North Boeing Field/ Georgetown Steam Plant Site Remedial Investigation/Feasibility Study

2010–2011 Stormwater Sampling Data Report

Prepared for

Washington State Department of Ecology
Toxics Cleanup Program
Northwest Regional Office
Bellevue, WA

Prepared by

Science Applications International Corporation
18912 North Creek Parkway, Suite 101
Bothell, WA 98011

January 2012

LIMITATIONS

SAIC's investigation was restricted to collection and analysis of a limited number of environmental samples, visual observations, and field data, in addition to summarizing available information from previous site documents. Because the current investigation consisted of evaluating a limited supply of information, SAIC may not have identified all potential items of concern. This report is intended to be used in its entirety; taking or using excerpts from this report is discouraged.

Table of Contents

Figures

Tables

Appendices

List of Acronyms

µg	microgram
µm	micron
2LAET	second lowest apparent effects threshold
ARI	Analytical Resources, Inc.
ASAOC	Administrative Settlement and Agreed Order on Consent
BF	base flow
CSL	Cleanup Screening Levels
DOC	dissolved organic carbon
DW	dry weight
EAP	Environmental Assessment Program
EcoChem	EcoChem, Inc.
Ecology	Washington State Department of Ecology
EOF	emergency overflow
EPA	U.S. Environmental Protection Agency
g	gram
gpm	gallons per minute
GTSP	Georgetown Steam Plant
HHO	human health for consumption of organisms
HPAH	high molecular weight polycyclic aromatic hydrocarbon
KBFI	Seattle Boeing Field-King County International Airport rain gauge
KC	King County
KCIA	King County International Airport
kg	kilogram
L	liter
LAET	lowest apparent effects threshold
LDW	Lower Duwamish Waterway
LPAH	low molecular weight polycyclic aromatic hydrocarbon
LS	lift station
LTST	long-term stormwater treatment
mg	milligram
mL	milliliter
mm	millimeter
NBF	North Boeing Field
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pg	picogram
PSEP	Puget Sound Estuary Program
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit

SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
SD	storm drain
SIM	Selective Ion Monitoring
SMS	Sediment Management Standards
SOP	standard operating procedure
SQS	Sediment Quality Standard
STST	short-term stormwater treatment
SVOC	semi-volatile organic compound
SW	stormwater
TEF	toxic equivalency factor
TEQ	toxic equivalent quotient
TOC	total organic carbon
TSS	total suspended solids
WAC	Washington Administrative Code
WHO	World Health Organization
WQC	water quality criteria

1.0 Introduction

Stormwater discharge from the North Boeing Field-Georgetown Steam Plant (NBF-GTSP) Site is a potential source of contaminants to Slip 4 on the Lower Duwamish Waterway (LDW). The Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA) identified cleanup of contaminated sediment in Slip 4 as a high priority for the LDW Superfund Site. Cleanup of Slip 4 has been delayed because of concerns about the potential recontamination of sediments in Slip 4 from releases of contaminants from this site.

To address these concerns, a Remedial Investigation/Feasibility Study (RI/FS) and cleanup of this site is currently being conducted by Ecology to identify and address contaminant sources to Slip 4. In addition, under an Administrative Settlement and Agreed Order on Consent (ASAOC) between EPA and The Boeing Company, Boeing implemented a Short-Term Stormwater Treatment (STST) system in September 2010 and is currently constructing a Long-Term Stormwater Treatment (LTST) system. As a result of these and other recent source tracing and cleanup activities conducted by Boeing, sediment cleanup in Slip 4 will begin in fall 2011.

To support the RI/FS, Ecology tasked Science Applications International Corporation (SAIC) with the collection of stormwater and continuous flow measurements from the storm drain (SD) line upstream of the King County International Airport (KCIA) SD#3/PS44 emergency overflow (EOF) outfall to Slip 4 (Figure 1). Sampling conducted during the 2009–2010 wet season is summarized in the Preliminary and Expanded Stormwater Sampling Interim Data Reports (SAIC 2010a, 2011a). Sampling conducted during the 2010–2011 wet season is summarized in this Interim Data Report.

During the 2010–2011 wet season, stormwater samples were collected at the following locations on the NBF site: a manhole on the downstream side of the King County (KC) lift station (LS431), manholes MH108 and MH 178 on the north lateral SD line, and catch basin CB173 on a tributary line to the north lateral SD (Figure 2). Filtered solids samples were collected at all locations; whole water samples were collected at LS431, MH108, and MH178. Samples were collected during nine storm events and three base flow events between November 17, 2010, and May 26, 2011. SAIC conducted sampling during five storm events and one base flow event, and collected all samples from CB173. Landau Associates, under contract to Boeing, collected samples during four storm events and two base flow events.

In addition, SAIC and Ecology collected filtered solids and centrifuged solids samples from the King County lift station vault (upstream of the lift station pumps) during two storm events and one base flow event. Results of the King County lift station vault sampling are included in data tables and appendices in this Interim Data Report; however, evaluation of these data will be provided in a separate Technical Memorandum (in preparation).

1.1 Site Description

The NBF site is located at 7500 East Marginal Way S and encompasses approximately 130 acres. The site is located east of Slip 4, approximately 4 miles south of downtown Seattle (Figure 1). Boeing leases the site from King County, with the exception of a few acres on either side of the

former GTSP flume, which is leased from the City of Seattle, and Building 3-390 and an adjacent parcel used for parking, which are owned by Boeing.

The NBF SD system drains a total area of approximately 328 acres, including 171 acres of KCIA (SAIC 2009b). Most areas of NBF drain to one of four lateral SD lines (the north, north-central, south-central, and south lateral SD lines), which are directed to a trunk line that passes through a KC lift station, under East Marginal Way S, and to the 60-inch KCIA SD#3/PS44 EOF outfall at Slip 4 (Figure 1). Additional stormwater drains to Slip 4 from a small area near Building 3-380 (which previously discharged to Slip 4 via a separate SD line) and a parking area downstream of the lift station.

1.2 Project Scope and Study Objectives

The purpose of the 2010–2011 stormwater sampling effort was to evaluate the impact of site-wide SD line cleaning and source control efforts conducted by Boeing on contaminant concentrations in the north lateral SD line, and to assess the post-STST concentrations of contaminants in stormwater at MH108 and LS431. Whole water and filtered solids samples were collected during both qualifying storm events and during times of base flow. Specific objectives for sampling were as follows:

- Target eight qualifying storm events at LS431, five at MH108, and three at CB173. Collect whole water and filtered solids samples at LS431 and MH108, and filtered solids samples at CB173.
- Continue to assess contaminant concentrations in stormwater due to infiltration of groundwater to the SD system by sampling of base flow at LS431 and CB173.
- Obtain a larger data set for whole water and filtered solids at LS431 and MH108 to allow for a better determination of the relationship between these two sample types and locations, and to assess the effect of stormwater treatment on contaminant concentrations.

Deviations from the Sampling and Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP) are described below:

- At EPA's request, sampling event responsibility for some locations and events was transferred to Landau Associates. SAIC and Landau coordinated staff, precipitation forecasting, equipment setup, sampling, and demobilization responsibilities for most events. After Landau collected the required target sample counts to meet Boeing's responsibilities to EPA under the ASAOC, SAIC regained full responsibility for all sampling for the duration of the season.
- Collection of filtered solids and whole water samples at MH178 was added to the sampling scope during five storm events and two base flow events. Existing dedicated SAIC filtered solids sampling equipment was used at this location and operated by Landau for one storm event and one base flow event. Landau oversaw and conducted the confined space installation of flow monitoring and whole water sampling ISCO equipment. A downhole pump, previously used at CB165, was decontaminated by Landau using Alconox soap solution and deionized water and modified to meet specific installation requirements for use at MH178. SAIC took over sampling at this location for the remaining four storm events and one base flow event.

1.3 Document Organization

The primary purpose of this report is to summarize and evaluate the results of the 2010–2011 NBF stormwater investigation. Section 1.0 describes the NBF site and document organization. Section 2.0 describes sample processing and analytical methods including those that differed from those described in the SAP/QAPP. Flow measurement data are summarized in Section 3.0. Analytical results for filtered solids and whole water are presented in Section 4.0. Section 5.0 summarizes the data validation reports, and a summary of findings is presented in Section 6.0. References are listed in Section 7.0. The appendices include data tables, totalizer logs, event flow and precipitation summaries, laboratory results, and data validation report.

2.0 Data Collection and Analytical Methods

This section describes the collection of flow measurement data and the sampling and analytical methods associated with filtered solids and whole water samples that were collected during storm flow and base flow conditions.

Samples were collected at four locations described below (Figure 2):

- LS431, located on the discharge (southwest) side of the KC lift station. All four major SD lines plus the Building 3-380 line drain to the lift station prior to entering Slip 4.
- MH108, located along the north lateral SD line, north of Building 3-380 and near the corner of Building 3-350. MH108 was selected to represent stormwater drainage from the north lateral SD line. MH108 is located 275 feet (85 meters) upstream of the connection between the north and north-central lateral SD lines, and approximately 250 feet (76 meters) downstream of the STST system.
- CB173, located along a tributary to the north lateral SD line in the parking lot west of Building 3-323 and about 125 feet (38 meters) southwest of the GTSP boundary.
- MH178, located along the north lateral SD line, is approximately 20 feet northwest of CB173 and is the farthest upgradient structure on the NBF property. Although a small area of NBF also drains to MH178, this location best represents the offsite contribution of stormwater flow to the north lateral.

SAIC was originally planned to perform all field sampling and coordinate all analytical services; however, Landau performed field sampling at select locations and coordinated associated analyses for the samples listed in Table 1 per EPA request. Splitting the sampling duties required a significant amount of coordination between the two firms so that the same sampling events were targeted for all locations, and so that the same field sampling methods and analytical procedures were used, as best as reasonably achievable, to ensure that all results were comparable and achieved the data quality objectives for both studies.

2.1 Flow Measurements

Stormwater flow measurements were collected using Teledyne Isco equipment owned by Boeing. Clearcreek Contractors performed all confined space entry necessary for the Isco installation at LS431 and MH108.

Continuous flow measurements at LS431 were collected using an Isco 6712 stormwater sampler equipped with a Model 750 area velocity module. AC power from the east side of the lift station was available to power the Isco unit. Due to the short cycling time of the lift station pumps, the flow sampler was programmed to collect data every 1 minute. On May 23, 2011, the area velocity module at LS431 malfunctioned. The malfunction was a result of a buildup of moisture at the sensor port, and this may have caused inaccuracies in the level and velocity measurements.

Continuous flow measurements at MH108 were collected using an Isco Model 4250 flow meter, running off a 12-volt marine battery. The battery was replaced every two to three weeks for the duration of the sampling period. The flow meter was programmed to collect data every 15 minutes.

Landau Associates performed confined space installation and maintenance at MH178, including troubleshooting of sensor malfunctions under the direction of SAIC. A weir had previously been installed at this location to facilitate collection of samples from sediment trap T5A between 2004 and 2011. Continuous flow measurements at MH178 were intended to be collected using an Isco 6712 stormwater sampler equipped with a Model 750 area velocity module. The weir made physical conditions in the water column difficult to accurately measure continuous flow readings. Several flow sensor configurations were tested; however, flow readings were unreliable. Therefore, during sampling events SW-7 through SW-9, whole water samples were collected on a time-weighted basis at this location.

No flow measurements were collected at CB173.

2.2 Sample Collection

Stormwater and base flow sample collection efforts began in November 2010 and ended in May 2011. A summary of event type, sample location, and sample media is presented in (Table 1).

A total of nine storm events and three base flow events were sampled. Whole water and filtered solids were collected at locations LS431, MH108, and MH178; filtered solids only were collected at CB173. Not all locations were sampled for each event.

Sample equipment for each location was stored in a lockable polypropylene shed to ensure sample chain-of-custody compliance throughout the duration of sampling activities and to provide sample and equipment protection from the elements. When not in operation, the sheds at MH108 and CB173 were moved to nearby storage location(s) to prevent interference with Boeing operations. Due to location-specific sampling equipment limitations, MH178 was left in place on a low-traffic flow driveway. Traffic cones and barricades were placed around the sampling equipment to increase visibility and reduce the possibility of damage from passing vehicles. To maintain compliance with Boeing regulations, an SAIC vehicle was parked in front of the flight line sample unit (MH108) to provide a buffer in the event of jet blasts.

The start and end time for each sampling event are based on the times listed on the totalizer log sheets (Appendix B). These times are listed separately for each location and vary depending on when each sample unit was activated or deactivated.

2.2.1 Filtered Solids Samples

Filtered solids were collected in a manner consistent with methods outlined in the preliminary stormwater sampling SAP/QAPP (SAIC 2009a). Events and locations where filtered solids were collected are listed in Table 1.

Prior to each sampling event, a clean filter, pre-weighed and pre-numbered by Analytical Resources, Inc. (ARI), was installed in each of the two filter housings, and the beginning totalizer readings were recorded on the totalizer field form (Appendix B). A maximum 48-gallon per minute (gpm) pump was positioned in the adjacent SD beneath the manhole cover. Once triggered, water was pumped up through the intake line and split into parallel filter housings. A float switch was attached to the pump, which activated filtered solids sampling when water reached a predetermined depth.

Each filter housing contained a 20-inch long, 4-inch diameter filter bag. All filter bags were constructed of 5 micron (µm) polypropylene felt mesh. The outflow from each filter housing was piped into a totalizer to measure flow. Outflow from both totalizers was combined and piped back into the SD. Discharge pipes were installed downstream of the effluent pump, avoiding the potential for re-circulation of water. After sampling was completed, the final totalizer readings were recorded, filter housings were drained, and filters were removed. Residual water in the filters was allowed to drain by gravity, or the water was gently squeezed through the filter bags. Filter samples were double bagged in clean, pre-labeled, Ziploc bags, and stored on ice for delivery to ARI.

Exceptions to this method are described below:

- **MH178.** Due to the installation of a weir at this location, the pump was continuously submerged. An automated timer was used to activate the pump at predetermined intervals. The pump intake was modified with a cap and piping that were secured at the head of the inlet pipe, in an attempt to eliminate contributions from pipes entering MH178 from NBF onsite areas and therefore to sample only the main SD line.
- **CB173.** The SD leaving this structure was engineered to be inverted (sloping upward). During a storm, discharge water from the filtration system flowed backwards into the CB173 vault. An unknown quantity of stormwater was likely re-circulated though the sample unit during sampling. For this reason, a float switch was not used, as the pump was continuously submerged. An automated timer was used to activate the pump at 15-minute on/off cycles, preventing the pump from overheating.

The sample collection method described above was also used to collect base flow samples from LS431, MH178, and CB173. Base flow sampling spanned a multiple-day dry period in order to collect enough filtered solids for chemical analysis. During dry periods, the lift station pumps are active for less than an hour per day.

2.2.2 Whole Water Samples

Whole water samples were collected using Isco 6712 stormwater sampling units at MH108, LS431, and MH178. The inlet for the Isco samplers and the flow sensors were mounted adjacent to each other on stainless steel scissors brackets. The flow sensor and Isco inlet were installed upstream of the filtered solids pump at MH108. However, the large vault-like drain configuration at the lift station prevented upstream installation of the bracket at LS431. Instead, the flow sensor and inlet were installed about 5 feet (1.5 meters) downstream of the effluent pump. The output from the filtered solids sampler was designed to discharge an additional 2 feet (0.6 meter) farther downstream.

Flow-weighted sampling programs were selected for the Isco units at LS431 and MH108 prior to a sampling event. Flow weighting consisted of collecting equal volume aliquots at predetermined volume intervals. The aliquot volume was constant at 500 milliliters (mL) for all sampled events. The volume interval was calculated using forecasted rainfall totals and the relationship between rainfall and stormwater flow established from previous rain events (Figure 3).

A flow-weighted sampling program was selected for MH178 during sampling events SW-5 and SW-6. Sensor error during event SW-6 resulted in the program's failure to collect whole water samples. A time-weighted sampling program was selected for the MH178 Isco unit prior to

sampling events SW-7 through SW-9. Time weighting consisted of collecting equal volume aliquots at predetermined time intervals. The aliquot volume was constant at 500 mL for all sample events. The time interval was calculated using forecasted storm duration divided by 25 aliquots.

All samples were collected in 5-gallon glass carboys. During sampling, the carboy and collected water were stored on ice in the base of the Isco unit. After sampling, the carboy was delivered to the ARI, where the sample was churn split for analysis. The laboratory was also responsible for decontamination of the carboy as specified in the SAP/QAPP Addendum (SAIC 2010b).

The methods described above were also used to collect base flow samples from LS431, MH178, and CB173. At LS431, the Isco sampler was set to collect an aliquot every lift station pump cycle. At MH178, the Isco was set to collect an aliquot every 4 hours. The filtered solids pump at MH178 was set on a timer at a rate of 15 minutes on, 15 minutes off to avoid damage to the pump.

2.2.3 Centrifuged Solids Samples

Centrifuged solids samples were collected as described in SAP/QAPP Addendum #3 (SAIC 2011b). Additional information regarding centrifuged samples and associated lift station vault filtered solids samples will be provided in a separate Technical Memorandum (in preparation).

2.3 Sample Preparation and Chemical Analysis

All analytical procedures were performed by subcontracted laboratories in accordance with Ecology guidelines as outlined in the SAP/QAPP and SAP/QAPP Addendums (SAIC 2009a, 2010b, 2010c, 2011b) with the exceptions noted in Section 2.3.4. Analytical methods are listed in the sample analysis summary tables (Tables 2 and 3).

2.3.1 Filtered Solids Samples

After sample collection, all filter bags were delivered to ARI of Tukwila, Washington for processing and analysis. One of the filters of the parallel filtration setup was air dried and extracted for polychlorinated biphenyls (PCBs) or processed for dioxin/furan analysis as described below. The second filter of the parallel filtration setup was cut in half and solids were removed, or scraped from the sides of the bag, to obtain material for the analysis of metals and grain size. Approximately 10 grams of filtered solids were removed for metals analysis, and approximately 20 grams of filtered solids were removed for grain size analysis. The filter bag and remaining solids were then either air dried and extracted for PCBs (if the first filter was used for dioxin/furan analysis), or extracted wet for polycyclic aromatic hydrocarbons (PAHs). Filter bags for PAH analysis were not air dried prior to extraction because of the potential for the loss of individual PAH compounds during the drying process.

For dioxin/furan analyses coordinated by SAIC, filter bags were air dried by ARI and shipped via FedEx to Axys Analytical Services, Ltd. (Axys) in Sidney, British Columbia. For dioxin/furan analyses coordinated by Landau, filter bags were air dried and analyzed by ARI, with the exception of the samples collected during sampling event SW-2, which were shipped by ARI to Axys for analysis.

2.3.2 Whole Water Samples

Five-gallon carboys containing whole water samples were delivered to ARI for churn splitting and analysis. Stormwater samples were analyzed for semi-volatile organic compounds (SVOCs), PAHs by Selective Ion Monitoring (SIM), PCBs, total and dissolved metals, and conventional parameters including hardness, pH, alkalinity, anions, total organic carbon (TOC), dissolved organic carbon (DOC), and total suspended solids (TSS). Samples for dissolved metals analysis were filtered by ARI prior to preservation and analysis.

A single 5-gallon carboy was delivered to ARI for each whole water sample, with two exceptions: due to extreme rainfall, two 5-gallon carboys were collected at MH108 and LS431 during sampling event SW-7 on April 27, 2011. For each sample, ARI composited and homogenized the water from both carboys prior to analysis.

2.3.3 Centrifuge Solids Samples

Centrifuge solids samples, centrifuge rinse water, and two sets of associated influent/effluent water samples were collected in accordance with the *SAP/QAPP Addendum #3 2010–2011 Stormwater Monitoring Centrifuge Sampling* (SAIC 2011b) and delivered to ARI. The centrifuge bowl rinse water contained solids material not captured during the centrifuge processing in the field. The laboratory performed additional centrifuging on the rinse water and combined the resultant solids material with the field centrifuged solids sample prior to analysis. The combined centrifuged solids sample was analyzed for PCBs, PAHs, total solids, metals, and grain size.

During each centrifuge sampling event, influent and effluent water samples from the centrifuge bowl and lift station vault filtration unit were delivered to ARI in one-gallon plastic containers for TSS analysis. Both sets of influent and effluent water samples were composited over time during field sampling.

Additional information regarding the analytical procedures for the centrifuge solids samples and associated influent/effluent water will be presented in a separate Technical Memorandum (in preparation).

2.3.4 Analytical Deviations

Analytical procedures were conducted as outlined in the SAP/QAPP and SAP/QAPP Addendums (SAIC 2009a, 2010b, 2010c, 2011b) with the following exceptions:

- Some targeted analyses (e.g., metals and/or grain size for some filtered solids samples) could not be performed because of insufficient sample volume. Analyses conducted for each sample are listed in Tables 2 and 3.
- Per the SAP/QAPP and SAP/QAPP Addendums, all chemical results were planned to be independently validated by EcoChem at full level EPA Stage 3 or 4; however, for samples collected by Landau, the associated PCB results were validated at an EPA Stage 2A compliance screening level (EPA 2009). No validation was performed by Landau for other chemicals.
- The SAP/QAPP and SAP/QAPP Addendums note that all dioxin/furan analyses would be conducted by Axys. For analyses coordinated by Landau, ARI performed the dioxin/furan analyses, except for the samples collected during sampling event SW-2,

which were analyzed by Axys. Both laboratories used the same analytical method (EPA 1613B) and results are assumed to be comparable between the two laboratories. The filtered solids sample collected during event SW-2 at MH108 was contaminated with ice melt during shipping from ARI to Axys; consequently, Landau canceled the request for dioxin/furan analysis for this sample.

- The bags containing filtered solids for dioxin/furan analysis at Axys were intended to be dried by ARI prior to shipment to Axys; however, the samples were initially delivered to Axys wet (un-dried). All filter bag samples except one (NBF-CB173B-113010-S, explained below) were returned to ARI for air drying. The return shipment was sent via FedEx overnight delivery but was detained in transit at the FedEx facility in Memphis, Tennessee, and arrived at ARI five days after departing Axys. The cooler temperature upon receipt at ARI was 10.8 degrees Celsius, a deviation from the target cooler temperature of 2–6 degrees Celsius. The dried filters were subsequently returned to Axys for continuation of analysis. Data quality is not expected to be affected.
- Filter bag sample NBF-CB173B-113010-S had been cut in half by Axys prior to halting the extraction process for dioxins/furans, so this sample was not returned to ARI with the other filter bags noted above. In order to prevent potentially compromising the sample during shipment, it was air dried by Axys instead. Due to laboratory error, the weight of the dried bag was not recorded by Axys; consequently, the dry weight for the associated filter bag collected in parallel was used to calculate final reported dioxin/furan concentrations in pg/g for this sample.
- Grain size analyses were originally performed using a Sedigraph for all SAIC coordinated analyses, or when sample volume was insufficient for sieving/gravimetric methods for Landau-coordinated analyses. Due to instrument breakdown of the Sedigraph on April 8, 2011, subsequent grain size analyses were instead performed using a laser diffraction unit. Both instruments used Puget Sound Estuary Program (PSEP) accepted methodology and produce comparable data of acceptable quality.
- Due to laboratory error in performing analyses based on analytical priority, metals results are not available for the centrifuged solids sample NBF-LS431CENT-052611-S. All remaining volume for this sample was consumed before metals analysis could be performed.
- The centrifuge sampling SAP/QAPP Addendum (SAIC 2011b) notes that for the effluent water samples, a full gallon of water would be analyzed for TSS. In most cases, the laboratory filter became clogged before the entire gallon could be processed.

3.0 Flow Measurement Results

This section presents a summary of flow measurements collected from the NBF lateral SD line. Measured values for flow are compared to the total area in each of the lateral SD line drainage areas.

3.1 Flow Measurements and Precipitation

Flow data logged by the Isco equipment were managed using the Isco program Flowlink (Version 5.10.304). All data incorporated into Flowlink are stored in a Microsoft Access database. Local precipitation data were added to the Access database to aid interpretation of the storm hydrographs.

3.1.1 Precipitation

Precipitation data from the Seattle Boeing Field-King County International Airport rain gauge (identified as "KBFI") were used to represent rainfall at NBF. Trace amounts of precipitation are reported as "T" and were replaced with 0.001 inch (0.0254 millimeter [mm]) for data processing purposes in the Access database. Precipitation data from October 2010 through May 2011 were added to the database. There were no gaps or other obvious recording issues during this time period.

3.1.2 Stormwater Flow Records

This section summarizes the flow measurements collected from mid-November 2010 through late June 2011. A regression analysis between volume of stormwater (gallons) and precipitation amount (inches) for all recorded rain events was performed for each location (Figure 3). The y-intercept of each regression line was set to zero to prevent negative flow volumes at low precipitation amounts. The slope of each regression line is a constant representing runoff from the area that drains to a specific sampling location.

Stormwater runoff from NBF drains to the King County lift station where it collects in an underground storage vault. Up to four pumps are activated to lift the water above sea level for discharge to Slip 4. The velocity of the lift station discharge causes a reduction in pressure as water flows over the area velocity sensor. The reduction in pressure results in an inaccurate water level reading. During a confined space entry in the 2009/2010 wet season, a water mark was observed approximately 8 inches above the average water level reading of 6 inches. An 8-inch correction factor was therefore applied to water level readings. As in previous data reports, the modified flows are used in the report text and figures to describe conditions at the lift station. Corrected lift station flows ranged between approximately 12,000 gpm with one active lift station pump to 30,000 gpm with three active lift station pumps.

3.1.3 Event Summaries

The goal of each storm event was to meet criteria established by Ecology's Environmental Assessment Program's (EAP) standard operating procedures (SOPs) for stormwater monitoring (Ecology 2009). Sample event summary figures are presented in Appendix C.

A qualifying storm event was defined as follows:

- At least 0.15 inch (3.8 mm) of rainfall;
- Event duration of at least 5 hours;
- No more than 0.04 inch (1 mm) of rainfall during the preceding 24 hours[1];
- Sampling duration that includes at least 75% of the storm event hydrograph, or at least 75% of the first 24 hours of the storm if the storm lasted more than 24 hours; and
- Collection of at least 10 sample aliquots, with a minimum volume of 200 mL per aliquot.

Whole water and filtered solids were collected during all nine storm events at LS431. Storm events SW-2, SW-4, SW-5, SW-7, SW-8, and SW-9 met all qualifying storm criteria. All storm events had durations of at least 5 hours. Results from all nine storm flow sampling events are presented in this Data Report.

Event SW-1 was the only storm sampling event where rainfall was below 0.15 inch.

During event SW-3, NBF received 3.7 inches of precipitation, which exceeded the whole water sampler programmed volume. Approximately 0.2 inch of precipitation fell before samplers were activated. Sample aliquots were collected at a more rapid pace than expected and the whole water sampler was automatically stopped when the carboy reached capacity. As a result, only 30 and 45 percent of the storm event hydrograph was sampled at LS431 and MH108, respectively. Filtered solids sampling continued for a total of 18 hours.

During event SW-6, rain began earlier than forecasted. Sampling for whole water and filtered solids began approximately half way through the storm event at LS431 and MH108. A flow sensor malfunction at MH178 resulted in insufficient sample volume.

During SW-7, NBF received a greater amount of rainfall than what was forecasted for this storm event. The whole water sample pacing at LS431 and MH108 was set for a smaller amount of rainfall and the carboys reached capacity during the storm. The field team switched carboys and continued sampling the storm at the same pacing as was originally set. Two carboys for each of these whole water samples were delivered to ARI and composited/homogenized during the churn splitting process. A time-weighted sample collection was successfully applied at MH178.

During event SW-8, the float switch malfunctioned at LS431 and would not activate the filtered solids pump. A new float switch was installed and filtered solids sampling resumed. MH108 was not sampled during Storm Event 8 or 9. A time-weighted sample collection was successfully applied at MH178.

A malfunction in the area velocity sensor at LS431 prior to the sampling of event SW-9 caused a failure of the whole water collection system. The field team manually activated the whole water sample during each pump cycle. A total of 12 aliquots were collected. A time-weighted sample collection was successfully applied at MH178.

[1] This criterion was reduced to 12 hours in February 2011, based on site observations regarding system recovery times after a storm event.

On January 4, 2011, and March 26, 2011, personnel and equipment were mobilized to sample storm events where the predicted rainfall was above 0.15 inch. After mobilization, the storm events failed to materialize and the sampling efforts were aborted.

The only criteria for the base flow sampling were to avoid precipitation and make sure enough aliquots were collected to be representative of the sampling period. In general, sampling periods with precipitation of less than or equal to 0.04 inch were considered to be representative of base flow. These criteria were met for all base flow sampling events.

4.0 Chemistry Results

This section presents and summarizes analytical results for the 2010–2011 stormwater sampling effort. Complete sampling results are provided in Appendix A. Laboratory data reports are provided in Appendix D (on CD); chemical data validation reports are included in Appendix E, and data validation results are summarized in Section 5.0.

4.1 Filtered Solids Samples

Filtered solids samples were collected at locations LS431, MH108, MH178, and CB173; results for detected chemicals are summarized in Tables 5 through 8, respectively. A complete table of results is presented in Appendix A, and laboratory data reports are provided in Appendix D.

4.1.1 Physical Parameters

Grain size analysis was conducted when sufficient material could be scraped from the filter bags; the percent of solid material classified as fines (silt/clay) and clay are summarized below for each sampling location.

Location	Event Type	No. of Samples	% Fines (<62 microns)		% Clay (<3.9 microns)	
			Range	Average	Range	Average
LS431	Storm	8	7.0 – 52.3	26.1	2.7 – 17.8	9.0
MH108	Storm	5	4.0 – 39.5	24.6	1.4 – 16.9	9.5
MH178	Storm	5	19.9 – 83.8	45.7	3.5 – 11.1	8.1
CB173	Storm	3	13.8 – 61.2	33.8	4.1 – 29.0	13.5
LS431	Base Flow	2	16.3 – 24.4	20.4	12.7 – 14.1	13.4
MH178	Base Flow	2	16.9 – 29.5	23.2	7.0 – 7.7	7.4

LS431 and MH108 contained similar average percentages of fine and clay particles during storm events (approximately 25% and 9%, respectively). MH178, located at the upstream end of the north lateral SD line, had the highest percentage of fine material, with an average of 45.7%, while CB173 had the highest percentage of clay, averaging 13.5%.

While the filtered solids samples were collected using a 5-micron mesh filter, it is clear that a significant portion of the solids collected on the filters are smaller than 5 microns. Figure 4 shows the percent fines and percent clay for each sampling event by location; in addition, this figure shows the rainfall corresponding to each sampling event. There appears to be some correlation between rainfall and percent fines: in general, higher rainfall events tend to be correlated with a lower percentage of fine material.

4.1.2 Chemical Analysis

Metals results were compared to the Washington State Sediment Management Standards (SMS) dry weight (DW) numeric Sediment Quality Standards (SQS) and Cleanup Screening Levels (CSL) criteria (Washington Administrative Code [WAC] 173-204). PCBs and PAH results were compared to the DW lowest apparent effects threshold (LAET) and the second LAET (2LAET)

(PTI 1988). The LAET and 2LAET are functionally equivalent to the SQS and CSL values, respectively, but are not organic carbon normalized. Collection of TOC data from the filters was not possible due to interference from the organic polypropylene filter bag; therefore, associated results could not be compared to the organic carbon normalized SMS criteria.

Sample results for individual sampling events and comparisons with relevant criteria are provided in Tables 5 through 8.

PCBs

Total PCB concentrations were reported as micrograms (µg)/filter and converted to mg/kg by dividing the mass of PCBs by the mass of total dried extracted solids. Total PCBs were calculated as the sum of detected Aroclors 1248, 1254, and 1260. Aroclors 1016, 1221, 1232, and 1242 were not detected in any samples. Total PCBs exceeded the LAET (0.13 mg/kg DW) in all filtered solids samples with the exception of base flow event BF-2 at LS431. Total PCBs exceeded the 2LAET (1.0 mg/kg DW) in one sample at LS431, all six samples at MH108, one sample at MH178, and all six samples collected at CB173.

Total PCB concentrations in filtered solids samples are summarized below:

Location	Event Type	No. of Samples	Total PCBs (mg/kg DW)		
			Range	Average	Standard Deviation
LS431	Storm	8	0.32 – 1.7	0.73	0.46
MH108	Storm	5	1.5 – 4.4	2.9	1.2
MH178	Storm	5	0.21 – 5.4	1.4	2.2
CB173	Storm	4	1.3 – 9.7	6.5	3.7
LS431	Base Flow	2	0.092 – 0.81	0.45	0.51
MH178	Base Flow	2	0.57 – 1.0	0.80	0.29
CB173	Base Flow	2	74 - 99	86	17.7

Shaded cells indicate that the average concentrations exceeds the LAET ( ) or 2LAET ( ).

Total PCB concentrations in filtered solids samples collected at LS431 and MH108 since October 2009 are shown in Figures 5 and 6, respectively. The shaded area on these figures indicates sampling conducted during the 2009–2010 wet season, which was prior to installation of the STST system in the north lateral SD line. The STST system began operation in September 2010.

For storm events, the highest PCB concentrations were detected at CB173; however, the average concentration of total PCBs exceeded the 2LAET at all locations except LS431. Average base flow concentrations were lower than storm flow concentrations at LS431 and MH178; at CB173, however, base flow PCB concentrations were significantly higher than storm flow. It should be noted that average base flow concentrations are based on only two sample events at each location.

CB173 also showed a different distribution of Aroclors than the other sampling locations (Figure 7). Aroclor 1248 was detected at CB173 in two of four samples during storm events (3.2 and 3.7 mg/kg DW) and in both base flow samples (48 and 56.2 mg/kg DW). Aroclor 1248 was

not detected in any other storm event filtered solids samples. In base flow, Aroclor 1248 was detected at LS431 (0.038 mg/kg DW) during base flow event BF-2, which corresponds to the 48 mg/kg DW detection at CB173 and may represent the diluted component of downstream flow from CB173.

Metals

When sufficient material was collected in the filter bags, an aliquot was removed from the filter bag for metals analysis. Chromium and lead did not exceed the SQS in any filtered solids samples. Arsenic and silver each exceeded the SQS in one sample (at CB173 and MH178, respectively).

Concentrations of cadmium, copper, mercury, and zinc in filtered solids samples are summarized below. These metals were detected in every filtered solids sample that was collected, with the exception of mercury in base flow at LS431, which was detected in one of two samples.

Location	Event Type	No. of Samples	Average Concentration (mg/kg DW) [Range of Concentrations]			
			Cadmium	Copper	Mercury	Zinc
SQS			5.1	390	0.41	410
CSL			6.7	390	0.59	960
LS431	Storm	9	4.7 [3.9 – 7.0]	55 [23 – 87]	0.75 [0.06 – 5.6]	407 [160 – 730]
MH108	Storm	5	7.3 [3.1 – 11.1]	191 [139 – 227]	0.39 [0.27 – 0.54]	880 [465 – 1,370]
MH178	Storm	5	4.0 [2.1 – 6.0]	223 [155 – 362]	4.6 [0.60 – 14.6]	430 [255 – 640]
CB173	Storm	4	12 [6.7 – 15.2]	246 [165 – 320]	0.86 [0.50 – 1.2]	2,610 [1,050 – 4,990]
LS431	Base Flow	2	3.5 [2.9 – 4.0]	27 [26 – 28]	0.060 [<0.06 – 0.09]	190 [125 – 254]
MH178	Base Flow	2	2.6 [1.2 – 4.0]	109 [92 – 126]	9.4 [2.6 – 16.1]	186 [122 – 250]
CB173	Base Flow	3	4.7 [2.0 – 7.0]	231 [102 – 466]	6.7 [0.40 – 18]	721 [342 – 1,100]

Shaded cells indicate that the average concentrations exceeds the SQS ( ) or CSL ( ).
Average concentrations were calculated using 0.5 times the reporting limit for non-detects.

Mercury exceeded the SQS and CSL at three locations (LS431, MH178, CB173). The highest average mercury concentrations were detected in base flow at MH178; this location also contained the highest average mercury concentrations in storm flow samples. In contrast, CB173 contained high concentrations of mercury in base flow (up to 18 mg/kg DW) but much lower concentrations in storm flow (up to 1.2 mg/kg DW). At the lift station (LS431), mercury in storm flow exceeded the CSL but was present in much lower concentrations in base flow.

In base flow, the highest concentrations of metals (other than mercury) were detected at CB173 during event BF-3: arsenic was detected above the SQS, and cadmium, copper, mercury, and zinc all exceeded the CSL.

PAHs

Concentrations of PAH compounds were reported as µg/filter and converted to mg/kg DW by dividing the mass of PAHs by the estimated dried mass of extracted solids. PAH concentrations should be considered estimates. Because the samples were not dried before analysis (to minimize volatilization of PAH compounds), assumptions regarding the dry weight mass of extracted solids were made based on the dry weight of solids collected on the second filter in each filter pair. Correction factors were applied to account for differences in the dry filter weights in each pair, and to correct for the removal of solids for metals and grain size analyses from the second filter in each filter pair. These assumptions may result in under- or overestimation of PAH concentrations.

Phenanthrene was the only low molecular weight polycyclic aromatic hydrocarbon (LPAH) detected in filtered solids samples at concentrations above the LAET, during sampling event SW-3 at MH108 and during SW-9 at MH178. Total LPAH also exceeded the LAET during event SW-9 at MH178.

Several high molecular weight polycyclic aromatic hydrocarbon (HPAH) compounds were detected in one or more sampling locations at concentrations above the LAET. At CB173, benzo(g,h,i)perylene was detected at 1.2 mg/kg DW during event SW-4. At MH178, several compounds were detected at concentrations above the 2LAET during event SW-9, with a total HPAH concentration of 43 mg/kg DW. At MH108, several HPAH concentrations were detected above the LAET and/or 2LAET during event SW-3, with a total HPAH concentration of 17 mg/kg DW. At LS431, HPAH compounds were detected at concentrations above the LAET during events SW-3, SW-5, and SW-8, with a total HPAH concentration ranging from 5.2 to 13.9 mg/kg DW for all storm events.

No HPAH compounds were detected above the LAET during base flow sampling events.

Dioxins/Furans

Dioxin/furan congeners were analyzed from sampling events SW-2, SW-4, SW-6, SW-7, and BF-2 (Table 2). Concentrations of each congener were normalized to the toxicity of 2,3,7,8-TCDD (tetrachlorodibenzodioxin) using toxic equivalency factors (TEFs) updated by the World Health Organization (WHO) in 2005 (Van den Berg et al. 2006). The toxic equivalent quotient (TEQ) is equal to the sum of the concentrations of individual congeners multiplied by their TEF. TEQ values are reported using 0.5 times the method detection limits for nondetected congeners. Total dioxin/furan TEQ concentrations were reported as nanograms (ng)/filter and converted to picograms per gram (pg/g) by dividing the mass of dioxins/furans by the mass of total dried extracted solids.

Location	Event Type	No. of Samples	Total Dioxin/Furan TEQ (pg/g DW)		
			Range	Average	Standard Deviation
LS431	Storm	4	7.5 – 71.3	32.3	28.6
MH108	Storm	3	27.2 – 69.4	49.8	21.3
MH178	Storm	2	29.0 – 30.8	29.9	1.3
CB173	Storm	1	274	NA	NA
LS431	Base Flow	1	2.9	NA	NA
MH178	Base Flow	1	4.1	NA	NA
CB173	Base Flow	1	64.4	NA	NA

For the storm event sample collected at CB173, the dry weight mass of extracted solids was not measured by the laboratory. For this sample, assumptions regarding the dry weight mass of extracted solids were made based on the dry weight of solids collected on the second filter in the filter pair. Correction factors were applied to account for the difference in dry filter weights between the two filters, and to correct for the removal of solids for metals and grain size analysis from the second filter. These assumptions may result in under- or overestimation of dioxin/furan concentrations in this sample.

Dioxin/furan TEQs were significantly higher during storm events than during base flow events at all sampling locations. The highest concentrations were found at CB173, with 274 pg/g DW in storm flow and 64.4 pg/g DW in base flow, based on a single sample of each type.

In general, dioxin/furan TEQs were higher during storm events with less precipitation (<0.5 inch) than during storm events with greater precipitation (>0.5 inch). All sample results exceeded the natural background concentration of dioxins/furans in LDW sediment of 2 pg/g DW (AECOM 2010).

4.2 Whole Water Samples

Whole water samples were collected at LS431, MH108, and MH178. Results are summarized in Tables 9 through 11. Concentrations are compared to the chronic marine water criteria (WAC 173-201A-240). Contaminants lacking marine criteria are compared to freshwater criteria (if available), or to the human health water quality criteria for consumption of organisms (HHO) (EPA 2006). Analytical results are listed in Appendix A, and laboratory data summaries are presented in Appendix D.

4.2.1 Physical Parameters

Conventional parameters including pH, alkalinity, hardness, TSS, chloride, nitrate, sulfate, DOC, and TOC were measured in each of the whole water samples. The pH ranged from 6.5 to 7.5 at all sampling locations. Average TOC, DOC and TSS are listed below. The measured TSS at LS431 during the first storm sampling event (SW-1) was unusually high (104 mg/L); the SW-1 sample collected at upstream location MH108 did not show elevated TSS. In addition, the DOC was measured at 30.4 mg/L, significantly higher than the TOC of 8.1 mg/L. The high TSS may be due to accumulated material in the storm drain system, since this was the first sampling event of the season, or may be due to the low precipitation (0.12 inch) recorded during this event.

Location	Event Type	pH	Average TOC (mg/L)	Average DOC (mg/L)	Average TSS (mg/L)
LS431 without SW-1*	Storm	6.5 – 7.3	4.9	3.9	24.5
LS431 with SW-1	Storm	6.5 – 7.3	5.2	6.8	33.3
MH108	Storm	6.6 – 7.5	3.9	7.2	18.5
MH178	Storm	6.6 – 7.1	5.9	3.7	101
LS431	Base Flow	7.3 – 7.5	8.1	5.7	23.9
MH178	Base Flow	6.6 – 7.1	5.5	4.9	81.7

*Note: Conventional parameters for event SW-1 at LS431 are not included in these averages; results appeared to be anomalous.

In general, TSS was high at MH178. At the time that sampling at this location was conducted, several partially covered piles of soil were present at the King County Maintenance Shop, located upstream of MH178. It is not known whether this is the source of the high TSS measured at this location.

In general, TSS was lowest at MH108, nearest the STST system, and somewhat higher at LS431 further downstream.

4.2.2 Chemical Analysis

PCBs

Total PCBs were calculated as the sum of detected Aroclors 1248, 1254, and 1260. Aroclors 1016, 1221, 1232, and 1242 were not detected in any samples. During sampled storm events, total PCBs exceeded the marine chronic water quality criterion (WQC) (0.030 µg/L) in five of nine samples at LS431, five of seven samples at MH108, and two of four samples at MH178. In base flow, both samples at MH178 exceeded the WQC.

Total PCB concentrations in whole water samples are summarized below:

Location	Event Type	No. of Samples	Total PCBs (µg/L)		
			Range	Average	Standard Deviation
LS431	Storm	9	0.011 – 0.17	0.046	0.050
MH108	Storm	7	0.013 – 0.10	0.052	0.033
MH178	Storm	4	<0.010 – 0.23	0.12	0.13
LS431	Base Flow	2	<0.010 – 0.013	0.0090	0.0057
MH178	Base Flow	2	0.048 – 0.13	0.089	0.058

Shaded cells indicate that the average concentration exceeds the WQC.
Average concentrations were calculated using 0.5 times the reporting limit for non-detects.

The average concentration of total PCBs exceeded the WQC during storm events at all sampling locations and during base flow events at MH178. Base flow concentrations were lower than storm flow concentrations at both LS431 and MH178.

Total PCB concentrations in whole water samples collected at LS431 and MH108 since October 2009 are shown in Figures 5 and 6, respectively. The shaded area indicates sampling conducted during the 2009–2010 wet season, which took place prior to installation of the STST system in the north lateral SD line.

Metals

Arsenic, cadmium, and chromium did not exceed the WQC in any whole water samples. Mercury was detected in a single sample, at MH178 during sampling event SW-7; total mercury was detected at 0.10 µg/L (above the WQC of 0.029 µg/L), and dissolved mercury was below detection. Nickel exceeded the WQC only at MH178, in two storm samples and two base flow samples. Selenium was not detected in any of the whole water samples. Silver was detected in two storm event samples at MH178 only, at a concentration of 0.20 µg/L.

Concentrations of total copper, lead, and zinc in whole water samples are summarized below. These metals were detected in every water sample that was collected, with the exception of lead in base flow at LS431, which was detected in one of two samples.

Location	Event Type	No. of Samples	Average Concentration (µg/L) [Range of Concentrations]		
			Total Copper	Total Lead	Total Zinc
WQC			3.1	8.1	81
LS431	Storm	9	7.1 [2.9 – 17.5]	7.3 [1.0 – 31]	51 [31 – 99]
MH108	Storm	7	6.8 [2.7 – 19.6]	3.4 [0.40 – 12]	57 [42 – 80]
MH178	Storm	4	54 [8.7 – 94]	60 [3.0 – 132]	153 [38 – 280
LS431	Base Flow	2	2.2 [1.6 – 2.7]	1.3 [<1.0 – 2.0]	15 [11 – 19]
MH178	Base Flow	2	29 [18 – 40]	130 [24 – 236]	78 [45 – 110]

Shaded cells indicate that the average concentration exceeds the WQC.
Average concentrations were calculated using 0.5 times the reporting limit for non-detects.

Average total copper concentrations exceeded the WQC in storm event samples at all locations, and at MH178 during base flow. Average concentrations of total lead and zinc exceeded the WQC at MH178 only. The highest concentrations of total metals in whole water samples were found at MH178, during both storm flow and base flow conditions.

Copper is the only dissolved metal that exceeded the WQC. One stormwater sample at LS431 (during SW-9), one stormwater sample at MH108 (SW-7), and all four samples collected at MH178 (SW-5, SW-7, SW-8, and SW-9) had dissolved copper concentrations above the WQC.

PAHs

HPAHs were detected more frequently than LPAHs (Tables 9 through 11). PAHs were compared to the marine water quality criteria for protection of human health from consumption of

organisms (HHO). Several HPAHs, including benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenz(a,h)anthracene, have an HHO criterion of 0.018 µg/L. These compounds frequently exceeded the HHO at LS431 and MH178. The HHO criterion was exceeded with about half this frequency at MH108.

Sample Location	Event Type	Average Total HPAH Concentration (µg/L)	Range of Total HPAH Concentrations (µg/L)
LS431	Storm	1.5	0.70 – 2.5
MH108	Storm	1.1	<0.011 – 4.8
MH178	Storm	18	0.54 – 41
LS431	Base Flow	0.19	0.072 – 0.30
MH178	Base Flow	5.9	4.5 – 7.2

Average concentrations were calculated using 0.5 times the reporting limit for non-detects.

The highest concentrations of HPAHs were detected at MH178. In general, base flow concentrations were lower than during storm events at a given location.

Other SVOCs

Additional SVOCs were analyzed but seldom detected. The following SVOCs were detected in whole water samples:

- Phenol (3 of 9 storm event samples at LS431; 2 of 7 storm event samples at MH108)
- Bis(2-ethylhexyl) phthalate (4 of 9 storm event samples at LS431; 3 of 4 storm event samples at MH178)
- Di-n-octylphthalate (1 of 9 storm event samples at LS431).

Bis(2-ethylhexyl)phthalate was detected at a level above the HHO criterion during event SW-5 at MH178 but was also detected in the associated blank sample.

4.3 Centrifuge Samples

Sampling results for centrifuged solids samples and associated lift station vault filtered solids samples are presented in Table 12. Evaluation of these results will be included in a subsequent Technical Memorandum (in preparation).

5.0 Quality Assurance/Quality Control

Analyses were conducted following the quality assurance/quality control (QA/QC) requirements specified in the project SAP/QAPP (SAIC 2009a, 2010b) and the referenced test methods. The QA/QC procedures ensure that the results of the investigation are defensible and usable for their intended purpose. An independent full-level, EPA Stage 3 or 4 data validation was performed on all of the chemical results by EcoChem, Inc. (EcoChem) of Seattle, Washington, following EPA guidance (EPA 1994, 2005, 2008, 2009, 2010) for analyses coordinated by SAIC. All results were considered acceptable for use, as qualified. No data were rejected during data validation. Issues resulting in data qualification are summarized below. A full list of qualified results including the reason for data qualification is presented in the data validation report in Appendix D.

Results for various chemicals were J- or UJ-qualified as estimated because one or more of the following were outside of control limits: calibration verification, matrix spike, laboratory control sample/laboratory control sample duplicate, ongoing precision and recovery, internal standard, surrogate, and/or reporting limit verification recoveries; or duplicate sample or second column confirmation results' relative percent difference. The DOC and TOC results in samples NBF-LS431-111710-W and NBF-MH108-111710-W were J-qualified as estimated because the DOC concentrations (30.4 and 31.1 mg/L, respectively) were significantly greater that the TOC concentrations (8.06 and 5.88 mg/L, respectively). The PCB results for samples NBF-MH108-042511-W and NBF-LS431-042511-W were also J-/UJ-qualified as estimated because they were reported outside of the standard 7 day holding time. These samples were initially extracted and analyzed within the standard 7 day holding time; however, they were re-extracted 14 days outside of holding time because laboratory contamination was suspected during the initial analysis.

Eighteen results for eight chemicals (i.e., nitrate and seven PAH compounds) in whole water samples were re-qualified as nondetect at elevated reporting limits (RLs) because of method blank contamination, including the following: five results for nitrate ranging from 0.2 to 0.4 mg/L; four results for naphthalene ranging from 0.020 to 0.029 µg/L; two results each for benzo(a)pyrene, benzo(g,h,i)perylene, and indeno(1,2,3-cd)pyrene ranging from 0.019 to 0.042 µg/L; and one result each for 2-methylnaphthalene, dibenzo(a,h)anthracene, and total benzofluoranthenes ranging from 0.010 to 0.066 µg/L.

Thirty results for five individual PCB Aroclors were Y-qualified by ARI as nondetect at elevated RLs because chromatographic interferences prevented adequate resolution of the compound at the standard RL. One result for 1,2,3,4,7,8- hexachlorodibenzofuran was K-qualified by Axys as being an estimated maximum possible concentration because not all method-required compound identification parameters were met. These results were re-qualified as nondetect (U-qualified) by EcoChem at the reported concentrations.

Some planned analyses (e.g., metals and/or grain size on some specific samples) and/or project specific laboratory QA/QC samples could not be performed because of insufficient sample volume. Field QA/QC samples such as field replicates, whole water equipment rinse blank samples (i.e., rinsate from the Isco samplers), and blank filter bag analyses were conducted as part of the preliminary and/or expanded stormwater sampling events (SAIC 2010a, 2011) and were not repeated for the stormwater sampling events reported herein.

6.0 Summary

Stormwater sampling conducted at NBF between November 2010 and May 2011 was a continuation of the stormwater monitoring program that was initiated in 2009. As part of this effort, filtered suspended solids and whole water samples were collected during nine storm events and three base flow events at one or more of the following sampling locations:

- LS431, located on the discharge (southwest) side of the KC lift station. All four major SD lines plus the Building 3-380 line drain to the lift station prior to entering Slip 4.
- MH108, located along the north lateral SD line, north of Building 3-380 and near the corner of Building 3-350. MH108 is approximately 250 feet (76 meters) downstream of the STST system.
- CB173, located along a tributary to the north lateral SD line in the parking lot west of Building 3-323 and about 125 feet (38 meters) southwest of the GTSP boundary.
- MH178, located along the north lateral SD line and approximately 20 feet northwest of CB173. MH178 is the farthest upgradient north lateral structure on the NBF property. Although a small area of NBF also drains to MH178, this location best represents the offsite contribution of stormwater flow to the north lateral.

Continuous flow measurements were collected at LS431, MH108, and MH178 during various portions of the sampling period. Results are summarized below by sampling location.

LS431

Filtered solids and whole water samples were collected during nine storm events and two base flow events at the KC lift station (sampling location LS431). In general, concentrations of contaminants were lower in base flow samples than in storm event samples. (Note that only two base flow samples were collected at LS431 during the 2010–2011 sampling season.)

PCBs. Despite implementation of STST, total PCBs in filtered solids at the lift station continued to exceed the LAET in all samples except one base flow sample. Concentrations ranged from 0.32 to 1.7 mg/kg DW in storm flow and from 0.092 to 0.81 mg/kg DW in base flow. In whole water samples, total PCB concentrations exceeded the marine chronic WQC of 0.030 µg/L in five of nine stormwater samples (0.011 to 0.17 µg/L). Neither of the base flow samples exceeded the WQC.

Metals. Cadmium, mercury, and zinc exceeded the SQS in at least one storm event filtered solids sample at LS431. Mercury (5.6 mg/kg DW during event SW-1) exceeded the CSL value of 0.59 mg/kg DW in one sample. In whole water, copper consistently exceeded the WQC of 3.7 µg/L (eight of nine storm event samples). In addition, lead (three of nine samples) and zinc (one sample) also exceeded the WQC.

PAHs. Several HPAH compounds were detected in filtered solids at estimated concentrations above the LAET: fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene, benzofluoranthenes, and total HPAH. Fluoranthene, indeno(1,2,3-cd)pyrene, and benzo(g,h,i)perylene exceeded the 2LAET. In general, exceedances were only slightly above the

LAET/2LAET. In whole water, the carcinogenic PAH compounds consistently exceeded the human health WQC of 0.018 µg/L.

Dioxins/Furans. Dioxins/furans were analyzed in filtered solids from four storm event samples and one base flow sample. Dioxin/furan TEQs ranged from 7.5 to 71.3 pg/g in storm event samples, with a lower concentration (2.9 pg/g TEQ) in the base flow sample. The storm event concentrations are consistently higher than the LDW dioxin/furan natural background concentration of 2 pg/g TEQ.

MH108

Seven storm event samples and no base flow samples were collected at MH108, located downstream of the STST system.

PCBs. PCBs in filtered solids exceeded the LAET (0.13 mg/kg DW) and the 2LAET (1.0 mg/kg DW) in all samples. Concentrations ranged from 1.5 to 4.4 mg/kg DW. In whole water, total PCBs exceeded the marine WQC of 0.030 µg/L in five of the seven samples collected, with concentrations ranging from 0.013 to 0.10 µg/L.

Metals. Cadmium and zinc exceeded the SQS in most of the storm event filtered solids samples, and mercury exceeded the SQS in one sample. In whole water samples, total copper exceeded the WQC in three samples, and dissolved copper exceeded the WQC in one sample. Total lead exceeded the WQC in one sample.

PAHs. PAH concentrations in filtered solids samples were estimated during two storm events; concentrations of most HPAH compounds exceeded the LAET. In whole water, several HPAH compounds exceeded the human health WQC in five of seven samples.

Dioxins/Furans. Dioxins/furans were analyzed in filtered solids from three storm event samples. Dioxin/furan TEQs ranged from 27.2 to 69.4 pg/g in storm event samples; these are consistently higher than the LDW dioxin/furan natural background concentration of 2 pg/g TEQ.

MH178

Filtered solids and whole water samples were collected during four storm events and two base flow events at MH178, located at the upstream end of the north lateral.

PCBs. Total PCBs in filtered solids samples exceeded the LAET in all samples analyzed, but only one sample (collected during event SW-9) exceeded the 2LAET. Concentrations ranged from 0.21 to 5.4 mg/kg DW in storm flow and from 0.57 to 1.0 mg/kg DW in base flow. In whole water samples, total PCB concentrations exceeded the marine chronic WQC of 0.030 µg/L in two of the four stormwater samples (<0.010 to 0.23 µg/L) and in both base flow samples (0.048 to 0.13 µg/L).

Metals. Mercury concentrations in filtered solids were consistently high at this location, with concentrations ranging from 0.60 to 14.6 mg/kg DW during storm events, and 2.6 to 16.1 mg/kg DW in base flow samples. These concentrations all exceed the CSL of 0.59 mg/kg DW. Total mercury in whole water exceeded the WQC in one sample (0.10 µg/L); however, reporting limits for all other samples were higher than the WQC (0.029 µg/L). In addition, total cadmium, silver, and zinc exceeded the SQS in one or more filtered solids samples. In whole water, concentrations of total copper (to 94 µg/L), total lead (to 132 µg/L), and total zinc (to 280 µg/L)

were particularly high in two of the four storm event samples (SW-5 and SW-7). Dissolved copper exceeded the WQC in all four storm event samples. Nickel also exceeded the WQC in storm flow and base flow samples.

PAHs. Several HPAH compounds and one LPAH compound were detected in filtered solids at estimated concentrations above the LAET during event SW-9. In whole water, the carcinogenic HPAH compounds[2] consistently exceeded the HHO water quality criterion of 0.018 µg/L. In particular, relatively high concentrations of carcinogenic PAH compounds (e.g., benzo[a]pyrene at 3.6 µg/L) were detected during sampling events SW-5 and SW-7. Total HPAH concentrations in these two whole water samples were 41 and 31 µg/L, respectively.

Dioxins/Furans. Dioxins/furans were analyzed in filtered solids from two storm event samples and one base flow sample. Dioxin/furan TEQs ranged from 29.0 to 30.8 pg/g in storm event samples, with a lower concentration (4.1 pg/g TEQ) in base flow. The storm event concentrations are consistently higher than the LDW dioxin/furan natural background concentration of 2 pg/g TEQ.

CB173

Filtered solids were collected during four storm events and three base flow events at CB173, located on a subdrainage of the north lateral SD. No whole water samples were collected at this location.

PCBs. Total PCBs in filtered solids samples exceeded the LAET and 2LAET in all samples analyzed. Concentrations ranged from 1.3 to 9.7 mg/kg DW in storm flow and from 75 to 99 mg/kg DW in base flow.

Metals. Cadmium (to 15.2 mg/kg DW) and mercury (to 1.2 mg/kg DW) exceeded the CSL in three samples, while zinc significantly exceeded the CSL in all four storm event samples (1,050 to 4,990 mg/kg DW) and one base flow sample (1,100 mg/kg DW). Lead and arsenic were also detected in one base flow sample at concentrations above the SQS and/or the CSL.

PAHs. Only one HPAH compound (benzo[g,h,i]perylene) was detected in filtered solids samples at CB173 at a concentration above the SQS.

Dioxins/Furans. Dioxins/furans were analyzed in filtered solids from one storm event sample and one base flow sample. Dioxin/furan TEQs were measured at 274 pg/g in storm event sample SW-2, and 64.4 pg/g in base flow sample BF-2. These concentrations are significantly higher than the LDW dioxin/furan natural background concentration of 2 pg/g TEQ.

[2] The following HPAH compounds detected in stormwater at NBF are considered carcinogenic: benzo(a)anthracene, chrysene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, and benzofluoranthenes.

7.0 References

Ecology. 2009. Standard Operating Procedure for Automatic Sampling for Stormwater Monitoring. Washington State Department of Ecology. Draft Version 1.0.

EPA. 2006. National Recommended Water Quality Criteria. Prepared by United States Environmental Protection Agency, Office of Water, Office of Science and Technology. 2006.

EPA, Office of Emergency and Remedial Response. February 1994. *USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review.* EPA 540/R-94/013. Washington, DC.

EPA, Analytical Services Branch. September 2005. USEPA Analytical Services Branch (ASB) National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review. Prepared by U.S. Environmental Protection Agency. EPA-540-R-05-001. Washington, DC.

EPA, Office of Emergency and Remedial Response. June 2008. *USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review*. EPA-540-R-08-01. Washington, DC.

EPA, Office of Emergency and Remedial Response. January 2009. *Guidance for labeling externally validated laboratory analytical data for Superfund use.* EPA-540-R-08-005. Washington, DC.

EPA, Office of Emergency and Remedial Response. January 2010. *USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review*. EPA 540-R-10-011. Washington, DC.

PTI. 1988. Sediment Quality Values Refinement: 1988 Update and Evaluation of Puget Sound AET. Volume I. Final Report. Prepared for Tetra Tech, Inc., Bellevue, WA, and the U.S. Environmental Protection Agency, Region 10, Seattle, WA. Prepared by PTI Environmental Services, Bellevue, WA.

SAIC. 2009a. North Boeing Field/Georgetown Steam Plant Site Remedial Investigation/ Feasibility Study: Sampling and Analysis Plan and Quality Assurance Project Plan for Preliminary Stormwater and Filtered Suspended Solids Sampling. Prepared for Toxics Cleanup Program, Northwest Regional Office, Washington State Department of Ecology, by SAIC, Bothell, WA. August 2009.

SAIC. 2009b. North Boeing Field and Georgetown Steam Plant, Supplemental Report: Summary of Existing Information and Identification of Data Gaps. Prepared for Toxics Cleanup Program, Northwest Regional Office, Washington State Department of Ecology, by SAIC, Bothell, WA. August 2009.

SAIC. 2010a. North Boeing Field/Georgetown Steam Plant Site Remedial Investigation/ Feasibility Study: Preliminary Stormwater Sampling Interim Data Report. Prepared for Washington State Department of Ecology Toxics Cleanup Program, Northwest Regional Office, by SAIC, Bothell, WA. May 2010.

SAIC. 2010b. North Boeing Field/Georgetown Steam Plant Site Remedial Investigation/ Feasibility Study: Work Plan and SAP/QAPP Addendum Expanded Stormwater Monitoring. Prepared for Toxics Cleanup Program, Northwest Regional Office, Washington State Department of Ecology, by SAIC, Bothell, WA. March 2010.

SAIC. 2010c. North Boeing Field/Georgetown Steam Plant Site Remedial Investigation/ Feasibility Study: Stormwater Sampling SAP/QAPP Addendum #2, 2010-2011 Stormwater Monitoring. Prepared for Toxics Cleanup Program, Northwest Regional Office, Washington State Department of Ecology, by SAIC, Bothell, WA. November 12, 2010.

SAIC. 2011a. North Boeing Field/Georgetown Steam Plant Site Remedial Investigation/ Feasibility Study: Expanded Stormwater Sampling Interim Data Report (Updated). Prepared for Washington State Department of Ecology Toxics Cleanup Program, Northwest Regional Office, by SAIC, Bothell, WA. January 2011.

SAIC. 2011b. North Boeing Field/Georgetown Steam Plant Site Remedial Investigation/ Feasibility Study: SAP/QAPP Addendum #3, 2010-2011 Stormwater Monitoring, Centrifuge Sampling. Prepared for Toxics Cleanup Program, Northwest Regional Office, Washington State Department of Ecology, by SAIC, Bothell, WA. February 17, 2011.

Van den Berg, M., L.S. Bimbaum, M. Denison, M. De Vito, W. Farland, M. Feeley, H. Fiedler, H. Hakansson, A. Hanberg, L. Haws, M. Rose, S. Safe, D. Schrenk, C. Tohyama, A. Tritscher, J. Tuomisto, M. Tysklind, N. Walker, and R. Peterson. 2006. The 2005 World Health Organization Re-Evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds. Prepared for the World Health Organization (WHO). ToxSci Advance Access published July 7, 2006. Published by Oxford University Press on behalf of the Society of Toxicology.

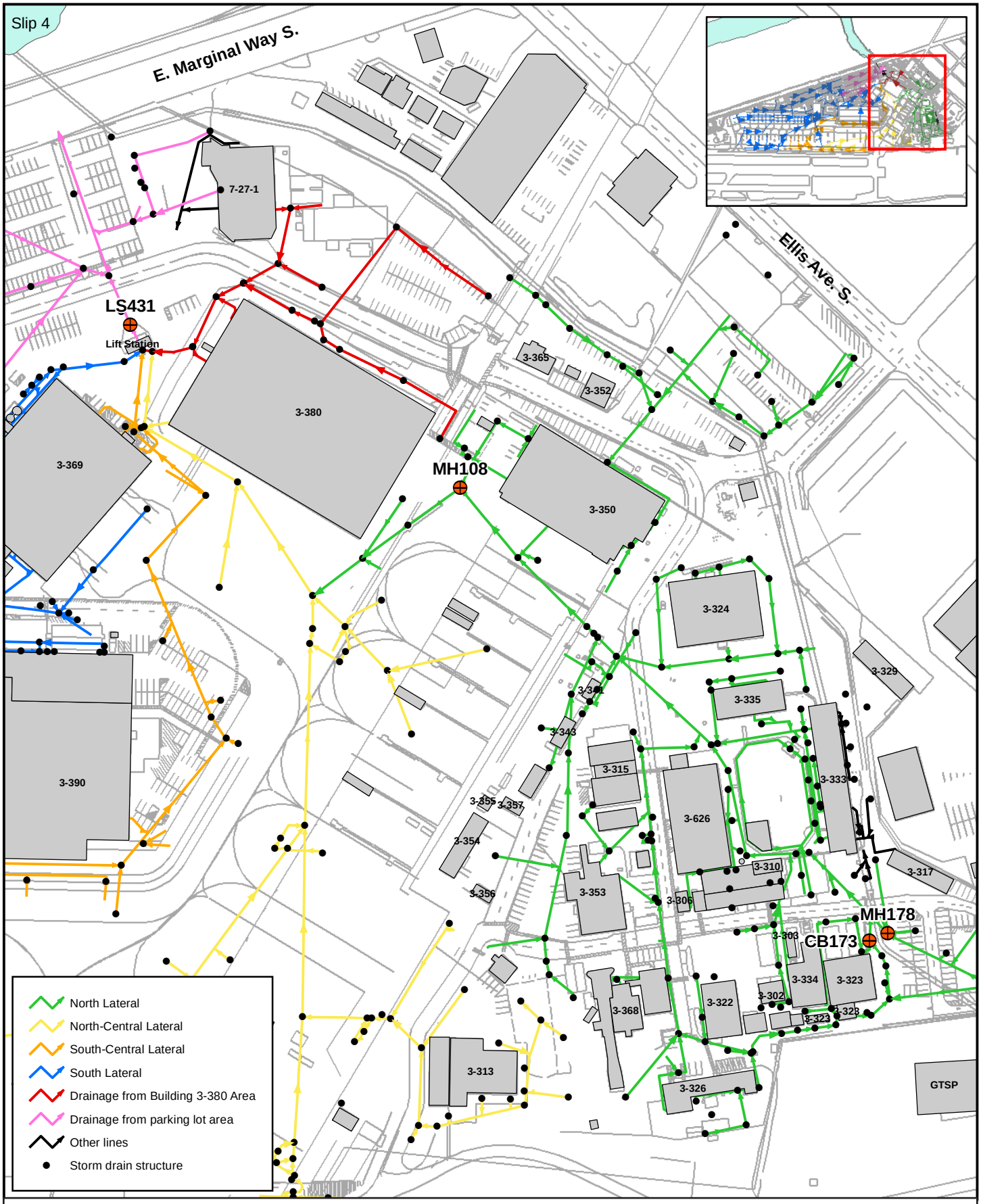
Figures

DEPARTMENT OF ECOLOGY
State of Washington

Figure 1. NBF Storm Drain Lines

0 300 600 1,200 Feet

SAIC® From Science to Solutions

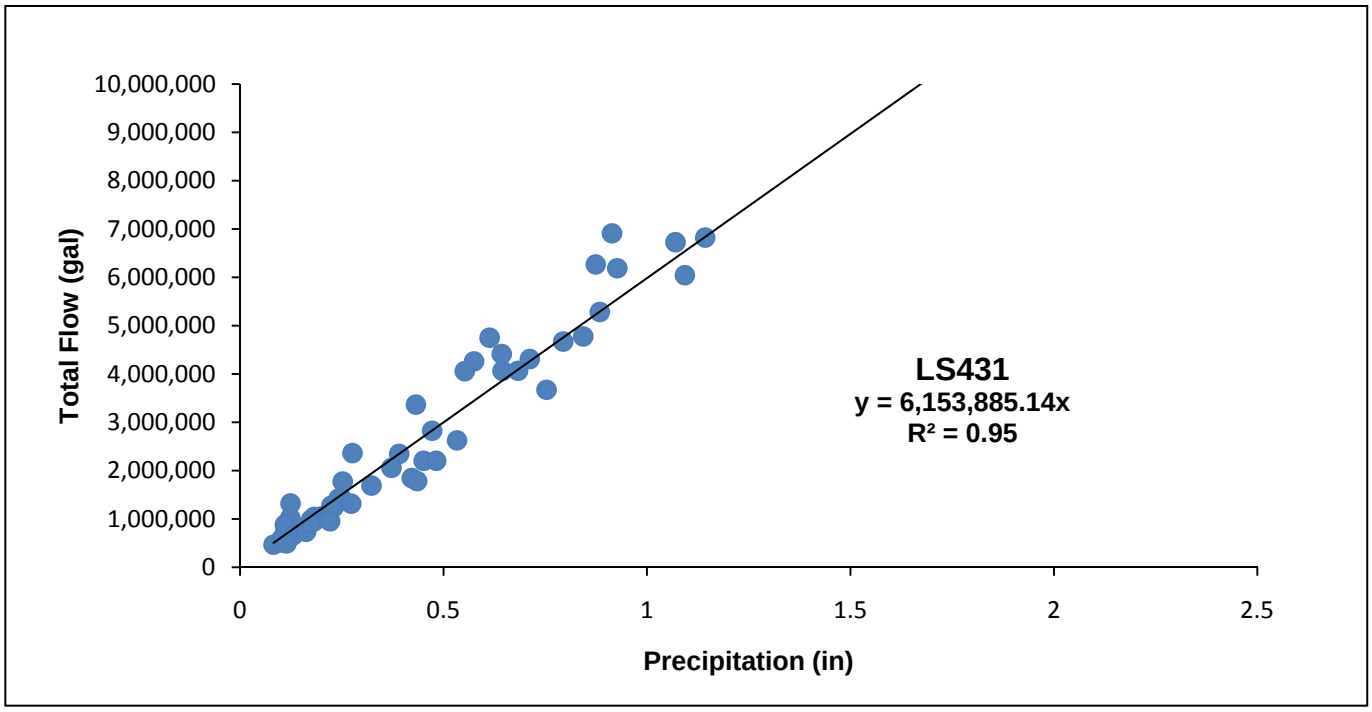


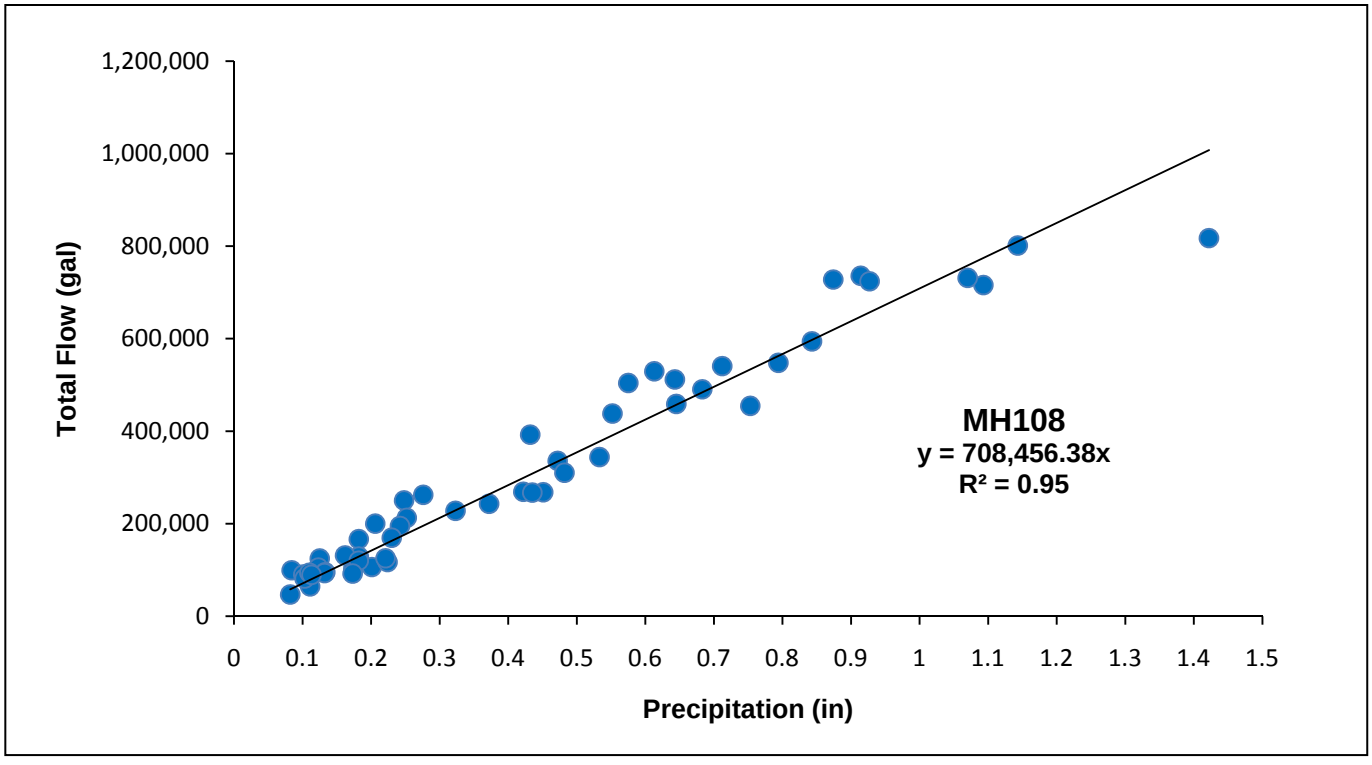
DEPARTMENT OF ECOLOGY
State of Washington

Figure 2. 2010–2011 Stormwater Sampling Locations

0 100 200 400 Feet

SAIC® From Science to Solutions



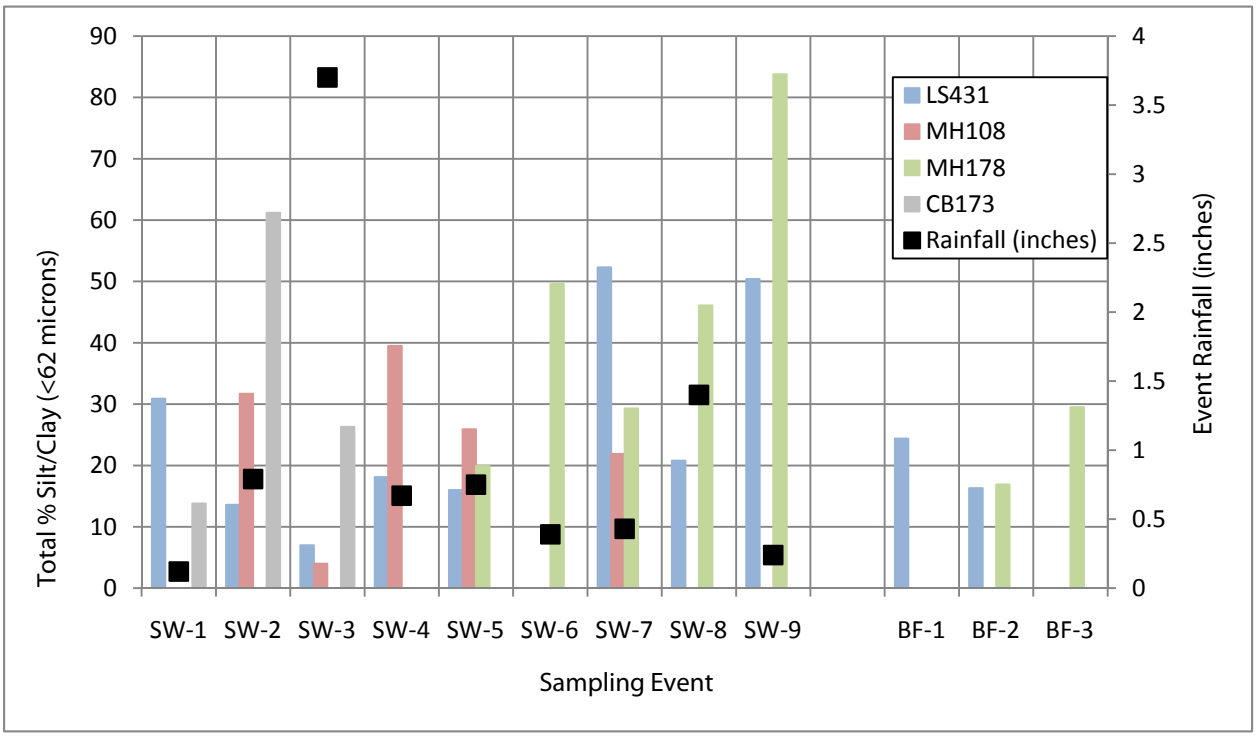


DEPARTMENT OF ECOLOGY
State of Washington

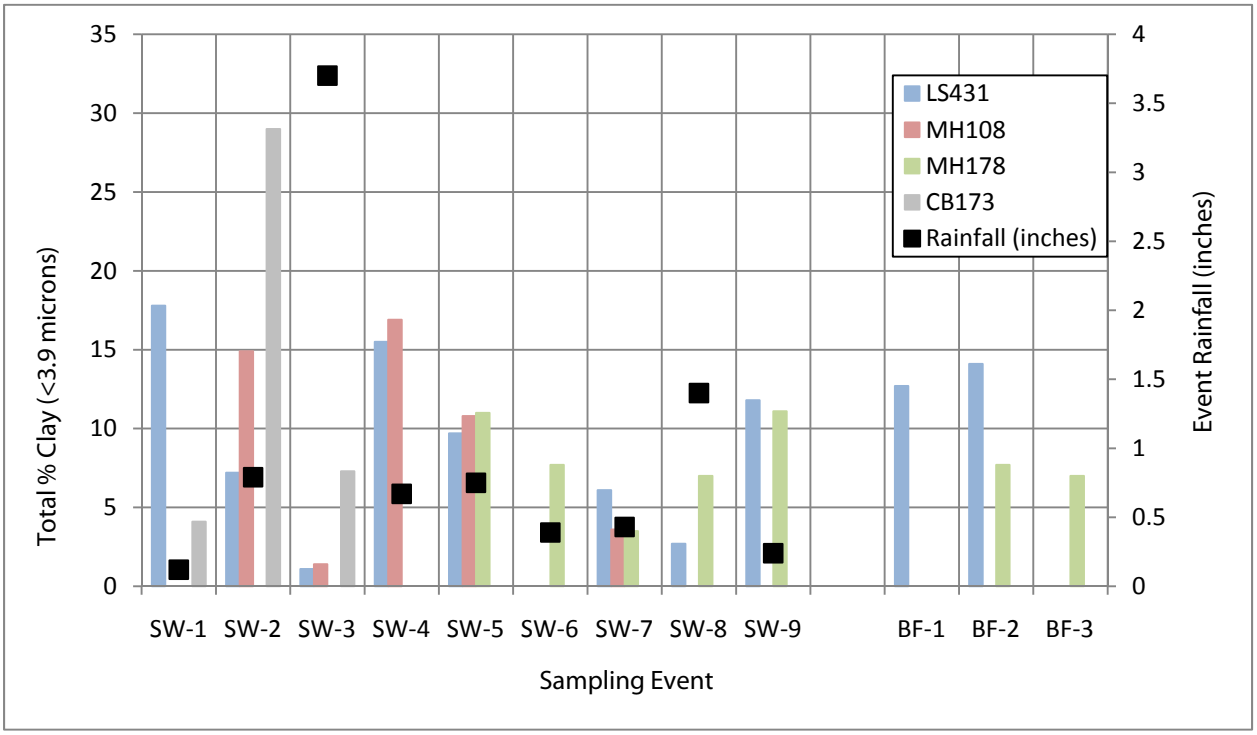
Figure 3. Runoff Volume vs. Precipitation

SAIC® From Science to Solutions

Percent Fines (<62 microns) in Filtered Solids Samples, by Sampling Event



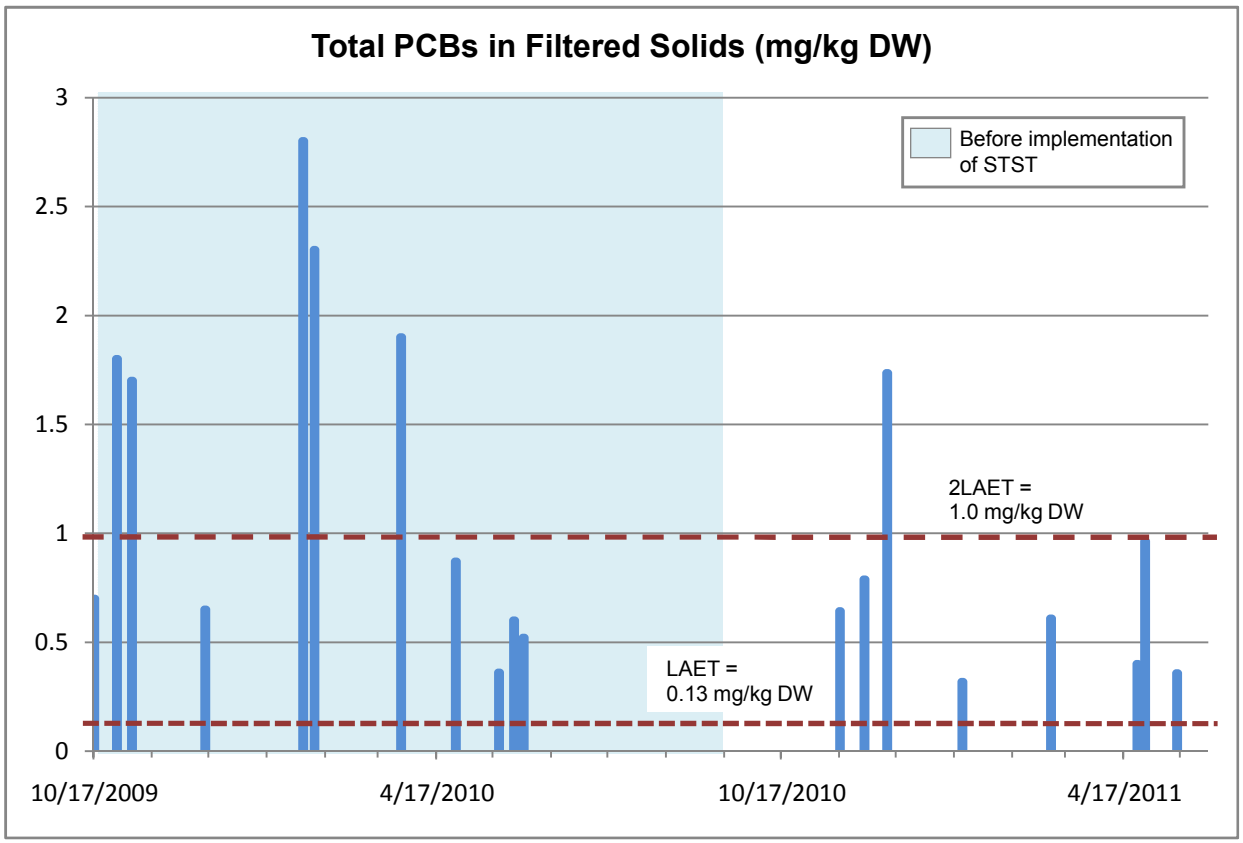
Percent Clay (<3.9 microns) in Filtered Solids Samples, by Sampling Event

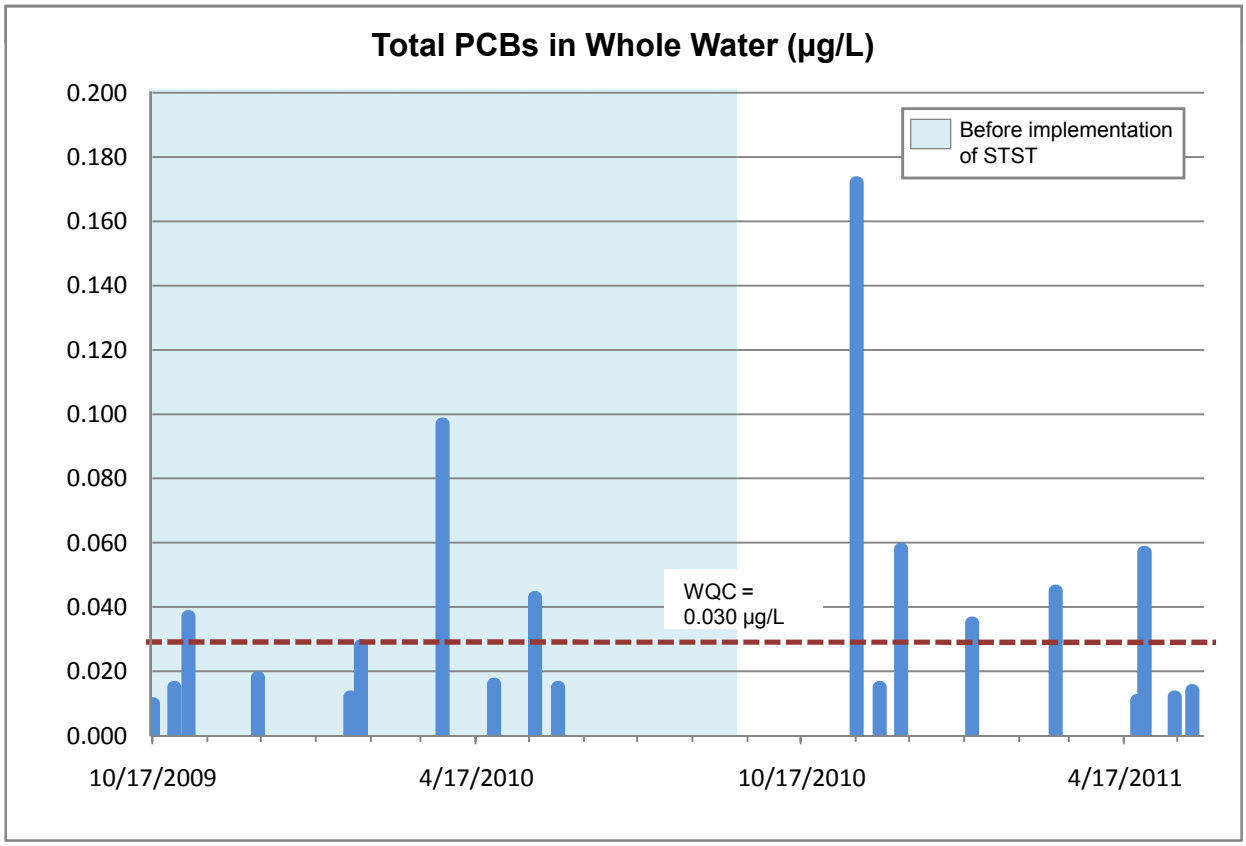


DEPARTMENT OF ECOLOGY
State of Washington

Figure 4. Percent Fines in Filtered Solids Samples

SAIC® From Science to Solutions

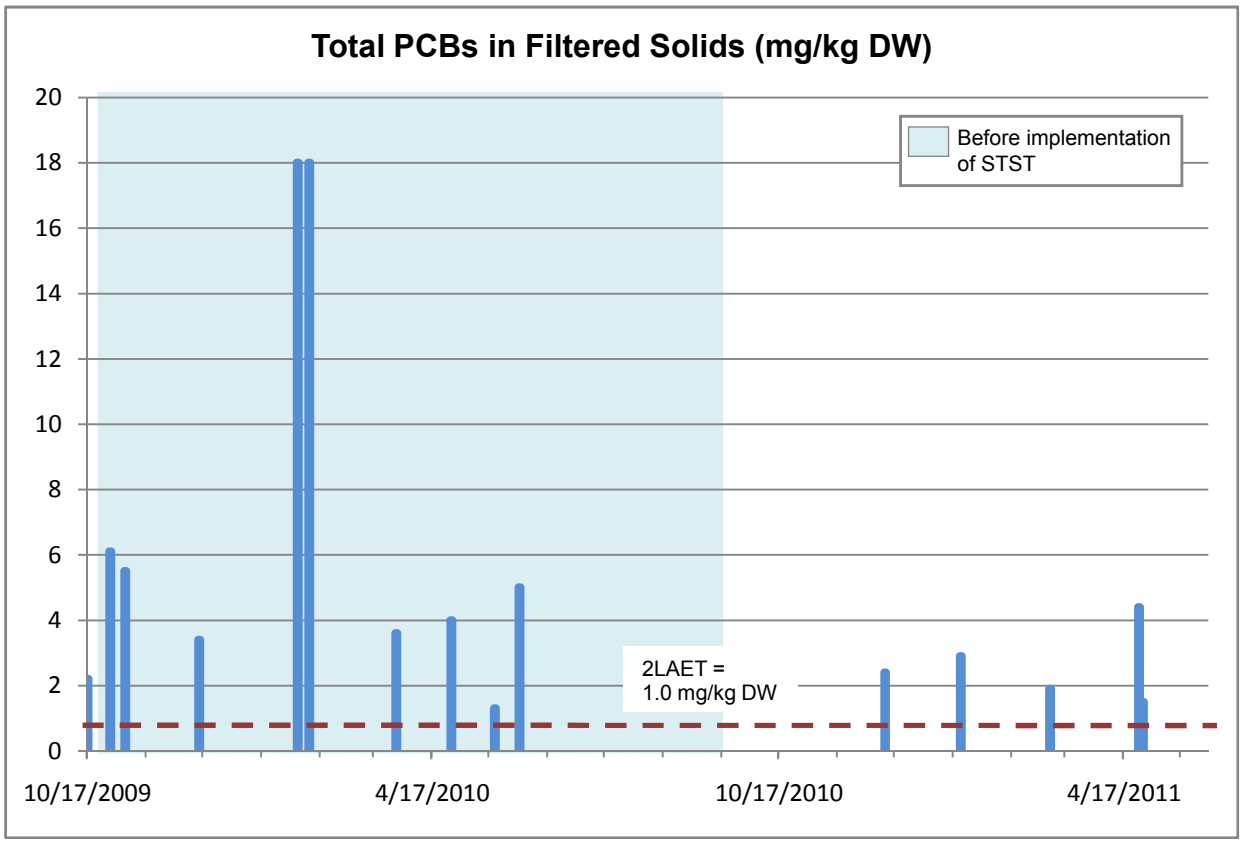


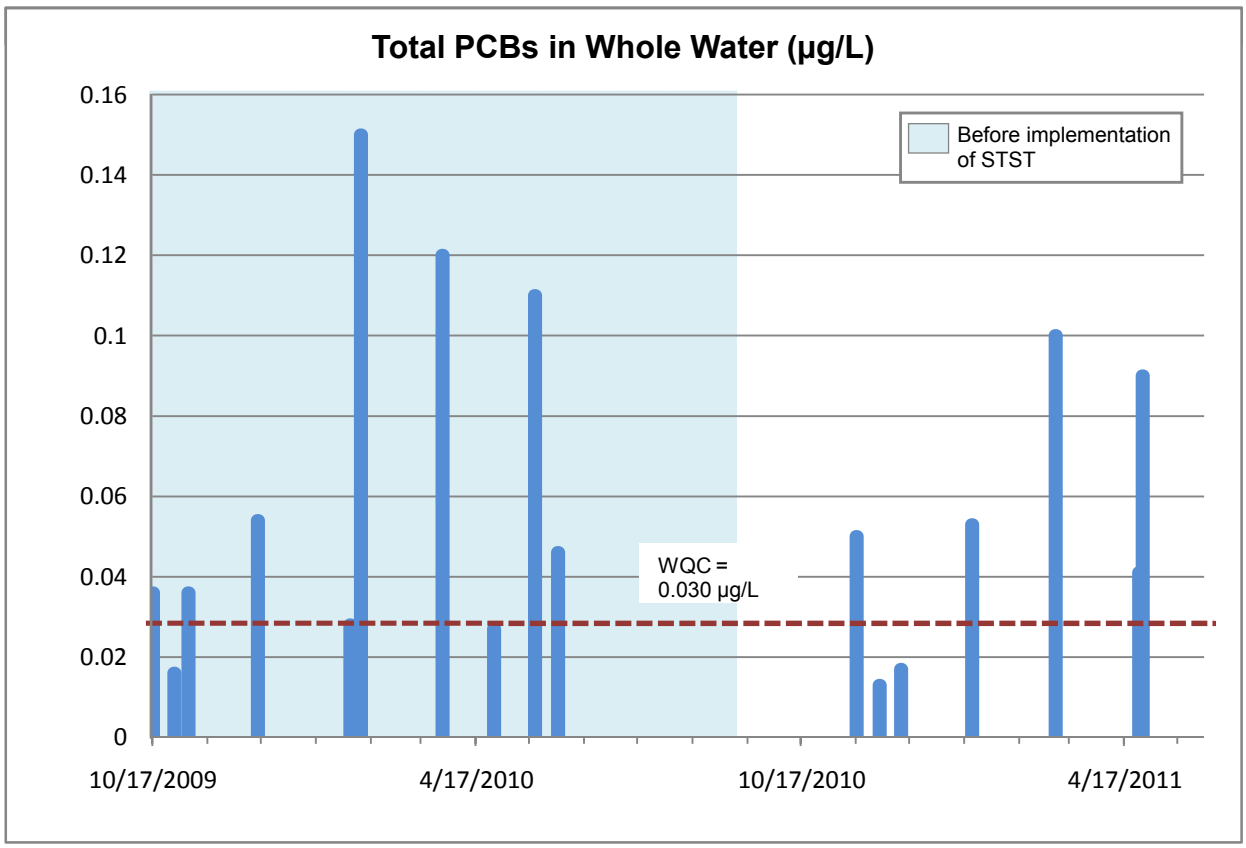


DEPARTMENT OF ECOLOGY
State of Washington

Figure 5. Total PCBs in Filtered Solids and Whole Water at LS431 (October 2009 through May 2011)

SAIC® From Science to Solutions



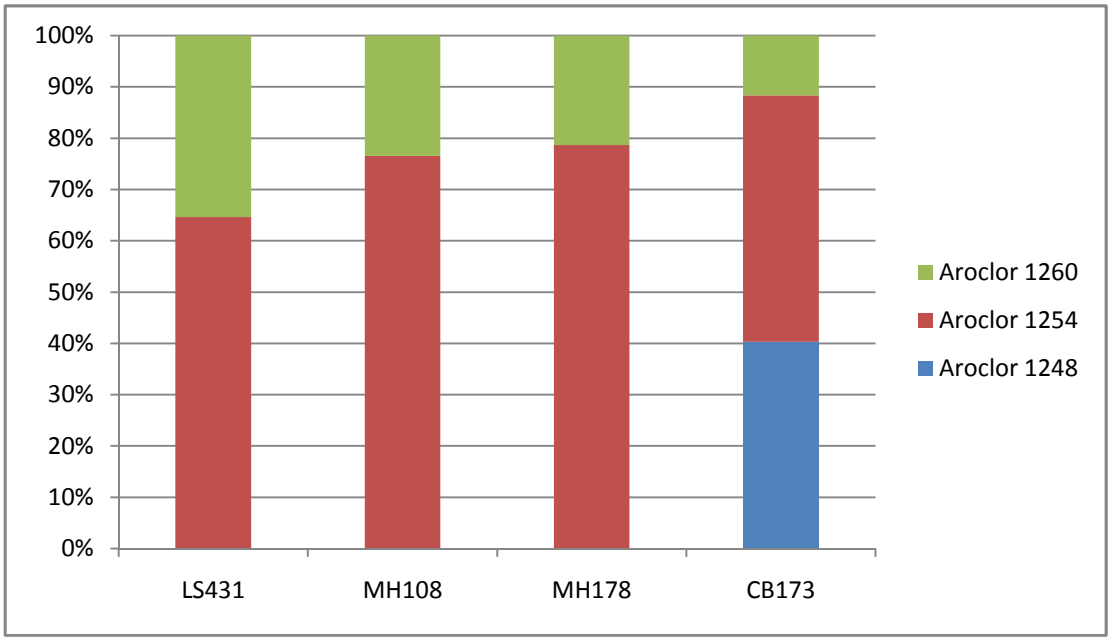


DEPARTMENT OF ECOLOGY
State of Washington

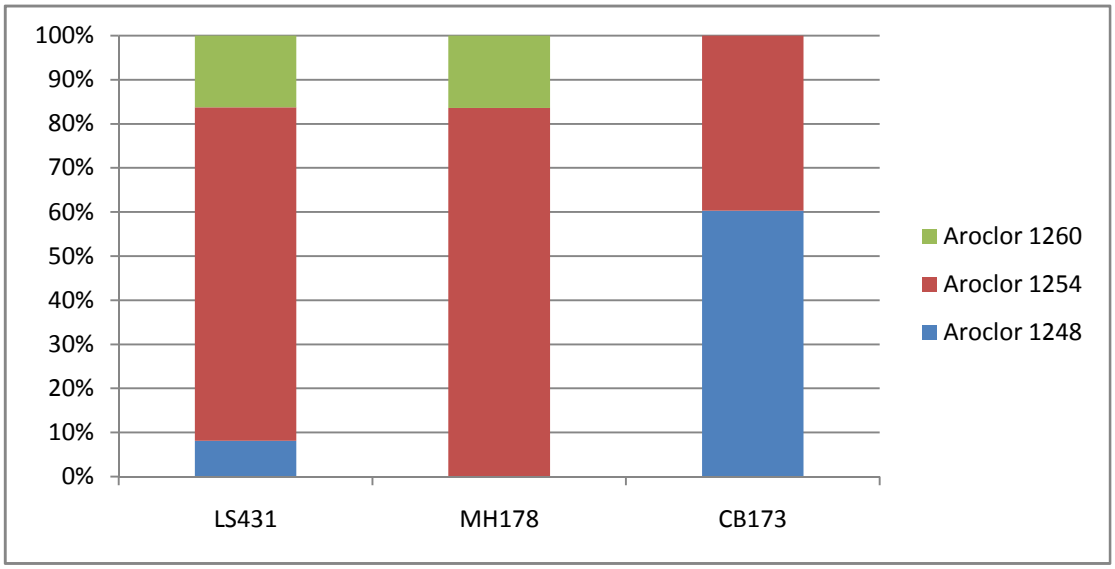
Figure 6. Total PCBs in Filtered Solids and Whole Water at MH108 (October 2009 through May 2011)

SAIC® From Science to Solutions

PCB Distribution by Aroclor In Filtered Solids - Storm Events



PCB Distribution by Aroclor in Filtered Solids - Base Flow Events



Note: Non-detected Aroclors were assumed to have a concentration of 0 mg/kg for purposes of this exercise.

DEPARTMENT OF ECOLOGY
State of Washington

Figure 7. PCB Distribution by Aroclors in Filtered Solids Samples

SAIC® From Science to Solutions

Tables

Table 1
2010-2011 Stormwater Sampling Events

Event Type	Event Number	Event Precipitation (inches)	Sample Location	Sample Begin Date	Sample End Date	Whole Water	Filtered Solids	Centrifuge Solids	Collected By
Storm Event	SW-1	0.12	CB173	11/17/2010	11/17/2010		●		SAIC
			LS431	11/17/2010	11/17/2010	●	●		SAIC
			MH108	11/17/2010	11/17/2010	●	●		SAIC
	SW-2	0.79	CB173	11/29/2010	11/30/2010		●		SAIC
			LS431	11/29/2010	11/30/2010	●	●		Landau
			MH108	11/29/2010	11/30/2010	●	●		Landau
	SW-3	3.7	CB173	12/11/2010	12/12/2010		●		SAIC
			LS431	12/11/2010	12/12/2010	●	●		Landau
			MH108	12/11/2010	12/12/2010	●	●		Landau
	SW-4	0.67	CB173	1/20/2011	1/21/2011		●		SAIC
			LS431	1/20/2011	1/21/2011	●	●		Landau
			MH108	1/20/2011	1/21/2011	●	●		Landau
	SW-5	0.75	LS431	3/9/2011	3/9/2011	●	●		Landau
			MH108	3/9/2011	3/9/2011	●	●		Landau
			MH178	3/9/2011	3/9/2011	●	●		Landau
	SW-6	0.39	LS431	4/25/2011	4/25/2011	●	●		SAIC
			MH108	4/25/2011	4/25/2011	●	●		SAIC
			MH178	4/25/2011	4/25/2011		●		SAIC
	SW-7	0.43	LS431	4/27/2011	4/27/2011	●	●		SAIC
			MH108	4/27/2011	4/27/2011	●	●		SAIC
			MH178	4/27/2011	4/27/2011	●	●		SAIC
	SW-8	1.4	LS431	5/14/2011	5/15/2011	●	●		SAIC
			MH178	5/14/2011	5/15/2011	●	●		SAIC
	SW-9	0.24	LS431	5/25/2011	5/25/2011	●	●		SAIC
			MH178	5/25/2011	5/25/2011	●	●		SAIC
Base Flow	BF-1	NA	CB173	1/25/2011	1/27/2011		●		SAIC
			LS431	1/25/2011	1/28/2011	●	●		Landau
	BF-2	NA	CB173	3/19/2011	3/23/2011		●		SAIC
			LS431	3/19/2011	3/21/2011	●	●		Landau
			MH178	3/19/2011	3/21/2011	●	●		Landau
	BF-3	NA	CB173	4/17/2011	4/21/2011		●		SAIC
			MH178	4/17/2011	4/21/2011	●	●		SAIC
Centrifuge/ Vault Sample	CF-1	NA	CF431V	3/25/2011	3/25/2011	●		●	SAIC
			LS431V	3/25/2011	3/25/2011	●	●		SAIC
	CF-2 (SW-7)	0.43	CF431V	4/27/2011	4/28/2011	●		●	SAIC
			LS431V	4/27/2011	4/28/2011	●	●		SAIC
	CF-3 (SW-9)	0.24	CF431V	5/25/2011	5/26/2011	●		●	SAIC
			LS431V	5/25/2011	5/25/2011	●	●		SAIC

Table 2
Chemical and Physical Analysis of Filtered Solids Samples

Sampling Event	Sample ID	Lab ID	PCB Aroclors (SW8082)	Metals (SW6010B)	Mercury (SW7471A)	PAHs (SW8270D)	SIM PAH (SW8270D-SIM)	Dioxin/ Furan Congeners (MLA-017/ EPA1613B)	Grain Size (PSEP 1986)	TOC (Plumb 1981)
SW-1	NBF-LS431A-111710-S	RX28E, RX28F	●	●	●				●	
	NBF-LS431B-111710-S	RX28G				●				
	NBF-MH108A-111710-S	RX28H	●							
	NBF-MH108B-111710-S	RX28J				●				
	NBF-CB173A-111710-S	RX28K, RX28L	●						●	
	NBF-CB173B-111710-S	RX28M, RX28N		●	●	●				
SW-2	NBF-CB173A-113010-S	RY65A, RY65B	●	●	●				●	
	NBF-CB173B-113010-S	L16461-1						●		
	NBF-LS431A-113010-S	RY71A, RY71B	●	●	●				●	
	NBF-LS431B-113010-S	L15874-1						●		
	NBF-MH108A-113010-S	RY71C, RY71D	●	●	●				●	
	NBF-MH108B-113010-S	L15874-2						●		
SW-3	NBF-CB173A-121210-S	SA46A	●							
	NBF-CB173B-121210-S	SA46B, SA46C		●	●	●			●	
	NBF-LS431A-121210-S	SA36A	●							
	NBF-LS431B-121210-S	SA36B, SA36C		●	●	●			●	
	NBF-MH108A-121210-S	SA36D	●							
	NBF-MH108B-121210S	SA36E, SA36F		●	●	●			●	
SW-4	NBF-CB173A-012111-S	SF80A	●							
	NBF-CB173B-012111-S	SF80B, SF80C		●	●	●				
	NBF-LS431A-012111-S	SF77A, SF77B	●	●	●				●	
	NBF-LS431B-012111-S	SF77E						●		
	NBF-MH108A-012111-S	SF77C, SF77D	●	●	●				●	
	NBF-MH108B-012111-S	SF77F						●		
SW-5	NBF-LS431A-030911-S	SM45A	●							
	NBF-LS431B-030911-S	SM45B, SM45C		●	●	●			●	
	NBF-MH108A-030911-S	SM45D	●							
	NBF-MH108B-030911-S	SM45E, SM45F		●	●	●			●	
	NBF-MH178A-030911-S	SM45G	●							
	NBF-MH178B-030911-S	SM45H, SM45I		●	●	●			●	
SW-6	NBF-MH178A-042511-S	L16511-2						●		
	NBF-MH178B-042511-S	ST90A, ST90B	●	●	●				●	
	NBF-MH108A-042511-S	L16511-3						●		
	NBF-MH108B-042511-S	ST90C	●							
	NBF-LS431A-042511-S	L16511-4						●		
	NBF-LS431B-042511-S	ST90E, ST90F	●	●	●					
SW-7	NBF-MH178A-042711-S	L16511-5						●		
	NBF-MH178B-042711-S	SU23E, SU23F	●	●	●				●	
	NBF-MH108A-042711-S	L16511-6						●		
	NBF-MH108B-042711-S	SU23G, SU23H	●	●	●				●	
	NBF-LS431A-042811-S	L16511-7						●		
	NBF-LS431B-042811-S	SU23I, SU23J	●	●	●				●	

Table 2
Chemical and Physical Analysis of Filtered Solids Samples

Sampling Event	Sample ID	Lab ID	PCB Aroclors (SW8082)	Metals (SW6010B)	Mercury (SW7471A)	PAHs (SW8270D)	SIM PAH (SW8270D-SIM)	Dioxin/ Furan Congeners (MLA-017/ EPA1613B)	Grain Size (PSEP 1986)	TOC (Plumb 1981)
SW-8	NBF-LS431A-051511-S	SW98C	●							
	NBF-LS431B-051511-S	SW98D, SW98I		●	●	●			●	
	NBF-MH178A-051511-S	SW98E	●							
	NBF-MH178B-051511-S	SW98F, SW98J		●	●	●			●	
SW-9	NBF-MH178A-052511-S	SY78A	●							
	NBF-MH178B-052511-S	SY78B, SY78C		●	●	●			●	
	NBF-LS431A-052511-S	SY78D	●							
	NBF-LS431B-052511-S	SY78E, SY78F		●	●	●			●	
BF-1	NBF-CB173A-012711-S	SG67A	●							
	NBF-CB173B-012711-S	SG67B, SG67C		●	●	●				
	NBF-LS431A-012811-S	SG73A	●							
	NBF-LS431B-012811-S	SG73B, SG73C		●	●	●			●	
BF-2	NBF-CB173A-032311-S	SO77A, SO77B	●	●	●					
	NBF-CB173B-032311-S	L16511-1						●		
	NBF-LS431A-032111-S	SO20A, SO20B	●	●	●					
	NBF-LS431B-032111-S	SO20E						●		
	NBF-MH178A-032111-S	SO20C, SO20D	●	●	●					
	NBF-MH178B-032111-S	SO20F						●		
BF-3	NBF-CB173A-42111-S	ST52A	●							
	NBF-CB173B-42111-S	ST52B, ST52C		●	●	●				
	NBF-MH178A-42111-S	ST52D	●							
	NBF-MH178B-42111-S	ST52E, ST52F		●	●	●			●	
CF-1	NBF-LS431UPA-32511-S	SO99A	●							
	NBF-LS431UPB-32511-S	SO99B		●	●				●	
	NBF-LS431CENT-32511-S	SP22A	●	●	●				●	
CF-2	NBF-LS431UPA-042811-S	L16511-8						●		
	NBF-LS431UPA-042811-S-sed	L16511-9						●		
	NBF-LS431UPB-042811-S	SU23K, SU23L	●	●	●				●	
	NBF-LS431CENT-042811-S	SU56A, L16461-10	●	●	●			●	●	●
CF-3	NBF-LS431UPA-052511-S	SY78G, SY78H	●							
	NBF-LS431UPA-052511-S-sed	SY78G, SY78H	●							
	NBF-LS431UPB-052511-S	SY78I, SY78J		●	●	●			●	
	NBF-LS431UPB-052511-S-sed	SY78I, SY78J					●			
	NBF-LS431CENT-052611-S	SY84A	●				●			●

SW = Storm Event
BF = Base Flow Event
CF = Centrifuge Sampling Event

PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
TOC = total organic carbon
SIM = selective ion monitoring

Method numbers listed in parentheses.

Table 3
Chemical and Physical Analysis of Whole Water Samples

Sampling Event	Sample ID	Lab ID	SVOC (SW8270D)	Low-Level PAHs (SW8270D-SIM)	Low-Level PCB Aroclors (SW8082)	Total Metals (EPA 200.8, SW6010B, SW7470A)	Dissolved Metals (EPA200.8)	Low-Level Dissolved Mercury (SW7470A)	TOC/DOC (EPA 415.1)	TSS (EPA 160.2)	Other Conventionals (EPA 150.1, SM 2320, EPA 300.0)
SW-1	NBF-LS431-111710-W	RX28A, RX28C, RX30A	●	●	●	●	●	●	●	●	●
	NBF-MH108-111710-W	RX28B, RX28D, RX30B	●	●	●	●	●	●	●	●	●
SW-2	NBF-LS431-113010-W	RY62B, RY62D, RY67B	●	●	●	●	●	●	●	●	●
	NBF-MH108-113010-W	RY62A, RY62C, RY67A	●	●	●	●	●	●	●	●	●
SW-3	NBF-LS431-121110-W	SA30A, SA30C, SA31A	●	●	●	●	●	●	●	●	●
	NBF-MH108-121210-W	SA30B, SA30D, SA31B	●	●	●	●	●	●	●	●	●
SW-4	NBF-LS431-012111-W	SF78A, SF78C, SF79A	●	●	●	●	●	●	●	●	●
	NBF-MH108-012111-W	SF78B, SF78D, SF79B	●	●	●	●	●	●	●	●	●
SW-5	NBF-LS431-030911-W	SM40A, SM40D, SM42A	●	●	●	●	●	●	●	●	●
	NBF-MH108-030911-W	SM40B, SM40E, SM42B	●	●	●	●	●	●	●	●	●
	NBF-MH178-030911-W	SM40C, SM40F, SM42C	●	●	●	●	●	●	●	●	●
SW-6	NBF-LS431-042511-W	ST71B, ST71D, ST81B	●	●	●	●	●	●	●	●	●
	NBF-MH108-042511-W	ST71A, ST71C, ST81A	●	●	●	●	●	●	●	●	●
SW-7	NBF-LS431-042811-W	SU27C, SU27F, SU28C	●	●	●	●	●	●	●	●	●
	NBF-MH108-042711-W	SU27B, SU27E, SU28B	●	●	●	●	●	●	●	●	●
	NBF-MH178-042711-W	SU27A, SU27D, SU28A	●	●	●	●	●	●	●	●	●
SW-8	NBF-LS431-051511-W	SW98A, SW98G, SX04A	●	●	●	●	●	●	●	●	●
	NBF-MH178-051511-W	SW98B, SW98H, SX04B	●	●	●	●	●	●	●	●	●
SW-9	NBF-LS431-052511-W	SY56B, SY56D, SY57B	●	●	●	●	●	●	●	●	●
	NBF-MH178-052511-W	SY56A, SY56C, SY57A	●	●	●	●	●	●	●	●	●
BF-1	NBF-LS431-012811-W	SG65A, SG65B, SG66A	●	●	●	●	●	●	●	●	●
BF-2	NBF-LS431-032111-W	SO18A, SO18C, SO19A	●	●	●	●	●	●	●	●	●
	NBF-MH178-032111-W	SO18B, SO18D, SO19B	●	●	●	●	●	●	●	●	●
BF-3	NBF-MH178-042111-W	ST19A, ST19B, ST20A	●	●	●	●	●	●	●	●	●
CF-1	NBF-LS431UPIN-32511-W	SO99C								●	
	NBF-LS431UPEFF-32511-W	SO99D								●	
	NBF-LS431CENTIN-32511-W	SO99E								●	
	NBF-LS431CENTEFF-32511-W	SO99F								●	
CF-2	NBF-LS431UPIN-042711-W	SU23A								●	
	NBF-LS431UPEFF-042711-W	SU23B								●	
	NBF-LS431CENTIN-042711-W	SU23C								●	
	NBF-LS431CENTEFF-042711-W	SU23D								●	
CF-3	NBF-LS431UPIN-052511-W	SY50A								●	
	NBF-LS431UPEFF-052511-W	SY50B								●	
	NBF-LS431CENTIN-052511-W	SY50C								●	
	NBF-LS431CENTEFF-052511-W	SY50D								●	

SW = Storm Event
BF = Base Flow Event
CF = Centrifuge Sampling Event

PAH = polycyclic aromatic hydrocarbon
SVOC = semivolatile organic compound
SIM = selective ion monitoring
PCB = polychlorinated biphenyl

TOC = total organic carbon
TSS = total suspended solids

Method numbers listed in parentheses.

Table 4
Comparison of Sampling Events to Stormwater Sampling Criteria

Criterion		Storm Event								
		SW-1 11/17/2010	**SW-2 11/30/2010**	**SW-3 12/12/2010**	**SW-4 1/21/2011**	**SW-5 3/9/2011**	**SW-6 4/25/2011**	**SW-7 4/27/2011**	**SW-8 5/15/2011**	**SW-9 5/25/2011**
Total Storm Event Precipitation (inches)	> 0.15	0.12	0.79	3.7	0.67	0.75	0.39	0.43	1.4	0.24
Storm Event Duration (hours)	> 5	10	28	27	16	14	9	6	21	10
Precipitation During 12- or 24-Hour Period Preceding Storm Event (inches) (a)	< 0.04	0	0.01	0	0.01	0	0.32	0.02	0	0
Percent of Storm Hydrograph Sampled (b)	> 75%	LS431: 100 MH108: 100	LS431: 85 MH108: 90	LS431: 30 MH108: 45	LS431: 95 MH108: 95	LS431: 85 MH108: 95 MH178: 95	LS431: 40 MH108: 50	LS431: 85 MH108: 95 MH178: 100	LS431: 100 MH178: 100	LS431: 75 MH178: 100
Number of Sample Aliquots Collected	> 10	LS431: 7 MH108: 8	LS431: 31 MH108: 30	LS431: 23 MH108: 35	LS431: 35 MH108: 24	LS431: 27 MH108: 35 MH178: 24	LS431: 21 MH108: 33	LS431: 38 MH108: 40 MH178: 24	LS431: 27 MH178: 29	LS431: 12 MH178: 30

(a) 24-hour antecedent dry period criterion was reduced in late February 2011 to 12 hours based on estimated system recovery time.
(b) Percent of storm hydrograph sampled is an estimate.

Criterion not met.

Table 5
Summary of Results for Filtered Solids Samples at LS431

Event			SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	BF-1	BF-2
Sample Date	**SQS/ LAET**	**CSL/ 2LAET**	**11/17/2010**	**11/30/2010**	**12/12/2010**	**1/21/2011**	**3/9/2011**	**4/24/2011**	**4/28/2011**	**5/15/2011**	**5/25/2011**	**1/28/2011**	**3/21/2011**
Sampled By			**SAIC**	**Landau**	**Landau**	**Landau**	**Landau**	**SAIC**	**SAIC**	**SAIC**	**SAIC**	**Landau**	**Landau**
Total Fines (% Silt/Clay)			30.9	13.6	7.0	18.1	16.0	NA	52.3	20.8	50.4	24.4	16.3
Total Solids (%)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOC (%)			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCBs (mg/kg DW)													
Aroclor 1248			<0.22 U	<0.19 U	<0.44 U	<0.17 U	>0.22 U	<0.15 U	<0.33 U	<0.17 U	NA	<0.44 U	**0.038**
Aroclor 1254			**0.39**	**0.47**	**1.1**	**0.20**	**0.42**	**0.29**	**0.62**	**0.24**	NA	**0.67**	**0.046**
Aroclor 1260			**0.25**	**0.32**	**0.60**	**0.12**	**0.19**	**0.11**	**0.34**	**0.12**	NA	**0.15**	**0.0083**
PCBs, total	0.13	1.0	**0.64**	**0.79**	**1.7**	**0.32**	**0.61**	**0.40**	**1.0**	**0.36**	NA	**0.81**	**0.092**
Metals (mg/kg DW)													
Arsenic	57	93	<30 U	<30 U	<8 U	<40 U	<10 U	<7 U	10	9	<60 U	<40 U	<20 U
Cadmium	5.1	6.7	**4.0**	**4.0**	**4.3**	**4.0**	**5.3**	**3.9**	**5.0**	**4.4**	**7.0**	**4.0**	**2.9**
Chromium	260	270	**31**	**30**	**37.5**	**45**	**39**	**18.4**	**32**	**32.5**	**44**	**25**	**20**
Copper	390	390	**43**	**64**	**63.8**	**41**	**71.1**	**23.0**	**64.5**	**35.4**	**87.0**	**28**	**26**
Lead	450	530	**60**	**70**	**120**	**140**	**70**	**32**	**79**	**138**	**60**	**50**	**27**
Mercury	0.41	0.59	**5.6**	**0.11**	**0.44**	**0.09**	**0.12**	**0.06**	**0.12**	**0.07**	**0.12**	**0.09**	<0.06 U
Zinc	410	960	**303**	**381**	**370**	**356**	**454**	**160**	**553**	**357**	**730**	**254**	**125**
LPAH (mg/kg DW - estimated)													
Naphthalene	2.1	2.4	**0.14** J	NA	**0.040**	NA	**0.12**	NA	NA	<0.21 U	NA	**0.031**	NA
2-Methylnaphthalene	0.67	1.4	<0.23 U	NA	**0.029**	NA	**0.22**	NA	NA	<0.21 U	NA	**0.031**	NA
1-Methylnaphthalene			<0.23 U	NA	**0.016**	NA	**0.10**	NA	NA	<0.21 UJ	NA	**0.020**	NA
Acenaphthene	0.50	0.73	<0.23 U	NA	<0.013 U	NA	<0.014 U	NA	NA	<0.21 U	NA	**0.056**	NA
Fluorene	0.54	1.0	<0.23 U	NA	<0.013 U	NA	**0.059**	NA	NA	<0.21 U	NA	**0.009** J	NA
Phenanthrene	1.5	5.4	**0.48**	NA	**1.1**	NA	**0.75**	NA	NA	**0.64**	NA	**0.087**	NA
Anthracene	0.96	4.4	<0.23 U	NA	<0.013 U	NA	**0.050**	NA	NA	<0.21 U	NA	**0.009** J	NA
LPAH, total	5.2	13	0.62	NA	**1.2**	NA	**0.87**	NA	NA	**0.64**	NA	**0.12**	NA
HPAH (mg/kg DW - estimated)													
Fluoranthene	1.7	2.5	**1.2**	NA	**2.9**	NA	**1.8**	NA	NA	**1.9**	NA	**0.21**	NA
Pyrene	2.6	3.3	**0.84** J	NA	**1.9**	NA	**1.2**	NA	NA	**1.1**	NA	**0.15**	NA
Benzo(a)anthracene	1.3	1.6	**0.22**	NA	**0.68**	NA	**0.45**	NA	NA	**0.32**	NA	**0.049**	NA
Chrysene	1.4	2.8	**0.84**	NA	**1.9**	NA	**1.3**	NA	NA	**1.0**	NA	**0.14**	NA
Benzo(a)pyrene	1.6	3.0	**0.28**	NA	**1.1**	NA	**0.67**	NA	NA	**0.51**	NA	**0.067**	NA
Indeno(1,2,3-cd)pyrene	0.60	0.69	**0.31**	NA	**1.0**	NA	**0.73**	NA	NA	**0.56**	NA	**0.063**	NA
Dibenz(a,h)anthracene	0.23	0.54	<0.23 U	NA	**0.026**	NA	**0.045**	NA	NA	<0.21 U	NA	<0.011 U	NA
Benzo(g,h,i)perylene	0.67	0.72	**0.38**	NA	**1.1**	NA	**0.78**	NA	NA	**0.68**	NA	**0.074**	NA
Dibenzofuran	0.54	0.70	<0.23 U	NA	<0.013 U	NA	**0.050**	NA	NA	<0.21 UJ	NA	<0.011 U	NA
Benzofluoranthenes, total	3.2	3.6	**1.1**	NA	**3.4**	NA	**2.2**	NA	NA	**1.5**	NA	**0.22**	NA
HPAH, total	12	17	**5.2**	NA	**13.9**	NA	**9.2**	NA	NA	**7.6**	NA	**0.98**	NA
Dioxins/Furans (pg/g)													
Dioxin/Furan TEQ			NA	14.9	NA	7.5	NA	71.3	35.4	NA	NA	NA	2.9

Chemical detected at a concentration above the SQS/LAET
Chemical detected at a concentration above the CSL/2LAET
Chemical not detected, but reporting limit is above the criterion

NA = not analyzed
Detected concentrations are shown in **Bold**
Only chemicals that have been detected in at least one sample are shown

Note: No data verification or validation was performed for metals, PAH, and dioxin/furan samples collected by Landau.
An EPA Stage 2A data verification and validation check was conducted for PCB samples collected by Landau; results are provided in Appendix E2.
EPA Stage 4 data validation was conducted for all samples/analytes collected by SAIC; results are provided in Appendix E1.

Table 6
Summary of Results for Filtered Solids Samples at MH108

Event			SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7
Sample Date	SQS/	CSL/	11/17/2010	11/30/2010	12/12/2010	1/21/2011	3/9/2011	4/25/2011	4/27/2011
Sampled By	LAET	2LAET	SAIC	Landau	Landau	Landau	Landau	Landau	SAIC
Total Fines (% Silt/Clay)			NA	31.7	4.0	39.5	25.9	NA	21.9
Total Solids (%)			NA	NA	NA	NA	NA	NA	NA
TOC (%)			NA	NA	NA	NA	NA	NA	NA
PCBs (mg/kg DW)									
Aroclor 1248			NA	<2.2 U	<0.88 U	<1.5 U	<0.93 U	<2.7 U	<0.78 U
Aroclor 1254			NA	**3.0**	**1.8**	**2.3**	**1.6**	**3.7**	**1.1**
Aroclor 1260			NA	**1.4**	**0.65**	**0.61**	**0.37**	**0.67**	**0.43**
PCBs, total	0.13	1.0	NA	**4.4**	**2.4**	**2.9**	**1.9**	**4.4**	**1.5**
Metals (mg/kg DW)									
Arsenic	57	93	NA	**30**	<10 U	<20 U	**10**	NA	**30**
Cadmium	5.1	6.7	NA	**11.1**	**6.7**	**6.0**	**3.1**	NA	**9.5**
Chromium	260	270	NA	**66**	**68**	**58**	**41**	NA	**87**
Copper	390	390	NA	**227**	**187**	**213**	**139**	NA	**190**
Lead	450	530	NA	**187**	**272**	**140**	**134**	NA	**178**
Mercury	0.41	0.59	NA	**0.39**	**0.27**	**0.40**	**0.54**	NA	**0.37**
Silver	6.1	6.1	NA	<1 U	**3.6**	<1 U	**1.2**	NA	**1.6**
Zinc	410	960	NA	**1,370**	**846**	**765**	**465**	NA	**952**
LPAH (mg/kg DW - estimated)									
Naphthalene	2.1	2.4	NA	NA	**0.098**	NA	**0.087**	NA	NA
2-Methylnaphthalene	0.67	1.4	NA	NA	**0.081**	NA	**0.11**	NA	NA
1-Methylnaphthalene			NA	NA	**0.043**	NA	**0.050**	NA	NA
Acenaphthene	0.50	0.73	NA	NA	**0.049**	NA	<0.0093 U	NA	NA
Fluorene	0.54	1.0	NA	NA	**0.084**	NA	**0.045**	NA	NA
Phenanthrene	1.5	5.4	NA	NA	**1.6**	NA	**0.60**	NA	NA
Anthracene	0.96	4.4	NA	NA	**0.15**	NA	**0.041**	NA	NA
LPAH, total	5.2	13	NA	NA	**1.7**	NA	**0.68**	NA	NA
HPAH (mg/kg DW - estimated)									
Fluoranthene	1.7	2.5	NA	NA	**3.5**	NA	**1.2**	NA	NA
Pyrene	2.6	3.3	NA	NA	**3.2**	NA	**0.95**	NA	NA
Benzo(a)anthracene	1.3	1.6	NA	NA	**1.5**	NA	**0.28**	NA	NA
Chrysene	1.4	2.8	NA	NA	**2.1**	NA	**0.87**	NA	NA
Benzo(a)pyrene	1.6	3.0	NA	NA	**1.0**	NA	**0.50**	NA	NA
Indeno(1,2,3-cd)pyrene	0.60	0.69	NA	NA	**0.75**	NA	**0.35**	NA	NA
Dibenz(a,h)anthracene	0.23	0.54	NA	NA	<0.043 U	NA	**0.017**	NA	NA
Benzo(g,h,i)perylene	0.67	0.72	NA	NA	**0.81**	NA	**0.39**	NA	NA
Dibenzofuran	0.54	0.70	NA	NA	**0.11**	NA	**0.041**	NA	NA
Benzofluoranthenes, total	3.2	3.6	NA	NA	**3.7**	NA	**1.4**	NA	NA
HPAH, total	12	17	NA	NA	**17**	NA	**6.0**	NA	NA
Dioxins/Furans (pg/g)									
Dioxin/Furan TEQ			NA	NA	NA	**69.4**	NA	**27.2**	**52.8**

Chemical detected at a concentration above the SQS/LAET
Chemical detected at a concentration above the CSL/2LAET
Chemical not detected, but reporting limit is above the criterion

NA = not analyzed
Detected concentrations are shown in **Bold**
Only chemicals that have been detected in at least one sample are shown

Note: No data verification or validation was performed for metals, PAH, and dioxin/furan samples collected by Landau.
An EPA Stage 2A data verification and validation check was conducted for PCB samples collected by Landau; results are provided in Appendix D2.
EPA Stage 4 data validation was conducted for all samples/analytes collected by SAIC; results are provided in Appendix D1.

Table 7
Summary of Results for Filtered Solids Samples at MH178

Event			SW-5	SW-6	SW-7	SW-8	SW-9	BF-2	BF-3
Sample Date	SQS/	CSL/	3/9/2011	4/25/2011	4/27/2011	5/15/2011	5/25/2011	3/21/2011	4/21/2011
Sampled By	LAET	2LAET	Landau	SAIC	SAIC	SAIC	SAIC	Landau	SAIC
Total Fines (% Silt/Clay)			19.9	49.6	29.3	46.1	83.8	16.9	29.5
Total Solids (%)			NA	NA	NA	NA	NA	NA	NA
TOC (%)			NA	NA	NA	NA	NA	NA	NA
PCBs (mg/kg DW)									
Aroclor 1248			<0.071 U	<0.21 U	<0.14 U	<0.13 U	<1.3 U	<0.25 U	<0.21 U
Aroclor 1254			**0.16**	**0.47**	**0.47**	**0.32**	**4.2**	**0.85**	**0.57**
Aroclor 1260			**0.047**	**0.14**	**0.090**	**0.15**	**1.1**	**0.14**	<0.16 U
PCBs, total	0.13	1.0	**0.21**	**0.60**	**0.56**	**0.47**	**5.4**	**1.0**	**0.57**
Metals (mg/kg DW)									
Arsenic	57	93	**10**	**50**	**30**	<40 U	<80 U	**20**	<30 U
Cadmium	5.1	6.7	**2.1**	**3.0**	**3.1**	**6.0**	**6.0**	**1.2**	**4.0**
Chromium	260	270	**88**	**39**	**40**	**54**	**45**	**23**	**27**
Copper	390	390	**155**	**175**	**181**	**244**	**362**	**92.2**	**126**
Lead	450	530	**125**	**190**	**297**	**250**	**430**	**92**	**160**
Mercury	0.41	0.59	**1.7**	**3.7**	**14.6**	**2.5**	**0.60**	**16.1**	**2.6**
Silver	6.1	6.1	<0.6 U	<2 U	**8.2**	<3 U	<5 U	**1.3**	<2 U
Zinc	410	960	**255**	**349**	**397**	**508**	**640**	**122**	**250**
LPAH (mg/kg DW - estimated)									
Naphthalene	2.1	2.4	**0.040**	NA	NA	<0.077 U	**0.32**	NA	**0.029**
2-Methylnaphthalene	0.67	1.4	**0.052**	NA	NA	<0.077 U	**0.58**	NA	**0.029**
1-Methylnaphthalene			**0.022**	NA	NA	<0.077 UJ	**4.2**	NA	<0.021 U
Acenaphthene	0.50	0.73	**0.016**	NA	NA	<0.077 U	**0.32**	NA	**0.042**
Fluorene	0.54	1.0	**0.020**	NA	NA	<0.077 U	**0.32**	NA	**0.058**
Phenanthrene	1.5	5.4	**0.28**	NA	NA	**0.67**	**5.8**	NA	**0.62**
Anthracene	0.96	4.4	**0.023**	NA	NA	<0.077 U	<0.26 U	NA	**0.071**
LPAH, total	5.2	13	**0.32**	NA	NA	**0.67**	**6.1**	NA	**0.65**
HPAH (mg/kg DW - estimated)									
Fluoranthene	1.7	2.5	**0.63**	NA	NA	**1.8**	**14**	NA	**1.3**
Pyrene	2.6	3.3	**0.46**	NA	NA	**0.77**	**7.9**	NA	**1.0**
Benzo(a)anthracene	1.3	1.6	**0.16**	NA	NA	**0.22**	**2.3**	NA	**0.42**
Chrysene	1.4	2.8	**0.39**	NA	NA	**0.72**	**6.9**	NA	**0.83**
Benzo(a)pyrene	1.6	3.0	**0.27**	NA	NA	**0.36**	**2.7**	NA	**0.67**
Indeno(1,2,3-cd)pyrene	0.60	0.69	**0.18**	NA	NA	**0.37**	**4.1**	NA	**0.54**
Dibenz(a,h)anthracene	0.23	0.54	**0.016**	NA	NA	**0.13**	**3.6**	NA	<0.021 U
Benzo(g,h,i)perylene	0.67	0.72	**0.20**	NA	NA	**0.45**	**0.69**	NA	**0.62**
Dibenzofuran	0.54	0.70	**0.016**	NA	NA	<0.077 UJ	**0.32**	NA	**0.071**
Benzofluoranthenes, total	3.2	3.6	**0.69**	NA	NA	**1.1**	**1.1**	NA	**1.6**
HPAH, total	12	17	**3.0**	NA	NA	**5.9**	**43**	NA	**7.0**
Dioxins/Furans (pg/g)									
Dioxin/Furan TEQ			NA	**30.8**	**29.0**	NA	NA	**4.1**	NA

Chemical detected at a concentration above the SQS/LAET
Chemical detected at a concentration above the CSL/2LAET
Chemical not detected, but reporting limit is above the criterion

NA = not analyzed
Detected concentrations are shown in **Bold**
Only chemicals that have been detected in at least one sample are shown

Note: No data verification or validation was performed for metals, PAH, and dioxin/furan samples collected by Landau.
An EPA Stage 2A data verification and validation check was conducted for PCB samples collected by Landau; results are provided in Appendix D2.
EPA Stage 4 data validation was conducted for all samples/analytes collected by SAIC; results are provided in Appendix D1.

Table 8
Summary of Results for Filtered Solids Samples at CB173

Event			SW-1	SW-2	SW-3	SW-4	BF-1	BF-2	BF-3
Sample Date	SQS/ LAET	CSL/ 2LAET	11/17/2010	11/30/2010	12/12/2010	1/21/2011	1/27/2011	3/23/2011	4/21/2011
Sampled By			SAIC	SAIC	SAIC	SAIC	SAIC	SAIC	SAIC
Total Fines (% Silt/Clay)			13.8	61.2	26.3	NA	NA	NA	NA
Total Solids (%)			NA	NA	NA	NA	NA	NA	NA
TOC (%)			NA	NA	NA	NA	NA	NA	NA
PCBs (mg/kg DW)									
Aroclor 1248			<1.6 U	**3.7** J	**3.2**	<16 U	NA	**48**	**56.2**
Aroclor 1254			**1.3**	**2.6**	**3.9**	**8.5**	NA	**26**	**42.3**
Aroclor 1260			<0.98 UJ	**0.6**	**1.1**	**1.2**	NA	<1.6 U	<0.033 U
PCBs, total	0.13	1.0	**1.3**	**6.9**	**8.2**	**9.7**	NA	**74**	**99**
Metals (mg/kg DW)									
Arsenic	57	93	<40 U	<30 U	**20**	**20**	<20 U	**23**	**80**
Cadmium	5.1	6.7	**12**	**14**	**15.2**	**6.7**	**5.0**	**2.0**	**7.0**
Chromium	260	260	**222**	**82**	**116** J	**43** J	**19**	**42.5**	**70**
Copper	390	390	**320**	**231**	**268** J	**165**	**102** J	**125**	**466**
Lead	450	530	**160**	**210**	**335** J	**131** J	**42** J	**51**	**130**
Mercury	0.41	0.59	**1.2**	**1.0**	**0.78**	**0.50** J	**0.40**	**18**	**1.8**
Silver	6.1	6.1	<3 U	<2 U	**0.9**	<1 U	<1 U	<0.5 U	<2 U
Zinc	410	960	**4,990**	**2,230**	**2,170**	**1,050**	**722** J	**342**	**1,100**
LPAH (mg/kg DW - estimated)									
Naphthalene	2.1	2.4	<1.4 U	NA	**0.11**	<1.0 U	NA	NA	<0.33 U
2-Methylnaphthalene	0.67	1.4	<1.4 U	NA	**0.071**	<1.0 U	NA	NA	<0.33 U
1-Methylnaphthalene			<1.4 U	NA	**0.041**	<1.0 U	NA	NA	<0.33 U
Fluorene	0.54	1.0	<1.4 U	NA	**0.066**	<1.0 U	NA	NA	<0.33 U
Phenanthrene	1.5	5.4	<1.4 U	NA	**0.58**	<1.0 U	NA	NA	<0.33 U
LPAH, total	5.2	13	<1.4 U	NA	**0.70**	<1.0 U	NA	NA	<0.33 U
HPAH (mg/kg DW - estimated)									
Fluoranthene	1.7	2.5	<1.4 U	NA	**0.73**	**1.1**	NA	NA	**0.43**
Pyrene	2.6	3.3	<1.4 U	NA	**1.0**	**1.5**	NA	NA	**0.52**
Benzo(a)anthracene	1.3	1.6	<1.4 U	NA	**0.29**	<1.0 U	NA	NA	<0.33 U
Chrysene	1.4	2.8	<1.4 U	NA	**0.51**	**0.95** J	NA	NA	**0.35**
Benzo(a)pyrene	1.6	3.0	<1.4 U	NA	**0.29**	<1.0 U	NA	NA	<0.33 U
Indeno(1,2,3-cd)pyrene	0.60	0.69	<1.4 U	NA	**0.20**	<1.0 U	NA	NA	<0.33 U
Benzo(g,h,i)perylene	0.67	0.72	<1.4 U	NA	**0.27**	**1.2** J	NA	NA	<0.33 U
Dibenzofuran	0.54	0.70	<1.4 U	NA	**0.078**	<1.0 U	NA	NA	<0.33 U
Benzofluoranthenes, total	3.2	3.6	<1.4 U	NA	**0.78** J	**0.88** J	NA	NA	**0.53**
HPAH, total	12	17	<1.4 U	NA	**4.1**	**5.6**	NA	NA	**1.8**
Dioxins/Furans (pg/g)									
Dioxin/Furan TEQ			NA	**274**	NA	NA	NA	**64.4**	NA

Chemical detected at a concentration above the SQS/LAET
Chemical detected at a concentration above the CSL/2LAET
Chemical not detected, but reporting limit is above the criterion

NA = not analyzed
Detected concentrations are shown in **Bold**
Only chemicals that have been detected in at least one sample are shown

Table 9
Summary of Results for Whole Water Samples at LS431

Event	Criterion (ug/L)	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	BF-1	BF-2
Sample Date		**11/17/2010**	**11/30/2010**	**12/11/2010**	**1/21/2011**	**3/9/2011**	**4/25/2011**	**4/28/2011**	**5/15/2011**	**5/25/2011**	**1/28/2011**	**3/21/2011**
Sampled By		**SAIC**	**Landau**	**Landau**	**Landau**	**Landau**	**SAIC**	**SAIC**	**SAIC**	**SAIC**	**Landau**	**Landau**
PCBs (ug/L)												
Aroclor 1248		<0.059 U	<0.010 U	<0.020 Y	<0.030 Y	<0.020 Y	<0.010 UJ	**0.017**	<0.010 U	<0.010 U	<0.015 Y	<0.010 U
Aroclor 1254		**0.12**	**0.015**	**0.040**	**0.035**	**0.035**	**0.011** J	**0.029**	**0.012**	**0.014**	<0.010 U	**0.013**
Aroclor 1260		**0.052**	<0.010 U	**0.018**	<0.010 U	**0.010**	<0.010 UJ	**0.011**	<0.010 U	<0.010 U	<0.010 U	<0.010 U
PCBs, total	0.030	**0.17**	**0.015**	**0.058**	**0.035**	**0.045**	**0.011**	**0.057**	**0.012**	**0.014**	<0.010 U	**0.013**
Total Metals (ug/L)												
Arsenic	36	**4.6**	**0.80**	**0.80**	**0.80**	**1.0**	**0.90**	**1.5**	**0.80**	**1.5**	**1.3**	**1.4**
Cadmium	94	**1.3**	**0.40**	**0.70**	**0.30**	**0.60**	**0.20**	**0.50**	**0.20**	**0.50**	**<0.2 U**	**0.30**
Chromium	50	**7.1**	**1.2**	**2.0**	**0.90**	**1.3**	**1.1**	**2.0**	**1.1**	**1.7**	<1 U	<1 U
Copper	3.7	**17.5**	**4.9**	**6.0**	**2.9**	**5.1**	**4.2**	**10**	**4.3**	**9.2**	**1.6**	**2.7**
Lead	8.5	**31**	**4.0**	**9.0**	**1.0**	**9.0**	**1.6**	**5.6**	**1.6**	**2.6**	<1 U	**2.0**
Nickel	8.3	**4.4**	**1.0**	**1.3**	**0.80**	**1.4**	**0.80**	**1.8**	**0.80**	**1.7**	**1.2**	**1.8**
Zinc	86	**99**	**47**	**52**	**35**	**47**	**35**	**57**	**31**	**52**	**11**	**19**
Dissolved Metals (ug/L)												
Arsenic	36	**0.50**	**0.30**	**0.30**	**0.30**	**0.40**	**0.40**	**0.40**	**0.40**	**0.60**	**0.50**	**0.60**
Cadmium	93	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<0.1 U	<0.1 U	<0.1 U	<0.1 U	<0.2 U	<0.2 U
Chromium	50	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	<0.5 U	**0.50**	**0.50**	<0.5 U	<0.5 U
Copper	3.1	**1.8**	**1.8**	**1.3**	**1.5**	**1.8**	**2.2**	**3.0**	**2.2**	**5.0**	**1.0**	**1.1**
Lead	8.1	<1 U	<1 U	<1 U	<1 U	<1 U	**0.20**	**0.20**	**0.20**	**0.20**	<1 U	<1 U
Nickel	8.2	**1.1**	**0.50**	<0.5 U	**0.70**	**0.70**	**0.50**	**1.0**	**0.60**	**1.3**	**1.1**	**1.5**
Zinc	81	**9.0**	**25**	**23**	**26**	**23**	**18**	**22**	**32**	**21**	**7.0**	<4 U
LPAH (ug/L)												
Naphthalene		**0.026** U	**0.054** B	**0.047** B	**0.027**	**0.056**	**0.034**	**0.030**	<0.010 U	**0.040**	**0.028** B	**0.062** B
2-Methylnaphthalene		**0.012** J	**0.084**	**0.027**	**0.022**	**0.10**	**0.024**	**0.011**	<0.010 U	**0.028**	**0.017**	**0.018**
1-Methylnaphthalene		<0.010 U	**0.063**	**0.018**	**0.017**	**0.078**	**0.12**	**0.0078** J	**0.019**	**0.019**	<0.010 U	**0.015**
Acenaphthene	990	**0.034**	**0.018**	**0.014**	**0.019**	**0.030**	**0.012**	**0.014**	**0.022**	**0.025**	**0.073**	**0.071**
Fluorene	5,300	<0.010 U	**0.011**	**0.018**	**0.011**	**0.016**	<0.010 U	**0.0078** J	**0.019**	<0.010 U	<0.010 U	<0.010 U
Phenanthrene		**0.082**	**0.11**	**0.19**	**0.098**	**0.13**	**0.056**	**0.15**	**0.13**	**0.055**	**0.014**	**0.028**
Anthracene	40,000	**0.013**	<0.010 U	**0.019**	<0.010 U	**0.010**	<0.010 U	**0.014**	**0.055**	<0.010 U	<0.010 U	<0.010 U
LPAH, total		**0.11**	**0.16**	**0.24**	**0.13**	**0.19**	**0.090**	**0.18**	**0.13**	**0.095**	**0.042**	**0.090**
HPAH (ug/L)												
Fluoranthene	140	**0.26**	**0.30**	**0.58**	**0.34**	**0.37**	**0.14**	**0.46**	**0.24**	**0.17**	**0.027**	**0.063**
Pyrene	4,000	**0.21**	**0.19**	**0.40**	**0.17**	**0.22**	**0.074**	**0.31**	**0.13**	**0.099**	**0.017**	**0.047**
Benzo(a)anthracene	0.018	**0.081**	**0.050**	**0.13**	**0.058**	**0.064**	**0.019**	**0.093**	**0.023**	**0.026**	<0.010 U	**0.016**
Chrysene	0.018	**0.16**	**0.18**	**0.31**	**0.14** Q	**0.22**	**0.080**	**0.32**	**0.093**	**0.10**	**0.011** Q	**0.039**
Benzo(a)pyrene	0.018	**0.10**	**0.088**	**0.20**	**0.088**	**0.12**	**0.031**	**0.17**	**0.038**	**0.041**	<0.010 U	**0.026**
Indeno(1,2,3-cd)pyrene	0.018	**0.067**	**0.082**	**0.16**	**0.083**	**0.11**	**0.036**	**0.18**	**0.036**	**0.047**	<0.010 U	**0.020**
Dibenz(a,h)anthracene	0.018	**0.025**	**0.028**	**0.059**	**0.031**	**0.039**	**0.011**	**0.065**	<0.010 U	<0.010 U	<0.010 U	<0.010 U
Benzo(g,h,i)perylene		**0.085**	**0.098**	**0.18**	**0.094**	**0.12**	**0.040**	**0.19**	**0.041**	**0.054**	<0.010 U	**0.023**
Dibenzofuran		<0.01 U	**0.010**	**0.012**	<0.010 U	**0.013**	<0.010 U	**0.0090** J	**0.011**	<0.010 U	<0.010 U	<0.010 U
Benzofluoranthenes, total	0.018	**1.4**	**0.27**	**0.49**	**0.29**	**0.37**	<1.0 U	**0.52**	**0.12**	**0.16**	**0.017**	**0.065**
HPAH, total		**2.4**	**1.3**	**2.5**	**1.3**	**1.6**	**0.43**	**2.3**	**0.72**	**0.70**	**0.072**	**0.30**
Other Semivolatile Organics (ug/L)												
Phenol	1,700,000	<1.0 U	**5.7**	<1.0 U	<1.0 U	**1.2**	**2.3**	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
bis(2-Ethylhexyl)phthalate	2.2	**1.1**	<1.0 U	<1.0 U	<1.0 U	**1.1** B	<1.0 U	<1.0 U	**1.0**	**2.0**	<1.0 U	<1.0 U
Di-n-octylphthalate		**1.0**	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Conventionals												
pH (units)		7.29	6.74	6.49	6.83	6.89	7.12	6.88	6.79	7.34	7.51	7.33

Table 9
Summary of Results for Whole Water Samples at LS431

Event		SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	BF-1	BF-2
Sample Date	**Criterion**	**11/17/2010**	**11/30/2010**	**12/11/2010**	**1/21/2011**	**3/9/2011**	**4/25/2011**	**4/28/2011**	**5/15/2011**	**5/25/2011**	**1/28/2011**	**3/21/2011**
Sampled By	**(ug/L)**	**SAIC**	**Landau**	**Landau**	**Landau**	**Landau**	**SAIC**	**SAIC**	**SAIC**	**SAIC**	**Landau**	**Landau**
Alkalinity (mg/L CaCO3)		104	33.7	15.2	40	46.7	23.2	44.1	21.1	73.5	144	140
Carbonate (mg/L CaCO3)		<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Bicarbonate (mg/L CaCO3)		104	33.7	15.2	40	46.7	23.2	44.1	21.1	73.5	144	140
Hydroxide (mg/L CaCO3)		<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Total Suspended Solids (mg/L)		104	17.3	32.8	26.7	11.5	15	22.2	17.2	53.4	24.9	22.8
Chloride (mg/L)		21.9	5.8	1.7	5.9	7.0	2.8	6.4	2.4	8.7	27.8	25.3
N-Nitrate (mg-N/L)		0.2	0.1	<0.1 U	<0.1 U	0.2	0.2 U	0.2 U	0.2	3.9	0.2	0.2
Sulfate (mg/L)		4.0	1.2	0.6	2.4	2.5	1.3	3.0	1.4	5.0	7.4	7.8
Total Organic Carbon (mg/L)		8.06 J	7.76	2.66	3.87	4.13	3.23	5.68	3.22	8.51	9.22	6.95
Dissolved Organic Carbon (mg/L)		30.4 J	7.01	1.93	2.96	3.17	2.54	4.05	2.51	6.84	5.35	6.02

Chemical detected at a concentration above the WQC
Chemical detected at a concentration at least 10x the WQC
Chemical not detected, but reporting limit is above the criterion

Detected concentrations are shown in **Bold**
Only chemicals that have been detected in at least one sample are shown

Criteria for metals are chronic marine water quality criteria, except silver (acute marine water quality criterion); criteria for SVOCs are marine human health criteria - consumption of organisms only
U = Target analyte not detected at the reported concentration.
J = Estimated concentration when the value is less than established reporting limits.
Y = Target analyte not detected at the reported concentration; reporting limit is elevated.
Q = Target analyte detected, but calibration not within criteria.
B = Analyte detected in an associated method blank.

Note: No data verification or validation was performed for metals or PAH samples collected by Landau.
An EPA Stage 2A data verification and validation check was conducted for PCB samples collected by Landau; results are provided in Appendix D2.
EPA Stage 4 data validation was conducted for all samples/analytes collected by SAIC; results are provided in Appendix D1.

Table 10
Summary of Whole Water Sample Results for MH108

Event		SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7
Sample Date	**Criterion**	**11/17/2010**	**11/30/2010**	**12/12/2010**	**1/21/2011**	**3/9/2011**	**4/25/2011**	**4/27/2011**
Sampled By	**(ug/L)**	**SAIC**	**Landau**	**Landau**	**Landau**	**Landau**	**SAIC**	**SAIC**
PCBs (ug/L)								
Aroclor 1248		<0.053 U	<0.015 Y	<0.012 Y	<0.035 Y	<0.050 Y	**0.025** J	**0.042**
Aroclor 1254		**0.050**	**0.013**	**0.017**	**0.053**	**0.084**	**0.016** J	**0.048**
Aroclor 1260		<0.010 U	<0.010 U	<0.010 U	<0.010 U	**0.017**	<0.010 UJ	<0.010 U
PCBs, total	0.030	**0.050**	**0.013**	**0.017**	**0.053**	**0.10**	**0.041**	**0.090**
Total Metals (ug/L)								
Arsenic	36	**2.0**	**0.60**	**0.40**	**0.60**	**1.4**	**0.70**	**1.4**
Cadmium	94	<0.2 U	**0.20**	**0.20**	**0.20**	**0.40**	**0.20**	**0.40**
Chromium	50	<0.5 U	**0.50**	**1.0**	**0.50**	**2.2**	<0.5 U	**1.3**
Copper	3.7	**2.7**	**3.7**	**4.6**	**3.3**	**19.6**	**3.1**	**10.4**
Lead	8.5	<1 U	**1.0**	**3.0**	**1.0**	**12**	**0.40**	**6.0**
Nickel	8.3	**1.3**	**0.90**	**1.0**	**1.3**	**3.6**	**1.1**	**2.2**
Zinc	86	**49**	**69**	**51**	**48**	**80**	**42**	**61**
Dissolved Metals (ug/L)								
Arsenic	36	**1.3**	**0.40**	<0.2 U	**0.40**	**0.40**	**0.50**	**0.50**
Cadmium	93	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<0.2 U	**0.10**	**0.20**
Copper	3.1	**2.0**	**1.9**	**0.90**	**1.4**	**2.4**	**2.4**	**3.5**
Lead	8.1	<1 U	<1 U	<1 U	<1 U	<1 U	<0.1 U	**0.20**
Nickel	8.2	**1.3**	**0.70**	<0.5 U	**1.0**	**0.90**	**1.0**	**1.4**
Zinc	81	**26**	**56**	**38**	**38**	**34**	**35**	**36**
LPAH (ug/L)								
Naphthalene		0.029 U	**0.052** B	**0.041** B	**0.018**	<0.030 U	**0.042**	**0.037**
2-Methylnaphthalene		**0.012** J	**0.052**	**0.028**	**0.012**	<0.030 U	**0.011**	**0.0086** J
1-Methylnaphthalene		<0.011 U	**0.041**	**0.020**	<0.010 U	<0.030 U	<0.010 U	**0.0063** J
Acenaphthene	990	<0.011 U	<0.010 U	<0.010 U	<0.010 U	<0.030 U	<0.010 U	**0.0073** J
Fluorene	5,300	<0.011 U	**0.010**	**0.012**	<0.010 U	<0.030 U	<0.010 U	**0.0085** J
Phenanthrene		<0.011 U	**0.030**	**0.094**	**0.018**	**0.37**	**0.032**	**0.15**
Anthracene	40,000	<0.011 U	<0.010 U	**0.013**	<0.010 U	**0.031**	<0.010 U	**0.015**
LPAH, total		**0.029**	**0.082**	**0.14**	**0.036**	**0.37**	**0.074**	**0.19**
HPAH (ug/L)								
Fluoranthene	140	<0.011 U	**0.038**	**0.22**	**0.046**	**1.0**	**0.043**	**0.36**
Pyrene	4,000	<0.011 U	**0.027**	**0.16**	**0.027**	**0.73**	**0.017**	**0.25**
Benzo(a)anthracene	0.018	<0.011 U	<0.010 U	**0.052**	<0.010 U	**0.23**	<0.010 U	**0.076**
Chrysene	0.018	<0.011 U	**0.020**	**0.11**	**0.017** Q	**0.56**	**0.010**	**0.21**
Benzo(a)pyrene	0.018	<0.011 U	<0.010 U	**0.078**	**0.011**	**0.42**	<0.010 U	**0.15**
Indeno(1,2,3-cd)pyrene	0.018	<0.011 U	<0.010 U	**0.058**	<0.010 U	**0.35**	<0.010 U	**0.13**

Table 10
Summary of Whole Water Sample Results for MH108

Event		SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7
Sample Date	**Criterion**	**11/17/2010**	**11/30/2010**	**12/12/2010**	**1/21/2011**	**3/9/2011**	**4/25/2011**	**4/27/2011**
Sampled By	**(ug/L)**	**SAIC**	**Landau**	**Landau**	**Landau**	**Landau**	**SAIC**	**SAIC**
Dibenz(a,h)anthracene	0.018	<0.011 U	<0.010 U	**0.022**	<0.010 U	**0.11**	<0.010 U	**0.048**
Benzo(g,h,i)perylene		<0.011 U	<0.010 U	**0.075**	**0.012**	**0.42**	<0.010 U	**0.16**
Dibenzofuran		<0.011 U	<0.010 U	<0.010 U	<0.010 U	<0.030 U	<0.010 U	**0.0088** J
Benzofluoranthenes, total	0.018	<0.011 U	**0.024**	**0.18**	**0.028**	**1.0**	<0.010 U	**0.36**
HPAH, total		<0.011 U	**0.11**	**1.0**	**0.14**	**4.8**	**0.07**	**1.7**
Other Semivolatile Organics (ug/L)								
Phenol	1,700,000	<1.0 U	**7.4**	<1.0 U	<1.0 U	5.9 U	**2.4**	<1.0 U
Conventionals								
pH (units)		7.46	6.58	6.64	7.24	7.12	7.07	6.79
Alkalinity (mg/L CaCO3)		98.4	30.0	3.2	42.7	30.5	25.8	44.9
Carbonate (mg/L CaCO3)		<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Bicarbonate (mg/L CaCO3)		98.4	30.0	3.2	42.7	30.5	25.8	44.9
Hydroxide (mg/L CaCO3)		<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Total Suspended Solids (mg/L)		4.0	6.6	22.4	5.6	45.7	1.7	43.6
Chloride (mg/L)		3.7	2.9	0.4	1.8	1.4	1.1	2.1
N-Nitrate (mg-N/L)		0.4	0.2	<0.1 U	0.3	0.3	0.2 U	0.3 U
Sulfate (mg/L)		7.9	3.6	0.4	7	4.6	3.0	6.2
Total Organic Carbon (mg/L)		5.88 J	6.18	2.04	2.41	3.37	2.71	4.88
Dissolved Organic Carbon (mg/L)		31.1 J	5.67	2.08	2.55	2.43	2.26	4.31

Chemical detected at a concentration above the WQC
Chemical detected at a concentration at least 10x the WQC
Chemical not detected, but reporting limit is above the criterion

Detected concentrations are shown in **Bold**
Only chemicals that have been detected in at least one sample are shown

U = Target analyte not detected at the reported concentration.
J = Estimated concentration when the value is less than established reporting limits.
Y = Target analyte not detected at the reported concentration; reporting limit is elevated.
Q = Target analyte detected, but calibration not within criteria.
B = Analyte detected in an associated method blank.

Note: No data verification or validation was performed for metals or PAH samples collected by Landau.
An EPA Stage 2A data verification and validation check was conducted for PCB samples collected by Landau; results are provided in Appendix D2.
EPA Stage 4 data validation was conducted for all samples/analytes collected by SAIC; results are provided in Appendix D1.

Table 11
Summary of Whole Water Sample Results for MH178

Event		SW-5	SW-7	SW-8	SW-9	BF-2	BF-3
Sampling Date	Criterion	3/9/2011	4/27/2011	5/15/2011	5/25/2011	3/21/2011	4/21/2011
Sampled By	(ug/L)	Landau	SAIC	SAIC	SAIC	Landau	SAIC
PCBs (ug/L)							
Aroclor 1254		**0.16**	**0.18**	<0.010 U	<0.010 U	**0.036**	**0.11**
Aroclor 1260		**0.056**	**0.052**	<0.010 U	<0.010 U	**0.012**	**0.024**
PCBs, total	0.030	**0.22**	**0.23**	<0.010 U	<0.010 U	**0.048**	**0.13**
Total Metals (ug/L)							
Arsenic	36	**6.2**	**7.0**	**0.70**	**0.90**	**2.1**	**3.0**
Cadmium	94	**2.0**	**2.7**	**0.20**	**0.30**	**0.80**	**1.1**
Chromium	50	**9.1**	**8.0**	**0.60**	**0.70**	**2.0**	**4.0**
Copper	3.7	**94.3**	**90.7**	**8.7**	**21.3**	**18.4**	**40.4**
Lead	8.5	**99**	**132**	**4.7**	**3.0**	**24**	**236**
Mercury	0.029	<0.1 U	**0.10** J	<0.1 U	<0.1 U	<0.1 U	<0.1 U
Nickel	8.3	**11.7**	**11.4**	**1.0**	**2.4**	**4.0**	**6.4**
Silver		**0.20**	**0.20**	<0.2 U	<0.2 U	<0.2 U	<0.2 U
Zinc	36	**227**	**280**	**38**	**65**	**45**	**110**
Dissolved Metals (ug/L)							
Arsenic	36	**0.30**	**0.30**	**0.40**	**0.40**	**0.30**	**0.40**
Cadmium	93	<0.2 U	<0.1 U	**0.20**	**0.20**	<0.2 U	<0.1 U
Copper	3.1	**3.4**	**3.6**	**5.2**	**14.5**	**2.0**	**2.4**
Lead	8.1	<1 U	**0.30**	**0.30**	**0.40**	<1 U	**0.10**
Nickel	8.2	**0.90**	**1.7**	**0.80**	**2.1**	**1.9**	**2.9**
Zinc	81	**19**	**20**	**31**	**56**	**6.0**	**8.0**
LPAH (ug/L)							
Naphthalene		<0.10 U	**0.087** J	**0.011**	**0.020**	**0.12** B	**0.036**
2-Methylnaphthalene		**0.10**	<0.10 U	<0.010 U	<0.010 U	**0.020**	<0.010 U
1-Methylnaphthalene		<0.10 U	<0.10 U	<0.010 U	<0.010 U	**0.027**	<0.010 U
Acenaphthylene		<0.10 U	<0.10 U	<0.010 U	<0.010 U	**0.022**	<0.010 U
Acenaphthene	990	**0.34**	**0.081** J	<0.010 U	<0.010 U	**0.038**	**0.018**
Fluorene	5,300	**0.34**	**0.12**	<0.010 U	<0.010 U	**0.043**	**0.017**
Phenanthrene		**4.4**	**2.1**	**0.069**	**0.070**	**0.40**	**0.39**
Anthracene	40,000	**0.74**	**0.31**	<0.010 U	<0.010 U	**0.071**	**0.042**
LPAH, total		**4.4**	**2.2**	**0.080**	**0.090**	**0.52**	**0.43**
HPAH (ug/L)							
Fluoranthene	140	**9.0**	**5.6**	**0.14**	**0.18**	**1.2**	<1.0 U
Pyrene	4,000	**6.6**	**4.0**	**0.062**	**0.077**	**0.84**	**0.92**
Benzo(a)anthracene	0.018	**2.7**	**1.9**	**0.020**	**0.015**	**0.34**	**0.34**
Chrysene	0.018	**4.3**	**3.6**	**0.065**	**0.068**	**0.79**	**0.65**
Benzo(a)pyrene	0.018	**3.6**	**3.1**	**0.054**	**0.029**	**0.66**	**0.48**

Table 11
Summary of Whole Water Sample Results for MH178

Event		SW-5	SW-7	SW-8	SW-9	BF-2	BF-3
Sampling Date	**Criterion**	**3/9/2011**	**4/27/2011**	**5/15/2011**	**5/25/2011**	**3/21/2011**	**4/21/2011**
Sampled By	**(ug/L)**	**Landau**	**SAIC**	**SAIC**	**SAIC**	**Landau**	**SAIC**
Indeno(1,2,3-cd)pyrene	0.018	**2.7**	**2.4**	**0.053**	**0.033**	**0.66**	**0.41**
Dibenz(a,h)anthracene	0.018	**0.94**	**1.1**	**0.016**	<0.010 U	**0.23**	**0.14**
Benzo(g,h,i)perylene		**3.2**	**2.8**	**0.066**	**0.043**	**0.76**	**0.46**
Dibenzofuran		**0.20**	**0.11**	<0.010 U	<0.010 U	**0.024**	**0.017**
Benzofluoranthenes, total	0.018	**7.5**	**6.4**	**0.12**	**0.091**	**1.7**	**1.1**
HPAH, total		**41**	**31**	**0.60**	**0.54**	**7.2**	**4.5**
Other Semivolatile Organics (ug/L)							
bis(2-Ethylhexyl)phthalate	2.2	**2.3** B	<1.0 U	**1.3**	**1.7**	<1.0 U	<1.0 U
Conventionals							
pH (units)		7.06	6.56	6.73	6.83	7.10	6.64
Alkalinity (mg/L CaCO3)		22.7	42.5	24.5	53	123	127
Carbonate (mg/L CaCO3)		<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Bicarbonate (mg/L CaCO3)		22.7	42.5	24.5	53	123	127
Hydroxide (mg/L CaCO3)		<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U
Total Suspended Solids (mg/L)		170	118	66.8	50.9	32.4	131 J
Chloride (mg/L)		1.3	2.4	1.0	2.6	6.0	5.8
N-Nitrate (mg-N/L)		0.3	0.4 U	0.3	0.7	1.3	1.2
Sulfate (mg/L)		4.5	8.2	4.3	11.6	31.2	26.2
Total Organic Carbon (mg/L)		6.04	6.17	3.01	8.33	5.05	5.87
Dissolved Organic Carbon (mg/L)		2.45	2.80	2.76	6.83	5.56	4.22

Chemical detected at a concentration above the WQC
Chemical detected at a concentration at least 10x the WQC
Chemical not detected, but reporting limit is above the criterion

Detected concentrations are shown in **Bold**
Only chemicals that have been detected in at least one sample are shown

U = Target analyte not detected at the reported concentration.
J = Estimated concentration when the value is less than established reporting limits.
Y = Target analyte not detected at the reported concentration; reporting limit is elevated.
Q = Target analyte detected, but calibration not within criteria.
B = Analyte detected in an associated method blank.

Note: No data verification or validation was performed for metals or PAH samples collected by Landau.
An EPA Stage 2A data verification and validation check was conducted for PCB samples collected by Landau; results are provided in Appendix D2.
EPA Stage 4 data validation was conducted for all samples/analytes collected by SAIC; results are provided in Appendix D1.

Table 12
Lift Station Vault Solids Sample Results

Sample Type	SQS/ LAET	CSL/ 2LAET	Lift Station Vault - Centrifuge	Lift Station Vault - Filtered Solids	Lift Station Vault - Centrifuge	Lift Station Vault - Filtered Solids (Analyzed with Filter Bag)	Lift Station Vault - Filtered Solids (Collected from Filter Bag)	Lift Station Vault - Centrifuge	Lift Station Vault - Filtered Solids (Analyzed with Filter Bag)	Lift Station Vault - Filtered Solids (Collected from Filter Bag)
Event			CF-1	CF-1	CF-2	CF-2	CF-2	CF-3	CF-3	CF-3
Sample Date			3/25/2011	3/25/2011	4/28/2011	4/28/2011	4/28/2011	5/26/2011	5/25/2011	5/25/2011
Sampled By			SAIC/Ecology	SAIC	SAIC/Ecology	SAIC	SAIC	SAIC/Ecology	SAIC	SAIC
Total % Clay (< 3.9 microns)			41.9	4.6	0.6	1.3	NA	NA	0.6	NA
Total % Fines (< 62 microns)			46.9	6.3	4.7	1.4	NA	NA	3.8	NA
Total Solids (%)			17.6	NA	67.7	NA	NA	11.4	NA	NA
TOC (%)			NA	NA	1.11	NA	NA	13.5	NA	NA
PCBs (mg/kg DW)										
Aroclor 1248			<0.84 U	**0.083**	<0.049 U	<0.037 U	NA	<0.68 U	<0.068 U	<0.071 U
Aroclor 1254			**0.42**	**0.14**	**0.16**	**0.13**	NA	**1.4** J	**0.15**	**0.15**
Aroclor 1260			**0.21**	**0.076**	**0.060**	**0.051**	NA	**0.32** J	**0.070**	**0.087**
PCBs, total	0.13	1.0	**0.63**	**0.30**	**0.22**	**0.18**	NA	**1.7**	**0.22**	**0.24**
Metals (mg/kg DW)										
Arsenic	57	93	<70 U	<20 U	<7 U	<6 U	NA	NA	<6 U	NA
Cadmium	5.1	6.7	**6.0**	**3.5**	**3.9**	**3.6**	NA	NA	**3.4**	NA
Chromium	260	270	**83**	**20**	**38.6**	**19.6**	NA	NA	**17**	NA
Copper	390	390	**59**	**30.2**	**24.9**	**24**	NA	NA	**18.1**	NA
Lead	450	530	**70**	**41**	**103**	**22**	NA	NA	**26**	NA
Mercury	0.41	0.59	<0.1 U	**0.06**	**0.05**	**0.06**	NA	NA	**0.05**	NA
Zinc	410	960	**280**	**177**	**188**	**135**	NA	NA	**140**	NA
LPAH (mg/kg DW - estimated)										
Naphthalene	2.1	2.4	NA	NA	NA	NA	NA	**0.40**	**0.0080**	**0.013**
2-Methylnaphthalene	0.67	1.4	NA	NA	NA	NA	NA	**0.56**	**0.016**	**0.023**
1-Methylnaphthalene			NA	NA	NA	NA	NA	**0.36**	**0.36**	**0.0096**
Acenaphthylene	1.3	1.3	NA	NA	NA	NA	NA	**0.096**	**0.0049**	**0.0072**
Acenaphthene	0.50	0.73	NA	NA	NA	NA	NA	**0.54**	**0.044**	**0.033**
Fluorene	0.54	1.0	NA	NA	NA	NA	NA	**0.43**	**0.047**	**0.040**
Phenanthrene	1.5	5.4	NA	NA	NA	NA	NA	**3.1**	**0.62**	**0.46**
Anthracene	0.96	4.4	NA	NA	NA	NA	NA	**0.41**	**0.16**	**0.096**
LPAH, total	5.2	13	NA	NA	NA	NA	NA	**5.0**	**0.63**	**0.65**
HPAH (mg/kg DW - estimated)										
Fluoranthene	1.7	2.5	NA	NA	NA	NA	NA	**4.7**	**1.2**	**0.92**
Pyrene	2.6	3.3	NA	NA	NA	NA	NA	**3.4**	**0.89**	**0.75**
Benzo(a)anthracene	1.3	1.6	NA	NA	NA	NA	NA	**1.1**	**0.55**	**0.48**
Chrysene	1.4	2.8	NA	NA	NA	NA	NA	**3.5**	**0.62**	**0.55**
Benzo(a)pyrene	1.6	3.0	NA	NA	NA	NA	NA	**1.5**	**0.27**	**0.43**
Indeno(1,2,3-cd)pyrene	0.6	0.69	NA	NA	NA	NA	NA	**1.7**	**0.58**	**0.28**
Dibenz(a,h)anthracene	0.23	0.54	NA	NA	NA	NA	NA	**0.68**	**0.33**	**0.093**
Benzo(g,h,i)perylene	0.67	0.72	NA	NA	NA	NA	NA	**1.9**	**0.11**	**0.31**
Dibenzofuran	0.54	0.70	NA	NA	NA	NA	NA	**0.45**	**0.015**	**0.017**
Benzofluoranthenes, total	3.2	3.6	NA	NA	NA	NA	NA	**5.4**	**0.16**	**0.87**
HPAH, total	12	17	NA	NA	NA	NA	NA	**23.9**	**4.7**	**4.7**
Dioxins/Furans (pg/g)										
Dioxin/Furan TEQ			NA	NA	**4.4**	**0.21**	**4.0**	NA	NA	NA

Chemical detected at a concentration above the SQS/LAET
Chemical detected at a concentration above the CSL/2LAET
Chemical not detected, but reporting limit is above the criterion

NA = not analyzed
Detected concentrations are shown in **Bold**
Only chemicals that have been detected in at least one sample are shown