

City of Portland, Oregon

**Intergovernmental Agreement for
Remedial Investigation and Source Control Measures**

DEQ No. LQVC-NWR-03-10

Stormwater Evaluation Report

**City of Portland Outfall Project
ECSI No. 2425**

February 2010

Prepared By:
City of Portland, Bureau of Environmental Services

This page intentionally left blank.

Executive Summary

City of Portland (City) stormwater systems collect and convey stormwater draining industrial, commercial, residential, and undeveloped lands to the Portland Harbor area of the Willamette River. In 2003, the City and the Oregon Department of Environmental Quality (DEQ) entered into an Intergovernmental Agreement (IGA) to collaborate on the identification and control of upland contaminant sources discharging to the City's shared stormwater conveyance systems (i.e., outfall basins). In accordance with the IGA, the City has been conducting remedial investigations (RI) of City outfall basins to assist with the identification of significant contaminant sources and to determine if source control measures (SCMs) are needed. These efforts are part of the DEQ-led upland environmental investigations and source control work being conducted in conjunction with the U.S. Environmental Protection Agency's in-water Portland Harbor RI / feasibility study.

In 2007 and 2008, during the course of their respective Portland Harbor-related investigations, the City, the Lower Willamette Group (LWG), and others collected stormwater data from 25 City outfall basins and 24 non-City outfall basins. This report provides a basis for identifying City outfall basins where additional source tracing activities may be needed and supports the development of the City outfall basin RI/SCM reports.

This report does not evaluate potential risks or the significance of stormwater analytes discharging to the river through the City's conveyance system. The RI/SCM reports will integrate City basin investigation findings, upland site stormwater pathway evaluations conducted under DEQ oversight, and other pertinent data to summarize how sources have been identified and controlled through the respective authorities of DEQ and the City. The Basin RI/SCM process will be informed by the inriver remedial investigation, risk assessment, and feasibility study being completed by the LWG.

Evaluation Approach and Results

A multiple-step process was used to evaluate the stormwater data from City outfall basins.

Stormwater Screening

The first step in the evaluation process was to compare analyte detections to conservative Joint Source Control Strategy (JSCS) screening level values (SLVs) selected to be protective of inriver receptors. In some cases, SLV exceedances were noted for stormwater concentrations below DEQ's estimated background surface water concentrations or from areas with no significant sources (e.g., Forest Park). Therefore, to better understand which analytes in each City outfall basin may need further source tracing, additional data evaluation was necessary.

Statistical Analyses

For each analyte exceeding its SLV in at least one City outfall basin stormwater sample, the next step consisted of conducting a statistical analysis of stormwater data collected by the City, the LWG and others from City *and* non-City outfall basins within Portland Harbor.

The harborwide analyses resulted in the sorting of analytes by basin into one of three “source tracing categories” (i.e., “lower,” “moderate,” and “higher” relative to harborwide concentration levels) as the basis for identifying which analytes in each City outfall basin should be evaluated further to determine whether additional source tracing is needed. Stormwater analytes in either the “moderate” or “higher” source tracing categories were further evaluated by comparison to relevant screening factors (e.g.,

estimated surface water background concentrations, factors of exceedance of SLVs, and industrial stormwater permit benchmark concentrations). This evaluation identified a list of analytes for each City outfall basin to be carried forward into basin-specific assessments for determining future City source tracing needs.

Stormwater Evaluation Process

Stormwater Screening

1. Screen stormwater data for City outfall basins against JSCS SLVs.
2. Select analytes for harborwide statistical analysis.

Statistical Analyses

1. Categorize stormwater analytes in each City basin by likelihood of having significant uncontrolled sources.
2. Identify analytes for further evaluation in each City basin.

City Basin Source Tracing Assessment

1. Assess whether known or potential sources within each City outfall basin may account for observed concentrations.
2. Make recommendations for additional

City Basin Source Tracing Assessment

The basin-specific assessments considered potential upland sources of the identified analytes (and whether these sites have conducted or are conducting stormwater source investigations under DEQ oversight), available LWG stormwater solids data, and other relevant information. The final step in the basin assessments resulted in each City outfall basin receiving one of the following source tracing recommendations:

- *No further City source tracing is planned* – Represents City outfall basins (13) that have low stormwater analyte concentrations and are considered the least likely to include significant, uncontrolled upland sources.
- *No further source tracing is recommended at this time (but may be needed in the future)* – Represents City outfall basins (10) where analytes were identified for further evaluation but where potential upland sources have been identified that may account for the observed concentrations and are in the process of conducting source control evaluations under DEQ oversight. The need for additional City source tracing efforts, DEQ-required source control measures at upland sites, or DEQ site discovery actions are contingent on the findings of the ongoing upland site source control evaluations.
- *Further source tracing may be needed* – Represents City outfall basins (Basins 52C and 53) where analytes are present in stormwater at levels that indicate uncontrolled sources may exist within the basin or that nearby sources may be impacting stormwater quality in the basins (e.g., air deposition, particle tracking)

and for which potential sources have not been identified. Additional City and DEQ evaluation is recommended to determine whether additional source tracing and/or DEQ site discovery efforts are needed.

Conclusions

The results indicate significant progress by the City, DEQ, and upland sites in identifying and controlling sources of contaminants to the City's shared stormwater conveyance systems within the Study Area. Key findings and conclusions include:

- Stormwater analyte concentrations in City outfall basins are predominantly lower than concentrations detected in non-City outfall basins (i.e., most of the basins in the "higher" source tracing category are non-City basins).
- Further source tracing is not needed for most analytes in the majority of the City outfall basins.
- City outfall basins in the "higher" source tracing category typically have known or potential upland sources of the analytes identified, and most of these upland sources are in the process of conducting source control evaluations under DEQ oversight. The City will continue to work with DEQ to track the progress of ongoing source control evaluations at these sites and will identify any further source investigation efforts that may be needed based on the results of these evaluations.
- The need for further source tracing in Basins 52C and 53 was identified. The City will work with DEQ to assess the need and priority for further source tracing in these basins, based on consideration of inriver sediment data, results from the Port of Portland's T-4 Early Action Recontamination evaluation, and other factors. .

The results of the stormwater evaluation are intended to focus City resources and future source tracing activities. The results are not intended to be used by upland sites to limit the analyses of potential chemicals of concern. In addition, the results are not intended to evaluate potential risks or the significance of stormwater analytes discharging to the river through the City's conveyance system. The City recognizes that analytes not being carried forward for source tracing evaluation may warrant additional consideration in the context of inriver cleanup goals defined by the inriver feasibility study or to address recontamination concerns during remedial design. Based on the analyses presented in this report, the City will work with DEQ on source identification in two identified basins and will review new information as it becomes available to further inform the outfall basin RI/SCM reports and to guide its ongoing source investigation program.

This page intentionally left blank.

Contents

Executive Summary	ES-1
Contents	i
1 Introduction	1
1.1 Objective.....	1
1.2 Report Organization.....	2
1.3 Relationship to Other Documents.....	2
2 Background	4
3 Data Sources	6
3.1 City Data.....	6
3.1.1 Stormwater Grab Samples.....	6
3.1.2 Stormwater Composite Samples.....	6
3.2 Non-City Data.....	7
3.2.1 Stormwater Composite Samples.....	8
3.2.2 Stormwater Grab Samples.....	9
3.2.3 Stormwater Sediment Samples.....	9
4 Stormwater Data Evaluation	11
4.1 Overview of Stormwater Data Evaluation Approach.....	11
4.2 Stormwater Screening.....	11
4.3 Statistical Analyses.....	12
4.4 Selection of Analytes for City Outfall Basin Assessments.....	13
5 Stormwater Basin Assessments	15
5.1 Assessment Methodology and Rationale.....	15
5.2 Results.....	17
5.2.1 Basins Where Further Source Tracing is Not Planned.....	17
5.2.2 Basins Where Further Source Tracing is Not Recommended at This Time.....	18
5.2.3 Basins Where Further Source Tracing May Be Needed.....	18
6 Findings and Conclusions	19
6.1 Further Source Tracing in City Outfall Basins.....	19
6.2 Next Steps.....	20
7 References	23

Appendices

Appendix A: 2007-2008 City Outfall Stormwater Data Summary Report

Appendix B: Outfall 19 MS4 Program Monitoring Documentation

Appendix C: Harborwide Stormwater Data Evaluation

Appendix D: Stormwater Analytical Results by City Outfall Basin

Appendix E: LWG and Port Sediment Trap Data for City Outfall Basins

List of Tables

- Table 3-1. Portland Harbor Outfall Basin Data Sources
- Table 4-1. Stormwater Analytes Selected for Statistical Evaluation
- Table 4-2. Source Tracing Categories for Selected Stormwater Analytes in City Outfall Basins
- Table 4-3. Assessment of Stormwater Analytes Identified in City Outfall Basins
- Table 5-1. Summary of Upland Site and Source Investigation Information in City Outfall Basins
- Table 5-2. Source Tracing Recommendations for City Outfall Basins
- Table 6-1. Summary of City Outfall Basin Source Tracing Categorization for Selected Analytes

List of Figures

- Figure 1-1. City Outfall Basin Evaluation Process
- Figure 2-1. Drainage Overview
- Figure 3-1a. Basins Sampled, River Miles 02 to 05
- Figure 3-1b. Basins Sampled, River Miles 05 to 08
- Figure 3-1c. Basins Sampled, River Miles 08 to 11

Abbreviations and Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
BEHP	di(2-ethylhexyl)phthalate or bis(2-ethylhexyl)phthalate
BES	City of Portland Bureau of Environmental Services
City	City of Portland
COI	contaminant of interest
CSM	conceptual site model
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DDx	sum of DDD, DDE and DDT
DEQ	Oregon Department of Environmental Quality
DOC	dissolved organic carbon
ECSI	Environmental Cleanup Site Information
EPA	U.S. Environmental Protection Agency
FS	feasibility study
FSP	field sampling plan
FSR	field sampling report
FY	fiscal year
GE	General Electric
IGA	Intergovernmental Agreement
ISA	initial study area
JSCS	Joint Source Control Strategy
LWG	Lower Willamette Group
µg/L	micrograms per liter
mg/L	milligrams per liter
MRL	method reporting limit
MS4	Municipal Separate Storm Sewer System
NA	not applicable
NFA	no further action
NPDES	National Pollutant Discharge Elimination System
OAR	Oregon Administrative Rules
OF	Outfall
ORS	Oregon Revised Statutes
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyls
Port	Port of Portland
QAPP	Quality Assurance Project Plan

RA	risk assessment
RI	remedial investigation
RM	river mile
ROD	Record of Decision
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SCD	source control decision
SCM	source control measures
SLV	screening level value
Study Area	Portland Harbor Study Area
TBD	to be determined
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TS	total solids
TSS	total suspended solids
UIC	underground injection control

1 Introduction

This report presents an evaluation of the stormwater analytical results collected from City of Portland (City) stormwater outfalls discharging to the Willamette River within the Portland Harbor Study Area (Study Area). City stormwater systems convey stormwater draining from industrial, commercial, residential, and undeveloped lands to the Willamette River. In 2003, the City and the Oregon Department of Environmental Quality (DEQ) entered into an Intergovernmental Agreement (IGA) to collaborate on the identification and control of upland contaminant sources to City stormwater conveyance systems discharging to the Portland Harbor Study Area. The City has been conducting remedial investigations of City outfall basins (City of Portland Outfall Project), in accordance with the IGA, to assist with the identification and implementation of source control measures (SCM). These efforts are part of the DEQ-led upland environmental investigations and source control work being conducted in conjunction with the U.S. Environmental Protection Agency's (EPA) in-water Portland Harbor remedial investigation / feasibility study (RI/FS).

During the course of their respective Portland Harbor related investigations, the City, the Lower Willamette Group (LWG), and the Port of Portland (Port) collected stormwater and inline sediment trap data from 25 City outfall basins, at locations near the outfalls. This report provides an evaluation of these data to identify basins where significant sources may be present but have not been identified for source control measures. This information will be utilized to prioritize further City conveyance system source tracing.

1.1 Objective

This report presents the results of an outfall basin data analysis conducted to identify City outfall basins discharging to the Study Area where additional source tracing is needed. The evaluation steps were:

1. Screen stormwater data collected from City stormwater conveyance systems to identify a list of analytes for statistical analysis and potential source tracing activities.
2. Perform a statistical analysis of harborwide stormwater concentrations for the identified list of analytes using stormwater data from City and non-City stormwater conveyance systems discharging to the Willamette River within the Study Area to assess the relative significance of observed analyte concentrations.
3. Evaluate the results of the statistical analysis for City outfall basins, considering information on upland sites (known or potential sources), stormwater solids data, and other factors, to assess the need for additional source tracing in City outfall basins that discharge to the Portland Harbor.

Information presented in this report will also be used to support development of the outfall basin RI/SCM reports (see Section 1.3).

1.2 Report Organization

The report is divided into the following sections:

- *Section 2: Background*
This section provides the overall context for the report, including a description of the City's outfall basin RI/SCM process and an explanation of how the stormwater data evaluation fits into this overall process.
- *Section 3: Data Sources*
This section describes the sources of data evaluated for this report.
- *Section 4: Harborwide Stormwater Evaluation*
This section presents the results of screening and statistical analysis of harborwide stormwater data discharging to the Portland Harbor to identify City outfall basins with potentially significant concentrations of one or more analytes in stormwater discharges. The analytes identified for potential source tracing are carried forward into the basin assessments presented in Section 5.
- *Section 5: Stormwater Basin Assessments*
This section presents a basin-by-basin assessment of the stormwater analytes identified for potential source tracing. The basin assessments consider stormwater solids data, known potential upland sources, and other information to identify basins where additional source tracing efforts may be needed.
- *Section 6: Findings and Conclusions*
This section summarizes findings and conclusions regarding the need for additional source tracing activities within specific City outfall basins.

1.3 Relationship to Other Documents

In 2004, the City developed the *Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project* (Programmatic WP) (CH2M Hill, 2004), which included a structured, weight-of-evidence evaluation of City outfall basins that discharge stormwater to the initial study area (ISA) designated for the Portland Harbor Superfund Site to prioritize each basin for source investigation. Since that time, several technical memoranda and reports have been submitted to DEQ under the IGA that document the City's investigations of its stormwater conveyance systems.

Information in these documents and this report will support the development of the City's outfall basin RI/SCM reports, required under the IGA. The process employed by DEQ and the City to evaluate and control sources to City outfall basins is depicted conceptually in Figure 1-1. The RI/SCM reports will integrate City basin investigation findings, upland site stormwater pathway evaluations conducted under DEQ oversight,

and other pertinent data to summarize how sources have been identified and controlled through the respective authorities of DEQ and the City. The Basin RI/SCM process will be informed by the inriver remedial investigation, risk assessment (RA), and feasibility study (FS) being completed by the LWG. Additional source control may be required in some basins before sediment cleanup occurs, if inriver FS or Remedial Design evaluations identify a potential for recontamination. Therefore, a Basin RI/SCM report is also intended to provide sufficient information to guide further source reduction efforts by the City and DEQ, if needed.

2 Background

In December 2000, a section of the Willamette River called the Portland Harbor (shown on Figure 2-1), was added to EPA's Superfund National Priority List. Potential sources of the contamination that led to the Superfund listing include overwater activities and upland releases. DEQ and EPA, under a February 2001 Memorandum of Understanding, developed the *Portland Harbor Joint Source Control Strategy*¹ (JSCS), which provides a framework for identifying, evaluating, and controlling sources of contamination to the River.

The JSCS also establishes contaminant screening level values (SLVs) for assessing the need for upland source evaluation and control and for prioritizing upland source control tasks. As the SLVs are not cleanup levels², an exceedance of an SLV does not necessarily indicate that the upland source of contamination poses an unacceptable risk to human or the environment, but does require further consideration of whether source control is needed. Screening results and consideration of other factors identified in the JSCS are used by DEQ to prioritize upland sites as high, medium, and low priority and to determine if source control is required. Medium priority sites undergo a site-specific weight-of-evidence evaluation to determine if source control measures are required, using both upland information and in-water data. Low priority sources are those for which source control measures will not be required unless determined necessary by the Portland Harbor RI/FS or Record of Decision (ROD).

The City's Portland Harbor Outfall Project is being conducted in accordance with the August 13, 2003 IGA between the City and DEQ for the remedial investigation and source control measure evaluation. The source control work under the IGA is a shared effort with DEQ to identify, evaluate, and control upland sources of discharges to the City stormwater conveyance system that might adversely affect sediment and surface water quality in Portland Harbor. The IGA identifies the following joint City/DEQ objectives:

- Identifying significant sources of contaminants to City-owned outfalls using the authorities of DEQ and the City.
- Collecting and evaluating sufficient data to determine if source control measures are needed for discharges to the City stormwater collection systems or whether existing source control measures are effective.
- Identifying and implementing source control measures for discharges to the City stormwater collection system, in accordance with the following provisions:
 - The City will identify permitted and unpermitted upland discharges to its public stormwater collection system and make recommendations as to where source control measures are appropriate for upland sites.

¹ The JSCS was finalized in December 2005 (DEQ/EPA, 2005) and updated in July 2007.

² The EPA Portland Harbor ROD(s) will establish contaminant specific cleanup levels for the Superfund Site using Applicable or Relevant and Appropriate Requirements (ARARs) or risk-based levels (DEQ/EPA, 2005).

- DEQ and the City, using their respective authorities, will implement or require appropriate source control measures.

Initial priorities for source investigation activities conducted by the City were identified through two sequential planning efforts. The first of these, the development of the Programmatic WP (CH2M Hill, 2004), included a structured, weight-of-evidence evaluation of City outfall basins that discharge stormwater to the ISA to prioritize each basin for source investigation. The additional outfall basins within the expanded Study Area have been prioritized informally for source investigation using a similar approach as that used in the Programmatic WP (results of the prioritization of the basins in the expanded Study Area will be submitted to DEQ in Spring 2010).

The objectives of City's outfall investigation work to date have been to identify significant upland sources with complete stormwater pathways in basins prioritized for source tracing³, to collect sufficient data in other basins to confirm that they are not significant pathways to the river, and to coordinate with DEQ on site investigations and implementation of source control measures under the City's and DEQ's respective authorities. The City has largely completed its source investigation work through a combination of data collection efforts, including the stormwater sampling described in this report and evaluation of upland site stormwater pathway data collected under DEQ oversight. Working collaboratively with DEQ under the IGA, the City has collected data that have supported the inclusion of additional sites in DEQ's Cleanup program, and supported the expansion of scopes of upland source investigation and source control activities at cleanup sites to address discharges to City conveyance systems.

The City's and DEQ's joint goal is to have significant sources of upland contamination to City stormwater conveyance systems identified before EPA's planned issuance of the ROD establishing cleanup goals for Portland Harbor, and to have these sources controlled before the inriver cleanup begins. This stormwater data evaluation report provides a basis for identifying City outfall basins where additional source tracing activities may or may not be needed and supports the development of the City outfall basins RI/SCM reports.

³ "Priority 1" and "Priority 2" basins, as identified in the Programmatic WP (CH2M Hill, 2004) and the forthcoming *Prioritization of Study Area Basins* report (BES, in progress).

3 Data Sources

The sources of the data evaluated in this report include the City's stormwater data collected in 2007 and 2008 for the City of Portland Outfall Project, stormwater data collected between 2006 and 2009 under the City's municipal stormwater discharge permit, and data collected and/or compiled by the LWG in 2007 and 2008 for City and non-City outfalls discharging to the Portland Harbor Study Area. These data sources are described below. The locations of City and non-City outfall basins included in the stormwater data evaluation are shown on Figures 3-1a, 3-1b, and 3-1c. Data sources, sample type(s), and chemical analyses for all data used in the evaluation are summarized by outfall basin in Table 3-1.

3.1 City Data

The City designed its stormwater sampling program to obtain data in support of the IGA objectives: to evaluate the status of ongoing source tracing activities, to confirm whether significant sources are discharging to City stormwater conveyance systems associated with the outfalls, and/or to verify that significant sources have been identified and controlled. Stormwater data for this project were collected in accordance with the project-specific *Fall 2007 Stormwater Grab Sampling and Analysis Plan* (BES, 2007a) and *Winter 2008 Stormwater Sampling and Analysis Plan* (BES, 2007b) (stormwater SAPs), and the *Amended Programmatic Quality Assurance Project Plan* (QAPP) (BES, 2007c) and *Amended Programmatic Sampling and Analysis Plan* (Programmatic SAP) (BES, 2007d) for collection of water and solids samples for the City of Portland Outfall Project. Additional data for the Outfall Project are obtained through other City monitoring programs, such as the stormwater conveyance system discharge monitoring conducted under the City's NPDES Municipal Separate Storm Sewer System (MS4) Discharge Permit. The types of samples collected by the City for use in the City of Portland Outfall Project are described below.

3.1.1 Stormwater Grab Samples

Seventeen City outfalls were each sampled during four storm events in the 2007/2008 wet season (see Table 3-1). The grab sampling location within each basin was chosen to represent as much of the drainage basin as possible and to avoid low-elevation areas susceptible to backup flow from the river. Descriptions of the grab sampling locations, sample collection dates and methods, storm events sampled, chemical analyses, and sampling results are presented in Appendix A.

3.1.2 Stormwater Composite Samples

Outfall Basin 53

The City collected flow-weighted composite stormwater samples from Basin 53 as part of the 2007/2008 stormwater sampling, in accordance with the Winter 2008 stormwater

SAP (BES, 2007b). The City's sampling location in Basin 53 was selected to be representative of discharges from the entire basin and to supplement the Basin 53 data set collected in 2007 by the Port (the Port's data collection activities are described in Section 3.2). Descriptions of the Outfall 53 sampling location, sample collection dates and methods, storm events sampled, chemical analyses, and flow-weighted composite sampling results are presented in Appendix A.

Outfall Basin 19

Stormwater discharges from the City's stormwater outfall system are authorized and regulated under MS4 Discharge Permit #101314, issued jointly to the City, Multnomah County, and the Port. To supplement data obtained through the source investigations under the IGA, the City's Outfall Project team uses information gathered from the MS4 program to evaluate potential upland sources and identify areas where further investigation may be needed. Stormwater from Basin 19 has been monitored during at least three storm events per year starting in fiscal year (FY) 1998/1999 to generate a long-term effectiveness measure of the City's Industrial Stormwater Program. Starting in FY 2005/2006, the list of constituents analyzed in samples collected at Outfall 19 was expanded to meet the objectives of both the MS4 program and the City of Portland Outfall Project. The Outfall 19 MS4 monitoring data have previously been reported to DEQ in the City's Annual MS4 permit reports (<http://www.portlandonline.com/bes/index.cfm?c=50289>). Data and additional documentation for the Outfall 19 MS4 monitoring are provided in Appendix B. The Outfall 19 MS4 data for FY 2005/2006 through FY 2008/2009 as previously reported to DEQ are incorporated into the stormwater data evaluation presented in this report.

3.2 Non-City Data

The primary source of non-City data used in this report is the LWG's Round 3 (including Rounds 3A and 3B) stormwater sampling, a component of the overall LWG RI/FS for the Portland Harbor. The purpose of the Round 3 stormwater data collection included evaluating the potential for sediment recontamination from stormwater discharge to the river after cleanup of the Portland Harbor has been completed (Anchor and Integral 2007a, 2008b).

The Round 3 stormwater evaluation activities were conducted in 2007 and 2008. Concurrent with the LWG's Round 3 stormwater sampling and analyses, the Port collected stormwater data in the vicinity of its Terminal 4 property (including in Outfall Basin 53) and General Electric (GE) collected stormwater data at the GE Decommissioning Facility. The LWG included the Terminal 4 and GE Decommissioning Facility stormwater sampling data in its Round 3A/3B Stormwater Data Report. Including these data sources, the LWG's Round 3 stormwater evaluation incorporated the results from the collection of: flow-weighted composite stormwater samples at 36 sampling locations (including 11 City outfall basins); grab stormwater samples at 10 of these sampling locations; and sediment trap samples at 32 of these locations. Table 3-1 lists the basins sampled, sample type(s), and chemical analyses for each sampling

location included in the LWG's Round 3A/3B stormwater evaluation. Figures 3-1a through 3-1c show the stormwater basins included in the Round 3 data evaluation.

The LWG's Round 3 stormwater and sediment sampling activities are briefly summarized below. Detailed descriptions of these data collection efforts are available in the following documents:

- *Round 3A Stormwater Sampling Field Sampling Plan* (FSP; Anchor and Integral 2007a),
- *Round 3A Stormwater Sampling Field Sampling Plan Addendum* (FSP Addendum; Anchor and Integral 2007b),
- *Round 2 Quality Assurance Project Plan Addendum 8* (QAPP; Integral 2007), *Round 3A Stormwater Sampling Rationale* (Anchor and Integral 2007c),
- *Round 3A and Round 3B Stormwater Sampling Field Sampling Reports* (FSRs; Anchor and Integral 2007d; Anchor and Integral 2008a), and
- *Round 3A and 3B Stormwater Data Report* (Anchor and Integral, 2008b).

The Port's Terminal 4 field sampling activities are detailed in the following documents:

- *Storm Water Evaluation Work Plan* (Ash Creek Associates/Newfields, 2007),
- *Field Sampling Procedures Report Storm Water Sampling Program Terminal 4 Upland Facility* (Ash Creek Associates/Newfields, 2009a),
- *Storm Water Source Control Evaluation Terminal 4 Slip 1 and Slip 3 Upland Facilities* (Ash Creek Associates/Newfields, 2009b), and
- *Terminal 4 Recontamination Analysis* (BBL, 2006).

The field sampling activities conducted at the GE Decommissioning Facility are detailed in four GE stormwater monitoring reports (AMEC, 2007a, 2007b, 2007c, and 2007d).

3.2.1 Stormwater Composite Samples

The LWG, Port, and GE composite stormwater sampling efforts are described below.

LWG Sampling Locations

The LWG collected flow-weighted composite stormwater samples at 27 selected sampling locations⁴ during Round 3A (conducted from February through July 2007) and Round 3B (conducted from November 2007 through February 2008). Nine City outfall basins were included in the LWG effort, and three to six samples were collected from each sampling location. The samples were collected using automated samplers as

⁴ Two of these locations are treated as a single sampling location; sample site WR-145 became obstructed and was therefore moved to site WR-142 following the first round of sampling (Anchor and Integral, 2008b).

described in the FSP (Anchor and Integral 2007a, 2007b) and submitted unfiltered for organic compound analyses and as filtered/unfiltered pairs for metals analyses.

Port of Portland Terminal 4

The Port conducted stormwater characterization at seven locations in the vicinity of its Terminal 4 facility to evaluate whether stormwater and stormwater solids may be a potential source for future adverse impact to the Willamette River by recontamination of river sediments after cleanup of the Portland Harbor (Ash Creek Associates/Newfields, 2007). As noted above, one of the Port's sampling locations represented stormwater discharge from City Outfall Basin 53; another represented City Outfall Basin 52C. Three to five flow-weighted composite stormwater samples were collected from each sampling location during the winter/spring 2007 storm season and the fall 2007/winter 2008 storm season.

GE Decommissioning Facility

During its source control evaluation of the GE Decommissioning Facility, GE collected flow-weighted composite stormwater samples at two locations (designated "Manhole 2" and "Sample Vault 1") discharging stormwater from the site to the City's Basin 17 stormwater conveyance system. A total of three storms were sampled at each location during the spring and fall of 2007 (AMEC, 2007a, 2007b, 2007c, and 2007d).

3.2.2 Stormwater Grab Samples

As part of the Round 3A/3B stormwater evaluation, the LWG collected grab samples from ten basins during one to two storm events in 2007. The purpose of the grab samples was to collect partitioning (chemical dissolved phase/suspended sediment) rather than loading data; to meet this objective, the grab samples were collected during the rising limb of the storm hydrograph to increase the likelihood of detecting the target analytes (Anchor and Integral 2007a). Three of the grab sampling locations were within City outfall basins (see Table 3-1). The sampling locations were selected based on general knowledge of site uses and potential contaminant sources (Anchor and Integral 2007c).

3.2.3 Stormwater Sediment Samples

Stormwater sediment traps were deployed at most of the stormwater sampling locations established for the LWG's Round 3 stormwater data evaluation (including the Port's Terminal 4 sampling locations). The objective was to obtain samples of suspended stormwater sediment to supplement the chemical loading evaluation. Sediment was collected from a total of 32 locations (including 11 City basins) during the Round 3 sampling activities; stormwater sediment trap samples were not collected at four locations (WR-4, WR-181/Basin Q, and the two GE Decommissioning Facility locations) because no feasible location was available to install the sediment traps (Anchor and Integral, 2008b). Each sediment trap was installed as close as possible to the automated stormwater sampler and was in place for a minimum duration of 3 months. For cases where insufficient sediment volume accumulated at a particular station, analyses were

selected in accordance with the analytical priorities established in the FSP (Anchor and Integral 2008b). The basins where stormwater sediment traps were installed and the associated chemical analyses for each sediment trap location are indicated on Table 3-1.

4 Stormwater Data Evaluation

This section summarizes the data evaluation and statistical process used to identify City outfall basins and associated stormwater analytes that may warrant further source tracing to identify potentially significant uncontrolled upland sources. This process was developed to supplement the JSCS screening process to differentiate potentially significant sources that may need immediate action from lower contributing sources. Additional technical information and detail regarding the evaluation methodology are provided in Appendix C.

4.1 Overview of Stormwater Data Evaluation Approach

A multiple-step process was used to evaluate the stormwater data from City outfall basins. The process included the comparison of stormwater analyte concentrations detected in City stormwater outfall basins to established criteria in order to select analytes for statistical evaluation. This screening is followed by statistical analyses of harborwide stormwater data collected by the City, LWG and others for City and non-City outfall basins discharging to the Study Area to provide an objective context for interpreting the potential significance of results. Concentrations in City basins at the higher

end of the spectrum can be compared to concentrations observed at known sources to help indicate where significant sources to the river may be present in City basins. The results of the stormwater data evaluation provide a basis for identifying City outfall basins where further source tracing may be needed for specific analytes. These analytes are carried forward into the basin-specific assessments of source-tracing needs presented in Section 5. This analysis does not evaluate the inriver sediment in the vicinity of City outfalls to determine if there is a complete pathway for upland contributions (e.g., an outfall may be identified for further source tracing even if there are no elevated sediment concentrations adjacent to the outfall).

Stormwater Data Evaluation Process

1. Stormwater Screening

Screen stormwater data for City outfall basins against JSCS SLVs to select analytes for harborwide statistical analysis.

2. Statistical Analyses

Categorize stormwater analytes in each basin by relative likelihood of having significant uncontrolled sources.

3. Identification of Basin Analytes

Apply additional reference values (e.g. DEQ background and NPDES benchmarks) to statistical results to generate analyte list per basin for further evaluation in Section 5.

4.2 Stormwater Screening

The first step in the evaluation process was to compare individual stormwater sampling event analyte detections to conservative JSCS SLVs (see Appendix A). Because the SLVs are conservative screening values selected to be protective of inriver receptors, application of these values to in-pipe media (stormwater and stormwater solids) results in the identification of analytes that in some cases are below estimated background

concentrations or concentrations from areas with no sources, such as Forest Park. Additionally, SLVs do not recognize state-authorized NPDES discharges to the City's system (i.e., metals benchmarks are one to two orders-of-magnitude higher than the SLVs) and therefore are not always useful in evaluating where uncontrolled sources may be present. For this evaluation, the SLVs were used for the purpose of identifying the list of analytes to include in the statistical analyses.

To account for the inherent variability in stormwater data, geometric mean concentrations were calculated for analytes detected at concentrations above the JSCS SLV in at least one sampling event in any City outfall basin⁵. The geometric mean was selected as an appropriate measure of stormwater outfall concentrations for the purposes of the harborwide statistical analysis. Tables summarizing the mean and geometric mean concentrations and additional rationale and assumptions pertaining to these calculations are presented in Appendix C. All analytes for which at least one basin geometric mean concentration exceeded the SLV (see Table 4-1 and Appendix D) were carried forward into the harborwide statistical analysis for all City basins, as discussed below.

Selection of Analytes for Statistical Evaluation

3. Screen individual stormwater event data points for City outfall basins against JSCS SLVs (Appendix A)
4. For any analyte >SLV in at least one sample, calculate arithmetic and geometric mean concentrations for each outfall basin (Appendix C, Attachment C-2)
5. Screen geometric mean concentrations for City outfall basins against JSCS SLVs (Appendix D).
6. Analytes with geometric mean concentrations >JSCS SLVs were evaluated in the harborwide statistical analysis (Appendix C).

4.3 Statistical Analyses

A statistical mixture model was used for the analysis of the harborwide stormwater outfall data. A detailed description of the model (including the key assumptions, limitations, and statistical output) is provided in Appendix C. The model was used to analyze the distribution of the geometric mean concentrations for harborwide outfall basins and to assign each outfall basin to one of three concentration groups (i.e., lower, moderate, or higher). This concept is consistent with the JSCS method for identifying low, medium, and high priority sites. Statistical analysis was performed for the analytes selected based on the data screening described in Section 4.2 (unless the number of samples was insufficient to conduct a valid statistical analysis; see Table 4-1). Graphs of the results of the statistical evaluation are included in Appendix C.

Use of the full harborwide data set in the statistical evaluation allowed comparison of stormwater concentrations in City outfall basins to other stormwater discharges in the Portland Harbor Study Area. Source tracing categories were statistically identified based on specific outfall concentrations relative to harborwide concentration levels. For

⁵ See data tables in Appendices A and B for data collected by the City; see Anchor and Integral 2008b for City outfall basin data collected by others.

each analyte included in the statistical evaluation, each outfall basin was assigned to one of three source tracing categories:

- **Category 1.** Stormwater analyte concentrations in these basins are lower relative to stormwater concentrations harborwide (i.e., relative to other private and public outfalls) and are least likely to have significant uncontrolled sources. The need for additional source tracing in City outfall basins within this category is low.
- **Category 2.** Stormwater analyte concentrations in these basins generally fall within a narrow moderate range and may or may not have significant uncontrolled sources. The need for additional source tracing in City outfall basins within this category should be evaluated further, unless otherwise indicated (see discussion below in Section 4.4).
- **Category 3.** Stormwater analyte concentrations in these basins are higher relative to harborwide concentrations and are the most likely to have significant uncontrolled sources. The need for additional source tracing in City outfall basins in this category is evaluated.

The break lines defining Categories 1 through 3 for each analyte are described and shown on the graphs in Appendix C. Table 4-2 summarizes the resulting distributions of source tracing categories by analyte and City outfall basin. Analytes identified as Category 2 or 3 source tracing categories were further evaluated to assess whether additional source tracing is needed in Section 4.4.

4.4 Selection of Analytes for City Outfall Basin Assessments

The source tracing categories defined in Section 4.3 are based on harborwide concentration distributions. Due to the conservative assumptions in the statistical analysis (selection of analytes for the statistical analyses, assumptions in calculating the geometric mean concentrations, etc.) analytes identified as Category 2 or 3 were further evaluated to identify those basin-specific analytes that may indicate the presence of significant uncontrolled upland sources. Basin geometric mean concentrations were compared to relevant screening considerations (e.g., DEQ surface water background concentrations, factors of exceedance of SLVs, and industrial stormwater permit benchmark concentrations).

Selection Steps

1. For each City outfall basin, screen the geometric mean concentration of each Group 2 and 3 analyte against the following, as applicable:
 - a. DEQ background concentration,
 - b. 10x the JSCS SLV, and
 - c. 0.1x the NPDES benchmark concentration.
2. For each City outfall basin, carry forward all analytes that exceed applicable screening criteria (Table 4-3) to the basin-specific assessments (Section 5).

Analytes meeting one or more of the following conditions are considered unlikely to present a significant uncontrolled source and were not carried forward in the basin assessment for a given City outfall basin:

- The geometric mean concentration for a given City outfall basin was less than DEQ's background surface water concentration (DEQ, 2002) (metals only).
- The geometric mean concentration for a given City outfall basin was within one order of magnitude of the JSCS SLV. As most SLVs are conservative for stormwater-related media, a ten-fold exceedance was not considered a high priority for further source tracing.
- The geometric mean concentration for a given City outfall basin was less than 10 percent of the NPDES 1200Z benchmark concentration (applies only to copper, lead, and zinc).
- Total PAHs⁶ are not carried forward if all individual PAH compounds are less than one order of magnitude greater than their respective JSCS SLVs.

Table 4-3 provides a basin-by-basin summary of the screening considerations and resulting analytes that were carried into the basin assessments presented in Section 5.

⁶ The JSCS does not establish an SLV for total PAHs. Individual PAH compounds, as well as total PAHs, were statistically evaluated and assessed through further screening; however, only total PAHs were carried forward to the basin-specific assessments and potential future source tracing activities. PAH compounds typically have common sources (e.g., petroleum oils and coal-based products, combustion, fuels, asphalt, wood preservatives, and automobile fluids), and individual PAH compounds do not typically occur alone.

5 Stormwater Basin Assessments

This section evaluates the results of the statistical analysis of stormwater data described in Section 4 in the context of basin-specific information such as known upland sources, stormwater pathway investigation status, and sediment trap sampling results, to identify City outfall basins within the Study Area where additional source tracing efforts may be needed.

5.1 Assessment Methodology and Rationale

The assessment of each City outfall basin involves three primary evaluation steps:

Step 1: Identification of Stormwater Analytes for Further Evaluation

As discussed in Section 4, basin-specific stormwater analytes for each City outfall basin were identified by the statistical evaluation of harborwide stormwater concentrations and comparison to additional screening criteria. These analytes are summarized in Table 4-3 and carried forward to Step 2.

Step 2: Evaluation of Identified Stormwater Analytes in the Context of Relevant Basin Information

This step evaluates basin-specific source information for the stormwater analytes carried forward from Step 1. It considers upland site information, City source investigation findings, LWG and Port sediment trap results (as available) and comparisons of stormwater concentrations to industrial stormwater permit benchmarks to determine source-tracing needs. The evaluation steps are described below.

➤ *Information on Potential Upland Sources*

Information on identified upland sites (potential sources) discharging to the City's stormwater conveyance system are inventoried to assess whether known sources may account for the presence of the identified stormwater analytes.

The upland facilities identified as potential sources for the purpose of this evaluation include DEQ Cleanup Program sites, as listed in DEQ's Environmental Cleanup Site Information (ECSI) database, and facilities permitted by DEQ under the NPDES industrial stormwater discharge (1200Z) permit program due to stormwater exposures to industrial operations. Although limiting the list of potential sources to those meeting either of these criteria may omit some potential sources (such as sites with unidentified contamination issues, sites that do not require an NPDES permit, or sites that have had spills or that may illicitly discharge contaminants to the stormwater conveyance system), the list for each basin is intended to capture the known and likely potential sources based on

available information to facilitate the basin evaluations. These potential sources are listed by basin in Table 5-1.

For ECSI sites, Table 5-1 lists the current status under the DEQ cleanup program and indicates whether a stormwater pathway evaluation has been (or is being) conducted under DEQ oversight. This information has bearing on source tracing status; for example, if a site has been remediated and a stormwater pathway evaluation has been completed, the site may not be a significant ongoing source of contaminants to the conveyance system. Likewise, if stormwater pathway evaluations are currently underway at one or more upland sites within a given basin, it may not be possible to fully assess whether all significant sources within a basin have been identified until the stormwater pathway evaluations are completed.

➤ *City Stormwater Conveyance System Source Investigations*

Table 5-1 also lists source investigations that the City has conducted to date in each City outfall basin. For some investigations, the results have been evaluated and reported to DEQ, while for others the evaluation is still in progress. Acknowledging the fact that basins with larger industrial areas typically warrant more extensive source investigations compared to smaller basins with fewer upland sites, the extent to which the conveyance system has been investigated provides a general indication of the progress that has been made toward tracing the contaminant sources in each basin. This information, together with information on the upland sites, provides the basis for whether stormwater analytes under evaluation are likely accounted for by the identified sources (see Table 5-1, right-hand column ["Stormwater Analytes Likely Accounted for by Identified Potential Sources?"]). General findings from City source investigations were also considered in the basin assessment conclusions (see Table 5-2).⁷

➤ *Sediment Trap Solids Data*

For those analytes not available in stormwater data, LWG and Port sediment trap solids data (collected in City outfall basins 16, 18, 19, 22, 22B, 22C, 49, 52C, 53, M-1 and M-2) are incorporated into the basin assessments to evaluate whether these additional analytes need further source tracing efforts. Analytes detected in sediment trap solids samples are evaluated with regard to the JSCS Toxicity SLVs. If an analyte exceeds the JSCS Toxicity SLV in sediment trap solids but was not analyzed in stormwater, it is added to the list of analytes evaluated to determine whether further source tracing may be needed (see Table 5-2). The LWG and Port sediment trap data for City outfall basins are summarized in Appendix E.

⁷ The City source investigation findings will be incorporated in detail in the outfall basin RI/SCM reports. The source investigation data helps identify the general location of potential sources within a basin and may be combined with upland site information to suggest where significant contributions to the shared conveyance system occur.

➤ *Comparison to NPDES 1200Z Permit Benchmarks*

NPDES industrial stormwater permits establish benchmark concentrations for certain contaminants, identifying a performance threshold for these constituents. Discharges in excess of permit benchmarks warrant site response under the terms of the 1200Z permits. Among the parameters listed under the permit benchmarks are three metals (copper, lead, and zinc) that also are analytes included in the City stormwater data evaluation. The associated NPDES permit benchmarks are 100 µg/L for copper, 400 µg/L for lead, and 600 µg/L for zinc. For basins receiving discharges under NPDES 1200Z permits, the stormwater concentrations are compared to the applicable permit benchmarks (see Table 5-2). Stormwater analytes with concentrations less than the permit benchmarks are not recommended for additional source tracing in these basins at this time.

Step 3: Identification of Source Tracing Recommendations by Analyte

The information developed through the evaluation conducted in Step 2 is synthesized in Step 3 to provide source tracing recommendations by analyte for each basin. The conclusions and supporting rationale for source tracing recommendations are summarized in Table 5-2.

5.2 Results

Results of the basin assessment are presented in Tables 5-1 and 5-2. Table 5-2 summarizes conclusions with regard to the need for further source tracing efforts by the City in each basin evaluated. Based on these conclusions, each basin is placed into one of the following three groups: (1) basins for which no further source tracing is planned; (2) basins where further source tracing is not recommended at this time but may be needed in the future (depending on the outcome of current upland stormwater pathway evaluations and/or evaluation of City source investigation results); and (3) basins where further source tracing may be needed. The following table lists the basins that are categorized into each of these three groups:

Further Source Tracing Not Planned	Further Source Tracing Not Recommended At This Time	Further Source Tracing May Be Needed
22C, 22D, 45, 47, 48, 49, 50, 52A, M-2, M-3, S-2, S-5, S-6	16, 18, 19, 22, 22B, 46, 52, 53A, M-1, S-1	52C, 53

The basin assessment outcomes by group are summarized below. For further detail, refer to Table 5-2.

5.2.1 Basins Where Further Source Tracing is Not Planned

The basin assessments results indicate that no further source tracing is needed for 13 City outfall basins. Factors supporting this conclusion include:

- No stormwater analytes were identified for further evaluation based on the results of the harborwide statistical analysis and selection process described in Section 4, and no additional analytes were detected at concentrations greater than JSCS Toxicity SLVs in the associated Port/LWG sediment trap solids samples (where collected).
(Applies to Basins 22C, 22D, 47, 48, 49, 50, 52A, M-2, M-3, S-2 and S-5)
- The only analyte identified for further evaluation in stormwater is a permitted metal, and stormwater concentrations did not exceed the corresponding permit benchmarks.
(Applies to Basins 45 and S-6)

If new information arises that indicates the presence of significant unidentified sources to the stormwater conveyance system in any of these basins, the City will reevaluate the need for further source tracing in the basin and undertake further action as appropriate.

5.2.2 Basins Where Further Source Tracing is Not Recommended at This Time

For the ten City outfall basins in this group, analytes were identified for further evaluation in stormwater or exceeded JSCS Toxicity SLVs in sediment trap solids. Further source tracing efforts in these basins are considered premature at the current time because pending information from ongoing or recently completed upland investigations will inform the need for additional source tracing activities. The following factors support that further source tracing activities are not needed at this time:

- Stormwater pathway evaluations are currently underway at one or more upland sites in the City outfall basin. Analytes identified for further evaluation in this report have been found on upland site(s) or are under investigation. Results of these evaluations may indicate whether source control will be required by DEQ at these sites or if further source tracing is needed to identify other potential sources. (Applies to all basins in this category)
- The City has conducted one or more source investigations in the basin post-dating the 2007–2008 stormwater sampling. Evaluations of the results are in progress. (Applies to Basins 16, 18, 52, and 53A)
- Extensive source control measures are in the process of being implemented by upland sites in the basin; data collected following implementation of these source control measures will indicate whether further source tracing is needed. (Applies to Basins 18, 19, 22, 22B, 53A, and M-1)

5.2.3 Basins Where Further Source Tracing May Be Needed

Basin assessment results for Basins 52C and 53 indicate that further source tracing may be needed in these basins. In both these basins, PCBs were identified for further source tracing evaluation in stormwater and no sources of these analytes have been identified. A single pesticide was also identified for further source tracing in Basin 53.

6 Findings and Conclusions

The evaluation of stormwater data from City outfall basins discharging to the Portland Harbor Study Area, in the context of a harborwide stormwater data set and other relevant information (e.g., sediment trap data and information on upland sites/sources), provides a comprehensive basis for assessing the need for additional source tracing in City outfall basins and comprises a major component of the City's overall basin RI process (see Figure 1-1). The results of the evaluation indicate significant progress by the City, DEQ, and upland sites in identifying and controlling sources of contaminants to the City's shared stormwater conveyance systems within the Study Area.

This section presents key findings and conclusions regarding the need for additional source tracing activities. It also discusses the recommended actions by the City and/or DEQ to complete the identification and control of significant upland sources to City outfall basins before the EPA-directed Portland Harbor inriver cleanup begins.

Findings and conclusions of the statistical evaluation and source tracing categorization of harborwide stormwater data include:

- Of the 25 City outfall basins included in the stormwater data evaluation, only two are recommended for further evaluation of source tracing investigations at this time.
- Most analytes in City outfall basins are identified as source tracing Category 1 (i.e., least likely to have significant unidentified sources) as shown in Table 6-1.
- City outfall basins with stormwater source tracing Category 2 and 3 analytes typically have known or potential upland sources of the analytes identified. Most of these upland sources are in the process of conducting source control evaluations under DEQ oversight, as discussed in Section 5.
- Stormwater analyte concentrations in City outfall basins are predominantly on the lower range of the spectrum of harborwide stormwater concentrations.

The City's approach for identifying outfall basins for further source tracing is consistent with DEQ's current approach for identifying the priority for stormwater discharges in Portland Harbor under the JSCS (DEQ, 2010).

6.1 Further Source Tracing in City Outfall Basins

The source-tracing status of the City outfall basins, as identified through the basin-specific assessments discussed in Section 5 and summarized in Table 5-2, fall into three general groups:

- *No further City source tracing is planned* – This group, comprising the majority (13) of City outfall basins evaluated, represents basins for which stormwater analyte concentrations are low and which are least likely to include significant, uncontrolled upland sources. The City does not anticipate conducting further

source tracing activities in the stormwater conveyance systems within these basins.

- *No further source tracing is recommended at this time (but may be needed in the future)* – This group, comprising ten City outfall basins, generally represents basins where data analysis indicates contaminant sources are present but for which potential upland sources have been identified and are in the process of conducting source control evaluations under DEQ oversight. As indicated in Table 5-2, the City plans to review findings of the source control evaluation investigations of the identified sites. Whether additional City source tracing efforts, DEQ-required source control measures at upland sites, or DEQ site discovery actions are needed depends largely on the findings of the ongoing source control evaluations. Therefore, the City does not plan to conduct further source tracing in the stormwater conveyance systems within these basins at this time and will determine the need for further source tracing once additional information is available.
- *Further source tracing may be needed* – This group, comprising two City outfall basins (OF 52C and OF 53), represents basins where contaminants are present in stormwater at levels that indicate uncontrolled sources may exist within the basin or that nearby sources may be impacting stormwater quality in the basins (e.g., air deposition, particle tracking) and for which potential sources have not been identified. Additional City and DEQ evaluation is recommended to determine whether additional source tracing and/or DEQ site discovery efforts are needed.

It is important to note that source tracing recommendations have been developed in this report without review of relevant inriver data. For all basins where data indicate that source tracing should be considered now or following completion of investigation and control of known sources, inriver sediment data will be evaluated to ascertain the potential significance of the outfall as a contaminant pathway. The City recognizes that analytes not being carried forward for source tracing evaluation may warrant additional consideration in the context of inriver cleanup goals defined by the inriver FS, or to address recontamination evaluation concerns during remedial design.

6.2 Next Steps

The need for source tracing in Basins 52C and 53 was identified. The City will work with DEQ to assess the need and priority for further source tracing in these basins. The scope and timing of potential future source tracing activities will consider:

- Inriver sediment data (which are not elevated in the vicinity of these outfalls);
- Results from the Port of Portland's T-4 Early Action recontamination evaluation for stormwater discharges from various outfalls including OF 52C and OF 53;
- Results from upland investigations that may inform whether air deposition or particle tracking may be contributing to these basins; and

- Basin size, land use, and stormwater concentrations relative to DEQ upland source control decisions.

In addition, the City is currently initiating watershed planning activities along the east shore of the river, including the St. Johns area where Basins 52C and 53 are located, and will be identifying opportunities for improving stormwater management to further reduce pollutant contributions to the river.

For the remainder of the City outfall basins included in the stormwater data evaluation, the City will continue to work with DEQ to track the progress of ongoing source control evaluations at upland sites and will identify any further source investigation efforts that may be needed based on the results of these evaluations. The results of the stormwater data evaluation presented in this report will also assist DEQ in identifying upland site stormwater pathway evaluation and source control needs in City outfall basins and will support development of the basin RI/SCM reports that will be submitted to DEQ under the terms of the IGA.

Overall, the findings of this stormwater data evaluation indicate the collaborative work conducted by the City and DEQ under the IGA has been effective in identifying and characterizing upland sources of analytes to City stormwater outfall basins. The City expects that concentrations of contaminants to the City stormwater conveyance systems will be reduced by the ongoing and future implementation of site source control measures, as sites complete their source control evaluations under DEQ oversight. Reductions in contaminant discharges to City conveyance systems have also been achieved by other City stormwater and watershed health programs, including City Industrial Stormwater programs, water quality requirements for new and redeveloped sites under the Stormwater Management Manual, implementation of the Portland Watershed Management Plan, and other green infrastructure and incentive programs. These programs will continue to be implemented to maintain current gains and to further reduce overall loading as redevelopment and other changes across the landscape occur.

As noted in Section 5, many upland sites could be contributing contaminants to City stormwater conveyance systems, but the focus of this evaluation has been to assess basin stormwater data in the context of upland site information to identify basins where significant uncontrolled sources may be present but have not been accounted for. The City recognizes that future stormwater and solids data collected from any of the upland sites or City stormwater conveyance systems, as well as developments in the larger Portland Harbor RI/FS process, will help to refine the basin source tracing conclusions presented in this report. The City will review new information as it becomes available to guide its ongoing source investigation program. The City recognizes that analytes not being carried forward for source tracing evaluation may warrant additional consideration in the context of inriver cleanup goals defined by the inriver FS or to address recontamination concerns during remedial design.

The results of the stormwater evaluation are intended to focus City resources and future source tracing activities. The results are not intended to be used by upland sites to limit

the analyses of potential chemicals of concern. In addition, the results are not intended to evaluate potential risks or the significance of stormwater analytes discharging to the river through the City's conveyance system. Based on the analyses presented in this report, the City will work with DEQ on source identification in two identified basins and will review new information as it becomes available to further inform the outfall basin RI/SCM reports and to guide its ongoing source investigation program.

7 References

- AMEC, 2007a. April 2007 Storm Water Monitoring Report, GE Energy – Energy Services, Portland Inspection & Repair Service (I&RS) Center, 2727 NW 29th Avenue, Portland, Oregon. Submitted to Oregon DEQ. August 2007.
- AMEC. 2007b. June 2007 Storm Water Monitoring Report, GE Energy – Energy Services, Portland Inspection & Repair Service (I&RS) Center, 2727 NW 29th Avenue, Portland, Oregon. Submitted to Oregon DEQ. October 2007.
- AMEC. 2007c. October 2007 Storm Water Monitoring Report, GE Energy – Energy Services, Portland Inspection & Repair Service (I&RS) Center, 2727 NW 29th Avenue, Portland, Oregon. Submitted to Oregon DEQ. February 2008.
- AMEC. 2007d. November 2007 Storm Water Monitoring Report, GE Energy – Energy Services, Portland Inspection & Repair Service (I&RS) Center, 2727 NW 29th Avenue, Portland, Oregon. Submitted to Oregon DEQ. May 2008.
- Anchor Environmental, L.L.C. (Anchor) and Integral Consulting, Inc. (Integral). 2007a. Portland Harbor Remedial Investigation/Feasibility Study (RI/FS). Round 3A Field Sampling Plan – Stormwater Sampling. Prepared for the Lower Willamette Group, Portland, OR. Anchor Environmental, L.L.C., Seattle, WA. March 1, 2007.
- Anchor and Integral. 2007b. Portland Harbor RI/FS. Round 3A Stormwater Field Sampling Plan Addendum. Prepared for the Lower Willamette Group, Portland, OR. Anchor Environmental, L.L.C., Seattle, WA. November 9, 2007.
- Anchor and Integral. 2007c. Portland Harbor RI/FS. Round 3A Stormwater Sampling Rationale. Prepared for the Lower Willamette Group, Portland, OR. Anchor Environmental, L.L.C., Seattle, WA. March 1, 2007.
- Anchor and Integral. 2007d. Portland Harbor RI/FS. Round 3A Stormwater Sampling Field Sampling Report. Prepared for the Lower Willamette Group, Portland, OR. Anchor Environmental, L.L.C., Seattle, WA. November 30, 2007.
- Anchor and Integral. 2008a. Portland Harbor RI/FS. Round 3B Stormwater Sampling Field Sampling Report. Prepared for the Lower Willamette Group, Portland, OR. Anchor Environmental, L.L.C., Seattle, WA. June 13, 2008.
- Anchor and Integral. 2008b. Portland Harbor RI/FS. Round 3A and 3B Stormwater Data Report. Prepared for the Lower Willamette Group, Portland, OR. Anchor Environmental, L.L.C., Seattle, WA. September 2008.
- Ash Creek Associates/Newfields. 2007. Storm Water Evaluation Work Plan Terminal 4 Slip 1 and Slip 3 Upland Facilities. Prepared for the Port of Portland. June 2007.

- Ash Creek Associates/Newfields. 2009a. Field Sampling Procedures Report Storm Water Sampling Program Terminal 4 Upland Facility. Prepared for the Port of Portland. February 2009.
- Ash Creek Associates/Newfields. 2009b. Storm Water Source Control Evaluation Terminal 4 Slip 1 and Slip 3 Upland Facilities. Prepared for the Port of Portland. September 2009.
- BBL. 2006. Terminal 4 Recontamination Analysis. (Appendix N to *Engineering Evaluation/Cost Analysis, Port of Portland Terminal 4 Early Action*, Blasland, Bouck & Lee, Inc, May 31, 2005.) Blasland, Bouck & Lee, Inc. November 2006.
- BES. 2007a. City of Portland Outfalls Project, Fall 2007 Stormwater Grab Sampling and Analysis Plan. Letter to K. Tarnow (Department of Environmental Quality) from L. Scheffler. August 23, 2007.
- BES. 2007b. City of Portland Outfalls Project, Winter 2008 Stormwater Sampling and Analysis Plan. Letter to K. Tarnow (Department of Environmental Quality) from L. Scheffler. December 20, 2007.
- BES. 2007c. Amended Programmatic Quality Assurance Project Plan, City of Portland Outfalls Project, Revision to Programmatic Source Control Remedial Investigation Work Plan Appendix D. Prepared by the City of Portland, Bureau of Environmental Services, Portland Harbor Program. August 2007.
- BES. 2007d. Amended Programmatic Sampling and Analysis Plan, City of Portland Outfalls Remedial Investigation/Source Control Measures Project. Prepared by the City of Portland, Bureau of Environmental Services, Portland Harbor Program. August 2007.
- BES. In progress. Prioritization of Study Area Basins, City of Portland Outfall Project.
- CH2M Hill. 2004. Programmatic Source Control Remedial Investigation Work Plan for the City of Portland Outfalls Project. Prepared for the City of Portland Bureau of Environmental Services. March 19, 2004.
- DEQ. 2002. Default background concentrations for metals. Memorandum from DEQ's Toxicology Workgroup to DEQ Cleanup Project Managers. Dated October 28, 2002.
- DEQ. 2010. Stormwater Source Control Strategy: Site Specific Source Control Decisions. Environmental Law Education Center 2010 Environmental Cleanup Conference. January 8, 2010. Karen Tarnow, Portland Harbor Stormwater Coordinator, Oregon Department of Environmental Quality.
- DEQ and EPA. 2005 (amended 2007). Portland Harbor Joint Source Control Strategy. Prepared by the Oregon Department of Environmental Quality and the U.S.

Environmental Protection Agency. December 2005 (Table 3-1 updated July 2007).
Available online at
<http://www.deq.state.or.us/lq/cu/nwr/PortlandHarbor/jointsource.htm>.

Integral. 2007. Portland Harbor RI/FS Round 2 Quality Assurance Project Plan
Addendum: Round 3A Stormwater Sampling. Prepared for the Lower Willamette
Group, Portland, OR. Integral Consulting Inc., Mercer Island, WA. March 1, 2007.

Integral Consulting Inc., Windward Environmental LLC, Kennedy/Jenks Consultants,
and Anchor Environmental, L.L.C. 2009. Portland Harbor RI/FS, Draft Remedial
Investigation Report. Prepared for the Lower Willamette Group. October 27, 2009.

This page intentionally left blank

Tables

This page intentionally left blank

Figures

This page intentionally left blank

Appendix A

This page intentionally left blank

This page intentionally left blank