their effectiveness under varying conditions.	☐	☐	☐	☐
59. Traffic control devices are inspected at the beginning and continuously during work shift.	☐	☐	☐	☐
60. Traffic control devices are restored to their proper position immediately and continuously.	☐	☐	☐	☐
61. Damaged, old, or ineffective devices are removed and replace immediately and continuously.	☐	☐	☐	☐
62. Devices using reflected light for illumination are cleaned and monitored continuously.	☐	☐	☐	☐

CH2MHILL

H&S Self-Assessment Checklist – TRAFFIC CONTROL

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Auditor: ______________________________ Project Manager: __________________________________

Health and Safety Self Assessment Checklist-BOATS

This self assessment is only to be used at locations where CH2M HILL controls the work. It is not to be used at locations where others control the work.

Project Name: ______________________ Project No.: ______________

Location: __________________________ PM: ____________________

Auditor: ___________________ Title: ________________ Date: ______

If an assessment item is complete/correct the "Yes" box should be checked. If an item is incomplete or deficient the "No" box should be checked. Items that are considered to be imminently dangerous must be corrected immediately or all exposed personnel must be removed from the hazard. All deficiencies shall be brought to the attention of the appropriate party that is responsible for correcting the deficiency. If an item is not applicable, the "N/A" box should be checked. If an item is applicable but was not observed during the assessment, the "N/O" box should be checked.

	Yes	No	NA	N/O
GENERAL				
1. Weather forecast checked	☐	☐	☐	☐
2. At Least one Team Member is trained in First Aid/CPR	☐	☐	☐	☐
3. Lights, horn, battery, fuel, steering, bilge pump, anchor & propeller checked	☐	☐	☐	☐
4. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
5. Personal Floatation Devices (PFD's) inspected daily	☐	☐	☐	☐
6. Fire extinguisher available, charged and accessible	☐	☐	☐	☐
5. First aid kit available	☐	☐	☐	☐
7. Project Instructions and H&S Plan available	☐	☐	☐	☐
8. Potable water available	☐	☐	☐	☐
9. Sunscreen & Bug Spray available	☐	☐	☐	☐
10. Distress communications available (flare gun, air horn, cell phone, CB)	☐	☐	☐	☐
11. An oar is available on board the boat in the event of mechanical failure	☐	☐	☐	☐
BOAT TRANSPORT				
13. Boat motor secured prior to boat transport	☐	☐	☐	☐
14. Turn signals and brake lights verified as operable	☐	☐	☐	☐
15. Safety chains available on trailer and secured in a criss-cross fashion	☐	☐	☐	☐
16. Trailer winch engaged	☐	☐	☐	☐
17. Ball hitch seated and latch pin installed	☐	☐	☐	☐
18 Tools and equipment secured prior to boat movement	☐	☐	☐	☐
19 Personnel not allowed ride on boat as it is being towed	☐	☐	☐	☐
20. Safe distance is maintained with traveling around power lines	☐	☐	☐	☐
21. Backup alarm or spotter used when backing boat	☐	☐	☐	☐
22. Boat is unhitched on a level and stabile surface	☐	☐	☐	☐
BOAT OPERATION				
23. Boat holds appropriate size load	☐	☐	☐	☐
24. Personnel cleared during boat start-up	☐	☐	☐	☐
25. Kill switch clearly identified and operational	☐	☐	☐	☐
26. Personnel wearing appropriate PPE	☐	☐	☐	☐
27. All personnel wearing PFDs	☐	☐	☐	☐
28. Boat will not be used for recreational purposes	☐	☐	☐	☐