King County Lower Duwamish Waterway Source Control Annual Report Year 2016

December 2017

FINAL

King County

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King County
Lower Duwamish Waterway
Source Control
Annual Report
Year 2016

Prepared for:

Washington State Department of Ecology

Submitted by:

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ACRONYMS

BMPs	best management practices
BEHP	bis(2-ethylhexyl)phthalate
BBP	butyl benzyl phthalate
CSL	cleanup screening level
CSO	combined sewer overflow
CA	consistent attainment
DPER	Department of Permitting and Environmental Review
ERTS	Environmental Report Tracking System
FMD	Facilities Management Division
GSI	green stormwater infrastructure
HPAHs	high molecular weight polycyclic aromatic hydrocarbons
ISGP	Industrial Stormwater General Permit
KCIW	King County Industrial Waste
KCIA	King County International Airport
LHWMP	Local Hazardous Waste Management Program
LPAHs	low molecular weight polycyclic aromatic hydrocarbons
LDW	Lower Duwamish Waterway
LAET	lowest apparent effects threshold
MTCA	Model Toxics Control Act
MS4	municipal separate storm sewer system
NPDES	National Pollutant Discharge Elimination System
NBF	North Boeing Field
OWS	oil–water separator
ORC	oxygen release compound
PCBs	polychlorinated biphenyls
PAHs	polycyclic aromatic hydrocarbons
SPU	Seattle Public Utilities
SQS	sediment quality standard
SIU	significant industrial user
SCIP	Source Control Implementation Plan
SPS	South Pump Station
SWS	Stormwater Services Section
TSS	total suspended solids
EPA	U.S. Environmental Protection Agency
Ecology	Washington State Department of Ecology
WTD	Wastewater Treatment Division
WLRD	Water and Land Resources Division

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1.0 INTRODUCTION

This document summarizes King County's (County) Lower Duwamish Waterway (LDW) source control activities in 2016. It is the second annual report that documents implementation of actions outlined in the County's LDW Source Control Implementation Plan (SCIP) for 2014 to 2018 (King County 2016a)[1].

The SCIP does the following:

- Identifies actions within the County's authority that are needed to sufficiently control existing sources of contaminants to the LDW to begin sediment cleanup in the waterway.

- Strives to minimize the risk of recontaminating sediments after sediment cleanup to levels above the sediment cleanup standards established in the U.S. Environmental Protection Agency's (EPA) Record of Decision for the LDW Superfund site (EPA 2014).

- Supports the Washington State Department of Ecology's (Ecology) LDW Source Control Strategy Plan (Ecology 2016) and implementation of EPA's Record of Decision for the LDW Superfund Site.

This annual report is organized according to the County departments and divisions specified in the SCIP.

1.1 LDW Source Control Area

The LDW source control area is defined as drainage areas that discharge to the LDW Superfund site (Figure 1). The area includes (1) King County and Seattle Public Utilities (SPU) combined sewer overflow (CSO) basins and (2) separated stormwater basins that are the responsibility of King County and the cities of Seattle, Tukwila, Burien, and SeaTac, respectively. This annual report covers actions in combined sewer basins associated with County CSO outfalls, County separated storm sewer basins, and County properties in the LDW source control area.

1.2 Internal Coordination Efforts

Most of King County's responsibility for LDW source control rests with four county divisions: Wastewater Treatment Division (WTD), Water and Land Resources Division (WLRD), King County International Airport (KCIA), and Roads Services Division. In 2016,

[1] King County provided previous source control updates to the LDW Source Control Work Group and to the Washington State Department of Ecology's LDW Source Control Status Reports (2003–2013). The Ecology status reports can be found at http://www.ecy.wa.gov/programs/tcp/sites_brochure/lower_duwamish/source_control/sc.html.

biannual meetings were held to discuss and coordinate source control efforts across divisions and departments. These meetings included representatives from the divisions listed above as well as from other county agencies and departments (Facilities Management Division [FMD], Solid Waste Division, Public Health–Seattle & King County, Department of Permitting and Environmental Review [DPER], and Local Hazardous Waste Management Program [LHWMP]).

Figure 1. Lower Duwamish Waterway Source Control Area.

2.0 WASTEWATER TREATMENT DIVISION

This section summarizes source control actions taken by King County's WTD in the LDW drainage area during 2016.

2.1 CSO Control Program

WTD is responsible for managing the regional wastewater system. WTD's CSO Control Program fulfills requirements under the National Pollutant Discharge Elimination System (NPDES) permit for the County's West Point Treatment Plant (WA0029181) in Seattle and requirements in Washington Administrative Code (WAC) 173-245-090. The most recent West Point NPDES permit was issued on December 19, 2014, and became effective on February 1, 2015.

The County's previous investments in CSO control have significantly reduced CSO volumes and pollutant loads into Seattle-area waterways. Three CSO control projects are underway in the LDW. The projects, estimated to cost $174 million (2010 dollars), are (1) West Duwamish storage and green stormwater infrastructure (GSI) (West Michigan and Terminal 115 CSOs); (2) Georgetown Wet Weather Treatment Station (Brandon and South Michigan CSOs); and (3) Rainier Valley Wet Weather Storage and conveyance improvements (Hanford #1 CSO). The three projects will control the remaining uncontrolled County CSOs in the LDW to the state standard of no more than one untreated CSO discharge on average per year at each outfall, and will remove most of the untreated CSOs in the LDW. The projects are currently in design or construction phases and are anticipated to be in operation by 2030. Table 1 summarizes progress made in 2016 to meet project milestones.

Table 1. Summary of King County CSO Control Project Milestones in the LDW for 2016.

Project Name (Status)	Discharge Serial Number	Milestone Deadline	Milestone Completed
Georgetown Wet Weather Treatment Station (construction)	039, 041	Completion of Bidding by December 2017	Submitted Facility Plan November 2015
Rainier Valley Wet Weather Storage (construction)	031a, 031b, 031c	Construction Completion by December 2019	Completed bidding May 2016
West Duwamish (predesign)	038, 044	Submit facility plan by December 2020	In progress

2.2 RainWise Program

Since 2010, King County, in partnership with the City of Seattle, has administered the RainWise program. This program provides rebates to homeowners living in specific combined sewer areas for installing rain gardens and cisterns on their properties. RainWise helps to slow, detain, or retain stormwater, which reduces both the volume and timing of combined sewer flows and reduces sources of pollution into the combined system. The program is underway in the neighborhoods of South Park and Highland Park. To date, RainWise installations in these two neighborhoods are capturing stormwater from 108,683 square feet (2.5 acres) of roof area and removing approximately 1.3 million gallons of stormwater from the combined sewer system.

2.3 Green Grants

From 2011 through 2016, WTD funded community projects, environmental education, and community outreach efforts in the Duwamish River Valley through the Green Grants Program. Over the four-year period, $411,300 in grants were awarded. The purpose of the program is to help improve air and water quality in the Duwamish Watershed, support the successful implementation of CSO control projects in this area, and meet regulatory obligations for clean air. Grants are also offered to promote partnerships in the LDW area with the goals of advancing source control for the LDW Superfund cleanup, developing local expertise in water and air quality protection, and enhancing small-scale environmental and economic opportunities in the community. The program was completed in 2016 and, therefore, will no longer be reported.

The 2016 recipients and projects are as follows:

- *Green Solutions to Air Pollution ($45,000)*. This project will implement strategies to address sources of air pollution in Georgetown and South Park. Strategies will be selected from those identified as highly effective in a literature review (green walls, green billboards, and redesigning tree-planting methods). Strategies will be chosen and implemented in collaboration with the community, including mapping potential locations, engaging businesses, training interested community members, and collaborating with other opportunities.

- *Restoration of Wetland at 23rd Avenue SW and SW Findlay Street ($40,000)*. Delridge Neighborhood Development Association will lead a community effort to improve the water quality and hydrology of Longfellow Creek and its outfall into the West Waterway of the Duwamish River through the purchase and restoration of a 7,144 square foot wetland. The wetland is part of a 20,000 square foot parcel being surplused by Seattle City Light. The project will provide needed GSI in a combined sewer overflow basin and an underserved neighborhood. It provides the opportunity to engage the surrounding community with hands-on science related to water quality and wetland restoration.

- *Green Infrastructure Job Corps: Growing Green Infrastructure Careers through On-the-Job Training ($15,980 and $37,000 from the WTD Green Stormwater Infrastructure Program)*. This project provides a portion of the funding needed to organize and run three sessions of the "Green Infrastructure Job Corps" (fall 2015, winter 2016, and spring 2016). This program develops skills and career pathways for young adults 17 years and older to pursue green infrastructure design, construction, landscaping, or operations and maintenance careers. The grant pays stipends to participants, and other funding (from direct invoicing to customers) will pay for technical support for small-scale green infrastructure projects in the Georgetown and South Park neighborhoods of Seattle. The program builds confidence in young adults through training and participation in a crew that assists with community-driven projects like tree planting, wetland restoration, rain garden design and construction, maintaining existing GSI installations, and vegetation management.

2.4 WaterWorks Grant Funding

King County manages grant programs that promote source control partnerships, develop local expertise in water quality protection, and enhance economic opportunities in the community. The programs fund small-scale projects undertaken by residents, organizations, and small businesses to improve air and water quality. The projects support the success of King County's CSO control projects by controlling new and ongoing sources of pollution that could harm the environment or recontaminate cleaned-up areas in the LDW.

In 2016, $436,500 (not including administration costs) in grants were awarded for projects in the Green/Duwamish Watershed through the King County WaterWorks program, a competitive grant funding program administered by WTD. The 2016 grant projects, all of which will benefit water quality, are as follows:

- *Futurewise: Stormwater Pollution Reduction Project for Algona ($81,565).* This project works with community groups and teachers in the City of Algona on a variety of stewardship projects emphasizing the role that residents can play in reducing stormwater impacts. This project includes creating a "Toxics for Teens" program, planting trees, creating a pilot community garden, and creating educational signage at a wetland.

- *King County WLRD: Duwamish Floating Wetlands ($154,986).* This project is evaluating the potential for using floating wetlands to enhance shorelines, improve water quality, and increase salmon habitat. Different types of floating wetlands are being tested, including commercial and custom designs.

- *Mountains to Sound Greenway Trust: Me-Kwa-Mooks Park Community Engagement and Restoration ($50,000).* This project performs ecological restoration work at Me-Kwa-Mooks Park in West Seattle. Approximately three acres of invasive plants are being removed and restored with native plantings, engaging local school groups.

- *Nature Vision: Water Quality Education Project ($24,949).* This project is teaching in-class programs and conducting field trips about water quality and wastewater to students at schools in the Green/Duwamish Watershed. The focus is on place-based water quality education for students in low-income schools to help them become water stewards.

- *Seattle Tilth Association: Improving Water Quality through Changes to Agriculture Practices ($50,000).* This project is conducting educational workshops and providing ongoing technical assistance at the Green River Farm in Kent, which is farmed by Hmong families, to help support the farm's transition from conventional to organic practices. Invasive plants are also being removed and replaced with native species as a buffer for the farm's agricultural practices.

- *Stewardship Partners: GSI Mini Grants and Community Engagement Campaign ($75,000).* This project is developing a small grant program for GSI on non-RainWise-eligible private properties and launching a community engagement campaign across WTD's service area to increase public awareness of GSI.

2.5 Industrial Waste Program

The King County Industrial Waste (KCIW) Program regulates industrial customers of King County's regional wastewater system. The program functions under WTD as a delegated pretreatment program required by the NPDES permits for operation of the division's wastewater treatment plants. Duties include issuing approvals for discharging industrial wastewater to the sewer system, monitoring permitted dischargers, conducting inspections, and taking enforcement action when necessary.

KCIW issues several types of discharge approvals (control documents). The type of approval is determined by the nature of the business, volume and characteristics of the wastewater, and potential risks to the system. Of the more than 600 customers under an active control document, approximately 25 percent are in the LDW drainage area.

This section describes KCIW's work related to the LDW drainage area in 2016 under the following subsection headings:

- Listing of Industrial Users
- Listing of Inspections
- Collaborations
- Special Studies and Incident Responses

A comprehensive list of KCIW activities can be found in the annual pretreatment reports submitted to Ecology.

2.5.1 Listing of Industrial Users

Industrial users that were active at the end of each year in the LDW drainage area are listed in Appendix A, Table A-1. The table includes a column to designate whether the particular industrial user is a significant industrial user (SIU) with a waste discharge permit or a non-SIU with a lower-level discharge authorization.

2.5.2 Listing of Inspections

KCIW inspects each SIU at least once annually, including all facilities that have applied to renew their discharge approvals. KCIW also conducts periodic inspections of major non-SIUs, typically once within the five-year permitting cycle or if significant facility modifications occur during the cycle. KCIW staff conducts miscellaneous inspections alone or jointly with other agency staff. Inspections conducted in 2016 in the LDW drainage area are listed in Appendix A, Table A-2.

2.5.3 Collaborations

KCIW coordinates with several other agencies on an ongoing basis to control sources of pollutants in the LDW. The following are some of the most significant collaborations during 2016:

- Duwamish Inspectors Group. A lead investigator from KCIW participated in the Duwamish Inspectors Group, which is a forum for inspectors from the City of Seattle, Ecology, King County, and other agencies to discuss regulatory issues at commercial and industrial facilities in the LDW basin.

- Review of source control documents. KCIW staff reviewed drafts of various source control reports and provided input to King County's proposed future source control activities.

- Technical support for source control studies. A KCIW staff engineer reviewed documents and provided technical assistance to the project manager for the WTD-funded LDW-related source control studies (see "Summary of Source Control Studies" below).

- Sediment acceptance screening criteria for sediment transload facilities. In 2016, KCIW staff developed sediment acceptance screening criteria for facilities accepting contaminated sediments from marine dredging operations that generate wastewater for treatment and discharge to the King County sanitary sewer system. Depending on conditions of a waste discharge permit, an industrial user may accept sediments that exceed these criteria with prior permission from KCIW. The sediment acceptance screening criteria were developed based on information from an industrial user permit application, the LDW remedial investigation dataset, Washington State Sediment Management Standards (Chapter 173-204 WAC), U.S. Army Corps of Engineers Dredged Material Management Office[2], Washington State Model Toxics Control Act (Chapter 173-340 WAC), and Washington State Dangerous Waste Regulations (Chapter 173-303 WAC).

2.5.4 Special Studies and Incident Responses

This subsection describes KCIW special studies and incident responses in 2016.

2.5.4.1 Surveys of Potential Industrial Dischargers

During 2016, a survey was conducted in accordance with Ecology's *Guidance Manual for Performing an Industrial User Survey* (Ecology Publication No. 11-10-055). After sorting businesses based on type, location, and risk to the system, the survey was mailed to 24,000 businesses throughout the County's wastewater service area. The survey reached 17,000 businesses that are most likely to discharge non-domestic wastewater. The survey was conducted online and was available in five languages in addition to English. KCIW identified and prioritized types of businesses that were most likely to require a permit or additional oversight by the Industrial Waste Pretreatment Program. These 2,600 businesses received additional mailings and other follow-up to increase the participation rate. The response rate for this group was 83 percent. The overall survey response rate was 36 percent (6,000 businesses total).

King County is currently reviewing the data and conducting follow-up with businesses to determine which ones may need to be permitted or otherwise regulated. In an initial review of the completed surveys for the high-priority businesses, KCIW staff identified approximately 300 businesses that need further assessment to determine compliance status, including approximately 35 in the LDW.

The project will continue in 2017 as one of KCIW's priority projects. Lower Duwamish area facilities will be priority for follow-up.

2.5.4.2 Response to Unusual Occurrences

In 2016, KCIW staff continued to work with County treatment plant and conveyance inspection staff, local sewer agencies, and other regulatory agencies to evaluate and respond to referrals of unusual occurrences in the wastewater system. Staff also responded to notifications from Ecology's Environmental Report Tracking System (ERTS). The ERTS system notifies local agencies of complaint calls regarding potential illicit discharges to the sanitary sewer. KCIW evaluates each referral on a case-by-case basis. Responses include

[2] The Seattle District Dredged Material Management Office is the main point of contact for the interagency Dredged Material Management Program (DMMP). The DMMP brings together agencies with roles in management and regulation of dredged material to streamline testing and decision-making.

follow-up calls to industrial facilities, inspections, sampling, and surveillance monitoring at key sampling manholes.

The program responded to 11 referrals within the Lower Duwamish area. Referrals regarding permitted facilities were handled by the assigned staff. The program mailed standard KCIW surveys to at least three businesses and made permitting decisions based on the survey data. There was no further follow-up required in 2016.

2.5.4.3 Surveillance Monitoring

KCIW investigates potential sources of spills, slug loads, or illicit discharges by monitoring contaminants of concern at strategic manholes near suspected industrial users or possible polluters. In addition, KCIW designs key manhole studies to collect technical data in the regional wastewater system to use in the evaluation of local limits. There was no new surveillance monitoring required or conducted in the LDW drainage area in 2016.

KCIW staff conducted follow-up actions with one permitted facility, Marine Vacuum, that was identified as a potential discharger in the South Michigan CSO basin. The previous King County Source Control Annual Report for 2014-2015 (King County 2016b) referred to an investigation of detected fuel-like odors in the combined sewer lines within the South Michigan CSO basin. During 2016, and under orders from KCIW, Marine Vacuum implemented changes to its pretreatment process in addition to making other site modifications, and continues to work on additional changes that will eliminate the potential of future incidents.

2.6 Sediment Management Program

This section presents a summary of the source control activities supported by WTD's Sediment Management Program in 2016.

2.6.1 Source Tracing Activities

Since 2010, King County has been collecting solids samples from pipes, wet wells, and outfall weir structures in the combined sewer collection system in the LDW basin to trace sources of pollution (see King County 2016b; Appendix B for 2010 to 2015 data). The 8th Avenue South CSO basin was sampled in 2015 and 2016[3]. A reconnaissance effort determined there were not sufficient accumulated solids in the sewer lines to sample except at one location next to the regulator station. Thus, an in-line solids grab was collected in this location. In addition, a sediment trap was deployed at the same time the in-line grab was collected; the sediment trap sample was retrieved approximately seven months later (Table 2). The sediment trap was re-deployed in this location to collect suspended solids for the next wet season (2016 to 2017). The next round of sediment trap

[3] The 2015 sample is being reported for 2016 activities because the analytical results were not available until 2016.

data will be reported in the next annual report. A reconnaissance effort was also undertaken for solids that could represent what may be discharged from the T115 CSO (which is a shared storm drain outfall). Approximately five manhole access points were evaluated in September 2016 and no accumulated solids were found. Therefore, no source tracing samples could be collected.

Table 2. Summary of Source Tracing Samples Collected from the Combined Sewer System (2015 and 2016).

Sample Type and Year	Number of Samples
	8th Ave. South CSO Basin
Sediment traps	
2015	0
2016	1
In-line solids	
2015	1
2016	0

The sediment trap was installed at a level above sewage baseflows in the 8th Avenue South sampling location. The goal is to capture solids indicative of flows associated with CSOs.

As outlined in King County's LDW SCIP, source tracing screening levels for the combined sewer system are two times the second lowest apparent effects threshold (2LAET) and the source tracing focuses on metals, mercury, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and certain other semivolatile organic compounds. Analyses of sediment trap samples, therefore, included metals, mercury, PCBs, and semivolatile organic chemicals for all samples. The sediment trap was also analyzed for dioxin/furans. In addition, solids from combined sewer lines typically result in analytical matrix interferences that, in turn, often result in elevated detection limits[4].

The in-line solids grab sample had concentrations of mercury and bis(2-ethylhexyl) phthalate (BEHP) above combined sewer system source tracing screening levels. Concentrations of chromium and zinc in the in-line solids grab sample were greater than the 2LAET, but not the screening levels. The sediment trap sample exceeded combined sewer system screening levels for BEHP, whereas mercury concentrations were only above the 2LAET. Phthalates have been found to be ubiquitous in source tracing data from both separated storm and combined sewer lines as well as difficult to source trace. Sediments near the CSO outfall only had an exceedance of the Sediment Management Standard's sediment quality standard (SQS) for total PCBs at one station (AECOM 2012); other nearby stations had no exceedances of the SQS.

[4] Smaller mass of sample often is used from the sample jar for analytical extraction methods or dilutions are required after analytical extraction methods. This is done so that analytical quality control/quality assurance performance is acceptable, although it can result in elevated detection limits.

The sediment trap was re-deployed to determine if mercury levels, on average, exceed the screening level and how variable are the concentrations. Mercury tends to be heterogeneous in the combined sewer basins based on sampling in other combined sewer basins and the laboratory duplicate sample data associated with samples collected from the 8th Avenue CSO basin.

2.6.2 Summary of Source Control Studies

Sources of chemical contaminants to the LDW Superfund site include both historical and current sources. Current sources can be transported through various pathways to the LDW, including inputs from the Green River, direct discharge of stormwater, CSOs, atmospheric deposition, spills and leaks of contaminated material, groundwater, and bank erosion or leaching of contaminants from materials. King County has been conducting studies to characterize contaminants in some of these pathways identified for the LDW. This section summarizes the status of the remaining studies to be completed. The previous year's source control annual report summarized the full list of these studies (King County 2016b).

2.6.2.1 Suspended Solids Sampling in the Green River Watershed

King County completed a suspended solids sampling study in the Green River Watershed (King County 2016c). This study characterized chemical concentrations in suspended solids and the differences of suspended solids quality between major tributary basins and the Green River during both dry conditions and wet season/storm events. While this study did not estimate contaminant loading to the LDW, the data can be used to help characterize the contaminants exported to the LDW and to assist in development of future studies to evaluate contaminant loading to the LDW. The results of this study can also be used to inform future source control efforts in the watershed.

2.6.2.2 CSO Basin Inputs Study

King County's CSO basin inputs study is a pilot study to examine pathways of contaminant sources to combined sewer basins in the LDW (King County 2011, 2013). Combined sewer basins include inputs from domestic and industrial wastewater (sewage), groundwater infiltration into combined sewer lines (infiltration), and stormwater runoff (inflow). This study aims to better understand the present-day pathways for loadings of select chemicals into combined sewer basins. Specifically, the study aims to identify primary pathways of LDW contaminants of concern in combined sewers to determine whether contaminants are primarily from stormwater, sewage, or groundwater infiltration entering the system. The results of this study are intended to help guide source tracing efforts in combined basins prior to CSO control by estimating the primary pathways of contaminant sources during stormflow conditions (storm events when sewage and stormwater are both present in the system) that could lead to CSO discharge. King County selected the Brandon and South Michigan combined sewer basins for this study, both of which are priorities for CSO control in the LDW. The Brandon Combined Sewer Basin Study Report was completed in 2016 (King County 2016d). In 2016, data analysis was conducted for the Michigan Combined Sewer Basin Study; the report is expected to be completed in 2017.

2.6.2.3 Green River PCB Equipment Blank Study

King County is conducting a study to evaluate the potential for sampling equipment to cause contamination in samples analyzed for low-level PCBs (King County 2015). Equipment blank samples collected for previous studies suggest that autosampler equipment may be contributing PCBs to surface water samples collected from the Green River Watershed. This study includes the collection of surface water samples from the Green River as well as autosampler tubing equipment blank samples. These samples will allow a determination of specific PCB congener contamination from autosampler equipment and evaluate the potential bias to Middle and Lower Green River surface water samples collected in previous King County Green River Watershed studies. Once the source of the PCB contamination was determined, additional Green River water samples were collected in 2016 to generate new data without the equipment identified as cause of the sample contamination. Additional autosampler equipment tubing blank samples were also generated in 2016. However, the PCB congener laboratory experienced analytical issues (e.g., high method blank contamination) that invalidated the sample data. Because of this, additional samples were collected in 2017. This has delayed the final data analysis and reporting to early 2018.

3.0 WATER AND LAND RESOURCES DIVISION

This section summarizes source control actions taken by King County's WLRD in the LDW drainage area during 2016.

3.1 Stormwater Services

3.1.1 Mapping Updates

In accordance with the NPDES Phase I Municipal Stormwater Permit (S5.C.2, Municipal Separate Storm Sewer System Mapping and Documentation), King County is required to map and document the municipal separate storm sewer system (MS4) on the properties it owns or operates, including the county right-of-way, and on properties that discharge to the MS4. Since the issuance of the municipal stormwater NPDES permit in 1995, various county departments and divisions that hold properties that contain MS4 structures and facilities have mapped their systems to meet the requirements of the County's MS4 mapping program.

King County submits annual progress reports to Ecology on the MS4 mapping effort; this occurs as part of the Municipal Stormwater NPDES Annual Report. In 2016, King County also continued gap analyses for MS4 mapping in the LDW. In isolated cases, these analyses have identified the need for closed-circuit TV equipment to better understand potential system incongruity. King County is assembling these instances so that a project can be formed to resolve them. These actions improve the stormwater asset inventory datasets in the LDW drainage area in unincorporated King County.

3.1.2 Business Inspections

An inventory of the parcels in the unincorporated area of the LDW drainage area was created and each parcel was rated according to its potential to pollute and its stormwater inspection compliance history. A schedule of these accelerated inspections began in 2016. Thirty-seven source control inspections were conducted in 2016. Table 3 summarizes these business inspections.

Table 3. Business Source Control Inspection Results.

Company	Date	Comments
AAAA Mini Storage 9640 Des Moines Memorial Dr. S	2/1/2016	No issues
Absolute German 9510 14th Ave. S	4/20/2016	Small spills and drips with sorbant material needed sweeping. Used oil and antrifreeze not labeled (labels provided)
Ace Galvanizing 429 S 96th St.	2/1/2016, 3/30/2016	Zinc solids outside window in production shed. Window was opened and is not supposed to be except when treating very long pieces. Not all CBs stenciled. Berm to collected contaminated water at entry was broken again. Corrected by return visit.
Aero-Lac 420 S 96th St.	1/25/2016	No issues
Allied Body Works 625 S 96th St	2/3/2016	No issues
Anmarco Yard 1110 S 96th St.	2/16/2016, 3/16/2016	No issues
Bakersfield Pipe & Supply 1050 S 96th St.	2/3/2016	No issues. Storm drain stencils provided.
Beckwith & Kuffel 1313 S 96th St.	2/16/2016	No Issues
Bidadoo Auctions 1541 S 96th St.	3/3/2016	No longer in business
CDL Recycling 9208 4th Ave. S	3/2/2016	No longer in business. Property changed hands to a freight company
Dominic's Red Apple Market 9627 Des Moines Memorial Dr. S	3/16/2016, 8/22/2016	Two catch basins required cleaning and stenciling, and waste oil receptacles needed to be replaced. All issues corrected by return visit.
Duwamish Yacht Club 1801 S 93rd St.	3/17/2016	No issues
Harrasch Industrial Park 1605 S 93rd St.	3/17/2016	No issues
Industrial Automation 9300 14th Ave. S	3/24/2016	No issues in the areas in which inspector was allowed access
Northwest Grating Products 9230 4th Ave. S	3/7/2016, 6/6/2016	Catch basins required cleaning and labeling. All issues corrected by return visit.
PSF Industries 9322 14th Ave. S	3/23/2016	No issues
Puget Sound Coatings 9400 8th Ave. S	11/17/2016	No issues

Company	Date	Comments
Pyrometric Service Inc. 1312 S 96th St.	2/16/2016	No longer in business
SP Plus Transportation 9301 4th Ave. S	3/16/2016, 3/17/2016	No issues
Rick's Master Marine 1411 S Thistle St.	4/6/2016	No issues
Riverton Distribution Center 9600 8th Ave. S	12/2/2016	New development, food bank distribution center. All waste is recycled.
Sea King Industrial Park 1621 S 92nd Pl.	3/24/2016	No issues
Sea King Industrial Park 1521 S 92nd Pl.	2/17/2016	No issues
Sealaska Seafoods 9411 8th Ave. S	3/23/2016	No issues
Seattle City Light 10000 West Marginal Pl. S	3/29/2016	No issues
Security Contractor Services 9226 4th Ave. S	5/11/2016	No issues
Security Contractor Services 9617 8th Ave. S	5/11/2016	No issues
615 S 96th St.	2/17/2016	No issues
Shell Gas Station 9525 14th Ave. S	2/18/2016	No issues
South Park Marina 8604 Dallas Ave. S	3/24/2016	No issues
South Park Tire Factory 8510 Dallas Ave. S	3/17/2016	No issues
Terex Utilities 9426 8th Ave. S	2/17/2016	No issues
Woolridge Boats 1303 S 96th St.	2/17/2016	Needed to replace dumpster with cracked lid, and drain markers/stencil applied to catch basins. No further issues.
Old Dominion Freight 600 S 96th St.	6/7/2016	No issues

King County received two water quality complaints that were promptly investigated, shown in Table 4.

Table 4. Water Quality-Complaint Investigations in 2016.

Company	Date	Comments
Delta Marine	**2/4/2016**	**Employee noted what he thought was sewage and debris in water. No source found.**
South Park Marina **8604 Dallas Ave. S**	**3/29/2016**	**Unknown amount of diesel released from vessel. Stormwater treatment system accidentally disconnected. On-site personnel addressed problem.**

3.1.3 Participation in Duwamish Inspectors Group

The Source Control Program manager regularly attended the Duwamish Inspectors Group meetings, sharing information about inspections and coordinating inspections whenever possible. Other members of this group include Ecology, City of Seattle, and other King County programs.

3.1.4 Source Tracing Activities

The following summaries provide a review of the source tracing solids data collected in April or June 2016 by County's Stormwater Services Section (SWS) from unincorporated King County LDW drainage basins. Sediment trap samples were collected from sampling locations 96-ST1, 96-ST2, and 96-ST1, which are all associated with stormwater drainages that flow into the North Fork Hamm Creek. A sediment trap sample was also collected from sampling location HC-ST1, which is associated with South Fork Hamm Creek. The locations LDW-SG1 through LDW-SG3 are catch basin solids grab samples from small drainage basins near the South Park Bridge. The sampling locations are shown in Appendix C. All samples were analyzed for metals, mercury, PCBs, and semi-volatile organic compounds. The sediment trap samples were also analyzed for dioxins/furans. The sample results are shown in Appendix C. The summary below includes a comparison of sample data to source control screening benchmarks (LAET and 2LAET) per steps in the County's SCIP (see SCIP Appendix F). The receiving water sediment data reviewed as part of the source tracing data evaluation were from the LDW Feasibility Study (AECOM 2012) and outfall sediment sampling by Ecology (SAIC 2011).

Location 96-ST1 (sediment trap collected April 7, 2016)

One high molecular weight polycyclic aromatic hydrocarbon (HPAH) compound and total HPAHs were above the LAET and zinc, bis(2-ethylhexyl)phthalate (BEHP), and six HPAH compounds and one low molecular weight PAH (LPAH) compound were above the 2LAET. No other chemicals analyzed were above screening benchmarks.

The BEHP is at a level often seen in source tracing storm drain solid samples and there are no BEHP Sediment Management Standards sediment quality standard (SQS) exceedances in available nearby receiving sediment samples. The BEHP is at a level that is commonly observed in storm drain solids and would not likely be traceable to a particular source. Zinc and HPAHs are at levels above most storm drain solids data and, therefore, would be identified as contaminants to source trace. However, zinc and HPAHs do not exceed SQS (or

LDW remedial action levels) in nearby sediments. The drainage for this basin is discharged from the North Fork of Hamm Creek.

The County's SWS is conducting additional monitoring of this location as well as reviewing historical data to understand how frequently zinc and PAHs are above the screening benchmarks. The County's SWS is also reviewing business inspections for this area.

Location 96-ST2 (sediment trap collected in April 7, 2016)
Zinc and benzyl butyl phthalate were above the LAET and BEHP was above the 2LAET. No other chemicals analyzed were above screening benchmarks. Dioxin/furans were also analyzed in this sample. No screening benchmarks have been established for dioxin/furans and nearby sediment data do not indicate sediments above the remedial action level for dioxins. The drainage for this basin is discharged from the North Fork of Hamm Creek.

Zinc, benzyl butyl phthalate, and BEHP are at levels often seen in source tracing storm drain solid samples and there are no SQS exceedances in available nearby receiving sediment samples for any of these chemicals. Zinc is currently undergoing source tracing in this basin based on past sampling results. The levels of zinc detected in the sample are similar to those detected in the "upstream" sampling location 96-ST3. The County's SWS has identified two sources of zinc (Ace Galvanizing is a primary source and Security Contractor Services is a secondary source) in the basin so far and has been working with Ecology to control zinc from these sources.

Location 96-ST3 (sediment trap collected in April 7, 2016)
Zinc was above the LAET. No other chemicals analyzed were above screening benchmarks. Dioxin/furans were also analyzed in this sample. No screening benchmarks have been established for dioxin/furans and nearby sediment data do not indicate sediments above the remedial action level for dioxins. The drainage for this basin is discharged from the North Fork of Hamm Creek.

Zinc is at levels often seen in source tracing storm drain solid samples and there are no SQS exceedances in available nearby receiving sediment samples for any of these chemicals. This location includes runoff from Highway 509 and is situated "upstream" of other two sampling locations within this basin.

Location HC-ST1 (sediment trap collected in April 7, 2016)
There are no chemicals above screening benchmarks. This sample represents suspended solids from South Fork of Hamm Creek. The sample, previous years' sediment trap data, and nearby receiving sediment data indicate that no further source tracing efforts are needed.

Location LDW-SG1 (June 2, 2016, grab sample; catch basin associated with outfall 2215)
Zinc was above the LAET and BEHP was above the 2LAET. No other chemical for which source tracing is conducted was above screening benchmarks. Zinc and BEHP are at levels

often seen in source tracing storm drain solid samples and there are no SQS exceedances in available nearby receiving sediment samples for any chemicals. Overall, the sample and nearby receiving sediment data suggest further source tracing efforts would not be needed.

Location LDW-SG2 (June 1, 2016, grab sample; catch basin associated with outfall 3037)
There are no chemicals above screening benchmarks and there are no SQS exceedances in nearby receiving sediment samples for any chemicals. Overall, the sample and nearby receiving sediment data indicate further source tracing efforts would not be needed.

Location LDW-SG3 (June 1, 2016, grab sample; catch basin associated with outfall 3031)
Benzyl butyl phthalate was above the LAET and chromium and BEHP were above the 2LAET. No other chemical for which source tracing is conducted was above screening benchmarks.

Benzyl butyl phthalate and BEHP are at levels often seen in source tracing storm drain solid samples and would not likely be traceable to a particular source. Additional sample aliquots were re-analyzed for chromium and the laboratory results indicate much lower levels (101, 58, and 37 mg/kg, dry weight) in the sample; these results and the metal shavings observed in the sample indicate the chromium is not consistently found at higher concentrations throughout the catch basin solids. The catch basin where this sample was collected receives runoff from a portion of the new South Park Bridge. The drainage system for the bridge has “as-builts” stamped in October 2015. The sediments adjacent to this outfall have been recently remediated by the Boeing Company as part of their Boeing Plant 2 early action area cleanup. The sediments were contaminated from historical inputs and, therefore, cannot be used to assess any potential effects from this newly built outfall. The catch basin and drainage lines associated with this catch basin were requested to be cleaned in 2017. Samples will be collected following cleaning once sufficient solids accumulate in the catch basin to evaluate if there are ongoing sources of chromium.

Based on the foregoing results summations, the next steps for 2017 are planned to minimally include sediment trap sample acquisition and analysis from 96-ST1, 96-ST2, and 96-ST3 for the same parameters (less dioxins, furans, and mercury analyses) in April 2017. Sediment bottles will be replaced at the time of bottle retrieval. There is no plan to collect sediment trap solids in 2017 at HC-ST1 because chemistry data have not been above any screening benchmarks.

No further grab samples will be collected at LDW-SG1 and LDW-SG2, per the foregoing results summation. The catch basin and drainage lines associated with LDW-SG3 are expected to be cleaned in 2017, and further sampling will likely occur in 2018 once sufficient solids accumulate in the catch basin.

3.2 Local Hazardous Waste Management Program

LHWMP implements the moderate-risk waste plan, which addresses hazardous wastes generated by residents and small quantities generated by businesses. LHWMP activities in the LDW for 2016 are summarized below. More information on LHWMP's services is available at www.hazwastehelp.org.

Table 5 summarizes the number of site visits by LHWMP in the LDW drainage area in 2016. The effort focused on on-site technical assistance visits to small businesses for hazardous material and waste management.

Table 5. LHWMP Site Visits in 2016 in the LDW Drainage Area.

Zip Code	2016
98106	15
98108	16
98134	9
98168	4
Total	44

These site visits were conducted in the Brandon combined sewer basin as follow-up to the 2015 work and included outreach to property managers as an area of field team focus. LHWMP's field team visited businesses in the Brandon combined sewer basin that generate or store hazardous wastes and materials. These site visits occurred between January and December 2016. The businesses made improvements in hazardous waste and material storage, spill prevention, and waste disposal. LHWMP issued seven vouchers to reimburse businesses 50 percent of their costs (up to $500 dollars) for purchasing and installing pollution prevention equipment or to cover full costs (up to $500 dollars) for secondary spill containment pallets.

LHWMP also worked with selected businesses and ethnic groups known to work in topic areas such as the following: dry cleaning companies to explore alternatives to using perchloroethylene and other chlorinated solvent spot cleaners; nail salons to address worker and customer exposures to hazardous solvent vapor; custodial services regarding the safe use of cleaning products and the promotion of safer alternatives; lead to reduce childhood lead poisoning in residential housing; and autobody shops to promote waterborne paint systems instead of solvent-based paint systems.

Through a contract with the Environmental Coalition of South Seattle, the LHWMP Business Field Services team also continued to provide spill kits, customized drainage maps, spill plans, and spill cleanup training to businesses that lacked these items.

4.0 DEPARTMENT OF TRANSPORTATION

This section summarizes source control actions taken in 2014 and 2015 in the LDW drainage area by KCIA and the Road Services Division of the King County Department of Transportation.

4.1 King County International Airport

KCIA source control activities conducted in 2016 include Industrial Stormwater General Permit (ISGP) compliance, MS4 permit compliance, contaminated site cleanups, spill responses, annual stormwater solids monitoring, and stormwater line cleaning.

A map of KCIA drainage areas[5] is provided in Appendix D, Map 1. KCIA is divided into four source control areas in associated drainage basins:

- Slip 4 (LDW river mile [RM] 2.8; north drainage area)
- Boeing Isaacson/Central KCIA/Former Slip 5 (LDW RM 3.7–3.9; central drainage basin)
- Slip 6 (LDW RM 3.9–4.3t; southcentral drainage basin)
- Norfolk CSO/Storm Drain (LDW RM 4.9; south drainage basin)

The Ecology Source Control Action Plans for these KCIA source control areas was reviewed, and 2016 actions described in this section are consistent with those listed in the LDW Source Control Status Report for 2013 [Ecology 2014]).

Source control activities related to ISGP compliance, the MS4 permit, and other source control activities organized by four different KCIA source control areas are discussed below. Maps of sampling areas as well as past source tracing data can be found in the previous annual report (King County 2016b).

4.1.1 Industrial Stormwater General Permit Compliance

In 2016, KCIA monitored stormwater at two sampling points in two of the airport's drainage areas in accordance with the ISGP. The two areas sampled were central KCIA basin (SP2 sampling point) and southcentral/Slip 6 basin (SP3 sampling point). Sampling at the third area, north/Slip 4 basin (SP1 and SPM sampling points), was not required in 2016. Sampling point SP4, located in the relatively small south drainage basin, was

[5] These drainage areas do not delineate the entire geographic area or basin that drains to each of these slips or outfalls. They are only intended to delineate the areas within the airport (not including the North Boeing Field area leased by the Boeing Company) that drain to each of these areas.

removed in 2012 because no airport industrial facilities are located in the basin. These sampling locations have been shown on maps included in the previous annual report (King County 2016b). Sample parameters include turbidity, pH, zinc, copper, and petroleum sheen unless consistent attainment (CA) was achieved[6]. The status of each sampling point is as follows:

- The SP1 and SPM sampling points achieved CA for turbidity, pH, zinc, and copper. In accordance with the 2015 ISGP, sampling of these parameters ceased in the first quarter of 2015 and will resume the first quarter of 2018. Petroleum sheen and total suspended solids (TSS) will continue to be monitored at SP1 and SPM.
- CA was achieved at SP2 for pH, zinc, and copper. Sampling will resume for these parameters in the fourth quarter of 2018. Turbidity, petroleum sheen, and TSS at SP2 will continue to be monitored.
- CA was achieved at SP3 for turbidity, pH, and zinc. Sampling at this location will resume for these parameters in the fourth quarter of 2018. Copper, petroleum sheen, and TSS at SP3 will continue to be monitored.

Table 6 shows the 2016 values for turbidity and copper based on quarterly data from discharge monitoring reports. Turbidity measurements were below benchmark value. Copper results for the third quarter were above the benchmark value of 14.0. A level-one corrective action was performed that included a site investigation and review of best management practices (BMPs) and re-sampling on October 14, 2016. The re-sampling resulted in a copper concentration (8.8 µg/L) below benchmark value, indicating the source as temporary. Pavement sweeping and oil–water separator (OWS) maintenance was performed during the quarter. Line cleaning was performed during the second quarter.

Table 6. ISGP Discharge Monitoring Data for 2016.

Location	Turbidity (NTU)	Zinc (µg/L)	Copper (µg/L)
SP1	CA	CA	CA
SP2	21.8	CA	CA
SP3	CA	CA	15.1
SPM	CA	CA	CA
Benchmarks	25	117	14

KCIA implemented airport-wide BMPs in accordance with its ISGP Stormwater Pollution Prevention Plan. Treatment BMPs such as OWSs, water quality vaults, and StormFilter systems have been installed and are being maintained. KCIA performs daily mechanical sweeping of paved areas, annual inspections of stormwater facilities, and weekly

[6] CA is achieved when eight consecutive quarterly samples demonstrate a reported value equal to or less than the benchmark value or when they are within the range of 5.0 to 9.0 standard units for pH. Sampling is resumed 12 months after CA is achieved.

maintenance of OWSs. KCIA inspects tenant and airport common areas monthly to ensure that BMPs are being maintained. Stormwater line cleaning is being performed in accordance with the ISGP (see "Source Tracing Activities and Remediation" below).

Several tenants at KCIA who are also covered by an ISGP comply directly with Ecology on the ISGP requirements. KCIA ISGP tenants are listed in Table 7.

Table 7. KCIA Tenants and ISGP Numbers.

Tenant and Facility Name	Permit Number
Signature Aviation (formerly Landmark Aviation)	WAR000607
UPS (Boeing Field)	WAR000434
The Boeing Company (North Boeing Field)	WAR000226
Ameriflight, LLC	WAR002830
KC WTD (Georgetown Yard)	WAR010792
Charles Air	WAR127177

4.1.2 MS4 Permit Compliance

KCIA performed spill response activities in 2016 in accordance with its spill response policy. The policy requires that spills be addressed immediately upon discovery[7]. Notification requirements include contacting airport operations and firefighting units. To ensure zero discharge to receiving waters, pump stations are turned off when spills enter the stormwater drainage system. Seventeen spill events were recorded in 2016. Spill events resulted in proper cleanup and Ecology notifications, as needed. None of these spills entered receiving waters.

In September 2016, KCIA performed annual illicit discharges/connection inspections. Inspections were performed during dry periods and at various discharge points on airport property. No suspected or obvious illicit connections were identified at KCIA discharge points. Data are used to track and source-trace any suspected or obvious discharges that are observed.

In December 2016, KCIA performed annual stormwater facility inspections. The inspections involved measuring the amount of sediments in 20 stormwater structures, including OWSs, stormwater vaults, water quality vaults, StormFilter treatment systems, and stormwater retention systems. Measurements were used to develop schedules for cleaning. OWSs are also maintained weekly for oils and floatables (e.g., replacing oil absorbent booms).

[7] In addition, spill prevention materials (e.g., oil-absorbing materials such as booms and mats) are available in areas required per the NPDES ISGP permit.

4.1.3 Source Tracing Activities and Remediation

In 2016, source control activities such as sampling, source tracing, remediation, and line cleaning (per the ISGP) were performed in KCIA's four source control areas. A map of sampling, source tracing, and remediation locations was provided in the previous annual report (King County 2016b).

Stormwater solids samples were collected in source control areas draining to Slip 4, Former Slip 5, and Slip 6, as part of annual stormwater solids sampling and in support of the County's LDW SCIP. The numbers of source tracing samples collected in each area in 2016 are shown in Table 8. Source tracing sampling data for 2016 are provided in Appendix E. As outlined in King County's LDW SCIP, source tracing screening levels for the storm drain solids are the SQS/LAET and the cleanup screening level (CSL)/2LAET of the Washington State Sediment Management Standards.

Table 8. Number of Source Tracing Samples Collected from KCIA Source Control Areas in 2016.

Sample Type	Number of Samples		
	Slip 4	Former Slip 5	Slip 6
In-line solids grab	4	2	1
Sediment traps	4	2	1
Catch basin/OWS	0	9	6

Summaries of source control activities, including sampling and any remedial activities, are presented by drainage basin below. In accordance with the County's LDW SCIP, annual in-line trap and grab sampling will continue in 2017. The ongoing sampling will assist in investigating contaminant trends.

4.1.3.1 Slip 4 Basin

The KCIA Slip 4 source control area is located in the north area of KCIA. North Boeing Field (NBF), an area of KCIA leased by the Boeing Company, is downgradient of the KCIA drainage area; KCIA non-leased areas (runways and taxiways) and areas leased by tenants other than Boeing are located upgradient of NBF. Off-site stormwater from the east (Airport Way) discharges into the KCIA stormwater system. Stormwater is discharged from NBF through the north pump station and to Slip 4 via a stormwater pipe.

Sampling and Source Tracing

In May 2016, KCIA collected annual in-line trap and grab stormwater solids samples at the south (SL4-T2A) and south central lateral (SL4-T3A) drainage areas of Slip 4. The Boeing Company collected stormwater solids samples at the north central (SL4-T4A) and north lateral (SL4-T5B) drainage areas of Slip 4[8]. These sampling locations are the major laterals

[8] Boeing provides data results for samples SL4-T4A and SL4-T5A/B to EPA, Ecology, and KCIA.

of the KCIA Slip 4 source control area that discharge into the NBF site. The sampling results are presented in Appendix E, Tables E-1a through E-1d, and include a summary table showing all results compiled since 2005. Below is a summary of 2016 in-line trap and solids grab sample data compared to source control screening benchmarks:

- North Lateral/SL4-T5B. Zinc and total PCBs were above the SQS/LAET, but were below the CSL/2LAET. Phenanthrene, eight individual HPAH compounds, total HPAHs, and BEHP were above the CSL/2LAET. Heavy oil was below the Model Toxics Control Act (MTCA) Method A standards. Similar exceedances of benchmarks have been observed in past data, except there were no exceedances for di-n-octyl phthalate or butyl benzyl phthalate (BBP) in 2016 compared to past years.

- Northcentral Lateral/SL4-T4A. Total PCBs in 2016 were above the SQS/LAET, but below the CSL/2LAET. Phenanthrene, seven individual HPAH compounds, total HPAHs, BEHP, and di-n-octyl phthalate were above the CSL/2LAET. Similar exceedances of screening benchmarks have been observed in past data. Boeing did not analyze for metals in 2016.

- Southcentral Lateral/SL4-T3A. In the in-line trap samples, BEHP, BBP, and benzo(a)anthrancene were below the SQS/LAET compared to 2014 and 2015 samples. Similar to 2014 and 2015, phenanthrene, six individual HPAHs, and total HPAHs were above the CSL/2LAET in the in-line trap samples. None of these compounds exceeded the benchmarks in the grab sample in 2016. However, mercury in the grab sample was above SQS/LAET, but below the CSL/LAET. In the past, mercury has not been above screening benchmarks.

- South Lateral/SL4-T2A. Similar to past years, total PCBs in 2016 were above the SQS/LAET in both trap and grab samples. Zinc in the trap sample and BEHP in the grab sample were above the SQS/LAET, but below the CSL/2LAET in 2016. The grab sample results in 2016 were above the CSL/2LAET for zinc, phenanthrene, 10 individual HPAHs, and total HPAH; this is similar to findings from past years.

In accordance with EPA and Ecology requirements, Boeing installed the North Boeing Field Stormwater Treatment System at the KCIA north pump station in 2011 to reduce contaminants leaving NBF and entering the LDW at Slip 4. Boeing also rerouted KCIA stormwater to a separate pipe from the north lateral to efficiently treat stormwater from Boeing's north lateral drainage basin. Boeing continues to treat stormwater, which comprises mostly baseflows in NBF and KCIA Slip 4 drainage areas. Boeing also continues to operate and evaluate the system in compliance with their NPDES industrial permit.

In accordance with the NBF/Georgetown Steam Plant Remedial Investigation/Feasibility Study Work Plan, KCIA performed data gap sampling of stormwater structures upgradient of the NBF/Georgetown steam plant site in fall 2014. The sampling results were submitted to Ecology in a data gaps report in June 2016 (Cardno 2016). Data showed elevated concentrations of some PAH compounds, BEHP, and zinc compared to source tracing screening benchmark values such as the LAET. Additional source tracing at KCIA Slip 4 drainage area is planned for 2017 to determine potential sources of contamination, either at the KCIA or from stormwater upgradient of the KCIA, which commingles with stormwater at the airport. Actions are pending following an Ecology review of the data gaps report. Other source tracing and source control activities are included in the MTCA North Boeing Field/Georgetown Steam Plant Site remedial investigation activities.

Remediation Activities
The following remediation was done in 2016 in the Slip 4 area:

- Shultz Fuel Farm Site – 1495 South Hardy Street. In 2014, a remedial investigation/feasibility study was prepared by the tenant to determine alternatives for cleanup. The tenant has entered the site into Ecology's Voluntary Cleanup Program. Site groundwater was monitored quarterly from March 2014 through December 2015. Ecology required installation of additional shallow wells. Shallow wells were installed and continue to be monitored by the tenant.

- Boeing Electronics Manufacturing Facility Site. In August 2016, Boeing conducted groundwater sampling to monitor performance and provide remedial optimization data for the enhanced reductive dechlorinization remediation activities occurring at the site. Boeing has not provided a report of the sampling as of yet. The Electronics Manufacturing Facility Engineering Evaluation/Cost Analysis (Calibre Systems 2015a) and the Remedial Optimization Work Plan (Calibre Systems 2015b) were both undergoing public review in 2016.

4.1.3.2 Former Slip 5 Basin

The KCIA Former Slip 5 source control area is located in the central area of KCIA. Off-site stormwater from the east (Airport Way–City of Seattle) discharges into the KCIA stormwater system. East Marginal Way in the City of Tukwila also discharges stormwater into the KCIA pipe to the Former Slip 5 outfall.

Sampling and Source Tracing
In May 2016, KCIA collected annual in-line trap and grab stormwater solids samples at KCIA2 and south pump station (SPS) locations in the Former Slip 5 drainage areas of KCIA. The KCIA2 sampling point, located at the westernmost downgradient structure of the basin, represents KCIA stormwater discharges and tidal backflow from both LDW and East Marginal Way stormwater drainage. The SPS sampling point is more representative of KCIA stormwater drainage than KCIA2. The sampling results are presented in Appendix E, Table E-2, and include a summary table showing all results compiled since 2009. Below is a summary of 2016 data compared to screening thresholds:

- KCIA2. Arsenic was above SQS/LAET in the grab sample, but not the trap sample. No other contaminants, in grab or trap samples, had detected concentrations above the SQS/LAET in 2016, which indicates that source control activities have been effective.

- KCIA SPS. A grab sample in 2016 did not have any chemical concentrations above the SQS/LAET. This is consistent with past samples since 2012[9].

The LDW feasibility study (AECOM 2012) did not show any sediment exceedances in samples nearest the basin's outfall for arsenic, but there were some PAH and phthalate exceendaces of SQS and/or CSL. Samples farther from the outfall did show SQS exceedance for arsenic and PCBs. As noted above, off-site discharges and tidal backflow from LDW enter the pipe associated with KCIA2. As part of the ISGP, stormwater drainage lines, up-gradient of where KCIA2 is collected, were cleaned in 2016.

Remediation Activities
The following remediation activities occurred in 2016 in the Former Slip 5 basin:

- Former Standard Oil Site – 7400 Perimeter Road. Independent cleanup of the Former Standard Oil Site was completed in November and December 2014. Cleanup activities included excavation and disposal of petroleum-contaminated soil, post-excavation sampling, dewatering, backfilling, oxygen release compound (ORC) advanced injections, and well installation. Post-construction groundwater monitoring was performed in 2016. Data indicate concentrations were below standards in WAC 173-340 (Hart Crowser 2017).

- Former Hangar 5 Site – 7585 Perimeter Road. Independent cleanup of the Former Hangar 5 Site was completed in February 2015. Cleanup activities included soil excavation and disposal, post-excavation sampling, dewatering, backfilling, ORC placement, and well reinstallation. Post-construction groundwater monitoring was performed in 2016. Data indicate concentrations were below standards in WAC 173-340 (Greylock Consulting 2017).

4.1.3.3 Slip 6 Basin

The KCIA Slip 6 source control area is located in the south central area of KCIA. Off-site stormwater from the east (Airport Way ─ City of Seattle) discharges into the KCIA stormwater system. Other off-site properties such as the Museum of Flight, Airfield Business Center, East Marginal Way (City of Tukwila), Aviation High School, and International Auto Auctions discharge stormwater into the KCIA stormwater pipe which drains to the Slip 6 outfall.

Sampling and Source Tracing

[9] Ecology collected the 2013 samples. Results were reported in the LDW NPDES Inspection Sampling Report prepared by Leidos in January 2015.

In May 2016, KCIA collected annual in-line trap and grab stormwater solids samples in the Slip 6 drainage areas of KCIA. The KCIA1 sampling point was initially installed at the westernmost downgradient structure of the basin in 2009. The sampling point was moved in 2012 to a more upgradient location to avoid off-site discharges and tidal backflow and relabeled as “KCIA1A”. The KCIA1A sampling point has been sampled since 2013 and more accurately represents KCIA stormwater discharges to the LDW. Sampling results for both locations are presented in Appendix E, Table E-3, and include a summary table showing all results compiled since 2009. Below is a summary of 2016 data compared to screening thresholds:

- KCIA1A. Zinc and arsenic were above the SQS/LAET in the in-line trap sample collected, but were below SQS/LAET in the grab sample; zinc findings from in-line trap sample in 2016 is similar to 2014 and 2015, but arsenic previously had concentrations above CLS/2LAET in 2014. In 2016, the BEHP and di-butyl phthalate trap samples were above the CSL/2LAET and the di-butyl phthalate grab sample was above the SQS/LAET. BEHP had not been above a screening benchmark since sampling began in 2013 and di-butyl phthalate had never been above a benchmark. Although previous years have also shown some HPAH compounds as well as total HPAHs with concentrations above screening benchmarks, none were above in 2016.

The LDW feasibility study (AECOM 2012) did not show any sediment exceedances in samples nearest the basin’s outfall, but there were some PAH SQS exceedances within approximately 150 feet of the outfall; there were no exceedances for zinc in the river sediment in Slip 6.

A Slip 6 source tracing/investigation was conducted on April 11, 2016, to review three major (east, central, and west) laterals to KCIA’s Slip 6 Basin. The sampling effort was to determine areas to focus source control investigations and mitigation. The following results were compared to the screening benchmarks:

- The West Lateral data had total LPAH, total HPAH, some individual PAHs, and BEHP concentrations above the CSL/2LAET; zinc, BBP, and di-n-butyl phthalate concentrations were above the SQS/LAET, but below the CSL/2LAET.
- The Central Lateral sample only had zinc concentrations above the SQS/LAET, but below the CSL/2LAET.
- The East Lateral had phenanthrene, total HPAH, and individual HPAH concentrations above the CSL/2LAET and zinc concentrations above the SQS/LAET, but below the CSL/2LAET.

The arsenic and zinc in the KCIA1A trap sample may be more attributable to off-site discharges from East Marginal Way drainage system, which still can backflow to the airport drainage system. In addition, the corresponding grab sample did not have concentrations above screening benchmarks.

There were no elevated LPAHs or HPAHs in the KCIA1A trap sample. Therefore, it is possible that the concentrations above benchmarks observed from the source tracing samples were not exiting the airport drainage system. This is likely attributable to the on-site treatment system that includes a wet vault downstream of the West Lateral sample location and an OWS downstream of all the laterals. Stormwater solids may also be trapped in the stormwater system, portions of which are cleaned annually such that the entire system is cleaned every three years.

There may be a potential off-site source from the East Lateral sample location. Approximately 113 acres of City of Seattle stormwater drainage from Beacon Hill and Airport Way enters the airport Slip 6 drainage basin.

4.1.3.4 Norfolk CSO/Storm Drain Basin

The KCIA Norfolk source control area includes a portion of Perimeter Road and some grassy areas. Off-site stormwater from the east (Airport Way—City of Seattle) and south (Unified Grocers) discharges to a stormwater pipe located within the boundaries of the KCIA property. The pipe extends westward into the Boeing Military Flight Center, connects to the City of Tukwila stormwater drainage system, and discharges to the Norfolk CSO/storm drain outfall in the LDW.

Sampling and Remediation
No sampling was conducted by KCIA in 2016. Past sampling indicated PCB contamination concerns; source control action was taken by Boeing to address the PCB contamination discovered on Boeing property that migrated to the off-site KCIA property. Boeing, EPA, and Ecology continue to address the remaining sources. Post-remediation soil sampling was performed by Boeing in June 2016.

4.1.3.5 Stormwater Line Cleaning

The 2015 ISGP requires stormwater line cleaning for permitted sites that discharge to the LDW. Line cleaning is performed in conjunction with the current catch basin cleaning schedule.

Stormwater line cleaning was performed in 2016 at the KCIA Central Area (runways and taxiways), and cleaning for 2017 is planned for the KCIA West Areas (taxiways, parking lots, maintenance shop, airparks, and outfalls).

4.2 Roads Services Division

In 2016, the King County Road Services Division continued to maintain roads in the unincorporated area of the LDW source control area. Source control work primarily focused on catch basin inspections and cleaning. Catch basins were physically inspected using protocols developed for the King County NPDES Municipal Permit. The inspections identify catch basins that need cleaning and any physical limitations or maintenance needs.

Following catch basin inspections, 35 catch basins were cleaned or underwent sediment removal by a vacuum truck.

5.0 OTHER KING COUNTY DEPARTMENTS AND DIVISIONS

This section summarizes source control actions taken in 2016 in the LDW drainage area by various King County departments and divisions that have smaller roles in the LDW source area than the county agencies described in previous chapters. No activity related to Brownfields work in the LDW source control area was undertaken by the Solid Waste Division during this period.

5.1 Facilities Management Division

This section presents source control updates for 2016 for the Facilities Management Division (FMD). Activities to implement Ecology's Source Control Action Plan relative to the Harbor Bond properties during this period are included in Table 2-1 in the King County SCIP and are further described below. No additional relevant FMD sites have been discovered in the LDW source control area during construction or normal maintenance.

5.1.1 Stormwater Inspections

FMD contracts with King County WLRD to perform water quality/business BMP inspections and stormwater facility inspections on properties that are under FMD custodial control. Vacant tax title and open space parcels are inspected every five years for water quality compliance. Similarly, all developed parcels are inspected every five years for water quality/business BMP compliance. Annual facility maintenance inspections are performed on all FMD properties with constructed stormwater facilities, such as catch basins or storage and treatment ponds.

Within the LDW source control area, water quality inspections were performed at four undeveloped properties in 2016 and all were compliant. Water quality inspections were also performed at the Duwamish Waterway Park and the Comet Lodge Cemetery. Both parcels were found to be compliant with County source control requirements. Finally, water quality inspections were performed at the Youth Services Center, which was compliant after several catch basins were stenciled, and the Barclay-Dean Building and Elections Warehouse, which were both compliant at the time of the inspection.

Annual stormwater facility inspections in the LDW source control area include the five parcels with buildings and County tenants (Youth Services Center [two parcels], Orcas Building, Barclay-Dean Building, and the Elections Warehouse); three businesses on leased County property fronting on the Duwamish (Manson Construction, Lehigh-Cadman, and Ardagh Glass Company); and one tax title property that is undeveloped except for a stormwater facility:

- The 2016 inspection at the Youth Services Center determined 16 catch basins that needed vactoring; this work was completed in November 2016.
- The Orcas Building inspections determined four catch basins that needed cleaning; this was completed in August 2016.
- The 2016 inspection at Barclay-Dean determined that both catch basins needed maintenance; this work was performed in August 2016.
- Three catch basins at the Elections Warehouse were vactored in August 2016 in response to the inspection that year.
- The inspection at Manson Construction determined two catch basins that needed cleaning; this was accomplished by June 2016.
- The Lehigh-Cadman inspection resulted in the repair of five catch basins and the removal of a large quantity of sediment from a settling vault by October 2016.
- The Ardagh facility regained compliance by repairing one catch basin and cleaning a second by June 2016.
- The inspection at the vacant parcel found one catch basin that needed cleaning; this was accomplished in December 2016.

5.1.2 Source Tracing Activities

Pursuant to the County's LDW SCIP for 2014-2018, FMD conducted a sampling program of catch basin solids to evaluate solids quality for source tracing purposes on the Harbor Bond Triangle properties. Solids quality is evaluated per steps in Appendix F of the County's SCIP. Sampling sites were chosen based, ideally, on their being the last structure that might catch solids (e.g., particulates or soils from property) before the outfall to the LDW. Only three active outfalls[10] remain on the Harbor Bond properties; these are labeled "2008", "2009", and "2010" per an Ecology sponsored study (Leidos 2014). All of these outfalls are on the Ardagh Glass-leased parcel. Outfall 2006 on the Lehigh-Cadman property was plugged in 2015, causing all stormwater runoff on that parcel to be routed to a large cistern where water is stored and used in the company's batch concrete operations. Outfall 2007, formerly on the Ardagh Glass parcel, was decommissioned and flows were rerouted to outfall 2010 several years ago. In mid-2016, this small area was again rerouted to outfall 2008 through the installation of a new stormwater system on the parcel. Outfall 2011, although located on County property, has no inflow from County property; rather, it collects runoff from Ardagh Glass-owned property east of Ohio Avenue South.

[10] Outfall 2006 associated with the Cadman operation has been plugged and outfall 2007 associated with the Ardagh operation was rerouted to outfall 2008.

King County Environmental Laboratory staff conducted the catch basin grab solids sampling on July 27, 2016; staff from FMD, Ardagh Glass, and GHD (Ardagh's environmental consulting firm) were also present. Samples were taken from a fabric top filter in catch basins discharging to outfalls 2008 and 2009. The catch basin discharging to outfall 2008 was the second-to-last structure before the outfall because the structure last in line was installed recently and during the dry season, thus not allowing sufficient solids to collect. Tributary areas to this catch basin include surface runoff from asphalt paved areas subject to high frequency, heavy trucks braking around a sharp corner, and air deposition. In addition, this catch basin receives untreated runoff from warehouse rooftops, although the rooftop runoff enters below the fabric filter.

The catch basin sampled for outfall 2009 was the last structure before discharge to the LDW. This catch basin also contains a limestone filter below the fabric filter, although the solids sample was taken prior to the limestone bed. Tributary areas to this catch basin are similar to the prior catch basin and include frequent, heavy truck traffic and air deposition on asphalt pavement.

The third solids sample was taken from the upstream chamber of a Contech Vortech treatment vault. This is the final structure before discharge to the LDW through outfall 2010. Tributary areas include the trafficked areas on the County parcel leased by Ardagh, but also include the large paved area of Ohio Avenue South between the County-owned warehouses and the Ardagh glass manufacturing facility. In addition to the truck traffic and atmospheric deposition, this paved area is also subject to travel by forklifts moving between the manufacturing facility and the street. Ardagh implements Level 1 and 2 source control strategies in all of these areas. The Vortech vault was installed in 2015 as a Level 3 treatment system as required by Ecology.

The following summaries provide a review of the source tracing solids data collected from Ardagh Glass on the Harbor Bond property. The sampling results are presented in Appendix F. The summaries include a comparison of sample data to source control screening benchmarks (LAET and 2LAET).

Locator CB-4 (associated with outfall 2008)
Zinc was above the LAET and BEHP was above the 2LAET. No other chemicals analyzed were above source tracing screening benchmarks. The zinc concentrations are at a level often seen in source tracing storm drain solid samples and there are no zinc SQS exceedances in available nearby-receiving sediment samples. The BEHP is at a level that is commonly observed in storm drain solids and would not likely be traceable to a particular source. In addition, BEHP does not exceed SQS in nearby sediments. The sample and nearby-receiving sediment data do not indicate further source tracing efforts would be needed.

Locator CB-5 (associated with outfall 2009)
BEHP was above the LAET; no other chemicals analyzed were above screening benchmarks. The BEHP is at a level that is commonly observed in storm drain solids and would not likely be traceable to a particular source. BEHP does not exceed SQS in nearby sediments. The sample and nearby receiving sediment data do not indicate further source tracing efforts would be needed.

Locator V-1 (associated with outfall 2010)
Cadmium and total PCBs were above the LAET and zinc, 3,4-methylphenol and BEHP were above the 2LAET screening benchmarks. This sample represents conditions prior to treatment for discharges from the outfall associated with a Vortex Separator, and thus these contaminants may be addressed through the treatment process. No other chemicals analyzed were above screening benchmarks. Cadmium was only slightly above the lower benchmark and no LDW sediments in the area by the outfall exceed SQS for cadmium. Total PCBs in nearby sediments have been identified above the LDW remedial action level in EPA's Record of Decision as well as SQS. Zinc and BEHP are at levels above most storm drain solids data. However, zinc, 3,4-methylphenol, and BEHP do not exceed SQS (or LDW remedial action levels) in nearby sediments.

Based on these results, and the fact that additional treatment systems exist downstream from where the solids samples were taken (i.e., a limestone catch basin filter bed prior to outfall 2009 and a Vortech treatment vault and downspout treatment cisterns packed with limestone prior to outfall 2010), no additional source control identification efforts will be pursued at this time.

Independently, Ardagh Glass conducted a round of catch basin sediment sampling on September 22, 2016, pursuant to their renewed ISGP. In addition to the three locations sampled by King County, Ardagh Glass also sampled a catch basin upstream of the outfall 2008, a catch basin sampled by the County, and also combined samples from two catch basins that are a tributary to outfall 2011. Results of this sampling effort can be found in Ecology's PARIS database.

5.2 Department of Permitting and Environmental Review

DPER provides two primary services for unincorporated King County and KCIA that are directly aimed at controlling the release of contaminants from development sites. DPER reviews and issues development and use permits and inspects the permits for compliance with plans and conditions of permit approval. Table 9 shows the number of permits and final construction approvals in 2016 for projects that could potentially introduce or mobilize contaminants.

Table 9. DPER Permitting/Inspection Activity in 2016.

Construction Type	Number of Permits Approved	Number of Final Construction Approvals
Residential	17	15
Business/Commercial	2	0
Industrial – KCIA	0	0
Industrial – Other	2	1
Total	21	16

Projects approved in 2016 were as follows:

- Residential. Six tank removal projects, four new single-family residences, five additions, one demolition project, and one hazard tree removal project.
- Business/commercial. Terminal 117 habitat restoration project and minor clearing of site for future commercial development.
- Industrial development outside of KCIA. One sign installation permit and maintenance dredging at a marina.
- Redevelopment at KCIA. No permits were approved at KCIA in 2016.

Five permits were not approved until later in 2016 and did not receive final construction approval in 2016.

5.3 Environmental Health Services Division

This section summarizes the source-control-related activities under the King County Environmental Health Services Division regulatory programs to (1) administer and enforce state and local regulations governing the safe handling of solid waste and (2) minimize potential human and environmental exposures to sewage and chemicals released from properties that have on-site sewage (septic) systems in the LDW drainage basin.

5.3.1 Public Health–Seattle & King County Solid Waste Program

Twenty-five percent of all permitted solid waste facilities and approximately 30 percent of all permit-exempt solid waste facilities in King County are located in the LDW drainage basin.

5.3.1.1 Permitted Facilities

Figure 2 shows the locations of solid waste facilities and illegal dumping complaints in the LDW drainage basin during 2016. Table 10 lists the permitted facilities within the LDW drainage basin. The Solid Waste Program's solid waste permit approval and enforcement activities in 2016 in the LDW drainage area are as follows:

- There were nine permitted solid waste facilities and 31 solid waste facilities exempt from permitting that discharge into the LDW drainage basin (Figure 2). For the permitted facilities, Public Health–Seattle & King County (Public Health) reviews site schematics, evaluates operational plans, issues permits, monitors operations, and performs routine inspections.
- The program collaborated with multiple agencies, including Ecology and KCIW, to review the solid waste piles permit application and plan of operation for the Waste Management 8th Avenue Reload Facility located on Slip 4 of the LDW at 7400 8th Avenue South, Seattle. This site received its solid waste piles permit to handle upland contaminated soils and dredged materials in August 2016.

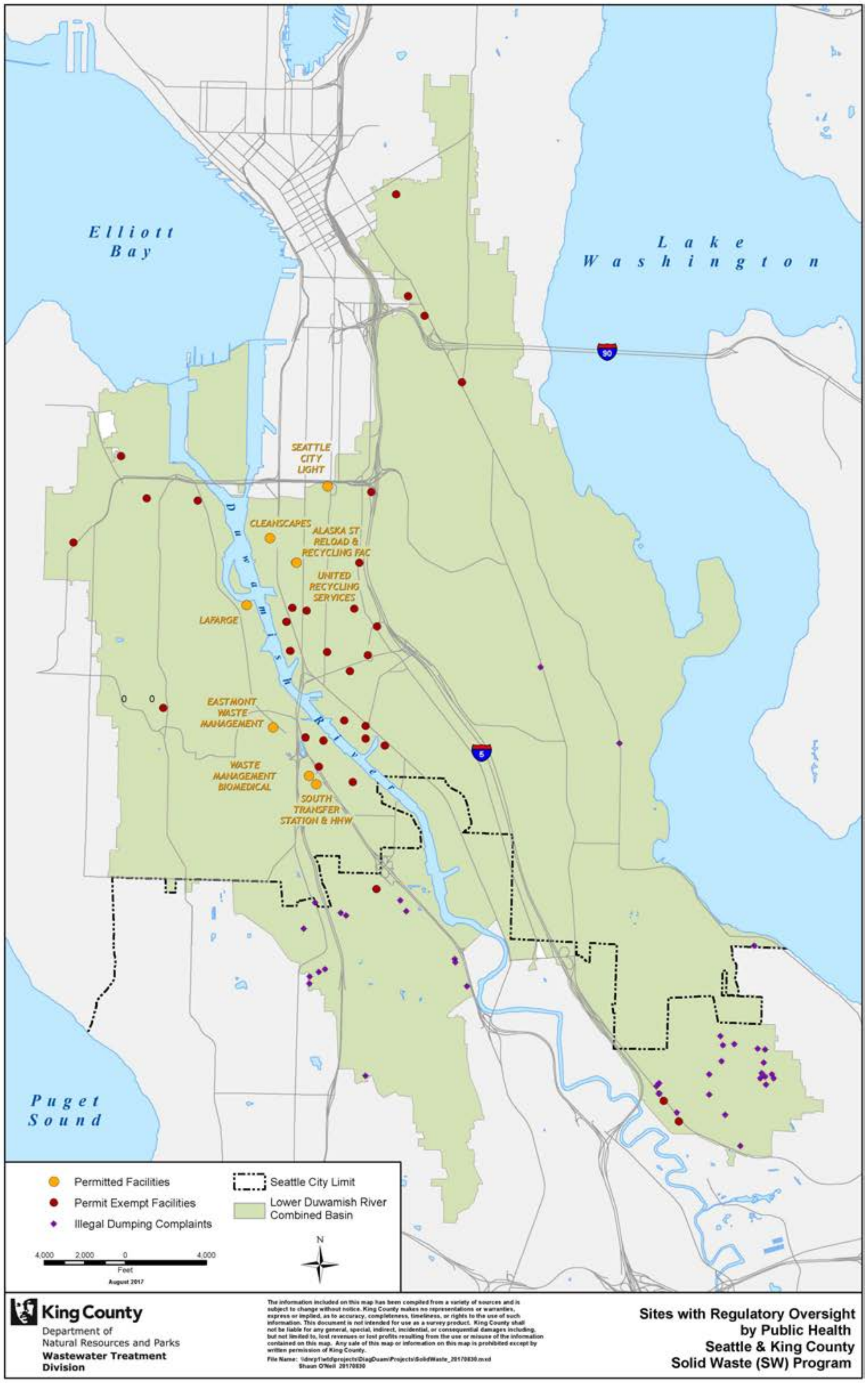

Figure 2. Sites with Regulatory Oversight by Public Health–Seattle & King County Solid Waste Program.

Table 10. Solid Waste Facilities in the LDW Drainage Basin Permitted by Public Health–Seattle & King County in 2016.

Name	Type of Facility	Site Address
South Transfer Station (SPU)	Municipal transfer station	8100 Second Ave. S Seattle, WA 98108
South Recycle & Disposal Station (Seattle Public Utilities)	Municipal transfer station	130 South Kenyon St. Seattle, WA 98108
South Seattle Household Hazardous Waste Facility	Moderate risk waste processing facility	8100 Second Ave. S Seattle, WA 98108
Eastmont Waste Management (Waste Management)	Recycling operation – material recovery facility	7201 W Marginal Way SW Seattle, WA 98108
Alaska Street Reload and Recycling	Solid waste piles that accept dredged materials and petroleum-contaminated soils	70 S Alaska St. Seattle, WA 98134
Lafarge	Solid waste piles that accept dredged materials and petroleum-contaminated soils	5400 W Marginal Way SW Seattle, WA 98106
Seattle City Light South Service Center	Moderate-risk waste processing facility	3613 Fourth Ave. S Seattle, WA 98134
Cleanscapes (A Recology Company)	Material recovery facility	4401 E Marginal Way S Seattle, WA 98134
Waste Management Biomedical Waste Treatment Facility	Biomedical waste treatment facility	149 SW Kenyon St. Seattle, WA 98108

5.3.1.2 Permit Violations

Permit violations in 2016 were as follows:

- In 2016, 30 violations from permitted solid waste facilities, permit-exempt facilities, and solid waste transporters were documented. Some of the violations noted were as follows: no provision of secondary containment, not meeting local fire codes, unmarked moderate-risk waste containers, not following protocols for moderate-risk waste handling, fugitive dust, inadequate litter control, lack of all-weather surfaces for vehicle traffic, leaking oil from solid waste transporters, and lack of protection for solid waste from the outdoor elements. Continued violations of zoning regulations by one facility, CDL Recycle, resulted in self-closure in May 2016 to avoid civil penalties by Public Health.

5.3.1.3 Illegal Dumping Complaints

Figure 2 shows the locations of complaints of unlawful garbage dumping in the basins discharging into the LDW in 2016. Staff visited these sites to assess conditions and to educate the owners on how to comply with code. If no action was taken after a follow-up letter, Public Health enforced compliance as necessary and appropriate.

5.3.2 Public Health–Seattle & King County On-Site Wastewater Program

Public Health administers and enforces the "on-site" (on the property) sewage (septic) code. These regulatory standards are intended to minimize human and environmental exposure to sewage from on-site sewage systems. The following summarizes the program's source-control-related activities in the LDW drainage area in 2016:

- **Number of septic systems.** In the County's LDW SCIP, Public Health reported 45 known properties with septic systems in the source control area, primarily in the City of Seattle. In 2015, the On-Site Wastewater Program began to investigate the number of properties with septic systems in King County. As of December 30, 2016, the program identified 1,414 properties that are likely served by septic systems in the LDW drainage basin. Most of these are outside of the City of Seattle and have been in place for many years. The number of systems and the number of properties (or parcels) should be equal because, in most cases, there is only one system (one house) per parcel.

- **Failing septic systems.** In 2016, the program received three complaints of possible failing septic systems in the LDW drainage basin. Two of these complaints were closed because there was no evidence of obvious failure of a septic system. One complaint was open and under investigation in 2016 for a failure. Four additional complaints were still open from previous years.
- **New septic systems.** In 2016, Public Health approved one application for a new septic system in the LDW drainage area, and two applications were disapproved. One new septic system has been installed with an as-built completed and approved. The last step of an installation of a septic system under permit, whether it represents a new system or a repair, is the approval of the as-built for the work completed. The as-built shows the system location, type, tank location, reserve area location, and other features.

- **Septic system repairs.** In 2016, two septic systems requested a limited repair. One was approved and completed, including an as-built; however, the second was disapproved. "Limited repairs" are typically only a repair of a single component like a broken transport pipe or damaged distribution box and are not complete replacements of tanks or drainfields. They may or may not be the result of a failure complaint. The program received two full-repair permit applications in the LDW drainage basin; the two full repairs have been installed and are awaiting as-builts as the final step of completion.

6.0 REFERENCES

AECOM. 2012. Final Feasibility Study Lower Duwamish Waterway, Seattle, Washington. Prepared for Lower Duwamish Waterway Group for submittal to U.S. Environmental Protection Agency, Seattle, WA, and Washington State Department of Ecology, Bellevue, WA. Prepared by AECOM, Seattle, WA. October 2012.

Calibre Systems, Inc. 2015a. Engineering Evaluation/Cost Analysis Report, EMF Site. Revision 2, August 2015. Prepared for the Boeing Company by Calibre Systems, Inc., Bellevue, WA.

Calibre Systems, Inc. 2015b. Work Plan for Remedial Optimization of Enhanced Reductive Dechlorination Treatment Processes. August 2015. Prepared for the Boeing Company by Calibre Systems, Inc., Bellevue, WA.

Cardno. 2016. North Boeing Field/Georgetown Steamplant Remedial Investigation/Feasibility Study: Data Summary Report of Stormwater Solids Assessment King County International Airport. Prepared for King County International Airport by Cardno GS, Inc., Government Services Division, Seattle, WA. June 2016.

Ecology. 2014. Lower Duwamish Waterway Source Control Status Report January through December 2013. Publication #14-09-337. Prepared by Washington State Department of Ecology, Toxics Cleanup Program, Bellevue, WA. June 2014.

Ecology. 2016. Lower Duwamish Waterway Source Control Strategy. Prepared by Washington State Department of Ecology, Toxics Cleanup Program, Bellevue, WA.

EPA. 2014. Record of Decision: Lower Duwamish Waterway Superfund Site. Prepared by U.S. Environmental Protection Agency, Region 10, Seattle, WA. November 2014.

Greylock Consulting, LLC. 2017. Quarterly Groundwater Monitoring Report. Former Hangar 5 site. Prepared by Greylock Consulting, LLC, Federal Way, WA.

Hart Crowser. 2017. Perf romance Groundwater Monitoring Report, Former Standard Oil Parcel. Prepared by Hart Crowser, Seattle, WA.

King County. 2011. Lower Duwamish Waterway Source Control Brandon Combined Sewer Basin Study – Sampling and Analysis Plan. Prepared by Dean Wilson, Water and Land Resources Division, Seattle, WA.

King County. 2013. Lower Duwamish Waterway Source Control Michigan Combined Sewer Basin Study – Sampling and Analysis Plan Addendum. Prepared by Richard Jack and Debra Williston, Water and Land Resources Division, Seattle, WA.

King County. 2015. Green River PCB Equipment Blank Study – Sampling and Analysis Plan. Prepared by Debra Williston, Water and Land Resources Division, Science and Technical Support Section, Seattle, WA.

King County, 2016a. King County Lower Duwamish Waterway Source Control Implementation Plan 2014-2018. Prepared for Washington State Department of Ecology, Seattle, WA.

King County 2016b. King County Lower Duwamish Waterway Source Control 2014-2015 Annual Report. Prepared by Department of Natural Resources and Parks, Department of Transportation, and Department of Executive Services, Seattle, WA.

King County. 2016c. Lower Duwamish Waterway Source Control: Green River Watershed Suspended Solids Data Report. Prepared by Carly Greyell and Debra Williston, Water and Land Resources Division, Seattle, WA.

King County. 2016d. Lower Duwamish Source Control: Brandon Combined Sewer Basin Study Data Report. Prepared by Richard Jack, Carly Greyell, and Debra Williston, King County Water and Land Resources Division, Science and Technical Support Section, Seattle, WA.

Leidos. 2014. Lower Duwamish Waterway Outfall Inventory Update January 2012-February 2014. Prepared for Washington Department of Ecology by Leidos (formerly SAIC), Bothell, WA.

SAIC. 2011. Surface Sediment Sampling at Outfalls in the Lower Duwamish Waterway Seattle, WA Data Report. Prepared for Washington State Department of Ecology, Seattle, WA. October 2011.

Appendix A: KCIW Industrial Users

Table A-1. Active Industrial Users within the LDW Drainage Basin in 2016.

Facility Name	Treatment Plant	CSO Basin	Authorization Type	Permit	Customer Type
Coast Crane Company	West Point	8th Ave	Minor Discharge Authorization	788-02	Pressure Washing
First Student Inc.	West Point	8th Ave	Minor Discharge Authorization	854-01	Vehicle Washing
Flying Fish Express	West Point	8th Ave	Minor Discharge Authorization	783-02	Food Processing-Fish
Gary Merlino Construction Co. Inc.	West Point	8th Ave	Letter of Authorization	11117-02	Vehicle Washing
Industrial Container Services - WA, LLC	West Point	8TH AVE	PERMIT	7130-05	Barrel Cleaning
Kerry Inc.	West Point	8TH AVE	PERMIT	7854-02	Food Processing-Other
Magnetic and Penetrant Services Co.	West Point	8TH AVE	PERMIT	7873-02	Metal Finishing - CFR 433
National Products Inc.	West Point	8TH AVE	PERMIT	7834-02	Metal Finishing - CFR 433
Seattle Housing Authority - Maintenance Facility	West Point	8th Ave	Letter of Authorization	10399-03	Vehicle Washing
Seattle, City of - Joint Training Facility	West Point	8th Ave	Letter of Authorization	10849-02	General Type
Seattle, City of - SPU - South Park Water Quality Facility Pilot Test	West Point	8th Ave	Major Discharge Authorization	4393-01	Construction Dewatering
Seattle, City of - SPU - South Transfer Station	West Point	8TH AVE	PERMIT	7878-01	Solid Waste - Transfer Fac
South Park Industrial Properties LLC	South	8th Ave	Major Discharge Authorization	4086-03	Groundwater Remediation - Organics
The Gear Works	West Point	8TH AVE	PERMIT	7892-01	Metal Finishing - CFR 433
The Revere Group	West Point	8th Ave	Minor Discharge Authorization	877-01	Printing
Washington Liftruck	West Point	8th Ave	Minor Discharge Authorization	806-02	Pressure Washing
Waste Management Inc. - Eastmont Transfer Station	West Point	8th Ave	Minor Discharge Authorization	322-06	Solid Waste - Transfer Fac
Waste Management Inc. - Seattle	West Point	8th Ave	Minor Discharge Authorization	785-04	Container Washing
Lineage Seafreeze	West Point	8TH AVE OR TERMINAL 115	PERMIT	7896-01	Food Processing-Seafood
Northland Services Inc.	West Point	8th Ave or Terminal 115	Letter of Authorization	10742-02	Pressure Washing
Ardagh Glass Inc.	West Point	Brandon	Major Discharge Authorization	555-05	Glass Manufacturing
Art Brass Plating Inc.	West Point	BRANDON	PERMIT	7722-05	Metal Finishing - CFR 433
Cadman (Seattle) Inc.	West Point	Brandon	Major Discharge Authorization	4235-01	Cement/Readymix
Foster's Frame & Axle	West Point	Brandon	Minor Discharge Authorization	948-01	Vehicle Washing
General Electric Co. - Dawson Street	West Point	Brandon	Major Discharge Authorization	543-04	Groundwater Remediation - Organics
Gensco Building Construction Project	West Point	Brandon	Letter of Authorization	11677-01	Construction Dewatering
Kamco Seafood Inc.	West Point	Brandon	Minor Discharge Authorization	739-03	Food Processing-Fish
Seadrunar Recycling	West Point	Brandon	Letter of Authorization	11430-01	Metals Recycling
Seattle, City of - SPU - Materials Storage Yard	West Point	Brandon	Major Discharge Authorization	774-03	General Type
United Rentals - Seattle	West Point	Brandon	Letter of Authorization	11436-01	General Type
Georgetown Brewing Co.	West Point	Brandon or Duwamish	Major Discharge Authorization	4154-02	Food Processing-Brewery
Harborview Medical Center	West Point	Connecticut, Hanford 1/2, or Lander	Minor Discharge Authorization	712-03	Hospital

Table A-1. Active Industrial Users within the LDW Drainage Basin in 2016.

Facility Name	Treatment Plant	CSO Basin	Authorization Type	Permit	Customer Type
Yesler Investors 2 LLC - Yesler Terrace Block 2 Construction Project	West Point	Connecticut, Hanford 1/2, or Lander	Minor Discharge Authorization	1040-01	Construction Dewatering
Ash Grove Cement Company	West Point	Duwamish	Major Discharge Authorization	4009-05	Cement/Readymix
Auto-Chlor System	West Point	Duwamish	Letter of Authorization	10415-01	General Type
Bloch Steel Industries	West Point	Duwamish	Major Discharge Authorization	4085-04	Groundwater Remediation - Petroleum
Cascade Designs Inc.	West Point	Duwamish	Major Discharge Authorization	4179-02	Metal Fabrication
Cascade Machinery and Electric Inc.	West Point	Duwamish	Minor Discharge Authorization	802-02	General Type
ConGlobal Industries Inc.	West Point	Duwamish	Minor Discharge Authorization	932-01	Pressure Washing
MacMillan-Piper Inc. - Edmunds Street Facility	West Point	Duwamish	Letter of Authorization	10638-03	General Type
North Star Casteel Products Inc.	West Point	Duwamish	Letter of Authorization	11557-01	Metal Fabrication
Northwest Container Services Inc. - Seattle Intermodal Yard	West Point	Duwamish	Minor Discharge Authorization	964-01	Container Washing
Schwartz Brothers Bakery - Seattle	West Point	Duwamish	Minor Discharge Authorization	743-04	Food Processing-Bakery
Seattle Barrel Co.	West Point	DUWAMISH	PERMIT	7113-04	Barrel Cleaning
Seattle Radiator LLC	West Point	Duwamish	Minor Discharge Authorization	796-02	Radiator Repair
Stoneway Concrete - Seattle	West Point	Duwamish	Major Discharge Authorization	232-05	Cement/Readymix
Union Pacific Railroad - Argo Yard	West Point	Duwamish	Major Discharge Authorization	668-05	Vehicle Washing
United Parcel Service - Seattle	West Point	Duwamish	Major Discharge Authorization	4020-03	Vehicle Washing
Waste Management Inc. - Alaska Street Facility	West Point	Duwamish	Minor Discharge Authorization	691-04	Solid Waste - Transfer Fac
Alaska Marine Lines Inc.	West Point	Duwamish West	Minor Discharge Authorization	459-04	Container Washing
BP West Coast Products LLC	West Point	DUWAMISH WEST	PERMIT	7592-05	Fueling Facility
Chemithon Corporation	West Point	Duwamish West	Major Discharge Authorization	4112-03	Manufacturing-Misc
Encore Oils LLC	West Point	DUWAMISH WEST	PERMIT	7751-04	Rendering
FOG-TITE Meter Seal Inc.	West Point	Duwamish West	Minor Discharge Authorization	815-02	Cement/Readymix
Glacier Northwest Inc. - Vehicle Washing	West Point	Duwamish West	Minor Discharge Authorization	510-04	Vehicle Washing
Lafarge - Seattle Plant	West Point	Duwamish West	Major Discharge Authorization	4204-03	Cement/Readymix
LMV Interbay Holdings LLC - 3230 16th Ave. W. Construction Project	West Point	Duwamish West	GLA-Construction	40018-01	Construction Dewatering
Rainier Petroleum Corp.	West Point	Duwamish West	Minor Discharge Authorization	536-04	Fueling Facility
Vigor Shipyards Inc.	West Point	DUWAMISH WEST	PERMIT	7782-07	Boat/Shipyard
Westway Feed Products LLC	West Point	Duwamish West	Minor Discharge Authorization	952-01	Manufacturing-Misc
VA Puget Sound Healthcare System - Seattle Division	West Point	Duwamish, Hanford 1/2, Lander, Michigan/Rainier	Minor Discharge Authorization	818-02	Hospital
Seattle, City of - Seattle City Light - South Service Center	West Point	Duwamish, Hanford 2, or Lander	Major Discharge Authorization	4194-03	General Type

Table A-1. Active Industrial Users within the LDW Drainage Basin in 2016.

Facility Name	Treatment Plant	CSO Basin	Authorization Type	Permit	Customer Type
VA Puget Sound Healthcare System - Mental Health and Research Building	West Point	Duwamish, Hanford, Lander, Michigan/Rainier	Minor Discharge Authorization	1037-01	Construction Dewatering
Boeing Commercial Airplane - North Field	West Point	E MARGINAL OR MICHIGAN	PERMIT	7594-06	Metal Finishing - CFR 433
Boeing North Field Facility - PCB Treatment System for Duwamish Area Boeing Facilities	West Point	E Marginal or Michigan	Major Discharge Authorization	4223-01	Water Treatment
Cucina Fresca Gourmet Foods	West Point	E Marginal or Michigan	Minor Discharge Authorization	891-01	Food Processing-Other
King County International Airport - Boeing Field	West Point	E Marginal or Michigan	Major Discharge Authorization	4109-03	Transportation Facility
King County International Airport - GWR	West Point	E Marginal or Michigan	Major Discharge Authorization	4129-03	Groundwater Remediation - Petroleum
Mente LLC - Mente Hangar Construction Project	West Point	E Marginal or Michigan	Major Discharge Authorization	4379-01	Construction Dewatering
Quad 7 Development LLC/Signature Flight Support	West Point	E Marginal or Michigan	Minor Discharge Authorization	849-01	Vehicle Washing
East Union 22 LLC - 2220 East Union Street Construction Project	West Point	Hanford 1/2 or Lander	Major Discharge Authorization	4394-01	Construction Dewatering
Franz-Gai's Bakery - Weller St.	West Point	Hanford 1/2 or Lander	Major Discharge Authorization	4296-01	Food Processing-Bakery
JCMV - 2100 East Madison Mix-use Building Construction Project	West Point	Hanford 1/2 or Lander	GLA-Construction	40030-01	Construction Dewatering
Jefferson Park LLC - Jefferson Park Construction Project	West Point	Hanford 1/2 or Lander	GLA-Construction	40081-01	Construction Dewatering
King County FMD - Children and Family Justice Center Construction Project	West Point	Hanford 1/2 or Lander	Major Discharge Authorization	4383-01	Construction Dewatering
Laboratory Corporation of America/Dynacare	West Point	Hanford 1/2 or Lander	Minor Discharge Authorization	704-04	Laboratory
Lighthouse for the Blind Inc.	West Point	Hanford 1/2 or Lander	Letter of Authorization	10454-01	Manufacturing-Misc
Photographic Center Northwest	West Point	Hanford 1/2 or Lander	Letter of Authorization	11531-01	Photo Processing
Rainier Commons LLC - Old Rainier Brewery Site	West Point	HANFORD 1/2 OR LANDER	PERMIT	7927-01	General Type
Seattle University - Onsite Compost Facility	West Point	Hanford 1/2 or Lander	Letter of Authorization	11179-02	Composting-Yard Waste
Sound Transit Operations and Maintenance Facility	West Point	Hanford 1/2 or Lander	Minor Discharge Authorization	801-03	Transportation Facility
Swedish Medical Center - Cherry Hill	West Point	Hanford 1/2 or Lander	Minor Discharge Authorization	707-03	Hospital
U.S. Alliance Broadstone First Hill LLC - 1001 James Street Construction Project	West Point	Hanford 1/2 or Lander	Letter of Authorization	11693-01	Construction Dewatering

Table A-1. Active Industrial Users within the LDW Drainage Basin in 2016.

Facility Name	Treatment Plant	CSO Basin	Authorization Type	Permit	Customer Type
University of Washington Consolidated Laundry	West Point	Hanford 1/2 or Lander	Major Discharge Authorization	4301-01	Laundry - Linen
Cascade Columbia Distribution	West Point	Michigan	Major Discharge Authorization	4156-02	Container Washing
Ceradyne, Inc., a 3M Company - Seattle	West Point	MICHIGAN	PERMIT	7507-05	Glass Manufacturing
Classic Impressions Inc.	West Point	Michigan	Minor Discharge Authorization	860-01	General Type
Dawn Food Products	West Point	Michigan	Letter of Authorization	11009-02	Food Processing
EcoChemical Inc.	West Point	Michigan	Minor Discharge Authorization	918-01	General Type
Elysian Brewing Company - Airport Way S.	West Point	Michigan	Major Discharge Authorization	4211-03	Food Processing-Brewery
Emerald, An Environmental Company - Brighton Facility	West Point	Michigan	Major Discharge Authorization	4372-01	Fuel - Bulk Storage
Evergreen Tractor LLC	West Point	Michigan	Letter of Authorization	11008-02	Vehicle Washing
FleetMasters Inc.	West Point	Michigan	Letter of Authorization	11704-01	Vehicle Washing
Marine Vacuum Service Inc.	West Point	MICHIGAN	PERMIT	7676-06	Centralized Waste Treatment-CFR 437
Northwest Porosity & Heat Treat LLC	West Point	Michigan	Letter of Authorization	11173-02	Manufacturing-Misc
Recology CleanScapes Inc.	West Point	Michigan	Minor Discharge Authorization	850-02	Container Washing
Seattle Iron and Metals Corp.	West Point	Michigan	Minor Discharge Authorization	750-03	Vehicle Washing
Waste Management National Services - 8th Avenue South Reload Facility	West Point	MICHIGAN	PERMIT	7928-01	Solid Waste - Transfer Fac
7-Eleven Inc. - Store 27390 Groundwater Remediation	West Point	Norfolk	Letter of Authorization	11694-01	Groundwater Remediation - Petroleum
Affordable Auto Wrecking	South	Norfolk	Major Discharge Authorization	4134-02	General Type
Coluccio Construction	West Point	Norfolk	Minor Discharge Authorization	779-02	Vehicle Washing
Dressel-Collins Fish Co.	West Point	Norfolk	Letter of Authorization	11349-01	Food Processing-Seafood
Northwest Gourmet Food Products Inc. - Seattle Facility	West Point	Norfolk	Minor Discharge Authorization	784-02	Food Processing-Other
OHNO Construction Company	West Point	Norfolk	Letter of Authorization	11279-02	Pressure Washing
Otto Rosenau & Associates Inc.	West Point	Norfolk	Letter of Authorization	11402-01	General Type
Seattle, City of - SPU - Henderson North CSO Reduction Project	West Point	Norfolk	Letter of Authorization	11598-02	Construction Dewatering
Starline Luxury Coaches	West Point	Norfolk	Letter of Authorization	11528-01	Vehicle Washing
Seattle, City of - SPU - West Seattle Decant Station	West Point	West Michigan	Major Discharge Authorization	416-05	Decant Station

Table A-2. KC IW Inspections in LDW Drainage Basin for 2016.

Facility	Authorization number
Discharge Authorizations	
7-Eleven Inc. - Store No. 23020 DPE Remediation System	4212-01
Affordable Auto Wrecking	4134-02
Ardagh Glass Inc.	555-04
Ash Grove Cement Company	4009-04
Boeing Commercial Airplane - Apron C Improvement Project	1003-01
Chemithon Corporation	4112-03
Elysian Brewing Company - Airport Way S.	4211-02
King County International Airport - Boeing Field	4109-03
King County Metro Transit South Base Facilities Maintenance	288-04
Marine Systems Inc.	400335-01
Mente LLC - Mente Hangar Construction Project	4379-01
Northstar Pediatric Dentistry	
Rainier Commons LLC - Old Rainier Brewery Site	4201-01
Seattle, City of - SPU - Lower Duwamish Waterway Storm Drain Cleaning Project	
Seattle, City of - SPU - South Park Water Quality Facility Pilot Test	4393-01
Stickney, Richard, DDS	
Sun Liquor Manufacturing	200082-01
Swiss Hotel 110 LLC - 10733 Meridian Avenue North Construction Project	1014-01
VA Puget Sound Healthcare System - Seattle Division	818-02
Seattle, City of - Seattle City Light - Denny Substation Construction Project	4370-01
Permits	
Art Brass Plating Inc.	7722-05
Boeing Commercial Airplane - North Field	7594-06
BP West Coast Products LLC	7592-05
Ceradyne, Inc., a 3M Company - Seattle	7507-05
Emerald Services Inc. - Airport Way Facility	7884-01
Encore Oils LLC	7751-04
Industrial Container Services - WA, LLC	7130-05
Industrial Container Services - WA, LLC	7929-01
Kerry Inc.	7854-02
Lineage Seafreeze	7896-01
Magnetic and Penetrant Services Co.	7873-01
Marine Vacuum Service Inc.	7676-06
National Products Inc.	7834-02
Rainier Commons LLC - Old Rainier Brewery Site	7927-01
Seattle Barrel Co.	7113-04
Seattle, City of - SPU - South Transfer Station	7878-01
Stoller Metals Inc.	7823-04
The Gear Works	7892-01
Vigor Shipyards Inc.	7782-07
Waste Management National Services - 8th Avenue South Reload Facility	7903-01

Appendix B: WTD Source Tracing Combined Sewer Solids Datasets

Table B-1. King County LDW CSO Source Tracing Sample Locators and Associated Coordinates and Sample Types for 2015/2016

Locator	Description	Xplan	Yplan	Latitude	Longitude	Samples Collected	Sample Type	Samples Collected	Sample Type
S071308	8th Ave S. Regulator; 8th Ave S. from Cloverdale (sample in wet well)	1272447	198151	47.533458	-122.3229972	11/10/2015	in-line grab	--	--
ST_8AVE-01	8th Ave WEWDUWAM W14-316 (near 7703 8th Ave S where 8th turns to S. Portland St)	1272497	198097.89	47.533316	-122.322785	--	--	6/9/2016	Sed Trap

Locators with 'ST_' added to beginning indicates sample is sediment trap rather than in-line grab sample.
X/Y Coordinates are in NAD1983 WA State Plane North.

Note: Recon efforts at other locations within 8th Ave S.CSO basin either yielded no solids in line
Last Updated November 2017

Table B-2. Combined sewer system solids sampling results for 2016.

King County Environmental Lab Analytical Report

Project:	423589-340-4	Project:	423589-340-4
Locator:	ST_8AVE-01	Locator:	S071308
Descrip:	8TH AVE SOUTH INLINE	Descrip:	8TH AVE. SO. REGULATOR
Sample:	L65591-1	Sample:	L64195-1
Matrix:	SH IN-LINESED	Matrix:	SH IN-LINESED
ColDate:	6/9/16 0:00	ColDate:	11/10/15 0:00
Sample typ	Sediment Trap	Sample typ	In-line grab
TotalSolid:	57	TotalSolid:	58.2
DRY Weight Basis		**DRY Weight Basis**	

Parameters	Value	Qual	Val Qual	MDL	RDL	Units	Value	Qual	Val Qual	MDL	RDL	Units
CV ASTM D422												
Fines*	-						9.2			0.8	1.5	%
Gravel*	-						4.5			0.2	1.5	%
Sand*	-						89.9			0.2	1.5	%
Silt*	-						6.9			0.8	1.5	%
Clay*	-						2.3			0.8	1.5	%
p+0.00*	-						4.3			0.2	1.5	%
p+1.00*	-						9.8			0.2	1.5	%
p+10.0(equal/more than)*	-						1.5	RDL	J	0.8	1.5	%
p+2.00*	-						31.2			0.2	1.5	%
p+3.00*	-						32.9			0.2	1.5	%
p+4.00*	-						11.6			0.2	1.5	%
p+5.00*	-						6.2			0.8	1.5	%
p+6.00*	-							<MDL	U	0.8	1.5	%
p+7.00*	-						0.8	<RDL	J	0.8	1.5	%
p+8.00*	-							<MDL	U	0.8	1.5	%
p+9.00*	-						0.8	<RDL	J	0.8	1.5	%
p-1.00*	-						3			0.2	1.5	%
p-2.00(less than)*	-						1.3	<RDL	J	0.2	1.5	%
p-2.00*	-						0.3	<RDL	J	0.2	1.5	%
CV ASTM D422/D3977-97												
500 Micron (equal to/more than)*	10.9			0.005	0.01	%	16.4			0.005	0.01	%
CV ISO 13320:2009(E)												
Fines*	44.95			0.01	0.01	% Volume	21.06			0.01	0.01	% Volume
Sand<1000*	44.1			0.01	0.01	% Volume	62.27			0.01	0.01	% Volume
Silt*	39.2			0.01	0.01	% Volume	19.89			0.01	0.01	% Volume
Clay*	5.76			0.01	0.01	% Volume	1.17			0.01	0.01	% Volume
p+1.00*	3.77			0.01	0.01	% Volume	5.33			0.01	0.01	% Volume
p+10.0(more than)*	1.05			0.01	0.01	% Volume		<MDL	U	0.01	0.01	% Volume
p+10.0*	1.6			0.01	0.01	% Volume		<MDL	U	0.01	0.01	% Volume

Table B-2. Combined sewer system solids sampling results for 2016.

King County Environmental Lab Analytical Report

Project:	423589-340-4	Project:	423589-340-4
Locator:	ST_8AVE-01	Locator:	S071308
Descrip:	8TH AVE SOUTH INLINE	Descrip:	8TH AVE. SO. REGULATOR
Sample:	L65591-1	Sample:	L64195-1
Matrix:	SH IN-LINESED	Matrix:	SH IN-LINESED
ColDate:	6/9/16 0:00	ColDate:	11/10/15 0:00
Sample typ	Sediment Trap	Sample typ	In-line grab
TotalSolid:	57	TotalSolid:	58.2
DRY Weight Basis		**DRY Weight Basis**	

Parameters	Value	Qual	Val Qual	MDL	RDL	Units	Value	Qual	Val Qual	MDL	RDL	Units
p+2.00*	9.94			0.01	0.01	% Volume	19.38			0.01	0.01	% Volume
p+3.00*	13.21			0.01	0.01	% Volume	20.91			0.01	0.01	% Volume
p+4.00*	17.18			0.01	0.01	% Volume	16.65			0.01	0.01	% Volume
p+5.00*	11.54			0.01	0.01	% Volume	7.75			0.01	0.01	% Volume
p+6.00*	12.43			0.01	0.01	% Volume	6.36			0.01	0.01	% Volume
p+7.00*	9.41			0.01	0.01	% Volume	3.88			0.01	0.01	% Volume
p+8.00*	5.81			0.01	0.01	% Volume	1.9			0.01	0.01	% Volume
p+9.00*	3.11			0.01	0.01	% Volume	1.17			0.01	0.01	% Volume
CV SM2540-G												
Total Solids*	57			0.005	0.01	%	58.2			0.005	0.01	%
CV SW846 9060 PSEP96												
Total Organic Carbon	107000			10000	20000	mg/Kg	45900			9600	19400	mg/Kg
MT SW846 3050B*SW846 6010C												
Arsenic, Total, ICP	5.3	<RDL	J	2.3	11	mg/Kg	12.7	J	J	2.2	11.1	mg/Kg
Cadmium, Total, ICP	0.68	<RDL	J	0.18	0.882	mg/Kg	1.33			0.17	0.885	mg/Kg
Chromium, Total, ICP	64.7			0.26	1.32	mg/Kg	320	J	J	0.26	1.33	mg/Kg
Copper, Total, ICP	131	J	J	0.35	1.77	mg/Kg	189	J	J	0.36	1.77	mg/Kg
Lead, Total, ICP	69.5			1.8	8.82	mg/Kg	227	J	J	1.7	8.85	mg/Kg
Nickel, Total, ICP	31.4			0.44	2.21	mg/Kg	27.1			0.45	2.22	mg/Kg
Silver, Total, ICP	0.81	<RDL	J	0.35	1.77	mg/Kg	3.21	J	J	0.36	1.77	mg/Kg
Vanadium, Total, ICP	34.7			0.88	4.4	mg/Kg	35.1			0.89	4.43	mg/Kg
Zinc, Total, ICP	539			0.44	2.21	mg/Kg	1100			2.2	11.1	mg/Kg
MT SW846 7471B												
Mercury, Total, CVAA	0.96	<RDL,JG	J	0.18	1.75	mg/Kg	5.96	J	J	0.067	0.667	mg/Kg
OR SW846 3550B*SW846 8082A												
Aroclor 1016		<MDL	U	18	70.2	ug/Kg		<MDL	U	4.6	18.4	ug/Kg
Aroclor 1221		<MDL	U	53	70.2	ug/Kg		<MDL	U	14	18.4	ug/Kg
Aroclor 1232		<MDL	U	53	70.2	ug/Kg		<MDL	U	14	18.4	ug/Kg
Aroclor 1242		<MDL	U	18	70.2	ug/Kg		<MDL	U	4.6	18.4	ug/Kg
Aroclor 1248		<MDL	U	18	70.2	ug/Kg		<MDL	U	4.6	18.4	ug/Kg

Table B-2. Combined sewer system solids sampling results for 2016.

King County Environmental Lab Analytical Report

Project:	423589-340-4	Project:	423589-340-4
Locator:	ST_8AVE-01	Locator:	S071308
Descrip:	8TH AVE SOUTH INLINE	Descrip:	8TH AVE. SO. REGULATOR
Sample:	L65591-1	Sample:	L64195-1
Matrix:	SH IN-LINESED	Matrix:	SH IN-LINESED
ColDate:	6/9/16 0:00	ColDate:	11/10/15 0:00
Sample typ	Sediment Trap	Sample typ	In-line grab
TotalSolid:	57	TotalSolid:	58.2
DRY Weight Basis		**DRY Weight Basis**	

Parameters	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**
Aroclor 1254	30	<RDL	J	18	70.2	ug/Kg	29.7			4.6	18.4	ug/Kg
Aroclor 1260	61	<RDL	J	18	70.2	ug/Kg	33.7			4.6	18.4	ug/Kg
Total PCBs (calc)	91.2			18	70.2	ug/Kg	63.4			4.6	18.4	ug/Kg
OR SW846 3550B*SW846 8270D												
1,2,4-Trichlorobenzene		<MDL	U	18	35.1	ug/Kg		<MDL	U	1.7	3.44	ug/Kg
1,2-Dichlorobenzene		<MDL	U	175	175	ug/Kg		<MDL	U	17.2	17.2	ug/Kg
1,4-Dichlorobenzene		<MDL	U	263	263	ug/Kg	91.8			25.8	25.8	ug/Kg
1-Methylnaphthalene		<MDL	U	180	351	ug/Kg	34	<RDL	J	17	34.4	ug/Kg
2,4-Dimethylphenol		<MDL	U	180	351	ug/Kg		<MDL,JG	UJ	17	34.4	ug/Kg
2-Methylnaphthalene		<MDL	U	180	351	ug/Kg	33	<RDL	J	17	34.4	ug/Kg
2-Methylphenol		<MDL	U	180	351	ug/Kg		<MDL	U	17	34.4	ug/Kg
3-,4-Methylphenol	53000			880	1750	ug/Kg	6100			86	172	ug/Kg
Acenaphthene		<MDL,J	UJ	180	351	ug/Kg	27	<RDL	J	17	34.4	ug/Kg
Acenaphthylene		<MDL	U	180	351	ug/Kg		<MDL	U	17	34.4	ug/Kg
Anthracene		<MDL,J	UJ	180	351	ug/Kg	430			17	34.4	ug/Kg
Benzo(a)anthracene	250	<RDL,J	J	180	351	ug/Kg	706			17	34.4	ug/Kg
Benzo(a)pyrene	230	<RDL,J	J	180	351	ug/Kg	552			86	172	ug/Kg
Benzo(b,j,k)fluoranthene	467	J	J	180	351	ug/Kg	1230			86	172	ug/Kg
Benzo(g,h,i)perylene		<MDL,J	UJ	180	351	ug/Kg	120	<RDL	J	86	172	ug/Kg
Benzoic Acid		<MDL,J	UJ	3510	3510	ug/Kg	378			344	344	ug/Kg
Benzyl Alcohol		<MDL	U	439	439	ug/Kg	411			43	43	ug/Kg
Benzyl Butyl Phthalate		<MDL	U	263	263	ug/Kg	154			129	129	ug/Kg
Bis(2-Ethylhexyl)Phthalate	7040	J		350	702	ug/Kg	9140			34	68.7	ug/Kg
Carbazole		<MDL,J	UJ	180	351	ug/Kg		<MDL	U	17	34.4	ug/Kg
Chrysene	320	<RDL,J	J	180	351	ug/Kg	529			17	34.4	ug/Kg
Dibenzo(a,h)anthracene		<MDL,J	UJ	180	351	ug/Kg		<MDL	U	86	172	ug/Kg
Dibenzofuran		<MDL	U	180	351	ug/Kg		<MDL	U	17	34.4	ug/Kg
Diethyl Phthalate		<MDL	UJ	350	702	ug/Kg		<MDL	U	34	68.7	ug/Kg
Dimethyl Phthalate		<MDL,J	UJ	351	351	ug/Kg		<MDL	U	34.4	34.4	ug/Kg
Di-N-Butyl Phthalate		<MDL	UJ	350	702	ug/Kg		<MDL	U	34	68.7	ug/Kg

Table B-2. Combined sewer system solids sampling results for 2016.

King County Environmental Lab Analytical Report

Project:	423589-340-4	Project: 423589-340-4
Locator:	ST_8AVE-01	Locator: S071308
Descrip:	8TH AVE SOUTH INLINE	Descrip: 8TH AVE. SO. REGULATOR
Sample:	L65591-1	Sample: L64195-1
Matrix:	SH IN-LINESED	Matrix: SH IN-LINESED
ColDate:	6/9/16 0:00	ColDate: 11/10/15 0:00
Sample typ	Sediment Trap	Sample typ In-line grab
TotalSolid:	57	TotalSolid: 58.2
DRY Weight Basis		**DRY Weight Basis**

Parameters	Value	Qual	Val Qual	MDL	RDL	Units	Value	Qual	Val Qual	MDL	RDL	Units
Di-N-Octyl Phthalate		<MDL	U	351	351	ug/Kg	234			172	172	ug/Kg
Fluoranthene	350	<RDL,J	J	180	351	ug/Kg	1040			17	34.4	ug/Kg
Fluorene		<MDL,J	UJ	180	351	ug/Kg	31	<RDL	J	17	34.4	ug/Kg
Hexachlorobenzene		<MDL	U	18	35.1	ug/Kg		<MDL	U	1.7	3.44	ug/Kg
Hexachlorobutadiene		<MDL	U	88	175	ug/Kg		<MDL	U	8.6	17.2	ug/Kg
Indeno(1,2,3-Cd)Pyrene		<MDL,J	UJ	180	351	ug/Kg	242			86	172	ug/Kg
Naphthalene		<MDL	U	180	351	ug/Kg	21	<RDL	J	17	34.4	ug/Kg
N-Nitrosodiphenylamine		<MDL	U	439	439	ug/Kg		<MDL	U	43	43	ug/Kg
Pentachlorophenol		<MDL	U	2630	2630	ug/Kg		<MDL	U	258	258	ug/Kg
Phenanthrene	260	<RDL,J	J	180	351	ug/Kg	433			17	34.4	ug/Kg
Phenol		<MDL	U	880	2630	ug/Kg	130	<RDL	J	86	258	ug/Kg
Pyrene	502	J	J	180	351	ug/Kg	1520			17	34.4	ug/Kg
Total HPAHS (calc)	2119			180	351	ug/Kg	5939			86	172	ug/Kg
Total LPAHs (calc)	260			180	351	ug/Kg	942			17	34.4	ug/Kg

* Not converted to dry weight basis
MDL - method detection limit
RDL - reporting detectin limit
J - estimated value
U- not detected
JL-estimated value; probable high bias
H - holding time
B- value is < 5x method blank (MB)
B2 or B3- value > 5 and ≤ 10 times MB
TA- narrative info available
Shaded value > source control
screening benchmark for CSO system
see Appendix F of King County 2016

Table B-3. Combined sewer system solids sampling results for 2016: dioxins/furans.

Locator	ST_8AVE-01	**Sample type**	Sediment trap
KC Sample ID	L65591-1	**Pacific Rim Sample ID**	PR162798
Collect Date	6/9/2016		

COMPOUND	Result (pg/g dw)	Lab Qualifier	Validation Qaulifier	Sample Detection Limit (pg/g dw)	TEF	TEQ (ng TEQ/kg dw)
2,3,7,8-TCDD	0.712	N J	U	0.26	1	0.71
1,2,3,7,8-PeCDD	5.8			1.28	1	5.80
1,2,3,4,7,8-HxCDD	10.4			1.28	0.1	1.04
1,2,3,6,7,8-HxCDD	21.4			1.28	0.1	2.14
1,2,3,7,8,9-HxCDD	17.5			1.28	0.1	1.75
1,2,3,4,6,7,8-HpCDD	457			1.28	0.01	4.57
OCDD	3160			2.56	0.0003	0.95
2,3,7,8-TCDF	1.77	N J	U	0.26	0.1	0.18
1,2,3,7,8-PeCDF	2.37			1.28	0.03	0.07
2,3,4,7,8-PeCDF	6.3			1.28	0.3	1.89
1,2,3,4,7,8-HxCDF	7.52			1.28	0.1	0.75
1,2,3,6,7,8-HxCDF	6.21			1.28	0.1	0.62
2,3,4,6,7,8-HxCDF	7.58			1.28	0.1	0.76
1,2,3,7,8,9-HxCDF	1.98			1.28	0.1	0.20
1,2,3,4,6,7,8-HpCDF	96.9			1.28	0.01	0.97
1,2,3,4,7,8,9-HpCDF	6.57			1.28	0.01	0.07
OCDF	233			2.56	0.0003	0.07
TOTAL (TEQ ND=DL)						22.53

N = Did not meet all parameter identification criteria (used by Pacific Rim Lab)
Value is estimated maximum potential concentration and was requalified as non-detect.
U = Not Detected
J = Estimated Value

TEF = Toxicity Equivalency Factor
TEQ = Toxicity Equivalents

Dioxin and furan congener concentrations were converted to TEQ concentrations based on 2,3,7,8-Tetrachlorodibenzodioxin (2,3,7,8-TCDD) toxicity for mammals (from Van den Berg et al. 2006)

Van den Berg, M., L.S. Birnbaum, M. Denison, M. De Vito, et al. 2006. The 2005 World Health Organization reevaluation of human and mammalian toxic equivalency factors for dioxins and dioxin-like compounds. Toxicological Sciences 93(2):223-24

Appendix C: SWS Business Inspections and Source Tracing Solids Datasets

Table C-1. SWS Inspection Schedule for Businesses within the LDW Drainage Area in Unincorporated King County.

Parcel Number	Company Name	Site Address	Inspection Cycle	Next Inspection
5624200390	AAA Mini Storage	9640 Des Moines Memorial Dr. S	5 Years	2016
5624200130	ABC Supply Co.	1050 S 96th St.	5 Years	2016
5624200091	Absolute German	9510 14th Ave. S	Annual	2016
0523049008	Ace Galvanizing	429 S 96th St.	2 Years	2016
0523049194	Ace Galvanizing	401 S 96th St.	2 Years	2016
0523049246	Ace Galvanizing	439 S 96th St.	2 Years	2016
3224049071	Aero-Lac	420 S 96th St.	3 Years	2016
5624200232	Allied Body Works	625 S 96th St.	5 Years	2016
5624200442	Andonian 4-plex	9920 Des Moines Memorial Dr. S	5 Years	2017
5624200110	Anmarco Yard	1110 S 96th St.	3 Years	2016
5624200132	Anmarco Yard	1110 S 96th St.	3 Years	2016
5624200439	Arnold 4-plex	9926 Des Moines Memorial Dr. S	5 Years	2017
5624200351	Beckwith & Kuffel	1313 S 96th St.	3 Years	2016
5624200411	Bidadoo Auctions	1541 S 96th St.	3 Years	2016
7883608601	Boeing	1420 S Trenton St.	NA	NA
7883608603	Boeing	1420 S Trenton St.	NA	NA
0001600016	Carey Limousine	1237 S Director St.	3 Years	2017
3224049023	CDL Recycling	9208 4th Ave. S	Annual	2016
5624200517	City View Apartments	9929 14th Ave. S	5 Years	2016
1646700020	Cloverdale Industrial Park	9320 4th Ave. S	5 Years	2020
5624200208	Concrete Restoration Inc.	9587 8th Ave. S	3 Years	2017
0001600029	Delta Marine	1801 S 93rd St.	3 Years	2017
0001600062	Delta Marine	1801 S 93rd St.	3 Years	2017
5624200005	Delta Marine	1801 S 93rd St.	3 Years	2017
5624200006	Delta Marine	1801 S 93rd St.	3 Years	2017
5624200021	Delta Marine	1801 S 93rd St.	3 Years	2017
5624200371	Dominic's Plaza	9626 Des Moines Memorial Dr. S	5 Years	2016
0001600061	Duwamish Yacht Club	1801 S 93rd St.	5 Years	2016
5624200438	Eng 4-plex	9916 Des Moines Memorial Dr. S	5 Years	2017
5624200435	Fisseha 4-plex	9928 Des Moines Memorial Dr. S	5 Years	2017
0001600042	Frog Hollow	1425 S 93rd St.	5 Years	2018
3224049056	Graham Trucking	9301 4th Ave. S	3 Years	2016
5624200931	Hamm Creek Restoration Area		NA	

Parcel Number	Company Name	Site Address	Inspection Cycle	Next Inspection
0001600050	Harrash Industrial Park	1605 S 93rd St.	3 Years	2016
0001600058	IAM District 751	9135 15th Pl. S	5 Years	2016
5624200310	Icon Materials	1031 S 96th St.	2 Years	2016
5624200311	Icon Materials	1031 S 96th St.	2 Years	2016
5624200330	Icon Materials	1031 S 96th St.	2 Years	2016
5624200335	Icon Materials	1115 S 96th St.	2 Years	2016
5624200452	India Pentecostal Assembly	1443 S 99th St.	5 Years	2016
0001600037	Industrial Automation	9300 14th Ave. S	3 Years	2016
5624200370	McDonalds		3 Years	2020
5624200372	McDonalds	9610 Des Moines Memorial Dr. S	3 Years	2020
2185001105	National Products Inc.	8436 Dallas Ave. S	3 Years	2017
2185001250	National Products Inc.	8436 Dallas Ave. S	3 Years	2017
2185001107	National Products Inc.	8432 Dallas Ave. S	3 Years	2017
2185001130	National Products Inc.	8410 Dallas Ave. S	3 Years	2017
2185001140	National Products Inc.	1205 S Orr St.	3 Years	2017
2185001260	National Products Inc.	1229 S Orr St.	3 Years	2017
2185001270	National Products Inc.	1229 S Orr St.	3 Years	2017
5624200434	Nguyen 4-plex	9914 Des Moines Memorial Dr. S	5 Years	2017
3224049051	Northwest Grating Products	9230 4th Ave. S	3 Years	2016
5624200441	Norton 4-plex	9924 Des Moines Memorial Dr. S	5 Years	2017
5624200170	NRC Environmental Service Inc.	910 S 96th St.	5 Years	2018
3224049034	Old Dominion Freight	600 S 96th St.	5 Years	2018
3224049072	Old Dominion Freight	600 S 96th St.	5 Years	2018
5624200211	Old Dominion Freight	600 S 96th St.	5 Years	2018
5624200212	Old Dominion Freight	600 S 96th St.	5 Years	2018
5624200213	Old Dominion Freight	600 S 96th St.	5 Years	2018

Parcel Number	Company Name	Site Address	Inspection Cycle	Next Inspection
0001600055	Pacific Industrial Supply	1251 S Director St.	3 Years	2017
0523049005	Pacific Northwest Motor Freight Lines	515 S 96th St.	5 Years	2020
0001600044	Port of Seattle Terminal 117	8700 Dallas Ave. S	NA	NA
5624200208	Pro Weld	9585 8th Ave. S	3 Years	2017
0001600046	PSF Industries	9322 14th Ave. S	2 Years	2016
5624200190	Puget Sound Coatings	9400 8th Ave. S	Annual	2016
5624200210	Pure Water Corporation	9411 8th Ave. S	5 Years	2016
2185600070	Rick's Master Marine	1411 S Thistle St.	3 Years	2016
5624200270	Riverton Distribution Center	9600 8th Ave. S	5 Years	2016
5624200290	Riverton Distribution Center	9600 8th Ave. S	5 Years	2016
0001600060	Sea King Industrial Park	1621 S 92nd Pl.	5 Years	2016
7619000000	Sea King Industrial Park	1521 S 92nd Pl	5 Years	2016
5624200930	Seattle City Light	10000 West Marginal Pl. S	5 Years	2016
5624200920	Seattle City Light	10000 West Marginal Pl. S	5 Years	2016
3224049103	Security Contractor Services	9226 4th Ave. S	Annual	2016
5624200250	Security Contractor Services	9617 8th Ave. S	2 Years	2016
5624200230	Selland Auto Transport	615 S 96th St.	5 Years	2016
5624200097	Shell Gas Station	9525 14th Ave. S	Annual	2016
5624200150	Simplex Grinnell	9520 10th Ave. S	3 Years	2018
0001600001	South Park Marina	8604 Dallas Ave. S	5 Years	2016
2185600025	South Park Tire Factory	8510 Dallas Ave. S	5 Years	2016
5624200099	Tek-line Roofing	1312 S 96th Ave. S	Annual	2016
5624200191	Terex Utilities	9426 8th Ave. S	3 Years	2016
5624200443	Thach 4-plex	9922 Des Moines Memorial Dr. S	5 Years	2017
1646700010	The Revere Group	9310 4th Ave. S	5 Years	2020
5624200170	Universal Intermodal Services	9515 10th Ave. S	5 Years	2019
0523049060	Vacant		NA	
3224049043	Vacant		NA	

Parcel Number	Company Name	Site Address	Inspection Cycle	Next Inspection
5624200100	**Vacant**		**NA**	
5624200412	**Vacant**	**9840 West Marginal Way S**	**NA**	
5624200416	**Vacant**		**NA**	
5624200479	**Vacant**		**NA**	
5624200482	**Vacant**		**NA**	
5624200490	**Vacant**		**NA**	
5624200511	**Vacant**	**1120 S 99th St.**	**NA**	
5624200516	**Vacant**		**NA**	
7258200020	**Vacant**	**1219 S 99th St.**	**NA**	
2185001045	**Vacant**		**NA**	
2185001075	**Vacant**	**8442 Dallas Ave. S**	**NA**	
2185001275	**Vacant**		**NA**	
2185000895	**Vacant**		**NA**	
5624200431	**Vacant (pending construction)**	**9820 Des Moines Memorial Dr. S**	**5 Years**	**2017**
5624200253	**Warp Corporation**	**631 S 96th St.**	**3 Years**	**2017**
5624200527	**Willow Terrace**	**1102 S 99th Pl. S**	**5 Years**	**2019**
5624200531	**Willow Terrace**	**1108 S 99th St.**	**5 Years**	**2019**
5624200550	**Willow Terrace**	**1016 S 99th St.**	**5 Years**	**2019**
5624200440	**Woldetatios 4-plex**	**9918 Des Moines Memorial Dr. S**	**5 Years**	**2017**
5624200360	**Woolridge Boats**	**1303 S 96th St.**	**5 Years**	**2016**

NA = not applicable

Table C-2. King County LDW Separated Stormdrain and Hamm Creek Source Tracing Sample Locators and Associated Coordinates and Sample Types

Locator	Sample Type	FeatureType	X	Y	Description
HC-ST1	Sediment Trap	Closed Conveyance	1275383	190530.6	Traps in South Fork of Hamm Creek, prior to crossing under Des Moines Memorial Drive S.
96-ST1	Sediment Trap	Sump	1275076	192295.6	Traps in 8-ft-deep, type 2 catch basin with slotted lid, just east of the lawn of the Delta Marine admin building and just north of S 96th St.
96-ST2	Sediment Trap	Sump	1274675	192705	Traps in 14-foot-deep, type 2 CB with vaned, slotted lid near NE corner of 15th S. and S. 95th. Down-pipe drain system from 96-ST3.
96-ST3	Sediment Trap	Pond/Vault	1270741	192246.7	Traps on south wall of 13-ft deep stormwater vault at corner of 4th Ave S and S 96th St. Up-pipe drain system from 96-ST2.
LDW_SG1	ROW Catch Basin Grab	Sump	1274557	196236	Type-2 catch basin with rectangular grated lid located at SW corner of the intersection of S Orr St and S Thistle St, in street up against curb.
LDW_SG2	ROW Catch Basin Grab	Sump	1273892	196791.4	Type-1 catch basin with rectangular grated lid located on north side of S Southern St near 1206/1212 S Southern St.
LDW_SG3	ROW Catch Basin Grab	Sump	1274773	197443.3	Type-2 catch basin with rectangular slotted lid located in bike lane of southbound approach to South Park bridge.

X/Y Coordinates are in NAD1983 WA State Plane North.
ROW - right of way

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

	96-ST1	96-ST2
Project:	421195-590	421195-590
Locator:	96-ST1	96-ST2
Descrip:	SUMP 2219. THIS IS	SUMP 2228. THIS IS
Sample:	L65182-1	L65182-2
Matrix:	SE FRSHWTRSED	SE FRSHWTRSED
ColDate:	4/7/16 8:35	4/7/16 9:45
TotalSolid:	43.6	61.9
	DRY Weight Basis	**DRY Weight Basis**

Parameters	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**
CV ASTM D422												
Clay*	6.7			0.8	1.7	%	5.4			0.8	1.5	%
Fines*	21.8			0.8	1.7	%	20.8			0.8	1.5	%
Gravel*	8.9			0.2	1.7	%	3.5			0.2	1.5	%
p+0.00*	7.4			0.2	1.7	%	3.6			0.2	1.5	%
p+1.00*	26.3			0.2	1.7	%	5.7			0.2	1.5	%
p+10.0(equal/more than)*	4.2			0.8	1.7	%	3.1			0.8	1.5	%
p+2.00*	26.3			0.2	1.7	%	21.6			0.2	1.5	%
p+3.00*	5			0.2	1.7	%	26.9			0.2	1.5	%
p+4.00*	3.2			0.2	1.7	%	12.2			0.2	1.5	%
p+5.00*	8.4			0.8	1.7	%	10			0.8	1.5	%
p+6.00*	1.7	RDL	J	0.8	1.7	%	1.5	RDL	J	0.8	1.5	%
p+7.00*	2.5			0.8	1.7	%	3.1			0.8	1.5	%
p+8.00*	2.5			0.8	1.7	%	0.8	<RDL	J	0.8	1.5	%
p+9.00*	2.5			0.8	1.7	%	2.3			0.8	1.5	%
p-1.00*	3.2			0.2	1.7	%	2.3			0.2	1.5	%
p-2.00(less than)*	5.2			0.2	1.7	%	0.7	<RDL	J	0.2	1.5	%
p-2.00*	0.5	<RDL	J	0.2	1.7	%	0.5	<RDL	J	0.2	1.5	%
Sand*	68.2			0.2	1.7	%	69.9			0.2	1.5	%
Silt*	15.1			0.8	1.7	%	15.4			0.8	1.5	%
CV ASTM D422/D3977-97												
500 Micron (equal to/more than)*												
CV ISO 13320:2009(E)												
Clay*												
Fines*												
p+1.00*												
p+10.0(more than)*												
p+10.0*												
p+2.00*												
p+3.00*												
p+4.00*												
p+5.00*												
p+6.00*												

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

	96-ST1	96-ST2
Project:	421195-590	421195-590
Locator:	96-ST1	96-ST2
Descrip:	SUMP 2219. THIS IS	SUMP 2228. THIS IS
Sample:	L65182-1	L65182-2
Matrix:	SE FRSHWTRSED	SE FRSHWTRSED
ColDate:	4/7/16 8:35	4/7/16 9:45
TotalSolid:	43.6	61.9
	DRY Weight Basis	**DRY Weight Basis**

Parameters	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**
p+7.00*												
p+8.00*												
p+9.00*												
Sand<1000*												
Silt*												
CV SM2540-G												
Total Solids*	43.6			0.005	0.01	%	61.9			0.005	0.01	%
CV SW846 9060 PSEP96												
Total Organic Carbon	8280			550	1100	mg/Kg	3600			470	924	mg/Kg
MT SW846 3050B*SW846 6010C												
Arsenic, Total, ICP	57	<RDL	J	14	71.8	mg/Kg	10.5			2.1	10.1	mg/Kg
Cadmium, Total, ICP	0.85	<RDL	J	0.23	1.15	mg/Kg	0.63	<RDL	J	0.16	0.809	mg/Kg
Chromium, Total, ICP	42.4			1.7	8.62	mg/Kg	103			0.24	1.21	mg/Kg
Copper, Total, ICP	74.1			2.3	11.5	mg/Kg	59.6			0.32	1.62	mg/Kg
Lead, Total, ICP	69.7			11	57.6	mg/Kg	66.7			1.6	8.09	mg/Kg
Nickel, Total, ICP	66.7			3	14.4	mg/Kg	52			0.4	2.02	mg/Kg
Silver, Total, ICP	0.83	<RDL	J	0.46	2.29	mg/Kg		<MDL	U	0.32	1.62	mg/Kg
Vanadium, Total, ICP	80.7			5.7	28.7	mg/Kg	43.8			0.81	4.04	mg/Kg
Zinc, Total, ICP	1010			3	14.4	mg/Kg	796			0.4	2.02	mg/Kg
MT SW846 7471B												
Mercury, Total, CVAA	0.11	<RDL	J	0.012	0.12	mg/Kg	0.074	<RDL	J	0.008	0.077	mg/Kg
OR SW846 3550B*SW846 8082A												
Aroclor 1016		<MDL	U	3	11.5	ug/Kg		<MDL	U	2.1	8.08	ug/Kg
Aroclor 1221		<MDL	U	8.7	11.5	ug/Kg		<MDL	U	6.1	8.08	ug/Kg
Aroclor 1232		<MDL	U	8.7	11.5	ug/Kg		<MDL	U	6.1	8.08	ug/Kg
Aroclor 1242	5	<RDL	J	3	11.5	ug/Kg		<MDL	U	2.1	8.08	ug/Kg
Aroclor 1248		<MDL	U	3	11.5	ug/Kg		<MDL	U	2.1	8.08	ug/Kg
Aroclor 1254	22	<RDL	J	11	45.9	ug/Kg	23.7			2.1	8.08	ug/Kg
Aroclor 1260	19	<RDL	J	11	45.9	ug/Kg	21.3			2.1	8.08	ug/Kg
Total Aroclors	46.1			3	11.5	ug/Kg	45.1			2.1	8.08	ug/Kg
OR SW846 3550B*SW846 8270D												
1,2,4-Trichlorobenzene		<MDL	U	0.76	1.53	ug/Kg		<MDL	U	0.53	1.08	ug/Kg
1,2-Dichlorobenzene		<MDL	U	7.64	7.64	ug/Kg		<MDL	U	5.38	5.38	ug/Kg

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

	96-ST1	96-ST2
Project:	421195-590	421195-590
Locator:	96-ST1	96-ST2
Descrip:	SUMP 2219. THIS IS	SUMP 2228. THIS IS
Sample:	L65182-1	L65182-2
Matrix:	SE FRSHWTRSED	SE FRSHWTRSED
ColDate:	4/7/16 8:35	4/7/16 9:45
TotalSolid:	43.6	61.9
	DRY Weight Basis	**DRY Weight Basis**

Parameters	Value	Qual	Val Qual	MDL	RDL	Units	Value	Qual	Val Qual	MDL	RDL	Units
1,4-Dichlorobenzene		<MDL	U	11.5	11.5	ug/Kg		<MDL	U	8.08	8.08	ug/Kg
1-Methylnaphthalene	9.6	<RDL	J	7.6	15.3	ug/Kg		<MDL	U	5.3	10.8	ug/Kg
2,4-Dimethylphenol		<MDL	UJ	7.6	15.3	ug/Kg		<MDL	UJ	5.3	10.8	ug/Kg
2-Methylnaphthalene	11	<RDL	J	7.6	15.3	ug/Kg		<MDL	U	5.3	10.8	ug/Kg
2-Methylphenol		<MDL	U	7.6	15.3	ug/Kg		<MDL	U	5.3	10.8	ug/Kg
3-,4-Methylphenol	511			39	76.4	ug/Kg		<MDL	U	27	53.8	ug/Kg
Acenaphthene	98.9			7.6	15.3	ug/Kg	11.6			5.3	10.8	ug/Kg
Acenaphthylene	8.7	<RDL	J	7.6	15.3	ug/Kg		<MDL	U	5.3	10.8	ug/Kg
Anthracene	573			76	153	ug/Kg		<MDL	U	53	108	ug/Kg
Benzo(a)anthracene	1510			76	153	ug/Kg	288			53	108	ug/Kg
Benzo(a)pyrene	1390			76	153	ug/Kg	286			53	108	ug/Kg
Benzo(b,j,k)fluoranthene	2870			76	153	ug/Kg	693			53	108	ug/Kg
Benzo(g,h,i)perylene	800			76	153	ug/Kg	205			53	108	ug/Kg
Benzoic Acid	486			153	153	ug/Kg	126			108	108	ug/Kg
Benzyl Alcohol	53.9			19.1	19.1	ug/Kg	33			13.5	13.5	ug/Kg
Benzyl Butyl Phthalate		<MDL	U	115	115	ug/Kg	341			80.8	80.8	ug/Kg
Bis(2-Ethylhexyl)Phthalate	4520			150	305	ug/Kg	2200			110	215	ug/Kg
Carbazole	319			76	153	ug/Kg		<MDL	U	53	108	ug/Kg
Chrysene	1620			76	153	ug/Kg	388			53	108	ug/Kg
Dibenzo(a,h)anthracene	196			76	153	ug/Kg	55	<RDL	J	53	108	ug/Kg
Dibenzofuran	69.5			7.6	15.3	ug/Kg	10	<RDL	J	5.3	10.8	ug/Kg
Diethyl Phthalate		<MDL	U	15	30.5	ug/Kg		<MDL,JG	UJ	11	21.5	ug/Kg
Dimethyl Phthalate	644	JG	J	15.3	15.3	ug/Kg	34.7	JG	J	10.8	10.8	ug/Kg
Di-N-Butyl Phthalate		<MDL	U	150	305	ug/Kg		<MDL	U	110	215	ug/Kg
Di-N-Octyl Phthalate		<MDL	U	153	153	ug/Kg		<MDL	U	108	108	ug/Kg
Fluoranthene	3720			76	153	ug/Kg	549			53	108	ug/Kg
Fluorene	179			7.6	15.3	ug/Kg	13.5			5.3	10.8	ug/Kg
Hexachlorobenzene		<MDL	U	0.76	1.53	ug/Kg		<MDL	U	0.53	1.08	ug/Kg
Hexachlorobutadiene		<MDL	U	3.9	7.64	ug/Kg		<MDL	U	2.7	5.38	ug/Kg
Indeno(1,2,3-Cd)Pyrene	807			76	153	ug/Kg	199			53	108	ug/Kg
Naphthalene	14	<RDL	J	7.6	15.3	ug/Kg		<MDL	U	5.3	10.8	ug/Kg
N-Nitrosodiphenylamine		<MDL	U	19.1	19.1	ug/Kg		<MDL	U	13.5	13.5	ug/Kg

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

	Project: 421195-590 Locator: 96-ST1 Descrip: SUMP 2219. THIS IS Sample: L65182-1 Matrix: SE FRSHWTRSED ColDate: 4/7/16 8:35 TotalSolid: 43.6 **DRY Weight Basis**						Project: 421195-590 Locator: 96-ST2 Descrip: SUMP 2228. THIS IS Sample: L65182-2 Matrix: SE FRSHWTRSED ColDate: 4/7/16 9:45 TotalSolid: 61.9 **DRY Weight Basis**					
Parameters	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**
Pentachlorophenol		<MDL	U	115	115	ug/Kg		<MDL	U	80.8	80.8	ug/Kg
Phenanthrene	2890			76	153	ug/Kg	288			53	108	ug/Kg
Phenol		<MDL	U	39	115	ug/Kg		<MDL	U	27	80.8	ug/Kg
Pyrene	3850			76	153	ug/Kg	599			53	108	ug/Kg
Total HPAH (calc)	16763						3262					
Total LPAH (calc)	3763.6						313.1					

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

	96-ST3	HC-ST1
Project:	421195-590	421195-590
Locator:	96-ST3	HC-ST1
Descrip:	POND/VAULT 144. TH	CULVERT 66983. THI
Sample:	L65182-3	L65182-4
Matrix:	SE FRSHWTRSED	SE FRSHWTRSED
ColDate:	4/7/16 10:35	4/7/16 11:15
TotalSolid:	36.1	58.5
	DRY Weight Basis	**DRY Weight Basis**

Parameters	Value	Qual	Val Qual	MDL	RDL	Units	Value	Qual	Val Qual	MDL	RDL	Units
CV ASTM D422												
Clay*							3.2	J	J	0.6	1.3	%
Fines*							7.8	J	J	0.6	1.3	%
Gravel*							1.2	<RDL	J	0.1	1.3	%
p+0.00*							5.6			0.1	1.3	%
p+1.00*							17.3			0.1	1.3	%
p+10.0(equal/more than)*							1.3	RDL	J	0.6	1.3	%
p+2.00*							39.5			0.1	1.3	%
p+3.00*							23			0.1	1.3	%
p+4.00*							7.6			0.1	1.3	%
p+5.00*							3.9		J	0.6	1.3	%
p+6.00*								<MDL	UJ	0.6	1.3	%
p+7.00*							0.6	<RDL	J	0.6	1.3	%
p+8.00*								<MDL	UJ	0.6	1.3	%
p+9.00*							1.9		J	0.6	1.3	%
p-1.00*							1.2	<RDL	J	0.1	1.3	%
p-2.00(less than)*								<MDL	U	0.1	1.3	%
p-2.00*								<MDL	U	0.1	1.3	%
Sand*							93			0.1	1.3	%
Silt*							4.5	J	J	0.6	1.3	%
CV ASTM D422/D3977-97												
500 Micron (equal to/more than)*	1.97			0.005	0.01	%						
CV ISO 13320:2009(E)												
Clay*	4.45			0.01	0.01	% Volume						
Fines*	46.21			0.01	0.01	% Volume						
p+1.00*	3.41			0.01	0.01	% Volume						
p+10.0(more than)*	0.84			0.01	0.01	% Volume						
p+10.0*	1.21			0.01	0.01	% Volume						
p+2.00*	10.7			0.01	0.01	% Volume						
p+3.00*	15.79			0.01	0.01	% Volume						
p+4.00*	21.91			0.01	0.01	% Volume						
p+5.00*	14.26			0.01	0.01	% Volume						
p+6.00*	13.49			0.01	0.01	% Volume						

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

Project:	421195-590	Project:	421195-590
Locator:	96-ST3	Locator:	HC-ST1
Descrip:	POND/VAULT 144. TH	Descrip:	CULVERT 66983. THI
Sample:	L65182-3	Sample:	L65182-4
Matrix:	SE FRSHWTRSED	Matrix:	SE FRSHWTRSED
ColDate:	4/7/16 10:35	ColDate:	4/7/16 11:15
TotalSolid:	36.1	TotalSolid:	58.5
DRY Weight Basis		**DRY Weight Basis**	

Parameters	Value	Qual	Val Qual	MDL	RDL	Units	Value	Qual	Val Qual	MDL	RDL	Units
p+7.00*	9.02			0.01	0.01	% Volume						
p+8.00*	5			0.01	0.01	% Volume						
p+9.00*	2.41			0.01	0.01	% Volume						
Sand<1000*	51.81			0.01	0.01	% Volume						
Silt*	41.76			0.01	0.01	% Volume						
CV SM2540-G												
Total Solids*	36.1			0.005	0.01	%	58.5			0.005	0.01	%
CV SW846 9060 PSEP96												
Total Organic Carbon	4290			1100	2250	mg/Kg	750			190	388	mg/Kg
MT SW846 3050B*SW846 6010C												
Arsenic, Total, ICP	17	<RDL	J	3.3	17.3	mg/Kg	6.5	<RDL	J	2.1	10.6	mg/Kg
Cadmium, Total, ICP	0.53	<RDL	J	0.28	1.39	mg/Kg		<MDL	U	0.17	0.853	mg/Kg
Chromium, Total, ICP	51			0.42	2.07	mg/Kg	52.6			0.26	1.28	mg/Kg
Copper, Total, ICP	64.8			0.55	2.77	mg/Kg	17.8			0.34	1.7	mg/Kg
Lead, Total, ICP	73.7			2.8	13.9	mg/Kg	14.7			1.7	8.53	mg/Kg
Nickel, Total, ICP	49.9			0.69	3.46	mg/Kg	72.8			0.43	2.14	mg/Kg
Silver, Total, ICP		<MDL	U	0.55	2.77	mg/Kg	0.41	<RDL	J	0.34	1.7	mg/Kg
Vanadium, Total, ICP	72.6			1.4	6.93	mg/Kg	44.8			0.85	4.26	mg/Kg
Zinc, Total, ICP	601			0.69	3.46	mg/Kg	102			0.43	2.14	mg/Kg
MT SW846 7471B												
Mercury, Total, CVAA							0.034	<RDL	J	0.008	0.084	mg/Kg
OR SW846 3550B*SW846 8082A												
Aroclor 1016		<MDL	U	3.6	13.9	ug/Kg		<MDL	U	2.2	8.55	ug/Kg
Aroclor 1221		<MDL	U	11	13.9	ug/Kg		<MDL	U	6.5	8.55	ug/Kg
Aroclor 1232		<MDL	U	11	13.9	ug/Kg		<MDL	U	6.5	8.55	ug/Kg
Aroclor 1242		<MDL	U	3.6	13.9	ug/Kg		<MDL	U	2.2	8.55	ug/Kg
Aroclor 1248		<MDL	U	3.6	13.9	ug/Kg		<MDL	U	2.2	8.55	ug/Kg
Aroclor 1254	19.1			3.6	13.9	ug/Kg		<MDL	U	4.3	8.55	ug/Kg
Aroclor 1260	24.9			3.6	13.9	ug/Kg	2.2	<RDL	J	1.3	8.55	ug/Kg
Total Aroclors	44			3.6	13.9	ug/Kg	2.2	<RDL	J	1.3	8.55	ug/Kg
OR SW846 3550B*SW846 8270D												
1,2,4-Trichlorobenzene								<MDL	U	0.56	1.14	ug/Kg
1,2-Dichlorobenzene								<MDL	U	5.69	5.69	ug/Kg

Table C-3. SWS Stormdrain solids sampling results for 2016.

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	Project: 421195-590 Locator: 96-ST3 Descrip: POND/VAULT 144. TH Sample: L65182-3 Matrix: SE FRSHWTRSED ColDate: 4/7/16 10:35 TotalSolid: 36.1 **DRY Weight Basis**						Project: 421195-590 Locator: HC-ST1 Descrip: CULVERT 66983. THI Sample: L65182-4 Matrix: SE FRSHWTRSED ColDate: 4/7/16 11:15 TotalSolid: 58.5 **DRY Weight Basis**					
Parameters	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**
1,4-Dichlorobenzene								<MDL	U	8.55	8.55	ug/Kg
1-Methylnaphthalene								<MDL	U	5.6	11.4	ug/Kg
2,4-Dimethylphenol								<MDL	UJ	5.6	11.4	ug/Kg
2-Methylnaphthalene								<MDL	U	5.6	11.4	ug/Kg
2-Methylphenol								<MDL	U	5.6	11.4	ug/Kg
3-,4-Methylphenol								<MDL	U	29	56.9	ug/Kg
Acenaphthene								<MDL	U	5.6	11.4	ug/Kg
Acenaphthylene								<MDL	U	5.6	11.4	ug/Kg
Anthracene							7.7	<RDL	J	5.6	11.4	ug/Kg
Benzo(a)anthracene							29.6			5.6	11.4	ug/Kg
Benzo(a)pyrene							29.9			5.6	11.4	ug/Kg
Benzo(b,j,k)fluoranthene							62.4			5.6	11.4	ug/Kg
Benzo(g,h,i)perylene							21.2			5.6	11.4	ug/Kg
Benzoic Acid								<MDL	U	114	114	ug/Kg
Benzyl Alcohol								<MDL	U	14.2	14.2	ug/Kg
Benzyl Butyl Phthalate								<MDL	U	8.55	8.55	ug/Kg
Bis(2-Ethylhexyl)Phthalate							369			11	22.7	ug/Kg
Carbazole								<MDL	U	5.6	11.4	ug/Kg
Chrysene							35.6			5.6	11.4	ug/Kg
Dibenzo(a,h)anthracene								<MDL	U	5.6	11.4	ug/Kg
Dibenzofuran								<MDL	U	5.6	11.4	ug/Kg
Diethyl Phthalate								<MDL	U	11	22.7	ug/Kg
Dimethyl Phthalate								<MDL,JG	UJ	11.4	11.4	ug/Kg
Di-N-Butyl Phthalate								<MDL	U	11	22.7	ug/Kg
Di-N-Octyl Phthalate								<MDL	U	11.4	11.4	ug/Kg
Fluoranthene							60.9			5.6	11.4	ug/Kg
Fluorene								<MDL	U	5.6	11.4	ug/Kg
Hexachlorobenzene								<MDL	U	0.56	1.14	ug/Kg
Hexachlorobutadiene								<MDL	U	2.9	5.69	ug/Kg
Indeno(1,2,3-Cd)Pyrene							19.5			5.6	11.4	ug/Kg
Naphthalene								<MDL	U	5.6	11.4	ug/Kg
N-Nitrosodiphenylamine								<MDL	U	14.2	14.2	ug/Kg

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

	Project: 421195-590 Locator: 96-ST3 Descrip: POND/VAULT 144. TH Sample: L65182-3 Matrix: SE FRSHWTRSED ColDate: 4/7/16 10:35 TotalSolid: 36.1 **DRY Weight Basis**						Project: 421195-590 Locator: HC-ST1 Descrip: CULVERT 66983. THI Sample: L65182-4 Matrix: SE FRSHWTRSED ColDate: 4/7/16 11:15 TotalSolid: 58.5 **DRY Weight Basis**					
Parameters	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**
Pentachlorophenol								<MDL	U	85.5	85.5	ug/Kg
Phenanthrene							61.4			5.6	11.4	ug/Kg
Phenol								<MDL	U	29	85.5	ug/Kg
Pyrene							78.3			5.6	11.4	ug/Kg
Total HPAH (calc)							337.4					
Total LPAH (calc)							69.1					

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

	Sample 1	Sample 2
Project:	421195-590	421195-590
Locator:	LDW-SG1	LDW-SG2
Descrip:	S 96TH STREET DRAI	S 96TH STREET DRAI
Sample:	L65467-1	L65467-2
Matrix:	SE FRSHWTRSED	SE FRSHWTRSED
ColDate:	6/2/16 11:30	6/1/16 9:30
TotalSolid:	78.3	81.9
	DRY Weight Basis	**DRY Weight Basis**

Parameters	Value	Qual	Val Qual	MDL	RDL	Units	Value	Qual	Val Qual	MDL	RDL	Units
CV ASTM D422												
Clay*	5.1			0.6	1.3	%	1.6			0.5	1.1	%
Fines*	19.8			0.6	1.3	%	2.7			0.5	1.1	%
Gravel*	16.2			0.1	1.3	%	48			0.1	1.1	%
p+0.00*	9.3			0.1	1.3	%	16.3			0.1	1.1	%
p+1.00*	14.1			0.1	1.3	%	12.2			0.1	1.1	%
p+10.0(equal/more than)*	3.2			0.6	1.3	%	1.1	RDL	J	0.5	1.1	%
p+2.00*	16.5			0.1	1.3	%	11.5			0.1	1.1	%
p+3.00*	12.6			0.1	1.3	%	4.3			0.1	1.1	%
p+4.00*	7.7			0.1	1.3	%	1.5			0.1	1.1	%
p+5.00*	7			0.6	1.3	%	0.5	<RDL	J	0.5	1.1	%
p+6.00*	2.6			0.6	1.3	%		<MDL	U	0.5	1.1	%
p+7.00*	3.2			0.6	1.3	%		<MDL	U	0.5	1.1	%
p+8.00*	1.9			0.6	1.3	%	0.5	<RDL	J	0.5	1.1	%
p+9.00*	1.9			0.6	1.3	%	0.5	<RDL	J	0.5	1.1	%
p-1.00*	7.3			0.1	1.3	%	19			0.1	1.1	%
p-2.00(less than)*	6.9			0.1	1.3	%	25.2			0.1	1.1	%
p-2.00*	2			0.1	1.3	%	3.7			0.1	1.1	%
Sand*	60.2			0.1	1.3	%	45.8			0.1	1.1	%
Silt*	14.7			0.6	1.3	%	1.1	RDL	J	0.5	1.1	%
CV ASTM D422/D3977-97												
500 Micron (equal to/more than)*												
CV ISO 13320:2009(E)												
Clay*												
Fines*												
p+1.00*												
p+10.0(more than)*												
p+10.0*												
p+2.00*												
p+3.00*												
p+4.00*												
p+5.00*												
p+6.00*												

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

	LDW-SG1						LDW-SG2					
	Project: 421195-590 Locator: LDW-SG1 Descrip: S 96TH STREET DRAI Sample: L65467-1 Matrix: SE FRSHWTRSED ColDate: 6/2/16 11:30 TotalSolid: 78.3 **DRY Weight Basis**						Project: 421195-590 Locator: LDW-SG2 Descrip: S 96TH STREET DRAI Sample: L65467-2 Matrix: SE FRSHWTRSED ColDate: 6/1/16 9:30 TotalSolid: 81.9 **DRY Weight Basis**					
Parameters	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**
p+7.00*												
p+8.00*												
p+9.00*												
Sand<1000*												
Silt*												
CV SM2540-G												
Total Solids*	78.3			0.005	0.01	%	81.9			0.005	0.01	%
CV SW846 9060 PSEP96												
Total Organic Carbon	6040			430	871	mg/Kg	4600			460	918	mg/Kg
MT SW846 3050B*SW846 6010C												
Arsenic, Total, ICP	4.9	<RDL	J	1.5	7.94	mg/Kg	4.4	<RDL	J	1.5	7.63	mg/Kg
Cadmium, Total, ICP	0.37	<RDL	J	0.13	0.635	mg/Kg	0.38	<RDL	J	0.12	0.611	mg/Kg
Chromium, Total, ICP	186			0.19	0.953	mg/Kg	16.5			0.18	0.916	mg/Kg
Copper, Total, ICP	88.5			0.26	1.27	mg/Kg	35.5			0.24	1.22	mg/Kg
Lead, Total, ICP	19.8			1.3	6.35	mg/Kg	19.7			1.2	6.11	mg/Kg
Nickel, Total, ICP	29.9			1.5	7.94	mg/Kg	16.2			0.31	1.53	mg/Kg
Silver, Total, ICP		<MDL	U	0.26	1.27	mg/Kg		<MDL	U	0.24	1.22	mg/Kg
Vanadium, Total, ICP	74.3			0.64	3.18	mg/Kg	33.1			0.61	3.05	mg/Kg
Zinc, Total, ICP	835			1.5	7.94	mg/Kg	195			0.31	1.53	mg/Kg
MT SW846 7471B												
Mercury, Total, CVAA	0.029	<RDL	J	0.007	0.065	mg/Kg	0.018	<RDL	J	0.006	0.06	mg/Kg
OR SW846 3550B*SW846 8082A												
Aroclor 1016		<MDL	U	1.7	6.39	ug/Kg		<MDL	U	1.6	6.11	ug/Kg
Aroclor 1221		<MDL	U	4.9	6.39	ug/Kg		<MDL	U	4.6	6.11	ug/Kg
Aroclor 1232		<MDL	U	4.9	6.39	ug/Kg		<MDL	U	4.6	6.11	ug/Kg
Aroclor 1242	2.9	<RDL	J	1.7	6.39	ug/Kg		<MDL	U	1.6	6.11	ug/Kg
Aroclor 1248		<MDL	U	1.7	6.39	ug/Kg		<MDL	U	1.6	6.11	ug/Kg
Aroclor 1254	11	<RDL	J	6.4	25.5	ug/Kg	4.8	<RDL	J	1.6	6.11	ug/Kg
Aroclor 1260	15	<RDL	J	6.4	25.5	ug/Kg	4.2	<RDL	J	1.6	6.11	ug/Kg
Total Aroclors	29			1.7	6.39	ug/Kg	8.91			1.6	6.11	ug/Kg
OR SW846 3550B*SW846 8270D												
1,2,4-Trichlorobenzene		<MDL	U	2.2	4.25	ug/Kg		<MDL	U	0.4	0.814	ug/Kg
1,2-Dichlorobenzene		<MDL	U	21.3	21.3	ug/Kg		<MDL	U	4.07	4.07	ug/Kg

Table C-3. SWS Stormdrain solids sampling results for 2016.

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	LDW-SG1	LDW-SG2
Project:	421195-590	421195-590
Locator:	LDW-SG1	LDW-SG2
Descrip:	S 96TH STREET DRAI	S 96TH STREET DRAI
Sample:	L65467-1	L65467-2
Matrix:	SE FRSHWTRSED	SE FRSHWTRSED
ColDate:	6/2/16 11:30	6/1/16 9:30
TotalSolid:	78.3	81.9
	DRY Weight Basis	**DRY Weight Basis**

Parameters	Value	Qual	Val Qual	MDL	RDL	Units	Value	Qual	Val Qual	MDL	RDL	Units
1,4-Dichlorobenzene		<MDL	U	31.9	31.9	ug/Kg		<MDL	U	6.11	6.11	ug/Kg
1-Methylnaphthalene		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
2,4-Dimethylphenol		<MDL	UJ	22	42.5	ug/Kg		<MDL	UJ	4	8.14	ug/Kg
2-Methylnaphthalene		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
2-Methylphenol		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
3-,4-Methylphenol	398			110	213	ug/Kg		<MDL	U	21	40.7	ug/Kg
Acenaphthene		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
Acenaphthylene		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
Anthracene		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
Benzo(a)anthracene		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
Benzo(a)pyrene		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
Benzo(b,j,k)fluoranthene		<MDL	U	22	42.5	ug/Kg	46.4			4	8.14	ug/Kg
Benzo(g,h,i)perylene		<MDL	U	22	42.5	ug/Kg	13.9			4	8.14	ug/Kg
Benzoic Acid		<MDL	U	425	425	ug/Kg	107			81.4	81.4	ug/Kg
Benzyl Alcohol	188	J	J	53.3	53.3	ug/Kg		<MDL	U	10.2	10.2	ug/Kg
Benzyl Butyl Phthalate		<MDL	U	31.9	31.9	ug/Kg		<MDL	U	6.11	6.11	ug/Kg
Bis(2-Ethylhexyl)Phthalate	2410			42	85.2	ug/Kg	394			8.2	16.2	ug/Kg
Carbazole		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
Chrysene		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
Dibenzo(a,h)anthracene		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
Dibenzofuran		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
Diethyl Phthalate		<MDL	U	42	85.2	ug/Kg		<MDL	U	8.2	16.2	ug/Kg
Dimethyl Phthalate		<MDL,JG	UJ	42.5	42.5	ug/Kg		<MDL,JG	UJ	8.14	8.14	ug/Kg
Di-N-Butyl Phthalate	91.7	J	J	42	85.2	ug/Kg	12	<RDL	J	8.2	16.2	ug/Kg
Di-N-Octyl Phthalate		<MDL	U	42.5	42.5	ug/Kg		<MDL	U	8.14	8.14	ug/Kg
Fluoranthene	98.9			22	42.5	ug/Kg	22.1			4	8.14	ug/Kg
Fluorene		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
Hexachlorobenzene		<MDL	U	2.2	4.25	ug/Kg	1.07			0.4	0.814	ug/Kg
Hexachlorobutadiene		<MDL	U	11	21.3	ug/Kg		<MDL	U	2.1	4.07	ug/Kg
Indeno(1,2,3-Cd)Pyrene		<MDL	U	22	42.5	ug/Kg	9.13			4	8.14	ug/Kg
Naphthalene		<MDL	U	22	42.5	ug/Kg		<MDL	U	4	8.14	ug/Kg
N-Nitrosodiphenylamine		<MDL	U	53.3	53.3	ug/Kg		<MDL	U	10.2	10.2	ug/Kg

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

	LDW-SG1						LDW-SG2					
	Project: 421195-590						Project: 421195-590					
	Locator: LDW-SG1						Locator: LDW-SG2					
	Descrip: S 96TH STREET DRAI						Descrip: S 96TH STREET DRAI					
	Sample: L65467-1						Sample: L65467-2					
	Matrix: SE FRSHWTRSED						Matrix: SE FRSHWTRSED					
	ColDate: 6/2/16 11:30						ColDate: 6/1/16 9:30					
	TotalSolid: 78.3						TotalSolid: 81.9					
	DRY Weight Basis						**DRY Weight Basis**					
Parameters	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**	**Value**	**Qual**	**Val Qual**	**MDL**	**RDL**	**Units**
Pentachlorophenol		<MDL	U	319	319	ug/Kg		<MDL	U	61.1	61.1	ug/Kg
Phenanthrene	116			22	42.5	ug/Kg	15.5			4	8.14	ug/Kg
Phenol	220	<RDL	J	110	319	ug/Kg		<MDL	U	21	61.1	ug/Kg
Pyrene	195			22	42.5	ug/Kg	37.5			4	8.14	ug/Kg
Total HPAH (calc)	293.9						129.03					
Total LPAH (calc)	116						15.5					

Table C-3. SWS Stormdrain solids sampling results for 2016.

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Project: 421195-590
Locator: LDW-SG3
Descrip: S 96TH STREET DRAI
Sample: L65467-3
Matrix: SE FRSHWTRSED
ColDate: 6/1/16 11:05
TotalSolid: 76.6
DRY Weight Basis

Parameters	Value	Qual	Val Qual	MDL	RDL	Units
CV ASTM D422						
Clay*	1.3	RDL	J	0.6	1.3	%
Fines*	2.6			0.6	1.3	%
Gravel*	0.4	<RDL	J	0.1	1.3	%
p+0.00*	2.8			0.1	1.3	%
p+1.00*	19.6			0.1	1.3	%
p+10.0(equal/more than)*	1.3	RDL	J	0.6	1.3	%
p+2.00*	47.3			0.1	1.3	%
p+3.00*	21.3			0.1	1.3	%
p+4.00*	4.2			0.1	1.3	%
p+5.00*	0.6	<RDL	J	0.6	1.3	%
p+6.00*		<MDL	U	0.6	1.3	%
p+7.00*		<MDL	U	0.6	1.3	%
p+8.00*	0.6	<RDL	J	0.6	1.3	%
p+9.00*		<MDL	U	0.6	1.3	%
p-1.00*	0.4	<RDL	J	0.1	1.3	%
p-2.00(less than)*		<MDL	U	0.1	1.3	%
p-2.00*		<MDL	U	0.1	1.3	%
Sand*	95.3			0.1	1.3	%
Silt*	1.3	RDL	J	0.6	1.3	%
CV ASTM D422/D3977-97						
500 Micron (equal to/more than)*						
CV ISO 13320:2009(E)						
Clay*						
Fines*						
p+1.00*						
p+10.0(more than)*						
p+10.0*						
p+2.00*						
p+3.00*						
p+4.00*						
p+5.00*						
p+6.00*						

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

Project: 421195-590
Locator: LDW-SG3
Descrip: S 96TH STREET DRAI
Sample: L65467-3
Matrix: SE FRSHWTRSED
ColDate: 6/1/16 11:05
TotalSolid: 76.6
DRY Weight Basis

Parameters	Value	Qual	Val Qual	MDL	RDL	Units
p+7.00*						
p+8.00*						
p+9.00*						
Sand<1000*						
Silt*						
CV SM2540-G						
Total Solids*	76.6			0.005	0.01	%
CV SW846 9060 PSEP96						
Total Organic Carbon	1380			170	341	mg/Kg
MT SW846 3050B*SW846 6010C						
Arsenic, Total, ICP	3.4	<RDL	J	1.6	8.04	mg/Kg
Cadmium, Total, ICP	0.22	<RDL	J	0.13	0.644	mg/Kg
Chromium, Total, ICP	731			0.2	0.965	mg/Kg
Copper, Total, ICP	75.3			0.26	1.29	mg/Kg
Lead, Total, ICP	22.2			1.3	6.44	mg/Kg
Nickel, Total, ICP	398			0.33	1.61	mg/Kg
Silver, Total, ICP		<MDL	U	0.26	1.29	mg/Kg
Vanadium, Total, ICP	40.1			0.64	3.21	mg/Kg
Zinc, Total, ICP	228			0.33	1.61	mg/Kg
MT SW846 7471B						
Mercury, Total, CVAA	0.026	<RDL	J	0.006	0.062	mg/Kg
OR SW846 3550B*SW846 8082A						
Aroclor 1016		<MDL	U	1.7	6.53	ug/Kg
Aroclor 1221		<MDL	U	5	6.53	ug/Kg
Aroclor 1232		<MDL	U	5	6.53	ug/Kg
Aroclor 1242	11.4			1.7	6.53	ug/Kg
Aroclor 1248		<MDL	U	1.7	6.53	ug/Kg
Aroclor 1254	14.2			1.7	6.53	ug/Kg
Aroclor 1260	17.4			1.7	6.53	ug/Kg
Total Aroclors	43			1.7	6.53	ug/Kg
OR SW846 3550B*SW846 8270D						
1,2,4-Trichlorobenzene		<MDL	U	2.2	4.35	ug/Kg
1,2-Dichlorobenzene		<MDL	U	21.8	21.8	ug/Kg

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

Project: 421195-590
Locator: LDW-SG3
Descrip: S 96TH STREET DRAI
Sample: L65467-3
Matrix: SE FRSHWTRSED
ColDate: 6/1/16 11:05
TotalSolid: 76.6
DRY Weight Basis

Parameters	Value	Qual	Val Qual	MDL	RDL	Units
1,4-Dichlorobenzene		<MDL	U	32.6	32.6	ug/Kg
1-Methylnaphthalene		<MDL	U	22	43.5	ug/Kg
2,4-Dimethylphenol		<MDL	UJ	22	43.5	ug/Kg
2-Methylnaphthalene		<MDL	U	22	43.5	ug/Kg
2-Methylphenol		<MDL	U	22	43.5	ug/Kg
3-,4-Methylphenol	884			110	218	ug/Kg
Acenaphthene		<MDL	U	22	43.5	ug/Kg
Acenaphthylene		<MDL	U	22	43.5	ug/Kg
Anthracene		<MDL	U	22	43.5	ug/Kg
Benzo(a)anthracene	58.2			22	43.5	ug/Kg
Benzo(a)pyrene		<MDL	U	22	43.5	ug/Kg
Benzo(b,j,k)fluoranthene	142			22	43.5	ug/Kg
Benzo(g,h,i)perylene	27	<RDL	J	22	43.5	ug/Kg
Benzoic Acid		<MDL	U	435	435	ug/Kg
Benzyl Alcohol	85.9			54.4	54.4	ug/Kg
Benzyl Butyl Phthalate	568			32.6	32.6	ug/Kg
Bis(2-Ethylhexyl)Phthalate	6630			43	87.1	ug/Kg
Carbazole		<MDL	U	22	43.5	ug/Kg
Chrysene	111			22	43.5	ug/Kg
Dibenzo(a,h)anthracene		<MDL	U	22	43.5	ug/Kg
Dibenzofuran		<MDL	U	22	43.5	ug/Kg
Diethyl Phthalate		<MDL	U	43	87.1	ug/Kg
Dimethyl Phthalate		<MDL,JG	UJ	43.5	43.5	ug/Kg
Di-N-Butyl Phthalate	109			43	87.1	ug/Kg
Di-N-Octyl Phthalate		<MDL	U	43.5	43.5	ug/Kg
Fluoranthene	161			22	43.5	ug/Kg
Fluorene		<MDL	U	22	43.5	ug/Kg
Hexachlorobenzene		<MDL	U	2.2	4.35	ug/Kg
Hexachlorobutadiene		<MDL	U	11	21.8	ug/Kg
Indeno(1,2,3-Cd)Pyrene	33	<RDL	J	22	43.5	ug/Kg
Naphthalene		<MDL	U	22	43.5	ug/Kg
N-Nitrosodiphenylamine		<MDL	U	54.4	54.4	ug/Kg

Table notes:

* Not converted to dry weight basis
MDL - method detection limit
RDL - reporting detectin limit
J - estimated value
U- not detected
JL-estimated value; probable high bias
H - holding time
B- value is < 5x method blank (MB)
B2 or B3- value > 5 and ≤ 10 times MB
TA- narrative info available
Shaded value > SQS/LAET
Shaded/underlined value > CSL/2LAET
see Appendix F of King County 2016

Total LPAHs were calculated as the sum of acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene

Total HPAHs were calculated as the sum of benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, total benzofluoranthenes, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene

Table C-3. SWS Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

Project: 421195-590
Locator: LDW-SG3
Descrip: S 96TH STREET DRAI
Sample: L65467-3
Matrix: SE FRSHWTRSED
ColDate: 6/1/16 11:05
TotalSolid: 76.6
DRY Weight Basis

Parameters	Value	Qual	Val Qual	MDL	RDL	Units
Pentachlorophenol		<MDL	U	326	326	ug/Kg
Phenanthrene	142			22	43.5	ug/Kg
Phenol		<MDL	U	110	326	ug/Kg
Pyrene	202			22	43.5	ug/Kg
Total HPAH (calc)	734.2					
Total LPAH (calc)	142					

Table C-4. Stormdrain solids sampling results for 2016: dioxins/furans.

Locator	96-ST3	**Sample type**	Sediment trap
KC Sample ID	L65182-3	**Pacific Rim Sample ID**	PR162796
Collect Date	4/7/2016		

COMPOUND	Result (pg/g dw)	Lab Qualifier	Validation Qaulifier	Sample Detection Limit (pg/g dw)	TEF	TEQ (ng TEQ/kg dw)
2,3,7,8-TCDD	0	U J		0.5	1	0.50
1,2,3,7,8-PeCDD	8.23			2.48	1	8.23
1,2,3,4,7,8-HxCDD	8.49			2.48	0.1	0.85
1,2,3,6,7,8-HxCDD	24.3			2.48	0.1	2.43
1,2,3,7,8,9-HxCDD	17.7			2.48	0.1	1.77
1,2,3,4,6,7,8-HpCDD	523			2.48	0.01	5.23
OCDD	3150			4.96	0.0003	0.95
2,3,7,8-TCDF	0	U J		0.5	0.1	0.05
1,2,3,7,8-PeCDF	4.69	N J	U	2.48	0.03	0.14
2,3,4,7,8-PeCDF	9.79			2.48	0.3	2.94
1,2,3,4,7,8-HxCDF	11.6			2.48	0.1	1.16
1,2,3,6,7,8-HxCDF	10.2			2.48	0.1	1.02
2,3,4,6,7,8-HxCDF	10.4			2.48	0.1	1.04
1,2,3,7,8,9-HxCDF	3.21			2.48	0.1	0.32
1,2,3,4,6,7,8-HpCDF	136			2.48	0.01	1.36
1,2,3,4,7,8,9-HpCDF	9.57			2.48	0.01	0.10
OCDF	193			4.96	0.0003	0.06
TOTAL (TEQ ND=DL)						28.14

N = Did not meet all parameter identification criteria (used by Pacific Rim Lab)
Value is estimated maximum potential concentration and was requalified as non-detect.
U = Not Detected
J = Estimated Value

TEF = Toxicity Equivalency Factor
TEQ = Toxicity Equivalents

Dioxin and furan congener concentrations were converted to TEQ concentrations based on 2,3,7,8-Tetrachlorodibenzodioxin (2,3,7,8-TCDD) toxicity for mammals (from Van den Berg et al. 2006)

Van den Berg, M., L.S. Birnbaum, M. Denison, M. De Vito, et al. 2006. The 2005 World Health Organization reevaluation of human and mammalian toxic equivalency factors for dioxins and dioxin-like compounds. Toxicological Sciences 93(2):223-24

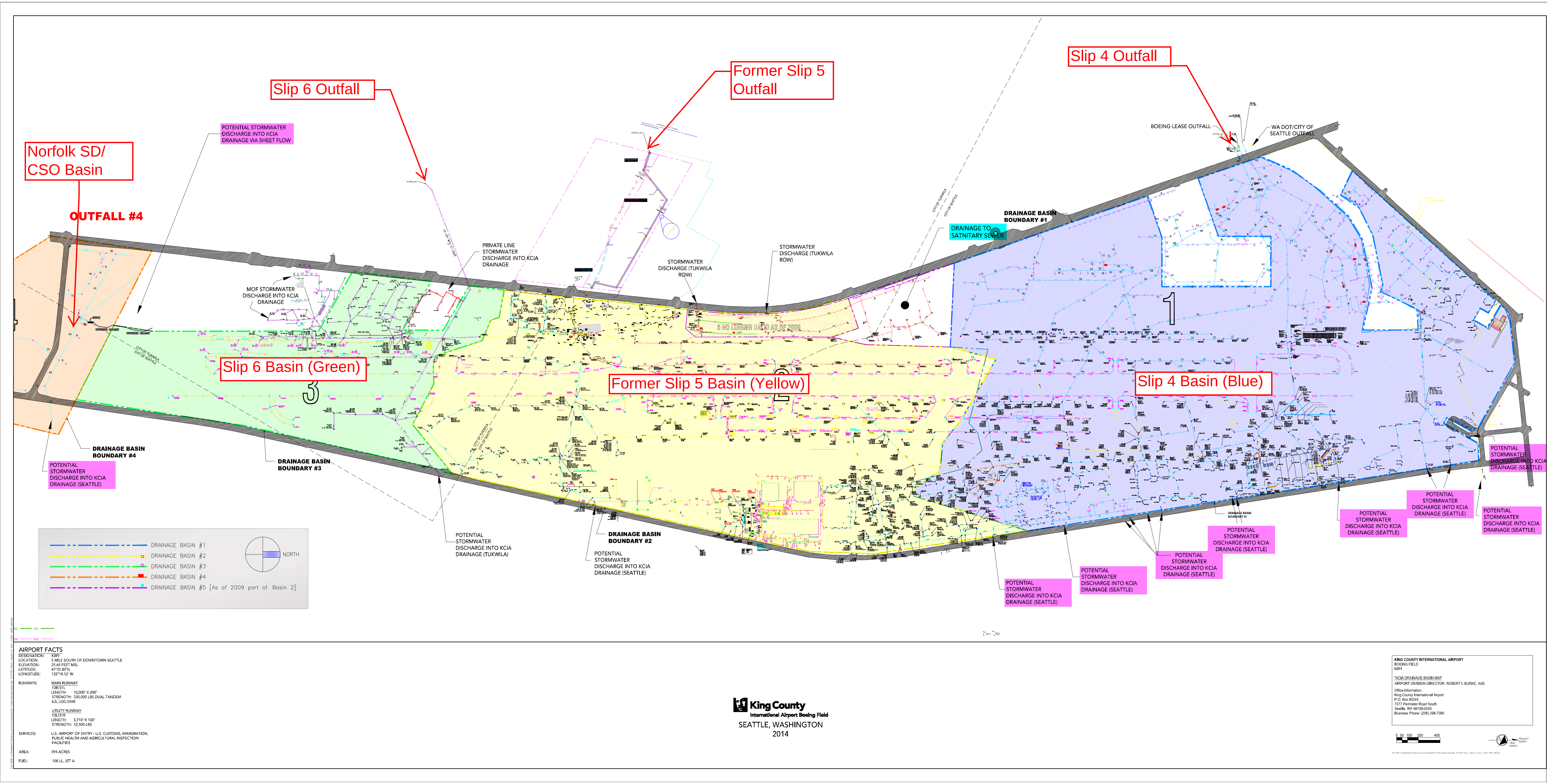
Table C-4. Stormdrain solids sampling results for 2016: dioxins/furans.

Locator	96-ST3	**Sample type**	Sediment trap
KC Sample ID	L65182-2	**Pacific Rim Sample ID**	PR162797
Collect Date	4/7/2016		

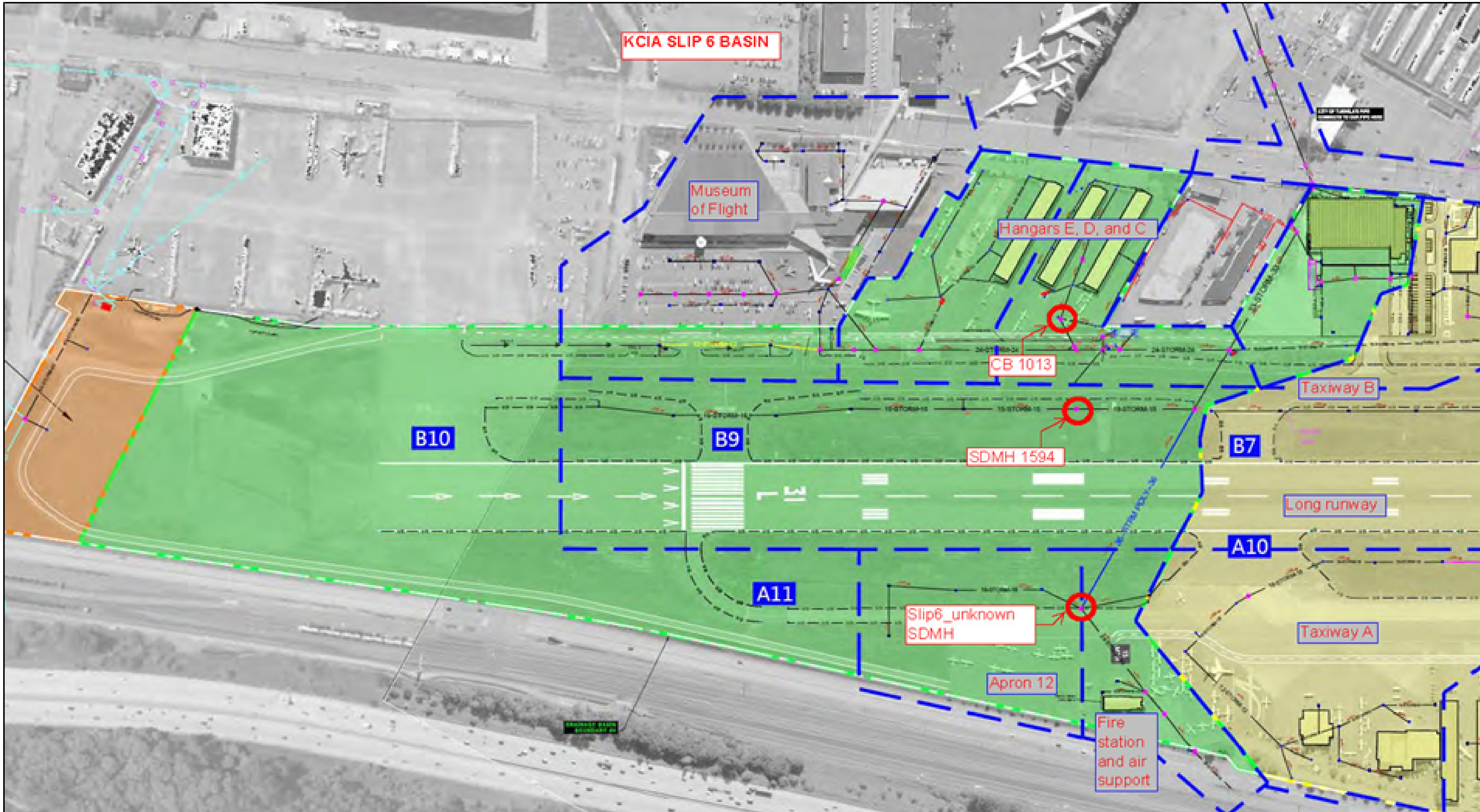
COMPOUND	Result (pg/g dw)	Lab Qualifier	Validation Qaulifier	Sample Detection Limit (pg/g dw)	TEF	TEQ (ng TEQ/kg dw)
2,3,7,8-TCDD	12.3			0.24	1	12.30
1,2,3,7,8-PeCDD	25.4			1.22	1	25.40
1,2,3,4,7,8-HxCDD	16.4			1.22	0.1	1.64
1,2,3,6,7,8-HxCDD	60.6			1.22	0.1	6.06
1,2,3,7,8,9-HxCDD	54.3			1.22	0.1	5.43
1,2,3,4,6,7,8-HpCDD	1080			1.22	0.01	10.80
OCDD	6260			2.44	0.0003	1.88
2,3,7,8-TCDF	3.26	N J	U	0.24	0.1	0.33
1,2,3,7,8-PeCDF	7.07			1.22	0.03	0.21
2,3,4,7,8-PeCDF	16.8			1.22	0.3	5.04
1,2,3,4,7,8-HxCDF	24.9			1.22	0.1	2.49
1,2,3,6,7,8-HxCDF	9.81			1.22	0.1	0.98
2,3,4,6,7,8-HxCDF	12.7			1.22	0.1	1.27
1,2,3,7,8,9-HxCDF	13.2			1.22	0.1	1.32
1,2,3,4,6,7,8-HpCDF	138			1.22	0.01	1.38
1,2,3,4,7,8,9-HpCDF	8.35			1.22	0.01	0.08
OCDF	142			2.44	0.0003	0.04
TOTAL (TEQ ND=DL)						76.65

Appendix D: KCIA Maps

Appendix D, Figure 1. KCIA Stormwater Drainage Basins



Appendix D, Figure 2. Slip 6 Reconnaissance Stations



Red circles indicate sampleable stations, gray circles indicate non-sampleable stations due to lack of sediment accumulation. Map prepared by King County, annotated by Cardno

Appendix E: KCIA Source Tracing Storm Drain Solids Datasets

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Table E-1. Slip 4 Drainage Basin Stormdrain Solids Sample Results for 2016.

Location	SQS LAET	CSL 2LAET	SL4-T5A Grab		SL4-T4A Trap		SL4-T3A Trap		SL4-T3A Grab		SL4-T2A Trap		SL4-T2A Grab	
Sampled By			Boeing		Boeing		KCIA		KCIA		KCIA		KCIA	
Date			4/26/2016		4/26/2016		5/13/2016		5/13/2016		5/13/2016		5/13/2016	
Description			North Lateral		N. Central Lateral		S. Central Lateral		S. Central Lateral		South Lateral		South Lateral	
			Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual
METALS (mg/kg dw)														
Arsenic (total)	57	93	20	U	NA		11		4		10		43	
Copper	390	390	104		NA		32		12		120		82	
Lead	450	530	201		NA		26		4.2		17		260	
Mercury	0.41	0.59	0.35		NA		0.06		0.51		1.10		0.29	
Zinc	410	960	407		NA		110		44		900		1600	
PCB (mg/kg dw)														
pcb - Aroclor 1016	---	---	0.020	U	0.020	U	0.0024	U	0.0013	U	0.170	U	0.029	U
pcb - Aroclor 1221	---	---	0.020	U	0.020	U	0.0024	U	0.0013	U	0.170	U	0.029	U
pcb - Aroclor 1232	---	---	0.020	U	0.020	U	0.0024	U	0.0013	U	0.170	U	0.029	U
pcb - Aroclor 1242	---	---	0.020	U	0.020	U	0.0024	U	0.0013	U	0.170	U	0.029	U
pcb - Aroclor 1248	---	---	0.049	Y	0.050	Y	0.0024	U	0.0013	U	0.170	U	0.029	U
pcb - Aroclor 1254	---	---	0.160		0.072		0.0032		0.0013	U	0.450		0.042	
pcb - Aroclor 1260	---	---	0.064		0.097		0.0048		0.0017		0.500		0.092	
Total PCB	0.130	1.000	0.273		0.340		0.0080		0.0017		0.950		0.134	
LPAH (mg/kg dw)														
acenaphthene	0.500	0.500	0.280	U	1.100	U	0.048	U	0.027	U	NA		0.100	U
acenaphthylene	1.300	1.300	0.280	U	1.100	U	0.067		0.027	U	NA		0.390	
anthracene	0.960	0.960	0.240	J	0.940	J	0.190		0.027	U	NA		0.470	
fluorene	0.540	0.540	0.280	U	1.100	U	0.061		0.027	U	NA		0.110	
methylnaphthalene, 2-	0.670	0.670	0.280	U	1.100	U	0.048	U	0.027	U	NA		0.100	U
naphthalene	2.100	2.100	0.280	U	1.100	U	0.048	U	0.027	U	NA		0.100	U
phenanthrene	1.500	1.500	2.000		5.000		1.700		0.190		NA		2.700	
Total LPAH[1]	5.200	5.200	2.240		5.940		1.890		**0.217**		NA		3.670	
HPAH (mg/kg dw)														
benzo[a]anthracene	1.300	1.600	1.300		1.000	J	1.200		0.110		NA		2.700	
benzo[a]pyrene	1.600	1.600	2.100		3.900		2.000		0.150		NA		4.500	
benzo[b]fluoranthene	---	---	NA		NA		4.200		0.290		NA		7.800	
benzo[k]fluoranthene	---	---	NA		NA		1.000		0.081		NA		2.400	
Total Benzoflouranthenes	3.200	3.600	5.200		10.000		5.200		0.371		NA		10.200	
benzo(g,h,i)perylene	0.670	0.720	2.100		4.800		2.500		0.180		NA		4.800	
chrysene	1.400	2.800	3.200		6.800		2.600		0.190		NA		5.000	
dibenz[a,h]anthracene	0.230	0.230	0.500		1.300		0.540		0.033		NA		0.700	
fluoranthene	1.700	2.500	4.600		1.100	U	4.200		0.390		NA		7.200	
indeno[1,2,3-cd]pyrene	0.600	0.690	2.000		4.100		2.300		0.160		NA		4.500	
pyrene	2.600	3.300	3.400		7.800		3.000		0.280		NA		2.700	
Total HPAH[2]	12.000	17.000	24.400		42.100		28.740		**2.235**		NA		52.500	
PHTHALATES (mg/kg dw)														
bis(2-ethylhexyl) phthalate	1.300	3.100	11.000		10.00		1.100		0.140		NA		2.300	
butyl benzyl phthalate	0.063	0.900	0.170	J	1.00	J	0.120	U	0.066	U	NA		0.370	U
diethyl phthalate	0.200	1.200	0.280	U	1.10	U	0.240	U	0.130	U	NA		0.730	U

Table E-1. Slip 4 Drainage Basin Stormdrain Solids Sample Results for 2016.

Location	SQS LAET	CSL 2LAET	SL4-T5A Grab		SL4-T4A Trap		SL4-T3A Trap		SL4-T3A Grab		SL4-T2A Trap		SL4-T2A Grab	
Sampled By			Boeing		Boeing		KCIA		KCIA		KCIA		KCIA	
Date			4/26/2016		4/26/2016		5/13/2016		5/13/2016		5/13/2016		5/13/2016	
Description			North Lateral		N. Central Lateral		S. Central Lateral		S. Central Lateral		South Lateral		South Lateral	
			Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual	Results	Qual
dimethyl phthalate	0.071	0.160	0.280	U	1.10	U	0.120	U	0.066	U	NA		0.370	U
di-butyl phthalate (di-n-butyl phth.)	1.400	5.100	0.280	U	1.30		0.820		1.300		NA		0.580	
di-n-octyl phthalate	6.200	6.200	0.810		6.80		0.120	U	0.066	U	NA		0.370	U
TPH (mg/kg dw)														
Diesel (MTCA A)	2000	2000	350		NA		93		33	U	NA		300	
Heavy Oil (Motor Oil MTCA A)	2000	2000	1800		NA		660		230		NA		1800	
Conventionals (%)														
Solids, Total	---	---	55.5		16.7		42.0		75.0		23.0		68.0	
Total Organic Carbon	---	---	8.1		21.6		3.6		0.4		5.1		2.6	
<-1 Phi Gravel, >2000 micron	---	---	3.5		NA		NA		NA		NA		11.7	
-1-0 Phi Very Coarse Sand, 1000-2000 micron	---	---	5.2		NA		NA		NA		NA		11.6	
0-1 Phi Coarse Sand, 500-1000 micron	---	---	9.5		NA		NA		12.5		NA		16.3	
1-2 Phi Medium Sand, 250-500 micron	---	---	24.1		NA		NA		73.1		NA		20.6	
2-3 Phi Fine Sand, 125-250 micron	---	---	26.3		NA		NA		79.3		NA		8.0	
3-4 Phi Very Fine Sand, 62.5-125 micron	---	---	6.2		NA		NA		19.3		NA		2.3	
4-5 Phi Coarse Silt, 31-62.5 micron	---	---	2.3		NA		NA		5.7		NA		8.3	
5-6 Phi Medium Silt, 15.6-31 micron	---	---	10.3		NA		NA		4.4		NA		0.1	
6-7 Phi Fine Silt, 7.8-15.6 micron	---	---	6.1		NA		NA		0.4		NA		1.2	
7-8 Phi Very Fine Silt, 3.9-7.8 micron	---	---	4.1		NA		NA		0.6		NA		0.1	
8-9 Phi Clay, 2-3.9 micron	---	---	0.5		NA		NA		0.7		NA		0.1	
9-10 Phi Clay, 1-2 micron	---	---	0.8		NA		NA		0.7		NA		0.1	
>10 Phi Clay, <1 micron	---	---	11.0		NA		NA		0.5		NA		1.9	
Total Fines	---	---	25.2		NA		NA		5.0		NA		NA	

Indicates > than the SQS/LAET

Indicates > than the CSL/2LAET

NA = Not Analyzed

U - Not detected

J - Estimated value

1. Total LPAHs were calculated as the sum of acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene

2. Total HPAHs were calculated as the sum of benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, total benzofluoranthenes, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene

SQS/LAET - Sediment Quality Standards/Lowest Apparent Effects Threshold

CSL/2LAET - Cleanup Screening Level/Second Lowest Apparent Effects Threshold

SQS/LAET and CSL/2LAET are source tracing benchmarks (See Appendix F of Kiing County 2016)

Table E-2. Former Slip 5 Drainage Basin Stormdrain Solids Sample Results for 2016

Location	SQS LAET	CSL 2LAET	KCIA2 Trap		KCIA2 Grab		SPS Grab	
Sampled By			KCIA		KCIA		KCIA	
Date			5/13/2016		5/13/2016		5/13/2016	
			Results	Qual	Results	Qual	Results	Qual
METALS (mg/kg)								
Arsenic (total)	57	93	7		61		3	
Copper	390	390	19		40		13	
Lead	450	530	13		16		11	
Mercury	0.41	0.59	0.024		0.080		0.015	
Zinc	410	960	110		430		67	
PCB (mg/kg)								
pcb - Aroclor 1016	---	---	0.002	U	0.009	U	0.005	U
pcb - Aroclor 1221	---	---	0.002	U	0.009	U	0.005	U
pcb - Aroclor 1232	---	---	0.002	U	0.009	U	0.005	U
pcb - Aroclor 1242	---	---	0.002	U	0.009	U	0.005	U
pcb - Aroclor 1248	---	---	0.002	U	0.009	U	0.005	U
pcb - Aroclor 1254	---	---	0.020		0.015		0.010	
pcb - Aroclor 1260	---	---	0.047		0.037		0.023	
Total PCB	0.130	1.000	0.067		0.052		0.033	
LPAH (mg/kg)								
acenaphthene	0.500	0.500	0.036	U	0.042	U	0.008	U
acenaphthylene	1.300	1.300	0.024		0.042	U	0.008	U
anthracene	0.960	0.960	0.089		0.042	U	0.025	
fluorene	0.540	0.540	0.089		0.042	U	0.008	U
methylnaphthalene, 2-	0.670	0.670	0.027		0.042	U	0.008	U
naphthalene	2.100	2.100	0.014	U	0.042	U	0.008	U
phenanthrene	1.500	1.500	0.780		0.043		0.150	
Total LPAH[1]	5.200	5.200	1.009		0.043		0.175	
HPAH (mg/kg)								
benzo[a]anthracene	1.300	1.600	0.360		0.042	U	0.130	
benzo[a]pyrene	1.600	1.600	0.500		0.063		0.170	
benzo[b]fluoranthene	---	---	0.960		0.220		0.280	
benzo[k]fluoranthene	---	---	0.310		0.049		0.076	
benzo(g,h,i)perylene	0.670	0.720	0.530		0.110		0.150	
chrysene	1.400	2.800	0.660		0.140		0.200	
dibenz[a,h]anthracene	0.230	0.230	0.110		0.042	U	0.033	
fluoranthene	1.700	2.500	1.300		0.140		0.370	
indeno[1,2,3-cd]pyrene	0.600	0.690	0.470		0.088		0.140	
pyrene	2.600	3.300	0.970		0.130		0.260	
total benzofluoranthenes	3.200	3.600	1.270		0.269		0.356	
Total HPAH[2]	12.000	17.000	6.170		0.940		1.809	
PHTHALATES (mg/kg)								
bis(2-ethylhexyl) phthalate	1.300	3.100	0.490		0.370		0.120	
butyl benzyl phthalate	0.063	0.900	0.036	U	0.110	U	0.020	U

Table E-2. Former Slip 5 Drainage Basin Stormdrain Solids Sample Results for 2016

Location	SQS LAET	CSL 2LAET	KCIA2 Trap		KCIA2 Grab		SPS Grab	
Sampled By			KCIA		KCIA		KCIA	
Date			5/13/2016		5/13/2016		5/13/2016	
			Results	Qual	Results	Qual	Results	Qual
diethyl phthalate	0.200	1.200	0.071	U	0.210	U	0.410	U
dimethyl phthalate	0.071	0.160	0.036	U	0.110	U	0.020	U
di-butyl phthalate (di-n-butyl phth.)	1.400	5.100	0.290		1.000		0.460	
di-n-octyl phthalate	6.200	6.200	0.360	U	0.110	U	0.020	U
TPH (mg/kg)								
Diesel (MTCA A)	2000	2000	55	U	160	U	30	U
Heavy Oil (Motor Oil MTCA A)	2000	2000	250		520		220	
Comments								
Conventionals (%)								
Solids, Total			47.0		11.0		82.0	
Total Organic Carbon			0.7		7.4		0.3	
<-1 Phi Gravel, >2000 micron			NA		11.2		3.6	
-1-0 Phi Very Coarse Sand, 1000-2000 micron			NA		9.8		6.4	
0-1 Phi Coarse Sand, 500-1000 micron			NA		12.7		25.6	
1-2 Phi Medium Sand, 250-500 micron			NA		22.7		30.8	
2-3 Phi Fine Sand, 125-250 micron			NA		5.9		4.7	
3-4 Phi Very Fine Sand, 62.5-125 micron			NA		2.1		3.3	
4-5 Phi Coarse Silt, 31-62.5 micron			NA		1.8		2.2	
5-6 Phi Medium Silt, 15.6-31 micron			NA		0.1		0.9	
6-7 Phi Fine Silt, 7.8-15.6 micron			NA		1.0		0.3	
7-8 Phi Very Fine Silt, 3.9-7.8 micron			NA		0.3		0.8	
8-9 Phi Clay, 2-3.9 micron			NA		0.1		0.6	
9-10 Phi Clay, 1-2 micron			NA		0.1		0.3	
>10 Phi Clay, <1 micron			NA		2.1		0.5	
Total Fines			NA		NA		NA	

Indicates > than the SQS/LAET

Indicates > than the CSL/2LAET

NA = Not Analyzed

U - Not detected

J - Estimated value

1. Total LPAHs were calculated as the sum of acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene

2. Total HPAHs were calculated as the sum of benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, total benzofluoranthenes, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene

SQS/LAET - Sediment Quality Standards/Lowest Apparent Effects Threshold

CSL/2LAET - Cleanup Screening Level/Second Lowest Apparent Effects Threshold

SQS/LAET and CSL/2LAET are source tracing benchmarks (See Appendix F of Kiing County 2016)

Table E-3. Slip 6 Drainage Basin Stormdrain Solids Sample Results for 2016

Location	SQS LAET	CSL 2LAET	KCIA1A Trap		KCIA1A Grab	
Sampled By			KCIA		KCIA	
Date			5/13/2016		5/13/2016	
			Results	Qual	Results	Qual
METALS (mg/kg)						
Arsenic (total)	57	93	75		12	
Copper	390	390	120		33	
Lead	450	530	64		10	
Mercury	0.41	0.59	0.19		0.11	U
Zinc	410	960	710		120	
PCB (mg/kg)						
pcb - Aroclor 1016	---	---	0.028	U	0.022	U
pcb - Aroclor 1221	---	---	0.028	U	0.022	U
pcb - Aroclor 1232	---	---	0.028	U	0.022	U
pcb - Aroclor 1242	---	---	0.028	U	0.022	U
pcb - Aroclor 1248	---	---	0.028	U	0.022	U
pcb - Aroclor 1254	---	---	0.028	U	0.022	U
pcb - Aroclor 1260	---	---	0.028	U	0.022	U
Total PCB	0.130	1.000	0.028	U	0.022	U
LPAH (mg/kg)						
acenaphthene	0.500	0.500	0.190	U	0.065	U
acenaphthylene	1.300	1.300	0.190	U	0.065	U
anthracene	0.960	0.960	0.190	U	0.065	U
fluorene	0.540	0.540	0.190	U	0.065	U
methylnaphthalene, 2-	0.670	0.670	0.190	U	0.065	U
naphthalene	2.100	2.100	0.190	U	0.065	U
phenanthrene	1.500	1.500	0.210		0.065	U
Total LPAH[1]	5.200	5.200	0.210		0.065	U
HPAH (mg/kg)						
benzo[a]anthracene	1.300	1.600	0.220		0.065	U
benzo[a]pyrene	1.600	1.600	0.230		0.065	U
benzo[b]fluoranthene	---	---	0.390		0.092	
benzo[k]fluoranthene	---	---	0.190	U	0.065	U
benzo(g,h,i)perylene	0.670	0.720	0.270		0.065	U
chrysene	1.400	2.800	0.280		0.065	
dibenz[a,h]anthracene	0.230	0.230	0.190	U	0.065	U
fluoranthene	1.700	2.500	0.550		0.160	
indeno[1,2,3-cd]pyrene	0.600	0.690	0.210		0.065	U
pyrene	2.600	3.300	0.380		0.092	
total benzofluoranthenes	3.200	3.600	0.390		0.092	
Total HPAH[2]	12.000	17.000	3.290		0.409	
PHTHALATES (mg/kg)						
bis(2-ethylhexyl) phthalate	1.300	3.100	3.200		0.440	
butyl benzyl phthalate	0.063	0.900	0.480	U	0.160	U
diethyl phthalate	0.200	1.200	0.950	U	0.320	U
dimethyl phthalate	0.071	0.160	0.480	U	0.160	U
di-butyl phthalate (di-n-butyl phth.)	1.400	5.100	18.000		5.000	
di-n-octyl phthalate	6.200	6.200	0.480	U	0.160	U

Table E-3. Slip 6 Drainage Basin Stormdrain Solids Sample Results for 2016

Location	SQS LAET	CSL 2LAET	KCIA1A Trap		KCIA1A Grab	
Sampled By			**KCIA**		**KCIA**	
Date			**5/13/2016**		**5/13/2016**	
			Results	**Qual**	**Results**	**Qual**
TPH (mg/kg)						
Diesel (MTCA A)	2000	2000	710	U	240	U
Heavy Oil (Motor Oil MTCA A)	2000	2000	1400	U	490	U
Conventionals (%)						
Solids, Total			3.5		4.6	
Total Organic Carbon			12.0		8.8	
<-1 Phi Gravel, >2000 micron			NA		2.0	
-1-0 Phi Very Coarse Sand, 1000-2000 micron			NA		1.4	
0-1 Phi Coarse Sand, 500-1000 micron			NA		1.4	
1-2 Phi Medium Sand, 250-500 micron			NA		1.4	
2-3 Phi Fine Sand, 125-250 micron			NA		0.7	
3-4 Phi Very Fine Sand, 62.5-125 micron			NA		1.4	
4-5 Phi Coarse Silt, 31-62.5 micron			NA		21.6	
5-6 Phi Medium Silt, 15.6-31 micron			NA		7.2	
6-7 Phi Fine Silt, 7.8-15.6 micron			NA		7.1	
7-8 Phi Very Fine Silt, 3.9-7.8 micron			NA		4.4	
8-9 Phi Clay, 2-3.9 micron			NA		3.0	
9-10 Phi Clay, 1-2 micron			NA		1.7	
>10 Phi Clay, <1 micron			NA		6.2	
Total Fines			NA		NA	

Indicates > than the SQS/LAET

Indicates > than the CSL/2LAET

NA = Not Analyzed

U - Not detected

1. Total LPAHs were calculated as the sum of acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene

2. Total HPAHs were calculated as the sum of benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, total benzofluoranthenes, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene

SQS/LAET - Sediment Quality Standards/Lowest Apparent Effects Threshold

CSL/2LAET - Cleanup Screening Level/Second Lowest Apparent Effects Threshold

SQS/LAET and CSL/2LAET are source tracing benchmarks (See Appendix F of Kiing County 2016)

Table E-4. Slip 6 Subbasin Drainage Stormdrain Solids Sample Results for 2016

Location	SQS LAET	CSL 2LAET	Unknown SDMH		CB1013		SDMH1594	
Sampled by			KCIA		KCIA		KCIA	
Description			East Lateral		West Lateral		Central Lateral	
Date			4/11/2016		4/11/2016		4/11/2016	
			Result	Qualifier	Result	Qualifier	Result	Qualifier
Arsenic	57	93	39		25		13	
Cadmium	5.1	6.7	5.0		5.6		2.0	
Chromium	260	270	23		80		38	
Copper	390	390	51		130		76	
Lead	450	530	140		290		33	
Mercury	0.41	0.59	0.025		0.150		0.100	
Silver	6.1	6.1	0.19	U	0.68		0.22	
Zinc	410	960	460		540		460	
PCB (mg/kg)								
pcb - Aroclor 1016	-	-	0.0015	U, X, Z	0.0035	U, X, Z	0.0050	U1, X
pcb - Aroclor 1221	-	-	0.0015	U, X, Z	0.0035	U, X, Z	0.0050	U1, X
pcb - Aroclor 1232	-	-	0.0015	U, X, Z	0.0035	U, X, Z	0.0050	U1, X
pcb - Aroclor 1242	-	-	0.0015	U, X, Z	0.0035	U, X, Z	0.0050	U1, X
pcb - Aroclor 1248	-	-	0.0015	U, X, Z	0.0035	U, X, Z	0.0050	U1, X
pcb - Aroclor 1254	-	-	0.0050	X, Z	0.0190	X, Z	0.0065	X
pcb - Aroclor 1260	-	-	0.0061	X, Z	0.0290	X, Z	0.0075	X
Total PCB	0.130	1.000	0.0111		0.0480		0.0140	
LPAH (mg/kg)								
acenaphthene	0.500	0.500	0.0920		1.8000		0.0150	U
acenaphthylene	1.300	1.300	0.1100		0.6400		0.0150	U
anthracene	0.960	0.960	0.470		3.700		0.015	U
fluorene	0.540	0.540	0.2100		2.5000		0.0150	U
methylnaphthalene, 1-	-	-	0.0510	U	0.2200	U	0.0150	U
methylnaphthalene, 2-	0.670	0.670	0.0510	U	0.2200	U	0.0150	U
naphthalene	2.100	2.100	0.0510	U	0.2200	U	0.0150	U
phenanthrene	1.500	1.500	4.100		39.000		0.047	
Total LPAHs[1]	5.200	5.200	4.982		47.640		0.047	
HPAH (mg/kg)								
benzo[a]anthracene	1.300	1.600	2.800		26.000		0.036	
benzo[a]pyrene	1.600	1.600	3.600		29.000		0.047	
benzo[b]fluoranthene	-	-	5.800		52.000		0.087	
benzo(j,k)fluoranthene	-	-	1.800		16.000		0.023	
benzo(g,h,i)perylene	0.670	0.720	2.600		23.000		0.044	
chrysene	1.400	2.800	4.000		42.000		0.062	
dibenz[a,h]anthracene	0.230	0.230	0.750		5.500		0.015	U
fluoranthene	1.700	2.500	9.000		88.000		0.110	
indeno[1,2,3-cd]pyrene	0.600	0.690	2.600		22.000		0.037	
pyrene	2.600	3.300	5.500		59.000		0.085	

Table E-4. Slip 6 Subbasin Drainage Stormdrain Solids Sample Results for 2016

Location	SQS LAET	CSL 2LAET	Unknown SDMH		CB1013		SDMH1594	
Sampled by			KCIA		KCIA		KCIA	
Description			East Lateral		West Lateral		Central Lateral	
Date			4/11/2016		4/11/2016		4/11/2016	
			Result	Qualifier	Result	Qualifier	Result	Qualifier
Total benzofluoranthenes	3.200	3.600	7.600		68.000		0.110	
Total HPAHs[2]	12.000	17.000	38.450		362.500		0.531	
PHTHALATES (mg/kg)								
bis(2-ethylhexyl) phthalate	1.300	3.100	0.340		3.500		0.190	
butyl benzyl phthalate	0.063	0.900	0.130	U	0.800		0.038	U
diethyl phthalate	0.200	1.200	0.250	U	1.100	U	0.077	U
dimethyl phthalate	0.071	0.160	0.130	U	0.550	U	0.038	U
di-n-butyl phthalate	1.400	5.100	0.830		3.000		0.910	
di-n-octyl phthalate	6.200	6.200	0.130	U	0.550	U	0.038	U
PHENOLS (mg/kg)								
phenol	0.420	1.200	0.130	U	0.550	U	0.038	U
pentachlorophenol	0.360	0.690	0.250	U	1.100	U	0.077	U
2-chlorophenol	-	-	0.130	U	0.550	U	0.038	U
2-methylphenol (o-cresol)	0.063	0.063	0.130	U	0.550	U	0.038	U
2-nitrophenol	-	-	0.130	U	0.550	U	0.038	U
benzyl alcohol	0.057	0.073	0.250	U	1.100	U	0.077	U
2,3,4,6-tetrachlorophenol	-	-	0.130	U	0.550	U	0.038	U
2,3,5,6-tetrachlorophenol	-	-	0.130	U	0.550	U	0.038	U
2,4-dichlorophenol	-	-	0.130	U	0.550	U	0.038	U
2,4-dimethylphenol	0.029	0.029	0.130	U	0.550	U	0.038	U
2,4-dinitrophenol	-	-	0.250	U	1.100	U	0.077	U
2,4,5-trichlorophenol	-	-	0.130	U	0.550	U	0.038	U
2,4,6-trichlorophenol	-	-	0.130	U	0.550	U	0.038	U
(3+4)-methylphenol (m,p-Cresol)	0.670	0.670	0.130	U	0.550	U	0.075	
4-chloro-3-methylphenol	-	-	0.130	U	0.550	U	0.038	U
4-nitrophenol	-	-	0.130	U	0.550	U	0.038	U
4,6-dinitro-2-methylphenol	-	-	0.250	U	1.100	U	0.077	U
TOTAL ORGANIC CARBON (%)			0.370		6.600		0.180	
TOTAL SOLIDS (%)			66.0		28.0		43.0	
TPH (mg/kg), MTCA Level A								
Diesel	2000	2000	410	N	660	N	88	
Heavy Motor Oil	2000	2000	2800		3000		630	
Dioxins/ Furans (pg/g)								
TEQ (ND = 0)	-	-	8.81		34.74			
TEQ (ND = 1/2DL)	-	-	8.83		34.74			

Table E-4. Slip 6 Subbasin Drainage Stormdrain Solids Sample Results for 2016

Location	SQS LAET	CSL 2LAET	Unknown SDMH		CB1013		SDMH1594	
Sampled by			KCIA		KCIA		KCIA	
Description			East Lateral		West Lateral		Central Lateral	
Date			4/11/2016		4/11/2016		4/11/2016	
			Result	Qualifier	Result	Qualifier	Result	Qualifier
GRAIN SIZE (% Retained)								
>10 Phi Clay, <1 micron	-	-	1.90%		10.40%		3.60%	
9-10 Phi Clay, 1-2 micron	-	-	<0.30%		11.40%		1.50%	
8-9 Phi Clay, 2-3.9 micron	-	-	1.50%		20.40%		4.90%	
7-8 Phi Very Fine Silt, 3.9-7.8 micron	-	-	2.50%		22.00%		6.50%	
6-7 Phi Fine Silt, 7.8-15.6 micron	-	-	1.70%		16.10%		3.90%	
5-6 Phi Medium Silt, 15.6-31 micron	-	-	6.50%		23.80%		6.00%	
4-5 Phi Coarse Silt, 31-62.5 micron	-	-	9.60%		22.50%		11.90%	
3-4 Phi Very Fine Sand, 62.5-125 micron	-	-	9.50%		8.30%		23.40%	
2-3 Phi Fine Sand, 125-250 micron	-	-	23.30%		10.70%		34.50%	
1-2 Phi Medium Sand, 250-500 micron	-	-	32.90%		11.80%		26.20%	
0-1 Phi Coarse Sand, 500-1000 micron	-	-	24.30%		6.50%		12.90%	
-1-0 Phi Very Coarse Sand, 1000-2000 micron	-	-	22.20%		4.50%		8.80%	
<-1 Phi Gravel, >2000 micron	-	-	37.60%		9.50%		28.10%	

Indicates > than the SQS/LAET
Indicates > than the CSL/2LAET
NA = Not Analyzed
U - Not detected
X = Sample extract treated with mercury cleanup procedure
Z - Sample extract treated with silica gel cleanup procedure
U1 - The detection limit is elevated due to interferences present in the sample.
1. Total LPAHs were calculated as the sum of acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene

2. Total HPAHs were calculated as the sum of benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, total benzofluoranthenes, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene

SQS/LAET - Sediment Quality Standards/Lowest Apparent Effects Threshold

CSL/2LAET - Cleanup Screening Level/Second Lowest Apparent Effects Threshold

SQS/LAET and CSL/2LAET are source tracing benchmarks (See Appendix F of Kiing County 2016)

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Appendix F: FMD Source Tracing Solids Datasets

Table F-1. FMD Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

	CB-4	CB-5	V-1
Project:	423589-340-4	423589-340-4	423589-340-4
Locator:	CB-4	CB-5	V-1
Descrip:	ARDAGH GLASS CATCH	ARDAGH GLASS CATCH	ARDAGH VORTEX SEPA
Sample:	L65805-1	L65805-2	L65805-3
Matrix:	SH IN-LINESED	SH IN-LINESED	SH IN-LINESED
ColDate:	7/27/2016	7/27/2016	7/27/2016
TotalSolid:	99.2	94.3	60.1
ClientLoc:	Catch Basin #4 closest to building	Catch Basin #5 in driveway approach	Vault -1
	DRY Weight Basis	**DRY Weight Basis**	**DRY Weight Basis**

Parameters	**Value**	**Qual**	**MDL**	**RDL**	**Units**	**Value**	**Qual**	**MDL**	**RDL**	**Units**	**Value**	**Qual**	**MDL**	**RDL**	**Units**
CV ASTM D422															
Fines*	43.6		0.5	1	%	8.5		0.5	1.1	%	42.2		0.9	1.8	%
Gravel*	5.7		0.1	1	%	43.2		0.1	1.1	%	10		0.2	1.8	%
Sand*	45.2		0.1	1	%	48.2		0.1	1.1	%	35.1		0.2	1.8	%
Silt*	38		0.5	1	%	6.9		0.5	1.1	%	33.2		0.9	1.8	%
Clay*	5.6		0.5	1	%	1.6		0.5	1.1	%	9		0.9	1.8	%
p+0.00*	4.8		0.1	1	%	13.8		0.1	1.1	%	5.5		0.2	1.8	%
p+1.00*	11.3		0.1	1	%	14.4		0.1	1.1	%	5		0.2	1.8	%
p+10.0(equal/more than)*	3		0.5	1	%	1.1	RDL	0.5	1.1	%	5.4		0.9	1.8	%
p+2.00*	12.5		0.1	1	%	10.7		0.1	1.1	%	9.1		0.2	1.8	%
p+3.00*	9.4		0.1	1	%	5.4		0.1	1.1	%	8.2		0.2	1.8	%
p+4.00*	7.2		0.1	1	%	3.9		0.1	1.1	%	7.4		0.2	1.8	%
p+5.00*	6.6		0.5	1	%	4.3		0.5	1.1	%	23.3		0.9	1.8	%
p+6.00*	20.8		0.5	1	%	1.1	RDL	0.5	1.1	%	2.7		0.9	1.8	%
p+7.00*	8.1		0.5	1	%	1.1	RDL	0.5	1.1	%	3.6		0.9	1.8	%
p+8.00*	2.5		0.5	1	%	0.5	<RDL	0.5	1.1	%	3.6		0.9	1.8	%
p+9.00*	2.5		0.5	1	%	0.5	<RDL	0.5	1.1	%	3.6		0.9	1.8	%
p-1.00*	2.4		0.1	1	%	13.7		0.1	1.1	%	4		0.2	1.8	%
p-2.00(less than)*	2.5		0.1	1	%	24.9		0.1	1.1	%	5.1		0.2	1.8	%
p-2.00*	0.7	<RDL	0.1	1	%	4.6		0.1	1.1	%	0.8	<RDL	0.2	1.8	%
CV SM2540-G															
Total Solids*	99.2		0.005	0.01	%	94.3		0.005	0.01	%	60.1		0.005	0.01	%
CV SW846 9060 PSEP96															
Total Organic Carbon	47800		4500	9160	mg/Kg	11200		3400	6820	mg/Kg	163000		18000	37400	mg/Kg
ES NONE															
Client Locator*	Catch Basin #4 closest to building					Catch Basin #5 in driveway approach to building					Vault -1				
Sample Information*	top filter, more dirt vs. sand with tons of glass fragments, dry					top filter, much finer sand & glass, some dirt, still tons of glass fragments, some moisture or dampness					eastern most hole of three at Vortex Separator, very soupy, but fine silt & mud due to water in the chamber				

Table F-1. FMD Stormdrain solids sampling results for 2016.

King County Environmental Lab Analytical Report

	CB-4		CB-5		V-1
Project:	423589-340-4	Project:	423589-340-4	Project:	423589-340-4
Locator:	CB-4	Locator:	CB-5	Locator:	V-1
Descrip:	ARDAGH GLASS CATCH	Descrip:	ARDAGH GLASS CATCH	Descrip:	ARDAGH VORTEX SEPA
Sample:	L65805-1	Sample:	L65805-2	Sample:	L65805-3
Matrix:	SH IN-LINESED	Matrix:	SH IN-LINESED	Matrix:	SH IN-LINESED
ColDate:	7/27/2016	ColDate:	7/27/2016	ColDate:	7/27/2016
TotalSolid:	99.2	TotalSolid:	94.3	TotalSolid:	60.1
ClientLoc:	Catch Basin #4 closest to building	ClientLoc:	Catch Basin #5 in driveway approach	ClientLoc:	Vault -1
DRY Weight Basis		**DRY Weight Basis**		**DRY Weight Basis**	

Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
MT SW846 3050B(MODSB)*SW846 6020A															
Arsenic, Total, ICP-MS						1.27	J	0.027	0.133	mg/Kg					
Silver, Total, ICP-MS						0.223	J	0.011	0.0529	mg/Kg					
MT SW846 3050B*SW846 6010C															
Arsenic, Total, ICP	4.7	<RDL	1.3	6.32	mg/Kg						16	<RDL	5.2	26	mg/Kg
Cadmium, Total, ICP	0.838		0.1	0.505	mg/Kg	0.24	<RDL	0.11	0.531	mg/Kg	5.82		0.42	2.08	mg/Kg
Chromium, Total, ICP	16		0.15	0.758	mg/Kg	4.44		0.16	0.797	mg/Kg	65.6		0.63	3.13	mg/Kg
Copper, Total, ICP	46.3		0.2	1.01	mg/Kg	10.7		0.21	1.06	mg/Kg	374		0.83	4.16	mg/Kg
Lead, Total, ICP	37.2		5	25.3	mg/Kg	12.3		1.1	5.31	mg/Kg	170		4.2	20.8	mg/Kg
Nickel, Total, ICP	17.4		0.25	1.26	mg/Kg	4.25		0.27	1.33	mg/Kg	52.9		1	5.21	mg/Kg
Silver, Total, ICP	0.37	<RDL	0.2	1.01	mg/Kg						0.87	<RDL	0.83	4.16	mg/Kg
Zinc, Total, ICP	612		0.25	1.26	mg/Kg	228		0.27	1.33	mg/Kg	2050		1	5.21	mg/Kg
MT SW846 7471B															
Mercury, Total, CVAA	0.0782		0.005	0.0504	mg/Kg	0.018	<RDL	0.0054	0.0538	mg/Kg	0.218		0.0082	0.082	mg/Kg
OR SW846 3550B*SW846 8082A															
Aroclor 1016		<MDL	1.3	5.04	ug/Kg		<MDL	1.4	5.3	ug/Kg		<MDL	8.3	33.3	ug/Kg
Aroclor 1221		<MDL	3.8	5.04	ug/Kg		<MDL	4	5.3	ug/Kg		<MDL	25	33.3	ug/Kg
Aroclor 1232		<MDL	3.8	5.04	ug/Kg		<MDL	4	5.3	ug/Kg		<MDL	25	33.3	ug/Kg
Aroclor 1242		<MDL	1.3	5.04	ug/Kg	1.5	<RDL	1.4	5.3	ug/Kg	78		8.3	33.3	ug/Kg
Aroclor 1248		<MDL	1.3	5.04	ug/Kg		<MDL	1.4	5.3	ug/Kg		<MDL	8.3	33.3	ug/Kg
Aroclor 1254	21.8		1.3	5.04	ug/Kg	3.7	<RDL	1.4	5.3	ug/Kg	433		8.3	33.3	ug/Kg
Aroclor 1260	16		1.3	5.04	ug/Kg	2.3	<RDL	1.4	5.3	ug/Kg	311		8.3	33.3	ug/Kg
Total Aroclors	37.8		1.3	5.04	ug/Kg	7.53		1.4	5.3	ug/Kg	822		8.3	33.3	ug/Kg
OR SW846 3550B*SW846 8270D															
1,2,4-Trichlorobenzene		<MDL	5	10.1	ug/Kg		<MDL	1.1	2.12	ug/Kg		<MDL	8.3	16.6	ug/Kg
1,2-Dichlorobenzene		<MDL	50.4	50.4	ug/Kg		<MDL	10.6	10.6	ug/Kg		<MDL	83.2	83.2	ug/Kg
1,4-Dichlorobenzene		<MDL	75.6	75.6	ug/Kg		<MDL	15.9	15.9	ug/Kg		<MDL	125	125	ug/Kg
1-Methylnaphthalene		<MDL	50	101	ug/Kg		<MDL	11	21.2	ug/Kg		<MDL	83	166	ug/Kg
2,4-Dimethylphenol		<MDL	50	101	ug/Kg		<MDL	11	21.2	ug/Kg		<MDL	83	166	ug/Kg
2-Methylnaphthalene		<MDL	50	101	ug/Kg		<MDL	11	21.2	ug/Kg		<MDL	83	166	ug/Kg

Table F-1. FMD Stormdrain solids sampling results for 2016.

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Project: 423589-340-4
Locator: CB-4
Descrip: ARDAGH GLASS CATCH
Sample: L65805-1
Matrix: SH IN-LINESED
ColDate: 7/27/2016
TotalSolid: 99.2
ClientLoc: Catch Basin #4 closest to building
DRY Weight Basis

Parameters	Value	Qual	MDL	RDL	Units
2-Methylphenol		<MDL	50	101	ug/Kg
3-,4-Methylphenol		<MDL	250	504	ug/Kg
Acenaphthene		<MDL	50	101	ug/Kg
Acenaphthylene		<MDL	50	101	ug/Kg
Anthracene		<MDL	50	101	ug/Kg
Benzo(a)anthracene		<MDL	50	101	ug/Kg
Benzo(a)pyrene		<MDL	50	101	ug/Kg
Benzo(b,j,k)fluoranthene		<MDL	50	101	ug/Kg
Benzo(g,h,i)perylene		<MDL	50	101	ug/Kg
Benzoic Acid		<MDL,JG	1010	1010	ug/Kg
Benzyl Alcohol		<MDL	126	126	ug/Kg
Benzyl Butyl Phthalate		<MDL	75.6	75.6	ug/Kg
Bis(2-Ethylhexyl)Phthalate	4590		100	202	ug/Kg
Carbazole		<MDL	50	101	ug/Kg
Chrysene		<MDL	50	101	ug/Kg
Dibenzo(a,h)anthracene		<MDL	50	101	ug/Kg
Dibenzofuran		<MDL	50	101	ug/Kg
Diethyl Phthalate		<MDL	100	202	ug/Kg
Dimethyl Phthalate		<MDL	101	101	ug/Kg
Di-N-Butyl Phthalate	130	<RDL	100	202	ug/Kg
Di-N-Octyl Phthalate		<MDL	101	101	ug/Kg
Fluoranthene	191		50	101	ug/Kg
Fluorene		<MDL	50	101	ug/Kg
Hexachlorobenzene		<MDL	5	10.1	ug/Kg
Hexachlorobutadiene		<MDL	25	50.4	ug/Kg
Indeno(1,2,3-Cd)Pyrene		<MDL	50	101	ug/Kg
Naphthalene		<MDL	50	101	ug/Kg
N-Nitrosodiphenylamine		<MDL	126	126	ug/Kg
Pentachlorophenol		<MDL	756	756	ug/Kg
Phenanthrene	157		50	101	ug/Kg

Project: 423589-340-4
Locator: CB-5
Descrip: ARDAGH GLASS CATCH
Sample: L65805-2
Matrix: SH IN-LINESED
ColDate: 7/27/2016
TotalSolid: 94.3
ClientLoc: Catch Basin #5 in driveway approach
DRY Weight Basis

Parameters	Value	Qual	MDL	RDL	Units
2-Methylphenol		<MDL	11	21.2	ug/Kg
3-,4-Methylphenol		<MDL	53	106	ug/Kg
Acenaphthene		<MDL	11	21.2	ug/Kg
Acenaphthylene		<MDL	11	21.2	ug/Kg
Anthracene		<MDL	11	21.2	ug/Kg
Benzo(a)anthracene		<MDL	11	21.2	ug/Kg
Benzo(a)pyrene		<MDL	11	21.2	ug/Kg
Benzo(b,j,k)fluoranthene		<MDL	11	21.2	ug/Kg
Benzo(g,h,i)perylene		<MDL	11	21.2	ug/Kg
Benzoic Acid		<MDL,JG	212	212	ug/Kg
Benzyl Alcohol		<MDL	26.5	26.5	ug/Kg
Benzyl Butyl Phthalate	142		15.9	15.9	ug/Kg
Bis(2-Ethylhexyl)Phthalate	1760		21	42.4	ug/Kg
Carbazole		<MDL	11	21.2	ug/Kg
Chrysene		<MDL	11	21.2	ug/Kg
Dibenzo(a,h)anthracene		<MDL	11	21.2	ug/Kg
Dibenzofuran		<MDL	11	21.2	ug/Kg
Diethyl Phthalate	50.9	B	21	42.4	ug/Kg
Dimethyl Phthalate		<MDL	21.2	21.2	ug/Kg
Di-N-Butyl Phthalate	52.8		21	42.4	ug/Kg
Di-N-Octyl Phthalate		<MDL	21.2	21.2	ug/Kg
Fluoranthene	42.5		11	21.2	ug/Kg
Fluorene		<MDL	11	21.2	ug/Kg
Hexachlorobenzene		<MDL	1.1	2.12	ug/Kg
Hexachlorobutadiene		<MDL	5.3	10.6	ug/Kg
Indeno(1,2,3-Cd)Pyrene		<MDL	11	21.2	ug/Kg
Naphthalene		<MDL	11	21.2	ug/Kg
N-Nitrosodiphenylamine		<MDL	26.5	26.5	ug/Kg
Pentachlorophenol		<MDL	159	159	ug/Kg
Phenanthrene	29.9		11	21.2	ug/Kg

Project: 423589-340-4
Locator: V-1
Descrip: ARDAGH VORTEX SEPA
Sample: L65805-3
Matrix: SH IN-LINESED
ColDate: 7/27/2016
TotalSolid: 60.1
ClientLoc: Vault -1
DRY Weight Basis

Parameters	Value	Qual	MDL	RDL	Units
2-Methylphenol		<MDL	83	166	ug/Kg
3-,4-Methylphenol	2500		420	832	ug/Kg
Acenaphthene		<MDL	83	166	ug/Kg
Acenaphthylene		<MDL	83	166	ug/Kg
Anthracene		<MDL	83	166	ug/Kg
Benzo(a)anthracene		<MDL	83	166	ug/Kg
Benzo(a)pyrene		<MDL	83	166	ug/Kg
Benzo(b,j,k)fluoranthene		<MDL	83	166	ug/Kg
Benzo(g,h,i)perylene		<MDL	83	166	ug/Kg
Benzoic Acid		<MDL	1660	1660	ug/Kg
Benzyl Alcohol		<MDL	208	208	ug/Kg
Benzyl Butyl Phthalate	1760		125	125	ug/Kg
Bis(2-Ethylhexyl)Phthalate	30400		1700	3330	ug/Kg
Carbazole		<MDL	83	166	ug/Kg
Chrysene		<MDL	83	166	ug/Kg
Dibenzo(a,h)anthracene		<MDL	83	166	ug/Kg
Dibenzofuran		<MDL	83	166	ug/Kg
Diethyl Phthalate		<MDL	170	333	ug/Kg
Dimethyl Phthalate		<MDL	166	166	ug/Kg
Di-N-Butyl Phthalate		<MDL	170	333	ug/Kg
Di-N-Octyl Phthalate		<MDL	166	166	ug/Kg
Fluoranthene	652		83	166	ug/Kg
Fluorene		<MDL	83	166	ug/Kg
Hexachlorobenzene		<MDL	8.3	16.6	ug/Kg
Hexachlorobutadiene		<MDL	42	83.2	ug/Kg
Indeno(1,2,3-Cd)Pyrene		<MDL	83	166	ug/Kg
Naphthalene		<MDL	83	166	ug/Kg
N-Nitrosodiphenylamine		<MDL	208	208	ug/Kg
Pentachlorophenol		<MDL	1250	1250	ug/Kg
Phenanthrene	484		83	166	ug/Kg

Table F-1. FMD Stormdrain solids sampling results for 2016.

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	Project: 423589-340-4					Project: 423589-340-4					Project: 423589-340-4				
	Locator: CB-4					Locator: CB-5					Locator: V-1				
	Descrip: ARDAGH GLASS CATCH					Descrip: ARDAGH GLASS CATCH					Descrip: ARDAGH VORTEX SEPA				
	Sample: L65805-1					Sample: L65805-2					Sample: L65805-3				
	Matrix: SH IN-LINESED					Matrix: SH IN-LINESED					Matrix: SH IN-LINESED				
	ColDate: 7/27/2016					ColDate: 7/27/2016					ColDate: 7/27/2016				
	TotalSolid: 99.2					TotalSolid: 94.3					TotalSolid: 60.1				
	ClientLoc: Catch Basin #4 closest to building					ClientLoc: Catch Basin #5 in driveway approach					ClientLoc: Vault -1				
	DRY Weight Basis					**DRY Weight Basis**					**DRY Weight Basis**				
Parameters	**Value**	**Qual**	**MDL**	**RDL**	**Units**	**Value**	**Qual**	**MDL**	**RDL**	**Units**	**Value**	**Qual**	**MDL**	**RDL**	**Units**
Phenol		<MDL	250	756	ug/Kg		<MDL	53	159	ug/Kg		<MDL	420	1250	ug/Kg
Pyrene	550		50	101	ug/Kg	154		11	21.2	ug/Kg	2310		83	166	ug/Kg
Total HPAH (calc)	741					196.5					2962				
Total LPAH (calc)	157					29.9					484				

Table notes:

* Not converted to dry weight basis
MDL - method detection limit
RDL - reporting detectin limit
J - estimated value
JG-estimated value; probable low bias
B- method blank contamination
Shaded value > SQS/LAET
Shaded/underlined value > CSL/2LAET
see Appendix F of King County 2016

Total LPAHs were calculated as the sum of acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene

Total HPAHs were calculated as the sum of benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, total benzofluoranthenes, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene