Lower Duwamish Waterway

Outfall Inventory Update
January 2012 – February 2014

Prepared for

DEPARTMENT OF ECOLOGY
State of Washington

Toxics Cleanup Program
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Figures

Outfall Inventory provided as a separate Excel spreadsheet.

List of Acronyms

CSO	combined sewer overflow
Ecology	Washington State Department of Ecology
EOF	emergency overflow
FS	feasibility study
GIS	Geographic Information System
ID	identification
LDW	Lower Duwamish Waterway
NAD	North American Datum
NPDES	National Pollutant Discharge Elimination System
PARIS	Ecology's Water Quality Permitting and Reporting Information System
PCB	polychlorinated biphenyl
RI	Remedial Investigation
RM	river mile
SAIC	Science Applications International Corporation
SCAP	Source Control Action Plan
SD	storm drain
SIC	standard industrial classification
SL	screening level
SPU	Seattle Public Utilities
SVOC	semivolatile organic compound
SW	stormwater
SWPPP	Stormwater Pollution Prevention Plan
TOC	total organic carbon

1.0 Introduction

In 2011, the Washington State Department of Ecology (Ecology) tasked Leidos (formerly Science Applications International Corporation [SAIC]) to conduct an outfall inventory and sediment sampling study to provide a better understanding of the relationship between stormwater/combined sewer outfalls and surface sediment contamination in the Lower Duwamish Waterway (LDW). As part of this study, SAIC/Leidos prepared a series of Outfall Inventory spreadsheets that summarized available information about stormwater outfalls and combined sewer overflows (CSOs), facilities in the LDW basin with stormwater discharge permits, sediment samples collected within close proximity (50 to 100 feet) of the outfalls, and stormwater and storm drain solids samples collected in the drainage basin discharging to each outfall.

A brief summary of the development of the Outfall Inventory is presented below:

- In 2003, Herrera Environmental Consultants (Herrera) conducted an outfall survey on behalf of Seattle Public Utilities (SPU) (Herrera 2004).
- The Herrera survey was used as the basis for a list of 243 outfalls in Appendix H of the LDW Remedial Investigation (RI) report (Windward 2010). Appendix H included general information such as primary and secondary outfall IDs, approximate location, ownership information, physical characteristics of the outfall pipe, outfall type, and apparent status at the time of the review.
- In 2011, SAIC/Leidos updated and amended the Appendix H outfall list to include newly available information, including data from stormwater and storm drain solids samples in the drainage systems associated with each outfall, and surface sediment samples collected in close proximity (within 50 to 100 feet) of each outfall.
- Based on preliminary updates to the outfall list (now called the Outfall Inventory) it became clear that no surface sediment samples had been collected near many of these outfalls. The preliminary Outfall Inventory was used to select potential surface sediment sampling locations near 114 outfalls. Surface sediment samples were collected in 2011 by SAIC/Leidos at 162 sampling locations near 84 outfalls. Analytical results are presented in *Surface Sediment Sampling at Outfalls in the Lower Duwamish Waterway – Data Report* (SAIC 2011a).
- These surface sediment sampling data near outfalls were incorporated into the Outfall Inventory; the expanded and updated inventory was submitted to Ecology in an *Outfall Inventory Summary Report* in December 2011 (SAIC 2011b).
- In 2012 and 2013, SAIC/Leidos obtained and reviewed the Stormwater Pollution Prevention Plans (SWPPPs) for most of the facilities in the LDW basin with stormwater discharge permits. Based on the information and maps provided in these SWPPPs, the status of some outfalls was updated and additional outfalls were identified.

This *Outfall Inventory Update* presents revised Outfall Inventory spreadsheets, describes the changes and new information that have been incorporated into this update, and defines the fields and terms used in the current spreadsheets. In addition, new maps showing outfall locations have been prepared and are included with this update.

2.0 Outfall Inventory Structure and Contents

The 2011 Outfall Inventory contained all information in a single spreadsheet. This resulted in a large and unwieldy file. In the current version, the inventory has been split into a series of five spreadsheets:

1. General information about each outfall;
2. Information related to National Pollutant Discharge Elimination System (NPDES) permits in the LDW basin;
3. Information related to sediment samples collected within close proximity to each outfall;
4. Information related to stormwater and storm drain solids samples collected in the drainage basin for each outfall; and
5. Historical information from the Herrera 2003 outfall survey and LDW RI Appendix H.

The first four spreadsheets are included in the Outfall Inventory file in two formats: the original spreadsheet, which lists pertinent information about each outfall in rows; and a transposed spreadsheet, which lists pertinent information about each outfall in columns. Depending on how the Outfall Inventory is used, one or the other of these two formats may be more useful. For example, the original "Outfalls" spreadsheet (spreadsheet 1) would allow the user to filter out all except active outfalls. The "Outfalls Transposed" spreadsheet (spreadsheet 1A) would allow the user to more easily print information about one or more specific outfalls.

Some data fields have been eliminated and others have been combined to streamline the spreadsheets. Additional fields have been added as needed. Text presented in red font represents questions or unknowns. Rows or columns shaded in gray indicate that the outfall is abandoned, inactive, or presumed inactive. Rows or columns shaded in pink indicate that the outfall status is unknown. Rows or columns with no shading indicate that the outfall is active or presumed active.

Each of these spreadsheets is described further in the following sections.

2.1 General Outfall Information Summary – Spreadsheet 1

The Outfall Inventory includes general information about each outfall. Some of this general information has been updated if new information was available. New outfalls were added based on stormwater drainage maps provided in facility SWPPPs. The "Outfalls" and "Outfalls Transposed" spreadsheets include the following information:

- **Leidos ID:** This number was assigned by Leidos to allow sorting of outfalls from north to south, east side of the LDW then west side of the LDW. Each Leidos ID consists of five digits: the first digit is the letter "L" to indicate that it was assigned by Leidos. The second and third digits refer to the source control area number. Source control area numbers are listed in Table 1. The fourth and fifth digits were assigned sequentially based on outfall location from north to south within each source control area.

- **Outfall ID:** This is a primary identification (ID) unique to each outfall. Four-digit numerical IDs were assigned by SPU (Herrera 2004; Windward 2010), the City of

Seattle, or the Port. In the absence of an existing numerical ID, other primary IDs are used to reflect the outfall location or nearby property owner. The outfalls identified with these primary IDs are presented on the attached LDW Outfall Locations maps.

- **Alternate Outfall ID:** Alternate outfall IDs may have been used by the associated facility operator, landowner, or regulatory agencies. These IDs were updated in the inventory, as applicable, using information presented in various SAIC data gaps reports and source control action plans (SCAPs).
- **Outfall Name:** Some public outfalls are known by a descriptive name, such as Duwamish/Diagonal CSO/SD or S Myrtle Street SD. A user may know an outfall by its name, rather than by its 4-digit Outfall ID.
- **Outfall Status:** Outfalls are identified active or presumed active, inactive or presumed inactive, abandoned, unknown, or "not an outfall." "Unknown" indicates that insufficient information was available to include it in one of the other categories. "Not an outfall" refers to locations that were previously identified as outfalls, but are now believed to represent other types of structures. For example, Outfall ID 2020 is a reservoir overflow, not a stormwater outfall. These have been retained in the spreadsheet for now.
- **Outfall Type:** Outfall classification, which represents both the type of structure (storm drain [SD], CSO, emergency overflow [EOF], creek, ditch) and outfall ownership (city, county, port, private, etc.). Unless noted otherwise, "city" refers to the city of Seattle.
- **Est. River Mile:** An estimate of the outfall location, by river mile, to within about 0.1 mile. A second digit after the decimal is used to allow sorting of outfalls that are in close proximity to each other, for example at the head of slips; this second digit is not intended to be accurate.
- **River Side:** Indicates whether the outfall is on the east or west bank of the LDW, or on Harbor Island.
- **Source Control Area:** River mile designation for the source control area within which the outfall is located, for example RM 1.7-2.0E.
- **Source Control Area Name:** Descriptive name for the source control area, for example Slip 2 to Slip 3.
- **Outfall Diameter:** The dimensions of each outfall, in inches, when known.
- **Outfall Material:** The outfall pipe material, when known.
- **Decimal Latitude and Decimal Longitude:** Provides coordinates for the outfall location in decimal latitude/longitude format. Some of the outfall coordinates have been modified from the earlier version of this Outfall Inventory, based on new information.
- **X, Y, and Z Coordinate:** Geographical location (X and Y) and elevation (Z) coordinates of each outfall in the Washington State Plane NAD-83 coordinate system, if available. Some outfall locations were estimated using facility maps and Geographic Information System (GIS) software. Elevation coordinates are from the Herrera 2003 outfall survey.

- **Parcel Number:** The King County parcel number of the tax parcel on which the outfall is located, or nearest to the outfall location. Information was obtained from King County's Parcel Viewer.[1]
- **Parcel Name:** The name of the tax parcel, as listed in King County's Parcel Viewer.
- **Taxpayer Name:** The taxpayer for the parcel on which the outfall is located, as listed in King County's Parcel Viewer. This field replaced the Owner_Operator field in the previous version of the Outfall Inventory.
- **SW Permit:** Lists all active stormwater (SW) permits associated with the outfall, by number and permittee. Municipal permittees are listed as Municipal (City), Municipal (County), Municipal (Port), etc.
- **Outfall Notes:** Additional notes about the outfall, as relevant.
- **Outfall References:** Sources of information for the entries in other fields within this spreadsheet, as appropriate.

2.2 Stormwater Permit Summary – Spreadsheet 2

This section of the Outfall Inventory summarizes the available information related to active NPDES permits for facilities that discharge to the LDW.

Information from the following sources was used to update this section of the inventory: Ecology's Water Quality Permitting and Reporting Information System (PARIS), facility SWPPPs and NPDES permits, LDW Data Gaps Reports and Source Control Action Plans (SCAPs), and LDW Source Control Status Reports.

The "Permits" and "Permits Transposed" spreadsheets include the following information:

- **Leidos ID:** Same as for Outfalls spreadsheet above.
- **Outfall ID:** Same as for Outfalls spreadsheet above.
- **Permit No:** Active permit number(s) listed in PARIS as of February 2014, with stormwater discharge to the designated outfall.
- **Permit Type:** The type of stormwater permit: industrial stormwater general permit, sand & gravel general permit, boatyard general permit, or individual permit. Construction stormwater permits are not included in the Outfall Inventory.
- **Permit Status:** Indicates whether the permit is active or inactive. In general, only active permits are included in the Outfall Inventory. However, if a permit was previously listed and recently became inactive, it has not been deleted.
- **Permit Date:** Indicates the date when the original permit for this facility became effective and the current permit expiration date. There may be gaps within this period when there was no permit coverage.

[1] http://www.kingcounty.gov/operations/GIS/PropResearch/ParcelViewer.aspx

- **Permittee:** The name of the permittee, as listed in PARIS.
- **Facility Name:** The common name of the facility; generally the name used in SCAPs and other source control documents.
- **Facility-Site DB Name:** The facility name as listed in Ecology's Facility/Site database. This is a new field.
- **FSID:** The facility/site ID as listed in Ecology's Facility/Site database.
- **SIC Code:** The facility's standard industrial classification (SIC) code(s), as listed in PARIS.
- **Facility Address:** Street address of the permitted facility, as listed in PARIS.
- **Discharge Point:** Location where stormwater is discharged from the facility; stormwater may be discharged to a public storm drain or directly to the LDW. This is based on information in the facility's SWPPP.
- **Discharge Point Coords:** Coordinates (in decimal latitude/longitude format) of the discharge point. If the discharge is directly to the LDW, the discharge point coordinates are generally the same as the outfall coordinates (from Outfalls spreadsheet).
- **Discharge Type:** This field indicates whether the facility discharges to a public storm drain, directly to the LDW, or to the ground surface. Information is based on the facility SWPPP.
- **Permit Notes:** Additional information related to the permit, facility, or discharge point, as relevant.
- **Monitoring Point:** Identifies permit-related monitoring location. Information was obtained from the facility's SWPPP and/or PARIS.
- **Monitoring Point Coordinates:** Coordinates (in decimal latitude/longitude format) of the monitoring point. Coordinates are based on information provided in the SWPPP, assigned based on available facility maps, or as provided in PARIS.
- **Monitoring Parameters:** Parameters for which monitoring is required as part of the facility's stormwater discharge permit. Information was obtained from PARIS.
- **Benchmark Exceedances?:** Indicates whether the facility has exceeded monitoring parameter benchmarks during the period 2010 through 2013. Information was obtained from PARIS.
- **No. Benchmark Exceedances:** Indicates the number and year of benchmark exceedances during the period 2010 through 2013. Information was obtained from PARIS.
- **Exceedance Parameters:** Indicates the parameter and number of benchmark exceedances during the period 2010 through 2013. Information was obtained from PARIS.

- **Ecology Action:** Identifies any Ecology actions during the period 2010 through 2013, such as Notices of Violation, informal action letters, etc. Information was obtained from PARIS.
- **Monitoring Notes:** Any additional notes related to monitoring location or other pertinent information.
- **Date Updated:** Date that monitoring data were updated.

2.3 Surface Sediment Sample Summary – Spreadsheet 3

This section of the Outfall Inventory summarizes the available information related to surface sediment samples collected in proximity to each outfall. The primary source of sediment sampling data was the Sherlock database maintained by Leidos (December 2013 version). The distance of the surface sediment sample nearest to the outfall was measured using ArcMap GIS software tools. Surface sediment samples collected between 2000 and 2014 were included. Samples collected prior to 2000 were not considered to be representative of current conditions.

The "Sed Sampling" and "Sed Sampling Transposed" spreadsheets include the following information:

- **Leidos ID:** Same as for Outfalls spreadsheet above.
- **Outfall ID:** Same as for Outfalls spreadsheet above.
- **Outfall Name:** Same as for Outfalls spreadsheet above.
- **Distance Criterion:** The distance criterion is 50 feet or 100 feet, depending on outfall diameter (in Outfalls spreadsheet). For outfalls with a diameter greater than 24 inches, the distance criterion is 100 feet. For outfalls with a diameter of 24 inches or less, the distance criterion is 50 feet. Outfalls with unknown outfall diameter were assigned a distance criterion of 50 feet.
- **Is Nearest Sample Within Criterion?** Indicates whether the nearest surface sediment sample is within the distance criterion (yes or no).
- **No. of Samples Within 50 Feet/100 Feet:** Identifies how many surface sediment samples have been collected within 50 feet and within 100 feet of the outfall.
- **Nearest Sed Sample:** Provides the location name of the sediment sample collected since 2000 that is nearest the outfall.
- **Nearest Sample Distance:** Identifies the distance (in feet) of the nearest surface sediment sample collected since 2000. Only sample information within 100 feet of the outfall was compiled; samples more than 100 feet from the outfall are listed as ">100 feet."
- **Nearest Sample Date:** Provides the date that the nearest surface sediment sample was collected.

- **Samples Within Criterion:** Lists the location names of all surface sediment samples collected since 2000 within the distance criterion.
- **Parameters Sampled:** Identifies the chemical parameter classes that were analyzed in the samples collected within the distance criterion, for example metals, polychlorinated biphenyls (PCBs), semivolatile organic compounds (SVOCs), pesticides, total organic carbon (TOC), grain size, and dioxins/furans.
- **Lower SL Exceedances:** Chemicals detected in one or more samples within the distance criterion that exceeded only the lower screening level (SL). Screening levels are listed in Table 2.
- **Upper SL Exceedances:** Chemicals detected in one or more samples within the distance criterion that exceeded both the lower and upper SL. Screening levels are listed in Table 2.
- **Notes:** This field contains additional relevant information. For example, if the distance criterion for an outfall was 50 feet and no surface sediment sample was collected within 50 feet, but one or more samples were collected between 50 and 100 feet (outside the distance criterion), SL exceedances in these samples are summarized in the Notes field. Also, if no samples were collected within 100 feet since 2000, but older samples within the distance criterion were collected, the older sample location name is provided where available.
- **Sampling Limitations:** Includes notes from previous outfall surveys (primarily the SAIC 2011 outfall sediment sampling project) about barriers and limitations to sample collection within the distance criterion.
- **Date Updated:** Provides the date that the information for a given outfall was changed or updated.

2.4 Stormwater and Storm Drain Solids Sample Summary – Spreadsheet 4

This section of the Outfall Inventory summarizes the available information related to stormwater and storm drain solids samples collected within the drainage basin for each outfall. The primary sources of stormwater and storm drain solids sampling data are SPU's source tracing data summary (through June 2013), and the Sherlock database maintained by Leidos (December 2013 version), including King County CSO monitoring reports, Ecology's Lateral Loading and Accelerated Source Tracing Studies, North Boeing Field RI/FS sampling, and miscellaneous other studies and samples. Samples collected prior to 2000 were considered too old to be representative of current conditions.

This spreadsheet does not include stormwater monitoring samples collected for NPDES permit monitoring purposes, except city and county samples, as appropriate. Adding available information from PARIS for permit monitoring samples will be considered for future updates.

Additional storm drain solids sampling data collected by Ecology's Water Quality Program staff or by private parties are not included in this version of the Outfall Inventory. Some of these data

are included in the December 2013 version of the Sherlock database, but the specific outfalls associated with these data have not been tabulated. Identifying the relevant outfall for any additional storm drain solids samples and adding them to this Outfall Inventory will be considered for future updates.

The "SW&Solids Sampling" and "SW&Solids Sampling Trans" spreadsheets include the following information:

- **Leidos ID:** Same as for Outfalls spreadsheet above.
- **Outfall ID:** Same as for Outfalls spreadsheet above.
- **Outfall Name:** Same as for Outfalls spreadsheet above.
- **SW Samples Collected?:** This column indicates whether stormwater data representative of the effluent discharge of the outfall are available. This is a Yes/No field.
- **SW Sample Type:** Indicates whether the sample(s) is a composite (time-weighted or flow-weighted if known) or grab sample.
- **SW Sample Date:** Provides the date(s) that stormwater samples were collected.
- **SW Sample Location:** Provides the location name where relevant stormwater samples were collected.
- **SW Parameters Samples:** Lists the parameters analyzed in one or more stormwater samples, by parameter class.
- **SL Exceedances in SW:** Identifies those chemicals that exceeded the stormwater SL in at least one sample. Screening levels are listed in Table 2.
- **SW Notes:** Additional notes containing other relevant information pertaining to stormwater samples, if any, are provided in this field.
- **SW References:** Source information for stormwater data is provided, where available.
- **SD Solids Samples Collected?:** Indicates whether storm drain solids samples have been collected within the drainage basin to the specified outfall. Yes or No field.
- **SD Solids Sample Type:** Describes the type of storm drain solids samples that have been collected: sediment trap, grab, inline/catch basin/right-of-way catch basin (where known). For sediment traps, this field also lists the number of sediment traps installed within the storm drain basin.
- **SD Solids Sample Dates:** Generally provides the range of dates during which storm drain solids samples were collected.
- **SD Solids Sample Locations:** Lists the sample location names where storm drain solids samples have been collected. In some cases, there were too many samples to list (e.g., Diagonal SD basin, North Boeing Field).
- **SD Parameters Sampled:** Identifies the chemical parameters (by parameter class) that were analyzed in at least one storm drain solids sample.

- **Lower SL Exceedances:** Chemicals detected in one or more storm drain solids samples that exceeded only the lower SL. Screening levels are listed in Table 2.
- **Upper SL Exceedances:** Chemicals detected in one or more storm drain solids samples that exceeded both the lower and upper SL. Screening levels are listed in Table 2.
- **SD Solids Notes:** This field provides additional notes relevant to storm drain solids samples, as appropriate.
- **SD Solids References:** Source information for stormwater data is provided, where available.

2.5 Historical Information – Spreadsheet 5

This spreadsheet provides notes from the Herrera 2003 outfall survey and the LDW RI Appendix H tables for each outfall. While some of this information is now considered out-of-date, it has been retained for reference purposes. Addition of notes from SAIC's 2011 outfall survey will be considered for future updates.

3.0 Limitations and Next Steps

Several limitations should be noted regarding the data compilation process and/or usability of the Outfall Inventory. Such limitations are summarized below:

- Facility specific SWPPPs and NPDES permits were often incomplete.
- Many outfalls are listed with inconsistent identification by Data Gaps Reports, SCAPs, outfall owner/facility documents, PARIS database, and NPDES permits. These have been reconciled to the extent feasible, and remaining questions/uncertainties are shown in red font.
- Outfalls may discharge stormwater from more than one facility (permitted or not) within a drainage area. Therefore, it was often difficult to relate an outfall to specific facilities.
- Some facilities that discharge to an outfall but do not have a NPDES permit may not be included in this inventory because the drainage information is unknown. Only facilities with a stormwater discharge permit were related to a specific outfall.
- Some of the outfall coordinates in the PARIS database appeared to be the monitoring points rather than the location of the outfalls. Errors and inaccuracies related to outfall location coordinates were corrected as feasible using GIS mapping methods.
- The Outfall Inventory only contains information available at the time of data compilation. As new information becomes available (e.g., new chemistry data are published, outfalls become decommissioned) parts of the inventory may become obsolete.
- Not all data previously published (Herrera 2004; Windward 2011) could be verified.

The Outfall Inventory continues to be a work in progress, and is intended to serve as an evolving tool for source control in the LDW. In order for the outfall inventory to serve as an effective tool for LDW source control over time, it will require periodic updating to remain current and inclusive of ongoing investigations. To serve this purpose, the following tasks should be considered:

- Include additional surface sediment data, stormwater data, and storm drain solids data as they become available.
- Update general outfall information such as the outfall status, ownership, and reconstruction, as needed and as information becomes available.
- Update facility, NPDES permit, and SWPPP information related to active outfalls, as needed.
- Add NPDES monitoring data for relevant parameters, as appropriate, to the SW&Solids Sampling spreadsheet.
- Identify relevant outfalls for storm drain solids samples not included in the current version of the Outfall Inventory, and add them to the SW&Solids Sampling spreadsheet.
- Add SAIC 2011 outfall survey and sampling notes to the Historical Info spreadsheet.

4.0 References

Herrera 2004. Summary Report, Lower Duwamish Waterway Outfall Survey. Prepared for Seattle Public Utilities.

SAIC 2011a. Surface Sediment Sampling at Outfalls in the Lower Duwamish Waterway: Data Report. Prepared by Science Applications International Corporation for Washington State Department of Ecology. October 2011.

SAIC 2011b. Lower Duwamish Waterway Outfall Inventory Summary Report. Prepared by Science Applications International Corporation for Washington State Department of Ecology. December 2011.

Windward 2010. Lower Duwamish Waterway Remedial Investigation, Remedial Investigation Report, Final. July 9, 2010.

Tables

Table 1
Source Control Area Names and Numbers

Source Control Area Number	Source Control Area Name
1	RM 0.0-0.1 East (Spokane Street to Ash Grove Cement)
2	RM 0.1-0.9 East (EAA-1: Duwamish/Diagonal Way)
3	RM 0.9-1.0 East (Slip 1)
4	RM 1.0-1.2 East (KC Lease Parcels)
5	RM 1.2-1.7 East (St. Gobain to Glacier Northwest)
6	RM 1.7-2.0 East (Slip 2 to Slip 3)
7	RM 2.0-2.3 East (Slip 3 to Seattle Boiler Works)
8	RM 2.3-2.8 East (Seattle Boiler Works to Slip 4)
9	RM 2.8 East (EAA-3: Slip 4)
10	RM 2.8-3.7 East (EAA-4: Boeing Plant 2/Jorgensen Forge)
11	RM 3.7-3.9 East (EAA-6: Boeing Isaacson/Central KCIA)
12	RM 3.9-4.3 East (Slip 6)
13	RM 4.3-4.9 East (Boeing Developmental Center)
14	RM 4.9 East (EAA-7: Norfolk CSO/SD)
15	RM 0.0-1.0 West (Spokane Street to Kellogg Island)
16	RM 1.0-1.3 West (Kellogg Island to Lafarge Cement)
17	RM 1.3-1.6 West (Glacier Bay)
18	RM 1.6-2.1 West (Terminal 115)
19	RM 2.1 West (1st Avenue S Storm Drain)
20	RM 2.1-2.2 West (EAA-2: Trotsky Inlet)
21	RM 2.2-3.4 West (Riverside Drive)
22	RM 3.4-3.8 West (EAA-5: Terminal 117)
23	RM 3.8-4.2 West (Sea King Industrial Park)
24	RM 4.2-5.8 West (Restoration Areas)
25	Combined Sewer Area

Table 2
Screening Levels for Chemicals
in LDW Storm Drain and Sediment Samples

Parameter	Lower SL	Upper SL
Surface Sediment and Storm Drain Solids		
PCB Aroclors (mg/kg DW)	**LAET**	**2LAET**
Total PCBs	0.13	1.0
PAHs (mg/kg DW)	**LAET**	**2LAET**
Naphthalene	2.1	2.4
Acenaphthylene	1.3	1.3
Acenaphthene	0.50	0.73
Fluorene	0.54	1.0
Phenanthrene	1.5	5.4
Anthracene	0.96	4.4
2-Methylnaphthalene	0.67	1.4
Total LPAH	5.2	13
Fluoranthene	1.7	2.5
Pyrene	2.6	3.3
Benzo(a)anthracene	1.3	1.6
Chrysene	1.4	2.8
Total Benzofluoranthenes	3.2	3.6
Benzo(a)pyrene	1.6	3.0
Indeno(1,2,3-cd)pyrene	0.6	0.69
Dibenz(a,h)anthracene	0.23	0.54
Benzo(g,h,i)perylene	0.67	0.72
Total HPAH	12	17
cPAH (mg TEQ/kg)	**RAL**	**UCL-ENR**
Total cPAH	1.0	3.0
Phthalates (mg/kg DW)	**LAET**	**2LAET**
Dimethylphthalate	0.071	0.16
Diethylphthalate	0.20	1.2
Di-n-Butylphthalate	1.4	5.1
Butylbenzylphthalate	0.063	0.90
Bis(2-ethylhexyl)phthalate	1.3	1.9
Di-n-octyl phthalate	6.2	6.2
Phenols (mg/kg DW)	**SQS**	**CSL**
Phenol	0.42	1.2
2-Methylphenol	0.063	0.063
4-Methylphenol	0.67	0.67
2,4-Dimethylphenol	0.029	0.029
Pentachlorophenol	0.36	0.69
Dioxin/Furan (ng TEQ/kg)	**RAL**	**UCL-ENR**
Dioxin/Furan Congeners	25	50
Metals (mg/kg DW)	**SQS**	**CSL**
Arsenic	57	93
Cadmium	5.1	6.7
Chromium	260	270

Table 2
Screening Levels for Chemicals
in LDW Storm Drain and Sediment Samples

Parameter	Lower SL	Upper SL
Copper	390	390
Lead	450	530
Mercury	0.41	0.59
Silver	6.1	6.1
Zinc	410	960
Stormwater	**Screening Level**	
PCB Aroclors (ug/L)	**WQC Chronic**	
Total PCBs	0.030	
Total Metals (ug/L)	**WQC Chronic**	
Arsenic	36	
Cadmium	9.3	
Copper	3.1	
Lead	8.1	
Mercury	0.025	
Silver	--	
Zinc	81	

Notes:

2LAET - second lowest apparent effects threshold
cPAH - carcinogenic PAH
CSL - cleanup screening level
DW - dry weight
HPAH - high molecular weight PAH
LAET - lowest apparent effects threshold
LDW - Lower Duwamish Waterway
LPAH - low molecular weight PAH
mg/kg - milligrams per kilogram
ng - nanogram
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
RAL - LDW Feasibility Study Remedial Action Level
SQS - Sediment Quality Standard
SL - screening level
TEQ - toxic equivalent quotient
UCL-ENR - Upper concentration limit for enhanced natural recovery
WQC Chronic - Washington State Marine Water Quality Criteria (chronic)

Figures

Lower Duwamish Waterway Outfall Locations
River Mile 0.0 to 1.3

Outfall Location
- Active or Presumed
- Inactive or Presumed Inactive
- Abandoned
- Unknown

Utility Lines
- Storm Drain Line
- Combined Sewer Line
- Ditch or Trench
- Building
- Parcel
- NPDES Permitted Facility

0 200 400 800 Feet

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leidos

Coordinate System:
NAD 1983 StatePlane Washington North FIPS 4601 Feet
Prepared By: mlf
File: Fig-X_Outfall-Location-MapSeries.mxd
3/11/2014
Illustrative purposes only.

Lower Duwamish Waterway Outfall Locations
River Mile 1.3 to 2.5

Outfall
- Active or Presumed
- Inactive or Presumed
- Abandoned
- Unknown
- Not an Outfall

Utility Lines
- Storm Drain
- Combined Sewer
- Ditch or
- Building
- Parcel
- NPDES Permitted

0 200 400 800 Feet

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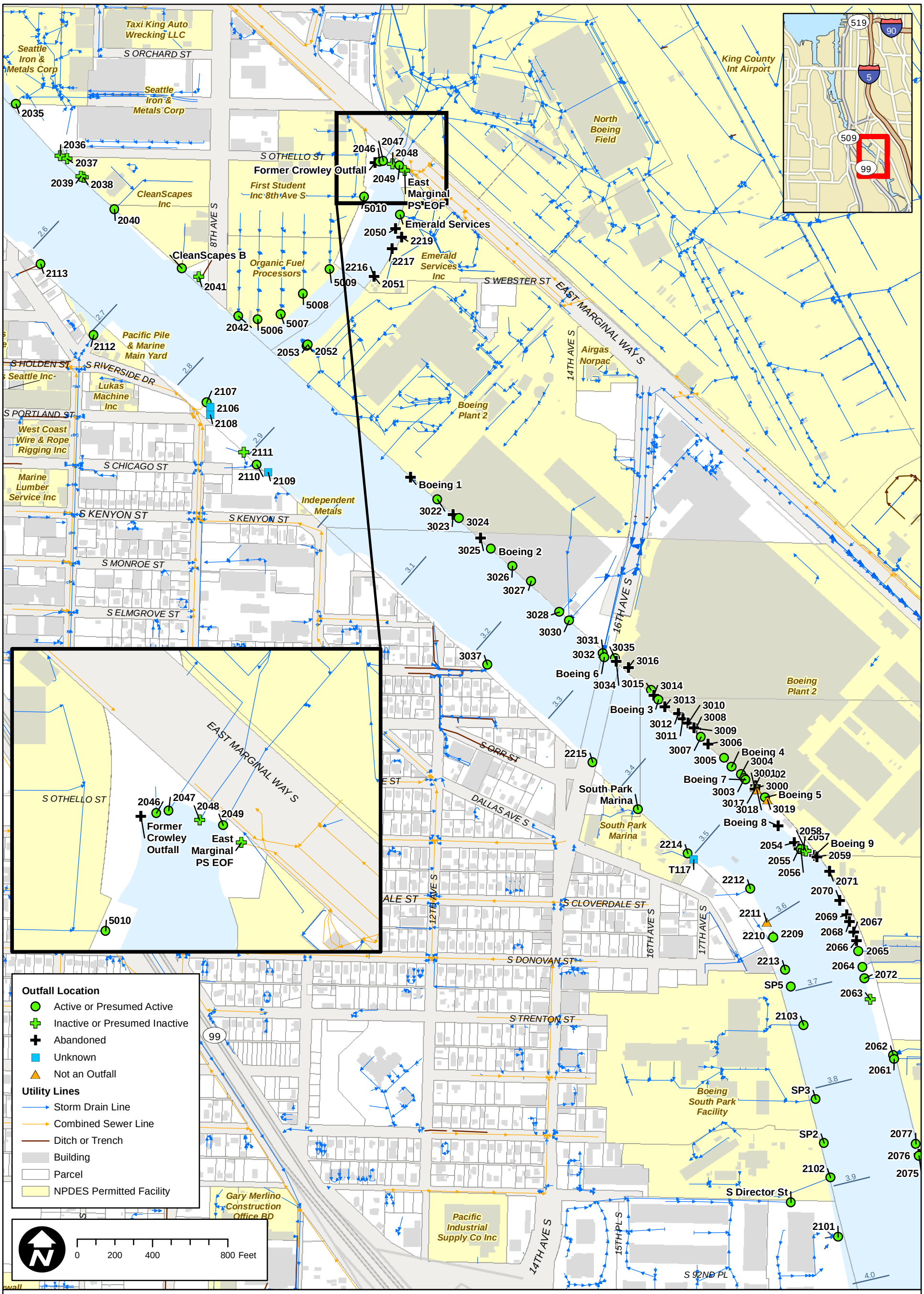
leidos

Coordinate System:
NAD 1983 StatePlane Washington North FIPS 4601 Feet
Prepared By: mlf
File: Outfall-Location-MapSeries_RM1-3_2-5.mxd
3/11/2014
Illustrative purposes only.



Lower Duwamish Waterway Outfall Locations
River Mile 2.5 to 3.8

DEPARTMENT OF ECOLOGY
State of Washington

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Coordinate System:
NAD 1983 StatePlane Washington North FIPS 4601 Feet
Prepared By: mlf
File: Outfall-Location-MapSeries_RM2-5_3-8.mxd
3/11/2014
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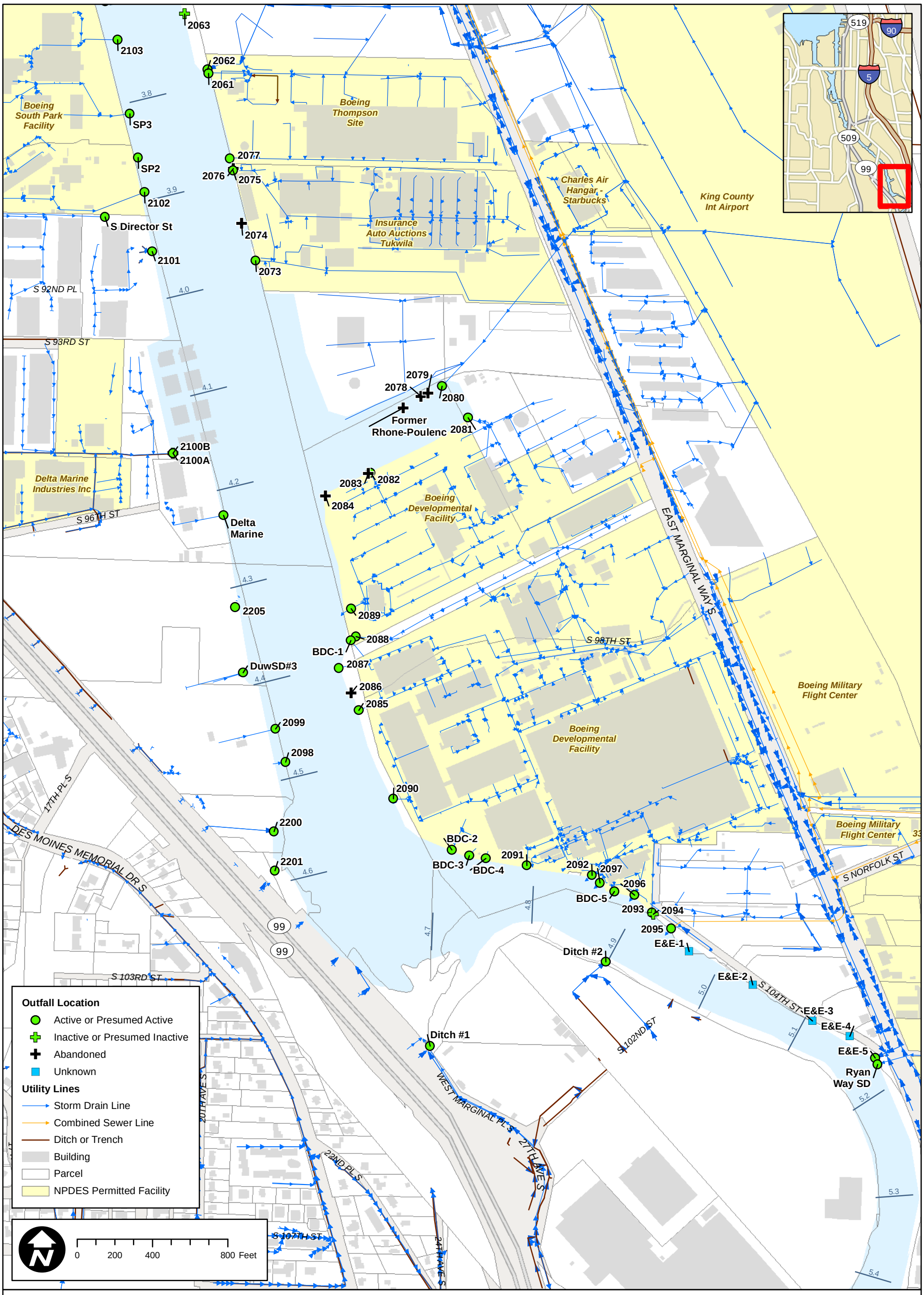

Lower Duwamish Waterway Outfall Locations
River Mile 3.8 to 5.4

DEPARTMENT OF ECOLOGY
State of Washington

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Coordinate System:
NAD 1983 StatePlane Washington North FIPS 4601 Feet
Prepared By: mlf
File: Fig-X_Outfall-Location-MapSeries.mxd
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