WSDOT NPDES Municipal Stormwater Permit Rest Areas, Maintenance Facilities, and Ferry Terminals Stormwater Monitoring Report (S7.D) Water Year 2012

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Prepared by

Stormwater and Watersheds Program

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Stormwater Monitoring Report

Rest Areas, Maintenance Facilities, and Ferry Terminals
Water Year 2012

Approved by:

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for willful violations.

Signature: Date:

Megan White, Director, WSDOT Environmental Services Office

Signatures are not available on the Internet version.

WSDOT = Washington State Department of Transportation

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1 Introduction

1.1 Permit Overview

In February 2009, the Washington State Department of Ecology (Ecology) issued a National Pollutant Discharge and Elimination System (NPDES) and State Waste Discharge Permit (permit) (Ecology 2009a) to the Washington State Department of Transportation (WSDOT) (Permit #WAR043000A). Under Special Condition S7 of the permit, WSDOT must collect baseline stormwater monitoring data from its highways, rest areas, ferry terminals, and maintenance facilities. In addition, the department must evaluate the effectiveness of stormwater treatment and hydrologic (flow control) best management practices (BMPs) following guidelines from Ecology's *Guidance for Evaluating Emerging Stormwater Treatment Technologies, Technology Assessment Protocol – Ecology* (TAPE) (Ecology 2008).

Under Special Conditions S7.B-E and S8.F of the permit, a detailed monitoring report on data collected from the October 1, 2011 through September 30, 2012 water year (WY 2012) is required. The following report satisfies this requirement and provides a summary of monitoring activities completed at WSDOT rest areas, maintenance facilities, and ferry terminal in water year 2012 (WY 12). A separate report covers monitoring activities completed at WSDOT highway and BMP monitoring sites in WY 12.

1.2 Monitoring Requirements (S7.D)

WSDOT must collect baseline water quality data for stormwater runoff from transportation facilities at the following locations:

- Two high-use rest areas
- One high-use ferry terminal
- Six maintenance facilities, one in each WSDOT region

For each facility, sampling locations must be established to capture runoff from most of the site and be located down gradient from major pollutant-generating activities. Composite samples must be collected from seven storm events; five in the wet season, one in the dry season, and one representing the seasonal first flush.

1.3 Monitoring Schedule

In accordance with Special Condition S7.G.1.c, WSDOT submitted a *Quality Assurance Project Plan (QAPP) for Baseline Stormwater Monitoring of WSDOT Maintenance Facilities, Rest Areas, and Ferry Terminals* (WSDOT 2011a) for approval to Ecology on September 2, 2011. The department received a QAPP approval letter from Ecology on September 16, 2011. The QAPP describes the objectives of the facilities monitoring program and the procedures used to ensure the quality and integrity of collected data. The QAPP also identifies project timelines and schedules.

Under Special Condition S7.G.1.d, the permit required full implementation of the monitoring program no later than September 6, 2011. On October 20, 2011, as required under General Condition G20 in the permit, the department notified Ecology that it would be unable to fully comply with this deadline due primarily to government hiring and equipment purchase freezes in effect through early summer 2011.

In a letter to Ecology on November 29, 2011, the department explained that it would use a phased approach to fully implement the monitoring program. Sampling would begin at three facility monitoring sites on November 30, 2011, with the remainder of the sites fully operational by February 27, 2012. WSDOT successfully met these revised timelines and schedules.

Appendix A provides copies of the G20 notification letters to Ecology.

2 Facility Sampling Sites

2.1 Site Selection

Fifteen maintenance facilities, six ferry terminals, and six rest areas were evaluated as potential monitoring sites. Selecting an appropriate sampling location was relatively straightforward at some facilities. In other cases, sampling locations were identified by minimizing complicating factors. Typically the first step in identifying suitable sampling locations involved evaluating the site's stormwater drainage areas.

At most facilities, the largest drainage area was the preferred and most appropriate location. However, at some facilities multiple discharge points and the orientation of activities away from a single stormwater discharge point made monitoring from the largest drainage areas not representative of site activities. In these situations, sampling from smaller drainage areas with runoff that was isolated and representative of typical facility activities became the preferred strategy. In other cases, retrofitting existing site infrastructure or installing new structures to direct stormwater runoff occurred to meet the need to monitor representative site activities.

Six maintenance facilities, two rest areas, and one ferry terminal were selected for monitoring. These sites are listed in Table 1 and shown on the following map (Figure 1).

Table 1 Selected maintenance facilities, rest areas, and ferry terminals.

WSDOT Region	Facility Name	Facility Location
Maintenance Facilities		
Northwest	Ballinger	City of Shoreline
Olympic	Lakeview	City of Lakewood
South Central	Clarkston	City of Clarkston
Southwest	Vancouver	City of Vancouver
North Central	Euclid	City of Wenatchee
Eastern	Geiger	City of Spokane
Rest Areas		
Northwest	Smokey Point Northbound	North of Marysville (Snohomish County)
Northwest	Smokey Point Southbound	North of Marysville (Snohomish County)
Ferry Terminal		
Ferries Division in NW Region	Bainbridge Island Terminal	City of Bainbridge Island

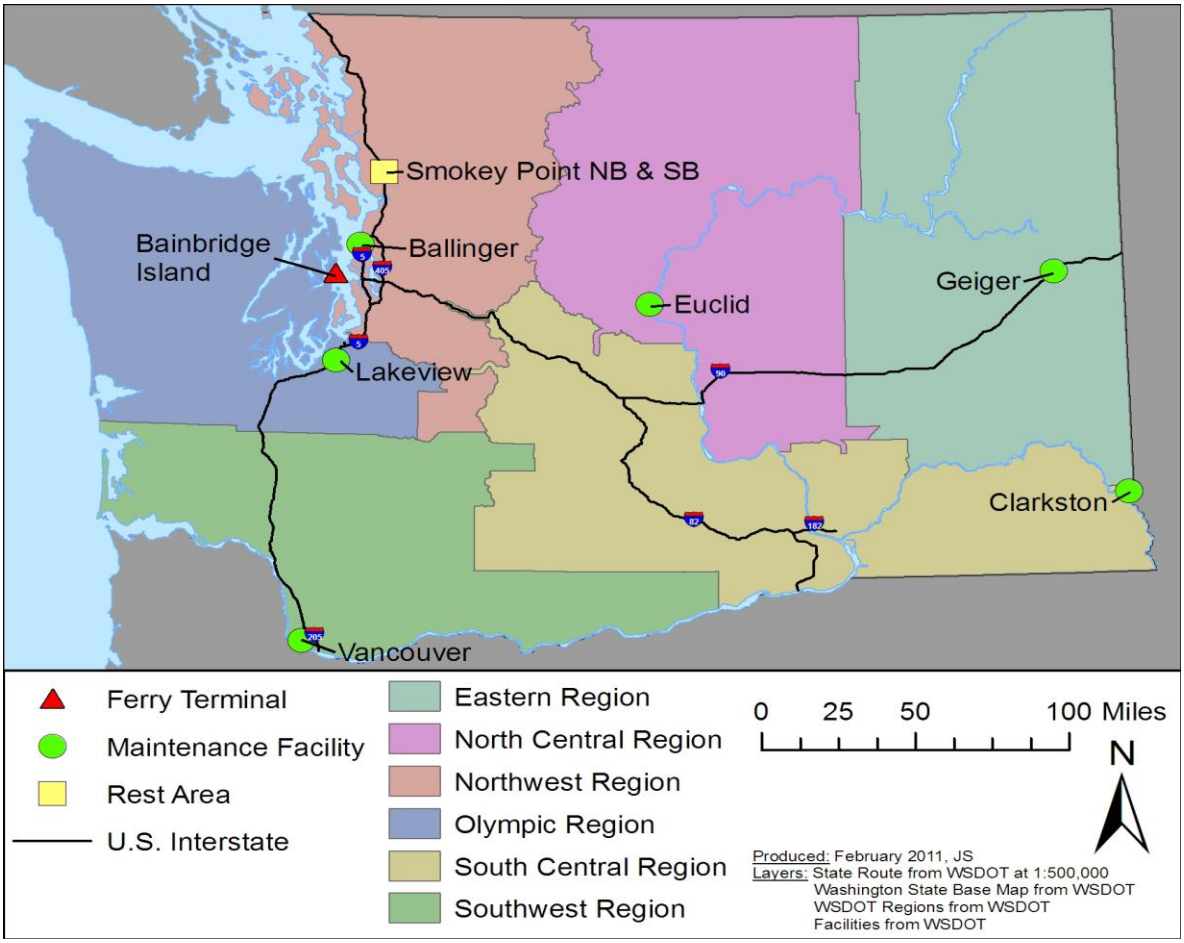

Figure 1 WSDOT regions and facilities selected for monitoring.

2.2 Rest Areas

WSDOT used the following criteria to select rest area monitoring locations:

- Location within the permit coverage area
- High-use as defined by a minimum 81,000 annual average daily traffic (AADT) on the highway that the rest area serves
- Site representativeness
- Site topography
- Hydraulic characteristics
- Adequate drainage area
- Absence of a high groundwater table
- Lack of runoff from off-site locations
- Ease of access for sampling

Although WSDOT rest areas are located across the state, only sites west of the Cascades fall within the permit coverage area and meet AADT criteria. Thus WSDOT selected the Smokey Point rest areas along north and southbound lanes of Interstate 5 (I-5) near Marysville in Snohomish County for monitoring.

Sampling site access, large drainage areas, and close proximity to other WSDOT monitoring sites made both Smokey Point rest areas good choices for sampling. Potential pollutant-generating activities at the rest areas include vehicle traffic, truck and recreational vehicle (RV) parking, sewage holding tanks, runoff from buildings, and various grounds-keeping activities. Potential pollutants from landscaped areas include pet waste, fertilizers, herbicides (glyphosate), and soils that wash off planted and unplanted areas.

Smokey Point Rest Area (Northbound I-5)

The northbound (NB) Smokey Point rest area lies east of I-5 near Marysville, approximately one half mile north of Exit 206. The drainage area selected for monitoring is 4.89 acres in size and includes catch basins that collect stormwater from paved parking, and some landscaped areas, which is piped to an oil/water separator that drains to a stormwater pond. Sample collection occurred at the oil/water separator tee, post treatment, before stormwater discharges to the pond.[1]

Figure B-1 in Appendix B shows the sampling point and drainage area at the NB Smokey Point rest area.

Smokey Point Rest Area (Southbound I-5)

The southbound (SB) Smokey Point rest area lies west of I-5 just north of Marysville, approximately one mile south of Exit 208. The drainage area selected for monitoring is approximately 6.70 acres in size and collects stormwater runoff from buildings, vehicle traffic lanes, and vehicle parking areas. Runoff from the drainage area flows through a catch basin system to an oil/water separator that discharges to a small creek. Sample collection occurred at the outlet of the oil/water separator before the stormwater discharged.

Figure B-2 in Appendix B shows the sampling point and drainage area at the SB Smokey Point rest area.

2.3 Maintenance Facilities

For each of the maintenance facilities selected, WSDOT identified the most representative and suitable locations for stormwater discharge monitoring. In most cases, WSDOT chose stormwater sample collection points located prior to stormwater treatment structures, such as on-site bioswales and stormwater detention or retention ponds. Therefore, water year 2012 (WY 12) chemical constituent data should not be characterized as effluent discharge to a clean water body.

[1] At the rest areas and two maintenance facilities (Lakeview and Euclid), sampling prior to oil/water separators was not possible. At these facilities, Ecology and WSDOT agreed during the QAPP approval process that sampling at the outlet of the oil/water separator was the most practicable and representative location. Oil/water separators are designed to separate oil from water, and will have an effect on TPH monitoring results.

Due to climatic variation, stormwater treatment strategies in eastern and western Washington vary. Oil/water separators and detention ponds are typically used for treatment west of the Cascades, whereas evaporation ponds or retention ponds and containment strategies are more common on the east.

Table 2 lists the potential pollutant generating materials and maintenance facility activities occurring within the drainage areas of the selected monitoring sites.

Table 2 Maintenance facility sampling location and materials/activities matrix.

Region	Facility	Materials and Activities													
		Galvanized Metals	Treated Lumber	Prewash Pad	Sand Storage	Salt	Deicer Storage	Road Sweepings	Landscaping	Truck Parking	Storage Buildings	Maintenance Buildings	Vehicle Maintenance Shop	Offices	Fuel Station	Herbicide/Fertilizer[2]
Northwest	Ballinger			X[1]	x	x		x	x	x		x	x	x	x	x[1]
Olympic	Lakeview	x	x	x[1]			x		x	x	x	x	x	x	x	x[1]
Southwest	Vancouver								x	x	x	x	x	x	x	x[1]
North Central	Euclid	x				x				x	x	x	x			x[1]
Eastern	Geiger		x	x[1]	x					x	x	x	x	x	x	x[1]
South Central	Clarkston			x			x					x		x	x[1]	

[1] Possible vehicle track-out of contaminants only. It is possible to collect some, but not all, of the runoff from this activity.

[2] Herbicides and fertilizers (those listed in S7.B.4) are stored, used, or in trucks parked within the drainage area of the monitoring station.

Ballinger (Northwest Region)

The Ballinger Maintenance Facility is located in Shoreline, just north of the City of Seattle. Residential areas border the facility to the south and east, with a shopping center located to the west. A four-lane city street runs along the north side of the site.

Ballinger is a small facility with a consolidated stormwater control system that collects stormwater runoff from most of the facility. Runoff discharges from a central catch basin to ponds that function as a treatment system.

Sampling occurred prior to stormwater discharge to the detention ponds. Figure B-3 in Appendix B shows the central catch basin and outlines approximately 0.79 acres that drain to the stormwater detention ponds.

Lakeview (Olympic Region)

The Lakeview Maintenance Facility is in the City of Lakewood, just south of Tacoma. The facility is bordered by Interstate 5 (I-5) to the east and surrounded by side streets and commercial properties in all other directions. Lakeview is a midsized maintenance facility, with a stormwater system that collects runoff from nearly the entire site.

Sampling occurred at the outlet of a large catch basin with an integrated oil/water separator. This catch basin discharges to an on-site swale and retention pond. Figure B-4 in Appendix B shows the catch basin and drainage area of approximately 4.01 acres in size.

Vancouver (Southwest Region)

The Vancouver Maintenance Facility, in Vancouver, Washington, is a large facility bordered by a residential street to the east and by high-density housing in all other directions. Figure B-5 in Appendix B shows the sampling location in a catch basin near the main entrance to the facility. This location collects stormwater runoff from most of the site with a discharge area approximately 5.48 acres in size. Runoff from this facility drains to the City of Vancouver storm sewer system.

Euclid (North Central Region)

The Euclid Maintenance Facility is in the City of Wenatchee. An undeveloped property borders the facility to the west, and the Wenatchee Apple Commission building and its adjoining property borders the site to the east. A city street and major highway run along the south and north sides of the site, respectively.

WSDOT collected stormwater samples from inside a catch basin draining the northern portion of the facility (Figure B-6 in Appendix B), after which the stormwater discharges to a retention pond. A building in the drainage area contains materials storage and offices, as well as a carpenter shop, materials lab, and vehicle maintenance shop. This sampling location represents most of the typical activities for this facility with a drainage area for this location of approximately 3.20 acres.

Geiger (Eastern Region)

The Geiger Maintenance Facility is near the Spokane International Airport west of the City of Spokane. Open areas border the site to the east and west, and county roads run along the north and south sides of the facility. Figure B-7 in Appendix B shows the sampling location at a concrete inlet structure or sump built to discharge stormwater to a retention pond northwest of the fuel station. WSDOT collected stormwater runoff from a discharge area approximately 1.16 acres in size that includes the fueling station and vehicle and materials storage areas.

Clarkston (South Central Region)

The Clarkston Maintenance Facility is near the western edge of the City of Clarkston. The Clarkston Golf and Country Club borders the facility to the west, and residential housing and small commercial properties border the site to the south and east. A major city street runs along the north side of the facility.

WSDOT collected stormwater samples from the northeast corner of the facility (Figure B-8 in Appendix B), where the majority of runoff from the facility flows to the edge of an asphalt parking area and collects in a shallow paved depression. The drainage area is approximately 5.48 acres.

2.4 Ferry Terminal

WSDOT is required to collect baseline water quality samples from one high-use ferry terminal. The term "high-use" is not defined in the permit. Therefore, the department used ridership values from the 2009 Washington State Ferries Traffic Statistics Rider Segment Reports (WSDOT 2009) to identify a suitable site for sampling consistent with the term "high use."

The following criteria were used to select the ferry terminal monitoring location:

- Within the permit coverage area
- High use as defined by ridership levels
- Site representativeness
- Site topography
- Hydraulic characteristics
- Adequate drainage area
- Lack of runoff from off-site locations
- Ease of access for sampling
- Adequate space for monitoring equipment
- Equipment security
- Sampling would not interfere with normal ferry terminal operations

WSDOT evaluated six ferry terminals in the permit coverage area to determine their suitability for monitoring. All of the terminals under consideration were similar in function, but had very different orientations and site plans. Most of the terminals were unsuitable for monitoring without extensive site reconfiguration or modification. For example, in order to establish a monitoring station at one of the terminals evaluated, the terminal's stormwater treatment facility would need to be disconnected from the local city storm sewer system.

Several other attributes common to most WSDOT ferry terminals pose distinct challenges to stormwater monitoring. These include extremely steep or flat topography; parking lots and holding lanes with multiple discharge points; terminal piers built with flow-through drains; and on-site flows from adjacent commercial development, city streets, and residential areas.

Bainbridge Island Ferry Terminal

WSDOT identified the Bainbridge Island Ferry Terminal as the most suitable site for monitoring. The ferry terminal is on Eagle Harbor along the east shoreline of Bainbridge Island. High-occupancy vehicle parking lots border the facility to the north and northeast. Eagle Harbor (part of Puget Sound) borders the site to the south and southeast, with residential development surrounding the terminal to the west and east.

WSDOT sampled stormwater at the south end of the vehicle holding lanes, located just above the ferry terminal pier, from a drainage area approximately 1.77 acres in size. The drainage area consists of pavement and discharges into a catch basin. Figure B-9 in Appendix B shows the drainage area and catch basin. The site has a moderate slope that collects runoff from outside the 1.77-acre drainage area during high intensity rainfall. Stormwater runoff during these large storm events can run onto the vehicle holding lanes from the highway and parking lots near the ferry terminal.

The stormwater conveyance system includes three catch basins located along the center lanes of the vehicle holding area and a pipe that discharges down a vegetated slope and eventually to Eagle Harbor. WSDOT collected samples from the discharge pipe outlet.

3 Sampling and Monitoring Procedures

3.1 Monitoring Stations

Monitoring stations at facilities typically include a concrete pad, equipment enclosure (cabinet) with lock, Global Positioning System (GPS), antenna, solar panel, and rain gage. The antenna, solar panel, and rain gage are attached to a mounting pole installed on the side of the equipment enclosure. Where electric power is available, an alternating current (AC) connection eliminates the need for the solar panel.

The equipment enclosure houses a data logger, refrigerated automatic sampler, sample tubing, an analog module to run a thermistor (temperature sensor) and float switch, and a 12-volt battery. Sample tubing runs from the automatic sampler through protective conduit located outside the enclosure to the designated sampling point. The locked enclosure provides a secure location for equipment as well as protection from wind, rain, and snowfall.

3.2 Weather Tracking

WSDOT monitoring staff used weather information – from satellite imagery, prediction models, the National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), and private forecasters – to forecast potentially qualifying storm events on a daily basis during the monitoring period. As candidate storms approached, staff used radar observations and hourly reports from land-based weather stations to track and evaluate storm potential. Staff used data received from individual monitoring stations via the Emergency Data Distribution Network (EDDN) message through the Geostationary Operational Environmental Satellite Data Collection System (GOES DCS) to track the progress of a storm event and the beginning of runoff. WSDOT used this information to direct field team deployments for sample collection.

To qualify, a storm must meet minimum rainfall depth and antecedent dry period criteria. Table 3 lists storm event criteria for facilities monitoring.

Table 3 Storm event criteria for facilities monitoring

Criteria	Wet Season	Dry Season
Monitoring Period	Western WA (Oct 1 – Apr 30); Eastern WA (Oct 1 – Jun 30)	Western WA (May 1 – Sep 30); Eastern WA (Jul 1 – Sep 30)
Rainfall Depth	0.20” minimum; no fixed maximum	0.20” minimum; no fixed maximum
Rainfall Duration	No fixed minimum or maximum	No fixed minimum or maximum
Antecedent Dry Period	< 0.02” rain or no surface runoff in the previous 24 hours	< 0.02” rain or no surface runoff in the previous 72 hours
Inter-Event Dry Period	6 hours	6 hours
Intensity	Not specified	Not specified

At each of the facility monitoring sites, the permit requires sampling of at least five qualifying storm events in the wet season, one event in the dry season, and one event that represents the seasonal first-flush. The permit requires a one-week antecedent dry period prior to the seasonal first-flush event. The first-flush sampling event cannot occur prior to August 1 each year.

The permit requires collection of representative stormwater samples from the first hour of runoff at WSDOT rest areas, maintenance facilities, and the ferry terminal (S7.D.3). Since sampling occurs during the first hour of runoff only, the rainfall depth criterion (i.e., 0.20-inch minimum) is less important for facilities monitoring than other types of stormwater monitoring that requires sampling the entire storm. Early in the facilities monitoring cycle, WSDOT observed that retaining stormwater samples from storms forecasted to qualify but that did not meet the 0.20-inch rainfall depth criterion, would help improve the department's ability to successfully meet permit requirements without compromising the quality or representativeness of the stormwater samples from the facilities.

Based on a review of sampling records at WSDOT facilities, the Washington State Department of Ecology (Ecology) approved the following modification to permit requirements. This change incorporates language similar to Special Condition S7.B.6 in the "Baseline Monitoring of WSDOT Highways" section of the permit (Ecology 2009a) (Foroozan Labib, Department of Ecology, written communication, March 30, 2012):

> *WSDOT may collect and report data from up to two storm events that were forecast qualifying storms but which did not meet the qualifying storm event criterion for rainfall depth (0.20-inch minimum). These two non-qualifying storm events may be collected and counted as part of the seven required storm events.*

Precipitation Measurement

At each monitoring station, WSDOT installed a pole-mounted tipping bucket rain gage to accurately capture on-site rainfall measurements. Each rain gage was leveled and installed in a secure location where no trees, buildings, overpasses, or other objects obstruct or divert precipitation prior to entering the rain gage. WSDOT referenced National Weather Service criteria as guidance for rain gage installation (NWS 2010). Staff implement rain gage calibration and maintenance procedures according to manufacturers' specifications. These procedures include leveling the gage and cleaning filter screens and drain holes during each maintenance visit. Field staff conduct maintenance every six to eight weeks.

WSDOT collected rain gage data every 15 minutes and stored it in the data logger's memory. WSDOT used these data, transmitted via telemetry to a WSDOT database, to track and record site-specific precipitation measurements.

3.3 Sampling Parameters

The permit identifies a unique suite of sampling parameters for each land-use type (i.e., rest areas, maintenance facilities, and the ferry terminal). Table 4 lists these parameters in order of priority. If WSDOT collected insufficient sample volume, the permit instructed the department to process samples for the highest priority pollutants per the volume requirements.

Table 4 Sampling water quality parameters listed in order of priority.

Rest Areas	Maintenance Facilities	Ferry Terminal
TPH-Dx and TPH-Gx	TSS	PAHs
Cu, Zn, Cd, Pb (total & dissolved)	TPH-Dx and TPH-Gx	TPH-Dx and TPH-Gx
PAHs	PAHs	Cu, Zn, Cd, Pb (total & dissolved)
TSS	triclopyr	MBAS
triclopyr	2, 4-D	TSS
2, 4-D	clopyralid	fecal coliform
clopyralid	diuron	temperature
diuron	dichlobenil	hardness
dichlobenil	picloram	chlorides[3]
picloram	glyphosate	
glyphosate	total phosphorus	
total phosphorus	orthophosphate	
nitrate/nitrite	nitrate/nitrite	
orthophosphate	total Kjeldahl nitrogen	
total Kjeldahl nitrogen	Cu, Zn, Cd, Pb (total & dissolved)	
chlorides	MBAS	
phthalates	chlorides	
fecal coliform	hardness	
temperature[1]		
hardness[2]		

[1] WSDOT used temperature, measured by in situ probe, as a threshold for triggering autosamplers.

[2] Hardness is not a permit-required parameter. However, Ecology recommended inclusion on the list because of the effect of hardness on the bioavailability of metals in solution.

[3] Chlorides, while not a permit-required parameter for ferry terminals, were sampled at the ferry terminal to provide additional information for maintenance.

Herbicide and nutrient monitoring were conducted at rest areas and maintenance facilities where listed herbicides and nutrients are applied on site, stored on site, or applied by vehicles parked on site. WSDOT defined “on site” to mean within the monitoring site drainage area.

The stormwater monitoring team checks storage, use, and transport of herbicides and nutrients in monitoring site drainage areas on an annual basis. WSDOT used these annual reviews to update the list of herbicides and nutrients monitored at each site.

3.4 Grab Samples

WSDOT staff are required by the permit to manually collect grab samples during the first 20 minutes of a qualifying runoff event at WSDOT rest areas, maintenance facilities, and the ferry terminal. The permit allows grab sample collection from a separate qualifying event when collecting a manual grab sample during the first 20 minutes of runoff is not possible. A grab sample collected after the first 20 minutes of runoff, but before sampling is completed in the first hour of runoff, was qualified as an estimate.

WSDOT collected grab samples with a pole sampler, bailer, or by hand following methods described in the *Standard Operating Procedures for Collecting Grab Samples from Stormwater Discharges* (Ecology 2009b).

WSDOT used refrigerated autosamplers to collect time-weighted composite samples. WSDOT programmed each station's telemetered data logger with a step-triggering system that collected environmental data (e.g., rainfall and water temperature) to determine whether a storm event qualified and to initiate sampling. The data logger prompted the autosampler to initiate sample collection upon meeting the programmed rainfall threshold (i.e., 0.02-inch of rain). The autosampler collected programmed sample volumes in accordance with permit requirements and analytical needs. The permit describes time-weighted sampling as a minimum of five equally spaced stormwater aliquots (individual, discrete sample volumes) within the first hour of runoff.

Each type of stormwater sampling requires different bottle combinations depending on sample volume requirements, planned replicates, field blanks, or storm size. Table 5 lists the minimum targeted volumes for composite sample collection.

Table 5 Minimum targeted volumes for composite sample collection (Ecology 2009a; MEL 2008; 40 CFR 136.3).

Recommendations	Rest Areas	Maintenance Facilities	Ferry Terminals
Minimum volume of sample needed to analyze all parameters except herbicides[1][2]	4.3 liters	3.7 liters	3.2 liters
Minimum volume of sample needed to analyze all parameters including herbicides[1][2]	7.4 liters	6.8 liters	N/A
Maximum additional sample volume needed for quality control (QC) analyses	Dependent on QC samples and parameters of interest up to 7.4 liters	Dependent on QC samples and parameters of interest up to 6.8 liters	Dependent on QC samples and parameters of interest up to 3.2 liters
Recommended compositor bottle size (glass)	9.4 liters	9.4 liters	9.4 or 3.8 liters

[1] Herbicide sampling was only required if used, stored, or in trucks parked at the facility. Therefore, some facilities may not require collection of these parameters.

[2] Estimates do not include needed volumes for quality control (QC) samples.

WSDOT used the U.S. Environmental Protection Agency's "clean hands/dirty hands" protocol (USEPA 1996) for low-level detection of metals as a guideline for sample collection procedures. Field staff used nitrile gloves during sample collection and followed standard health and safety procedures. Preservation and filtration of samples (if applicable) occurred as field staff collected composited samples. Upon completion of sampling, field staff collected sample bottles in coolers with bubble wrap and freezer packs or ice for shipping to analytical laboratories. Chain of custody (COC) forms were completed and shipped with the coolers.

Upon sampling completion, the data logger and autosampler returned to normal operation modes, and staff retrieved samples from the autosampler to fill the appropriate sample bottles. Staff then inspected and cleaned the autosampler in preparation for subsequent sampling events. Sample collection tubing was checked after each sampling event and replaced, if necessary. WSDOT followed standard operating procedures (SOPs) as guides during the autosampler inspection and cleaning processes (Ecology 2009c; WSDOT 2011b and WSDOT 2011c).

3.5 Station Maintenance

WSDOT field staff completed monitoring station maintenance after sampled storm events or at routine six to eight week intervals. Monitoring staff performed a visual inspection of the monitoring site to identify possible damage to equipment and any new or unsafe conditions. Staff inspected equipment enclosures for signs of tampering or forced entry. Unusual odors and the presence of water or debris were recorded and addressed through further investigation and site retrofit or rehabilitation, if necessary. Staff also inspected and cleaned outlet pipes, sampling basins, and conveyance systems to ensure proper monitoring station operation.

Following the *Standard Operating Procedure for Equipment Maintenance and Cleaning* (WSDOT 2011c), WSDOT field staff conducted station maintenance visits that included equipment inventory, inspections, testing, and replacement of worn or missing parts. Staff inspected internal wires and cables to evaluate wear and ensure cable connections to the data logger were in good operating condition. WSDOT checked station antennae declinations and bearings to ensure correct operation. Solar panels were cleaned to remove accumulated debris. For required servicing or calibration of scientific equipment at monitoring stations, monitoring staff followed manufacturers' specifications and conducted servicing and calibration of equipment on site or in a controlled environment, as appropriate.

Equipment Decontamination

Pump tubing, churners, and sample containers, as well as filters or other materials that contact sampled stormwater, were decontaminated prior to each use or were certified as precleaned from the equipment source. WSDOT staff or a contract laboratory cleaned intake tubing prior to installation and WSDOT changed tubing once a year after the collection of blank samples. Equipment was cleaned and decontaminated using the following step-by-step procedure:

1. Washed in nonphosphate detergent and hot tap water.
2. Rinsed with hot tap water.
3. Rinsed with hydrochloric or nitric acid solution (approximate pH of 2).
4. Rinsed three times with deionized water.
5. Air dried in a clean area free of contaminants.
6. Rinsed with pesticide-grade acetone or hexane.
7. Air dried in a contaminant-free area.

Air dried equipment was wrapped in aluminum foil or stored in polyethylene bags for transport to field stations. If new equipment could not be cleaned with solvents, it was washed with non-phosphate soap, rinsed three times with deionized water, and air dried.

3.6 Staff Roles and Responsibilities

WSDOT used Stormwater and Watersheds Program staff in the Headquarters (HQ) Environmental Services Office (ESO) and staff from the department's regions to implement its monitoring program in water year 2012 (WY 12). Seven staff from the HQ ESO played key roles in implementing the stormwater monitoring strategy. Staff from regional offices across the state supported ESO efforts on a part-time basis and participated in stormwater monitoring at different levels.

4 Quality Assurance and Quality Control

4.1 Field Quality Control Procedures

During the water year 2012 (WY 12) sampling season, WSDOT staff implemented quality control (QC) procedures in all phases of fieldwork including:

- Weather tracking
- Autosampler operation
- Equipment rinsate blanks
- Documentation review
- Field audits

Weather Tracking QC Procedures

Staff reviewed rainfall data from rest area, maintenance facility, and the ferry terminal monitoring stations on a regular basis using telemetered data stored in the StreamTrac hydrologic database. Data review included identifying inconsistencies such as: excessive dry or wet periods that did not match observed conditions; measurements in conflict with other nearby rain gage readings; and any measurements that appeared unrealistic and out of the norm. Staff manually downloaded rainfall data from the data logger during each site maintenance visit.

When WSDOT observed irregular rainfall data, the stormwater monitoring field team deployed to perform monitoring station quality checks and repaired, replaced, or field-calibrated the rain gages, as needed. Such interventions included cleaning debris from rain gage catchment funnels, leveling the gages, and replacing the rain gages, if necessary.

Autosampler Procedures

During regular site maintenance visits, WSDOT staff inspected and calibrated the autosamplers as needed to ensure the quality and representativeness of the aliquots (individual, discrete sample volumes) collected. Refrigeration temperature was noted regularly and autosamplers were replaced if they were not sufficiently cooling. Staff visually inspected autosampler tubing for worn segments and replaced any worn tubing to maintain integrity. The autosampler internal clock was checked during each maintenance visit for any positive or negative drift that could compromise the accuracy of aliquot collection times. If autosampler clock discrepancies were noticed, staff made corrections to match the data logger time. Desiccants and cables were regularly checked and replaced, if necessary. Field staff also performed volume calibrations annually or as needed to ensure accurate aliquot programmed volumes were delivered to the sample bottle. If the autosampler pump tubing was replaced, a volume calibration was performed.

Equipment Rinsate Blank Procedures

During the WY 12 sampling season, WSDOT staff collected an equipment rinsate blank for most of the required parameters at six of the nine facilities. These facilities included the Ballinger, Clarkston, Vancouver, and Lakeview Maintenance Facilities, Bainbridge Island Ferry Terminal, and Smokey Point Rest Area (southbound). For composite samples, rinsate blanks consisted of laboratory-supplied deionized water that was drawn using the autosampler's pump from the inlet of the suction tubing through the entire autosampler system and into a clean sample bottle. Staff then collected samples from the bottle using decontaminated composite sampling equipment and normal sampling procedures. The goal was to mimic the sampling process in its entirety to determine whether contamination occurred at any point during the sampling process.

For grab samples, staff collected rinsate blanks using site-specific methods by either manually pouring or using a bailer to collect deionized water and transfer it into clean grab sample bottles. Blank samples were submitted blind to laboratories for analysis.

Blank collection was scheduled to occur as close as possible to a preceding qualifying storm event. Our objective was to collect blank samples that accurately represented any potential contamination associated with previous sampling.

Documentation Review QC Procedures

WSDOT staff completed sampling field forms in the field during sampling events. Completing the forms during sample collection ensured accurate real time data were recorded. When staff returned to the office, the completed forms were submitted to the monitoring field lead or a member of the field team who did not participate in completing the form. This other team member then reviewed the document for errors and checked the field form for completeness. Reviewed field forms were initialed, dated by the reviewer, and submitted to a member of the data management team for verification.

The data management team then checked the information on the field forms with the telemetered data stored in the StreamTrac hydrologic database. The reviewer checked for any discrepancies in the telemetered sample start/end and duration times, the number of aliquots collected by the autosampler, and any potential disqualifiers to the validity of the collected data and the submitted field forms. Once all information was verified to be correct, the data team reviewer submitted the field forms to a central filing location.

Members of the field team similarly collected and completed site maintenance field forms. Completed site maintenance field forms were stored in the central filing location.

Field Audit QC Procedures

The monitoring field lead or delegated monitoring staff conducted field audits. Audits were performed on all WSDOT field staff involved in sample collection. Field audits included observing staff conducting sampling procedures during a sampling event or training. Sampling procedures reviewed during audits involved monitoring station setup, sample collection, completing sample field and chain of custody (COC) forms, and sample cooler shipment or delivery to the appropriate laboratories. During or immediately after an audit, the monitoring field lead or monitoring staff recorded competencies on an audit form. After completing the audit, staff were told to correct any noted deficiencies in the sampling process.

4.2 Hydrologic Data Quality Control Procedures

Each monitored facility had equipment on site programmed to collect and transmit weather and storm data. The sampling process was initiated when 0.02 inch of rain was recorded in the rain gage. This triggered the data logger to check that a float switch had been activated by sufficient runoff and that the temperature of the runoff water was above 32 degrees Fahrenheit (32°F or 0° Celsius).

If all three criteria were met (i.e., 0.02-inch precipitation threshold, temperature above freezing, and sufficient water in the system), the sampling protocol was initiated and five samples were collected at equal time intervals over the first hour of runoff. The data logger had a failsafe function that would initiate the sampling protocol if the float switch had not been activated within 20 minutes of rainfall surpassing the 0.02-inch threshold.

When verifying facility hydrologic data, monitoring staff first confirmed that there was a sufficient antecedent dry period prior to the start of precipitation. In the wet season, antecedent requirements were met if less than 0.02 inch of rain had fallen in the previous 24-hour period. In the dry season, this antecedent was increased to 72 hours. Staff checked telemetered data from the rain gage during, or immediately following, a storm event to see that the antecedent had been met. A second quality control verification of antecedent dry period was performed later using data downloaded directly from the on-site data logger. In the event the rain gage was inoperable, staff manually activated the auto-sampler and accessed a nearby weather station to verify that the antecedent criteria were met.

Following confirmation of a sufficiently long antecedent dry period, WSDOT staff examined rainfall data to verify that data fell within the required parameters for storm qualification. Telemetered rainfall data was used to verify that at least 0.20 inch of rain was received during the storm event. A comparison was made between the amount of rainfall received at the start of the event (when the 0.02-inch rainfall threshold was crossed) and the time of first aliquot collection by the autosampler. This comparison dictated whether the runoff lag time was within a reasonable range. The rainfall data, like those of the antecedent dry period, were rechecked after the storm using downloaded data.

A final check of autosampler collection times and runoff water temperature completed the process. The autosamplers collected five aliquots at an even time distribution through the first hour of the storm to ensure a representative sample was collected. Staff checked water temperature to verify that the runoff and aliquots taken by the autosampler remained above 32°F (0°C) and the sample intake line was not obstructed by ice or snow.

Appendix C provides hydrologic storm reports for each of the facility monitoring sites.

4.3 Analytical Data Quality Assessment Report

A third-party analytical data quality assessment report (Appendix D) was prepared for WSDOT by Pyron Environmental, Inc. in Olympia and Cardno TEC, Inc. in Seattle. This report provides an overview of the analytical scheme, data verification and validation procedures, and the quality of analytical data collected from September 17, 2011, through November 6, 2012. The quality of the data are assessed and discussed in terms of Measurement Quality Objectives (MQOs) (i.e., precision, accuracy, representativeness, comparability, sensitivity, and completeness).

Data collected from WSDOT facility monitoring sites as well as the department's highway runoff and best management practices (BMP) effectiveness monitoring sites are included in the analytical data quality assessment report (Appendix D).

5 Monitoring Results

Analyses were successfully completed for 45 sampled storms at WSDOT's rest areas, maintenance facilities, and ferry terminal during water year 2012 (WY 12). The stormwater monitoring team made a total of 104 attempts at collecting stormwater samples. Of the 104 sampling attempts, 45 were successfully sampled, 37 were failed attempts, and 22 were missed events.

Water quality data collected at each of WSDOT's rest areas, maintenance facilities, and ferry terminal are presented in Appendix E. The Analytical Data Quality Assessment Report in Appendix D includes an explanation of the data qualifiers used in this report. Appendix F displays the storm sampling attempt records for WY 12 at each site.

5.1 Rest Areas

Smokey Point Rest Area (Northbound I-5)

WSDOT staff initiated sampling attempts at the northbound (NB) I-5 Smokey Point Rest Area on November 30, 2011, but the first successful sample was not collected until March 2012 due to equipment failures and storm forecast variability (Appendix F). Of 15 attempted storms in WY 12, three qualified wet season events were sampled along with one qualified dry season event. Grab samples were attempted during three of the four storms, but were missed each time due to staff arriving on site after the 20-minute permit-specified window. These delays were due in part to the difficulty in predicting storm start times, challenges in mobilizing monitoring staff on short notice, and travel times.

Conventional parameters, nutrients, and metals (total and dissolved) were detected in most of the samples collected (Appendix E). For metals, copper and zinc levels were found to be higher than lead and cadmium.

Nearly all polycyclic aromatic hydrocarbons (PAHs) and phthalate compounds were below reporting limits, the minimum values below which data are detected as nondetects. Many of them were below detection limits. Similarly, all herbicides were below reporting and detection limits except one measured value of dichlobenil (0.059ug/L) in a storm on March 9, 2012.

Smokey Point Rest Area (Southbound I-5)

WSDOT staff initiated sampling attempts at the southbound (SB) Smokey Point Rest Area on February 28, 2012. Of fifteen attempted storms in WY 12, three qualified wet season events were sampled along with one qualified dry season event (Appendix F). Grab samples were attempted at three of the four storms, but were missed each time due to staff arriving on site after the 20-minute permit-specified window. These delays were due in part to the difficulty in predicting storm start times, challenges in mobilizing monitoring staff on short notice, and travel times. No total petroleum hydrocarbon or fecal coliform samples were collected due to the missed grab samples.

Conventional parameters, nutrients, and metals (total and dissolved) were detected in most samples collected during WY 12 (Appendix E). Total recoverable cadmium was below reporting and detection limits in both the April 30 and May 21, 2012 storm events. For other metals, copper and zinc levels were found to be more prevalent than lead and cadmium. In the majority of samples, PAHs and phthalate compounds were below reporting limits and many of them were below detection limits. Similarly, all herbicides were below reporting and detection limits.

5.2 Maintenance Facilities

Ballinger (Northwest Region)

WSDOT staff initiated sampling attempts at the Ballinger Maintenance Facility on November 30, 2011. Of 15 attempted storms in WY 12, five qualified wet season events, one nonqualifying event (0.17 inch of rainfall), and one qualified dry season event were sampled (Appendix F). Grab samples were successfully collected at two of the seven storms, but were missed in all other attempts due to staff arriving on site after the 20-minute permit-specified window. These delays were due in part to the difficulty in predicting storm start times, challenges in mobilizing monitoring staff on short notice, and travel times.

- Of the two storms where grabs were collected, TPH-Gx (gasoline) samples were below the reporting limit. Both of the TPH-Dx (diesel) samples were below the reporting limits for the lube oil fraction. The diesel fuel fraction was below the reporting limit (Appendix E).
- Of the conventional parameters collected in WY 12, TSS was detected in all events, and chlorides were detected in five events.
- Total and dissolved zinc, copper, lead, and dissolved cadmium were detected in all of the wet season samples collected. Total recoverable cadmium was detected from samples collected in January and February, but was not detected in samples collected in April.
- PAH compounds were identified in samples from six of the seven storms.
- One phthalate sample was collected by field staff on February 28. Phthalates are not permit-required analytes, but are reported in this instance since they were inadvertently collected and analyzed.
- All herbicides were below reporting and detection limits except dichlobenil, which was present in three of the seven storm samples.
- Methylene blue active substances (MBAS) were collected in three of the seven storms and found present in each.
- Permit-specified nutrients were present in each sampled storm.

- Chloride concentrations were found to be consistently elevated throughout the water year as compared to other facilities. Stormwater samples at Ballinger were collected from a catch basin that is in close proximity to a salt shed. Through development and implementation of WSDOT's Stormwater Pollution Prevention Plan (SWPPP) program, a deficiency in the Ballinger salt shed was discovered that was allowing runoff to pass through the salt storage shed and into the sampling catch basin. This deficiency was remedied after WY 12 monitoring at this site was completed.

Lakeview (Olympic Region)

WSDOT staff initiated sampling attempts at the Lakeview maintenance facility on February 28, 2012. Of 14 attempted storms in WY 12, four qualified and one unqualified (0.18 inch of rain) wet season events were sampled along with one qualified dry season event (Appendix F). Staff successfully collected grab samples during only one of the six storms. Grabs were missed in all other attempts due to staff arriving on site after the 20-minute permit-specified window. These delays were due in part to the difficulty in predicting storm start times, challenges in mobilizing monitoring staff on short notice, and travel times.

- The TPH-Gx (gasoline) sample was found below the reporting limit. The TPH-Dx (diesel) sample was detected in the lube oil fraction. The diesel fuel fraction was below the reporting limit (Appendix E).
- All conventional parameters were detected in two of six sampling events, with TSS being the only parameter detected in all collected storms.
- Total and dissolved metals were detected consistently for all wet season samples, but they were not collected during the dry season event.
- PAH compounds were detected in all six of the sampling events, but were consistently below the reporting limits.
- The herbicide, dichlobenil, was detected in four of the six storms, and triclopyr was detected in every storm sampled at the Lakeview Maintenance Facility.
- Nutrients, including total phosphorus, total Kjeldahl nitrogen, and nitrate+nitrite, were detected in most samples collected, while orthophosphate was only detected from one sample.
- Methylene blue active substances (MBAS) were collected and found present in one of the six storms sampled.

Vancouver (Southwest Region)

WSDOT staff initiated sampling attempts at the Vancouver maintenance facility at the end of February 2012. Of 12 attempted storms, field staff sampled three qualified and one unqualified wet season events along with one qualified dry season event (Appendix F). Grab samples were successfully collected at three of the five storms. Grabs were missed in the other two attempts due to staff arriving on site after the 20-minute permit-specified window. These delays were due in part to forecasting errors, the difficulty in predicting storm start times, challenges in mobilizing monitoring staff on short notice, and travel times.

- From the grab samples, TPH-Gx (gasoline) was found below the reporting limit in all three samples collected. All three of the TPH-Dx (diesel) samples were detected in the lube oil fraction. The diesel fuel fraction was below the reporting limit (Appendix E).
- Conventional parameters were detected in all samples collected, and total and dissolved metals were detected in all wet season samples. A dry season metals sample was not collected.
- PAH compounds were consistently measured below reporting limits or were not detected.
- The herbicides detected in samples were triclopyr, dichlobenil, and diuron. Triclopyr was detected in each sample collected, dichlobenil was detected in two events, and diuron was only detected in one sampling event.
- Except for orthophosphate, all other nutrients were detected in the samples collected. Orthophosphate was not detected in any of the samples collected.
- Methylene blue active substances (MBAS) were collected and found present in two of the five storms.

Euclid (North Central Region)

WSDOT staff initiated sampling attempts at the Euclid Maintenance Facility on March 14, 2012. Six sampling attempts were made at the facility during WY 12 (Appendix F). Two qualified wet season events and one qualified dry season event were collected. The three unsuccessful storm events were missed due to inaccurate forecast data and reduced availability of staff at this site. Grab samples were successfully collected at two of the three storms. A grab sample was missed in the other attempt because staff were not available to sample within the 20-minute permit-specified window.

- From the grab samples, TPH-Gx (gasoline) was found below the reporting limit in both of the samples collected. Both of the TPH-Dx (diesel) samples were detected in the lube oil fraction. The diesel fuel fraction was below the reporting limit (Appendix E).
- All conventional parameters were detected in samples collected on June 7, 2012. Total suspended solids (TSS) were detected and the only conventional parameter sampled from a storm on April 25.
- Except for total recoverable cadmium, all other metals (total and dissolved) were detected from samples collected on April 25 and June 7. Total recoverable cadmium was measured below the reporting limit for these two storms.
- PAH compounds were detected in two of the three samples collected.
- Nutrients and three herbicides (2,4-D, picloram, and diuron) were detected in two of the three storms.
- No methylene blue active substances (MBAS) samples were collected in WY 12.

Geiger (Eastern Region)

WSDOT staff initiated sampling attempts at the Geiger Maintenance Facility on March 11, 2012. Sampling attempts were made for ten storms in WY 12, with two qualified and two non-qualified wet season storms, and one nonqualified dry season event sampled (Appendix F). Grab samples were successfully collected at only one of the five storms. Grabs were missed in all other attempts due to staff arriving on site after the 20-minute permit-specified window. Staff delays were due to difficulty in predicting storm start times, challenges in mobilizing monitoring staff on short notice, and travel times.

- From the grab sample, TPH-Gx (gasoline) was found below the reporting limit. Total petroleum hydrocarbons in the diesel fraction (TPH-Dx) were detected in the lube oil fraction. The diesel fuel fraction was below the reporting limit (Appendix E).
- All conventional parameters were detected in three of the five storms, with TSS the only parameter detected in all five storms.
- Total recoverable copper, lead, cadmium, and zinc were detected in four of the five wet season storms, while dissolved metals samples were collected from only three of the storms. Dissolved lead and cadmium were undetected in the storm on March 20.
- PAH compounds were detected in each of the samples collected.
- The herbicides 2,4-D, picloram, dichlobenil, triclopyr, and diuron were detected. Clopyralid and glyphosate were not detected in the samples collected.
- Total phosphorous, orthophosphate, total Kjeldahl nitrogen, and nitrate+nitrite were detected in four of the five samples collected for WY 12.
- Methylene blue active substances (MBAS) were collected in one of the wet season storms.

Clarkston (South Central Region)

WSDOT staff initiated sampling attempts at the Clarkston maintenance facility on March 9, 2012. Twelve sampling attempts were made with four qualified wet season events collected for WY 12 (Appendix F), while dry season storms were missed due to forecasting inaccuracies. Grab samples were successfully collected at two of the four storms. Grabs were missed in the other attempts because staff were not able to sample within the 20-minute permit-specified window.

- From the grab samples, TPH-Gx (gasoline) was found below the reporting limit in both samples. Both of the TPH-Dx (diesel) samples were detected in the lube oil fraction. The diesel fuel fraction was below the reporting limit (Appendix E).
- All conventional parameters were collected and detected in three of the four storms. Only chlorides were detected in the sample collected on March 15.
- Total recoverable copper, lead, cadmium, and zinc samples were collected and detected for three of the four storms, while dissolved metals samples were collected and detected from just two storms.
- PAH compounds were detected in each of the samples collected.

- The nutrients total phosphorous, orthophosphate, total Kjeldahl nitrogen, and nitrate+nitrite were detected in three of the four samples collected
- The herbicides dichlobenil and 2,4-D were detected in a few of the samples collected. Diuron, clopyralid, picloram, triclopyr, and glyphosate were detected, but below reporting limits in most cases.
- Methylene blue active substances (MBAS) were collected in two of the five storms.

5.3 Ferry Terminal

Bainbridge Island Ferry Terminal

WSDOT staff successfully collected samples at the Bainbridge Island Ferry Terminal at seven of the nine storms attempted in WY 12. These seven samples included the first flush event in September, four qualified and one nonqualified wet season events, and one qualified dry season event in May 2012. Grab samples were successfully collected at four of the seven storms. Grabs were missed in the other attempts due to staff not being able to sample within the 20-minute permit-specified window.

- From the grab samples, TPH-Gx (gasoline) was found below the reporting limit in all samples collected. All TPH-Dx (diesel) samples were detected in the lube oil fraction. The diesel fuel fraction was below the reporting limit (Appendix E). One fecal coliform sample was collected in the storm event on January 24, 2012, and had detectable levels of bacteria.
- Conventional parameters were detected at this site for all collected samples, excluding the first flush storm, where chlorides or hardness were not sampled.
- Total and dissolved metals were detected in samples from all collected storms. Total recoverable cadmium samples collected from two separate events in February were below the reporting limits.
- A high chloride value was measured from the storm on January 24. This was most likely due to deicing the parking lot after a previous snow event.
- PAH compounds were detected in each storm.
- Methylene blue active substances (MBAS) were collected in four of the seven storms and detected in each.

Glossary

analyte – An element, ion, compound, or chemical moiety (pH, alkalinity) that is to be determined. The definition can be expanded to include organisms, such as fecal coliform (Kammin 2010).

annual average daily traffic (AADT) – The average, over a year, of the number of vehicles passing a point on a highway in both directions each day (Mohamad et al., 1998). Counts are estimated using Trip Generation, published by the Institute of Transportation Engineers, or using a traffic study prepared by a professional engineer or transportation specialist with expertise in traffic volume estimation (WSDOT 2011d).

aliquots – Individual, discrete sample volumes that are taken at set intervals (flow, time, or precipitation) or otherwise composited together to form a representative sample of a monitoring period flow (Caltrans 2003).

best management practices (BMPs) – The structural devices, maintenance procedures, managerial practices, prohibitions of practices, and schedules of activities that are used singly or in combination to prevent or reduce the detrimental impacts of stormwater, such as pollution of water, degradation of channels, damage to structures, and flooding (WSDOT 2011d).

blank – A sample prepared to contain none (or as little as possible) of the analyte of interest. For example, in water analysis, pure water is used for the blank. In chemical analysis, a blank is used to estimate the analytical response to all factors other than the analyte in the sample. In general, blanks are used to assess possible contamination or inadvertent introduction of analyte during various stages of the sampling and analytical process (USGS 1998).

catch basin – A chamber or well for the admission of surface water to a sewer or subdrain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow (WSDOT 2011d).

chain of custody (COC) – A systematic procedure for tracking a sample or datum from its origin to its final use. The COC provides chronological documentation of the transfer and custody of a sample.

churner – A device used to homogenize stormwater samples during storm event sample processing.

Clean Water Act (CWA) – A federal act passed in 1972, formerly referred to as the Federal Water Pollution Control Act, which contains provisions to restore and maintain the quality of the nation's waters. Major amendments to the CWA in 1987 addressed stormwater pollution by extending the National Pollutant Discharge Elimination System (NPDES) permit program to include stormwater discharges. Section 402 of the CWA governs the NPDES permit program.

detection limit – The concentration or amount of an analyte that can be determined to a specified level of certainty to be greater than zero.

detention pond – A pond that temporarily stores stormwater runoff and subsequently releases it at a slower rate than is collected by the drainage facility system (WSDOT 2011d).

duplicate samples – Two samples taken from and representative of the same population, and carried through the steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess the variability of all method activities, including sampling and analysis (USEPA 1997).

fecal coliform – That portion of the coliform group that is present in the intestinal tracts and feces of warm-blooded animals as detected by the product of acid or gas from lactose in a suitable culture medium within 24 hours at 44.5 plus or minus 0.2 degrees Celsius (WAC 173-201A-20).

field blank – Blanks that are analyzed to determine whether there is contamination during sampling. For water sampling, these consist of pure (e.g., deionized, micro-filtered) water that is subjected to all aspects of sample collection, field processing, preservation, transportation, and laboratory handling as an environmental sample. The pure water must be obtained from the laboratory or other reliable supplier (Ecology 2004). Field blanks include the following types:

> ***equipment rinsate blank*** – Pure (deionized, micro-filtered) water that is run through the sample pickup, tubing, and collection apparatus of the automated sampler, and is otherwise subjected to all subsequent aspects of sample collection, field processing, preservation, transportation, and laboratory handling as an environmental sample. If the equipment is not cleaned or rinsed with pure water before each environmental sample is drawn, then the equipment should not be cleaned or rinsed with pure water before collecting the rinsate blank.
>
> ***filter blank*** – A special case of a rinsate blank prepared by filtering pure water through the filtration apparatus after routine cleaning. The filter blank may detect contamination from the filter or other part of the filtration apparatus (Ecology 2004). This is only applicable if filtration is done in the field.
>
> ***transport blank*** – A container of pure water that is prepared at the lab and carried unopened to the field and back with the other sample containers to check for possible contamination in the containers or for cross-contamination during transportation or storage of the samples (Ecology 2004).
>
> ***transfer blank*** – Prepared by filling a sample container with pure water during routine sample collection to check for possible contamination from the surroundings. The transfer blank will also detect contamination from the containers or from cross-contamination during transportation and storage of the samples (Ecology 2004).

first flush – Typically, the first 30 to 60 minutes of runoff from a rainfall event (Caltrans 2003). A first-flush rain event for facilities is defined in Special Condition S7.D.4 of the permit as the first qualifying rain event that occurs after July 31 with a one-week antecedent dry period (Ecology 2009a).

National Pollutant Discharge Elimination System (NPDES) – The national program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the federal Clean Water Act, for the discharge of pollutants to surface waters of the state from point sources. These permits are referred to as NPDES permits and, in Washington State, are administered by the Washington State Department of Ecology (Ecology 2009a).

nutrient – A substance such as carbon, nitrogen, or phosphorus used by organisms to live and grow. Too many nutrients in the water can promote algal blooms and rob the water of oxygen vital to aquatic organisms.

oil water separator – A vault, usually underground, designed to provide a quiescent environment to separate oil from water (WSDOT 2011d).

parameter – A specified characteristic of a population or sample. Also, an analyte or grouping of analytes. Benzene, nitrate+nitrite, and anions are all parameters (Ecology 2004; Kammin 2010).

quality assurance (QA) – A set of activities designed to establish and document the reliability and usability of measurement data (Kammin 2010).

quality assurance project plan (QAPP) – A document that describes the objectives of a monitoring project and the procedures necessary to ensure the quality and integrity of the collected data (Ecology 2004).

quality control (QC) – The routine application of measurement and statistical procedures to assess the accuracy of measurement data (Ecology 2004).

replicate samples – Two or more samples taken from the environment at the same time and place, using the same protocols. Replicates are used to estimate the random variability of the material sampled (USGS 1998).

reporting limit – (1) The minimum value below which data are documented as nondetects. (2) The minimum value of the calibration range. Analyte detections between the detection limit and the reporting limit are reported as having estimated concentrations (USEPA 2010).

representativeness – The state or quality of being accurately representative of something. Expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at the sampling point, or an environmental condition (USEPA 2006).

retention pond – A retention pond is designed to collect and hold stormwater runoff for a considerable length of time and then release it by evaporation, plant transpiration, or infiltration (WSDOT 2011d).

standard operating procedure (SOP) – Describes in detail the approved method for performing a routine procedure (Ecology 2004).

stormwater – That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface water body or a constructed infiltration facility (WSDOT 2011d).

time-weighted compositing – Samples of equal volume are taken at equal increments of time and composited to make an average sample (Ecology 2009c)

water year (WY) – The 12-month period beginning October 1 for any given year through September 30 of the following year. The water year is designated by the calendar year in which it ends. For example, the water year ending September 30, 2012, is called the "2012" water year (USGS 2013).

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Acronyms, Abbreviations, and Units of Measurement

Acronyms and Abbreviations

AADT	annual average daily traffic
AC	alternating current
BMP	best management practice
Cd	cadmium
COC	chain of custody
Cu	copper
Ecology	Washington State Department of Ecology
EDDN	Emergency Data Distribution Network
ESO	Environmental Services Office
GOES DCS	Geosynchronous Operational Environmental Satellite Data Collection System
GPS	Global Positioning System
I-5	Interstate 5
I-90	Interstate 90
MBAS	methylene blue active substances
MQO	measurement quality objectives
MP	milepost
NB	northbound
NPDES	National Pollutant Discharge Elimination System
NOAA	National Oceanic and Atmospheric Administration
NWS	Northwest Weather Service
PAH	polycyclic aromatic hydrocarbons
Pb	lead
QAPP	Quality Assurance Project Plan
QA	quality assurance
QC	quality control
RV	recreational vehicle
SB	southbound

SOP	standard operating procedure
SR	state route
SWPPP	Stormwater Pollution Prevention Plan
TAPE	Technology Assessment Protocol – Ecology (TAPE)
TPH	total petroleum hydrocarbon
TSS	total suspended solids
WSDOT	Washington State Department of Transportation
WY	water year
Zn	zinc

Units of Measurement

°C	degrees centigrade
°F	degrees Fahrenheit
ft	feet
g	gram, a unit of mass
in	inch
gal/min	gallons per minute
L/min	liters per minute
mg	milligrams
mg/Kg	milligrams per kilogram (parts per million)
mg/L	milligrams per liter (parts per million)
mL	milliliters
µg/Kg	micrograms per kilogram (parts per billion)
µg/L	micrograms per liter (parts per billion)
µm	micrometer
oz	ounce

Appendix A:
Special Condition G20 Letters Submitted to the Washington State Department of Ecology

Washington State Department of Transportation
Paula J. Hammond, P.E.
Secretary of Transportation

Transportation Building
310 Maple Park Avenue SE
Olympia, WA 98504-7300
360-705-7000
TTY: 1-800-833-6388
www.wsdot.wa.gov

October 20, 2011

Mr. Foroozan Labib
WSDOT Municipal Stormwater Permit Manager
Washington State Department of Ecology
Water Quality Program
P. O. Box 47600
Olympia, WA 98504-7996

RE: NPDES and State Waste Discharge Permit for Municipal Stormwater, G20 Notification for Non-Compliance with Special Conditions S7.C.1 and S7.G.1.d.

Dear Mr. Labib:

In accordance with General Condition 20 (G20) of the 2009 WSDOT NPDES and State Waste Discharge Permit for Municipal Stormwater (permit), this letter provides notification to the Washington State Department of Ecology (Ecology) that WSDOT will be unable to fully comply with terms in Special Conditions S7.C.1 and S7.G.1.d. WSDOT became aware that it would be unable to fully comply with these requirements on October 13, 2011. WSDOT alerted Ecology by phone and email on October 17, 2011.

S7.G.1.d requires that, "WSDOT shall begin full implementation of the monitoring program no later than September 6, 2011." Due to recent state government hiring and equipment purchase freezes, there have been delays in hiring and training monitoring support staff, and in establishing fully functional monitoring sites.

To remedy this situation, WSDOT will use information from three Ecology-approved, WSDOT quality assurance project plans to deliver sampling instructions to region support staff in an online training session scheduled for October 26, 2011. This training will be followed by hands-on trainings at facility, highway, and BMP monitoring study sites in October, November, and December 2011.

In addition, WSDOT will complete final testing and installation of sampling equipment at one ferry terminal, two rest areas, and six maintenance facilities in November 2011. Monitoring will begin at these facilities no later than November 30, 2011.

Grass establishment at best management practices (BMP) effectiveness monitoring sites has been difficult this year due to the need to reapply compost, an extended dry period this past summer, and impacts from a high-fiber optic cable installation project. During the week of October 24, 2011, WSDOT will reseed unvegetated areas and apply clear, plastic covering to improve growing conditions.

WSDOT will complete installation and testing of equipment at baseline highway and BMP effectiveness monitoring sites along Interstate 5 (I-5), State Route 9 (SR 9), and I-90 in

December 2011. Monitoring will begin for highway sites no later than January 15, 2012. For BMP effectiveness monitoring sites, sampling will begin when vegetation is fully established.
Special Condition S7.C.1 requires that, "WSDOT shall collect six toxicity screening samples and associated chemical analysis at least once per monitoring year in August or September. Samples shall be collected with at least a one-week antecedent dry period (or in October, irrespective of antecedent dry period, if unsuccessful in August or September)."

WSDOT tracked storms since implementation of the monitoring program on September 6, 2011. This year, no forecasted storms qualified for toxicity sampling in September due to the lack of a one-week antecedent dry period. In regard to toxicity sampling thus far in October, our sites are not fully functional and, in our view, we have missed the first flush event due to rainfall. WSDOT would like to delay collecting toxicity screening samples until all monitoring sites are fully established and next season's first-flush sampling is possible in August 2012.

WSDOT will make every effort to keep Ecology informed of the status of the agency's stormwater monitoring program. If you have questions or require additional information regarding this matter, please contact Fred Bergdolt, Stormwater Monitoring and Research Coordinator, at bergdof@wsdot.wa.gov or 360-570-6648.

I certify under penalty of law, that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for willful violations.

Sincerely,

Megan White, P.E., Director
Environmental Services Office

MW:pf
FB

cc: Kenneth M. Stone, WSDOT, Resource Programs Branch Manager
Fred Bergdolt, WSDOT, Stormwater Monitoring and Research Coordinator
NPDES Municipal Permit File

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

November 1, 2011

Megan White
Director
WSDOT Environmental Services Office
Transportation Building
310 Maple Park Avenue SE
PO Box 47331
Olympia, WA 98504-7331

RE: WSDOT NPDES Municipal Stormwater Permit, G20 Notification for Non-Compliance with Special Conditions S7.C.1 and S7.G.1.d.

Dear Ms. White:

The Washington State Department of Ecology (Ecology) received your notification letter, dated October 24, 2011, for non-compliance with the terms in Special Conditions S7.C.1 and S7.G.1.d of the 2009 WSDOT NPDES and State Waste Discharge Permit for Municipal Stormwater (permit). Your letter explains that recent state government hiring and equipment purchase freezes have caused delays in hiring and training monitoring support staff and in establishing fully functional monitoring sites. You indicate that monitoring equipment at a ferry terminal, rest areas, and maintenance facility sites will be fully functional by the end of November 2011 and those at the baseline highway and BMP sites will be ready to begin monitoring by January 15, 2012.

You also indicate that the establishment of grass at the BMP effectiveness monitoring sites has been difficult; however, WSDOT will have the monitoring equipment ready at the BMP sites by January 15, 2012 and will begin sampling when vegetation is fully established.

This letter is to inform you that Ecology expects WSDOT to be ready to begin monitoring at the ferry terminal, rest areas, and maintenance facility sites by the end of November 2011 and those at the baseline highway and BMP sites by January 15, 2012.

We understand that the opportunity for WSDOT to conduct first-flush toxicity sampling by October 2011 has passed due to delays in establishing the monitoring program. WSDOT shall proceed with the first-flush sampling in August 2012, in accordance with the 2011 approved Quality Assurance Project Plan.

Please contact me at (360) 407-6439, or foroozan.labib@ecy.wa.gov if you have any questions.

Sincerely,

Foroozan Labib, Permit Manager
Program Development Services Section

cc: Ecology HQ Permit file

Washington State Department of Transportation
Paula J. Hammond, P.E.
Secretary of Transportation

Transportation Building
310 Maple Park Avenue SE
Olympia, WA 98504-7300
360-705-7000
TTY: 1-800-833-6388
www.wsdot.wa.gov

November 29, 2011

Foroozan Labib
WSDOT Municipal Stormwater Permit Manager
Washington State Department of Ecology
Water Quality Program
P. O. Box 47600
Olympia, WA 98504-7996

RE: NPDES and State Waste Discharge Permit for Municipal Stormwater, Revision to the October 20, 2011 G20 Notification of Non-Compliance with Special Condition S7.G.1.d.

Dear Mr. Labib:

WSDOT became aware on November 21, 2011 that it will be unable to fully comply with commitments made in the October 20, 2011 G20 notification letter. Extensions to these commitment timelines are needed to be able to fully implement the monitoring program per Special Condition S7.G.1.d and "to produce scientifically credible data that represents discharges from WSDOT's various land uses" per S7.A.1. Delayed implementation means WSDOT will also be unable to meet the conditions of S7.B.6, S7.D.4, and S7.E.4.b that specify the number of storms to be sampled per year.

The October 20, 2011 G20 notification letter stated that monitoring will begin at facilities study sites no later than November 30, 2011. On November 30, 2011, WSDOT plans to initiate monitoring at one rest area, one maintenance facility, and one ferry terminal study site. In order to produce representative and scientifically credible data from facilities monitoring sites, we have determined that it is necessary to implement a phased approach to facility monitoring start-up. This is necessary in order to establish the stormwater monitoring process from sample collection through generation of usable data. This approach provides the ability to troubleshoot unanticipated problems as we progress to full compliance. Facilities study sites will be added to the monitoring program as the process is established and problems are resolved. We anticipate full implementation of the monitoring program at all nine facilities study sites by March 1, 2012. It is WSDOT's goal to sample a minimum of two qualifying storm events during the remainder of the 2011-12 wet season for facilities monitoring.

It has also become apparent that WSDOT will be unable to begin baseline highway and BMP effectiveness monitoring by January 15, 2012, as stated in the October 20, 2011 G20 notification. This delay is due to recent equipment testing that identified major deficiencies. Prior to January 15, 2012, WSDOT will provide Ecology with a revised schedule for initiating highway and BMP monitoring. An explanation of the steps needed to fully implement this portion of the monitoring program will also be included.

Our expectation that toxicity/first flush monitoring will begin in August 2012 remains unchanged.

WSDOT will make every effort to keep Ecology informed of the status of the agency's stormwater monitoring program. If you have questions or require additional information regarding this matter, please contact Fred Bergdolt, Stormwater Monitoring and Research Coordinator, at bergdof@wsdot.wa.gov or 360-570-6648.

I certify under penalty of law, that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for willful violations.

Sincerely,

Megan White, P.E., Director
Environmental Services Office

MW:pf

cc: Kenneth M. Stone, Resource Programs Branch Manager, WSDOT
Richard A. Gersib, Stormwater and Watersheds Program Manager, WSDOT
NPDES Municipal Permit File

Scan -
send to
Larry S
Dick G
Ken S

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

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January 10, 2012

Ms. Megan White
Director
WSDOT Environmental Services Office
Transportation Building
310 Maple Park Avenue SE
Olympia, WA 98504-7300

RE: WSDOT National Pollutant Elimination System (NPDES) Municipal Stormwater Permit, G20 Notification for Non-Compliance with Monitoring Timelines in Special Conditions S7

Dear Ms. White:

The Washington State Department of Ecology (Ecology) received your notification letter dated November 29, 2011, for non-compliance with the terms in Special Condition S7 of the 2009 WSDOT NPDES and State Waste Discharge Permit for Municipal Stormwater (permit). It states the reasons for delays in the start of the monitoring program and revises the projected timelines from an earlier G20 notification letter dated October 20, 2011. Your letter explains that WSDOT is implementing a phased approach to facility monitoring start-up and making progress in fully implementing the monitoring program at all nine facilities by March 1, 2012. Delays in the start of the monitoring program could affect the number of qualifying samples for the 2011-2012 wet season. These delays also affected baseline and BMP monitoring timelines.

This letter is to inform you that Ecology expects WSDOT to make their best effort toward fully establishing the monitoring program and meet sampling of the qualified storms specified in the permit.

Ecology understands that the opportunity for WSDOT to conduct first-flush toxicity sampling by October 2011 has passed due to delays in establishing the monitoring program. WSDOT shall proceed with the first-flush sampling in August 2012, in accordance with the 2011 approved Quality Assurance Project Plan.

Please contact me at foroozan.labib@ecy.wa.gov / (360) 407-6439 if you have any questions.

Sincerely,

Foroozan Labib
Permit Manager
Program Development Services Section

cc: Ecology HQ Permit file

Appendix B:
Monitoring Sites at WSDOT Facilities

Rest Areas

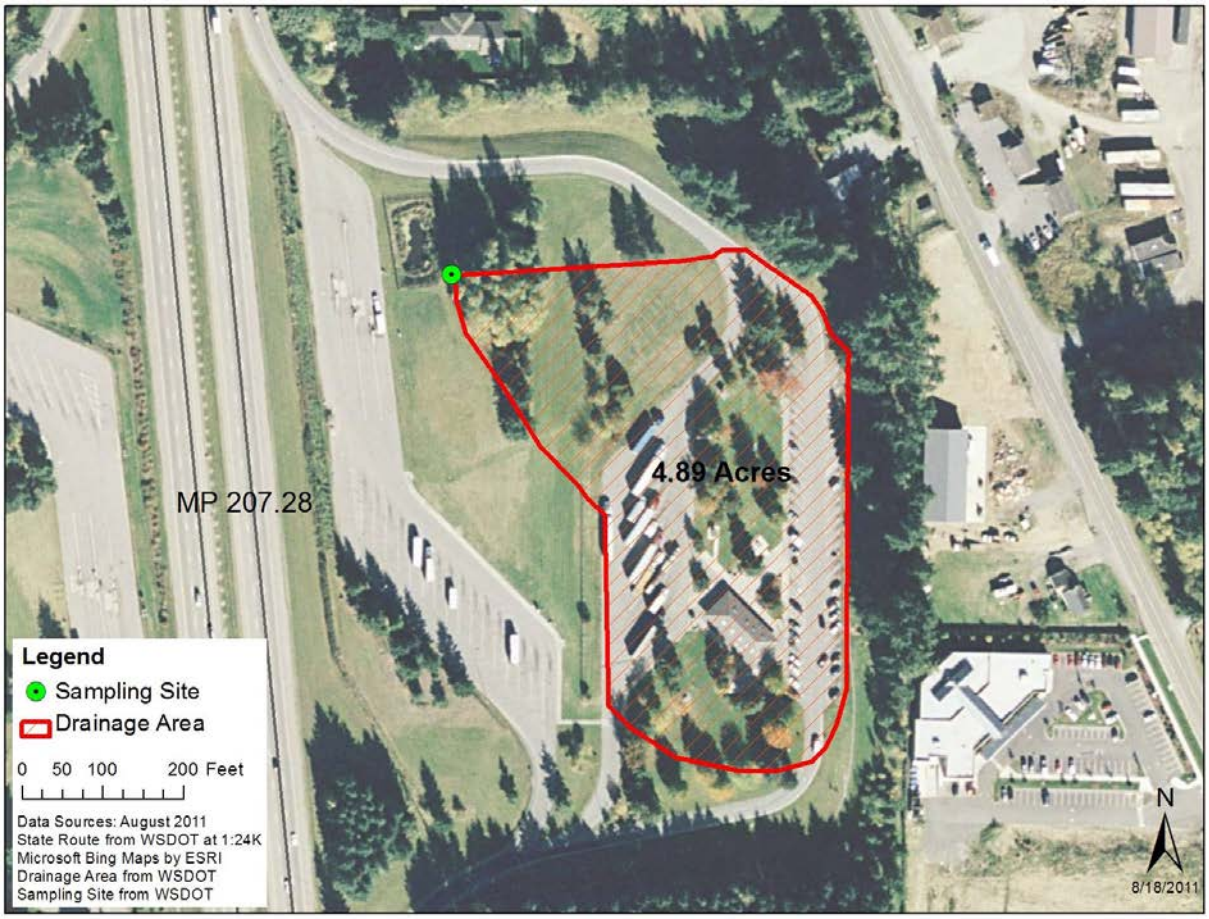

Figure B-1 Smokey Point (NB) Rest Area sampling location and contributing drainage area.

Rest Areas (continued)

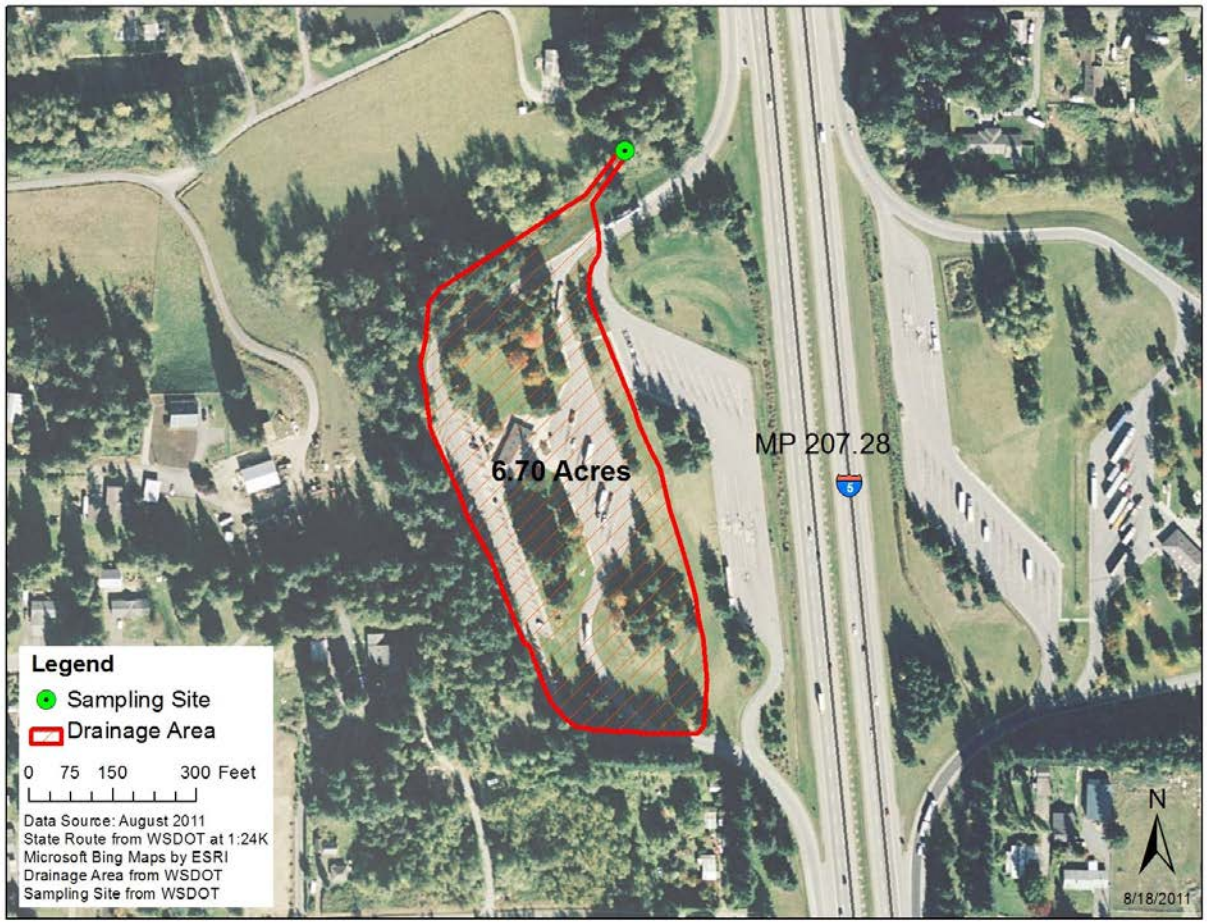

Figure B-2 Smokey Point (SB) Rest Area sampling location and contributing drainage area.

Maintenance Facilities

Figure B-3 Ballinger sampling location and contributing drainage area.

Maintenance Facilities (continued)

Figure B-4 Lakeview sampling location and contributing drainage area.

Maintenance Facilities (continued)

Figure B-5 Vancouver sampling location and contributing drainage area.

Maintenance Facilities (continued)

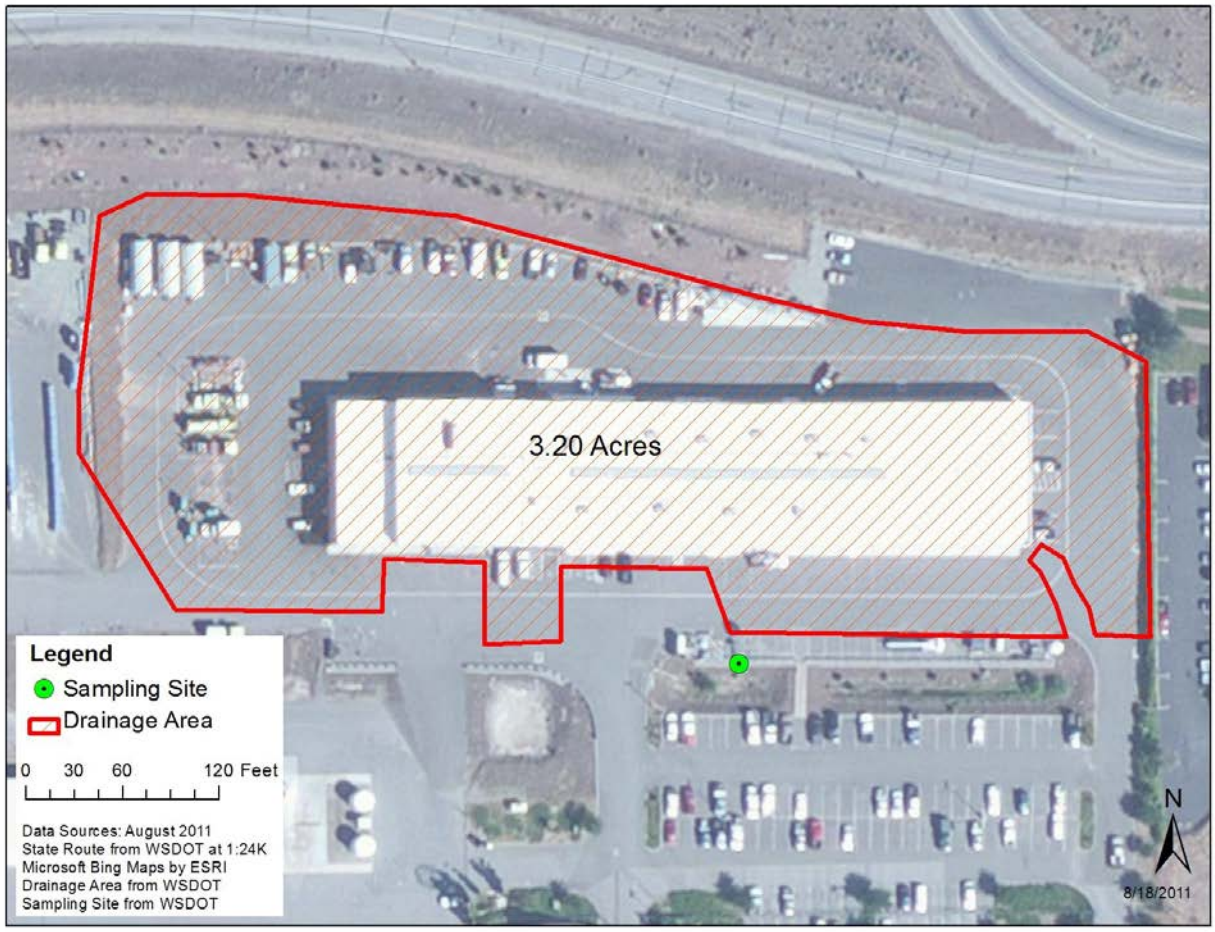

Figure B-6 Euclid sampling location and contributing drainage area.

Maintenance Facilities (continued)

Figure B-7 Geiger sampling location and contributing drainage area.

Maintenance Facilities (continued)

Figure B-8 Clarkston sampling location and contributing drainage area.

Ferry Terminal

Figure B-9 Bainbridge Island Ferry Terminal sampling location and drainage area.

Appendix C:
Hydrologic Data Quality Storm Reports

Rest Areas

Smokey Point Rest Area North Bound													
Precipitation						Water Temp		Aliquot					
Start Time (PST/PDT)	End Time (PST/PDT)	Total (in)	Duration (hours)	Antecedent (hours)	Antecedent Met?	Min (C°)	Max (C°	Samples Collected	First Sample (PST/PDT)	Last Sample (PST/PDT)	Sample Duration (hrs)	Aliquot Volume (mL)	Total Sample Volume (mL)
3/9/12 12:30	3/10/12 08:30	0.55	20	24	Y	5.8	7.6	5	3/9/12 14:00	3/9/12 15:00	1	1840	9200
4/3/12 10:15	4/3/12 18:00	0.57	7.75	24	Y	7.7	9.5	5	4/3/12 10:45	4/3/12 11:45	1	1840	9200
4/29/12 23:30	5/2/12 07:30	1.75	56	24	Y	9.3	13.4	5	4/29/12 23:45	4/30/12 0:45	1	1840	9200
5/20/12 11:30	5/20/12 21:45	0.32	10.25	72	Y	11.2	16.1	5	5/20/12 0:00	5/20/12 13:00	1	1840	9200

Smokey Point Rest Area South Bound													
Precipitation						Water Temp		Aliquot					
Start Time (PST/PDT)	End Time (PST/PDT)	Total (in)	Duration (hours)	Antecedent (hours)	Antecedent Met?	Min (C°)	Max (C°	Samples Collected	First Sample (PST/PDT)	Last Sample (PST/PDT)	Sample Duration (hrs)	Aliquot Volume (mL)	Total Sample Volume (mL)
3/9/12 12:45	3/10/12 08:45	0.57	20	24	Y	6.8	7.5	5	3/9/12 12:45	3/9/12 13:45	1	1840	9200
4/3/12 10:15	4/3/12 17:30	0.58	7	24	Y	8.1	8.9	5	4/3/12 10:30	4/3/12 11:30	1	1840	9200
4/29/12 23:30	5/2/12 04:45	1.79	53.25	24	Y	9	12.7	5	4/29/12 23:45	4/30/12 0:45	1	1840	9200
5/20/12 11:30	5/21/12 22:45	0.38	11.25	72	Y	13.8	15.5	5	5/20/12 11:45	5/20/12 12:45	1	1840	9200

Maintenance Facilities

Ballinger Maintenance Facility													
Precipitation						Water Temp		Aliquot					
Start Time (PST/PDT)	End Time (PST/PDT)	Total (in)	Duration (hours)	Antecedent (hours)	Antecedent Met?	Min (C°)	Max (C°	Samples Collected	First Sample (PST/PDT)	Last Sample (PST/PDT)	Sample Duration (hrs)	Aliquot Volume (mL)	Total Sample Volume (mL)
1/24/12 07:00	1/24/12 17:30	0.21	10.5	24	Y	2.8	4.9	5	1/24/12 7:30	1/24/12 8:30	1	1840	9200
2/24/12 14:30	2/26/12 01:00	0.20	27.5	24	Y	1.4	6.7	5	2/24/12 15:00	2/25/12 16:00	1	1840	9200
2/28/12 17:15	2/29/12 11:00	0.68	17.75	24	Y	0.9	5	5	2/28/12 17:30	2/28/12 18:30	1	1840	9200
3/9/12 13:00	3/10/12 07:00	0.37	17.25	24	Y	6	8.4	5	3/9/12 13:15	3/9/12 14:15	1	1840	9200
4/3/12 9:15	4/4/12 18:15	0.17	9	24	Y	7.8	10	5	4/3/12 10:00	4/3/12 11:00	1	1840	9200
4/29/12 23:00	4/30/12 05:45	0.28	6.75	24	Y	10.5	13.1	5	4/29/12 23:15	4/30/12 0:15	1	1840	9200
6/22/2012 10:30	6/23/12 02:15	0.92	15.75	72	Y	13.2	17.4	5	6/22/12 11:15	6/22/12 12:15	1	1840	9200

Lakeview													
Precipitation						Water Temp		Aliquot					
Start Time (PST/PDT)	End Time (PST/PDT)	Total (in)	Duration (hours)	Antecedent (hours)	Antecedent Met?	Min (C°)	Max (C°	Samples Collected	First Sample (PST/PDT)	Last Sample (PST/PDT)	Sample Duration (hrs)	Aliquot Volume (mL)	Total Sample Volume (mL)
4/3/12 08:15	4/3/12 12:30	0.18	4.25	24	Y	7.2	9.6	5	4/3/12 9:45	4/3/12 10:45	1	1840	9200
4/16/12 01:00	4/16/12 07:00	0.34	6	24	Y	9.5	12.5	5	4/16/12 1:15	4/16/12 2:15	1	1840	9200
4/17/12 15:15	4/18/12 16:45	0.24	25.5	24	Y	8.6	12.8	5	4/17/12 15:30	4/17/12 16:30	1	1840	9200
4/25/12 10:30	4/26/12 22:15	0.84	35.75	24	Y	11.1	15.9	5	4/25/12 11:15	4/25/12 12:15	1	1840	9200
4/29/12 22:30	4/30/12 17:00	0.45	18.5	24	Y	11.2	13.9	5	4/29/12 11:00	4/30/12 0:00	1	1840	9200
6/22/12 10:45	6/23/12 03:30	0.22	16.75	72	Y	13.7	18	5	6/22/2012 11:00	6/22/12 12:00	1	1840	9200

Maintenance Facilities (continued)

Vancouver

Precipitation						Water Temp		Aliquot					
Start Time (PST/PDT)	End Time (PST/PDT)	Total (in)	Duration (hours)	Antecedent (hours)	Antecedent Met?	Min (C°)	Max (C°	Samples Collected	First Sample (PST/PDT)	Last Sample (PST/PDT)	Sample Duration (hrs)	Aliquot Volume (mL)	Total Sample Volume (mL)
2/28/12 12:00	2/29/12 14:45	0.54	26.75	24	Y	6.1	7.4	5	2/28/12 14:45	2/28/12 15:45	1	1840	9200
4/3/12 07:00	4/3/12 13:00	0.26	6	24	Y	8.2	8.9	5	4/3/12 8:00	4/3/12 9:00	1	1840	9200
4/17/12 14:00	4/18/12 05:45	0.2	15.75	24	Y	8.8	9.2	5	4/17/12 14:45	4/17/12 15:45	1	1840	9200
4/25/12 07:45	4/25/12 09:00	0.04	1.25	24	Y	10.3	10.6	5	4/25/12 9:15	4/25/12 10:15	1	1840	9200
6/22/12 18:00	6/23/12 15:45	0.83	21.75	72	Y	13.9	17.3	5	6/22/12 18:30	6/22/12 19:30	1	1840	9200

Wenatchee

Precipitation						Water Temp		Aliquot					
Start Time (PST/PDT)	End Time (PST/PDT)	Total (in)	Duration (hours)	Antecedent (hours)	Antecedent Met?	Min (C°)	Max (C°	Samples Collected	First Sample (PST/PDT)	Last Sample (PST/PDT)	Sample Duration (hrs)	Aliquot Volume (mL)	Total Sample Volume (mL)
3/27/12 14:45	3/28/12 00:45	0.35	10	24	Y	6.4	8.3	5	3/27/12 18:00	3/27/12 19:00	1	1840	9200
4/25/12 16:15	4/25/12 20:45	0.33	4.5	24	Y	9.6	19.1	5	4/25/12 16:30	4/25/12 17:30	1	1840	9200
6/7/12 08:30	6/7/12 19:00	0.25	10.5	24	Y	12.8	16	5	6/7/12 10:15	6/7/12 11:15	1	1840	9200

Maintenance Facilities (continued)

Geiger													
Precipitation						Water Temp		Aliquot					
Start Time (PST/PDT)	End Time (PST/PDT)	Total (in)	Duration (hours)	Antecedent (hours)	Antecedent Met?	Min (C°)	Max (C°	Samples Collected	First Sample (PST/PDT)	Last Sample (PST/PDT)	Sample Duration (hrs)	Aliquot Volume (mL)	Total Sample Volume (mL)
3/14/12 18:00	3/15/12 23:00	1.22	29	24	Y	3.5	7.7	5	3/14/12 19:00	3/14/12 20:00	1	1840	9200
3/20/12 09:00	3/20/12 15:30	0.16	6.5	24	Y	0.03	6.5	5	3/20/12 9:15	3/20/12 10:15	1	1840	9200
3/26/12 06:45	3/26/12 16:15	0.63	9.5	24	Y	3.8	9.1	5	3/26/12 14:15	3/26/12 15:15	1	1840	9200
5/2/12 03:15	5/2/12 09:00	0.1	5.75	24	Y	6.3	12.4	5	5/2/12 3:30	5/2/12 4:30	1	1840	9200
6/24/12 19:30	6/24/12 23:15	0.15	3.75	24	Y	18.1	24.6	5	6/22/12 22:15	6/22/12 23:15	1	1840	9200

Clarkston													
Precipitation						Water Temp		Aliquot					
Start Time (PST/PDT)	End Time (PST/PDT)	Total (in)	Duration (hours)	Antecedent (hours)	Antecedent Met?	Min (C°)	Max (C°	Samples Collected	First Sample (PST/PDT)	Last Sample (PST/PDT)	Sample Duration (hrs)	Aliquot Volume (mL)	Total Sample Volume (mL)
3/15/12 19:15	3/16/12 10:00	0.35	14.75	24	Y	8.2	9.6	5	3/15/12 20:15	3/15/12 21:15	1	1840	9200
3/20/12 14:45	3/21/12 21:30	0.94	30.75	24	Y	5.8	8.7	5	3/20/12 16:00	3/20/12 17:00	1	1840	9200
4/4/12 05:30	4/4/12 12:45	0.32	7.25	24	Y	6.6	8.2	5	4/4/12 6:30	4/4/12 7:30	1	1840	9200
4/26/12 06:45	4/26/12 13:45	0.22	7	24	Y	16.6	19.6	5	4/26/12 10:00	4/26/12 11:00	1	1840	9200

Ferry Terminal

Bainbridge Island Ferry Terminal													
Precipitation						Water Temp		Aliquot					
Start Time (PST/PDT)	End Time (PST/PDT)	Total (in)	Duration (hours)	Antecedent (hours)	Antecedent Met?	Min (C°)	Max (C°	Samples Collected	First Sample (PST/PDT)	Last Sample (PST/PDT)	Sample Duration (hrs)	Aliquot Volume (mL)	Total Sample Volume (mL)
9/17/11 11:45	9/17/11 22:30	0.32	10.75	168	Y	13.7	18.6	5	9/17/11 12:00	9/17/11 13:00	1	1840	9200
1/24/12 06:15	1/24/12 20:30	0.33	14.25	24	Y	2.3	4.6	5	1/24/12 7:15	1/24/12 8:15	1	1840	9200
2/17/12 14:00	2/17/12 18:00	0.24	4	24	N	7.8	9.5	5	2/17/12 14:30	2/17/12 15:30	1	1840	9200
2/28/12 16:45	2/29/12 01:30	0.27	8.75	24	Y	4.4	6.4	5	2/28/12 17:30	2/28/12 18:30	1	1840	9200
3/9/12 14:15	3/10/12 05:30	0.21	15.25	24	Y	7.1	8.4	5	3/9/12 19:00	3/9/12 20:00	1	1840	9200
3/19/12 22:30	3/20/12 03:00	0.19	4.5	24	Y	6.2	6.9	5	3/20/12 0:15	3/20/12 1:15	1	1840	9200
5/17/12 17:45	5/18/12 01:15	0.39	7.5	72	Y	12.1	21.1	5	5/17/12 18:30	5/17/12 19:30	1	1840	9200

Appendix D:
Analytical Data Quality Assessment Report

Analytical Data Quality Assessment Report

Washington State Department of Transportation

NPDES Stormwater Monitoring Program

for

Data Collected during September 17, 2011 through November 6, 2012

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September 6, 2013

Executive Summary

This Data Quality Assessment Report (DQAR) presents an overview of the analytical scheme, data verification and validation procedures, and the quality of analytical data collected during the stormwater monitoring year 2012 (September 17, 2011 through November 6, 2012) under the Washington State Department of Transportation's (WSDOT) National Pollution Discharge Elimination System (NPDES) Stormwater Monitoring Program (Program). The quality of data was assessed and discussed in terms of Measurement Quality Objectives (MQOs), i.e., precision, accuracy, representativeness, comparability, sensitivity, and completeness.

A total of 82 stormwater and seven sediment samples were collected during this monitoring year. Sample analyses were primarily performed by the Washington State Department of Ecology (Ecology) Manchester Environmental Laboratory (MEL) with specialty analyses performed by AmTest Laboratories, Inc. (surfactants), TestAmerica Laboratories, Inc. (total Kjeldahl nitrogen [TKN] and glyphosate), and Analytical Resources, Inc. (particle size distribution in water).

A Stage 2a and 2b data validation was performed on 90 percent of the analytical data, and a Stage 3+4 validation on 10 percent of the data. Based on the on-going oversight of the laboratory performance and the outcome of the data validation, completeness of the data collection effort was calculated as 98.7 percent, thus achieving the monitoring goal of 95%. Significant observations and results of the analytical data quality assessment are summarized as follows:

1. Stormwater samples were not acid-digested for dissolved metals analyses (U.S. Environmental Protection Agency [EPA] Method 200.8). The re-analyses conducted on 11 samples showed no significant difference between the non-digested and digested results. The incident was then noted as a deviation from analytical method and the results footnoted in the Annual Report to indicate the deviation in sample preparation.

2. The sample filtration for dissolved metals and ortho-phosphate was to be conducted within 15 minutes of collection, according to 40CFR, Part 136. Due to technical difficulty, most of the samples were filtered outside the 15-minute window, yet within 24 hours of collection. The delay in filtration was not expected to result in significant effects on data quality. Dissolved metals and ortho-phosphate results were footnoted in the Annual Report for these cases.

3. The reporting limits (RLs) for semi-volatile organic compounds (SVOCs) in sediment samples were elevated three to eight times from the project goal for method RLs. This range of elevations resulted from the required dilution of sample extracts to overcome the oily nature of the samples. The reported sample-specific RLs were considered the best-possible RLs given the conditions of the samples. No further actions were feasible other than noting the incident in this document.

4. The initial calibration verification (ICV) analysis (using a second source standard) was not performed associated with herbicides (triclopyr, 2,4-D, clopyralid, and picloram) analyses. The laboratory instead reported the back-calculated recovery of each initial calibration

standard. The second-source verification was evaluated with the laboratory control sample (LCS) and LCS duplicate results. The lack of ICV analysis was noted as a deviation from analytical procedures

5. The recovery of all surrogate spikes for the polycyclic aromatic hydrocarbon (PAH) and phthalate analyses was less than 10% or the lower control limits in one stormwater sample, indicating a potential of unsuccessful extraction of this sample. The PAH and phthalate detections in this sample were qualified as estimate values and the non-detects were rejected.

Table of Contents

Acronyms and Abbreviations

%D	percent difference
%D_f	percent drift
%R	percent recovery
%RSD	percent relative standard deviation
ARI	Analytical Resources, Inc. – Tukwila, Washington
ASTM	American Society of Testing and Materials
CCB	continuing calibration blank
CCV	continuing calibration verification
CLP	U.S. EPA Contract Laboratory Program
COC	chain of custody
CS1	recovery of the first (lowest concentration) initial calibration standard
DQAR	data quality assessment report
DQO	data quality objective
DVR	data validation report
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ICAL	initial calibration
ICB	initial calibration blank
ICP	Inductively coupled plasma
ICP/MS	Inductively coupled plasma/mass spectrometry
ICV	initial calibration verification
LCL	lower control limit
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
µg/L	microgram per liter
mg/L	milligram per liter
MBAS	methylene blue active substances
MDL	method detection limit
MEL	Washington State Department of Ecology Manchester Environmental Laboratory
MQO	measurement quality objective

MS	matrix spike
MSD	matrix spike duplicate
NPDES	National Pollution Discharge Elimination System
OP	*ortho*-phosphate
PAH	polycyclic aromatic hydrocarbon
PQL	practical quantitation limit
Permit	WSDOT NPDES and State Waste Discharge Permit for Municipal Stormwater
Program	NPDES Stormwater Monitoring Program
PSD	particle size distribution
PSEP	Puget Sound Estuary Program
QAPP	quality assurance project plan
QC	quality control
RL	reporting limit
RPD	relative percent difference
SIM	selective ion monitoring
SMS	Washington State Sediment Management Standards
SVOCs	semi-volatile organic compounds
TAL	TestAmerica Laboratories, Inc.
TAPE	Guidance for Evaluating Emerging Stormwater Treatment Technologies, Technology Assessment Protocol – Ecology (Publication No. 02-10-037)
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TP	total phosphorus
TPH	total petroleum hydrocarbon
TSS	total suspended solids
WSDOT	Washington State Department of Transportation

SAMPLE COLLECTION AND ANALYTICAL PROGRAM

Field Sampling Program

Sample collection for the Washington State Department of Transportation (WSDOT) NPDES Stormwater Monitoring Program (Program) was conducted during September 17, 2011 through November 6, 2012 by WSDOT personnel, following the *Quality Assurance Project Plans* (QAPPs; WSDOT 2011a, 2011b, and 2011c). A total of 82 stormwater and seven sediment samples were collected during this period of monitoring.

Laboratory Analysis Program

Sample analyses were primarily performed by the Washington State Department of Ecology (Ecology) Manchester Environmental Laboratory (MEL) for semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), phthalates, pesticides (triclopyr, 2,4-D, clopyralid, and picloram), herbicides (diuron and dichlobenil), gasoline range total petroleum hydrocarbon (TPH), diesel/motor oil range TPH, metals (total and dissolved cadmium copper, lead, and zinc), and inorganic parameters (total suspended solids, hardness, chloride, nitrate/nitrite, *ortho*-phosphate (OP), and total phosphorus (TP). Selected specialty analyses were performed by AmTest Laboratories, Inc. (surfactants), TestAmerica Laboratories, Inc. (total Kjeldahl nitrogen and glyphosate), and Analytical Resources, Inc. (particle size and distribution in water).

Sample analysis schedule is summarized in **Table 1-1**.

DATA VERIFICATION AND VALIDATION

Data Quality Objectives

Data quality objectives (DQOs) for the Program were defined to meet the WSDOT NPDES and State Waste Discharge Permit for Municipal Stormwater (Permit), which was issued by Ecology on February 4, 2009 (Permit No. WAR043000A). Specific data quality goals (*i.e.*, measurement quality objectives [MQOs] commonly presented as precision, accuracy, representativeness, comparability, sensitivity, and completeness) are defined in the QAPPs (WSDOT 2011a, 2011b, and 2011c).

Data Verification Procedures

Data verification was performed to ensure completeness of the hardcopy and electronic analytical data reported and archived. A complete crosschecking of laboratory identification numbers with field identification numbers was performed to ensure that analyses had been performed as specified by the chain of custody (COC) documentation.

Hardcopy laboratory reports were inventory checked for sample result forms, instrument run logs, instrument initial calibration and continuing calibration verifications, associated QC analyses, and supporting documents.

Data Validation Procedures

A Stage 2a and 2b data validation was performed on 90 percent of the data, and a Stage 3+4 validation on 10 percent of the data. The validation followed the procedures specified in U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) National Functional Guidelines for Data Review (USEPA 2008–Organics; USEPA 2010–Inorganics), with modifications to accommodate program and analytical method requirements as specified in the WSDOT *Stormwater Monitoring Chemical Data Validation Guidance and Criteria, Version 1.2* (WSDOT 2013).

Data Assessment Results

As a result of the data validation, data qualifiers were appended to the affected data as:

- **J** - The result is an estimated quantity. The associated numerical value is approximate concentration of the analyte in the sample.
- **R** - The data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.

- **U** - The analyte was analyzed for, but not detected. The associated numerical value is at or below the method reporting limit (RL).
- **UJ** - The analyte was analyzed for, but not detected. The method detection limit (MDL) and practical quantitation limit (PQL) are estimated values.

Detailed scope of the data validation, validation findings, and data qualification were presented in the data validation reports (DVRs).

DATA QUALITY AND USABILITY ASSESSMENT

Based on the outcomes of the validation, the following sections present a data quality overview for analytical data collected during the stormwater monitoring year 2012. The following sections address accuracy, precision, representativeness, comparability, sensitivity, and completeness. Quality control (QC) parameters applied to evaluating each of the MQOs are summarized in **Table 3-1**.

Accuracy

Accuracy is a statistical measurement of correctness and includes components of random and systematic errors. It is quantified as the degree of agreement between a measurement with a known reference. Analytical accuracy is evaluated via the percent recovery (%R), percent difference (%D), or percent drift ($\%D_f$) values of initial and continuing calibration, internal standards, surrogate spikes, matrix spike (MS)/matrix spike duplicate (MSD), laboratory control sample (LCS)/ laboratory control sample duplicate (LCSD), in conjunction with results of method blanks, calibration blanks, and trip blanks. Results of blanks assist in identifying the type and magnitude of effects on system errors introduced via field and/or laboratory procedures.

Quality control anomalies affecting data accuracy were identified as follows:

Sample Preservation and Holding Times

The OP analyses were performed one to two days past the method recommended holding time for three samples. These results were qualified as estimated values, according to the data validation.

The surfactant analysis on sample GEIGER-01-WY11-04-01 was performed past the method recommended holding time; the result was qualified as estimated. Data qualified as a result of holding time and sample preservation violations are summarized in **Table 3-2**.

Calibration Verification

Initial and continuing calibration verification (ICV and CCV) analyses verify accuracy of the initial calibration (ICAL) and current instrument condition prior to sample analyses. The recovery of the first (lowest concentration) ICAL standard (CS1) was evaluated to verify the ICAL validity at the RL level. ICV, CCV, and CS1 results are presented as %D or $\%D_f$ values; excessive bias of a %D or $\%D_f$ value indicates a potential bias of the analytical results associated with these verification analyses.

The %D value for total Kjeldahl nitrogen (TKN) in one of the CCV analyses was less than the lower control limit (90-110%), indicating a potential low-bias associated the TKN analyses in this analytical batch. Seven samples were affected in this manner and the TKN results were qualified as estimated.

The %D value for benzo(a)anthracene in one of the ICV was less than the lower control limit. Three samples were affected and the benzo(a)anthracene results in these samples were qualified as estimated values.

The %D value for indeno(1,2,3-cd)pyrene in one of the ICV analyses was greater than the upper control limit, indicating a potential high-bias associated with the results of samples analyzed in this analytical sequence. Indeno(1,2,3-cd)pyrene was detected in sample BAINBRIDGE-01-WY11-02-01 and the result was qualified as estimated.

The recovery of CS1 biased low for dibenzo(a,h)anthracene and bis(2-ethylehxyl)phthalate in one of the initial calibrations. As a conservative measure, dibenzo(a,h)anthracene and *bis*(2-ethylehxyl)phthalate results for the five samples associated with this ICAL were qualified as estimated.

The recovery of CS1 biased high for benzo(a)pyrene in one of the initial calibrations. As a conservative measure, detections of this compound in the two samples associated with this ICAL were qualified as estimated.

The %D value for benzoic acid biased low in one of the CCV analyses. Two samples were affected and the results were qualified as estimated. Data usability affected by outlying CS1, ICV, and CCV results was summarized in **Table 3-3**.

Blanks

Presence of target analytes in blanks indicated potential effects on results for samples prepared/analyzed with these blanks, and the accuracy of the results might have been skewed.

Total Kjeldahl nitrogen was detected in one of the method blanks at a level less than the method RL. Ten samples were affected by the detection in this method blank. Associated sample results less than the RL were qualified as non-detected at the RL (0.5 mg/L). Results greater than the RL but less than 10x the detection in the method blank were qualified as estimated.

Naphthalene and *bis*(2-ethylehxyl)phthalate were each detected in a method blank; affected sample results were qualified likewise. Data qualified in this manner are summarized in **Table 3-4**.

Laboratory Control Sample (LCS) Recovery

The %R values for pentachloropenol, benzoic acid, and benzyl alcohol in one LCS analysis were less than 10%. Results for these compounds in the two sediment samples associated with this LCS were rejected.

The %R values for Diesel #2 and Lube Oil in two of the LCS analyses biased low. Results for the six associated samples were qualified as estimated.

The %R values for pesticides (2,4-D, clopyralid, diuron, and triclopyr) in selected LCS and/or LCSD analyses were less than the lower control limits (but greater than 10%). Pesticide results for the 18 samples associated with these LCS and LCSD analyses were qualified as estimated.

The %R values for selected PAHs and phthalates in a number of LCS and/or LCSD were less than the lower control limits. Affected sample results were qualified as estimated. Data affected by biased LCS and LCSD recovery are summarized in **Table 3-5**.

Matrix Spike (MS) and MS Duplicate (MSD) Recovery

The %R values for MS and MSD analyses indicate levels of potential effects on a given analytical system resulting from the nature of a sample.

The %R values for copper and lead in the MS and MSD analyses performed on sediment samples SED-SR09-01-WY11-01-01 and SED-PINES-02-WY11-01-01 were outside the control limits (75-125%). Copper and lead results for the six sediment samples in this preparation batch were qualified as estimated.

The %R value for zinc in the MS/MSD analyses performed on a water sample was outside the control limit (75-125%). Zinc results for the four samples were qualified as estimated.

Benzyl alcohol, benzoic acid, and pentachlorophenol were not recovered (%R = 0) from the MS/MSD analyses performed on sediment sample SED-PINES-02-WY11-01-01. Benzyl alcohol, benzoic acid, and pentachlorophenol results for sample SED-PINES-02-WY11-01-01 were rejected.

The %R values for benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, bis(2-ethylhexyl)phthalate, and butyl benzyl phthalate were less than the lower control limits in the MS/MSD analyses performed on sediment sample SED-PINES-02-WY11-01-01. The benzo(g,h,i)perylene, indeno(1,2,3-cd)pyrene, *bis*(2-ethylhexyl)phthalate, and butyl benzyl phthalate results for sample SED-PINES-02-WY11-01-01 were qualified as estimated.

Sample results affected by outlying MS recovery are summarized in **Table 3-6**.

Surrogate Spike Recovery

Surrogate spike recovery indicates the efficiency of sample extraction in particular.

The %R values for all surrogate spikes for PAHs and phthalates in sample SMKYPT-01-WY11-04-03 were less than 10% or lower control limits, indicating a potential of unsuccessful extraction of this sample. The PAH and phthalate detections in sample SMKYPT-01-WY11-04-03 were qualified as estimated values and the non-detects were rejected.

The %R value for the NWTPH-Dx surrogate spike in sample BALLINGER-01-WY11-05-02 was less than the lower control limit. Diesel #2 and Lube Oil results in this sample were qualified as estimated.

The %R values for selected pesticide surrogate spikes in three stormwater samples were less than the lower control limit. Pesticide results for the three samples were qualified as estimated. **Table 3-7** summarizes the qualified data.

Precision

Precision is defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Analytical precision is evaluated via the relative percent difference (RPD) values of LCS/LCSD analyses, MS/MSD analyses, and concentrations obtained from the two analytical columns for dual column methodologies. In addition, the RPD values of field duplicate analyses represent the combined precision of sample collection and analysis procedures, as well as sample homogeneity.

Quality control anomalies affecting data accuracy are identified and summarized below.

MS/MSD and Laboratory Duplicate Relative Percent Difference (RPD)

The RPD value for an MS/MSD pair or a laboratory duplicate analyses indicate the variability (imprecision) resulting from the sample matrix and/or analytical system.

The RPD values for copper in the laboratory duplicate analyses performed on sample SED-PINES-02-WY11-01-01 exceeded the control limit (<20%). Copper results for the two associated samples were qualified as estimated.

Relative percent difference values for *bis*(2-ethylhexyl)phthalate and butyl benzyl phthalate in the MS/MSD analyses performed on sample SED-PINES-02-WY11-02-01 were less than the lower control limits. *bis*(2-Ethylhexyl)phthalate and butyl benzyl phthalate results for sample SED-PINES-02-WY11-02-01 were qualified as estimated.

The RPD value for TKN in the laboratory duplicate analyses performed on sample GEIGER-01-WY11-06-03 exceeded the control limit (<20%). The TKN result for sample GEIGER-01-WY11-06-03 was qualified as estimated. Data qualified as a result of outlying MS/MSD and laboratory duplicate RPD values are presented in **Table 3-8**.

LCS/LCSD RPD

The RPD value for a LCS/LCSD pair indicates the variability resulted from the sample preparation and/or sample analysis processes. The RPD value for 2,4-D and selected PAHs in a number of LCS/LCSD pairs were outside the control criteria. Selected PAHs and 2,4-D results for the associated samples were qualified as estimated. Qualified data are presented in **Table 3-8**.

Representativeness

Representativeness is the level of confidence that the analytical data reflect the actual field condition. Representativeness is ensured by maintaining sample integrity during collection, preparation, and analysis. The evaluation of associated method and field blanks also assists in identifying artifacts that may skew the representativeness of the samples.

No anomalies were identified in sample preservation, handling, preparation, and analysis that affected data representativeness, except for the QC anomalies affecting accuracy (Section 3.1) and precision (Section 3.2) as discussed above. The data quality potentially resulting from these anomalies were evaluated and determined to have no significant effects on the data representativeness.

Comparability

Comparability is the confidence with which one data set can be compared to another data set. Using standard methods throughout the data generation processes ensures the comparability of data generated in separate sampling days or events.

All samples collected during monitoring year 2012 were analyzed using standardized analytical methodologies. Data generated from upcoming stormwater monitoring events are expected to be comparable to data generated in 2012, as long as the same or equivalent sampling protocols and analytical methodologies are applied to future sample collection activities and laboratory analysis.

Sensitivity

Sensitivity depicts the level of ability for an analytical system (*i.e.,* sample preparation and instrumental analysis) to detect a target component in a given sample matrix with a defined level of confidence. Factors affecting the sensitivity of an analytical system include: analytical system background (*e.g.,* laboratory artifact or method blank contamination), sample matrix (*e.g.,* mass spectrometry ion ratio change, co-elution of peaks, or baseline elevation) and instrument instability.

To evaluate if the analytical sensitivity achieved the project expectation, sample-specific PQLs were compared against the RL goals set forth in the *QAPPs.* In addition, sample results were compared to detections of target analytes in method blanks to identify potential effects of laboratory background on sensitivity.

The blank-related effects are discussed above in Section 3.1. Sample results affected by the detections in the blanks were qualified as non-detects at the standard PQLs, which sufficed the project PQL goals.

Sample Matrix Interference

The presence of target or non-target chemicals or subjects in samples may affect the ability of an analytical system to accurately quantitate the target analyte at the expected sensitivity

Non-target chemicals were present in sample BAINBRIDGE-01-WY11-02-02 interfering with the Lube Oil quantitation. The Lube Oil result for sample BAINBRIDGE-01-WY11-02-02 was qualified as estimated. Qualified data are presented in **Table 3-9**.

Sample-Specific Quantitation Limits

The RLs for SVOCs in sediment samples were elevated three to eight times from the project goal for method RLs. This range of elevations resulted from the required dilution of sample extracts to overcome the oily nature of the samples. The reported sample-specific RLs were considered the best-possible RLs given the conditions of the samples. No further actions were feasible other than noting the incident in this document.

Completeness and Data Usability

Completeness is defined as the percentage of usable data over the total amount of data collected. Data qualified (R)[2] and target analytes that were not analyzed or reported by the laboratory were counted as unusable data and factored in the completeness determination.

[2] R - The data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.

Overall Data Completeness

A total of 2,044 data points were collected, with 27 of the data points rejected. Overall analytical data completeness for WSDOT's NPDES Stormwater Monitoring Program during monitoring year 2012 was calculated at 98.7 percent, achieving the project goal of 95 percent.

REFERENCES

USEPA Methods for the Determination of Organic Compounds in Drinking Water, U.S. Environmental Protection Agency, December 1988 and Supplements I, II, and III, EPA 600/4-88/039.

USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, December 1996.

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WSDOT 2011a. *QAPP for Baseline Monitoring of WSDOT Highway Run-off.* Working draft, February 2011.

WSDOT 2011b. *QAPP for Baseline Monitoring of WSDOT Maintenance Facilities, Rest Area, and Ferry Terminals.* Working draft, February 2011.

WSDOT 2011c. *QAPP for WSDOT Roadway Stormwater Treatment Evaluation: Best Management Practices.* Working draft, March 2011.

TABLES

Table 1-1 Sample Analysis Schedule

Stormwater			
Parameter	**Analytical Method**	**Number of Samples**	**Analytical Laboratory**
Total Chloride	USEPA 300.0	42	Washington State Department of Ecology, Manchester Environmental Laboratory (MEL), Manchester, WA
Total Suspended Solids (TSS)	SM 2540D	53	
Fecal Coliform	SM 9222D	1	
Nitrate/Nitrite	SM 4500 NO_3-I	37	
Ortho-phosphate (OP)	SM 4500 P-G	30	
Total Phosphorus (TP)	SM 4500 P-F	38	
Total Metals (Cd, Cu, Pb, Zn)	EPA 200.8	45	
Dissolved Metals (Cd, Cu, Pb, Zn)	EPA 200.8	36	
Hardness	SM 2340B	38	
TPH-Diesel & Motor Oil	NWTPH-Dx	25	
TPH-Gasoline	NWTPH-Gx	20	
Polycyclic Aromatic Hydrocarbons (PAHs)	SW8270-SIM	49	
Phthalates	SW8270-SIM	13	
Triclopyr (total formula), 2,4-D, Clopyralid, Picloram	SW8270	37	
Diuron & Dichlobenil	SW8270	38	
Particle Size Distribution (PSD)	ASTM D3977-97/TAPE	1	Analytical Resources, Inc. (ARI) – Tukwila, WA
Glyphosate (non-aquatic formula)	USEPA 547	35	TestAmerica Laboratories, Inc. (TAL) – Savannah, GA
Total Kjeldahl Nitrogen (TKN)	USEPA 351.2	39	TAL – Portland, OR, Denver, CO, & Savannah, GA
Methylene Blue Active Substances (MBAS)	SM 5540C	16	AmTest Laboratories, Inc. Kirkland, Washington
Fecal Coliform	SM 9222D	1	
Sediment			
Parameter	**Analytical Method**	**Number of Samples**	**Analytical Laboratory**
Total Solids	SM 2540G	5	TAL – Seattle, WA
Grain Size	ASTM D422	6	
Total Organic Carbon (TOC)	PSEP Protocols	6	MEL – Manchester, WA
Metals (Cd, Cu, Pb, Zn)	EPA 200.8	6	
TPH-Diesel & Motor Oil	NWTPH-Dx	5	
Triclopyr (total formula) & Picloram	SW8270-SIM	5	
SVOCs (SMS compounds)	SW8270-SIM	5	

Notes:

1. SM – *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, 20th Edition, 1995

2. EPA Methods – *USEPA Methods for Chemical Analysis of Water and Wastes,* EPA–600/4-79-020, March 1983 Revision

3. SW Methods – *USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996

4. NWTPH – *Analytical Methods for Petroleum Hydrocarbons,* ECY 97-602, Washington State Department of Ecology, June 1997

5. ASTM – American Society of Testing and Materials

6. PSEP – Puget Sound Estuary Program

7. SIM – Selective ion monitoring

8. SMS – Washington State Sediment Management Standards

9. TAPE – Guidance for Evaluating Emerging Stormwater Treatment Technologies, Technology Assessment Protocol – Ecology, 2008

Table 3-1 Quality Control Parameters Corresponding to Measurement Quality Objectives

MQOs	QC Parameters
Precision	**RPD or Concentration Difference Values of:** LCS/LCSD MS/MSD (or Laboratory Duplicate) Dual Column Confirmation
Accuracy	Holding Time **%RPD, %R, %D, or $\%D_f$ Values of:** Calibration Verification (CS1, ICV, CCV) Surrogate Spikes Internal Standards LCS and LCSD MS and MSD Interference Check Sample for Metals Analyzed with ICP Methodologies Serial Dilution for Metals Analyzed with ICP Methodologies **Results of:** Instrument and Calibration Blanks (ICB/CCB) Method (Preparation) Blanks Trip Blanks
Representativeness	Results of All Blanks Sample Integrity Holding Times
Comparability	Sample-specific PQLs Sample Collection Methodologies Sample Preparation and Analytical Methodologies
Completeness	Data Qualifiers Laboratory Deliverables and Analyte Lists Requested/Reported Valid Results Number of Rejected Results
Sensitivity	Sample-specific MDLs and PQLs

Notes:

%RSD – Percent relative standard deviation
%R – Percent recovery
%D – Percent difference
$\%D_f$ – Percent drift
%RPD – Percent relative percent difference
CCB – Continuing calibration blank
CCV – Continuing calibration verification
CS1 – First (lowest) initial calibration standard
ICB – Initial calibration blank
ICV – Initial calibration verification
LCS – Laboratory control sample
LCSD – Laboratory control sample duplicate
MS – Matrix Spike
MSD – Matrix spike duplicate
PQL – Practical quantitation limit
RPD – Relative percent difference

Table 3-2 Data Affected by Sample Preservation and Holding Time Violations

Field Sample ID	Lab Sample ID	Analyte	Qualifier	Reason Code
CLARKSTON-01-WY11-02-01	1203075-01	Ortho-Phosphate	J	Holding Time
GEIGER-01-WY11-04-01	1203082-01	Ortho-Phosphate	J	Holding Time
SMKYPT-01-WY11-04-01	1205076-01	Ortho-Phosphate	J	Holding Time
GEIGER-01-WY11-04-01	12-A004383	Surfactants	J	Holding Time

Notes:

Holding Time – Analysis of the sample was performed past the method required holding time.

Table 3-3 Data Affected by Calibration Verification Outliers

Field Sample ID	Laboratory Sample ID	Analyte	Qualifier	Comment
SED-PINES-01-WY11-01-01	1211039-01	Benzoic Acid	**UJ**	CCV biased low
SED PINES-02-WY11-01-01	1211039-02	Benzoic Acid	**UJ**	CCV biased low
LAKEVIEW-01-WY11-01-01	580-32196-2	Total Kjeldahl Nitrogen	**J**	CCV biased low
BALLINGER-01-WY11-06-03	580-32628-1	Total Kjeldahl Nitrogen	**U**	CCV biased low
LAKEVIEW-01-WY11-05-01	580-32629-1	Total Kjeldahl Nitrogen	**J**	CCV biased low
LAKEVIEW-01-WY11-05-03	580-32630-1	Total Kjeldahl Nitrogen	**U**	CCV biased low
SMKYPT-02-WY11-03-01	580-32674-1	Total Kjeldahl Nitrogen	**J**	CCV biased low
GEIGER-01-WY11-06-03	580-33602-1	Total Kjeldahl Nitrogen	**UJ**	CCV biased low
VANCOUVER-01-WY11-05-03	580-33699-1	Total Kjeldahl Nitrogen	**J**	CCV biased low
BAINBRIDGE-01-WY11-02-01	1201046-01	Benzo(a)pyrene	**J**	CS1 biased high
BAINBRIDGE-01-WY11-05-01	1203074-03	Benzo(a)pyrene	**J**	CS1 biased high
BAINBRIDGE-01-WY11-02-01	1201046-01	Dibenzo(a,h)anthracene	**J**	CS1 biased low
BAINBRIDGE-01-WY11-06-01	1203074-01	Dibenzo(a,h)anthracene	**UJ**	CS1 biased low
BAINBRIDGE-01-WY11-05-01	1203074-03	Dibenzo(a,h)anthracene	**UJ**	CS1 biased low
SED-PINES-01-WY11-01-01	1211039-01	*bis*(2-Ethylhexyl) Phthalate	**J**	CS1 biased low
SED-PINES-01-WY11-01-01	1211039-01	Dibenzo(a,h)anthracene	**UJ**	CS1 biased low
SED PINES-02-WY11-01-01	1211039-02	*bis*(2-Ethylhexyl) Phthalate	**J**	CS1 biased low
SED PINES-02-WY11-01-01	1211039-02	Dibenzo(a,h)anthracene	**UJ**	CS1 biased low
BAINBRIDGE-01-WY11-02-01	1201046-01	Indeno(1,2,3-cd)pyrene	**J**	ICV biased high
BAINBRIDGE-01-WY11-02-01	1201046-01	Benz[a]anthracene	**J**	ICV biased low
BAINBRIDGE-01-WY11-06-01	1203074-01	Benz[a]anthracene	**UJ**	ICV biased low
BAINBRIDGE-01-WY11-05-01	1203074-03	Benz[a]anthracene	**J**	ICV biased low

Notes:

CCV – Continuing calibration verification

CS1 – First (lowest) initial calibration standard

ICV – Initial calibration verification

Table 3-4 Data Affected by Detections in Blanks

Field Sample ID	Laboratory Sample ID	Analyte	Adjusted Value	Qualifier	Unit	Comment
BALLINGER-01-WY11-05-01	580-32275-2	Total Kjeldahl Nitrogen	1.4	**J**	mg/L	MB
CLARKSTON-01-WY11-03-01	580-32275-1	Total Kjeldahl Nitrogen	0.99	**J**	mg/L	MB
SMKYPT-02-WY11-01-01	580-32275-3	Total Kjeldahl Nitrogen	1.2	**J**	mg/L	MB
VANCOUVER-01-WY11-02-01	580-32196-3	Total Kjeldahl Nitrogen	1.1	**J**	mg/L	MB
LAKEVIEW-01-WY11-05-01	580-32629-1	Total Kjeldahl Nitrogen	0.75	**J**	mg/L	MB
LAKEVIEW-01-WY11-05-03	580-32630-1	Total Kjeldahl Nitrogen	0.5	**U**	mg/L	MB
BALLINGER-01-WY11-06-03	580-32628-1	Total Kjeldahl Nitrogen	0.5	**U**	mg/L	MB
LAKEVIEW-01-WY11-01-01	580-32196-2	Total Kjeldahl Nitrogen	0.62	**J**	mg/L	MB
VANCOUVER-01-WY11-05-03	580-33699-1	Total Kjeldahl Nitrogen	0.55	**J**	mg/L	MB
SMKYPT-02-WY11-03-01	580-32674-1	Total Kjeldahl Nitrogen	1.4	**J**	mg/L	MB
BAINBRIDGE-01-WY11-09-01	1202066-01	Naphthalene	0.025	**J**	µg/L	MB
PILCHUCK-01-WY11-02-01	1207089-01	Naphthalene	0.022	**J**	µg/L	MB
EVERETT-04-WY11-01-01	1207104-01	Naphthalene	0.028	**J**	µg/L	MB
SMKYPT-02-WY11-03-01	1205044-01	*bis*(2-Ethylhexyl) Phthalate	0.76	**J**	µg/L	MB

Notes:
MB – Analyte was detected in method blank and sample result was affected.
µg/L – microgram per liter
mg/L – milligram per
U – Analyte was not detected at or above the adjusted value.

Table 3-5 Data Affected by Laboratory Control Sample Outliers

Field Sample ID	Laboratory Sample ID	Analyte	Qualifier	Comment
SED-PINES-01-WY11-01-01	1211039-01	Benzoic Acid	**R**	LCS %R <10%
SED PINES-02-WY11-01-01	1211039-02	Benzoic Acid	**R**	LCS %R <10%
SED-PINES-01-WY11-01-01	1211039-01	Benzyl Alcohol	**R**	LCS %R <10%
SED PINES-02-WY11-01-01	1211039-02	Benzyl Alcohol	**R**	LCS %R <10%
SED-PINES-01-WY11-01-01	1211039-01	Pentachlorophenol	**R**	LCS %R <10%
SED PINES-02-WY11-01-01	1211039-02	Pentachlorophenol	**R**	LCS %R <10%
BAINBRIDGE-01-WY11-04-02	1203052-02	#2 Diesel	**UJ**	LCS %R <LCL
GEIGER-01-WY11-04-02	1203082-02	#2 Diesel	**UJ**	LCS %R <LCL
EUCLID-01-WY11-01-02	1203083-01	#2 Diesel	**UJ**	LCS %R <LCL
LAKEVIEW-01-WY11-01-02	1204038-02	#2 Diesel	**UJ**	LCS %R <LCL
VANCOUVER-01-WY11-02-02	1204039-02	#2 Diesel	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-05-02	1204040-02	#2 Diesel	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-01-01	1201048-01	2,4-D	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-02-01	1202064-01	2,4-D	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-03-01	1203038-01	2,4-D	**UJ**	LCS %R <LCL
VANCOUVER-01-WY11-01-01	1203039-01	2,4-D	**UJ**	LCS %R <LCL
LAKEVIEW-01-WY11-02-01	1204055-01	2,4-D	**J**	LCS %R <LCL
LAKEVIEW-01-WY11-03-01	1204067-01	2,4-D	**J**	LCS %R <LCL
VANCOUVER-01-WY11-03-01	1204068-01	2,4-D	**J**	LCS %R <LCL
SMKYPT-01-WY11-04-01	1205076-01	2,4-D	**UJ**	LCS %R <LCL
SMKYPT-02-WY11-04-01	1205077-01	2,4-D	**UJ**	LCS %R <LCL
SMKYPT-01-WY11-04-03	1205078-01	2,4-D	**UJ**	LCS %R <LCL
EUCLID-01-WY11-03-01	1206050-01	2,4-D	**J**	LCS %R <LCL
GEIGER-01-WY11-07-01	1210077-01	2,4-D	**UJ**	LCS %R <LCL
BAINBRIDGE-01-WY11-03-01	1202056-01	Acenaphthylene	**J**	LCS %R <LCL
BALLINGER-01-WY11-02-01	1202064-01	Acenaphthylene	**J**	LCS %R <LCL
BAINBRIDGE-01-WY11-09-01	1202066-01	Acenaphthylene	**J**	LCS %R <LCL
BALLINGER-01-WY11-03-01	1203038-01	Acenaphthylene	**J**	LCS %R <LCL
BAINBRIDGE-01-WY11-04-01	1203052-01	Acenaphthylene	**J**	LCS %R <LCL
SMKYPT-02-WY11-02-01	1203062-01	Acenaphthylene	**J**	LCS %R <LCL
BALLINGER-01-WY11-04-01	1203063-01	Acenaphthylene	**J**	LCS %R <LCL
SMKYPT-01-WY11-02-01	1203064-01	Acenaphthylene	**J**	LCS %R <LCL
GEIGER-01-WY11-03-01	1205048-01	Acenaphthylene	**J**	LCS %R <LCL
BAINBRIDGE-01-WY11-07-01	1205075-01	Acenaphthylene	**UJ**	LCS %R <LCL
SMKYPT-02-WY11-04-01	1205077-01	Acenaphthylene	**J**	LCS %R <LCL
EUCLID-01-WY11-03-01	1206050-01	Acenaphthylene	**UJ**	LCS %R <LCL

Field Sample ID	Laboratory Sample ID	Analyte	Qualifier	Comment
BAINBRIDGE-01-WY11-07-01	1205075-01	Anthracene	**UJ**	LCS %R <LCL
SMKYPT-01-WY11-04-01	1205076-01	Anthracene	**UJ**	LCS %R <LCL
SMKYPT-02-WY11-04-01	1205077-01	Anthracene	**UJ**	LCS %R <LCL
GEIGER-01-WY11-03-01	1205048-01	Benz[a]anthracene	**J**	LCS %R <LCL
BALLINGER-01-WY11-02-01	1202064-01	Benzo(a)pyrene	**J**	LCS %R <LCL
BAINBRIDGE-01-WY11-09-01	1202066-01	Benzo(a)pyrene	**J**	LCS %R <LCL
BALLINGER-01-WY11-03-01	1203038-01	Benzo(a)pyrene	**J**	LCS %R <LCL
VANCOUVER-01-WY11-01-01	1203039-01	Benzo(a)pyrene	**UJ**	LCS %R <LCL
GEIGER-01-WY11-03-01	1205048-01	Benzo(a)pyrene	**J**	LCS %R <LCL
BAINBRIDGE-01-WY11-07-01	1205075-01	Benzo(a)pyrene	**J**	LCS %R <LCL
SMKYPT-01-WY11-04-01	1205076-01	Benzo(a)pyrene	**UJ**	LCS %R <LCL
SMKYPT-02-WY11-04-01	1205077-01	Benzo(a)pyrene	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-03-01	1203038-01	*bis*(2-Ethylhexyl) Phthalate	**J**	LCS %R <LCL
SMKYPT-01-WY11-03-01	1205043-01	*bis*(2-Ethylhexyl) Phthalate	**J**	LCS %R <LCL
SMKYPT-02-WY11-03-01	1205044-01	*bis*(2-Ethylhexyl) Phthalate	**J**	LCS %R <LCL
SMKYPT-01-WY11-04-01	1205076-01	*bis*(2-Ethylhexyl) Phthalate	**J**	LCS %R <LCL
PILCHUCK-WY11-01-01	1206077-01	*bis*(2-Ethylhexyl) Phthalate	**J**	LCS %R <LCL
BALLINGER-01-WY11-01-01	1201048-01	Clopyralid	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-02-01	1202064-01	Clopyralid	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-03-01	1203038-01	Clopyralid	**UJ**	LCS %R <LCL
VANCOUVER-01-WY11-01-01	1203039-01	Clopyralid	**UJ**	LCS %R <LCL
GEIGER-01-WY11-04-01	1203082-01	Clopyralid	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-03-01	1203038-01	Di-N-Octyl Phthalate	**J**	LCS %R <LCL
SMKYPT-01-WY11-02-01	1203064-01	Di-N-Octyl Phthalate	**J**	LCS %R <LCL
SMKYPT-02-WY11-01-01	1204041-01	Di-N-Octyl Phthalate	**J**	LCS %R <LCL
SMKYPT-01-WY11-01-02	1204041-02	Di-N-Octyl Phthalate	**UJ**	LCS %R <LCL
SMKYPT-01-WY11-03-01	1205043-01	Di-N-Octyl Phthalate	**J**	LCS %R <LCL
SMKYPT-02-WY11-03-01	1205044-01	Di-N-Octyl Phthalate	**UJ**	LCS %R <LCL
SMKYPT-01-WY11-04-01	1205076-01	Di-N-Octyl Phthalate	**UJ**	LCS %R <LCL
SMKYPT-02-WY11-04-01	1205077-01	Di-N-Octyl Phthalate	**UJ**	LCS %R <LCL
PILCHUCK-WY11-01-01	1206077-01	Di-N-Octyl Phthalate	**J**	LCS %R <LCL
BALLINGER-01-WY11-01-01	1201048-01	Diuron	**UJ**	LCS %R <LCL
LAKEVIEW-01-WY11-01-01	1204038-01	Diuron	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-05-01	1204040-01	Diuron	**UJ**	LCS %R <LCL
SMKYPT-02-WY11-01-01	1204041-01	Diuron	**UJ**	LCS %R <LCL
SMKYPT-01-WY11-01-02	1204041-02	Diuron	**UJ**	LCS %R <LCL
CLARKSTON-01-WY11-03-01	1204043-01	Diuron	**UJ**	LCS %R <LCL

Field Sample ID	Laboratory Sample ID	Analyte	Qualifier	Comment
LAKEVIEW-01-WY11-04-01	1204076-01	Diuron	**UJ**	LCS %R <LCL
CLARKSTON-01-WY11-04-01	1204078-01	Diuron	**UJ**	LCS %R <LCL
EUCLID-01-WY11-02-01	1204079-03	Diuron	**UJ**	LCS %R <LCL
LAKEVIEW-01-WY11-05-03	1204086-01	Diuron	**UJ**	LCS %R <LCL
LAKEVIEW-01-WY11-05-01	1204088-01	Diuron	**UJ**	LCS %R <LCL
SMKYPT-01-WY11-03-01	1205043-01	Diuron	**UJ**	LCS %R <LCL
SMKYPT-02-WY11-03-01	1205044-01	Diuron	**UJ**	LCS %R <LCL
GEIGER-01-WY11-03-01	1205048-01	Diuron	**J**	LCS %R <LCL
GEIGER-01-WY11-06-03	1206075-01	Diuron	**J**	LCS %R <LCL
GEIGER-01-WY11-05-01	1206081-01	Diuron	**J**	LCS %R <LCL
BAINBRIDGE-01-WY11-04-02	1203052-02	Lube Oil	**J**	LCS %R <LCL
GEIGER-01-WY11-04-02	1203082-02	Lube Oil	**J**	LCS %R <LCL
EUCLID-01-WY11-01-02	1203083-01	Lube Oil	**J**	LCS %R <LCL
LAKEVIEW-01-WY11-01-02	1204038-02	Lube Oil	**J**	LCS %R <LCL
VANCOUVER-01-WY11-02-02	1204039-02	Lube Oil	**J**	LCS %R <LCL
BALLINGER-01-WY11-05-02	1204040-02	Lube Oil	**J**	LCS %R <LCL
SED-PILCHUCK-01-WY11-01-01	1207080-02	Pentachlorophenol	**UJ**	LCS %R <LCL
SED-EVERETT-04-WY11-01-01	1207080-03	Pentachlorophenol	**UJ**	LCS %R <LCL
SED-EVERETT-01-WY11-01-01	1207080-04	Pentachlorophenol	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-02-01	1202064-01	Picloram	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-03-01	1203038-01	Picloram	**UJ**	LCS %R <LCL
VANCOUVER-01-WY11-01-01	1203039-01	Picloram	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-02-01	1202064-01	Triclopyr	**UJ**	LCS %R <LCL
BALLINGER-01-WY11-03-01	1203038-01	Triclopyr	**UJ**	LCS %R <LCL
VANCOUVER-01-WY11-01-01	1203039-01	Triclopyr	**J**	LCS %R <LCL

Notes:
LCS – Laboratory control sample
%R – Percent recovery
LCL = Lower control limit

Table 3-6 Data Affected by Matrix Spike Recovery Outliers

Field Sample ID	Laboratory Sample ID	Analyte	Qualifier	Comment
GEIGER-01-WY11-04-01	580-32196-1	Total Kjeldahl Nitrogen	**J**	
BALLINGER-01-WY11-07-01	580-33672-1	Total Kjeldahl Nitrogen	**J**	
LAKEVIEW-01-WY11-06-01	580-33672-3	Total Kjeldahl Nitrogen	**J**	
PILCHUCK-01-WY11-01-01	580-33672-2	Total Kjeldahl Nitrogen	**J**	
SED-SR09-01-WY11-01-01	1207080-01	Copper	**J**	
SED-PILCHUCK-01-WY11-01-01	1207080-02	Copper	**J**	
SED-EVERETT-04-WY11-01-01	1207080-03	Copper	**J**	
SED-EVERETT-01-WY11-01-01	1207080-04	Copper	**J**	
SED-SR09-01-WY11-01-01	1207080-01	Lead	**J**	
SED-PILCHUCK-01-WY11-01-01	1207080-02	Lead	**J**	
SED-EVERETT-04-WY11-01-01	1207080-03	Lead	**J**	
SED-EVERETT-01-WY11-01-01	1207080-04	Lead	**J**	
SED-PINES-01-WY11-01-01	1211039-01	Lead	**J**	
SED PINES-02-WY11-01-01	1211039-02	Lead	**J**	
SED-PINES-01-WY11-01-01	1211039-01	Copper	**J**	
SED PINES-02-WY11-01-01	1211039-02	Copper	**J**	
TOX-PILCHUCK-06-WY11-01-01	1209085-01	Zinc	**J**	
TOX-EVERETT-REF-WY11-01-01	1209085-02	Zinc	**J**	
TOX-PILCHUCK-REF-WY11-01-01	1209085-03	Zinc	**J**	
TOX-PILCHUCK-06-WY11-01-03	1209087-01	Zinc	**J**	
SED PINES-02-WY11-01-01	1211039-02	Benzyl Alcohol	**R**	MS/MSD %R <10%
SED PINES-02-WY11-01-01	1211039-02	Pentachlorophenol	**R**	MS/MSD %R <10%
SED PINES-02-WY11-01-01	1211039-02	Benzoic Acid	**R**	MS/MSD %R <10%
SED-PILCHUCK-01-WY11-01-01	1207080-02	Benzo(ghi)perylene	**J**	
SED-PILCHUCK-01-WY11-01-01	1207080-02	Indeno(1,2,3-cd)pyrene	**J**	
SED-PILCHUCK-01-WY11-01-01	1207080-02	*bis*(2-Ethylhexyl) Phthalate	**J**	
SED PINES-02-WY11-01-01	1211039-02	Butyl benzyl phthalate	**J**	

Notes:

MS – Matrix spike

MSD – Matrix spike duplicate

%R – Percent recovery

Table 3-7 Data Affected by Surrogate Spike Recovery Outliers

Field Sample ID	Laboratory Sample ID	Analyte	Qualifier	Comment
BALLINGER-01-WY11-05-02	1204040-02	#2 Diesel	**UJ**	
BALLINGER-01-WY11-05-02	1204040-02	Lube Oil	**J**	
BALLINGER-01-WY11-04-01	1203063-01	Triclopyr	**J**	
GEIGER-01-WY11-02-01	1203069-01	Dichlobenil	**J**	
GEIGER-01-WY11-02-01	1203069-01	Diuron	**J**	
GEIGER-01-WY11-03-01	1205048-01	Dichlobenil	**J**	
GEIGER-01-WY11-03-01	1205048-01	Diuron	**J**	
SMKYPT-01-WY11-04-03	1205078-01	Dichlobenil	**J**	
SMKYPT-01-WY11-04-03	1205078-01	Acenaphthene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Acenaphthylene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Anthracene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Benz[a]anthracene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Benzo(a)pyrene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Benzo(b)fluoranthene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Benzo(g,h,i)perylene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Benzo(k)fluoranthene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	*bis*(2-Ethylhexyl) Phthalate	**J**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Butyl benzyl phthalate	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Chrysene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Dibenzo(a,h)anthracene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Diethyl phthalate	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Dimethyl phthalate	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Di-N-Butylphthalate	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Di-N-Octyl Phthalate	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Fluoranthene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Fluorene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Indeno(1,2,3-cd)pyrene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Naphthalene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Phenanthrene	**R**	Unsuccessful extraction
SMKYPT-01-WY11-04-03	1205078-01	Pyrene	**R**	Unsuccessful extraction

Notes:

Unsuccessful extraction – Recovery of all surrogate spikes was less than the lower control limits or, in some cases, <10%, indicating a great potential of unsuccessful extraction of the sample. Detections in the samples were qualified (J) and non-detects qualified (R) and the results rejected.

Table 3-8 Data Affected by Precision Outliers

Field Sample ID	Laboratory Sample ID	Analyte	Qualifier	Comment
SED-PINES-01-WY11-01-01	1211039-01	Copper	**J**	Laboratory Duplicate
SED PINES-02-WY11-01-01	1211039-02	Copper	**J**	Laboratory Duplicate
SED-PILCHUCK-01-WY11-01-01	1207080-02	*bis*(2-Ethylhexyl) Phthalate	**J**	MS/MSD
SED PINES-02-WY11-01-01	1211039-02	Butyl Benzyl Phthalate	**J**	MS/MSD
GEIGER-01-WY11-06-03	580-33602-1	Total Kjeldahl Nitrogen	**UJ**	Laboratory Duplicate
BALLINGER-01-WY11-05-01	1204040-01	2,4-D	**UJ**	LCS/LCSD
LAKEVIEW-01-WY11-01-01	1204038-01	2,4-D	**J**	LCS/LCSD
CLARKSTON-01-WY11-03-01	1204043-01	2,4-D	**J**	LCS/LCSD
GEIGER-01-WY11-04-01	1203082-01	2,4-D	**J**	LCS/LCSD
VANCOUVER-01-WY11-02-01	1204039-01	2,4-D	**UJ**	LCS/LCSD
SMKYPT-02-WY11-01-01	1204041-01	2,4-D	**UJ**	LCS/LCSD
SMKYPT-01-WY11-01-02	1204041-02	2,4-D	**UJ**	LCS/LCSD
GEIGER-01-WY11-04-01	1203082-01	Picloram	**J**	LCS/LCSD
GEIGER-01-WY11-04-01	1203082-01	Triclopyr	**J**	LCS/LCSD
VANCOUVER-01-WY11-03-01	1204068-01	2,4-D	**J**	LCS/LCSD
LAKEVIEW-01-WY11-02-01	1204055-01	2,4-D	**J**	LCS/LCSD
LAKEVIEW-01-WY11-03-01	1204067-01	2,4-D	**J**	LCS/LCSD
SMKYPT-01-WY11-04-01	1205076-01	2,4-D	**UJ**	LCS/LCSD
VANCOUVER-01-WY11-01-01	1203039-01	2,4-D	**UJ**	LCS/LCSD
SMKYPT-02-WY11-04-01	1205077-01	2,4-D	**UJ**	LCS/LCSD
SMKYPT-01-WY11-04-03	1205078-01	2,4-D	**UJ**	LCS/LCSD
GEIGER-01-WY11-04-01	1203082-01	Clopyralid	**UJ**	LCS/LCSD
LAKEVIEW-01-WY11-04-01	1204076-01	Acenaphthylene	**J**	LCS/LCSD
LAKEVIEW-01-WY11-05-03	1204086-01	Acenaphthylene	**UJ**	LCS/LCSD
LAKEVIEW-01-WY11-05-01	1204088-01	Acenaphthylene	**UJ**	LCS/LCSD
VANCOUVER-01-WY11-04-01	1204077-01	Acenaphthylene	**UJ**	LCS/LCSD
BALLINGER-01-WY11-06-03	1204087-01	Acenaphthylene	**UJ**	LCS/LCSD
SMKYPT-01-WY11-04-01	1205076-01	Acenaphthylene	**J**	LCS/LCSD
SMKYPT-01-WY11-03-01	1205043-01	Acenaphthylene	**UJ**	LCS/LCSD
SMKYPT-02-WY11-03-01	1205044-01	Acenaphthylene	**UJ**	LCS/LCSD
EUCLID-01-WY11-02-01	1204079-03	Acenaphthylene	**J**	LCS/LCSD
CLARKSTON-01-WY11-04-01	1204078-01	Acenaphthylene	**UJ**	LCS/LCSD
BALLINGER-01-WY11-02-01	1202064-01	Anthracene	**J**	LCS/LCSD
BALLINGER-01-WY11-03-01	1203038-01	Anthracene	**J**	LCS/LCSD
VANCOUVER-01-WY11-01-01	1203039-01	Anthracene	**UJ**	LCS/LCSD
BAINBRIDGE-01-WY11-07-01	1205075-01	Benz[a]anthracene	**J**	LCS/LCSD
SMKYPT-01-WY11-04-01	1205076-01	Benz[a]anthracene	**UJ**	LCS/LCSD
SMKYPT-02-WY11-04-01	1205077-01	Benz[a]anthracene	**UJ**	LCS/LCSD
BAINBRIDGE-01-WY11-07-01	1205075-01	Dibenzo(a,h)anthracene	**UJ**	LCS/LCSD
SMKYPT-01-WY11-04-01	1205076-01	Dibenzo(a,h)anthracene	**UJ**	LCS/LCSD

Field Sample ID	Laboratory Sample ID	Analyte	Qualifier	Comment
SMKYPT-02-WY11-04-01	1205077-01	Dibenzo(a,h)anthracene	**UJ**	LCS/LCSD
BAINBRIDGE-01-WY11-04-01	1203052-01	Acenaphthylene	**J**	LCS/LCSD
BALLINGER-01-WY11-02-01	1202064-01	Acenaphthylene	**J**	LCS/LCSD
BALLINGER-01-WY11-03-01	1203038-01	Acenaphthylene	**J**	LCS/LCSD
BALLINGER-01-WY11-04-01	1203063-01	Acenaphthylene	**J**	LCS/LCSD
BAINBRIDGE-01-WY11-09-01	1202066-01	Acenaphthylene	**J**	LCS/LCSD
SMKYPT-01-WY11-02-01	1203064-01	Acenaphthylene	**J**	LCS/LCSD
SMKYPT-02-WY11-02-01	1203062-01	Acenaphthylene	**J**	LCS/LCSD
SMKYPT-02-WY11-04-01	1205077-01	Acenaphthylene	**J**	LCS/LCSD
SMKYPT-02-WY11-04-01	1205077-01	Anthracene	**UJ**	LCS/LCSD
BAINBRIDGE-01-WY11-07-01	1205075-01	Benzo(a)pyrene	**J**	LCS/LCSD
BALLINGER-01-WY11-02-01	1202064-01	Benzo(a)pyrene	**J**	LCS/LCSD
BALLINGER-01-WY11-03-01	1203038-01	Benzo(a)pyrene	**J**	LCS/LCSD
SMKYPT-01-WY11-04-01	1205076-01	Benzo(a)pyrene	**UJ**	LCS/LCSD
BAINBRIDGE-01-WY11-09-01	1202066-01	Benzo(a)pyrene	**J**	LCS/LCSD
VANCOUVER-01-WY11-01-01	1203039-01	Benzo(a)pyrene	**UJ**	LCS/LCSD
SMKYPT-02-WY11-04-01	1205077-01	Benzo(a)pyrene	**UJ**	LCS/LCSD

Notes:

MS/MSD – The relative percent difference (RPD) value for matrix spike and matrix spike duplicate was outside the control criteria.

LCS/LCSD – The RPD value for laboratory control sample and laboratory control sample duplicate was outside the control criteria.

Laboratory Duplicate - The RPD value for the laboratory duplicate analysis was outside the control criteria.

Table 3-9 Data Affected by Sample Matrix Interference

Field Sample ID	Laboratory Sample ID	Analyte	Qualifier	Comment
BAINBRIDGE-01-WY11-02-02	1201046-02	Lube Oil	**J**	Matrix Interference

Notes:

Matrix interference – Non-target chemical/subject that affected the accurate quantitation of the analyte was observed during analysis as noted by laboratory analyst.

Ion Ration – Ion abundance ratio for the reported detection did not meet method criteria for compound identification.

Appendix E:
Water Quality Data Tables

Rest Areas

Smokey Point Rest Area NB		Storm Event							
PARAMETER	**UNITS**	**3/9/2012**		**4/3/2012**		**4/29/2012**		**5/20/2012**	
Conventionals									
TSS	mg/L	28		33		30	J	50	
Chloride	mg/L	60.5		6.97		7.76		88.6	
Hardness as $CaCO_3$	mg/L	--		21.1		28.3		99.2	
Temperature	degrees C	--		--		--		--	
Bacteria									
Fecal coliform	cfu/100ml	--		--		--		--	
Nutrients									
Total Phosphorous	mg/L	--		0.181		0.361		1.84	
Orthophosphate	mg/L	--		0.0958		0.12	J	1.03	J
Total Kjeldahl Nitrogen	mg/L	--		1.9		4.9		22	
Nitrate-Nitrite	mg/L	--		0.348		0.451		0.805	
Metals									
Total Recoverable Copper	ug/L	--		16.5		19.1		82.9	
Dissolved Copper	ug/L	--		8.7		13.4		65.1	
Total Recoverable Lead	ug/L	--		2.99		1.76		2.24	
Dissolved Lead	ug/L	--		0.201		0.263		1.39	
Total Recoverable Cadmium	ug/L	--		0.14		0.14		0.55	
Dissolved Cadmium	ug/L	--		0.065		0.083		0.424	
Total Recoverable Zinc	ug/L	--		96.8		72.9		253	
Dissolved Zinc	ug/L	--		47.2		47.2		235	
PAH Compounds									
Acenaphthene	ug/L	0.0099	U	0.0097	U	0.027		0.06	
Acenaphthylene	ug/L	0.062	J	0.0097	U	0.0097	UJ	0.18	J
Anthracene	ug/L	0.0099	U	0.0097	U	0.0097	U	0.0099	UJ
Benzo(a)anthracene	ug/L	0.0091	J	0.0097	U	0.0097	U	0.0099	UJ
Benzo(b)fluoranthene	ug/L	0.024		0.041	J	0.018	J	0.0099	UJ
Benzo(k)fluoranthene	ug/L	0.0099	U	0.0097	UJ	0.0097	UJ	0.0099	UJ
Benzo(ghi)perylene	ug/L	0.019		0.024	J	0.0097	UJ	0.0099	UJ
Benzo(a)pyrene	ug/L	0.015		0.018	J	0.0097	UJ	0.0099	UJ
Chrysene	ug/L	0.023		0.026		0.017		0.0099	U
Dibenzo(a,h)anthracene	ug/L	0.0099	U	0.0097	UJ	0.0097	UJ	0.0099	UJ
Fluoranthene	ug/L	0.045		0.06		0.035		0.016	
Fluorene	ug/L	0.0099	U	0.0097	U	0.073		0.14	NJ
Indeno(1,2,3-cd)pyrene	ug/L	0.0091	J	0.01	J	0.0097	UJ	0.0099	UJ
Naphthalene	ug/L	0.021		0.0097	U	0.25		0.74	
Phenanthrene	ug/L	0.039		0.094		0.088		0.11	
Pyrene	ug/L	0.092		0.14		0.07		0.068	
Phthalates									
bis(2-Ethylhexyl)phthalate	ug/L	1.8	U	2.3	J	1.7	J	1.2	J
Butyl benzyl phthalate	ug/L	0.74		0.19	U	0.24		0.2	U
Di-n-butyl phthalate	ug/L	0.32	U	0.36	UJ	0.23	UJ	0.2	U
Diethyl phthalate	ug/L	0.2	J	0.19	U	0.19	U	0.39	
Dimethyl phthalate	ug/L	0.2	U	0.19	U	0.058	J	0.2	U
Di-n-octyl phthalate	ug/L	0.55	J	0.19	UJ	0.52	J	0.2	UJ

Herbicides									
Dichlobenil	ug/L	0.059		0.032	U	0.032	U	0.033	U
Diuron	ug/L	0.049	U	0.049	UJ	0.049	UJ	0.05	U
2,4-D	ug/L	0.062	U	0.061	UJ	0.062	U	0.062	UJ
Clopyralid	ug/L	0.062	U	0.061	U	0.062	U	0.062	U
Picloram	ug/L	0.062	U	0.061	U	0.062	U	0.062	U
Triclopyr	ug/L	0.062	U	0.061	U	0.062	U	0.062	U
Glyphosate	ug/L	--		25	U	25	U	25	U
TPH									
TPH-Diesel (NWTPH-Dx)	mg/L	--		--		--		--	
Diesel	mg/L	--		--		--		--	
Lube Oil	mg/L	--		--		--		--	
TPH-Gas (NWTPH-Gx)	mg/L	--		--		--		--	

Notes:

-- Parameter not analyzed

U – Analyte not detected above reported result

J – Estimated value

UJ – Analyte not detected above reported result; reported reporting limit may inaccurate

TPH-Diesel (NWTPH-Dx) values are calculated as the sum of the Diesel and Lube Oil concentrations

Smokey Point Rest Area SB		Storm Event							
PARAMETER	**UNITS**	**3/9/2012**		**4/3/2012**		**4/30/2012**		**5/21/2012**	
Conventionals									
TSS	mg/L	18		43		23	J	22	
Chloride	mg/L	45.2		10.3		20		16.2	
Hardness as $CaCO_3$	mg/L	--		32.7		47.4		54.5	
Temperature	degrees C	--		--		--		--	
Bacteria									
Fecal coliform	cfu/100ml	--		--		--		--	
Nutrients									
Total Phosphorous	mg/L	--		0.143		0.107		0.186	
Orthophosphate	mg/L	--		0.0284		0.0106	J	0.0479	
Total Kjeldahl Nitrogen	mg/L	--		1.2	J	1.4	J	2.3	
Nitrate-Nitrite	mg/L	--		0.178		0.248		0.296	
Metals									
Total Recoverable Copper	ug/L	--		36.9		7.63		11.6	
Dissolved Copper	ug/L	--		3.03		4.66		9.05	
Total Recoverable Lead	ug/L	--		2.6		0.77		0.83	
Dissolved Lead	ug/L	--		0.144		0.061		0.07	
Total Recoverable Cadmium	ug/L	--		0.26		0.1	U	0.1	U
Dissolved Cadmium	ug/L	--		0.043		0.035		0.048	
Total Recoverable Zinc	ug/L	--		91.9		39.4		65.8	
Dissolved Zinc	ug/L	--		27.8		24.9		43.4	
PAH Compounds									
Acenaphthene	ug/L	0.0097	U	0.01	U	0.01	U	0.0097	U
Acenaphthylene	ug/L	0.081	J	0.01	U	0.01	UJ	0.073	J
Anthracene	ug/L	0.0097	U	0.01	U	0.01	U	0.0097	UJ
Benzo(a)anthracene	ug/L	0.0097	UJ	0.01	U	0.01	U	0.0097	UJ
Benzo(b)fluoranthene	ug/L	0.02	J	0.028		0.01	U	0.0097	U
Benzo(k)fluoranthene	ug/L	0.0049	J	0.0087	J	0.01	U	0.0097	U
Benzo(ghi)perylene	ug/L	0.024		0.022		0.01	U	0.0097	U
Benzo(a)pyrene	ug/L	0.013	J	0.013		0.01	U	0.0097	UJ
Chrysene	ug/L	0.015		0.023		0.01	U	0.0097	U
Dibenzo(a,h)anthracene	ug/L	0.0097	U	0.01	U	0.01	U	0.0097	UJ
Fluoranthene	ug/L	0.032		0.047		0.014		0.0071	NJ
Fluorene	ug/L	0.0097	U	0.01	U	0.01	U	0.0097	U
Indeno(1,2,3-cd)pyrene	ug/L	0.0096	J	0.01	U	0.01	U	0.0097	U
Naphthalene	ug/L	0.0043	J	0.0056	J	0.0059	J	0.0097	U
Phenanthrene	ug/L	0.023		0.03		0.0094	J	0.0097	U
Pyrene	ug/L	0.074		0.082		0.02		0.013	
Phthalates									
bis(2-Ethylhexyl)phthalate	ug/L	1.4	UJ	1.5	U	0.76	J	0.48	J
Butyl benzyl phthalate	ug/L	0.59	J	0.2	U	0.21	U	0.19	U
Di-n-butyl phthalate	ug/L	0.25	UJ	0.36	U	0.21	U	0.19	U
Diethyl phthalate	ug/L	0.19	U	0.2	U	0.21	U	0.19	U
Dimethyl phthalate	ug/L	0.19	U	0.2	U	0.21	U	0.19	U
Di-n-octyl phthalate	ug/L	0.55	J	0.28	J	0.21	UJ	0.19	UJ
Herbicides									
Dichlobenil	ug/L	0.033	U	0.032	U	0.033	U	0.034	U

Diuron	ug/L	0.05	U	0.049	UJ	0.05	UJ	0.051	U
2,4-D	ug/L	0.061	U	0.062	UJ	0.061	U	0.062	UJ
Clopyralid	ug/L	0.061	U	0.062	U	0.061	U	0.062	U
Picloram	ug/L	0.061	U	0.062	U	0.061	U	0.062	U
Triclopyr	ug/L	0.061	U	0.062	U	0.061	U	0.062	U
Glyphosate	ug/L	--		25	U	25	U	25	U
TPH									
TPH-Diesel (NWTPH-Dx)	mg/L	--		--		--		--	
Diesel	mg/L	--		--		--		--	
Lube Oil	mg/L	--		--		--		--	
TPH-Gas (NWTPH-Gx)	mg/L	--		--		--		--	

Notes:

-- Parameter not analyzed

U – Analyte not detected above reported result

J – Estimated value

UJ – Analyte not detected above reported result; reported reporting limit may inaccurate

TPH-Diesel (NWTPH-Dx) values are calculated as the sum of the Diesel and Lube Oil concentrations

Maintenance Facilities (MF)

Ballinger MF		Storm Event													
PARAMETER	**UNITS**	**1/24/12**		**2/24/12**		**2/28/12**		**3/9/12**		**4/3/12**		**4/29/12**		**6/22/12**	
Conventionals															
TSS	mg/L	215		1140	J	408	J	223		196	J	313	J	2990	J
Chloride	mg/L	--		591		--		10600		6980		6550		2110	
Hardness as $CaCO_3$	mg/L	--		--		--		--		182		232		166	
Temperature	degrees C	--		--		--		--		--		--		--	
Nutrients															
Total Phosphorous	mg/L	0.531		--		0.396		--		0.188		0.472		4.84	
Orthophosphate	mg/L	0.023	J	--		0.0726		--		0.0536		0.0234	J	--	
Total Kjeldahl Nitrogen	mg/L	0.326		--		--		--		1.4	J	5		3.6	J
Nitrate-Nitrite	mg/L	0.5		--		0.364		--		0.257		0.391		0.342	
Metals															
Total Recoverable Copper	ug/L	58		--		43.3		--		28.3		61.8		--	
Dissolved Copper	ug/L	20.5		--		49.1		--		14.8		9.99		--	
Total Recoverable Lead	ug/L	46.6		--		30.8		--		18.8		35		--	
Dissolved Lead	ug/L	0.165		--		0.343		--		0.452		1.99		--	
Total Recoverable Cadmium	ug/L	0.71		--		1.14		--		1	U	1	U	--	
Dissolved Cadmium	ug/L	0.62		--		1.1		--		0.674		0.483		--	
Total Recoverable Zinc	ug/L	237		--		212		--		108		208		--	
Dissolved Zinc	ug/L	63.2		--		111		--		27.8		35.5	J	--	
PAH Compounds															
Acenaphthene	ug/L	0.0098	U	0.49		0.01	U	0.0097	U	0.01	U	--		0.085	
Acenaphthylene	ug/L	0.0098	U	0.034	J	0.041	J	0.15	J	0.01	U	--		0.043	
Anthracene	ug/L	0.035	J	1	J	0.037	J	0.018	J	0.01	U	--		0.32	
Benzo(a)anthracene	ug/L	0.061	J	2.5	J	0.17	J	0.045	J	0.048		--		1.3	
Benzo(b)fluoranthene	ug/L	0.16	J	4.4	J	0.48	J	0.14	J	0.14	J	--		2.2	
Benzo(k)fluoranthene	ug/L	0.053		1.3	J	0.13	J	0.041	J	0.045	J	--		0.99	
Benzo(ghi)perylene	ug/L	0.093	J	1.1	J	0.14	J	0.044	J	0.05	J	--		0.55	
Benzo(a)pyrene	ug/L	0.099	J	2.4	J	0.19	J	0.062	J	0.072	J	--		1.6	
Chrysene	ug/L	0.18		3		0.35		0.073		0.14		--		2.3	
Dibenzo(a,h)anthracene	ug/L	0.019	J	0.21	J	0.034	J	0.019	J	0.01	UJ	--		0.14	
Fluoranthene	ug/L	0.28		6.4		0.49		0.18		0.17		--		4	
Fluorene	ug/L	0.043		0.72		0.026	NJ	0.0097	U	0.012		--		0.15	
Indeno(1,2,3-cd)pyrene	ug/L	0.069	J	1.6	J	0.15	J	0.046	J	0.035	J	--		1.2	
Naphthalene	ug/L	0.045		0.11		0.037		0.055		0.023		--		0.062	
Phenanthrene	ug/L	0.19		5.2		0.25	NJ	0.14		0.085		--		2.3	
Pyrene	ug/L	0.36		6.2		0.6		0.26		0.22		--		3.8	
Phthalates															
bis(2-Ethylhexyl)phthalate	ug/L	--		--		11	J	--		--		--		--	
Butyl benzyl phthalate	ug/L	--		--		0.2	U	--		--		--		--	
Di-n-butyl phthalate	ug/L	--		--		0.66	UJ	--		--		--		--	
Diethyl phthalate	ug/L	--		--		0.19	J	--		--		--		--	
Dimethyl phthalate	ug/L	--		--		0.2	U	--		--		--		--	
Di-n-octyl phthalate	ug/L	--		--		5.5	J	--		--		--		--	
Herbicides															
Dichlobenil	ug/L	0.028	J	--		0.61		0.17		0.19		--		0.074	NJ
Diuron	ug/L	0.05	UJ	--		0.052	U	0.049	U	0.053	UJ	--		0.049	U

2,4-D	ug/L	0.062	UJ	0.062	UJ	0.076	UJ	0.063	U	0.062	UJ	--		0.062	U
Clopyralid	ug/L	0.062	UJ	0.062	UJ	0.076	UJ	0.063	U	0.062	U	--		0.062	U
Picloram	ug/L	0.062	UJ	0.062	UJ	0.076	UJ	0.063	U	0.062	U	--		0.062	U
Triclopyr	ug/L	0.062	U	0.062	UJ	0.076	UJ	0.61	J	0.062	U	--		0.13	NJ
Glyphosate	ug/L	25	U	--		25	U	25	U	25	U	--		25	U
TPH															
TPH-Diesel (NWTPH-Dx)	mg/L	3.25		--		--		--		0.88		--		--	
Diesel	mg/L	0.15	U	--		--		--		0.05	UJ	--		--	
Lube Oil	mg/L	3.1		--		--		--		0.83	J	--		--	
TPH-Gas (NWTPH-Gx)	mg/L	0.14	U	--		--		--		0.07	U	--		--	
Surfactants															
Methylene blue active substances (MBAS)	mg/L	0.036		--		--		--		0.108		0.466		--	

Notes:

-- Parameter not analyzed

U – Analyte not detected above reported result

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TPH-Diesel (NWTPH-Dx) values are calculated as the sum of the Diesel and Lube Oil concentrations

Lakeview MF		Storm Event											
PARAMETER	**UNITS**	**4/3/12**		**4/16/12**		**4/17/12**		**4/25/12**		**4/29/12**		**6/22/12**	
Conventionals													
TSS	mg/L	28		39		14		29		19		28	
Chloride	mg/L	--		--		--		--		1.89		5.7	
Hardness as $CaCO_3$	mg/L	--		--		--		--		3.75		19.9	
Temperature	degrees C	--		--		--		--		--		--	
Nutrients													
Total Phosphorous	mg/L	0.0816		--		--		0.0877		0.0403		0.0904	
Orthophosphate	mg/L	0.01	U	0.01	U	0.01	U	0.0239		0.01	U	--	
Total Kjeldahl Nitrogen	mg/L	0.62	J	--		--		--		0.75	J	1.6	J
Nitrate-Nitrite	mg/L	0.159		--		--		--		0.205		0.665	
Metals													
Total Recoverable Copper	ug/L	10.6		22.8		15		15.7		9.77		--	
Dissolved Copper	ug/L	5.65		14.5		12.3		15.3		6.62		--	
Total Recoverable Lead	ug/L	3.57		6.61		1.5		2.34		1.92		--	
Dissolved Lead	ug/L	0.144		0.339		0.166		0.336		0.587		--	
Total Recoverable Cadmium	ug/L	0.19		0.25		0.19		0.24		0.16		--	
Dissolved Cadmium	ug/L	0.133		0.178		0.163		0.18		0.128		--	
Total Recoverable Zinc	ug/L	286		420		364		376		275		--	
Dissolved Zinc	ug/L	251		342		331		341		244		--	
PAH Compounds													
Acenaphthene	ug/L	0.01	U	0.0099	U	0.0099	U	0.0098	U	0.0098	U	0.01	U
Acenaphthylene	ug/L	0.01	U	0.045		0.031		0.025	J	0.0098	UJ	0.092	
Anthracene	ug/L	0.01	U	0.0099	U	0.0099	U	0.0098	U	0.0098	U	0.01	U
Benzo(a)anthracene	ug/L	0.01	U	0.0099	U	0.0099	U	0.0098	U	0.0098	U	0.01	U
Benzo(b)fluoranthene	ug/L	0.032		0.016		0.0071	J	0.0098	U	0.016		0.015	
Benzo(k)fluoranthene	ug/L	0.031		0.0099	U	0.0099	U	0.0098	U	0.0098	U	0.01	U
Benzo(ghi)perylene	ug/L	0.023		0.0093	J	0.0099	U	0.0098	U	0.0098	U	0.021	
Benzo(a)pyrene	ug/L	0.015		0.0083	J	0.0099	U	0.0098	U	0.0098	U	0.01	U
Chrysene	ug/L	0.01	U	0.01		0.0099	U	0.0098	U	0.0098	U	0.01	U
Dibenzo(a,h)anthracene	ug/L	0.01	U	0.0099	U	0.0099	U	0.0098	U	0.0098	U	0.01	U
Fluoranthene	ug/L	0.045		0.022		0.013		0.014		0.019		0.025	
Fluorene	ug/L	0.01	U	0.0099	U	0.0099	U	0.0098	U	0.0098	U	0.01	U
Indeno(1,2,3-cd)pyrene	ug/L	0.013		0.0099	U	0.0099	U	0.0098	U	0.0098	U	0.01	U
Naphthalene	ug/L	0.011		0.0088	J	0.012		0.011		0.0098	U	0.01	U
Phenanthrene	ug/L	0.029		0.022		0.013		0.015		0.014		0.018	
Pyrene	ug/L	0.049		0.024		0.012		0.015		0.015		0.026	
Herbicides													
Dichlobenil	ug/L	0.039		0.12		0.079		0.056	NJ	0.063		0.033	U
Diuron	ug/L	0.051	UJ	0.049	U	0.05	U	0.049	UJ	0.049	UJ	0.05	U
2,4-D	ug/L	0.092	J	0.15	J	0.083	J	0.43	J	0.12	J	0.062	U
Clopyralid	ug/L	0.065	U	0.062	U	0.077	U	0.062	U	0.061	U	0.062	U
Picloram	ug/L	0.065	U	0.062	U	0.077	U	0.062	U	0.061	U	0.062	U
Triclopyr	ug/L	0.41		0.64		0.38		3.6	J	0.52		1.4	
Glyphosate	ug/L	25	U	25	U	--		25	U	25	U	--	
TPH													
TPH-Diesel (NWTPH-Dx)	mg/L	0.64		--		--		--		--		--	

Diesel	mg/L	0.05	UJ	--		--		--		--		--	
Lube Oil	mg/L	0.59	J	--		--		--		--		--	
TPH-Gas (NWTPH-Gx)	mg/L	0.07	U	--		--		--		--		--	
Surfactants													
Methylene blue active substances (MBAS)	mg/L	--		--		--		--		0.071		--	

Notes:

-- Parameter not analyzed

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TPH-Diesel (NWTPH-Dx) values are calculated as the sum of the Diesel and Lube Oil concentrations

Vancouver		Storm Event									
PARAMETER	**UNITS**	**2/29/2012**		**4/3/2012**		**4/18/2012**		**4/25/2012**		**6/22/2012**	
Conventionals											
TSS	mg/L	4		4		4		3		12	
Chloride	mg/L	--		52.5		49.2		39.1		31.4	
Hardness as $CaCO_3$	mg/L	105		50.1		53.3		48		57.4	
pH	N/A	--		--		--		--		--	
Temperature	degrees C	--		--		--		--		--	
Nutrients											
Total Phosphorous	mg/L	0.0251		0.0265		0.0285		0.0336		0.149	
Orthophosphate	mg/L	0.01	U	0.01	U	0.01	U	0.01	U	--	
Total Kjeldahl Nitrogen	mg/L	1.5		1.1	J	1.4		1.4		1.2	
Nitrate-Nitrite	mg/L	0.36		0.258		0.295		0.388		0.414	
Metals											
Total Recoverable Copper	ug/L	2.92		2.38		2.89		2.72		--	
Dissolved Copper	ug/L	1.98		1.1		1.82		2.04		--	
Total Recoverable Lead	ug/L	4.51		3.61		6.95		--		--	
Dissolved Lead	ug/L	0.893		0.626		1.59		1.15		--	
Total Recoverable Cadmium	ug/L	0.34		0.14		0.24		0.23		--	
Dissolved Cadmium	ug/L	0.296		0.117		0.236		0.226		--	
Total Recoverable Zinc	ug/L	267		201		226		228		--	
Dissolved Zinc	ug/L	258		219		225		225		--	
PAH Compounds											
Acenaphthene	ug/L	0.01	U	0.0098	U	0.01	U	0.0099	U	0.0098	U
Acenaphthylene	ug/L	0.01	R	0.0098	U	0.01	U	0.0099	UJ	0.0098	U
Anthracene	ug/L	0.01	UJ	0.0098	U	0.01	U	0.0099	U	0.0098	U
Benzo(a)anthracene	ug/L	0.01	U	0.0098	U	0.01	U	0.0099	U	0.0098	U
Benzo(b)fluoranthene	ug/L	0.01	U	0.0098	U	0.01	U	0.0099	U	0.0098	U
Benzo(k)fluoranthene	ug/L	0.01	U	0.0098	U	0.01	U	0.0099	U	0.0098	U
Benzo(ghi)perylene	ug/L	0.01	U	0.0098	U	0.01	U	0.0099	U	0.0084	J
Benzo(a)pyrene	ug/L	0.01	UJ	0.0098	U	0.01	U	0.0099	U	0.0098	U
Chrysene	ug/L	0.01	U	0.0098	U	0.01	U	0.0099	U	0.0098	U
Dibenzo(a,h)anthracene	ug/L	0.01	U	0.0098	U	0.01	U	0.0099	U	0.0098	U
Fluoranthene	ug/L	0.01	U	0.0098	U	0.01	U	0.0099	U	0.0098	U
Fluorene	ug/L	0.01	U	0.0098	U	0.01	U	0.0099	U	0.0098	U
Indeno(1,2,3-cd)pyrene	ug/L	0.01	U	0.0098	U	0.01	U	0.0099	U	0.0098	U
Naphthalene	ug/L	0.01	U	0.0045	J	0.01	U	0.0099	U	0.0098	U
Phenanthrene	ug/L	0.01	U	0.0098	U	0.01	U	0.0099	U	0.0098	U
Pyrene	ug/L	0.0074	J	0.0082	J	0.01	U	0.0099	U	0.0098	U
Herbicides											
Dichlobenil	ug/L	0.062		0.032	U	0.034	U	0.033		0.032	U
Diuron	ug/L	0.82		0.033	J	0.051	U	0.049	UJ	0.049	U
2,4-D	ug/L	0.064	UJ	0.061	UJ	0.028	J	0.046	J	0.095	NJ
Clopyralid	ug/L	0.064	UJ	0.061	U	0.062	U	0.064	U	0.061	U
Picloram	ug/L	0.064	UJ	0.061	U	0.062	U	0.064	U	0.061	U
Triclopyr	ug/L	0.16	J	0.47		0.19		0.13		1.2	
Glyphosate	ug/L	25	U	25	U	25	U	25	U	14	J
TPH											

TPH-Diesel (NWTPH-Dx)	mg/L	0.2		0.4		--		0.18		--	
Diesel	mg/L	0.05	U	0.05	UJ	--		0.05	U	--	
Lube Oil	mg/L	0.15		0.35	J	--		0.13		--	
TPH-Gas (NWTPH-Gx)	mg/L	0.07	U	0.07	U	--		0.07	U	--	
Surfactants											
Methylene blue active substances (MBAS)	mg/L	0.052		--		--		0.049		--	

Notes:

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TPH-Diesel (NWTPH-Dx) values are calculated as the sum of the Diesel and Lube Oil concentrations

Euclid MF (Wenatchee)		Storm Event					
PARAMETER	**UNITS**	**3/27/2012**		**4/25/2012**		**6/7/2012**	
Conventionals							
TSS	mg/L	--		308	J	32	
Chloride	mg/L	--		--		7.48	
Hardness as $CaCO_3$	mg/L	--		--		8.54	
Temperature	degrees C	--		--		--	
Nutrients							
Total Phosphorous	mg/L	--		0.477		0.131	
Orthophosphate	mg/L	--		0.0721		0.0597	J
Total Kjeldahl Nitrogen	mg/L	--		2.8		0.99	
Nitrate-Nitrite	mg/L	--		0.612		0.268	
Metals							
Total Recoverable Copper	ug/L	--		8.68		11.6	
Dissolved Copper	ug/L	--		8.48		8.04	
Total Recoverable Lead	ug/L	--		0.29		3	
Dissolved Lead	ug/L	--		0.27		0.278	
Total Recoverable Cadmium	ug/L	--		0.1	U	0.1	U
Dissolved Cadmium	ug/L	--		0.04		0.036	
Total Recoverable Zinc	ug/L	--		88.9		79.6	
Dissolved Zinc	ug/L	--		84.2		58	
PAH Compounds							
Acenaphthene	ug/L	--		0.0097	U	0.01	U
Acenaphthylene	ug/L	--		0.027	J	0.01	UJ
Anthracene	ug/L	--		0.036		0.01	U
Benzo(a)anthracene	ug/L	--		0.05		0.01	U
Benzo(b)fluoranthene	ug/L	--		0.18	J	0.014	
Benzo(k)fluoranthene	ug/L	--		0.057	J	0.01	U
Benzo(ghi)perylene	ug/L	--		0.066	J	0.016	
Benzo(a)pyrene	ug/L	--		0.066	J	0.01	U
Chrysene	ug/L	--		0.1		0.01	U
Dibenzo(a,h)anthracene	ug/L	--		0.0097	UJ	0.01	U
Fluoranthene	ug/L	--		0.17		0.018	
Fluorene	ug/L	--		0.068		0.01	U
Indeno(1,2,3-cd)pyrene	ug/L	--		0.043	J	0.01	U
Naphthalene	ug/L	--		0.036		0.01	U
Phenanthrene	ug/L	--		0.22		0.029	
Pyrene	ug/L	--		0.2		0.022	
Herbicides							
Dichlobenil	ug/L	--		0.032	U	0.034	U
Diuron	ug/L	--		0.049	UJ	16	
2,4-D	ug/L	--		3.5		0.53	J
Clopyralid	ug/L	--		0.061	U	0.061	U
Picloram	ug/L	--		0.061	U	0.33	
Triclopyr	ug/L	--		0.061	U	0.061	U
Glyphosate	ug/L	--		25	U	25	U
TPH							
TPH-Diesel (NWTPH-Dx)	mg/L	0.88		24.49		--	
Diesel	mg/L	0.05	UJ	0.49	U	--	
Lube Oil	mg/L	0.83	J	24		--	

TPH-Gas (NWTPH-Gx)	mg/L	0.07	U	0.07	U	--	
Surfactants							
Methylene blue active substances (MBAS)	mg/L	--		--		--	

Notes:

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TPH-Diesel (NWTPH-Dx) values are calculated as the sum of the Diesel and Lube Oil concentrations

Geiger MF (Spokane)		Storm Event									
PARAMETER	**UNITS**	**3/14/2012**		**3/20/2012**		**3/26/2012**		**5/3/2012**		**6/24/2012**	
Conventionals											
TSS	mg/L	585		660		468		208		330	
Chloride	mg/L	--		--		1030		158		57.1	
Hardness as $CaCO_3$	mg/L	--		--		183		63.1		42.7	
Temperature	degrees C	--		--		--		--		--	
Nutrients											
Total Phosphorous	mg/L	1.29		--		1.09		0.564		0.7	
Orthophosphate	mg/L	0.131		0.114		0.155	J	--		--	
Total Kjeldahl Nitrogen	mg/L	2.8		--		2.2	J	1.5		2.3	
Nitrate-Nitrite	mg/L	1.61		--		2.38		0.262		0.554	
Metals											
Total Recoverable Copper	ug/L	79.2		79.3		49.8		31.3		--	
Dissolved Copper	ug/L	11.5		14.8		16.4		--		--	
Total Recoverable Lead	ug/L	45.7		58		27.9		17.4		--	
Dissolved Lead	ug/L	0.063		0.2	U	0.26		--		--	
Total Recoverable Cadmium	ug/L	0.6		0.55		0.39		0.31		--	
Dissolved Cadmium	ug/L	0.058		0.2	U	0.092		--		--	
Total Recoverable Zinc	ug/L	460		382		234		182		--	
Dissolved Zinc	ug/L	11.6		24.9		23.3		--		--	
PAH Compounds											
Acenaphthene	ug/L	0.01	U	0.011	U	0.01	U	0.0096	U	0.0099	U
Acenaphthylene	ug/L	0.01	U	0.011	U	0.049		0.047	J	0.0099	U
Anthracene	ug/L	0.01	U	0.011	U	0.01	U	0.0096	R	0.0099	U
Benzo(a)anthracene	ug/L	0.01	UJ	0.039	J	0.015		0.012	J	0.0099	U
Benzo(b)fluoranthene	ug/L	0.21	J	0.18	J	0.07	J	0.044	J	0.032	
Benzo(k)fluoranthene	ug/L	0.01	UJ	0.036	J	0.01	UJ	0.011	J	0.0099	U
Benzo(ghi)perylene	ug/L	0.2	J	0.086	J	0.037	J	0.025	J	0.034	
Benzo(a)pyrene	ug/L	0.063	J	0.051	J	0.023	J	0.016	J	0.0099	U
Chrysene	ug/L	0.33	J	0.25		0.12		0.039		0.034	
Dibenzo(a,h)anthracene	ug/L	0.01	UJ	0.011	UJ	0.01	UJ	0.0096	UJ	0.0099	U
Fluoranthene	ug/L	0.17		0.16		0.077		0.057		0.035	
Fluorene	ug/L	0.01	U	0.011	U	0.021		0.0096	U	0.0099	U
Indeno(1,2,3-cd)pyrene	ug/L	0.11	J	0.047	J	0.016	J	0.011	J	0.014	
Naphthalene	ug/L	0.016		0.021		0.02		0.0096	U	0.0099	U
Phenanthrene	ug/L	0.18		0.14		0.071		0.029		0.041	
Pyrene	ug/L	0.74		0.33		0.16		0.1		0.043	
Herbicides											
Dichlobenil	ug/L	0.013	J	0.16		0.084		0.75	J	0.033	U
Diuron	ug/L	0.14	J	1.3		0.51		44	J	21	J
2,4-D	ug/L	0.73		--		0.35	J	0.56		0.68	
Clopyralid	ug/L	0.062	U	--		0.064	UJ	0.062	U	0.061	U
Picloram	ug/L	1.3		--		1.1	J	0.91		9.2	
Triclopyr	ug/L	0.47		--		0.4	J	0.32		0.061	U
Glyphosate	ug/L	25	U	--		--		25	U	25	U
TPH											
TPH-Diesel (NWTPH-Dx)	mg/L	--		--		2.45		--		--	
Diesel	mg/L	--		--		0.05	UJ	--		--	

Lube Oil	mg/L	--		--		2.4	J	--		--	
TPH-Gas (NWTPH-Gx)	mg/L	--		--		0.07	U	--		--	
Surfactants											
Methylene blue active substances (MBAS)	mg/L	0.085		--		--		--		--	

Notes:

-- Parameter not analyzed

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TPH-Diesel (NWTPH-Dx) values are calculated as the sum of the Diesel and Lube Oil concentrations

Clarkston MF		Storm Event							
PARAMETER	**UNITS**	**3/15/12**		**3/20/12**		**4/4/12**		**4/26/12**	
Conventionals									
TSS	mg/L	--		75		21		92	
Chloride	mg/L	17.9		11.2		4.28		17.7	
Hardness as $CaCO_3$	mg/L	--		13.5		9.29		21.7	
Temperature	degrees C	--		--		--		--	
Nutrients									
Total Phosphorous	mg/L	--		0.239		0.107		0.35	
Orthophosphate	mg/L	--		0.0596	J	0.0363		--	
Total Kjeldahl Nitrogen	mg/L	--		1.2		0.99	J	2.5	
Nitrate-Nitrite	mg/L	--		0.326		0.328		0.427	
Metals									
Total Recoverable Copper	ug/L	--		12.2		5.73		17.9	
Dissolved Copper	ug/L	--		5.28		3.23		--	
Total Recoverable Lead	ug/L	--		8.86		3.48		12	
Dissolved Lead	ug/L	--		0.211		0.26		--	
Total Recoverable Cadmium	ug/L	--		0.11		0.1	U	0.22	
Dissolved Cadmium	ug/L	--		0.02		0.023		--	
Total Recoverable Zinc	ug/L	--		76.4		30.1		109	
Dissolved Zinc	ug/L	--		17		17.9		--	
PAH Compounds									
Acenaphthene	ug/L	--		0.01	U	0.0097	U	0.0098	U
Acenaphthylene	ug/L	--		0.039		0.0097	U	0.0098	UJ
Anthracene	ug/L	--		0.01	U	0.0097	U	0.0098	U
Benzo(a)anthracene	ug/L	--		0.01	UJ	0.0097	U	0.0098	U
Benzo(b)fluoranthene	ug/L	--		0.04	J	0.017	J	0.074	J
Benzo(k)fluoranthene	ug/L	--		0.01	UJ	0.0097	UJ	0.014	J
Benzo(ghi)perylene	ug/L	--		0.023	J	0.0097	UJ	0.04	J
Benzo(a)pyrene	ug/L	--		0.01	UJ	0.0097	UJ	0.013	J
Chrysene	ug/L	--		0.082		0.036		0.17	
Dibenzo(a,h)anthracene	ug/L	--		0.01	UJ	0.0097	UJ	0.0098	UJ
Fluoranthene	ug/L	--		0.032		0.019		0.049	
Fluorene	ug/L	--		0.01	U	0.0097	U	0.0098	U
Indeno(1,2,3-cd)pyrene	ug/L	--		0.01	UJ	0.0097	UJ	0.012	J
Naphthalene	ug/L	--		0.01	U	0.012		0.0098	U
Phenanthrene	ug/L	--		0.032		0.029		0.051	
Pyrene	ug/L	--		0.048		0.025		0.086	
Herbicides									
Dichlobenil	ug/L	--		0.066		0.032	U	0.032	U
Diuron	ug/L	--		0.052	U	0.049	UJ	0.049	UJ
2,4-D	ug/L	--		--		0.36	J	2.6	
Clopyralid	ug/L	--		--		0.061	U	0.062	U
Picloram	ug/L	--		--		0.061	U	0.062	U
Triclopyr	ug/L	--		--		0.061	U	0.062	U
Glyphosate	ug/L	--		--		25	U	6.5	J
TPH									
TPH-Diesel (NWTPH-Dx)	mg/L	--		1.25		--		0.87	
Diesel	mg/L	--		0.15	U	--		0.05	U

Lube Oil	mg/L	--		1.1		--		0.82	
TPH-Gas (NWTPH-Gx)	mg/L	--		0.05	U	--		0.07	U
Surfactants									
Methylene blue active substances (MBAS)	mg/L	--		0.166		--		0.489	

Notes:

-- Parameter not analyzed

U – Analyte not detected above reported result

J – Estimated value

UJ – Analyte not detected above reported result; reported reporting limit may inaccurate

TPH-Diesel (NWTPH-Dx) values are calculated as the sum of the Diesel and Lube Oil concentrations

Ferry Terminal

Bainbridge Island		**Storm Event**													
PARAMETER	**UNITS**	**9/17/11**		**1/24/12**		**2/17/12**		**2/28/12**		**3/9/12**		**3/20/12**		**5/17/12**	
Conventionals	**Units**														
TSS	mg/L	76		106		281		53		44		41		23	
Chloride	mg/L	--		7980		32.7		26.9		301		680		30.7	
Hardness as $CaCO_3$	mg/L	--		349		15.8		11.5		72		97.5		29.6	
Temperature	degrees C	--		3.98		--		--		--		--		--	
Bacteria															
Fecal coliform	cfu/100ml	--		47		--		--		--		--		--	
Metals															
Total Recoverable Copper	ug/L	--		27.7		19		19		--		16.8		--	
Dissolved Copper	ug/L	--		8.41		--		--		--		6.81		--	
Total Recoverable Lead	ug/L	--		39.7		9		9		--		8.84		--	
Dissolved Lead	ug/L	--		2.77		--		--		--		0.106		--	
Total Recoverable Cadmium	ug/L	--		3.19		0.1	U	0.1	U	--		0.5		--	
Dissolved Cadmium	ug/L	--		3.58		--		--		--		0.418		--	
Total Recoverable Zinc	ug/L	--		1160		129		129		--		555		--	
Dissolved Zinc	ug/L	--		982		--		--		--		427		--	
PAH Compounds															
Acenaphthene	ug/L	0.011	U	0.0097	U	0.011		0.013		0.01	U	0.01	U	0.0098	U
Acenaphthylene	ug/L	0.011	U	0.0097	U	0.014	J	0.015	J	0.044	J	0.025		0.0098	UJ
Anthracene	ug/L	0.031		0.019		0.043		0.0098	U	0.01	U	0.01	U	0.0098	UJ
Benzo(a)anthracene	ug/L	0.18		0.089	J	0.26		0.2		0.028	J	0.033	J	0.012	J
Benzo(b)fluoranthene	ug/L	0.89		0.53		1.6		0.32		0.21	J	0.21	J	0.11	J
Benzo(k)fluoranthene	ug/L	0.23		0.16		0.43		0.084		0.052	J	0.053		0.028	J
Benzo(ghi)perylene	ug/L	0.49		0.15		0.35		0.087		0.065	J	0.071		0.034	J
Benzo(a)pyrene	ug/L	0.27		0.12	J	0.41		0.076	J	0.051	J	0.052	J	0.02	J
Chrysene	ug/L	0.51		0.34		0.85		0.19		0.11		0.13		0.047	
Dibenzo(a,h)anthracene	ug/L	0.067		0.028	J	0.061		0.023		0.02	J	0.01	UJ	0.0098	UJ
Fluoranthene	ug/L	0.43		0.34		0.78		0.19		0.13		0.13		0.091	
Fluorene	ug/L	0.011	U	0.015		0.021		0.032		0.01	U	0.01	U	0.0098	U
Indeno(1,2,3-cd)pyrene	ug/L	0.57		0.17	J	0.42		0.1		0.066	J	0.081	J	0.025	J
Naphthalene	ug/L	0.011	U	0.02		0.026		0.025	J	0.015		0.013		0.0098	U
Phenanthrene	ug/L	0.12		0.16		0.3		0.14		0.065		0.054		0.043	
Pyrene	ug/L	0.3		0.37		0.84		0.2		0.18		0.13		0.089	
TPH															
TPH-Diesel (NWTPH-Dx)	mg/L	--		0.32		0.19		0.05	U	0.21		--		--	
Diesel	mg/L	--		0.05	U	0.05	U	0.05	U	0.05	UJ	--		--	
Lube Oil	mg/L	--		0.27	J	0.14		0.14		0.16	J	--		--	
TPH-Gas (NWTPH-Gx)	mg/L	--		0.14	U	0.07	U	0.07	U	0.07	U	--		--	
Surfactants															
Methylene blue active substances (MBAS)	mg/L	--		0.025	U	0.095		0.095		--		0.065	J	--	

Notes:

-- Parameter not analyzed

U – Analyte not detected above reported result

J – Estimated value

UJ – Analyte not detected above reported result; reported reporting limit may inaccurate

TPH-Diesel (NWTPH-Dx) values are calculated as the sum of the Diesel and Lube Oil concentrations

2,4,6-Tribromophenol listed in facilities QAPP Table 5 but not in permit; no analytical data for this parameter for WY 12

Appendix F:
Sampling Attempt Records

Water Year 2012 Storm Events			
Station	**Attempt Date**	**Outcome**	**Notes**
Bainbridge Island FT	9/17/2011	successful attempt	grabs missed due to lack of available staff
Bainbridge Island FT	12/8/2011	failed attempt	discarded sample: non-qualified event
Bainbridge Island FT	1/24/2012	successful attempt	qualified-grabs collected
Bainbridge Island FT	2/17/2012	successful attempt	qualified-grabs collected
Bainbridge Island FT	2/28/2012	successful attempt	qualified-grabs collected
Bainbridge Island FT	3/9/2012	successful attempt	qualified-grabs collected
Bainbridge Island FT	3/20/2012	successful attempt	actual precipitation did not qualify grabs missed due to lack of available staff
Bainbridge Island FT	5/17/2012	successful attempt	grabs missed due to lack of available staff
Bainbridge Island FT	6/1/2012	missed storm	antecedent not forecasted to qualify: did not attempt
Bainbridge Island FT	6/27/2012	missed event	not forecast to qualify: not attempted
Bainbridge Island FT	7/20/2012	missed event	not forecast to qualify: not attempted
Geiger MF	3/11/2012	missed event	not forecast to qualify: not attempted
Geiger MF	3/15/2012	successful attempt	grabs missed due to lack of available staff
Geiger MF	3/19/2012	successful attempt	grabs missed due to lack of available staff
Geiger MF	3/26/2012	successful attempt	qualified-grabs collected
Geiger MF	4/25/2012	failed attempt	discarded sample: non-qualified event
Geiger MF	4/30/2012	missed event	not forecast to qualify: not attempted
Geiger MF	5/3/2012	successful attempt	grabs missed due to lack of available staff
Geiger MF	6/3/2012	failed attempt	missed due to lack of available staff
Geiger MF	6/24/2012	successful attempt	grabs missed due to lack of available staff
Geiger MF	7/17/2012	missed event	not forecast to qualify: not attempted
Euclid MF	3/14/2012	failed attempt	equipment failure
Euclid MF	3/27/2012	successful attempt	grab samples only
Euclid MF	4/25/2012	successful attempt	qualified-grabs collected
Euclid MF	6/3/2012	failed attempt	missed due to lack of available staff
Euclid MF	6/7/2012	successful attempt	grabs missed due to lack of available staff

Euclid MF	6/22/2012	failed attempt	discarded sample: non-qualified event
Vancouver MF	2/28/2012	successful attempt	qualified-grabs collected
Vancouver MF	3/5/2012	failed attempt	discarded sample: non-qualified event
Vancouver MF	3/26/2012	failed attempt	discarded sample: non-qualified event
Vancouver MF	3/28/2012	failed attempt	discarded sample: non-qualified event
Vancouver MF	4/3/2012	successful attempt	qualified-grabs collected
Vancouver MF	4/16/2012	failed attempt	not forecast to qualify: not attempted
Vancouver MF	4/18/2012	successful attempt	grabs missed due to lack of available staff
Vancouver MF	4/19/2012	failed attempt	not forecast to qualify: not attempted
Vancouver MF	4/25/2012	successful attempt	non-qualified event
Vancouver MF	4/30/2012	missed event	staff unavailable to set sampler
Vancouver MF	5/21/2012	failed attempt	grabs missed due to lack of available staff
Vancouver MF	6/22/2012	successful attempt	grabs missed due to lack of available staff
Clarkston MF	3/9/2012	failed attempt	forecast to qualify: weather changed
Clarkston MF	3/15/2012	successful attempt	limited samples collected due to hold times
Clarkston MF	3/20/2012	successful attempt	qualified-grabs collected
Clarkston MF	3/26/2012	missed event	not forecast to qualify: not attempted
Clarkston MF	4/4/2012	successful attempt	grabs missed due to lack of available staff
Clarkston MF	4/26/2012	successful attempt	qualified-grabs collected
Clarkston MF	4/30/2012	missed event	not forecast to qualify: not attempted
Clarkston MF	5/3/2012	missed event	not forecast to qualify: not attempted
Clarkston MF	6/4/2012	missed event	not forecast to qualify: not attempted
Clarkston MF	6/7/2012	missed event	not forecast to qualify: not attempted
Clarkston MF	6/26/2012	missed event	not forecast to qualify: not attempted
Clarkston MF	7/19/2012	missed event	not forecast to qualify: not attempted
Lakeview MF	2/28/2012	failed attempt	equipment failure
Lakeview MF	3/4/2012	failed attempt	discarded sample: non-qualified event
Lakeview MF	3/19/2012	failed attempt	discarded sample: non-qualified event
Lakeview MF	3/20/2012	missed event	equipment failure
Lakeview MF	3/25/2012	missed event	discarded sample: non-qualified event
Lakeview MF	4/3/2012	successful attempt	actual precipitation did not qualify
Lakeview MF	4/11/2012	missed event	not forecast to qualify: not attempted
Lakeview MF	4/16/2012	successful attempt	grabs missed due to lack of available staff
Lakeview MF	4/17/2012	successful attempt	grabs missed due to lack of available staff

Lakeview MF	4/19/2012	missed event	not forecast to qualify: not attempted
Lakeview MF	4/25/2012	successful attempt	grabs missed due to lack of available staff
Lakeview MF	4/29/2012	successful attempt	grabs missed due to lack of available staff
Lakeview MF	5/21/2012	failed attempt	equipment failure
Lakeview MF	6/22/2012	successful attempt	grabs missed due to lack of available staff
Ballinger MF	1/24/2012	successful attempt	qualified-grabs collected
Ballinger MF	2/24/2012	successful attempt	grabs missed due to lack of available staff
Ballinger MF	2/28/2012	successful attempt	grabs missed due to lack of available staff
Ballinger MF	3/9/2012	successful attempt	grabs missed due to lack of available staff
Ballinger MF	3/19/2012	failed attempt	discarded sample: non-qualified event
Ballinger MF	3/26/2012	failed attempt	discarded sample: non-qualified event
Ballinger MF	4/3/2012	successful attempt	actual precipitation did not qualify
Ballinger MF	4/11/2012	failed attempt	discarded sample: non-qualified event
Ballinger MF	4/19/2012	missed event	not forecast to qualify: not attempted
Ballinger MF	4/24/2012	missed event	not forecast to qualify: not attempted
Ballinger MF	4/29/2012	successful attempt	grabs missed due to lack of available staff
Ballinger MF	5/21/2012	failed attempt	equipment failure
Ballinger MF	6/22/2012	successful attempt	grabs missed due to lack of available staff
Ballinger MF	9/9/2012	failed attempt	discarded sample: non-qualified event
Smokey Point NB RA	12/2/2011	failed attempt	not sampled: non-qualified event
Smokey Point NB RA	1/24/2012	failed attempt	no precipitation
Smokey Point NB RA	2/24/2012	failed attempt	equipment failure
Smokey Point NB RA	2/28/2012	failed attempt	discarded sample: non-qualified event
Smokey Point NB RA	3/9/2012	successful attempt	grabs missed due to lack of available staff
Smokey Point NB RA	3/26/2012	missed event	storm started before station was set to sample
Smokey Point NB RA	4/3/2012	successful attempt	grabs missed due to forecasting errors
Smokey Point NB RA	4/11/2012	failed attempt	discarded sample: non-qualified event
Smokey Point NB RA	4/16/2012	failed attempt	discarded sample: non-qualified event

Smokey Point NB RA	4/19/2012	failed attempt	equipment failure
Smokey Point NB RA	4/24/2012	missed event	not forecast to qualify
Smokey Point NB RA	4/29/2012	successful attempt	grabs missed due to lack of available staff
Smokey Point NB RA	5/20/2012	successful attempt	grabs missed due to lack of available staff
Smokey Point NB RA	9/9/2012	failed attempt	discarded sample: non-qualified event
Smokey Point SB RA	2/28/2012	failed attempt	discarded sample: non-qualified event
Smokey Point SB RA	3/9/2012	successful attempt	grabs missed due to lack of available staff
Smokey Point SB RA	3/26/2012	missed event	storm started before station was set to sample
Smokey Point SB RA	4/3/2012	successful attempt	grabs missed due to forecasting errors
Smokey Point SB RA	4/11/2012	failed attempt	discarded sample: non-qualified event
Smokey Point SB RA	4/16/2012	failed attempt	discarded sample: non-qualified event
Smokey Point SB RA	4/19/2012	failed attempt	equipment failure
Smokey Point SB RA	4/24/2012	missed event	not forecast to qualify: not attempted
Smokey Point SB RA	4/29/2012	successful attempt	grabs missed due to lack of available staff
Smokey Point SB RA	5/21/2012	successful attempt	grabs missed due to lack of available staff
Smokey Point SB RA	9/9/2012	failed attempt	discarded sample: non-qualified event