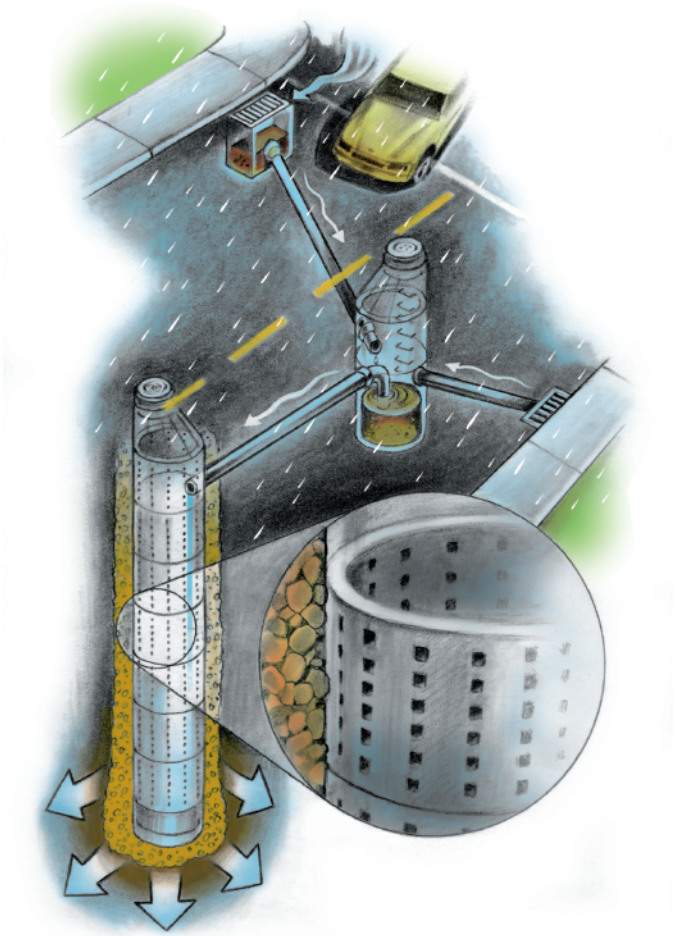
Annual Stormwater Discharge Monitoring Report

Year 2

October 2006 - May 2007



July 2007

Water Pollution Control Facilities (WPCF) Permit

Class V Stormwater Underground Injection Control Systems

DEQ Permit Number 102830

Prepared by

ENVIRONMENTAL SERVICES
CITY OF PORTLAND
working for clean rivers

City of Portland, Oregon

Water Pollution Control Facilities (WPCF) Permit For
Class V Stormwater Underground Injection Control Systems

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Underground Injection Control Systems
System Monitoring

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City of Portland, Bureau of Environmental Services

actions for these UICs will be identified, evaluated, and selected in accordance with the *Corrective Action Plan* (July 2006).

Permit compliance is demonstrated in this report by documenting that Year 2 sampling, analyses, data evaluation, and response actions are performed in accordance with the permit, SDMP, and UICMP.

TABLE OF CONTENTS

List of Appendices

List of Tables

List of Tables (Continued)

List of Figures

List of Figures (Continued)

List of Acronyms

BES	City of Portland Bureau of Environmental Services
BMP	Best management practice
City	City of Portland
C	Celsius
COC	Chain-of-Custody
DEHP	di(2-ethylhexyl)phthalate or bis(2-ethylhexyl)phthalate
DEM	digital elevation model
DEQ	Oregon Department of Environmental Quality
DFR	Daily Field Report
DQO	data quality objective
EC	electrical conductivity
EOP	end-of-pipe
EPA	U.S. Environmental Protection Agency
F	Fahrenheit
FDS	Field Data Sheet
FO	field operations
GIS	geographic information systems
GRTS	Generalized Random Tessellation Stratified
Gx	gasoline range
HYDRA	Hydrological Data Retrieval and Alarm System
IMS	Investigation and Monitoring Services
LCS	laboratory control sample
LIMS	BES Laboratory Information Management System
MADL	Maximum Allowable Discharge Limit
MDL	method detection limit
mg/kg	milligrams per kilogram
MRL	method reporting limit
MS	matrix spike
µmhos/cm	micromhos per centimeter
µg/L	micrograms per liter
NCA	North Creek Analytical
PAH	polycyclic aromatic hydrocarbon
PDOT	City of Portland Department of Transportation
PPS	Priority Pollutant Screen
QA	Quality Assurance
QAPP	Quality Assurance Project Plan

List of Acronyms (Continued)

QC	Quality Control
ROW	right(s)-of-way
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SDM	Stormwater Discharge Monitoring
SDMP	Stormwater Discharge Monitoring Plan
SOP	Standard Operating Procedures
SVOC	semi-volatile organic compound
TA	Test America
TPD	trips per day
TPH	total petroleum hydrocarbons
TSS	total suspended solids
UIC	Underground Injection Control
UICMP	UIC Management Plan
VOC	volatile organic compound
WPCF	Water Pollution Control Facility
WPCL	Water Pollution Control Laboratory

Section 1

1 Introduction and Organization

1.1 Introduction and Purpose

This annual Stormwater Discharge Monitoring (SDM) report presents the results of the second year of sampling performed under the *Stormwater Discharge Monitoring Plan* (SDMP) (City of Portland, 2006a). This report is a requirement of the Water Pollution Control Facilities (WPCF) permit issued to the City of Portland (City) in June 2005 by the Oregon Department of Environmental Quality (DEQ; Permit Number 102830). The permit requires the City to monitor stormwater entering City-owned or operated (*i.e.*, public) Underground Injection Control (UIC) structures throughout the life of the permit (ten years or permit term) and to submit this annual report. For the purposes of this report, all references to "WPCF" or "permit" refer to this permit.

The City currently has an estimated 9,000 Class V UICs, which collect stormwater from public rights-of-way (ROW) and discharge it to the subsurface. UICs are an essential element of the City's comprehensive watershed strategy to use stormwater as a resource by infiltrating it back into the ground.

Underground Injection Control

UIC, as used in this document, means any Class V underground control system owned or operated by the City of Portland.

In the Portland area, groundwater serves as a backup drinking water supply to the Bull Run reservoirs. The WPCF permit establishes the UIC construction, operation, and maintenance requirements that the City must implement to protect groundwater for use as a drinking water resource. The permit is designed to protect groundwater by implementing a comprehensive stormwater management strategy to prevent, minimize, and control pollutants at the surface before stormwater is discharged to the ground.

The SDMP is a mandatory element of the permit and consists of the *Sampling and Analysis Plan* (SAP) (City of Portland, 2006b) and the *Quality Assurance Project Plan* (QAPP) (City of Portland, 2006c). Adherence to the SAP and QAPP ensures that the stormwater data collected is of known and acceptable quality and can be used to demonstrate permit compliance. The purpose of the SAP is to present the methodology for selecting representative sampling locations and procedures for collecting and analyzing stormwater samples. The purpose of the QAPP is to establish the laboratory and field data quality standards and measures and to ensure that project-specific data quality objectives (DQOs) are met. The QAPP also presents the method for calculating the annual mean stormwater concentration for comparison to the Maximum Allowable Discharge Limits (MADL). The SDMP was submitted to DEQ in February 2006 and much of the background information in this report is summarized from that document.

1.2 Permit Requirements

The WPCF permit contains specific monitoring and reporting requirements. These requirements and how they are met are presented in Table 1-1. The permit requires the City to submit an annual SDM report to DEQ by July 15 of each permit year. The annual SDM report is intended to:

- Present the results of the previous year's wet season (October through May) stormwater monitoring results;
- Describe the storms sampled during each sampling event and any conditions that may affect the sampling results;
- Describe the UIC monitoring network;
- Identify and discuss any individual or annual mean MADL exceedances for common pollutants;
- Identify and discuss detected priority pollutant screen (PPS) analyte detections (required in Years 1, 4, and 9 only);
- Identify any ancillary pollutants detected; and
- Present the results of groundwater monitoring (if any).

In addition, the permit requires the City to submit an annual *UIC Management Plan* (UICMP) report. The first annual (July 1, 2005 through June 30, 2006) UICMP report was submitted to DEQ on December 1, 2006. In subsequent years, this annual report will be submitted by November 1. The annual UICMP report(s) will supplement this report and will include the following types of information related to the stormwater discharge monitoring results presented in this report:

- Identify traffic or land use changes that would modify sampling protocols or the sampling network;
- Evaluate trends in the cumulative monitoring data;
- Identify factors that strongly influence the quality of stormwater draining to public UICs to assist in enhancing protection of groundwater;
- Present a preliminary discussion of response actions; and
- Present action(s) taken in response to monitoring data.

1.3 Report Organization

This annual SDM report presents the City's UIC monitoring data for the period between October 1, 2006 and May 31, 2007 (*i.e.,* the permit defined wet season). This report includes sampling data collected during five sampling events, a summary of descriptive information for the UICs sampled (*e.g.,* location, surrounding land use), a description of individual storms comprising each sampling event, identification of MADL concentration exceedances, identification and discussion of common and ancillary pollutants detected, and a discussion of Year 2 response actions. This report is organized as follows:

- Section 1 Introduction and Organization;
- Section 2 Goals and Objectives;
- Section 3 UIC System Monitoring Network;
- Section 4 UIC Stormwater Discharge Monitoring Program;
- Section 5 Stormwater Discharge Monitoring Plan Implementation;
- Section 6 Data Management and Validation;
- Section 7 Data Evaluation;
- Section 8 Response Actions;
- Section 9 Preliminary Trend Analysis;
- Section 10 Findings and Conclusions; and
- Section 11 References.

Section 2

2 Goals and Objectives

2.1 Goals

The primary goal of the UIC monitoring program is to demonstrate that the quality of stormwater discharged into City-owned UICs meets permit conditions and is protective of groundwater quality (*i.e.*, highest beneficial use). Permit compliance is demonstrated in this report by documenting that Year 2 sampling, analyses, and data evaluation were performed in accordance with the WPCF permit and SDMP, and results are representative of the City's UIC system.

In addition, the results of the City's UIC monitoring program will be used to ensure UICs are constructed and operated in a manner that provides multiple watershed benefits and protects groundwater now and over time, as described in the SAP.

For many areas located east of the Willamette River, UICs are the only form of stormwater disposal available. UICs are also an essential element of a comprehensive watershed strategy to use stormwater as a resource by infiltrating it back into the ground. Demonstrating permit compliance is important to the City to ensure that UICs continue to have an integral role in achieving the City's Bureau of Environmental Services' (BES) mission.

2.2 Objectives

The overall objectives of the UIC monitoring program are to demonstrate compliance with permit requirements and to protect groundwater for its highest beneficial use. Compliance is demonstrated using data of known and acceptable quality that are representative of stormwater quality entering the City-owned UICs. The UIC monitoring program was designed to satisfy the following specific objectives, which are described in more detail in the SDMP:

- Monitor the quality of stormwater discharged into public UICs and demonstrate that groundwater is protected by meeting MADLs established in the WPCF permit (DEQ, 2005a, Table 1);
- Provide a high degree of confidence that the sampling design used for this program is representative of all UICs covered by the permit;
- Provide data that will be used to conduct trend analysis of the stormwater quality discharged into public UICs;
- Identify factors that strongly influence the quality of stormwater draining to public UICs to assist in enhancing protection of groundwater;
- Evaluate the effectiveness of actions implemented to improve stormwater quality and meet MADLs; and

- Provide data that can be compared with data collected from previous investigations conducted by the City and/or split/duplicate samples collected by others.

In addition, the monitoring data inform decision-making processes to identify the actions that will protect groundwater quality, improve UIC management practices, and improve overall watershed health.

Section 3

3 UIC System Monitoring Network

This section summarizes key elements of the UIC system monitoring network. The basis and details of the UIC monitoring program are presented in detail in the SDMP.

3.1 Sample Design

The City owns and/or operates approximately 9,000 active UICs. It is not technically practicable or financially feasible to collect and analyze stormwater from each of these UICs during every storm event. Therefore, a statistically robust method was used to identify a representative subset of the City's UICs for monitoring. This method, which is described in detail in the SAP, provides a high degree of confidence that the subset chosen is appropriately representative of the entire system. This allows the characteristics of the entire UIC population to be estimated using the measured results of a representative sampling subset. Figure 3-1 presents the general locations of City-owned and operated UICs.

3.1.1 Sample Size

Forty-seven UIC locations were sampled in Year 2 including:

- Thirty UICs selected to implement the required Year 2 monitoring (*i.e.*, monitoring network) described in the SDMP:
  - Panel 2 (15 rotating UIC locations sampled in Years 2 and 7);
  - Panel 6 (15 fixed UIC locations sampled in Years 1 through 10);
- One UIC location, P1_1, carried over from Year 1 monitoring due to an exceedance of the MADL for pentachlorophenol (See Section 3.1.3);
- Ten supplemental UICs located near drinking water wells (see Section 3.2.4);
- Five UICs located in areas without wood treated utility poles (see Section 3.2.5); and
- One UIC location sampled in response to a pre-sampling inspection (See Section 3.2.5).

The sample size, "n", for the UIC monitoring network is described in detail in the SDMP and was selected to be representative of the City's UIC system. The sample size is based on a specified confidence level, interval width, and the estimated proportion of UICs exceeding the MADL (definitions of these measurements are provided in the *Annual Stormwater Discharge Monitoring Report - Year 1* [City of Portland, 2006e]). To limit the amount of uncertainty around the estimated proportion of exceedances, the confidence interval was set at a 90% confidence level and a half-width of 12%, as described in the SAP.

The proportion of UICs exceeding a MADL was estimated from stormwater discharge data collected during a pre-permit pilot study (described in the SAP). This study indicated that the proportion of all City-owned UICs estimated to exceed the pentachlorophenol MADL was 8.1 %. Using this proportion, a 90% confidence interval, and a 12% precision half-width, 30 UIC locations were selected to be representative of the City's UIC population. The upper confidence limit on the number of UICs that may exceed the pentachlorophenol MADL was estimated to be 20.1%.

Year 1 and 2 results were consistent with the results of the pre-permit pilot study. As in the pre-permit pilot study, pentachlorophenol was the most frequently detected pollutant above its MADL of 1 microgram per liter (µg/L). The proportion of UICs exceeding the pentachlorophenol MADL ranged between 7 % (two UICs) and 24 % (seven UICs) during individual Year 2 sampling events (see Section 7.1). These results are consistent with the proportions estimated during the pre-permit pilot study and with the assumptions used to estimate the sample size.

3.1.2 Stratification

The permit requires that the sampled UIC population be divided into two traffic volume-based sub-populations, which are assumed to be associated with different stormwater qualities. These two traffic volume categories are identified in Table 2 of the WPCF permit and are presented in Table 3-1. The lower traffic volume category (<1,000 trips per day [TPD]) is presumed to be associated with lower pollutant concentrations. The higher traffic volume category (≥1,000 TPD) is presumed to be associated with higher pollutant concentrations. Once the sample size was determined, the sampling design was stratified in accordance with the two identified traffic volume categories.

As explained in the SAP, preliminary work by the City determined that approximately 57% of active City-owned UICs are in the <1,000 TPD category and 43% are in the ≥1,000 TPD category. To ensure that there were enough data points in each traffic category for statistical analysis, initially 50% of the sample locations were selected from the <1,000 TPD category, and 50% of the sample locations were selected from the ≥1,000 TPD category. Since the majority of active UICs are actually in the <1,000 TPD category, which are predominantly in residential areas, the sample design is considered conservative. The Year 2 sampling program selected 14 locations in the <1,000 TPD category and 16 locations in the ≥1,000 TPD category, for a total of 30 locations.

UIC locations for Year 3 monitoring (*i.e.*, Panel 3) will be submitted to DEQ by September 1, 2007.

3.1.3 Carry Over Locations from Year 1 MADL Exceedances

The permit requires the annual mean concentration to meet permit specified MADLs at the end-of-pipe (EOP) discharge point. Mean stormwater concentrations were calculated in Year 1 for those analytes and locations where the individual analyte was detected in at least one sampling event at a concentration ≥50% of the analytes respective MADL. The following five pollutants were detected in Year 1 at concentrations ≥50% of the MADL:

- Common pollutants: pentachlorophenol, di(2-ethylhexyl)phthalate (DEHP), benzo(a)pyrene, and lead.
- Priority Pollutant Screen (PPS) analyte: antimony.

The Year 1 annual geometric mean concentrations for five UIC locations (P1_1, P6_1, P6_7, P6_8 and P6_14) exceeded the MADL for pentachlorophenol. The annual geometric means for these locations ranges from 1.1 to 2.0 µg/L, slightly exceeding the pentachlorophenol MADL of 1.0 µg/L. The annual geometric mean values for DEHP, benzo(a)pyrene, lead, and antimony were, in general, <50% of their respective MADLs for individual UIC locations.

The permit states that City-owned UICs become non-compliant by failing to meet the annual mean MADL within one wet season after the exceedance or failing to satisfy the groundwater protection conditions of Permit Schedule A. Therefore, the five UIC locations (P1_1, P6_1, P6_7, P6_8 and P6_14) whose annual mean stormwater concentration exceeded the MADL for pentachlorophenol in Year 1 were monitored in Year 2 to determine if the annual mean concentration was exceeded for two consecutive wet seasons (Year 1 and Year 2). Four of the five UICs with annual mean exceedances are part of the fixed panel monitored annually. P1_1 was added to the Year 2 sampling schedule due to the annual mean MADL exceedance for pentachlorophenol.

3.2 UIC Sampling Locations and Characteristics

The UIC sampling design is described in detail in the SAP. To perform long-term trend analysis and evaluate permit compliance over the ten-year permit term, a sufficient number of UICs needed to be sampled to assess the spatial and temporal range of data. Therefore, the UIC sampling network consists of six sampling panels that are divided into two primary types: stationary and rotating. Each sampling panel consists of 15 UIC locations. Panel 6 locations are stationary (*i.e.,* fixed) and the same locations will be sampled annually for ten years. The other five panels of locations are rotated, so that each panel will be sampled twice during the ten-year permit term; once in years one through five, and once in years six through ten. After five years, 75 rotating locations (5 different panels *x* 15 locations per panel) will have been sampled once and after ten years they will have been sampled twice. Using this process, a total of 90 unique locations will be monitored over the permit term (15 stationary + 75 rotating locations).

Sampling locations were randomly selected and then stratified based on traffic category (<1,000 TPD, and ≥1,000 TPD). This approach also randomizes information for

multiple factors that may affect stormwater quality (including older and newer industrial/ commercial office buildings versus commercial salvage yards, etc.). Locations were identified using the Generalized Random Tessellation Stratified (GRTS) survey design (Stevens and Olsen, 2004). In accordance with the SAP, each selected UIC sampling location was inspected in August and September 2006 prior to sampling to confirm UIC information (*e.g.*, location, type of construction) and to determine suitability for sampling (*e.g.,* accessibility, potential health and safety concerns). Panel 1, Panel 2, and Panel 6 monitoring locations, sampled in Year 2, are listed in Tables 3-2 through 3-4, and are shown spatially in Figure 3-2.

Three UIC sampling locations were replaced in the stationary panel (Panel 6) after the Year 1 monitoring period. Sample concentrations from these three UIC locations were below MADLs for all pollutants analyzed. In February 2006, the City acquired more accurate geographic information systems (GIS) transportation system metadata, which resulted in changes to the traffic categories of three Panel 6 UICs from ≥1,000 TPD to <1,000 TPD. These three UICs were P6_2, P6_3, and P6_8. This change resulted in Panel 6 consisting of eight UICS with < 1,000 TPD and seven with ≥1,000 TPD and is documented in the *Stormwater Discharge Monitoring Report - Year 1.* In order to achieve the target stratification goal described in the SAP for Year 2, three UIC monitoring locations were changed from <1,000 TPD to ≥1,000 TPD. These three new UIC locations were randomly selected from the oversample panel presented in Appendix C of the SAP, and are as follows: P6_2, P6_10, and P6_12. This change is documented in a technical memorandum submitted to DEQ on July 11, 2006.

BES's Hansen database was continuously updated during the 2005-2006 (Year 1) monitoring period. In some cases, this may have affected the address fields included in the *Stormwater Discharge Monitoring Report*(s) tables. Hansen Database addresses should not be considered precise location information; rather, latitude and longitude should be used for this purpose. No sampling locations were changed as a result of this database update; however, these locations were footnoted in appropriate tables throughout the Year 1 report. Addresses noted in this report are consistent with Year 1 reporting.

The WPCF permit defines the compliance point for monitoring as the EOP discharge point. For UICs with no pretreatment device and more than one discharge pipe (*e.g.,* drainage from two catch basins), samples were collected from the discharge pipe with the largest estimated drainage catchment in the appropriate traffic category.

3.2.1 Stationary Panel (Panel 6)

Fifteen UICs in the stationary panel (Panel 6) were sampled during five storm events throughout the 2006-2007 wet season and will continue to be sampled throughout the term of the permit (*i.e.,* 10 years). The specific UICs included in Panel 6 were randomly selected using the GRTS process described in detail in the SAP. The SAP defined Panel 6 as including eight UICs with traffic counts <1,000 trips per day and seven UICs with

traffic counts ≥1,000 trips per day. As discussed in Section 3.2, a change in the TPD estimation methodology in Year 1 resulted in the recategorization of traffic volume for three UIC locations in Panel 6: P6_2, P6_3, and P6_8. All three UIC locations were recategorized from ≥1,000 TPD to <1,000 TPD in Year 1. Also discussed in Section 3.2, three new UIC locations in the ≥1,000 TPD traffic category were randomly selected to replace three UIC locations in the <1,000 TPD traffic category, in order to achieve the target stratification goal described in the SAP for Year 2. These three UICs were P6_2, P6_10, and P6_12.

Appendix A provides detailed maps showing individual Panel 6 UIC locations. Table 3-4 presents location information, characteristics, and maintenance information for each UIC in Panel 6.

3.2.2 Rotating Panel (Panel 2)

Fifteen UICs in the rotating panel (Panel 2) were sampled during five storm events throughout the 2006-2007 wet season. This panel will be resampled in Year 7 (2011 – 2012) of the permit. The specific UICs included in Panel 2 were randomly selected using the GRTS process described in detail in the SAP. The SAP defines Panel 2 as including six UICs with traffic counts <1,000 trips per day and nine UICs with traffic counts ≥1,000 trips per day.

As described previously in this document, the City acquired more accurate geographic information systems (GIS) transportation system metadata in 2006, which resulted in changing the traffic categories of two Year 1 Panel 1 (rotating) UICs from ≥1,000 TPD to <1,000 TPD. This change is documented in the *Stormwater Discharge Monitoring Report - Year 1.* In order to achieve the target stratification goal described in the SAP, it was proposed that Year 2 Panel 2 (rotating) UIC monitoring locations would be weighted toward high traffic locations, to achieve the 50%-50% stratification goal after two years of monitoring (Years 1 and 2; Years 6 and 7). Therefore, two Panel 2 UIC monitoring locations were changed from <1,000 TPD to ≥1,000 TPD. As described in the July 11, 2006 technical memo to DEQ, these two new UIC locations were randomly selected from the list of all known City-owned UICs presented in the *Systemwide Assessment*.

In addition to the 15 UIC locations discussed above, one additional rotating panel location was sampled during Year 2. As discussed in Section 3.1.3, the annual geometric mean concentration at UIC location P1_1 exceeded the MADL for pentachlorophenol during Year 1. Therefore, this location was included in the Year 2 monitoring program as required by the permit.

Appendix A provides detailed maps showing individual Panel 1 and Panel 2 UIC locations. Table 3-3 presents location information, characteristics, and maintenance information for each UIC in Panel 2. Table 3-2 presents the same information for the single UIC in Panel 1.

3.2.3 Oversample Panel

An oversample panel of 85 alternate locations was generated as described in the SAP in order to develop Panels 2 and 6. This panel was used to replace four of the original randomly selected Panel 2 UIC monitoring locations that were determined to be unsuitable for sampling during pre-sampling field investigations. Unsuitable UICs are replaced by selecting the first location on the oversample panel with a similar traffic categorization.

3.2.4 Supplemental Monitoring Near Drinking Water Wells

The UIC monitoring network presented in the SAP is based on statistical methods designed specifically to characterize large systems with a high degree of confidence. The size and nature of the monitoring network was designed to be representative of the entire UIC system which is primarily composed of UICs that drain public rights-of-way (ROWs). The monitoring network is designed to be representative of UICs identified during systemwide assessment activities, and UICs determined to be within a 500-foot setback or a two-year time of travel[1] for domestic, irrigation, or public drinking water wells[2]. All identified UICs have an equal chance of being selected during panel development.

During the 2006-2007 monitoring season (Year 2), the City voluntarily sampled at ten additional UIC locations to meet the following specific objectives:

- Assess the quality of stormwater discharged to UICs located near domestic or public drinking water wells; and
- Demonstrate that the results of the stormwater discharge monitoring program (described in the SDMP) are representative of stormwater discharging to UICs located within 500 feet of a domestic well, 500 feet of a public water well, and the two-year time of travel of a public water well.

Supplemental monitoring locations were taken from the list of the City-owned UICs in the *Systemwide Assessment* that are estimated to be located within 500 feet of a domestic well, 500 feet of a public water well that does not have a time of travel, or the two-year time of travel of a public water well. Locations were randomly selected from this list using the GRTS method described in the SDMP, and stratified by traffic category. The final list of supplemental monitoring locations consisted of five UICs with estimated traffic counts of <1,000 TPD and five locations with estimated traffic counts of >1,000 TPD. Locations were inspected in September 2006 to determine their suitability for sampling and their ability to represent the associated traffic categories. One location was

[1] Time of travel means the amount of time it takes groundwater to flow within an aquifer to a given public well. Time of travel is not designated for domestic wells.

[2] Domestic wells means a water supply well used to serve no more than three residences with water for drinking, culinary, or household use. Domestic wells include irrigation wells because irrigation wells can be used as drinking water wells unless there is an enforceable regulatory mechanism that prevents this. Public water wells means a water supply well serving a public water system for human consumption. For the purposes of this document, both domestic and public wells are referred to as "drinking water wells".

changed because stormwater discharging to the original location was not representative of the designated traffic category (*i.e.*, stormwater flow into the proposed UIC was predominantly from a street that receives <1,000 TPD rather than > 1,000 TPD). This change is reflected in Table 3-5. Supplemental monitoring locations were sampled during all five Year 2 storm events. Sampling and analyses were performed in accordance with the SDMP.

Information on the supplemental sampling locations is presented in Table 3-5, and locations are shown on Figure 3-3.

3.2.5 Additional Stormwater Monitoring Locations

One UIC location (SPO_EV3) was sampled in Year 2, during Event 1. This location was originally selected as a supplemental UIC location; however, it was not included in the sampling since the UIC did not receive drainage from a high traffic category street. During the inspection of this UIC prior to sampling activities, a paint release was identified in a UIC inlet. This UIC was sampled during Event 1 to demonstrate the effectiveness of the UIC cleaning. This investigation is further described in Section 8.1.1.

Five additional UIC locations (PBP1_1 through PBP1_5) were sampled once in Year 2 (during Storm Event 3). These UICs were selected to assess the presence of pentachlorophenol in UIC catchments without wood treated utility poles and are referred to in this document as "pentachlorophenol baseline" locations. This investigation is further described in Section 8.2.1. Information on the pentachlorophenol baseline sampling locations is presented in Table 3-6 and locations are shown on Figure 3-4. Maps showing the specific locations of these UICs are included in Appendix A. The pentachlorophenol baseline sampling results are discussed in Section 8.2.1.

Section

4

4 UIC Stormwater Discharge Monitoring Plan Implementation

This section describes how key elements of the SDMP were implemented in Year 2. Five stormwater samples were collected from each designated UIC sampling location required by the permit (P1_1 and Panels 2 and 6) during five storm events occurring between October 1, 2006 and May 31, 2007. Stormwater samples were also collected from the supplemental UICs located near drinking water wells for all five storm events. Sampling results are presented in Section 5.

Sampling *Event Summary Reports*, prepared by the City of Portland Water Pollution Control Lab (WPCL), are presented in Appendix B. The reports summarize weather conditions, describe field and laboratory quality assurance/quality control (QA/QC) procedures and samples collected, describe QA/QC issues, if any, and their resolution, and provide copies of field documentation. Field and laboratory data validation are discussed in greater detail in Section 6.

4.1 Sampling Staff

BES personnel performed Year 2 UIC sampling. At a minimum, the sampling staff included the Storm Event Coordinator and Event Sampling Teams. The Storm Event Coordinator was responsible for tracking weather patterns, directing sampling activities, and selecting the storm events to initiate sampling.

Multiple Event Sampling Teams were used during single stormwater sampling events in order to decrease the length of field time and the number of individual storms needed to collect samples from all 30 UIC locations designated by the SDMP, UIC location P1_1, and 10 supplemental locations near drinking water wells. Event Sampling Teams were composed primarily of the City's Field Operations' (FO) staff and were supplemented by other WPCL or BES personnel as needed. Sampling Teams were primarily two person teams, and at least one person was an experienced FO staff member. Individual samplers were used, on occasion, if no traffic control was required.

4.2 Storm Event Targeting

The Storm Event Coordinator worked directly with the City's contract weather forecasting service, Extended Range Forecasting Company, Inc., to obtain the weather forecasts, and to decide whether to proceed with a stormwater sampling event. To the extent practicable, staff adhered to target storm criteria to help ensure that stormwater runoff would be adequate for sample collection, representative of stormwater runoff, and consistent between sampling events. Prior to initiating a sampling event, the storm forecast was evaluated against the following three target storm criteria:

- Predicted rainfall amount of ≥0.2 inches per storm;
- Predicted rainfall duration of ≥6 hours; and
- Antecedent dry period of ≥6 hours (as defined by <0.1 inches of precipitation over the previous 6 hours).

Storms meeting these criteria were expected to provide the volume of runoff necessary to implement sampling. These criteria were used as general guidance to determine when forecasted storms should be targeted for sampling during this project. Some sampled storms may not have met the criteria when the sampling event was completed. Storm characteristics for the five required sampling events are documented in the *Event Summary Reports* and are further discussed in Section 5.2.

4.3 Field Sampling Procedures

Field sample collection procedures described in the SDMP were followed, to the extent practicable, to assure data of known and acceptable quality. *Event Summary Reports* and Section 6.4.2 describe field-sampling issues encountered during Year 2 monitoring events. Field data validation is described in Section 6.3.

4.4 Sample Collection Documentation

Field data were recorded on project-specific paperwork during each sampling event, in accordance with the procedures described in the SDMP. Each Event Sampling Team completed three separate forms while sampling: Daily Field Reports (DFR), Field Data Sheets (FDS), and Chain-of-Custody (COC) forms. Copies of the DFR, FDS, and WPCL COC forms are included in the *Event Summary Reports.* Copies of the Test America[3] (TA) COC forms are included with the analytical data reports presented in Appendix C. Field data management is discussed in Section 6.1, data validation is discussed in Section 6.3.

4.5 Year 2 Analytical Schedule

A total of 41 UIC locations were sampled during five storm events between October 1, 2006 and May 31, 2007 (Year 2) and measured for the analytes listed in bold in Table 4-1, in accordance with the SDMP. The 41 samples were collected from 30 representative UIC locations (Panels 2 and 6, selected in accordance with the SDMP), P1_1 (monitored in Year 2 due to annual mean concentration exceedance) and ten supplemental UIC locations (near drinking water wells). (The pentachlorophenol baseline sampling was conducted separately from the primary 41 UIC locations due to the focused nature of this sampling. Results of the pentachlorophenol baseline investigation are discussed in Section 8.2.1.). Monitoring was conducted, to the extent practicable, in accordance with

[3] Test America (TA) acquired North Creek Analytical (NCA) in February 2006. The Year 1 annual report and the SDMP use the acronym "NCA". The Year 2 report uses "TA".

Environmental Protection Agency (EPA) approved test methods, standard of industry practices, or use of best available technology.

The permit requires analysis of two lists of compounds: common pollutants and priority pollutant screen (PPS) analytes. Common pollutants are analyzed for all sampling events. PPS analytes are required to be analyzed in years 1, 4, and 9.

4.5.1 Common Pollutants

Common pollutants were measured at all UIC monitoring locations during each stormwater sampling event. All samples required by the permit and by the SAP were collected in Year 2. Analytical laboratories, analytical methods, method detection limits (MDLs), method reporting limits (MRLs) and MADLs for common pollutants are listed in Table 4-2. Analytical results are presented in Section 5 and data validation is presented in Section 6.

4.5.2 Priority Pollutant Screen Analytes

PPS analytes are listed in Table 4-3, with associated analytical methods, MDLs, MRLs, and MADLs. PPS analytes were not detected at concentrations >50 percent of their respective MADLs in Year 1. Therefore, PPS monitoring was not required in Year 2. However, the permit requires that analytes detected by any of the laboratory methods used in the stormwater monitoring program be reported. The permit defines ancillary pollutants as those analytes that are detected during the required monitoring for common pollutant or PPS analytes using EPA approved analytical methods. For the purposes of this report, ancillary pollutants that are also listed in the permit as PPS analytes are reported as PPS analytes. Nine PPS analytes were detected by the analytical methods for common pollutants and were therefore tested during Year 2. These nine PPS analytes include:

1. Carbon Tetrachloride;
2. Chlorobenzene;
3. 2,4-D;
4. o-Dichlorobenzene;
5. p-Dichlorobenzene;
6. 1,3-Dichlorobenzene;
7. Dinoseb;
8. Picloram; and
9. 1,2,4-Trichlorobenzene.

All nine PPS analytes were tested during each sampling event and at each sampling location in Year 2. These PPS analytes are tested using the same analytical methods used for several of the common pollutants. Table 4-2 provides the list of analytical methods

run in Year 2. Analytical results are presented in Section 5 and data validation is presented in Section 6.

4.5.3 Ancillary Pollutants

The permit requires that analytes detected by any of the laboratory methods used in the stormwater monitoring program be reported. Ancillary pollutants are those analytes that are detected during the required monitoring for common pollutant or PPS analytes using EPA approved analytical methods. Tables 4-2 and 4-3 provide lists of analytical methods run in Year 2. Appendix B of the QAPP contains lists of analytes detected by each method and their respective MRLs. Year 2 ancillary pollutants include some PPS analytes that are discussed in this report as PPS analytes.

4.5.4 Additional Testing

The City performed additional stormwater characterization testing in Year 2 including:

- Field parameters, including pH (EPA Method SM4500-HB), conductivity (EPA Method SM2510B), and temperature (EPA Method SM2550B), were measured at all UIC monitoring locations during each sampling event.
- Total Suspended Solids (TSS) were measured at all UIC monitoring locations during each sampling event, using EPA Method SM2540D.
- For each sampling event, dissolved copper, lead, zinc, and mercury were measured at 41 UIC monitoring locations. Samples were:
    1) Collected during each sampling event at EOP for dissolved metal analyses;
    2) Transported to the WPCL at the end of the sampling day;
    3) Filtered by WPCL staff within 24 hours of collection using a 0.45 micron filter;
    4) Preserved using nitric acid (pH < 2) prior to analyses; and
    5) Analyzed using the EPA Methods specified in the SDMP for metals.

Results are discussed in Section 5.

4.6 Year 2 – Field Audit

As required by the project QAPP, field audits of stormwater sampling procedures were performed. The primary objectives of the audits were to ensure that stormwater data were being collected in accordance with the SDMP and if necessary, to identify any areas requiring changes in field procedures or practices.

The audits were conducted and documented by City personnel not directly involved in Year 2 field sampling activities. At a minimum, the auditor:

- Inspected field sampling equipment prior to use to ensure that it was in proper working order;
- Observed stormwater sample collection procedures;
- Observed field sample labeling and storage procedures; and
- Reviewed available field sampling forms (*e.g.*, Chain-of-Custody (COC) forms, FDSs) to assess if they were properly and completely filled out.

Audit results are discussed in Section 6.

Section 5

5 Stormwater Discharge Monitoring Results

This section describes the data (*e.g.*, storm event, field, and analytical results) collected in accordance with the SDMP during the 2006–2007 wet season *(i.e.,* Year 2). Five stormwater samples were collected from each designated UIC sampling location required by the permit (P1_1 and Panels 2 and 6) during five storm events occurring between October 1, 2006 and May 31, 2007. Stormwater samples were also collected from supplemental UICs associated with drinking water wells for all five storm events. These samples were collected in general accordance with the permit and the SDMP. The following sections present the data collected during Year 2.

5.1 Year 2 Monitoring Results

Year 2 monitoring results are presented in this report in various tables, figures, and appendices. Tables and figures included in this report draw from, present, or summarize the raw data presented in Appendices B and C. Data sources are referenced as appropriate. Section 6 describes the management and validation of field and laboratory data generated in Year 2. The appendices contain the following information:

- **Event Summary Reports** (Appendix B). These reports draw from, present, or summarize the following information:
  - Storm data and general weather conditions (additional information described in Section 5.2 of this report);
  - UIC locations (described in Section 3 of this report);
  - QA/QC sample results and identification and resolution of QA/QC issues (further described in Section 6 of this report);
  - Analytical data summary (described in detail in Sections 5 and 7 of this report);
  - Identification of individual sampling event MADL exceedances (described in Section 7.1 of this report); and
  - Copies of event Daily Field Reports (DFR), Field Data Sheets (FDS) and Chain-of-Custody (COC) forms.
- **Analytical Laboratory Data Reports** (Appendix C). These reports present the results of UIC sample analyses, QA/QC samples, and any data flags. Copies of the field COC forms are also included.
- **Field Audit Documentation** (Appendix D). Field audits of stormwater sampling procedures were performed as required by the QAPP. The primary objectives of the audits were to ensure that stormwater data were being collected in accordance with the SDMP and if necessary, to identify any areas requiring changes in field procedures or practices.

- **Tabulated Stormwater Discharge Monitoring Data** (Appendix E). Analytical data and key UIC location characteristics (*e.g.,* traffic category, land use) are provided in a sortable Excel© Workbook on a CD. Key data fields in this spreadsheet include:
  - Permit Year;
  - Event;
  - Panel Identification;
  - Sample Identification;
  - Laboratory Identification;
  - Panel Number and Sample Location Number;
  - Hansen Database Node Number;
  - Street Address;
  - Traffic Category;
  - Predominant Land Use;
  - Sample Type;
  - Sample Date and Time;
  - Analytical Method;
  - Analytes;
  - Result;
  - Data Qualifier;
  - Units;
  - Method Reporting Limit; and
  - QA/QC Comments.

- **Summary data tables** (Appendix F). Table F-1 presents summary field parameter data, Table F-2 presents summary common pollutant data, and Table F-3 presents summary PPS analyte data.

5.2 Storm Event Data

As described in Section 4.2, the Storm Event Coordinator worked directly with the City's contract weather forecasting service, Extended Range Forecasting Company, Inc., to initiate and complete storm-sampling activities for individual storms that meet SAP defined criteria, to the extent practicable. Storms meeting the target storm criteria were expected to provide the volume of runoff necessary for sampling.

5.2.1 Year 2 Storm Events

Once a sampling event was completed, the characteristics of the storm or individual storms comprising the sampling event were evaluated using data from the City's Hydrological Data Retrieval and Alarm System (HYDRA) rain gage network. Rain gage data are available at http://or.water.usgs.gov/non-usgs/bes/raingage_info/. The website also provides a map of rain gage locations. Precipitation data from the following 13 rain gages across Portland were averaged and used to characterize individual storms for Years 1 and 2:

HYDRA (Rain gage) Station	**Address**
Station # 1 : Airport Way #2 P.S.	14614 NE Airport Way
Station # 2 : Arleta School	5109 SE 66th Ave.
Station # 3 : Astor School	5601 N Yale
Station # 4 : Beaumont School	4043 NE Fremont
Station # 5 : Cascade PCC_02	705 N Killingsworth St.
Station # 6 : Holgate	4507 SE 136th Ave.
Station # 7 : Kelly School	9030 SE Cooper
Station # 8 : Mallory	8030 NE Mallory Ave.
Station # 9 : Open Meadows School	7602 N Emerald Ave.
Station # 10 : PDX Post Office	7660 NE Airport Way
Station # 11 : Swan Island	2600 N Going St.
Station # 12 : Vernon School	2044 NE Killingsworth
Station # 13 : WPCL	6543 N Burlington

Sampling staff attempted to sample all locations that were scheduled for the 2006-2007 season during discrete storms; however, if rainfall ceased prior to the collection of all required samples, the sampling event was extended over additional storms (*i.e.*, sample collection period), as necessary. Each of the five Year 2 stormwater sampling events was comprised of several storms or sample collection periods. Dates of individual sample collection periods for each event are listed below:

- Event 1: 10/15/06, 10/18/06, 10/19/06, 11/2/06, 11/3/06
- Event 2: 12/11/06, 12/14/06
- Event 3: 1/3/07, 2/14/07, 2/15/07
- Event 4: 3/2/07, 3/7/07, 3/9/07, 3/19/07
- Event 5: 4/16/07, 4/17/07, 4/18/07, 4/21/07, 5/2/07, 5/3/07, 5/20/07

Hourly "average" precipitation records are summarized for each storm event in Tables 5-1 through 5-5 and hydrographs are provided for each storm event in Figures 5-1 though 5-5. Additional information regarding forecasted rainfall for individual storms in a storm event is provided in the *Event Summary Reports*, provided in Appendix B.

Information presented in Tables 5-1 through 5-5 and Figures 5-1 though 5-5 was used to estimate the duration, intensity, and the antecedent dry period for each sample collection period in each storm event. These storm characteristics are summarized for Event 1 through Event 5 in Table 5-6. The duration of an individual sample collection period was defined as a continuous rainfall event, preceded and followed by 0.0 inches of rain in an hour (*i.e.*, a dry hour). The intensity of an individual sample collection period was defined as the amount of precipitation recorded over the duration of the event. The antecedent dry period for each sample collection period was defined as the number of "dry" hours before the first measured rainfall in the sampling event.

The first predicted storm during the 2006-2007 wet season was targeted for sampling to investigate water quality differences that may be associated with the first significant rainfall of the fall season. All five monitoring events (Events 1 through 5) were distributed throughout the monitoring season as storms meeting the target storm event criteria, presented in Section 4.2, occurred.

Due to laboratory problems associated with the analyses of DEHP (See Section 6), samples collected during Event 2 were resampled on February 20 and 27, 2007 and samples collected during Event 4 were resampled on May 20, 2007 and analyzed for polycyclic aromatic hydrocarbons (PAHs) and phthalates using EPA Method 8270M-SIM.

5.2.2 Year 2 Regional Precipitation and Temperature Records

A summary of long-term (30 year) Year 1 (June 2005-May 2006) and Year 2 (June 2006 – May 2007) precipitation and temperature records for the Portland area is provided in Table 5-7. The permit-defined wet season months are shaded. Long-term, Year 1, and Year 2 precipitation totals are depicted graphically in Figure 5-6. Year 1 had about 5.69 inches more precipitation than the long-term average, which was recalculated to include the Year 1 data. In contrast, Year 2 received approximately 2.67 inches less precipitation than the long-term average. Every month in Year 2, with the exception of November and December 2006, was slightly below its corresponding long-term monthly average. Approximately 12 inches of precipitation was measured in November 2006, which is about one-third of the total precipitation for Year 2.

Samples during the latter part of Event 1 and all of Event 2 were collected in months with higher than average precipitation, and samples during Events 3, 4 and 5 were collected in months with lower than average precipitation.

5.3 Field Parameters

Field data were collected to aid in the interpretation of analytical results. Three field parameters (pH, specific conductivity, and temperature) were measured at all UIC locations during each stormwater sampling event. Measurements are included in the

Excel© Workbook in Appendix E. Appendix F (Table F-1) presents a summary of Year 2 field parameters. Summary statistics for field parameters are reported in Table 5-8.

pH. pH measurements ranged from 4.2 (Events 1 and 3) to 8.3 (Event 1) in stormwater discharge during Year 2. The mean pH readings for individual events ranged from 6.0 (Event 3) to 6.3 (Event 4).

Conductivity. Conductivity measurements ranged from 4 (Event 5) to 146 (Event 1) µmhos/cm in stormwater discharge during Year 2. The mean conductivity readings for individual sampling events ranged from 19.8 (Event 4) to 46.3 µmhos/cm (Event 1).

Temperature. Temperature measurements ranged from 4.6 (Event 4) to 15.3 (Event 5) ^{o}C in stormwater discharge during Year 2. The mean temperature measurements for individual sampling events ranged from 8.0 (Event 4) to 11.8 (Event 5) ^{o}C.

Field Parameter Definitions

pH: The pH of a water sample is a measure of the concentration of hydrogen ions. The pH of water determines the solubility (amount that can be dissolved in the water) and biological availability (amount that can be utilized by aquatic life) of chemical constituents such as nutrients (phosphorus, nitrogen, and carbon) and heavy metals (lead, copper, cadmium, etc.).

Conductivity: (specific conductivity; electrical conductivity, EC) estimates the amount of total dissolved solids, or the total amount of dissolved ions in the water. Conductivity is measured and reported in units of micromhos per centimeter (µmhos/cm).

Temperature: Temperature is important because of its potential influence on water chemistry. The rate of chemical reactions generally increases at higher temperature. Temperature is reported in degrees Celsius (^{o}C). Stormwater temperature is related to seasonal air temperatures and daily weather variations.

5.4 Year 2 Analytical Testing Results

5.4.1 Common Pollutants

All 14 common pollutants listed in Table 4-1 were detected during Year 2. All of the common pollutants except ethylbenzene were detected in Year 1. Appendix F (Table F-2) presents the Year 2 common pollutant sample concentrations for each UIC location by storm event. Table 5-9 provides a summary the information in Table F-2 and includes the number of detections (*i.e.*, ≥MRL), the number of samples analyzed, the frequency of detection, range of Year 2 concentrations, and the maximum percent of the MADL detected (*i.e.*, maximum concentration/MADL *x* 100) during Year 2. Table 5-10 provides a summary of the frequency of detection values for common pollutants and PPS analytes in Year 2. Common pollutants detected during Year 2 are discussed below.

Arsenic. Arsenic was detected in all 206 samples in Panel 1, Panel 2, Panel 6, and the supplemental panel. Sample concentrations ranged between 0.095 µg/L at P2_15 during Event 2 (TPD <1,000) and 4.64 µg/L at SP1_7 during Event 4 (TPD ≥1,000), well below the 10 µg/L MADL for arsenic.

Cadmium. Cadmium was detected in 91 of 206 samples in Panel 1, Panel 2, Panel 6, and the supplemental panel. Sample concentrations ranged between the QAPP target MRL of 0.1 µg/L and 2.56 µg/L at SP1_7 during Event 4 (TPD ≥1,000), which is below the 5.0 µg/L MADL for cadmium. Detections were fairly evenly distributed across sampling events, with between 13 and 23 detections per event.

Chromium. Chromium was detected in 164 of 206 samples in Panel 1, Panel 2, Panel 6, and the supplemental panel. Sample concentrations ranged between 0.24 µg/L at SP1_4 (<1,000 TPD) and 50.9 µg/L at SP1_7 (≥1,000 TPD), both during Event 4, and below the 100 µg/L MADL for chromium.

Copper. Copper was detected in all 206 samples in Panel 1, Panel 2, Panel 6, and the supplemental panel. Sample concentrations ranged between 1.54 µg/L at P6_9 during Event 2 (TPD <1,000) and 212 µg/L at SP1_7 during Event 4 (TPD ≥1,000), both below the 1,300 µg/L MADL for copper.

Lead. Lead was detected in all 206 samples in Panel 1, Panel 2, Panel 6, and the supplemental panel. Sample concentrations ranged between 0.22 µg/L at SP1_4 during Event 5 (TPD <1,000) and 149 µg/L at SP1_7 during Event 4 (TPD ≥1,000). Five sample concentrations exceeded the 50 µg/L MADL for lead, during Events 3, 4 and 5.

Zinc. Zinc was detected in all 206 samples in Panel 1, Panel 2, Panel 6, and the supplemental panel. Sample concentrations ranged between 3.21 µg/L at P6_3 during Event 1 (TPD <1,000) and 1,120 µg/L at SP1_7 during Event 4 (TPD ≥1,000), both well below the 5,000 µg/L MADL for zinc.

Total Nitrogen. Total nitrogen was detected in 64 of 206 samples in Panel 1, Panel 2, Panel 6, and the supplemental panel. Concentrations ranged between the QAPP target MRL of 0.1 mg/L to 0.66 mg/L at P6_6 during Event 1 (TPD ≤1,000), both well below the 10,000 µg/L MADL for total nitrogen.

Pentachlorophenol. Pentachlorophenol was detected in 188 of 206 samples in Panel 1, Panel 2, Panel 6, and the supplemental panel. Detected concentrations ranged from 0.0307 µg/L at P6_3 during Event 1 (TPD <1,000) to 4.67 µg/L at P2_5 during Event 3 (TPD ≥1,000). Forty-one primary sample concentrations (*i.e.*, not duplicate or resampled concentrations) exceeded the 1.0 µg/L MADL for pentachlorophenol across all five storm events.

Benzene. Benzene was detected in three of 206 samples in Panel 1, Panel 2, Panel 6, and the supplemental panel. All benzene and duplicate sample concentrations ranged between the QAPP target MRL of 0.20 µg/L and 1.1 µg/L at P6_12 during Event 3 (>1,000 TPD), below the 5.0 µg/L MADL for benzene.

Ethylbenzene. Ethylbenzene was detected in two of 206 samples in Panel 1, Panel 2, Panel 6, and the supplemental panel. All ethylbenzene and duplicate sample concentrations ranged between the QAPP target MRL of 0.5 µg/L and 1.27 µg/L at SP1_9 during Event 1 (<1,000 TPD), well below the 700 µg/L MADL for ethylbenzene.

Toluene. Toluene was detected in 87 out of 206 samples. Values ranged from the QAPP target MRL of 0.5 µg/L to 280 µg/L at SP1_9 during Event 1 (TPD <1,000). The next highest concentration for toluene was 52.0 µg/L at SP1_7. All concentrations were well below the 1,000 µg/L MADL for toluene. As identified in Section 4, the MDL and the MRL in the QAPP were reversed. The QAPP target MRL listed in Table 4-2 represents the correct value.

Xylenes. The permit identifies xylenes as a common pollutant. Total xylenes are the sum of the analytical concentrations measured for m,p-xylene and o-xylene. All total xylene sample concentrations were below 1.5 µg/L, with one exception. The single detection of 9.62 µg/L occurred at P6_12 during Event 3 (TPD ≥1,000), but is well below the 10,000 µg/L MADL. This concentration is the sum of 6.47 µg/L m,p-xylene and 3.15 µg/L o-xylene.

Benzo(a)pyrene. Benzo(a)pyrene was detected in 65 of the 206 samples and duplicates in Panel 1, Panel 2, Panel 6, and the supplemental panel. Concentrations ranged between 0.00962 µg/L at SP1_9 and P6_4 during Events 2 and 3 (both TPD <1,000) and 0.164 µg/L at P6_1 during Event 3 (TPD ≥1,000), below the 0.2 µg/L MADL for benzo(a)pyrene.

DEHP. Di(2-ethylhexyl)phthalate (DEHP) was detected in 143 of the 206 samples and duplicates in Panel 1, Panel 2, Panel 6, and the supplemental panel. Concentrations ranged from 0.621 µg/L at P6_9 during Event 4 (TPD <1,000) to 264 µg/L at P6_1 during Event 1 (TPD ≥1,000). Year 2 laboratory QC issues resulted in some DEHP data being considered potentially unreliable. These issues are described in Section 6.4.3.

5.4.2 Priority Pollutant Screen Analytes

Nine of the PPS analytes listed in Table 4-1 were derived from the analytical methods for common pollutants and were therefore tested during Year 2. Only two of these PPS analytes were detected during laboratory analysis for common pollutants in Year 2. Appendix F (Table F-3) presents the Year 2 PPS sample concentrations for each UIC location by storm event. Table 5-9 provides a summary of the information presented in Table F-3, including: the number of detections (*i.e.*, ≥ MRL), the number of samples analyzed, the frequency of detection, the range of Year 2 concentrations, and the maximum percent of the MADL detected (*i.e.*, maximum concentration/MADL *x* 100) during Year 2. Table 5-10 provides a summary of the frequency of detection for PPS analytes in Year 2. Table 5-11 provides a summary of the PPS analytes that were

analyzed but not detected in Year 2, including the number of samples analyzed and the range of Year 2 MRLs. PPS analytes detected during Year 2 are discussed in this section.

2,4-D. 2,4-D was detected in 38 of 206 samples and duplicates in Panel 1, Panel 2, Panel 6, and the supplemental panel. Sample concentrations ranged from the QAPP target MRL of 0.1 µg/L to 32.3 µg/L at P2_11 during Event 1 (TPD <1,000), below the 70.0 µg/L MADL for 2,4-D. The next highest concentration was 8.69 µg/L.

Chlorobenzene. Chlorobenzene was detected in one of 206 samples at a concentration of 0.213 µg/L in P6_1 during Event 3 (TPD ≥1,000), significantly below its 100.0 µg/L MADL.

5.4.3 Ancillary Pollutants

The permit requires that all analytes detected by any of the laboratory methods used in the stormwater monitoring program be reported. Ancillary pollutants are those analytes that are detected in addition to required monitoring for common pollutant or PPS analytes using EPA approved analytical methods. Table 5-12 provides a list of ancillary pollutants detected in Year 2. This table indicates by analyte, the analytical method, the sampling event, the number of samples analyzed, the number of detections, the frequency of detection, and the minimum and maximum concentrations. Appendix C contains the laboratory data sheets and Appendix E contains a sortable Excel© workbook.

Table 5-13 summarizes the individual sampling event frequencies of detection for ancillary pollutants in Year 2. All pollutants were analyzed for all five sampling events. Twenty-six ancillary pollutants were detected in Year 2. Eight of these were detected at a maximum frequency of less than or equal to 5% and ten were detected at maximum frequencies between 10% and 41%. The eight pollutants that were detected at the highest frequencies (between 51% and 98%) during the individual sampling events are PAHs and included: chrysene, phenanthrene, napthalene, pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, fluoranthene, and indeno(1,2,3-cd)pyrene. Of these, naphthalene had the highest concentration with a maximum of 1.09 µg/L.

The detection of PAH compounds was an expected result, due to the presence of numerous sources in an urban environment. PAH sources include, but are not limited to, fresh and used petroleum products (*e.g.*, gasoline, diesel, motor oil, used oil), petroleum and coal combustion, motor vehicle exhaust, tire wear, wood ash, asphalt, insecticides, wood preservatives, used cigarette filters, and air deposition. PAHs tend to adhere to sediment particles rather than dissolve in water.

PAHs will continue to be analyzed and reported as ancillary pollutants in future sampling events for UICs in the monitoring network, along with the common pollutant benzo(a)pyrene. Benzo(a)pyrene was detected as discussed in Section 5.4.1, with a frequency of detection ranging between 5% and 46% during individual sampling events.

5.4.4 Additional Testing

Dissolved Metals. Table 5-14 presents a summary of dissolved and total common pollutant and PPS metal analyses performed in Year 2. This table includes the number of samples analyzed, number of detected values, average (*i.e.*, arithmetic mean) concentration, geometric mean, minimum and maximum concentrations, and the ratio of the dissolved average concentration to the total average concentration. Total arsenic, total cadmium, total chromium, total and dissolved copper, total and dissolved zinc, and dissolved mercury were detected in most samples at concentrations well below their respective MADLs. The ratios of dissolved to total metal concentrations for ≥1,000 TPD traffic category ranged from 4% (lead) to 7% (copper) and between 33% (zinc) and 41% (copper) for <1,000 TPD. For individual metals, the ratio of dissolved to total metal concentrations is generally lower for the high traffic category. These results indicate that metal concentrations are strongly correlated to stormwater particulates.

Total Suspended Solids. Table 5-15 presents the summary statistics for TSS results. TSS in stormwater was analyzed for each UIC location during each of the five sampling events. TSS concentrations ranged from <2 mg/L to a maximum concentration of 2,750 mg/L. The second and third highest TSS values were 832 and 330 mg/L, respectively.

Of the 205 TSS samples, 176 samples had TSS concentrations less than 100 mg/L. The mean and geometric mean were calculated for Year 2 TSS data by traffic category. The ≥1,000 TPD traffic category average and geometric mean concentrations were in general about three times higher than the concentrations in the <1,000 TPD traffic category.

Section 6

6 Data Management and Validation

This section summarizes the types of information managed and maintained during Year 2 of the Stormwater Discharge Monitoring Program. It also summarizes the results of data validation conducted in the field and analytical laboratory data collected during the 2006-2007 wet season (*i.e.*, Year 2). Specific procedures for data management and data validation are described in the QAPP.

6.1 Data Management

Two general types of data were collected during the 2006-2007 wet season: technical data and management data. Technical data generated and used in this report include the following:

- Field data (described below);
- Analytical laboratory data (described below);
- UIC construction data (provided in Section 3);
- UIC locations (described in Section 3);
- Sedimentation manhole depth to sediment measurements (described in Section 3);
- Traffic volume data (described in Section 3);
- Land use (described in Section 3);
- Sampling event data (described in Section 4); and
- Calculated or manipulated data (described in Section 7).

There were no deviations from specific data management procedures described in the QAPP during the 2006-2007 wet season.

Additional technical data types are identified in the QAPP, but not specifically presented in this report. This information will be presented and discussed in other reports as appropriate.

6.1.1 Field Data

Field data were recorded on project-specific paperwork, as described in the SAP and in Sections 4.4 and 5.1 of this report. BES maintains field records in both hard copy and electronic (.pdf file) formats. The *Event Summary Reports* (included in Appendix B of this report) contain copies of the DFRs and FDSs. WPCL COC forms are included with the *Event Summary Reports* and the TA COCs are included with the analytical laboratory data packages (see below).

6.1.2 Laboratory Data

Analytical laboratory data (sample information and analytical results from both the WPCL and TA) were manually entered into the BES Laboratory Information Management System (LIMS), which functions as the BES database for data storage, sample tracking, and reporting. A WPCL chemist checked analytical data sheets and results of laboratory quality control samples to ensure that the QC statistics were within control limits and that appropriate corrective actions were taken if control limits were exceeded. The WPCL chemist also flagged or provided comments on results that did not strictly meet quality control criteria. The WPCL applied an "EST", which means estimated value, to qualify results. TA used customized flags to communicate detailed QC issues; these flags are included on the TA analytical laboratory reports.

WPCL staff verified the accuracy of data entry into the LIMs systems and did not release data until the data validation process was complete. The LIMS system was backed up on a daily basis. Appendix C contains electronic copies of the TA and WPCL analytical data reports.

The WPCL maintains project files containing any records necessary to reconstruct the analytical events associated with this project. All procedures for storage of hardcopy and electronic data comply with the *WPCL Quality Manual* (City of Portland, 2005). Records related to analytical laboratory data that are maintained include:

- COC forms (Copies included in analytical laboratory reports presented in Appendix C);
- Instrument calibration and tuning records (as applicable);
- Analytical standards preparation logs;
- Method Standard Operating Procedures (SOPs);
- Analytical QC results (including method blanks, internal standards, surrogates, replicates, spikes, and spike duplicate results, as applicable);
- Raw data, specifically instrument printouts;
- Bench worksheets and/or quantification reports;
- Corrective action reports (if any); and
- Details of the QA/QC program in place at the time that the project analyses were conducted.

Laboratory data were extracted from the LIMS system to generate Year 2 summary tables, in an electronic format, by UIC location and analytical constituent. A copy of the Excel© workbook containing a compilation of Year 2 Monitoring data is included in Appendix E. Tables were checked against copies of the original final data sheets prior to data analyses. Data are tabulated as they are shown on the original data sheets. However, specific data flags by TA are not included in the Excel© workbook.

Noteworthy laboratory quality control issues are included in the comments section of the spreadsheet.

6.1.3 Management Data

The second general category of data collected and managed during the 2006-2007 wet season was management data. This included information that must be tracked to monitor, manage, and document the performance of the UIC program; such as schedules, cost estimates, and project reports. All original data, calculations, drawings, etc., were systematically filed as they were collected for easy reference, and are maintained by BES.

6.1.4 Data Storage

All technical and management data described above will be retained indefinitely and no records will be destroyed without prior permission of the City's UIC Program Manager and notification of the DEQ UIC Permit Manager, as specified in the QAPP.

6.2 Data Quality Objectives

DQOs are defined for environmental sampling and laboratory activities as qualitative and quantitative statements that specify the quality of the data required to support the project objectives. DQOs provide the driving force for the level of quality control required for any particular sampling or analytical task. The key DQOs for the City's UIC monitoring program are to provide environmental data that are of known and acceptable quality, are scientifically defensible, and that demonstrate compliance with the WPCF Permit. The quality of data is known when all components associated with data generation are thoroughly documented. Data are of acceptable quality when a rigorous QA/QC program is implemented and the QC indicators fall within predefined limits of acceptability. The project QAPP describes the methods of data documentation and the mechanisms to be used in attaining data of acceptable quality.

Table 6-1 summarizes the project DQOs for analytical data. DQOs for Year 1 were carried forward into Year 2 without change. Additional information on DQOs can be found in the QAPP.

6.3 Data Validation

This section of the report summarizes the procedures used to review field and analytical data. The purpose of this review was to ensure that data collection and evaluation were conducted according to procedures specified in the SDMP, where deficiencies in data were noted, and the cause of these deficiencies. If these deficiencies required a corrective action, it is described in Section 6.4 of this report.

6.3.1 Field Data

Deviations from field procedures outlined in the SAP are noted in this section. Field data were collected in general accordance with the procedures described in the SDMP during the 2006-2007 wet season. The following paragraphs describe key components of the field program used to validate field data. All field data were determined to be valid and of acceptable quality.

Sample Locations. Pre-sampling investigations were conducted to determine whether any of the Panel 2, Panel 6 or supplemental UIC locations located near drinking water that were proposed for sampling during the 2006-2007 wet season were unsuitable for sampling. The factors used in this evaluation are described in the SAP. As a result of this investigation, one proposed supplemental location was determined to be unsuitable for sampling. Section 3.2.4 explains that stormwater discharging to this location was determined to be from a street categorized as <1,000 TPD, but that should have been ≥1,000 TPD. Therefore, this location was replaced to maintain the target stratification goal. This UIC was replaced by selecting the first location in the oversample panel with ≥1,000 TPD traffic categorization. This substitution was made prior to initiating Year 2 storm event sampling

Sample Stratification. As described in Section 3.1.2, the traffic categories of five UICs sampled in Year 1 were changed by PDOT after completion of the SAP and Year 1 monitoring was initiated. This resulted in a stratification for Year 1 that was unevenly distributed between <1,000 TPD and ≥1,000 TPD as specified by the SAP. Year 1 locations were selected on the best information and modeling available at the time the sampling network was defined and prior to initiating sampling. All Year 1 data is acceptable, however, it is more heavily weighted towards the lower traffic category. On July 11, 2006, the City submitted an approach to DEQ to modify the Year 2 sampling network to achieve the target stratification specified in the SAP. This plan was approved by DEQ and resulted in randomly replacing three of the <1,000 TPD UIC locations in the stationary panel (Panel 6) with three ≥1,000 TPD UIC locations. The modified Panel 6 will be carried forward for the duration of the permit with the corrected target stratification. The plan also resulted in replacing two <1,000 TPD UIC locations in the rotating panel (Panel 2) with two >1,000 TPD UIC locations. Although this results in a panel that is weighted with more >1,000 TPD UIC locations, the traffic categories will achieve the overall sample design target stratification when averaged over the duration of the permit.

Precipitation Events. A total of five sampling events were successfully completed during the 2006-2007 wet season, associated with precipitation events between October 2006 and May 2007. The precipitation events sampled are described in more detail in Section 5 of this report and in the *Event Summary Reports* (Appendix B). Storms targeted for sampling met the criteria identified in the SAP to the extent practicable and were determined to be acceptable.

Sample Collection Procedures. No issues associated with sample collection procedures occurred during the 2006-2007 wet season.

Field Data Documentation. Field data were recorded on project-specific paperwork, as described the SAP. Field documentation is reviewed by the BES Storm Event Coordinator data to ensure that sample collection was conducted according to procedures specified in the SDMP and that documentation is complete. The Year 2 field records document:

- Adherence to SAP protocols;
- Field corrective actions tracking and inherent data uncertainties;
- Field procedures do not impact samples (*i.e*., collection of appropriate QC samples); and
- Safe work practices are followed (*i.e.,* adherence to the Health and Safety Plan).

Specific field records maintained by BES in Year 2 include the following:

- DFRs, FDSs, and COC forms;
- Health and Safety Plan;
- Field meter calibration and maintenance records (as applicable);
- Sample collection standard operating procedures;
- Storm event information; and
- Sampling event summaries.

Field data documentation for sampling met the objectives identified in the SAP to the extent practicable and was determined to be acceptable.

6.3.2 Laboratory Data

Year 2 analytical data validation included, but was not limited to, a review of the following:

- **Timeliness**. Verified laboratory analyses were performed within the recommended analytical holding times. Samples not extracted or tested with the specified period were noted or flagged.
- **Detection Limits**. Verified analytic detection limits for each analysis met the project specific limits. Sample MRLs were less than the MADLs specified in the permit and met the MRLs proposed in the QAPP.
- **Chain-of-Custody**. Verified COC procedures were followed by the laboratory.

- **Reagent Blanks/Trip Blanks**. Verified blanks did not contain any analytes. Analytes detected in the reagent blank indicate laboratory-introduced contamination that can be identified and flagged or separated from the sample results.
- **Matrix Spikes and Matrix Spike Duplicates**. Verified the percent recoveries between the spike quantity recovered and the known spike value were acceptable. The relative percent difference (RPD) was calculated using the duplicate analyses results.
- **Surrogate Spike Analyses**. Verified the percent recoveries were within the acceptable range for the analytical laboratories database.
- **Blind Duplicates**. Verified the RPD between the original sample and the blind duplicate was acceptable.
- **Equipment Blanks/Field Decontamination Blanks**. Verified blanks did not contain any analytes. Analytes detected in the blank indicate introduced contamination from field or decontamination processes that can be identified and flagged.

Year 2 analytical data were determined to meet the DQOs described in Section 6.2 and to be of acceptable quality. All data are considered useable except for 12 data points that were rejected due to laboratory DEHP QC issues (described below). All planned data were collected and analyzed. Due to the identified QC issues associated with DEHP, about 20 UICs were resampled to assure an adequate data set. The resampling resulted in a data completeness which exceeded the 95% goal set in the QAPP. Data QA/QC issues identified during the data validation process are summarized in Tables 6-2 and 6-3 and described below. Appendices B, C, and E include the following information used for data validation:

- WPCL Laboratory Analysis Reports;
- TA Laboratory Analysis Reports;
- *Event Summary Reports;* and
- Year 2 Analytical Data (*e.g.*, Excel© Workbook, City of Portland Janus database).

Validation occurred throughout the sample collection and analytical process. Initial validation was performed during sample receipt and log-in and included the following steps: examination of the integrity of sample containers and labels, including suitability of containers for requested analyses; examination of the COC form for the presence of all required information and signatures; and verification of sample container identification numbers against those listed on the COC form.

Laboratory data validation also occurred during sample analysis and was carried out at the instrument by the analyst. This phase of validation involved performing and

maintaining instrument calibration and assessing precision and accuracy of the data via the analysis of the appropriate QC checks by the individual laboratories. The analyst ensured that the QC statistics were within control limits and took appropriate corrective actions during analysis if control limits were exceeded.

Laboratory data validation also included checking the data reduction and transcription/ data entry operations used to calculate final results. An analyst or chemist other than the one who conducted the analysis, but who is fully knowledgeable about the analysis, performed this validation. Results were verified against the raw data, including checking calculations, use of correct units and/or conversion factors, and use of correct sample preparation conditions. The technical reviewer also confirmed that all relevant previous validation checks were correctly applied and that QC statistics were within control limits.

Results that do not meet quality criteria were flagged by TA, WPCL, the WPCL QA Coordinator, or BES Investigation and Monitoring Services (IMS). Selected samples were flagged by the WPCL QA Coordinator using "EST", which means estimate, to qualify the results; the reason for the "EST" flag is described in the comments section of the WPCL Laboratory Analysis Reports and database. TA used customized flags to communicate QC issues. Definitions for these data qualifiers are included in the TA data reports (See Appendix C). Additional qualifiers were assigned through project data validation and are defined in the *Event Summary Reports* (provided in Appendix B).

The analytical data were entered into BES LIMS and hard copies of the entered data were checked for data entry errors. After sample results (TA and WPCL) had undergone technical and data entry review, the WPCL QA Coordinator electronically marked the sample in LIMS. The mark indicates that all analyses for that sample are complete and have been checked for errors. At that point, the data were released to the UIC Program for use.

Table 6-2 provides a summary of laboratory QC issues arising from DEHP analysis. Due to pervasive TA DEHP QC issues throughout most of Year 2, samples collected during Event 2 and Event 4 were re-sampled for phthalates between Event 2 and 3 and at the end of Event 5. Event 2 was re-sampled on February 20 and 27 and May 20 for phthalates. Samples collected during Event 4 were re-sampled on May 20 for phthalates. Information regarding these QC issues is also discussed in the *Event Summary Reports* included in Appendix B and in a separate technical memorandum, "*Di(2-ethylhexyl)phthalate Laboratory QC Issues and Data Usability for Year 2.*" This memorandum is presented in Appendix H.

Table 6-3 presents a summary of all remaining laboratory QC issues identified during the 2006-2007 wet season. The WPCL QA Coordinator reviewed all QC issues. Only noteworthy QC issues are noted in Tables 6-2 and 6-3. These issues are discussed in the comments section of the WPCL Laboratory Analysis Reports (see Appendix C) and database (See Appendix E). Additional detailed flags may be found on the TA

Laboratory Analysis Reports (Note: this information is not transferred to the WPCL Laboratory Analysis Reports comment section or database if it does not affect interpretation of the data).

6.4 Monitoring Program Corrections

Any unusual condition that occurred during a monitoring event that could impact the monitoring results was noted and, if necessary, corrected. These conditions may be classified as a deviation, nonconformance, or occurrence (as defined in the SAP and QAPP). Conditions or issues related to field sampling activities are discussed in Section 6.4.2. Conditions or issues related to activities in the laboratory are discussed in Section 6.4.3.

6.4.1 Deviations, Nonconformance, and Occurrences

A deviation is a planned or unplanned departure from a procedure deemed reportable and tracked by the City's UIC Program Manager. Nonconformance is a deficiency in characteristics, documentation, or procedures that renders the quality of an item or activity unacceptable or indeterminate. An occurrence is any condition or event that could affect the health and safety of the public, have an adverse affect on the environment, endanger the health and safety of workers, affect the operations and intended purpose of a facility, or result in loss or damage of property.

During the 2006-2007 wet season, no deviations, nonconformance or occurrences were noted.

6.4.2 Field Corrective Actions

A field corrective action was initiated if problems associated with field measurements or field sampling equipment were observed. These problems and associated corrective actions are documented on *Field Operation - Corrective Action Reports*. No corrective actions were taken during the 2006-2007.

6.4.3 Laboratory Corrective Actions

The QAPP requires that a laboratory corrective action be initiated if problems associated with laboratory procedures or equipment are observed. These problems and associated corrective actions are documented on a corrective action report specific to the laboratory in question. Two separate laboratory corrective actions were taken during the 2006-2007 wet season, and are summarized below and in Tables 6-2 and 6-3. TA's Laboratory Corrective Action Reports for Year 2 are presented in Appendix G.

Chronic laboratory DEHP QC issues were encountered at TA throughout most of Year 2. DEHP QC failures were documented for method blanks, LCS results, MS/MSD

recoveries and RPDs, field duplicate precision, and laboratory re-analyses for data from Events 1 through 4. Selected sampling locations were resampled and analyzed for phthalates only. DEHP QC issues and overall data usability are summarized in a separate technical memorandum addressing DEHP QC issues and data usability (see Appendix H).

For Event 5, due to a sample tracking error by TA, matrix spike (MS)/matrix spike duplicate (MSD) samples were not analyzed with most analytical batches. Laboratory Control Spike duplicates (LCSD) samples were analyzed instead. All other accuracy and precision criteria were met, thus, data quality and usability were judged not to be affected for Event 5.

No other issues requiring laboratory corrective action were noted during the 2006-2007 wet season.

Section 7

7 Data Evaluation

This section of the report presents the evaluation of stormwater data collected from the UICs during the 2006-2007 wet season (*i.e.,* permitYear 2). Requirements for the data evaluation are specified in the WPCF permit and described in the QAPP.

To achieve the objectives described in the SDMP, the following data evaluation tasks were performed:

- Comparison of individual sampling event results to MADLs;
- Calculation of annual mean analyte concentrations for permit compliance;
- Trend analysis to evaluate changes in analyte concentrations over time;
- Comparison of data obtained in the two traffic categories to assess potential differences in analyte concentrations as associated with the two traffic categories;
- Evaluation of analyte concentrations relative to factors that may have influenced stormwater quality; and
- Evaluation of analyte concentrations related to actions taken to improve stormwater quality to assess the effectiveness of the actions.

The ability to conduct detailed data analysis (trend analysis, correlation, or logistic regression) at individual UICs is limited due to the size of the data set (*i.e.,* five data points per UIC location). As data are collected in successive years and a more robust data set is available, more analysis will be possible. Additional data evaluation and analysis may be conducted and discussed in the annual UICMP report, which will be submitted to DEQ by November 1, 2007.

7.1 Individual Sampling Event MADL Exceedances

7.1.1 Common Pollutants

The permit requires that detected concentrations of common pollutants in each individual sampling event be compared to their respective MADLs. Table 7-1 summarizes the comparison of individual detected concentrations to MADL values for common pollutants. Only three common pollutants (pentachlorophenol, DEHP, and lead) were detected in Year 2 at concentrations above their MADLs in at least one sample, as shown on the following page:

Pentachlorophenol	**DEHP**	**Lead**
P1_1 (Events 1, 2, 3, 4)	P1_1 (Event 2*)	P6-1 (Event 3)
P2_3 (Event 4)	P2_2 (Event 5)	P6_5 (Event 5)
P2_5 (Events 1, 2, 3, 4, 5)	P2_5 (Event 4*)	P6_11 (Event 5)
P2_7 (Events 1, 2, 3, 4)	P2_10 (Events 2*)	SP1-7 (Event 3, 4)
P2_13 (Events 1, 2, 3, 4)	P2_11 (Event 4*)	
P2_14 (Events 1, 2, 3, 4, 5)	P2_15 (Event 4*)	
P6_1 (Events 2, 4)	P6_1 (Event 1*)	
P6_2 (Events 1, 3, 4, 5)	P6_11 (Event 2*)	
P6_4 (Events 1, 3)	P6_12 (Event 2*)	
P6_7 (Events 1, 2, 3, 4)	P6_15 (Event 2*)	
P6_14 (Event 1, 2, 4)	SP1_7 (Event 4*)	
SP1_1 (Event 1)	SP1_9 (Event 2*)	
SP1_7 (Event 2)		

*Note: Laboratory QC issues in Events 2 and 4 indicate that some data may be unreliable or biased high. See Section 6 for further discussion of Year 2 DEHP QC issues.

Pentachlorophenol. Thirteen Year 2 UIC sample locations exceeded the MADL of 1.0 µg/L, with between one and five exceedances per location. Of these 13 exceedances, 9 were collected from UICs categorized as ≥1,000 TPD, and 4 were collected from UICs categorized as <1,000 TPD. By sampling event, the fewest number of exceedances (3) occurred during Event 5 and the greatest number of exceedances (ten) occurred during both Events 1 and 4.

DEHP. Twelve Year 2 UIC sample locations exceeded the MADL of 6.0 µg/L for DEHP. Of these 12 sample locations, five UICs are categorized as ≥1,000 TPD, and seven UIC are categorized as <1,000 TPD. Exceedances occurred during each of Events 1, 2, 4, and 5. As noted in Section 6, numerous QA/QC issues were encountered with DEHP analyses and many of the samples were flagged as being biased high and are of suspect quality.

Lead. Four Year 2 UIC sample locations exceeded the MADL of 50.0 µg/L for lead. Of these four locations, three UICs are categorized as ≥1,000 TPD, and one UIC is categorized as <1,000 TPD. Exceedances occurred in Events 3, 4, and 5.

As required by the permit, the City reported observed MADL exceedances of common pollutants from each individual sampling event to DEQ within seven days following the receipt of validated analytical data. Exceedances were reported to DEQ in the following correspondence:

- MADL Exceedance Notification Year 2 – Event 1 – email dated December 21, 2006;
- MADL Exceedance Notification Year 2 – Event 2 – letter dated January 31, 2007;
- MADL Exceedance Notification Year 2 – Event 3 (Part 1)– letter dated February 9, 2007;
- MADL Exceedance Notification Year 2 – Event 3 (Part 2)– letter dated March 20, 2007;
- MADL Exceedance Notification Year 2 – Event 4 – letter dated April 26, 2007; and
- MADL Exceedance Notification Year 2 – Event 5 – letter dated June 25, 2007.

Causes of the MADL exceedances are largely unknown. All compounds detected at concentrations greater than the MADL appear ubiquitous at low concentrations. However, potential sources are identified below:

- **Pentachlorophenol**. Leaching from wood utility poles (*i.e.*, wood treatment). Poles have been observed in the vicinity of all UIC locations with pentachlorophenol exceedances. Other potential sources include: common pesticide (*e.g.*, lindane, hexachlorobenzene) breakdown products, insecticides, fungicides, herbicides, preservative (*e.g.*, laundry starch), glues, paper coatings, inks, incineration of chlorine containing wastes, etc.
- **DEHP**. Auto exhaust, tires, auto belts, used oil, brake pads, vinyl upholstery, air deposition, packing peanuts, used oil, paints, leaching and/or incineration from flexible plastic, etc. Laboratory QC issues in Year 2 Events 2 and 4 indicate that some data may be unreliable or biased high (see Section 6 for further discussion of Year 2 DEHP QC issues).
- **Lead**. Auto batteries, tires, tire weights, etc.

Section 8.0 describes City actions taken in response to MADL exceedances.

7.1.2 Priority Pollutant Screen Analytes

The permit requires that detected PPS analyte concentrations are reported and that concentrations from each individual sampling event are compared to their respective MADLs in Years 1, 4, and 9. As described in Section 5.4.2, nine PPS compounds were tested and reported as part of the routine monitoring of common pollutants. Two PPS analytes were detected in Year 2: 2,4-D and chlorobenzene.

No individual PPS analytes were detected at concentrations exceeding their respective MADLs. The causes of the PPS analyte detections are largely unknown. Since the

concentrations of these analytes are significantly (<50%) less than their respective MADLs for all sampling events, source investigations have not been conducted. This decision is consistent with the PPS actions levels presented in Table 7-2.

Table 5-9 presents the maximum percent of the MADL detected for PPS analytes. Year 2 concentrations were <50 % of their respective MADL concentrations.

7.2 Calculation of Annual Mean

7.2.1 Method for Calculating Annual Mean Concentrations

The permit requires the annual mean MADL concentration be met at the EOP discharge point after any pretreatment best management practices (BMPs) or structural controls. DEQ considers using either a lognormal or geometric mean calculation to determine the "annual mean concentration" to be appropriate methodologies (DEQb, 2005). The method proposed to calculate the geometric mean is described in the QAPP. In calculating the annual geometric mean value, a method needed to be identified for addressing non-detected values. The QAPP identifies several methods that could be used, depending on the percentage of non-detected values and the amount of available data. Based on the considerations outlined in the QAPP, ½ the MRL was used for non-detected values in calculating the geometric mean. In general, all data were used. No individual data points were identified as outliers and omitted from the calculations.

The annual mean concentration was calculated for pollutants detected in at least one sampling event or individual sampling location at a concentration >50% of their respective MADLs. The annual mean concentration cannot theoretically exceed the MADL for analytes detected at concentrations less than 50% of the MADL. Annual mean concentrations were calculated for the following pollutants in Year 2:

- Pentachlorophenol;
- DEHP;
- Benzo(a)pyrene; and
- Lead.

The annual mean concentrations were not calculated for cadmium (detected at approximately 52% of the MADL) and chromium (detected at approximately 51% of the MADL). The Year 2 annual geometric mean concentration estimates for DEHP, benzo(a)pyrene, lead, and pentachlorophenol are presented in Table 7-3. Table 7-4 presents a more in-depth evaluation of the annual geometric mean for DEHP for selected Year 2 UIC monitoring locations. The in-depth annual geometric mean concentration estimates use:

- Estimated DEHP concentrations (*i.e.*, values reported between the MDL and MRL);
- BES resampling data from selected UIC monitoring locations; and

- Laboratory reanalysis results.

The data, listed above, provide a more accurate and reliable estimate of the annual mean concentrations than using ½ the MRL. The reevaluation of the DEHP annual mean concentration uses only data determined to be valid based on review of the DEHP data usability for Year 2 (see Appendix H) and therefore provides results with more certainty.

Tables 7-3 and 7-4 also present applicable pollutants MADLs, the annual arithmetic mean, minimum, and maximum concentrations for reference and comparison. It should be noted that the arithmetic mean can be biased toward higher pollutant concentrations by outlier data points. Because stormwater data usually does not conform to a normal distribution and outlier data may bias the mean, using an arithmetic mean may be inappropriate (DEQb, 2005).

7.2.2 Common Pollutants

The annual geometric mean concentration for benzo(a)pyrene was calculated for one UIC location, P6_1, and was 0.04 µg/L. This concentration is five times less than the MADL of 0.2 µg/L.

The annual geometric mean concentration for lead was calculated for 15 UIC locations where the concentration ≥50% of the MADL (50 µg/L) in at least one sample. The annual geometric means for these locations range from 6.8 to 25.4 µg/L. The geometric means were generally <50% of the MADL for Year 2.

The annual geometric mean concentrations for pentachlorophenol was calculated for 24 UIC locations where the concentration ≥50% of the MADL (1.0 µg/L) in at least one sample. The geometric mean concentration for nine UIC locations (P1_1, P2_5, P2_7, P2_13, P2_14, P6_2, P6_7, and P6_14) exceeded the MADL in Year 2. The annual geometric means for these locations range from 1.0 to 3.2 µg/L, slightly exceeding MADL.

The annual geometric mean concentration was estimated for 28 locations where the DEHP concentration ≥50% of the MADL (6 µg/L) in at least one sample using only the results of the event samples and duplicate samples. The annual geometric means for these locations range from 1.0 to 6.8 µg/L. The geometric mean for one UIC, P6_1 exceeded the MADL in Year 2 (see Table 7-3). It should be noted that the annual mean concentrations for P6_1 included the anomalous concentration from Event 1 (264 µg/L) and did not include the result of the BES resampling events, P6_1 sampling event, or the laboratory reanalysis of selected samples.

Table 7-4 presents a more detailed evaluation of the DEHP annual geometric means and arithmetic means for Year 2. This analysis is based on the results of the DEHP data

usability evaluation (see Appendix H). The geometric mean and the arithmetic mean were evaluated in more detail for nine UIC locations in which the estimated geometric mean in Table 7-3 exceeded 50% of the DEHP MADL. These UICs included: P6_1, P6_2, P6_12, P6_14, P2_2, P2_5, P2_10, P2_15, and SP1_7. The geometric mean estimates presented in Table 7-3 used data "as reported" by the analytical laboratory data (*i.e.*, data that were subsequently rejected due to QA/QC issues [See Section 6 and Appendix H]). The annual geometric means presented in Table 7-4 are based on DEHP data that were determined to be valid and usable (see Appendix H) and include additional sampling data (e.g., BES resampling data, laboratory reanalysis data). A summary of available DEHP data and the data used in the annual mean calculations is shown on Table 7-4. The detailed evaluation of the annual geometric means for DEHP in the nine locations range from 1.9 to 5.3 µg/L. Based on these estimated, the annual geometric mean concentrations for DEHP are generally <50% of the MADL, except for one UIC (P6_1) which is approximately 88% of the MADL in Year 2. Therefore, no additional action is necessary other than to continue monitoring. P6_1 will be monitored annually for the duration of the permit as part of the fixed panel.

7.2.3 Priority Pollutant Screen Analytes

Geometric means were not calculated for PPS analytes detected in Year 2 given that their annual means cannot theoretically exceed the MADL because their concentrations were significantly <50% of the MADL.

7.3 Evaluation of Year 2 Results

This section evaluates Year 2 data using statistical and graphical methods to look for potential differences or similarities between sample panels, sampling events, and traffic categories. These methods are described in the following sections. Analytical results for Year 2 are introduced in Section 5.

7.3.1 Box Plots

Box plots were selected to present the results of selected analytes for Year 2. Box plots are an effective way to convey information that otherwise might require multiple graphs (such as contaminant concentration as a function of sampling location and traffic category). The statistical distribution of a given data set can be illustrated through use of a box plot. In general, box plots are a convenient way to graphically depict the range of stormwater concentrations, percentiles (25th, 50th, 75th), skewness, and identify outliers. Figure 7-1 illustrates and defines the components of a box plot.

Presenting box plots side-by-side allow both the general magnitude of the observations (*i.e.*, stormwater concentrations) in each plot to be ascertained and general comparisons to be made regarding the data sets.

Box plots were prepared only for analytes detected in Year 2 where the stormwater concentration in at least one sampling event was detected at a concentration ≥50% of the MADL. As identified previously in this section, six pollutants were detected in Year 2 at concentrations ≥50% the MADL including: pentachlorophenol, cadmium, chromium, lead, benzo(a)pyrene, and DEHP. Of these, cadmium, chromium, and benzo(a)pyrene did not exceed the MADL in any samples in Year 2.

Box plots showing the concentrations of pentachlorophenol (Figure 7-2), cadmium (Figure 7-3), chromium (Figure 7-4), lead (Figure 7-5), benzo(a)pyrene (Figure 7-6), and DEHP (Figure 7-7) concentrations were prepared using Year 2 stormwater discharge data, including non-detect values. Concentrations reported as non-detect (<MRL) used the MRL to generate the box plots. Figures were prepared to illustrate analyte concentrations by traffic category (*i.e.*, <1,000 TPD, ≥1,000 TPD). The following general observations are made regarding these figures:

- Pentachlorophenol, cadmium, chromium, lead, benzo(a)pyrene, and DEHP concentrations generally appear to be lognormally distributed. However, several plots are skewed by the nondetect values (*e.g.*, chromium, benzo(a)pyrene, DEHP).
- The ≥1,000 TPD traffic category has a slightly higher mean and median concentration than the <1,000 TPD category for the pollutants evaluated.
- The means, medians, and geometric means of the pollutants evaluated are, in general, <50% of their respective MADLs.
- Some individual event concentrations detected above their respective MADLs are identified as potential outliers by the box plot methodology (*e.g.*, chromium, benzo(a)pyrene, DEHP).

A box plot of Year 2 TSS concentrations is presented in Figure 7-8. The average and geometric mean were calculated for Year 2 TSS data by traffic category. The ≥1,000 TPD traffic category average and geometric mean concentrations were in general about three times higher than the concentrations in the <1,000 TPD traffic category.

A box plot of Year 2 dissolved lead concentrations is presented in Figure 7-9. This figure illustrates the very narrow concentration range for dissolved lead.

7.3.2 Individual UIC Location Concentration Data by Sampling Event

Dot plots (*i.e.*, Trellis Displays) were prepared for pentachlorophenol (Figure 7-10), chromium (Figure 7-11), lead (Figure 7-12), benzo(a)pyrene (Figure 7-13) and DEHP (Figure 7-14). These plots depict the concentration for each UIC sampling location in Year 2 by sampling event and traffic category. The UIC locations on these plots are ordered according to increasing average concentration along the *x*-axis. These plots show the concentration of pollutant at an individual UIC for each sampling event (*i.e.*, 1, 2).

Concentrations reported as non-detect (<MRL) were plotted at the MRL. The following general observations are made regarding these plots:

- The majority of individual sample concentrations (by event and by location) are below the applicable MADL.
- Concentrations at most individual UIC locations are within a narrow concentration range.
- Concentrations appear slightly higher in UICs categorized as ≥1,000 TPD.
- Benzo(a)pyrene was frequently not detected. Benzo(a)pyrene was only detected in one sample (P6_1) at a concentration ≥50% the MADL.
- Five UIC discharge sample concentrations exceeded the MADL for lead (50µg/L) in Year 2. Exceedances were observed in three separate monitoring events and four UIC locations.
- Higher DEHP concentrations were detected in Events 2 and 4 than other sampling Year 2 Events. As discussed in Section 6, laboratory QC issues in Events 2 and 4 indicate that some data may be unreliable or biased high.
- No consistent pattern in stormwater concentration between events is observed for the five pollutants plotted (*i.e.*, concentrations are not consistently higher or lower in a given event).

Figure 7-15 presents the concentration for each UIC sampling location in Year 2 by sampling event and traffic category for dissolved lead. Dissolved concentrations are significantly less than the MADL and the total lead concentrations depicted in Figure 7-5. Figure 7-15 shows that for many UIC monitoring locations that the dissolved lead concentrations were highest in the first sampling event. However, there is not a consistent ordering of dissolved lead concentrations by event in the Year 2 data.

7.3.3 Year 2 Concentration Data by Sampling Event

A box plot showing the concentrations of pentachlorophenol (Figure 7-16) by sampling event was prepared using Year 2 stormwater discharge data, including non-detect values. These box plots were generated using data from 41 UIC monitoring locations for each sampling event. Concentrations reported as non-detect (<MRL) used the MRL to generate the box plot. The following general observations are made regarding this plot:

- Event concentrations are lognormally distributed.
- Concentrations between sampling events are very similar.
- The majority of individual sample concentrations (by event and by location) are below the MADL.

7.3.4 Year 2 Concentration Data by Sampling Panel

Box plots showing the concentrations of pentachlorophenol (Figure 7-17), lead (Figure 7-18), and DEHP (Figure 7-19) by sampling panel were prepared using Year 2 stormwater discharge data, including non-detect values. These box plots were generated using one UIC location for Panel 1; 15 UIC locations for Panels 2 and 6; and ten UIC locations for the supplemental panel. It should be noted that the box plot for Panel 1 was created using only five sample data points. The following general observations were made regarding these plots:

- Panel concentrations are generally lognormally distributed.
- Concentration distributions are skewed by the non-detect values.
- Concentrations between sampling panels are very similar.
- The majority of individual sample concentrations (by event and by location) are below the MADL.

7.4 UIC Stormwater Infiltration Volumes

The permit requires that the annual SDM report provide information on the total volume of recharge (*i.e.*, stormwater infiltration) to the subsurface (*i.e.*, aquifer) from City-owned UICs. This section describes the methods used to estimate the volume of water infiltrated to City-owned UICs.

7.4.1 City-owned UIC Systemwide Infiltration Volume

BES estimated the catchment area (*i.e.*, basin drainage area) and impervious surface area (*e.g.*, roofs, parking lots, streets) for each known and active City-owned UIC. The impervious portion is the area of the UIC basin area assumed to provide stormwater runoff to the UIC. It was conservatively assumed that all of the impervious areas identified directed stormwater only to the subject UIC (*i.e.*, no infiltration into pavement, no infiltration into unpaved or curbless areas).

The equation used to calculate infiltration volume for each UIC is:

Infiltration Volume (cubic feet) = AP x (1ft/12 inches) x IA x LE (1)

Where:

AP = Annual Precipitation (inches)
IA = Impervious Area within UIC catchment (square feet)
LE = Loss to evaporation (1.0 – ELF)

Where:

ELF = Evaporative loss factor assumed to be 26% (0.26) (Snyder *et al.*, 1994)

Table 7-5 summarizes the total estimated stormwater infiltration volumes calculated for the city-owned UIC system for Years 1 and 2.

The total volume of stormwater infiltration was estimated using precipitation measurements from the Portland International Airport. Precipitation measurements for the periods between June 1 and May 30 for Year 1 (2005 – 2006), Year 2 (2006 – 2007), and the estimated long-term annual precipitation total are presented in Section 5.2. The total precipitation totals for these three periods were 42.77, 34.41, and 37.08 inches, respectively.

UIC drainage (*i.e.*, catchment) areas were estimated using a geographic information system (GIS). The total potential area of an individual UIC catchment and its related impervious area were estimated using an automated delineation routine. Delineations were performed using the Hydrology toolset in ArcGIS™ Spatial Analyst and a digital elevation model (DEM) with 5-foot elevation contours. The Hydrology toolset includes the tools required to delineate drainage areas using the Deterministic-8 Node (D8) algorithm. This algorithm requires each grid cell to flow into only one of its eight neighboring cells, and must follow the path of steepest descent (O'Callaghan and Mark, 1984). While this method has been used extensively for watershed-scale delineations, certain pre-processing steps were taken to modify this method to account for an urban drainage context. These modifications included the following:

- Five-foot interval point elevation data were converted to ArcGIS GRID format.
- Catch basins (inlets) draining to UICs were identified.
- Elevation corrections were applied (fill sinks, account for water bodies, create stream channels using street surface GIS coverage, and direct flow patterns toward inlets, etc.).

A number of the delineated drainage areas contained more than one UIC. When this was the case, the effective drainage area was assigned to an individual sump and the other sumps were removed from the calculation. Approximately 699 UIC sumps (~8% of city-owned UICs) were identified and removed in this category.

Based on these calculations, the City-owned UICs drain a total area of approximately 629,800,000 square feet (14,500 acres), of which approximately 223,500,000 square feet (5,130 acres) is impervious. Using these values, approximately 35% of the drainage area is considered impervious. The average area drained by a UIC system in the City of Portland was estimated to be approximately 81,500 square feet (1.9 acres), of which an average 35 percent or 28,900 square feet (0.7 acres) is impervious. The stormwater infiltration volumes for the City's UIC system were estimated to be approximately:

- 589 million cubic feet (4.4 billion gallons) in Year 1 (July 1, 2005 through May 30, 2006); and
- 474 million cubic feet (3.5 billion gallons) in Year 2 (July 1, 2005 through May 30, 2006).

The simplified method for calculating runoff used in this report assumes that all rain that falls on impervious areas becomes runoff and all rain that falls on pervious areas does not. *The method used to estimate stormwater volume described above is believed to yield a conservative estimate of stormwater infiltration volumes*. There are a number of uncertainties inherent in both the underlying information and method used to estimate the stormwater infiltration volume at each UIC. Uncertainties in the estimates may also be due to one or more of the following assumptions:

- All stormwater runoff from identified impervious areas is assumed to enter the UIC. This assumption overestimates the recharge volume.
- The evaporative loss factor was assumed to be constant. This value may vary due to weather conditions (ambient air temperature, impervious surface temperature, rainfall intensity, rainfall duration, land surface topography, impervious surface type and condition).
- Annual precipitation was based on data collected at the Portland International Airport. Total rainfall amounts are known to vary across the Portland metropolitan area. A constant precipitation rate may result in either an overestimate or underestimate of stormwater infiltration volume.
- Storm duration and intensity (longer storms will have a higher runoff percentage, as will more intense storms; storm intensity in the Portland area is usually not very high).
- Antecedent conditions (there will be more runoff if the ground/pavement is already saturated).
- Vegetative cover was not included in the stormwater infiltration estimates and therefore infiltration volumes may be overestimated. The effects of vegetative cover would vary seasonally (*e.g.*, summer versus winter) and spatially (*e.g.*, areas with high density of evergreen trees, areas with significant tree cover over roads, neighborhoods with no mature trees).
- Topography (flat areas will generally retain more water than steep slopes).

7.4.2 Year 2 Sampling Locations

BES estimated the catchment area (*i.e.*, basin drainage area) and impervious surface area (*e.g.*, roofs, parking lots, streets) for each of the 41 UICs sampled in Year 2 (*i.e.*, Panels 1, 2, 6 and the Supplement UIC panel), as described in Section 7.4.1. It was conservatively assumed that all of the impervious area identified was assumed to direct stormwater only to the subject UIC.

The equation (1) presented in Section 7.4.1 was used to calculate infiltration volume for each UIC sampled in Years 1 and 2.

The total amount of precipitation used in estimating the infiltration volumes was based on measurements during Year 1 (2005 – 2006) and Year 2 (2006 – 2007) and the estimated long-term annual precipitation total, as described in Section 5.2.

The estimated stormwater infiltration volumes calculated for each UIC panel sampled in Year 2 are presented in Table 7-6 for Panel 1, Table 7-7 for Panel 2, Table 7-8 for Panel 6, and Table 7-9 for the Supplemental Panel. Table 7-10 summarizes the infiltration volume estimates for each panel and UIC catchment characteristics.

The total panel drainage areas ranged between 1.1 and 1.7 million square feet of which between 0.3 and 0.7 million square feet where estimated to be is impervious. The range of impervious area ranged between 27 and 43%. The estimated stormwater infiltration volumes ranged between 0.7 (ten supplemental locations) and 1.6 (Panel 6) million cubic feet of water in Year 2.

The uncertainty factors identified in Section 7.4.1 are also applicable to these stormwater infiltration estimates. The method used to estimate stormwater volume described above is believed to yield a conservative estimate of stormwater infiltration volumes.

Section

8

8 Response Actions

This section presents a summary of the actions taken during the Year 2 wet season (October 2006 – May 2007) to further understand pollutant sources, to prevent pollutants of concern from exceeding respective MADLs, and to respond to conditions identified during implementation of the stormwater discharge monitoring program.

8.1 Source Investigations

8.1.1 Supplemental Panel Location Investigation (SP1_1)

In September 2006, pre-sampling inspections were performed in accordance with the SDMP of the UICs locations selected for the supplemental monitoring panel. The UIC originally selected as SP1_1 is located near 9204 SE Mitchell Street. This UIC was not included in the final Year 2 supplemental panel since it was determined it did not receive stormwater from a high traffic street. During the inspection an odorous turbid liquid was observed in the sedimentation manhole and the response described in the following paragraphs was initiated.

Field Inspection. On September 14, 2006, City WPCL staff visited the UIC location and made the following observations:

- The UIC is located on SE Mitchell Street near its intersection with SE 92nd Street. The UIC system is located in a residential neighborhood.
- Two catch basins capture stormwater. A sedimentation manhole provides stormwater pretreatment.
- A greenish white opaque material was noted in the sedimentation manhole and a catch basin. Field staff indicated that paint thinner was likely dumped in one catch basin.
- The UIC captures most of its stormwater flow from a low traffic (<1,000 TPD) street. Therefore, this location was removed from the supplemental panel and replaced with a UIC that is representative of the high traffic category.

Field Investigation. This investigation included the following:

- A grab sample of the standing water in the sedimentation manhole was collected on September 14, 2006, in general accordance with the SDMP. This sample was identified as SPO_3_SM and was submitted for the following laboratory analyses:
  - Oil and grease (EPA 1664 and EPA 1665);
  - Volatile Organic Compounds (EPA 8260);
  - Chlorinated Herbicides (EPA 515.3); and

- PAHs and phthalate (EPA 8270M-SIM).

- The UIC system (inlets, sedimentation manhole, and UIC) was cleaned by the City's response contractor on September 20, 2006.
- A stormwater sample was collected in accordance with the SDMP on October 15, 2006 during Event 1. The UIC was scheduled for sampling in Event 1 to document the effectiveness of the response action. This sample was identified as SPO_3EV1.

Results. The results of the sedimentation manhole grab sample are summarized in Table 8.1. The results of the Event 1 stormwater discharge monitoring are summarized in Table 8.2.

- *Sedimentation Manhole Grab Water Sample*: Three common pollutants were detected in this sample. The DEHP concentration of 15.5 µg/L exceeded the MADL. Six ancillary concentrations were detected including acetone and methylene chloride at notable concentrations. In addition, total petroleum hydrocarbons [(TPH) in the gasoline range (Gx) and motor oil range] and oil and grease were measured at elevated concentrations. The detected pollutants are consistent with a discharge of paint thinner. Following collection of this sample, the UIC system (inlets, lines, sedimentation manhole, UIC sump) was cleaned.
- *Event 1 Stormwater Discharge Sample*: A stormwater discharge sample was collected during Event 1 to demonstrate that the UIC cleaning was effective in reducing pollutant concentrations. Nine common pollutants (including six metals) and two PPS analytes were detected in the sample at concentrations significantly below their respective MADLs. Nine ancillary pollutants were detected at concentrations less than 0.0339 µg/L; the ancillary pollutants are PAH compounds and are likely associated with worn asphalt, worn tires, oil drippage, etc. The volatile organic compounds detected in the sedimentation manhole grab sample were not detected in this sample. The estimated separation distance in this UIC is estimated to be approximately 49 feet (*i.e.*, separation distance is the distance between the bottom of the UIC perforations to the approximate seasonal-high groundwater level). It is assumed that the paint thinner release was likely a *de minimus* volume. Based on the separation distance, *de minimus* volume, UIC cleaning, and Event 1 stormwater discharge results, no additional response was determined to be warranted at this location.

8.1.2 Supplemental Panel Location Investigation (SP1_5)

During Event 1 sampling of SP1_5, a supplemental monitoring panel UIC, a leaking transformer was observed near a UIC stormwater inlet. City staff notified PGE of the transformer release.

Field Inspection. On October 30, 2006, City WPCL staff visited the UIC location and made the following observations:

- The UIC is located near 13743 NE San Rafael Street in a residential neighborhood.
- Utility poles were observed on the north side of San Rafael Street.
- The subject utility pole and transformers and UIC inlet are located in front of 13725 NE San Rafael Street. The soil, street, and retaining wall are stained by transformer oil.
- The UIC system is located in a residential neighborhood.
- Two catch basins capture stormwater. A sedimentation manhole provides stormwater pretreatment.
- A private block retaining wall has been built over a portion of the subject UIC inlet.
- A sheen was observed on stormwater entering the system.

Field Investigation. This investigation included the following:

- PGE was notified and requested to clean up the spill. PGE responded and cleaned up the spill on November 1, 2007. The transformers were replaced.
- A stormwater sample was collected in accordance with the SDMP on October 19, 2006 during Event 1. Due to the potential presence of polychlorinated biphenyls (PCBs) in the transformer fluids, PCBs were analyzed during Event 1 using EPA Method 8082.

Results. The results of the investigations are summarized in Table 8.3.

- *Event 1 Stormwater Discharge Sample*: Eight common pollutants and one PPS analyte were detected in the sample at concentrations significantly below their respective MADLs. One ancillary pollutant was detected at a concentration less than 0.022 µg/L. PCBs were not detected. Based on these results, no additional response was determined to be warranted at this location.

8.1.3 P6_1 DEHP Assessment

8.1.3.1 Sedimentation Manhole Water Grab Sample

Event 1 stormwater results from UIC monitoring location, P6_1, detected DEHP at a concentration of 264 µg/L. This concentration is significantly above the applicable MADL and concentrations of DEHP measured detected in Year 1 monitoring. The concentration was considered anomalous and identified as a potential Year 2 outlier. As a result of the Event 1 result, a field investigation was initiated at P6_1, located near 3500 SE 112th Avenue. This investigation is described below.

Field Inspection. On December 21, 2006, City staff visited the UIC location. During the site inspection the following observations were made:

- The UIC is located on 112th Avenue near its intersection with Southeast Powell Boulevard. The UIC system is adjacent to a commercial automotive battery retailer, Battery Specialist, and a church.
- Two catch basins capture stormwater; one adjacent to the church and one adjacent to the Battery Specialist facility. A sedimentation manhole provides stormwater pretreatment.
- Drainage on Southeast Powell Boulevard (>25,000 TPD) drains to the east away from the subject UIC.
- Utility poles were observed on the west site of 112th Street.

Field Investigation. A field investigation was performed to assess potential source(s) of DEHP detected in the Event 1 stormwater sample from P6_1. This investigation included the following:

- Inspected the two inlets into the UIC system and assessed the amount and types of debris and/or sediment present in the catch basins.
- Opened the sedimentation manhole and collected a grab sample of the standing water for analyses of DEHP (EPA Method 8270M-SIM) and pentachlorophenol (EPA 515.3). This sample was collected on December 27, 2006.
- Samples were collected, in general accordance, with the SAP and maintained in a cooler at 4°C and under COC procedures.

Results. No obvious sources of DEHP were identified during the investigation (*e.g.*, used oil, plastics). The water results are presented in Table 8.4. DEHP was detected in the grab sample at a concentration of 1.31 µg/L; significantly, less than the previous Event 1 detection and the MADL. The sedimentation manhole grab sample was collected 66 days following collection of the Event 1 UIC sample (October 2, 2006). Pentachlorophenol was detected at a concentration of 1.06 µg/L, which was very similar to the detection during Event 1 of 1 µg/L. Based on these results, no additional response actions were taken.

8.1.3.2 P6_1 Event 1 Stormwater Discharge Resample

As discussed in Section 8.1.3.1, the Event 1 sampling for DEHP (264 µg/L) was considered anomalous and identified as a potential Year 2 outlier. Therefore, P6_1 was resampled in accordance with the SDMP on May 2, 2007. The purpose of the resample was to assure that if the Event 1 value was determined to be an outlier, that the minimum number (*i.e.*, five) individual stormwater samples were available for determining the annual mean concentration.

The resample results are presented in Table 8.5. DEHP was detected in the sample at a concentration of 1.57 µg/L, less than the MADL. This concentration was significantly less than the previous Event 1 detection and similar to the Event 4 concentration. Pentachlorophenol was detected at a concentration of 2.38 µg/L. This concentration was approximately twice the concentration detected during Event 1.

8.1.4 Fixed Panel Location Investigation (P6_3)

In April 2006, during Event 5 sampling activities, field sampling staff identified a release to P6_3, located at 4541 NE 80th Avenue (near the location of NE 80th and NE Prescott). The release was identified during stormwater-sampling activities due to a petroleum hydrocarbon odor emanating from the UIC sump and sedimentation manhole. A water sample was collected and the odor was noted by sampling staff.

Field Investigation. A field investigation was performed to assess potential paint waste disposal to sampling location P6_3. This investigation included the following:

- The UIC system (inlet, sedimentation manhole, and UIC sump) was inspected.
- An Event 5 stormwater discharge sample was collected on April 18, 2007, in accordance with the SDMP and analyzed for common pollutants.
- A grab sample from the sedimentation manhole was collected on April 19, 2007, prior to UIC system cleaning and analyzed for:
  - TPH (NWTPH Methods);
  - Volatile Organic Compounds (EPA 8260);
  - Total Metals (EPA 200.8) including arsenic, cadmium, chromium, copper, lead, and zinc;
  - PAHs and Phthalates (EPA 8270M-SIM); and
  - Oil and Grease (EPA 1664).
- This UIC system was cleaned on April 19, 2007 by the City's response contractor.

Results. Field staff noted that paint staining was present in the only catch basin that leads to this UIC system. The bottom of the catch basin had dried white-green paint, but the sedimentation manhole did not appear to have any whitish color, indicating that paint had not recently been dumped. There was a sheen present on the surface of the water in the sedimentation manhole, as well as in the sample water collected falling into the UIC sump. The odor was described by field staff as possibly being related to oil-based paint or paint thinner, but could not be specifically identified. The results of the investigation are summarized in Table 8.6.

- *Sedimentation Manhole Grab Water Sample*: TPH in the gasoline range was detected at a concentration of 84 milligrams per liter. Seven common pollutants were detected in the sample at concentrations significantly below their respective MADLs including toluene (17.9 µg/L) and xylenes (0.543 µg/L). Toluene was detected at a concentration < 2% of its MADL. Four ancillary pollutants were detected at concentrations less than 0.9 µg/L.

- *Event 5 Stormwater Discharge Sample*: Eight common pollutants and two PPS analytes were detected in the sample at concentrations significantly below their respective MADLs. Three ancillary pollutants were detected at concentrations less than 0.41 µg/L; the ancillary pollutants are PAH compounds and are likely associated with worn asphalt, worn tires, oil drippage, etc. Based on these results, no additional response was determined to be warranted at this location.

It should be noted that the Event 5 samples were collected immediately after discovering the release to the UIC catch basin and the sedimentation manhole grab sample was collected the following day prior to system cleaning. MADLs were not exceeded in either sample. Based on these results, no additional response was determined to be warranted at this location.

8.1.5 Event 5 DEQ Split Samples

Laboratory QC issues were initially identified for DEHP analyses by TA, the City's contract laboratory. Random and sometimes pervasive QC issues were encountered throughout the first four monitoring Events of Year 2. During this period, TA initiated internal investigations and implemented corrective actions to identify and eliminate potential sources of laboratory contamination (See Section 6, Appendix H and Appendix G). Laboratory QC issues included glassware preparation, method blank contamination, laboratory control sample (LCS) and matrix spike (MS) over-recoveries, and gross field duplicate precision failures.

These issues resulted in a high bias to sample concentrations in a significant portion of the Year 2 data. Documented laboratory QC issues have also resulted in DEHP exceeding the MADL during individual monitoring events. Laboratory issues and potential next steps were discussed by BES representatives, Rodney Weick (DEQ UIC permit manager), and representatives of TA and the DEQ laboratory on April 9, 2007.

Pursuant to the meeting, split samples were collected from Panel 6 locations during Event 5 and submitted to both DEQ's analytical laboratory and TA for DEHP analyses. Split samples for this investigation are defined as two or more representative portions taken from one sample in the field and analyzed by different laboratories. Split samples are QC samples that are used to assess analytical variability and comparability.

Investigation. Split samples were collected concurrent with Event 5 samples. Sample bottles for submittal to DEQ and TA were filled concurrently. Water from each grab sample was divided between all the bottles required for DEHP analyses. Samples were collected in accordance with the SDMP.

Results. DEQ laboratory reports are presented in Appendix C and are discussed in Appendix H. Split sample results from TA and DEQ are summarized in Table 8.7. TA reported Event 5 DEHP concentrations for Panel 6 to range between <0.521 µg/L and 3.05 µg/L. DEQ

reported DEHP concentrations ranging between 1 µg/L and 25 µg/L. DEQ reported laboratory DEHP concentrations are general slightly higher that those reported by TA.

The relative percent difference between the DEQ and TA DEHP results were calculated to quantify the difference between the two samples. RPD results are presented in Table 8.7. The RPD's range between approximately -11 and +184 percent. Seven (7) RPDs are within the acceptance criteria (± 50%) identified in the QAPP. Three (3) RPDs which exceed the acceptance criteria are for low-level concentrations and are within 5 times the method detection limit. The results for DEQ P6_7 and P6_8 results appear to be outliers. The results are considered generally comparable.

DEQ laboratory results are presented and used for comparison purposes only in this report. Data validation was not performed for the DEQ data set as laboratory QC packages were not included with the lab reports.

8.2 Pentachlorophenol Response Actions

8.2.1 Pentachlorophenol Baseline Evaluation

As discussed in Sections 3 and 5, pentachlorophenol is detected in up to 90% of the Year 1 and Year 2 UIC stormwater discharge samples. Additional UIC sampling was performed to assess whether pentachlorophenol is detected in stormwater discharges to UICs that do not have wood-treated utility poles within their drainage basins. The presence of pentachlorophenol in these samples might suggest additional sources (*e.g.*, air deposition, household sources, etc).

Field Inspection. Tentative UIC basins without above ground utilities were identified using aerial photographs. Five UICs were selected for sampling, based on the field verification performed in January 2007. Characteristics of the five selected UICs are summarized in Table 3.6 and their locations shown in Figure 3.4. These UICs are all located in low traffic (<1000 TPD) residential areas.

Field Investigation. Samples from these UICs were collected in accordance with the SDMP. Samples were collected once during Event 3.

Results. The results of the pentachlorophenol baseline investigation are presented in Table 8.8. In addition, Event 3 results for two UIC sampling locations, P2_15 and P6_6 are included in this table. These two locations also do not to have wood treated utility poles within their drainage catchments. Pentachlorophenol was not detected in these seven sample locations. Two UIC locations had no detections of PAHs, DEHP, or pentachlorophenol. DEHP was detected in three out of seven locations with a maximum concentration of 2.69 µg/L (<50% of the MADL). Up to 11 ancillary pollutants were detected at concentrations less than 0.08 µg/L; the ancillary pollutants are PAH compounds and are likely associated with worn asphalt, worn tires, oil drippage, etc.

8.2.2 Pentachlorophenol Pathway Evaluation

Pentachlorophenol was detected above the MADL in Year 1 of the UIC Stormwater Discharge Monitoring Program. Year 1 annual mean concentrations, at five locations (P1_1, P6_1, P6_7, P6_8, P6_14), exceeded the MADL. The permit requires the City to take response actions the following year to address the MADL exceedance in these UICs. The purpose of this evaluation is to assess potential source(s) of pentachlorophenol and potential contaminant migration pathways.

Field Investigation. The basic scope of the investigation includes evaluating and documenting wood-treated utility poles as a source of pentachlorophenol in stormwater discharged to UICs. The pathway analysis involves collection of samples from each of the five UIC monitoring locations listed above and included in the stormwater discharge monitoring program in Years 1 and 2. At each of the five locations, the following types of samples were collected, to the extent practicable:

- Treated-wood utility pole wipe samples (located near catch basins or inlets);
- Soil at the base of treated-wood utility poles (if adequate volume is available);
- Solids from catch basins (if adequate volume is available);
- Curb sweeping solids samples (if adequate volume is available); and
- Sedimentation manhole solids sample.

Results. Pentachlorophenol pathway samples were collected in late May 2007. Analytical results are not available for inclusion in this report. Results will be submitted to DEQ in either the *Annual UIC Management Plan Report* (to be submitted in November 2007) or in technical memorandum.

8.2.3 Pentachlorophenol - Filtered Stormwater Discharge Samples

As discussed in Section 8.1.5, pentachlorophenol has been detected above the MADL in numerous Year 1 and Year 2 samples collected for the UIC Stormwater Discharge Monitoring Program. The permit requires the City to take response actions the following year to address the MADL exceedance in these UICs. The purpose of this investigation was to assess if pentachlorophenol is entering the UIC system in a dissolved phase (***i.e.***, filtered) or associated with stormwater solids (***e.g.***, particulates).

Field Investigation. Field filtering of stormwater samples was conducted at three locations: P1_1 (6940 N. Macrum Avenue); P2_5 (10150 SE Ankeny Street); and P6_7 (607 NE 87th Avenue). These locations were selected based on the consistency and concentration of pentachlorophenol detections. During Event 5, additional sample volume was collected and field filtered using the procedure described below. Filtered samples were submitted for chlorinated herbicide analyses (EPA Method 515.3).

Whole water samples were collected from each UIC using a decontaminated stainless steel beaker. Whole water samples were poured into a decontaminated filtering apparatus that consisted of the following:

- Gelman Sciences stainless steel 1-liter parabola 47 millimeter (mm) filter holder;
- No. 8 rubber stopper:
- 47 mm TCLP binderless glass fiber filter;
- 1-liter Erlenmeyer filter flask; and
- Peristaltic pump and associated tubing.

The peristaltic pump was used to create a vacuum in the filter flask to facilitate filtration of the whole water sample. Due to the presence of solids in the whole water sample, the 47 mm glass fiber filter had to be changed several times during the filtering process in order to obtain the one liter of filtered water required for sample analysis. Filters were carefully handled by their edges with clean, fresh latex-gloved fingers during each filter replacement. Upon filtration, samples were poured from the filter flask into two 500 ml amber glass bottles containing sodium thiosulfate preservative, then placed in chilled coolers for transport. One equipment blank was collected in the field using the same technique.

Results. Pentachlorophenol was detected in both filtered and unfiltered samples. Results are presented in Table 8.9. The ratio of the filtered sample concentration to the unfiltered sample concentration ranged from 75% to 207%. The higher ratio may be due to problems associated with the field filtration or variation in the stormwater discharge. Two compounds, 2,4-D and Bentazon, were detected in two unfiltered samples and were not detected in their respective filtered sample.

8.2.4 Pentachlorophenol Fate and Transport Analyses

Pentachlorophenol was detected above the MADL in Years 1 and 2 of the UIC Stormwater Discharge Monitoring Program. Annual mean concentrations, at five locations (P1_1, P6_1, P6_7, P6_8, P6_14) exceeded the MADL in Year 1. The permit requires the City to take response actions the following year to address the MADL exceedance in these UICs. This analyses will be used to assess if pentachlorophenol is adversely impacting groundwater quality.

Scope of Analyses. The fate and transport of pentachlorophenol will be assessed following the steps outlined in the UIC Evaluation and Response Guidelines (UICER) presented in the *UIC Management Plan* (December 1, 2006). Specific activities include:

- Prepare a conceptual site model (CSM) of potential transport pathways for pentachlorophenol discharge to a UIC; and
- Assess the fate and transport of pentachlorophenol in the vadose zone (unsaturated soil), discharge into groundwater (dilution), and migration in groundwater (dilution, advection, biodegradation, etc.).

Results. The results of the pentachlorophenol fate and transport analyses are not available for inclusion in this report. The City met with DEQ on June 28, 2007 to discuss the general approach for this analysis. Subsequent meetings will be held to discuss specific modeling input parameters over the next several months. Available results will be summarized in either the *Annual UIC Management Plan Report* to be submitted in November 2007 or a technical memorandum.

8.2 UIC System Cleaning

As a result of observations during pre-sampling inspections or during stormwater event sampling, the City's UIC program requested that the City Bureau of Maintenance crews or the City's response contractor clean selected UICs. Cleaning activities were performed in general accordance with the *Surface Stormwater Facilities Maintenance Management Manual* (prepared for BES by Brown and Caldwell, April 1997) and UIC Management Plan (UICMP, submitted to DEQ in December 2006). In general, the following steps were performed:

Inlet(s)/Catch Basin(s):

- Check the amount of trash, debris, and/or sediment in the inlet or catch basin;
- Manually clean the inlet;
- Jet inlet or catch basin and associated lines with clean water; and
- Report: a) Number of inlets cleaned, b) Amount and type of debris removed, c) Linear feet of lines cleaned, and d) Any evidence of contamination.

Sedimentation Manhole:

- Examine area for signs of contamination;
- Check the amount of sediment in the manhole(s);
- Check for plugging of the manhole inlet(s) to sedimentation manhole or outlet to infiltration sump;
- Use vactor truck to pump water and debris from the manhole;
- Pressure wash/hose down sides of manhole and jet inlets and outlet;
- Use vactor truck to pump rinse water; and
- Report: a) Number of sedimentation manholes cleaned, b) Amount and type of debris removed, and c) Any evidence of contamination.

Infiltration Sump:

- Examine area for signs of contamination;
- Check the amount of sediment in the infiltration sump(s);
- Check for plugging of the sump inlet(s);

- Use vactor truck to pump water and debris from the sump;
- Pressure wash/hose down sides of sump and jet inlets;
- Use vactor truck to pump rinse water; and
- Report: a) Number of infiltration manholes cleaned, b) Amount and type of debris removed, and c) Any evidence of contamination.

The following UICs were cleaned due to debris in the sedimentation manhole or inlets prior to Year 2 sampling:

UIC Identification	**Date Cleaned**
P2_5	September 20, 2006
	December 21, 2006
P2_6	September 20, 2006
P2_14	September 20, 2006
SP1_1	September 20, 2006

The following UICs were cleaned due to observations during pre-sampling inspections or sampling events (See Section 8.1):

UIC Identification	**Date Cleaned**
SP1_1 (original)	September 20, 2006
P6_3	April 19, 2007

Section 9

9 Preliminary Trend Analyses

9.1 General

This section presents Year 1 and 2 stormwater discharge monitoring data using statistical and graphical methods to identify potential differences or similarities between permit years, traffic categories, and monitoring panels. Analytical results for Year 2 are introduced in Section 5. Year 1 results are presented in the *Annual Stormwater Discharge Monitoring Report – Year 1 – October 2005 – May 2006* submitted to DEQ in July 2006.

Box plots were prepared to present the results of selected analytes for Years 1 and 2. The box plots for Years 1 and 2 are presented side-by-side to allow both the general magnitude of stormwater concentrations and distribution in each plot to be viewed and to allow general comparisons to be made regarding the data sets.

Box plots were prepared for selected analytes detected in Years 1 and 2. In general, plots were prepared for pollutants where the stormwater concentration in at least one sampling event was detected at a concentration ≥MADL. These box plots were generated using all Year 1 and Year 2 data, including values reported by the analytical laboratories as "non-detect" and flagged data. Concentrations reported as non-detect (<MRL) were replaced with a value equal to the MRL in order to generate the box plots.

Additional data evaluation and analysis may be conducted and discussed in the annual UICMP report, as appropriate. The annual UICMP report is submitted to DEQ in November of each permit year.

9.2 Permit Year

Box plots were prepared to allow the comparison of stormwater discharge concentrations of selected analytes by permit year (*i.e.*, Years 1 and 2). Figures 9-1 through 9-5 present the box plots comparisons for pentachlorophenol, lead, DEHP, TSS, and dissolved lead, respectively. The following general observations are made regarding these figures:

- Pentachlorophenol, lead, DEHP, and TSS are lognormally distributed.
- Concentration ranges and distribution are very similar between Years 1 and 2.
- Annual mean, median, and geometric mean concentrations of the compounds evaluated are, in general, <50% of their respective MADLs for both years.
- Year 2 median concentrations of the compounds evaluated are slightly higher than Year 1 median concentrations (likely due to the heavier weighting of ≥1,000 TPD traffic category in Year 2; see Section 3).

- Dissolved lead concentrations appear lognormal but are skewed towards the non-detect values.
- Potential outliers are present in DEHP data for both years.

9.3 Traffic Categories

Box plots were prepared to compare the concentrations of selected analytes by traffic category (*i.e.*, <1,000 TPD, ≥1,000 TPD) for Years 1 and 2. Figures 9-6 through 9-8 present the box plots for pentachlorophenol, lead, and DEHP, respectively. The following general observations are made regarding these figures:

- For each permit year, both traffic categories have similar concentration ranges.
- Concentrations for both traffic categories have lognormal concentration distributions.
- Annual mean, median, and geometric mean concentrations of the compounds evaluated are, in general, <50% of their respective MADLs.
- The ≥1,000 TPD traffic category has slightly higher mean, geometric mean, and median concentrations than the <1,000 TPD category for the compounds evaluated.
- Year 2 DEHP data suggests several data points may be outliers. Several of these data points were flagged during data validation as being biased high and several were not considered representative for calculating the annual mean concentration. Therefore, the summary statistics should be considered biased high for Year 2 (See Section 6).
- The TSS mean and geometric mean concentrations for the ≥1,000 TPD traffic category UICs were, in general, about three times higher than the concentrations in the <1,000 TPD traffic category for both years.

9.4 Monitoring Panels

Box plots were prepared to compare the concentrations of selected analytes by monitoring panel. Year 1 monitoring included 15 rotating UIC monitoring locations (Panel 1) and 15 fixed monitoring locations (Panel 6). Year 2 monitoring included the following:

- 15 rotating UIC monitoring locations (Panel 2);
- 15 fixed UIC monitoring locations (Panel 6);
- One rotating UIC monitoring location (P1_1) carried over from Year 1 monitoring due to the annual mean concentration of pentachlorophenol exceeding the MADL; and

- 10 UIC monitoring locations near drinking water wells (Supplemental Panel (SP1)).

Figures 9-9 through 9-11 present box plots by panel for pentachlorophenol, lead, and DEHP, respectively. The following general observations are made regarding these figures:

- All panels show similar concentration ranges and have similar lognormal concentration distributions; and
- The mean, median, and geometric mean concentrations of the three compounds evaluated are, in general, < 50% of their respective MADLs for all panels.

Section

10

10 Findings and Conclusions

This section of the report presents the findings and conclusions for Year 2 of the UIC monitoring program.

10.1 Year 2 Monitoring Program

The UIC monitoring program was implemented in accordance with the SDMP. The Year 2 Monitoring Program demonstrates permit compliance by documenting sampling procedures, analyses, results, data evaluation, and reporting in accordance with the SDMP.

The monitoring program was designed to be representative of the estimated 9,000 active City-owned and/or operated UICs. The program is based on a statistically valid and robust method for identifying a representative subset of UIC locations for monitoring. This method provides a high level of confidence that the monitoring network is representative of the City's UIC population. Forty-six UIC locations were sampled in Year 2 including:

- 15 fixed locations (Panel 6) that are sampled for five storm events annually for each year of the 10-year permit;
- 15 rotating locations (Panel 2) that are sampled for five storm events annually in two separate years of the 10-year permit;
- One (1) rotating location from Year 1 (P1_1) that was sampled due to an annual mean MADL exceedance for pentachlorophenol in Year 1;
- Ten (10) supplemental monitoring locations near drinking water wells; and
- Five (5) pentachlorophenol baseline monitoring locations.

Sample locations are stratified on two traffic categories: <1,000 TPD and ≥1,000 TPD. The SDMP specifies that each year, 15 UIC monitoring locations in each traffic category will be monitored. As described in Section 3, Year 1 UIC locations were more heavily weighted towards the low traffic category (20 UIC locations in the <1,000 TPD category and 10 UIC locations in the ≥1,000 TPD category). To achieve the SDMP traffic stratification goal and balance the Year 1UIC locations, Year 2 UIC locations were more heavily weighted towards the high traffic category (20 UIC locations in the ≥1,000 TPD category and 10 UIC locations in the <1,000 TPD category). These adjustments will result in an approximate equal weighting of the traffic categories over the duration of the permit.

No significant land use or zoning changes were noted by BES that would be expected to result in modifications to traffic volumes during the 2006-2007 monitoring season.

10.2 Year 2 Sampling Results

Five sampling events were completed between October 2006 and May 2007, as required by the permit. Sampling events often consisted of multiple storms. Storms targeted for sampling met the criteria identified in the SAP to the extent practicable and were determined to be acceptable.

Stormwater samples, discharging to City-owned UICs, were analyzed for both common pollutants and those PPS analytes defined in the permit that were detected during laboratory analysis of the common pollutants (*i.e.,* not the full suite of PPS analytes). In addition to the required monitoring, the City also measured the following:

- TSS at all UIC monitoring locations during each sampling event; and
- Dissolved copper, lead, zinc, and mercury at all UIC monitoring locations during each sampling event.

Field and laboratory data collected during Year 2 were determined to meet the DQOs described in the QAPP and to be of known and acceptable quality. All data are considered useable, with the exception of 12 DEHP sample results, as described in Section 6.

10.2.1 Common Pollutants

All 14 common pollutants defined by the permit were detected during Year 2. The permit requires that detected concentrations of common pollutants in each individual sampling event be compared to their respective MADLs. As in Year 1, only three common pollutants, pentachlorophenol, DEHP, and lead were detected in Year 2 at concentrations above their MADLs in at least one sample.

10.2.2 Priority Pollutant Screen Analytes

Two PPS analytes were detected during Year 2. Chlorobenzene was detected in one sample during Event 3, and 2,4-D was detected in 7 to 50% of the samples for individual events. The permit requires that detected concentrations of PPS analytes be reported and that concentrations from each individual sampling event be compared to their respective MADLs. No individual detected concentration of chlorobenzene or 2,4-D exceeded 50% of their respective MADLs.

10.2.3 Ancillary Pollutants

The permit requires that all analytes detected by any of the laboratory methods used in the stormwater monitoring program be reported. Ancillary pollutants are those analytes that are detected in addition to required monitoring for common pollutant or PPS analytes using EPA approved analytical methods. Twenty-six ancillary pollutants were detected in Year 2. Eight of these were detected at a maximum frequency $\leq$5% of the samples and ten were detected at maximum frequencies between 10% and 41% of the samples. The eight remaining pollutants detected at the highest frequencies (between 51% and 98%)

during the individual sampling events are PAHs and included: chrysene, phenanthrene, napthalene, pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, fluoranthene, and indeno(1,2,3-cd)pyrene. Of these, naphthalene had the highest concentration with a maximum of 1.09 µg/L.

10.3 Individual Sampling Event MADL Exceedances

Three common pollutants exceeded MADL concentrations during individual sampling events in Year 2 including:

Pentachlorophenol. Forty-one sample concentrations from 13 UIC locations exceeded the MADL of 1.0 µg/L, including the Year 1 P1_1 location. Exceedances occurred during all five sampling events.

DEHP. Twelve sample concentrations from 13 UIC locations exceeded the MADL of 6.0 µg/L for DEHP. Exceedances occurred during Events 1, 2, 4 and 5.

Lead. Five sample concentrations from four UIC locations exceeded the MADL of 50.0 µg/L for lead. Exceedances occurred during Events 3, 4 and 5.

As required by the permit, the City reported the observed MADL exceedances to DEQ within 7 days following the receipt of validated analytical data.

The causes of the MADL exceedances are largely unknown. All compounds detected at concentrations greater than the MADL appear ubiquitous at low concentrations across the sampling locations.

10.4 Calculation of Annual Mean

The permit requires the annual mean MADL concentration be met at the EOP discharge point into the UIC. Mean concentrations were calculated for analytes and locations where Year 2 stormwater concentrations, in at least one sampling event, were detected at a concentration $\geq$50% of the MADL. Annual mean concentrations were calculated for pentachlorophenol, DEHP, benzo(a)pyrene, and lead.

Year 2 annual geometric mean concentrations for ten UIC locations (P1_1, P2_5, P2_7, P2_13, P2_14, P6_1, P6_2, P6_7, and P6_14) exceeded the MADL for pentachlorophenol. The annual geometric means for these locations ranges from 1.0 to 3.4 µg/L, slightly above the MADL of 1.0 µg/L. The annual geometric mean values for benzo(a)pyrene and lead were <50% of their respective MADLs for all individual UIC locations.

Year 2 annual geometric mean concentrations for DEHP ranged between 0.8 and 6.8 µg/L using data "as reported" by the laboratory (*i.e.*, without consideration of QC issues)

data for the 13 locations (See Table 7-3). As noted throughout the report, the City's contract analytical laboratory had numerous QC issues with DEHP analyses during Year 2. These issues resulted in the rejection of 12 DEHP data points, resampling of 20 UICs, and laboratory reanalysis of numerous samples (see Section 6). The additional sampling and laboratory reanalysis resulted in numerous DEHP concentrations being available for some UIC monitoring locations for a single sampling event (*e.g.*, Events 2 and 4). Therefore, the annual geometric mean and arithmetic mean concentrations were recalculated for those UICs where the annual geometric mean, presented in Table 7-3, estimated using the "as reported" data was >50% of the MADL. The recalculation of the annual mean concentrations excluded the DEHP data that were rejected during data validation and included usable resampling, laboratory reanalysis, and duplicate data (see Section 6 and Table 7-4). The corrected annual geometric mean concentrations ranged between 1.9 and 5.3 µg/L. The maximum annual DEHP concentration was detected in P6_1, and includes the anomalous Event 1 DEHP concentration of 264 µg/L.

10.5 Preliminary Trend Analysis – Traffic Categories

Year 1 and Year 2 pollutant concentration data were compared using Box Plots. Box plots were prepared to identify potential differences in pollutant concentrations between:

- Permit years (Year 1; Year 2);
- Traffic categories (*i.e.*, <1,000 TPD; ≥1,000 TPD); and
- Sample panels (*e.g.*, Panel 1, Panel 2, Panel 6, Supplemental Panel).

In general, the box plots prepared for Year 1 and Year 2 data are very similar for each variable. For the pollutants evaluated (*e.g.*, lead, dissolved lead, pentachlorophenol, DEHP) the concentration ranges were generally narrow and the concentration means, medians, and geometric means were well below their respective MADL (*i.e.*, <50%). Pollutant concentrations appear to be slightly higher in the ≥1,000 TPD traffic category than in the <1,000 TPD category and very similar between sample panels.

10.6 Analysis of Factors that Affect Stormwater

One of the goals of the permit and the SDMP is to identify factors that have a substantive effect on the quality of stormwater entering City-owned UICs. In order to identify these factors, an evaluation must be conducted regarding the potential associations and relationships between stormwater quality, potential sources of pollution, traffic category, land use, etc. Because only two years of sampling data are available, the ability to conduct detailed trend analysis, correlations, or logistic regression is limited. As data are collected in successive years, and a more robust data set becomes available, more analysis will be possible. As appropriate, this type of evaluation and analyses will be included in the annual UICMP report(s), which are submitted to DEQ by November 1 of each year. Types of analyses that may be performed include:

- Correlations between:
  - TSS and selected pollutants;
  - Traffic volume (*i.e.*, TPD) and selected pollutants;

- UIC catchment size (and/or percent impervious area) and selected pollutants; and
- Pollutants (*e.g.*, lead and arsenic. lead and antimony, DEHP and PAHs, lead and PAHs).

- Comparison of data groups to determine if they are statistically different (*i.e.*, concentrations between traffic categories).

10.7 Category 4 UICs

The WPCF permit requires the City to identify UICs in which the annual mean concentration exceeds the MADL for two consecutive years as Category 4[4] UICs.

The Year 1 annual mean concentration of pentachlorophenol exceeded the MADL in the following UIC locations (see *Annual Stormwater Discharge Monitoring Report – Year*, dated July 2006):

- P1_1;
- P6_1;
- P6_7;
- P6_8; and
- P6_14.

The Year 2 annual mean concentration of pentachlorophenol exceeded the MADL for a second consecutive year in four of the five UICs identified above. The UICs are identified as Year 2 Category 4 UICs in Table 10-1, along with UIC location information.

Table 10-1: Category 4 UICs Identified in Year 2

Location Code	Approximate Address	BES UIC No.	Traffic Category (TPD)	Separation Distance (ft)	Year 1 Annual Geometric Pentachlorophenol Concentration (µg/L)	Year 2 Annual Geometric Pentachlorophenol Concentration (µg/L)
P1_1	6940 N. Macrum Ave.	AAG769	< 1000	73	1.1	1.2
P6_1	3500 SE 112th Ave.	ADW577	≥ 1000	64	1.2	1.0
P6_7	608 NE 87th Ave.	ADV645	< 1000	148	2.0	1.8
P6_14	4289 NE Prescott St.	AD1252	≥ 1000	64	1.5	1.4

Figure 10-1 shows the locations the Category 4 UICs.

[4] Category 4 UICs are those UICs that become non-compliant by failing to meet the annual mean MADL within one wet season after the exceedance or failing to satisfy any groundwater protection conditions of Schedule A of the Permit.

The permit requires that Category 4 UICs be decommissioned or a corrective action implemented in order to bring the annual mean MADL concentration into compliance with the permit conditions and schedule.

Corrective actions for Category 4 UICs will be identified, evaluated and selected in accordance with the *Corrective Action Plan (CAP), 2006.* The proposed corrective action for these Category 4 UICs is a groundwater protectiveness demonstration (*i.e.*, "risk assessment"), performed in accordance with the UICMP (UICER Guideline No. 6). Category 4 UIC corrective actions will be initiated in FY2007/08 and completed in accordance with the permit schedules.

In addition to the proposed corrective action, P6_7 was targeted for replacement due to slow drainage. In addition, a sedimentation manhole will be installed. The new system at P6_7 is scheduled for construction during the summer of 2007, prior to the start of Year 3 monitoring. The UIC replacement and installation of pretreatment is consistent with the CAP and may reduce pentachlorophenol concentrations to acceptable levels. P6_7 will continue to be monitored as part of the fixed panel for the duration of the permit (*i.e.*, seven additional years).

Section 11

11 References

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Tables

Table 1-1: WPCF Permit Annual Monitoring Report Requirements[1]

7. **Monitoring Reporting**. The Permittee must submit to the Department annual monitoring reports in accordance with Schedule C.19. At a minimum, each annual monitoring reports must address the following conditions [2]:	**Report Section**
a. Provide a summary of the monitoring data for the preceding wet season being reported. At a minimum, the summary must include:	
i. Data pertinent to each storm event sampled, including but not limited to:	Section 5.2 Tables 5-1 through 5-7 Appendix B (Event Summary Reports)
(1) A description of the date and duration of storm event sampled;	
(2) Precipitation estimates of the storm event;	
(3) Duration and intensity of the storm event; and	
(4) The duration in days between storm events sampled and the previous storm event;	
ii. A summary table for the injection systems being sampled that includes, but not limited to:	
(1) DEQ ID number for the public UIC;	Table 3-2 - Year 2 Panel 1 Table 3-3 - Year 2 Panel 2 Table 3-4 - Year 2 Panel 6 Table 3-5 - Year 2 Supplemental Panel Table 3-6 PCP Baseline
(2) Latitude and longitude of each sample location;	
(3) Street location;	
(4) The traffic volume, traffic pattern and type of land use in accordance with Table 2 for each public UIC injection system sampled;	
(5) Type of pretreatment, if any, for the public UIC sampled;	Table 3-2 - Year 2 Panel 1 Table 3-3 - Year 2 Panel 2 Table 3-4 - Year 2 Panel 6 Table 3-5 - Year 2 Supplemental Panel Table 3-6 - PCP Baseline
(6) Depth to groundwater from ground surface based on USGS estimated depths to groundwater. Site specific data shall be used if available;	
(7) Date of the last maintenance and type of maintenance performed;	Table 3-2 - Year 2 Panel 1 Table 3-3 - Year 2 Panel 2 Table 3-4 - Year 2 Panel 6 Table 3-5 - Year 2 Supplemental Panel Table 3-6 - PCP Baseline Section 8.2
(8) Date of last maintenance and inspection;	
(9) The level of the sediment in a sediment manhole, if the injection system has a sediment manhole as part of the pretreatment. If no sediment manhole is present, report the sediment level in the associated catch basins and in the bottom of the public UIC.	Table 3-2 - Year 2 Panel 1 Table 3-3 - Year 2 Panel 2 Table 3-4 - Year 2 Panel 6 Table 3-6 - PCP Baseline
(10) The estimated total volume of recharge to the aquifer by public UICs.	Section 7.4 Table 7-10
iii. A map showing the location of the public UIC injection systems sampled in relation to the Permittee's other public UIC systems authorized by this permit and any domestic wells and public water system wells;	Figures 3-1 through 3-4 Appendix A (UIC monitoring location maps) Systemwide Assessment Report (July 2006)

Table 1-1: WPCF Permit Annual Monitoring Report Requirements[1]

iv. A map of sufficient scale that clearly shows the location of the specific public UIC being sampled;	Appendix A (UIC monitoring location maps)
v. Identification and discussion of any exceedance of an individual storm event MADL and any annual mean MADL concentration, including:	Section 7.1 (Individual sample events) Table 7-1 Section 7.2 (Annual geometric mean concentrations) Tables 7-3 and 7-4
(1) A discussion of any potential cause of the exceedance, to the extent practicable and if known, and	Event Summary Reports Sections 7.1 and 7.2
(2) Actions taken during the wet season to reduce the concentration of the pollutant of concern;	Section 8
vi. Identification and discussion of any detected PPS pollutant during a PPS screen sampling event, including:	Sections 5.4.2, 7.1.2, 7.2.3
(1) The pollutant concentration:	Tables 5-9, 5-10, and 5-11 Appendices C (raw laboratory data), E (Year 2 Compliation Spreadsheet), F (Summary Tables)
(2) The public UIC at which the detection occurred;	
(3) A discussion of the cause of the detection, if known; and	Section 7.1.2
(4) actions taken; and	Section 8
vii. A discussion of compliance response actions taken to correct a MADL annual mean exceedance.	Section 8
b. Provide a summary table of all laboratory monitoring data for the reporting period wet season, including:	Appendices C (raw laboratory data), E (Year 2 Compliation Spreadsheet), F (Summary Tables)
i. Ancillary pollutants derived from the approved analytical method;	Tables 4-2 and 4-3 Section 5.4.3 Tables 5-12 and 5-13 Appendices C (raw data), E (Year 1 Compliation Spreadsheet), F (Summary Tables)
ii. MRLs; and	
iii. Analytical method used.	
c. Discuss any unusual conditions that occurred during a monitoring event that may impact the monitoring results.	Event Summary Reports Section 6 Section 7
d. Include an analysis of the trends in the cumulative monitoring data, including water quality improvements or degradations for each annual report after the first year of reporting.	Section 9

Table 1-1: WPCF Permit Annual Monitoring Report Requirements[1]

e. Explain any outliers in the data used to determine the annual mean MADL concentration. If the outlier data was not used in the mean annual MADL concentration, provide an explanation of why the data was omitted from the determination.	No outliers identified (Section 7.2)
f. Include a statement that sampling and measurements taken as required herein are representative of the traffic volume and traffic patterns of the monitored discharge weighted or stratified in accordance with the Department-approved SDMP.	Section 3.2 Section 6.3
g. Discuss any annual mean MADL exceedance in accordance with Schedule C.10.	Section 7.2 Section 10
h. Discuss, in accordance with Schedule C.8, any PPS pollutant detection during a PPS sampling event. This condition applies to the 1st, 4th and 9th year PPS sampling events, or whenever the Permittee samples for the presence of PPS pollutants.	Sections 5.4.2, 7.1.2, 7.2.3 Tables 5-9, 5-10, 5-11, and 7-1
i. In the event conditions occur beyond the reasonable control of the Permittee as identified in Schedule B.3, the Permittee must explain the circumstances in the annual monitoring report. The explanation must include why the sampling event or sample anal	Not applicable for Year 2 (Note: Five events sampled in accordance with permit)
j. For Category 4 public UICs, as defined in Schedule D.11, the Permittee must report in the annual monitoring report the following:	Section 10.7 Table 10-1 Category 4 UICs are defined as public UICs that become non-compliant by failing to meet the annual mean MADL within one wet season after the exceedance, or fails to satisfy any groundwater protection conditions of Schedule A of the permit. (Continued on next page)
i. Provide a list of the Category 4 public UICs;	
ii. A brief description of the public UICs;	
iii. The location of the public UIC at which the non-compliant condition occurred, including traffic volume and the nature of land uses that may drain to the public UIC;	
iv. The nature and concentration of the pollutant that exceeded the annual mean MADL concentration;	
v. The vertical separation distance to groundwater;	
vi. The proposed corrective action, which may include a risk assessment that meets Department risk assessment protocols;	
vii. Discuss the corrective action(s) completed;	
viii. Discuss on-going corrective action(s), or corrective actions to be implemented, including but not limited to:	
(1) The type of corrective action;	
(2) Implementation date;	
(3) Completion date; and	(Continued from previous page)
(4) Other pertinent information regarding the public UIC or its corrective action obtained during the reporting period.	

Table 1-1: WPCF Permit Annual Monitoring Report Requirements[1]

k. In the event the Permittee undertakes groundwater monitoring, the Permittee must provide the following:	Not applicable to the Year 2 Stormwater Discharge Monitoring Report. Groundwater monitoring was not performed in Year 2.
i. Monitoring well locations with street location and latitude and longitude in decimal degrees;	
ii. Water level measurements and gradient;	
iii. As-built monitoring well construction details for any monitoring well installed during the reporting period;	
iv. The pollutant(s) being monitored;	
v. All groundwater monitoring data and other data pertinent to groundwater monitoring;	
vi. Any other pertinent data to groundwater monitoring obtained during the reporting period;	
vii. A discussion of the following:	
(1) Monitoring data;	
(2) Pollutant concentrations, including concentrations at background and compliance monitoring wells;	
(3) Compliance with Table 1 for groundwater;	
(4) Actions taken or to be taken by the Permittee with respect to groundwater monitoring;	
(5) An analyses of the data; and	
(6) Conclusions with respect to potential or demonstrated groundwater contamination from public UICs; and	
viii. If applicable, a discussion of any Department-approved groundwater corrective actions, including, but not limited to:	Not applicable to the Year 2 Stormwater Discharge Monitoring Report. Need for groundwater Corrective Action was not identified in Year 2.
(1) Nature of the action(s);	
(2) Status of the action(s);	
(3) All laboratory results related to the action;	
(4) Analyses of the data with respect to achieving the corrective action goal; and	
(5) Milestones reached.	
8. **Permittee Monitoring Responsibility**. The Permittee is responsible to protect groundwater quality while operating its public UICs. At a minimum, the Permittee must:	
a. Ensure data and information acquired through implementation of the SDMP is representative of the Permittee's entire public UIC system;	SDMP (August 2006) Section 3
b. Ensure the results of the system-wide assessment, required under Schedule D.8, are incorporated into the SDMP as appropriate;	SDMP (August 2006)
c. Notify the Department in the annual monitoring report of significant land use changes which change traffic volume or patterns which may affect public UICs in the SDMP. Significant land use changes include, but are not limited to:	Section 3
i. Zoning changes that result in an increase of 1,000 trips per day or more;	None
ii. A change in type of traffic, i.e. increase in truck traffic; or	Sections 3.2 and 6.3

Table 1-1: WPCF Permit Annual Monitoring Report Requirements[1]

iii. A change that may cause or causes an adverse impact to a BMP such that the BMP no longer performs as intended to meet the conditions of this permit;	None
d. Notify the Department when information or data indicates additional pollutants should be added to Table 1;	SDMP (August 2006)
e. Implement modifications to the permit, including the addition of pollutants that the Department deems necessary to incorporate into the SDMP or other actions under this permit as directed by the Department; and	SDMP (August 2006)
f. Ensure other verifiable data or information, which may indicate a potential that groundwater may be endangered by stormwater injection, is reported in a timely manner to the Department.	SDMP (August 2006)

[1] The report section provides a reference to the sections, tables or figures in the annual SDM report that best address given requirements.

[2] Conditions taken verbatim from Section B(7) of DEQ issued "Water Pollution Control Facilities Permit for Class V Stormwater Underground Injection Control Systems." [DEQ Permit (No. 102830), issued June 1, 2005].

Table 3-1: Vehicle Trips per Day and Predominant Land Use

Vehicle Trips per Day (TPD)	Predominant Land Use
< 1,000	Residential Streets; Small Parking Lot
≥ 1,000	Residential Feeder Streets; Commercially Zoned Areas; Transportation Corridors; Industrial Areas

Table 3-2: UIC Summary Information – Rotating Panel, Year 2, Panel 1

Location Code	Approximate Address [a]	Estimated Trips per Day (TPD)	Predominant Land Use	DEQ UIC No.	BES UIC No.[b]	Latitude/ Longitude	UIC Depth (feet)	Pretreatment System	Separation Distance [d]	Date of Last Maintenance	Maintenance Performed	Sediment Level (ft)[e]
P1-1	6940 N. Macrum Ave.	325	SFR	2235	AAG769	45.58146/ -122.73663	31	Sed MH [c]	73	3/13/2006	Cleaned UIC & Sed MH	4

Notes:

a Addresses should not be considered precise location information and are subject to change as City staff better describe the physical UIC locations relative to nearby properties. UIC Street addresses are assigned relative to nearby properties for general locating purposes. Latitude and longitude should be relied up for accurate locating of UICs.

b BES UIC number is obtained from the BES Hansen database.

c The estimated separation distance is defined as the approximate depth in feet from the bottom-most perforation in the UIC to the approximate seasonal-high groundwater level. The bottom-most perforation is defined as the bottom of the UIC – 2 feet. Two feet were added to all separation distance calculations to account for the standard depth of the sediment trap ring on standard City UIC design. This information is reported to DEQ by the City as "Depth to groundwater" (UIC Database Report) for inclusion in DEQ's UIC database. Reported to nearest foot.

d Sediment level represents "feet of sediment removed" as measured prior to cleaning.

e Sed MH = Sedimentation manhole

TPD = Trips per day SFR = Single family residential

Table 3-3: UIC Summary Information – Rotating Panel, Year 2, Panel 2

Location Code	Approximate Address [a]	Estimated Trips per Day (TPD)	Predominant Land Use	DEQ UIC No.	BES UIC No. [b]	Latitude/ Longitude	UIC Depth (feet)	Pretreatment System	Separation Distance [c]	Date of Last Maintenance	Maintenance Performed	Sediment Level (ft) [d]
P2_1	4335 NE Alameda St	1,648	SFR	1477	ADR102	45.54387/ -122.61792	26	Sed MH [e]	178	11/18/2005	Cleaned UIC & Sed MH	NA [f]
P2_2	5015 NE Killingsworth St.	11,040	MFR	1140	ADV361	45.543.87/ -122.61127	10 [f]	No Sed MH	94	6/29/2000	Raised sump lid	NA
P2_3	12220 SE Holgate Blvd.	5,249	COM	619	ADU749	45.48956/ -122.53725	24	Sed MH	5	3/22/2002	NA	NA
P2_4	490 NE 106th Ave.	29,453	MFR	8181	ADR922	45.52607/ -122.55387	30	Sed MH	135	9/7/2001	Cleaned UIC & Sed MH	NA
P2_5	10150 SE Ankeny St.	22,430	IND	8329	ADR885	45.52170/ -122.55862	15	Sed MH	155	NA	NA	NA
P2_6	1337 NE Shaver St.	449	SFR	3599	ADQ450	45.55205 -122.65199	30.6	Sed MH	133	11/6/2005	Cleaned UIC & Sed MH	NA
P2_7	7930 SE Henry St.	407	SFR	5587	ADV064	45.47687/ -122.58187	26.2 [f]	Sed MH	40	NA	NA	NA
P2_8	3938 SE 130th Ave.	1,735	SFR	6297	ADT436	45.49353/ -122.52998	30	Sed MH	7	1/11/2002	Cleaned UIC & Sed MH	NA
P2_9	2905 SE 143rd Ave.	510	SFR	1070	ADS687	45.50139/ -122.51642	30	Sed MH	21	9/13/2001	Cleaned UIC & Sed MH	NA
P2_10	5934 NE Cleveland Ave.	5,747	SFR	2857	ADP605	45.56626/ -122.66583	31.5	Sed MH	118	1/3/2002	Cleaned UIC & Sed MH	NA
P2_11	5003 SE 58th Ave.	550	SFR	6088	ADT613	45.48652/ -122.60407	29	Sed MH	95	6/14/2001	Cleaned UIC & Sed MH	NA
P2_12 *	7003 NE Everett	401	SFR	4478	AMP946	45.52491 -122.59124	31	Sed MH	122	NA	NA	NA
P2_13	4107 SE Reedway St.	2,420	SFR	5599	ADU790	45.48122/ -122.62053	30.7	Sed MH	63	6/16/2002	Cleaned UIC & Sed MH	NA
P2_14	8409 N. Woolsey Ave.	4,012	SFR	2380	AAH289	45.58422/ -122.71348	30	Sed MH	71	1/15/2001	Cleaned UIC & Sed MH	NA
P2_15	13075 NE Weidler St.	0	SFR	8999	ADV587	45.53420/ -122.52831	10.5 [f]	No Sed MH	98	11/8/2005	Cleaned roots from lines to UIC	NA

Notes:

a Addresses should not be considered precise location information and are subject to change as City staff better describe the physical UIC locations relative to nearby properties. UIC Street addresses are assigned relative to nearby properties for general locating purposes. Latitude and longitude should be relied up for accurate locating of UICs.

b BES UIC number is obtained from the BES Hansen database.

c The separation distance is defined as the approximate depth in feet from the bottom-most perforation in the UIC to the approximate seasonal-high groundwater level. The bottom-most perforation is defined as the bottom of the UIC – 2 feet. Two feet were added to all separation distance calculations to account for the standard depth of the sediment trap ring on standard City UIC design. This information is reported to DEQ by the City as "Depth to groundwater" (UIC Database Report) for inclusion in DEQ's UIC database. Reported to nearest foot.

d Sediment level represents "feet of sediment removed" as measured prior to cleaning.

e Sed MH = Sedimentation manhole

f UIC depth not reported in Hansen database. Measurement represents depth to top of sediments during pre-sampling field inspection.

* Location changed after submittal of "*Year 2 Stormwater Discharge Monitoring Locations"* on September 1, 2006 due to inadequate stormwater flow.

TPD = Trips per day MFR = Multifamily residental SFR = Single family residential

NA = Not available COM = Commercial POS = Parks & open space

Table 3-4: UIC Summary Information – Stationary Panel, Year 2, Panel 6

Location Code	Approximate Address [a]	Estimated Trips per day (TPD)	Predominant Land Use	DEQ UIC No.	BES UIC No. [b]	Latitude / Longitude	UIC Depth (feet)	Pretreatment System	Separation Distance [c]	Date of Last Maintenance	Maintenance Performed	Sediment Level (ft) [d]
P6_1	3500 SE 112th Ave.	25,838	COM	6707	ADW577	45.49676/ -122.54801	18.0	Sed MH [e]	64	01/09/06	Cleaned UIC & Sed MH	4
P6_2 *	3740 SE 104th Avenue	2,354	POS	662	ADT394	45.49511/ -122.55601	29.2	Sed MH	65	06/26/02	Cleaned UIC & Sed MH	NA [f]
P6_3	4541 NE 80th Ave.	0	SFR	3192	ADQ337	45.55605/ -122.58071	30.0	Sed MH	72	02/28/05	Raise UIC/sed system to grade (apprx.8")	NA
P6_4	9090 SE Claybourne St.	393	SFR	5070	ADT961	45.47471/ -122.56991	30.0	Sed MH	11	09/30/00	Cleaned UIC & Sed MH	NA
P6_5	2513 SE 153rd Ave.	36,904	MFR	6590	ADS740	45.50410/ -122.50598	30.1	Sed MH	26	08/05/04	Cleaned UIC & Sed MH	NA
P6_6	5201 N. Emerson Dr.	0	SFR	3311	ADV395	45.56048/ -122.69658	19.0	No Sed MH	26	01/09/06	Cleaned UIC	6
P6_7	608 NE 87th Ave.	729	MFR	1608	ADV645	45.52779/ -122.57361	21.0	No Sed MH	148	01/06/06 03/24/06	Cleaned UIC Cleaned UIC	6 1
P6_8	10064 SE Woodstock Blvd.	795	IND	5448	ADV169	45.57613/ -122.56014	25.0	Sed MH	7	03/24/06	Cleaned UIC & Sed MH	7.7
P6_9	3617 SE 168th Ave.	557	SFR	6117	ADT531	45.49604/ -122.48968	30.0	Sed MH	26	11/24/03	Cleaned UIC & Sed MH	NA
P6_10 *	5502 NE 13th Ave.	12,028	MFR	3074	ADP732	45.56285/ -122.65206	31.2	Sed MH	146	10/02/01	Cleaned UIC & Sed MH	NA
P6_11	1406 NE Skidmore St.	648	SFR	3605	AAU014	45.55440/ -122.65157	30.0	Sed MH	160	03/07/02	Cleaned UIC & Sed MH	NA
P6_12 *	550 SE 130th Ave.	3,536	SFR	7667	ADT061	45.51824/ -122.52998	28.7	Sed MH	73	10/17/05	Cleaned UIC & Sed MH	NA
P6_13	14350 NE Knott St.	291	SFR	4296	ADW213	45.45245/ -122.5143	19.6	No Sed MH	95	03/25/00	Cleaned UIC	NA
P6_14	4289 NE Prescott St.	8,100	COM	3510	ADQ252	45.55559/ -122.61931	26.8	Sed MH	156	03/02/06	Cleaned UIC & Sed MH	3.5
P6_15	13500 NE Glisan St.	19,380	POS	8422	ADR767	45.52646/ -122.52461	28.7	Sed MH	94	03/01/06	Cleaned UIC & Sed MH	5.5

Notes:

a Addresses should not be considered precise location information and are subject to change as City staff better describe the physical UIC locations relative to nearby properties. UIC Street addresses are assigned relative to nearby properties for general locating purposes. Latitude and longitude should be relied up for accurate locating of UICs.

b The BES UIC number is the node number and is obtained from the BES Hansen database.

c The estimated separation distance is defined as the approximate depth in feet from the bottom-most perforation in the UIC to the approximate seasonal-high groundwater level. The bottom-most perforation is defined as the bottom of the UIC – 2 feet. Two feet were added to all separation distance calculations to account for the standard depth of the sediment trap ring on standard City UIC design. This information is reported to DEQ by the City as "Depth to groundwater" (UIC Database Report) for inclusion in DEQ's UIC database. Reported to the nearest foot.

d Sediment level represents "feet of sediment removed" as measured prior to cleaning.

e Sed MH = Sedimentation manhole.

f NA = Information not available.

***** Indicates UIC was replaced for Year 2 sampling. Three Panel 6 locations were replaced due to reestimation of the traffic category during Year 1 sampling activities. See Section 4.2 of the SAP (August 2006) for additional information.

TPD = Trips per day MFR = Multifamily residental SFR = Single family residential

IND = Industrial COM = Commercial POS = Parks & open space

Table 3-5: UIC Summary Information – Supplemental Panel, Year 2

Location Code	Approximate Address [a]	Estimated TPD [b]	Predominant Land Use	DEQ UIC No.	BES UIC No.[c]	Latitude / Longitude	UIC Depth (ft)	Pretreatment System	Separation Distance [d]	Date of Last Maintenance	Maintenance Performed	Nearest Domestic/ Irrigation Well [e]	Within Two-year Time of Travel [e] ?
SP1_1 *	6400 SE 137th Ave.	19,334	SFR [h]	5333	ADT732	45.47676 -122.52235	30	Sed MH [g]	13	NA [i]	NA	314	No
SP1_2	5436 SE 108th Ave.	3,826	SFR	5763	ADW228	45.48293 -122.55253	18	No Sed MH	9	6/29/1999	Cleaned UIC	436	No
SP1_3	13140 NE Glisan St.	19,700	SFR	7979	ADS022	45.52633 -122.52757	29	Sed MH	84	9/20/2004	Cleaned UIC & Sed MH	183	No
SP1_4	15424 SE Tibbetts St.	353	SFR	442	ADS759	45.49966 -122.5043	30	Sed MH	32	9/29/2003	Cleaned UIC & Sed MH	162	No
SP1_5	13743 NE San Rafael St.	2,720	SFR	1460	ADR367	45.53731 -122.52142	30	Sed MH	108	8/17/2004	Cleaned UIC & Sed MH	43	No
SP1_6	6002 SE 140th Ave.	203	SFR	295	AMY013	45.47901 -122.51997	13	Sed MH	8	NA	NA	166	No
SP1_7	1520 NE 141st Ave.	19,735	SFR	8744	ADR345	45.53386 -122.51809	30	Sed MH	111	8/24/2001	Cleaned UIC & Sed MH	120	No
SP1_8	14814 SE Rhone St.	352	SFR	6344	ADT485	45.49604 -122.51035	30	Sed MH	33	9/9/2001	Cleaned UIC & Sed MH	1,715	Yes
SP1_9	15913 SE Grant St.	298	SFR	581	AMZ732	45.50716 -122.49888	0 [j]	Sed MH	19	9/14/2004	Cleaned UIC & Sed MH	461	No
SP1_10	4312 NE Emerson St.	382	SFR	3546	ADQ217	45.56149 -122.61932	30	Sed MH	112	9/1/2005	Cleaned UIC & Sed MH	305	No

Notes:

a Addresses should not be considered precise location information and are subject to change as City staff better describe the physical UIC locations relative to nearby properties. Latitude and longitude should be used for accurate locations of UICs.

b TPD = trips per day

c The BES UIC number is the node number and is obtained from the BES Hansen database.

d The estimated separation distance is defined as the approximate depth in feet from the bottom-most perforation in the UIC to the approximate seasonal-high groundwater level. The bottom-most perforation is defined as the bottom of the UIC – 2 feet. Two feet were added to all separation distance calculations to account for the standard depth of the sediment trap ring on standard City UIC design. This information is reported to DEQ by the City as "Depth to groundwater" (UIC Database Report) for inclusion in DEQ's UIC database. Reported to the nearest foot.

e Information obtained from Systemwide Assessment (City of Portland, July 2005)

f COM = commercial

g Sed MH = sedimentation manhole.

h SFR = single family residential

i NA = information not available.

j UIC depth not reported in Hansen database. Assumed depth was 30 feet in calculating separation distance.

* Location changed after BES submittal of '*Supplemental Stormwater Discharge Monitoring Locations"* on September 28, 2006 because stormwater discharging to original location was not representative of designated traffic category (i.e., stormwater flow into the proposed UIC was predominantly from a street that receives <1,000 TPD rather than≥ 1,000 TPD).

Table 3-6: UIC Summary Information – Pentachlorophenol Baseline, Year 2

Location Code	Approximate Address [a]	Estimated Trips per Day (TPD)	Predominant Land Use	DEQ UIC No.	BES UIC No.[b]	Latitude/ Longitude	UIC Depth (feet)	Pretreatment System[c]	Separation Distance[d]	Date of Last Maintenance	Maintenance Performed	Sediment Level (ft)[e]
PBP1_1	15110 SE Gladstone	454	SFR	6354	ADT498	45.492901/ -122.507359	25.7	Sed MH	49	12/8/2005	Clean Sump & Sed	4.8
PBP1_2	10145 SE Mill Court	0 [f]	SFR	6833	ADU540	45.507899 -122.558406	23	No Sed MH	90	8/22/1999	Clean Sump	15
PBP1_3	12532 SE Long Street	195	SFR	5926	ADU745	45.488070 -122.534171	15	Sed MH	3	3/25/2002	Clean Sump & Sed	8
PBP1_4	3660 NE 133rd Avenue	247	SFR	453	ADW065	45.549864 -122.526365	21	No Sed MH	30	6/16/2005	Clean Sump	7
PBP1_5	14304 NE Beech	415	SFR	3974	ADW078	45.548829 -122.515640	30[g]	No Sed MH	23 [h]	7/9/2004	Clean Sump	4

Notes:

a Addresses should not be considered precise location information and are subject to change as City staff better describe the physical UIC locations relative to nearby properties. UIC Street addresses are assigned relative to nearby properties for general locating purposes. Latitude and longitude should be relied upon for accurate locating of UICs.

b BES UIC number is obtained from the BES Hansen database.

c Sed MH = Sedimentation manhole

d The estimated separation distance is defined as the approximate depth in feet from the bottom-most perforation in the UIC to the approximate seasonal-high groundwater level. The bottom-most perforation is defined as the bottom of the UIC – 2 feet. Two feet were added to all separation distance calculatio to account for the standard depth of the sediment trap ring on standard City UIC design. This information is reported to DEQ by the City as "Depth to groundwater" (UIC Database Report) for inclusion in DEQ's UIC database. Reported to nearest foot.

e Sediment level represents "feet of sediment removed" as measured prior to cleaning.

f TPD values are estimated using interpolated values from neighboring streets using Portland Department of Transportation (PDOT) data. Per PDOT advice, the interpolated value for ADU540 was not used. This UIC location is at the end of a dead end/cul-de-sac and an assumed value of 0 (i.e., <1,000 TPD) applied.

g No depth is reported in Hansen for ADW078. Therefore, a depth of 30 feet was assigned and used for estimating separation distance.

h Hansen notes indicate UIC ADU540 is classified as a "bottomless" UIC - meaning that the UIC does not have a sediment trap ring. As per the maintenance record, there was 8 feet to debirs and removal ceased at 23 feet (the bottom of the UIC).

TPD = Trips per day; SFR = Single family residential

Table 4-1: UIC Stormwater Analytes

Common Pollutants	**Benzene**[1] **Toluene** **Ethylbenzene** **Xylenes**[3]	**Pentachlorophenol** **Di(2-ethylhexyl)phthalate**[2] **Benzo(a)pyrene**	**Arsenic (Total)** **Cadmium (Total)** **Chromium (Total)** **Copper (Total)** **Lead (Total)** **Zinc (Total)** **Nitrate-nitrogen**
Priority Pollutant Screen	Antimony (Total) Barium (Total) Beryllium (Total) Cyanide (Total) Mercury (inorganic) Selenium Thallium	Alachlor Atrazine Carbofuran **Carbon Tetrachloride** Chlordane **Chlorobenzene** **2,4-D** Dalapon **o-Dichlorobenzene**[4] **p-Dichlorobenzene**[5] **1,3-Dichlorobenzene**	Bis(2-chloroisopropyl)ether Bis(2-chloroethyl)ether **Dinoseb** Diqat Endothall Glyphosate Lindane **Picloram** **1,2,4-Trichlorobenzene**

Notes:

[1] Bold text indicates that the analyte was analyzed during Year 2.

[2] Di(2-ethylhexyl)phthalate is also known as bis(2-ethylhexyl)phthalate or DEHP.

[3] Xylenes is equal to o-xylene + m,p-xylene.

[4] o-Dichlorobenzene is also known as 1,2-dichlorobenzene.

[5] p-Dichlorobenzene is also known as 1,4-dichlorobenzene.

Table 4-2: Stormwater Quality Analytes – Common Pollutant Analyses

Analyte	Analytical Laboratory	Method	Method Detection Limit	Method Reporting Limit	MADL
Benzene	WPCL[1]	EPA 8260B	0.02 µg/L	0.2 µg/L	5.0 µg/L
Toluene	WPCL	EPA 8260B	0.2 µg/L [a]	0.5 µg/L [a]	1,000 µg/L
Ethylbenzene	WPCL	EPA 8260B	0.5 µg/L	0.5 µg/L	700 µg/L
Xylenes	WPCL	EPA 8260B	1.0 µg/L	1.0 µg/L	10,000 µg/L
Pentachloro-phenol	TA[2]	EPA 515.3[3]	0.004 µg/L	0.04 µg/L	1.0 µg/L
Di(2-ethylhexyl) phthalate	TA	EPA 8270-SIM[4]	0.3 µg/L	0.5 µg/L	6.0 µg/L
Benzo(a)pyrene	TA	EPA 8270-SIM[4]	0.01 µg/L	0.01 µg/L	0.2 µg/L
Total Arsenic	WPCL	EPA 200.8[5]	0.00134 µg/L	0.045 µg/L	10.0 µg/L
Total Cadmium	WPCL	EPA 200.8[5]	0.00078 µg/L	0.1 µg/L	5.0 µg/L
Total Chromium	WPCL	EPA 200.8[5]	0.00963 µg/L	0.4 µg/L	100 µg/L
Total Copper	WPCL	EPA 200.8[5]	0.00179 µg/L	0.2 µg/L	1300 µg/L
Total Lead	WPCL	EPA 200.8[5]	[4]0.00045 µg/L	0.1 µg/L	50.0 µg/L
Total Zinc	WPCL	EPA 200.8[5]	0.00424 µg/L	0.5 µg/L	5000 µg/L
Nitrate-Nitrogen	WPCL	EPA 300.0[6]	0.0041 mg/L	0.1 mg/L	10 mg/L

Notes:

[a] Values are corrected from QAPP –Table 5-1.

[1] WPCL indicates BES Water Pollution Control Laboratory

[2] TA indicates Test America. (North Creek Analytical, identified in the SDMP, was acquired by Test America in early 2006).

[3] Preparation: Adjust pH of a 40 milliliter sample to 12 with sodium hydroxide. Let stand for 1 hour. Acidify the sample with sulfuric acid and extract with MTBE. Derivitize the sample with diazomethane. Remove the diazomethane with nitrogen. Analyze the extract using GC/ECD.

[4] Preparation: Sample is extracted with DCM and taken to final volume. The extract is analyzed using GC/MS.

[5] Preparation: hot block digestion.

[6] Preparation: sample filtered by WPCL using a 0.45 micron filter.

Table 4-3: Stormwater Quality Analytes – Priority Pollutant Screen Analyses

Analyte	Analytical Laboratory	Method	Method Detection Limit	Method Reporting Limit	MADL
Total Antimony	WPCL[1]	EPA 200.8[2]	0.00111 µg/L	0.1 µg/L	6.0 µg/L
Total Barium	WPCL	EPA 200.8[2]	0.00575 µg/L	0.1 µg/L	2000 µg/L
Total Beryllium	WPCL	EPA 200.8[2]	0.00210 µg/L	0.1 µg/L	4.0 µg/L
Total Selenium	WPCL	EPA 200.8[2]	0.0127 µg/L	0.5 µg/L	50.0 µg/L
Total Thallium	WPCL	EPA 200.8[2]	0.00099 µg/L	0.1 µg/L	2.0 µg/L
Total (inorganic) Mercury	TA[3]	EPA 1631[4]	0.0009 µg/L	0.005 µg/L	2.0 µg/L
Total Cyanide	WPCL	SM 4500-CN-E[5]	0.01 mg/L	0.01 mg/L	0.2 mg/L
Alachlor	TA	EPA 8270C	0.170	1.0 µg/L	2.0 µg/L
Atrazine	TA	EPA 8270C	0.289	1.0 µg/L	3.0 µg/L
Carbofuran	TA	EPA 531.2	0.4 µg/L	1.0 µg/L	40.0 µg/L
Carbon Tetrachloride*	TA	EPA 8260B	0.2 µg/L	0.2 µg/L	5.0 µg/L
Chlordane (tech)	TA	EPA 8081	0.5 µg/L	1.0 µg/L	2.0 µg/L
Chlorobenzene*	TA	EPA 8260B	0.2 µg/L	0.2 µg/L	100 µg/L
2,4-D*	TA	EPA 515.3	0.05 µg/L	0.1 µg/L	70.0 µg/L
Dalapon	TA	EPA 552.2	0.1 µg/L	1.0 µg/L	200 µg/L
o-Dichlorobenzene*	TA	EPA 8260B	0.5 µg/L	1.0 µg/L	600 µg/L
p-Dichlorobenzene*	TA	EPA 8260B	0.5 µg/L	1.0 µg/L	75.0 µg/L
1,3-Dichlorobenzene*	TA	EPA 8260B	0.5 µg/L	1.0 µg/L	5.5 µg/L
Bis(2-chloroisopropyl) ether	TA	EPA 8270C	0.0846 µg/L	0.25 µg/L	0.80 µg/L
Bis(2-chloroethyl) ether	TA	EPA 8270C	0.117 µg/L	0.25 µg/L	0.30 µg/L
Dinoseb*	TA	EPA 515.3	0.03 µg/L	0.1 µg/L	7.0 µg/L
Diquat	TA	EPA 549.2	0.3 µg/L	0.4 µg/L	20.0 µg/L
Endothall	TA	EPA 548.1	2.6 µg/L	10.0 µg/L	100 µg/L
Glyphosate	TA	EPA 547	4.3 µg/L	10.0 µg/L	700 µg/L
Lindane	TA	EPA 8081	0.05 µg/L	0.1 µg/L	0.2 µg/L
Picloram*	TA	EPA 515.3	0.04 µg/L	0.4 µg/L	500 µg/L
1,2,4-Trichlorobenzene*	TA	EPA 8260B	0.5 µg/L	1.0 µg/L	70.0 µg/L

Notes:

* Indicates PPS pollutants analyzed during Year 2 as part of routine common pollutant testing and reporting.

[1] WPCL indicates BES Water Pollution Control Laboratory

[2] Preparation: hot block digestion.

[3] TA indicates Test America. (North Creek Analytical, identified in the SDMP, was acquired by Test America in early 2006).

[4] Preparation: 40 milliliters of sample are digested/oxidized with a 0.1N solution of $KBr/KBrO_3$ at room temperature. Mercury is reduced with stannous chloride and is measured by Cold Vapor Atomic Fluorescence.

Table 5-1: City of Portland HYDRA Rain Gage Data [1] Year 2, Event 1

Date	Hours																							Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
10/11/2006	[2]																								0.00
10/12/2006																									0.00
10/13/2006																									0.00
10/14/2006																									0.00
10/15/2006			0.04					0.02	0.07	0.08	0.13	0.02	0.01	0.01		0.01	0.02	0.01						0.06	0.49 [3]
10/16/2006	0.05	0.18					0.01	0.02						0.01											0.29
10/17/2006																									0.00
10/18/2006									0.02	0.01											0.01	0.03	0.02	0.02	0.11
10/19/2006		0.02	0.13	0.02		0.01	0.04	0.03	0.01																0.27
10/20/2006																									0.00
10/21/2006																									0.00
10/22/2006																									0.00
10/23/2006																									0.00
10/24/2006								0.03	0.03	0.01				0.01	0.02										0.11
10/25/2006																									0.00
10/26/2006																									0.00
10/27/2006																									0.00
10/28/2006																									0.00
10/29/2006								0.02	0.01																0.03
10/30/2006																									0.00
10/31/2006																									0.00
11/1/2006																									0.00
11/2/2006			0.03	0.06	0.02	0.04	0.03	0.01	0.06	0.05	0.07	0.08	0.01	0.03	0.12	0.04	0.03	0.08	0.1	0.13	0.11	0.02	0.02	0.02	1.18
11/3/2006	0.02						0.05	0.02	0.01		0.01	0.01		0.02	0.04	0.02	0.04	0.08	0.03			0.03	0.01		0.43

Notes:

Sample Collection Period

[1] Average of 13 rain gages in N, NE, and SE Portland, reported in inches

[2] Blank cells indicate less than one rain gage bucket tip per hour. One bucket tip = 0.01 inches of rainfall.

[3] Gage data for each hour has been reported to the nearest hundredth of an inch. Daily totals may not reflect the sum of hourly data due to rounding.

Table 5-10: Summary of Frequency of Detection for Common and PPS Pollutants[1] – Year 2

> 75 % [2]	> 50 - 75 %	≤ 50 %
Common Pollutants		
Arsenic (100%)	Cadmium (31 – 56%)	Ethylbenzene (0 – 2%)
Copper (100%)	Toluene (24 - 64%)	B(a)P (5 - 46 %)
Lead (100%)[3]	Total Nitrogen (2 - 71%)	Benzene (0 - 7%)
Zinc (100%)		Xylenes (0 – 2%)
Chromium (67 - 90%)		
Pentachlorophenol (88 – 98%)		
DEHP (45 - 83%)[4]		
Priority Pollutants		
		2,4-D (5 -50%)
		Chlorobenzene (0 – 2%)

Notes:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 2, Panel 6, the Supplemental Panel, P1_1, and SPO_3 (Event 1 only). This table does not include the results of duplicate samples, laboratory reanalysis, BES resampling events, or pentachlorophenol baseline samples (Event 3 only).

[2] Pollutants are grouped by the maximum frequency of detection observed during the five sampling events. The range of frequency of detection is shown in parentheses. A value of zero indicates the pollutant was not detected.

[3] Bolded values exceed MADL in at least one sampling event (see Section 7.1).

[4] Laboratory QC issues were encountered for DEHP in Year 2 (See Section 6 and Appendix H). Some data has been rejected and some data identified as being biased high. Refer to Appendix H prior to using phthalate data.

Table 5-11: Summary[1] of Non-Detect Priority Pollutant Stormwater Monitoring Data - Year 2

Analyte	MADL (ug/L)	Event	MRL Exeeds MADL	Number of Non-Detections	Number of Samples	Minimum Method Reporting Limit (µg/L)	Maximum Method Reporting Limit (µg/L)
Priority Pollutant Screen[2,3]							
Dinoseb	7.0	1	0	42	42	0.1	0.1
		2	0	41	41	0.1	0.1
		3	0	41	41	0.1	0.1
		4	0	41	41	0.1	0.1
		5	0	41	41	0.1	0.1
Picloram	500.0	1	0	42	42	0.4	0.4
		2	0	41	41	0.4	0.4
		3	0	41	41	0.4	0.4
		4	0	41	41	0.4	0.4
		5	0	41	41	0.4	0.4
1,2,4-Trichlorobenzene	70.0	1	0	42	42	0.5	0.5
		2	0	41	41	0.5	0.5
		3	0	41	41	0.5	0.5
		4	0	41	41	0.5	0.5
		5	0	41	41	0.5	1
1,3-Dichlorobenzene	5.5	1	0	42	42	0.5	0.5
		2	0	41	41	0.5	0.5
		3	0	41	41	0.5	0.5
		4	0	41	41	0.5	0.5
		5	0	41	41	0.5	1
Carbon tetrachloride	5.0	1	0	42	42	0.2	0.2
		2	0	41	41	0.2	0.2
		3	0	41	41	0.2	0.2
		4	0	41	41	0.2	0.2
		5	0	41	41	0.2	0.2
o-Dichlorobenzene[4]	600.0	1	0	42	42	0.5	0.5
		2	0	41	41	0.5	0.5
		3	0	41	41	0.5	0.5
		4	0	41	41	0.5	0.5
		5	0	41	41	0.5	1
p-Dichlorobenzene[5]	75.0	1	0	42	42	0.5	0.5
		2	0	41	41	0.5	0.5
		3	0	41	41	0.5	0.5
		4	0	41	41	0.5	0.5
		5	0	41	41	0.5	1

Notes:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 2, Panel 6, the Supplemental Panel, P1_1, and SPO_3 (Event 1 only). This table does not include the results of duplicate samples, laboratory reanalysis, BES resampling events, or pentachlorophenol baseline samples (Event 3 only).

[2] Table 5-9 provides a summary of common pollutants and PPS analytes detected in Year 2.

[3] Table 4-3 provides a complete list of PPS analytes. PPS analytes are thosed detected by analytical methods used for the required common pollutant monitoring. Full PPS testing is required by the WPCF permit in Years 1, 4, and 9.

[4] o-Dichlorobenzene is also known as 1,2-dichlorobenzene.

[5] p-Dichlorobenzene is also known as 1,4-dichlorobenzene.

Table 5-12: Summary of Detected Ancillary Pollutants[1] - Year 2

Analyte	Method	Event	Number of Detections	Number of Samples	Frequency of Detection (%)	Minimum Concentration[2] (µg/L)	Maximum Concentration[2] (µg/L)
Ancillary Pollutants Detected by Required Analyses							
Bentazon	EPA515.3	1	0	42	0	< 0.4[3]	< 0.4
		2	0	41	0	< 0.4	< 0.4
		3	0	41	0	< 0.4	< 0.4
		4	0	41	0	< 0.4	< 0.4
		5	2	41	5	< 0.4	1.83
Dicamba	EPA515.3	1	6	42	14	0.119	3.72
		2	0	41	0	< 0.2	< 0.2
		3	0	41	0	< 0.2	< 0.2
		4	1	41	2	< 0.2	0.745
		5	0	41	0	< 0.2	< 0.2
1,1,1-Trichloroethane	EPA8260	1	1	42	2	< 0.2	11.7
		2	1	41	2	< 0.2	12.1
		3	1	41	2	< 0.2	0.764
		4	1	41	2	< 0.2	2.01
		5	1	41	2	< 0.2	1.3
1,2,4-Trimethylbenzene	EPA8260	1	1	42	2	< 0.5	1.56
		2	0	41	0	< 0.5	< 0.5
		3	1	41	2	< 0.5	2.35
		4	0	41	0	< 0.5	< 0.5
		5	1	41	2	< 0.5	1.9
1,3,5-Trimethylbenzene	EPA8260	1	1	42	2	< 0.5	0.859
		2	0	41	0	< 0.5	< 0.5
		3	1	41	2	< 0.5	0.893
		4	0	41	0	< 0.5	< 0.5
		5	1	41	2	< 0.5	< 1
4-Isopropyltoluene	EPA8260	1	5	42	12	< 0.5	8.13
		2	0	41	0	< 0.5	< 0.5
		3	2	41	5	< 0.5	1.5
		4	1	41	2	< 0.5	0.994
		5	0	41	0	< 0.5	< 1
Acetone	EPA8260	1	7	42	17	< 20	33.9
		2	1	41	2	< 20	96.4
		3	1	41	2	< 20	24.1
		4	0	41	0	< 20	< 20
		5	0	41	0	< 20	< 20
Chloroform	EPA8260	1	0	42	0	< 0.2	< 0.2
		2	1	41	2	< 0.2	0.353
		3	1	41	2	< 0.2	0.225
		4	0	41	0	< 0.2	< 0.2
		5	2	41	5	< 0.2	1.39
Acenaphthylene	EPA8270M-SIM	1	0	42	0	< 0.0196	< 0.204
		2	2	41	5	< 0.0192	< 0.04
		3	4	41	10	< 0.0192	< 0.08
		4	0	41	0	< 0.0194	< 0.04
		5	0	41	0	< 0.0194	< 0.0392

Table 5-12: Summary of Detected Ancillary Pollutants[1] - Year 2

Analyte	Method	Event	Number of Detections	Number of Samples	Frequency of Detection (%)	Minimum Concentration[2] (µg/L)	Maximum Concentration[2] (µg/L)
Anthracene	EPA8270M-SIM	1	0	42	0	< 0.0196	< 0.141
		2	0	41	0	< 0.0192	< 0.04
		3	5	41	12	< 0.0192	< 0.08
		4	1	41	2	< 0.0194	< 0.04
		5	0	41	0	< 0.0194	< 0.02
Benzo(a)anthracene	EPA8270M-SIM	1	2	42	5	< 0.0098	< 0.03
		2	16	41	39	< 0.00962	0.0347
		3	16	41	39	< 0.00962	0.144
		4	15	41	37	< 0.00971	0.0501
		5	12	41	29	< 0.00971	0.042
Benzo(b)fluoranthene	EPA8270M-SIM	1	8	42	19	< 0.0098	< 0.05
		2	21	41	51	< 0.00962	0.0478
		3	23	41	56	< 0.00962	0.185
		4	17	41	41	< 0.00971	0.1
		5	20	41	49	< 0.00971	0.099
Benzo(ghi)perylene	EPA8270M-SIM	1	6	42	14	< 0.0196	0.0673
		2	21	41	51	< 0.0192	0.0901
		3	23	41	56	< 0.0192	0.329
		4	18	41	44	< 0.0194	0.152
		5	17	41	41	< 0.0194	0.0969
Benzo(k)fluoranthene	EPA8270M-SIM	1	2	42	5	< 0.0098	< 0.05
		2	14	41	34	< 0.00962	0.0282
		3	15	41	37	< 0.00962	0.161
		4	14	41	34	< 0.00971	0.045
		5	13	41	32	< 0.00971	0.072
Butyl benzyl phthalate[4]	EPA8270M-SIM	1	1	42	2	0.532	< 4
		2	0	41	0	< 0.962	< 2
		3	1	41	2	< 0.962	< 2
		4	0	41	0	< 0.971	< 2
		5	0	41	0	< 0.971	< 1
Chrysene	EPA8270M-SIM	1	14	42	33	< 0.0098	0.0428
		2	32	41	78	< 0.00962	0.0789
		3	29	41	71	< 0.00962	0.263
		4	25	41	61	< 0.00971	0.129
		5	30	41	73	< 0.00971	0.111
Di-n-butyl phthalate[4]	EPA8270M-SIM	1	1	42	2	0.623	< 4
		2	0	41	0	< 0.962	< 2
		3	1	41	2	< 0.962	< 2
		4	0	41	0	< 0.971	< 2
		5	0	41	0	< 0.971	< 1
Di-n-octyl phthalate[4]	EPA8270M-SIM	1	1	42	2	0.562	< 4
		2	0	41	0	< 0.962	< 2
		3	0	41	0	< 0.962	< 2
		4	8	41	20	< 0.971	2.14
		5	17	41	41	0.00727	1.41

Table 5-12: Summary of Detected Ancillary Pollutants[1] - Year 2

Analyte	Method	Event	Number of Detections	Number of Samples	Frequency of Detection (%)	Minimum Concentration[2] (µg/L)	Maximum Concentration[2] (µg/L)
Dibenzo(a,h)anthracene	EPA8270M-SIM	1	0	42	0	< 0.0098	< 0.0202
		2	2	41	5	< 0.00962	< 0.02
		3	7	41	17	< 0.00962	0.0633
		4	10	41	24	< 0.00971	0.0355
		5	4	41	10	< 0.00971	0.0237
Diethyl phthalate[4]	EPA8270M-SIM	1	0	42	0	< 0.98	< 4
		2	1	41	2	< 0.962	6.01
		3	1	41	2	< 0.962	12.2
		4	0	41	0	< 0.971	< 2
		5	0	41	0	< 0.971	< 1
Fluoranthene	EPA8270M-SIM	1	13	42	31	< 0.0196	< 0.0816
		2	32	41	78	< 0.0192	0.18
		3	31	41	76	< 0.0192	0.616
		4	28	41	68	< 0.0194	0.309
		5	27	41	66	< 0.0194	0.19
Fluorene	EPA8270M-SIM	1	0	42	0	< 0.0196	< 0.0816
		2	0	41	0	< 0.0192	< 0.04
		3	5	41	12	< 0.0192	0.0817
		4	2	41	5	< 0.0194	< 0.04
		5	0	41	0	< 0.0194	< 0.0392
Indeno(1,2,3-cd)pyrene	EPA8270M-SIM	1	2	42	5	< 0.0098	< 0.0202
		2	19	41	46	< 0.00962	0.0379
		3	21	41	51	< 0.00962	0.174
		4	15	41	37	< 0.00971	0.0617
		5	14	41	34	< 0.00971	0.0675
Naphthalene	EPA8270M-SIM	1	10	42	24	< 0.0196	< 0.404
		2	36	41	88	< 0.02	0.296
		3	29	41	71	< 0.0192	1.09
		4	28	41	68	< 0.0194	0.232
		5	29	41	71	< 0.0194	0.408
Phenanthrene	EPA8270M-SIM	1	20	42	48	< 0.0196	< 0.245
		2	39	41	95	< 0.02	0.172
		3	40	41	98	0.0218	0.516
		4	33	41	80	< 0.0194	0.173
		5	34	41	83	< 0.0194	0.126
Pyrene	EPA8270M-SIM	1	19	42	45	< 0.0196	0.0973
		2	35	41	85	< 0.0192	0.585
		3	38	41	93	< 0.0196	0.82
		4	30	41	73	< 0.0194	0.328
		5	31	41	76	< 0.0194	0.146

Notes:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 2, Panel 6, the Supplemental Panel, P1_1, and SPO_3 (Event 1 only). This table does not include the results of duplicate samples, laboratory reanalysis, BES resampling events, or pentachlorophenol baseline samples (Event 3 only).

[2] Concentrations reported with a minimum and maximum concentration range of <x to <y may indicate all concentrations were below MRLs or may indicate a concentration is below the maximum MRL. See Appendix F, Table F-3, for actual values.

[3] "<" Indicates laboratory reporting limit.

[4] Laboratory QC issues were encountered for DEHP in Year 2 (See Section 6 and Appendix H). Some data has been rejected and some data identified as being biased high. Refer to Appendix H prior to using phthalate data.

Table 5-13: Summary of Frequency of Detection for Ancillary Pollutants[1] – Year 2

Analyte	Frequency of Detection[2] (%)	Maximum Individual Sampling Event Frequency of Detection				
		>75%	>50 - ≤75%	>25 - ≤50%	>10 - ≤25%	≤10%
Ancillary Pollutants Detected by Required Analyses						
1,1,1-Trichloroethane	2%					X
1,2,4-Trimethyllbenzene	0 - 2 %[3]					X
1,3,5-Trimethylbenzene	0 - 2 %					X
4-Isopropyltoluene	0 - 12%				X	
Acenaphthylene	0 -10%					X
Acetone	0 - 17%				X	
Anthracene	0 - 12%				X	
Bentazon	0 - 5 %					X
Benzo(a)anthracene	5 - 39%			X		
Benzo(b)fluoranthene	19 - 56%		X			
Benzo(ghi)perylene	14 - 56%		X			
Benzo(k)fluoranthene	5 - 37%			X		
Butyl benzyl Phthalate[4]	0 - 2%					X
Chloroform	0 - 5%					X
Chrysene	33 - 78%	X				
Di -n-octyl phthalate[4]	0 - 41%			X		
Dibenzo(a,h)anthracene	0 - 24%				X	
Dicamba	0 - 14%				X	
Diethylphthalate[4]	0 - 2%					X
Di-n-butyl phthalate[4]	0 - 2%					X
Fluoranthene	31 - 78%	X				
Fluorene	0 - 12%				X	
Indeno(1,2,3-cd) pyrene	5 - 51%		X			
Naphthalene	24 - 88%	X				
Phenanthrene	48 - 98%	X				
Pyrene	45 - 93%	X				

Notes:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 2, Panel 6, the Supplemental Panel, P1_1, and SPO_3 (Event 1 only). This table does not include the results of duplicate samples, laboratory reanalysis, BES resampling events, or pentachlorophenol baseline samples (Event 3 only).

[2] Range of frequency of detections for individual sampling events

[3] "0" Indicates concentrations less than laboratory reporting limit.

[4] Laboratory QC issues were encountered for DEHP in Year 2 (See Section 6 and Appendix H). Some data has been rejected and some data identified as being biased high. Refer to Appendix H prior to using phthalate data.

Table 5-14: Summary of Total and Dissolved Metal Results - Year 2

Metal	Traffic Category (TPD)	MADL (ug/L)	Total (ug/L)				Ratio of Dissolved Average/Total Average
			Average[1]	Geometric Mean[1]	Minimum	Maximum	
Common Pollutants							
Arsenic (total)	<1000	10.0	0.46	0.36	0.095	2.14	NA
	≥1000		0.61	0.50	0.117	4.64	
Cadmium (total)	<1000	5.0	0.08	0.06	< 0.1	0.61	NA
	≥1000		0.20	0.14	< 0.1	2.56	
Chromium (total)	<1000	100	1.0	0.5	0.24	10.8	NA
	≥1000		3.7	2.2	< 0.4	50.9	
Copper (total)	<1000	1300	6.4	5.0	1.54	30.3	<1000 46% ≥1000 25%
	≥1000		16.1	11.6	1.65	212	
Copper (dissolved)	<1000	NA	3.0	2.3	0.39	16.6	
	≥1000		4.1	3.3	0.66	14.4	
Lead (total)	<1000	50.0	4.8	2.4	0.22	53.5	<1000 11% ≥1000 3%
	≥1000		15.5	9.5	0.53	149	
Lead (dissolved)	<1000	NA	0.5	0.2	< 0.1	20.5	
	≥1000		0.4	0.2	< 0.1	6.29	
Zinc (total)	<1000	5000	34.8	22.8	3.21	433	<1000 44% ≥1000 27%
	≥1000		86.9	63.1	12.6	1120	
Zinc (dissolved)	<1000	NA	15	11	2.08	141	
	≥1000		24	20	2.61	54	
Priority Pollutant Screen							
Mercury (dissolved)	<1000	NA	0.002	0.001	< 0.001	0.0091	NA
	≥1000		0.002	0.001	< 0.001	0.0082	

Note:

[1] All data were used in calculation of the mean and geometric mean. No outliers were omitted. Values reported at <MRL were included at 50% of the MRL. Duplicate sample results were not included.

Table 5-15: Summary of Total Suspended Solids (TSS) Results[1] - Year 2

	Total (mg/L)				
	Number of Samples	**Average**	**Geometric Mean**	**Minimum**	**Maximum**
< 1,000 Trips per Day (TPD)					
TSS	100	27	13	2	227
≥ 1,000 TPD					
TSS	105	98	45	3	2750

Note:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 2, Panel 6, the Supplemental Panel, P1_1, and SPO_3 (Event 1 only). This table does not include the results of duplicate samples, laboratory reanalysis, BES resampling events, or pentachlorophenol baseline samples (Event 3 only).

Table 5-2: City of Portland HYDRA Rain Gage Data [1] Year 2, Event 2

Date	Hours																							Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
12/7/2006	[2]																								0.00
12/8/2006																									0.00
12/9/2006				0.01	0.02	0.02	0.09	0.07																	0.20 3
12/10/2006									0.01	0.01					0.02								0.01	0.02	0.08
12/11/2006	0.03	0.01				0.01	0.05	0.1	0.02	0.06		0.1	0.14	0.02	0.02	0.01	0.02		0.03	0.02	0.01	0.1			0.77
12/12/2006				0.03	0.01	0.05	0.01												0.02	0.05	0.05	0.08	0.17	0.05	0.52
12/13/2006	0.13	0.11	0.03											0.01		0.01						0.01	0.02	0.01	0.35
12/14/2006			0.01	0.02	0.03	0.05	0.19	0.17	0.12	0.15	0.07	0.05	0.08	0.03		0.02	0.03	0.09	0.05	0.01			0.02	0.04	1.27

Notes:

Sample Collection Period

[1] Average of 13 rain gages in N, NE, and SE Portland, reported in inches

[2] Blank cells indicate less than one rain gage bucket tip per hour. One bucket tip = 0.01 inches of rainfall.

[3] Gage data for each hour has been reported to the nearest hundredth of an inch. Daily totals may not reflect the sum of hourly data due to rounding.

Table 5-3: City of Portland HYDRA Rain Gage Data [1] Year 2, Event 3

Date	Hours																								Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
12/30/2006	[2]																								0.00
12/31/2006																									0.00
1/1/2007											0.03	0.08	0.03												0.15 [3]
1/2/2007													0.08	0.04	0.14	0.14	0.14	0.07	0.06	0.06	0.04	0.04	0.05	0.06	0.93
1/3/2007	0.07	0.07	0.09	0.05	0.04	0.07	0.02	0.02			0.06	0.02													0.52
1/4/2007			0.01	0.02	0.03	0.09	0.01	0.05	0.06	0.03															0.31
1/5/2007																			0.02	0.01	0.05	0.07	0.1	0.02	0.27
1/6/2007	0.08	0.09			0.02																				0.22
1/7/2007					0.01	0.01					0.13	0.1	0.02	0.01	0.01	0.01									0.30
1/8/2007											0.01	0.01	0.01												0.04
1/9/2007																		0.1	0.01			0.02	0.01		0.15
1/10/2007																									0.01
1/11/2007										0.03	0.01														0.04
1/12/2007																									0.00
1/13/2007																									0.00
1/14/2007																									0.00
1/15/2007																									0.00
1/16/2007																									0.00
1/17/2007											0.02	0.06	0.08	0.05	0.01										0.22
1/18/2007																									0.00
1/19/2007									0.01	0.03	0.02	0.01	0.01	0.01				0.01	0.02				0.02		0.16
1/20/2007															0.01										0.02
1/21/2007																									0.00
1/22/2007																									0.00
1/23/2007																									0.00
1/24/2007																									0.00
1/25/2007																									0.00
1/26/2007																									0.00
1/27/2007																									0.00
1/28/2007																									0.00
1/29/2007																									0.00
1/30/2007																									0.00
1/31/2007																									0.00
2/1/2007																									0.00
2/2/2007																									0.00

2/3/2007													0.03	0.05	0.04										0.12
2/4/2007																									0.00
2/5/2007																									0.00
2/6/2007																									0.00
2/7/2007																			0.02	0.02	0.05	0.02			0.11
2/8/2007					0.01	0.02																			0.03
2/9/2007	0.02	0.06	0.08	0.09	0.01	0.01																			0.28
2/10/2007															0.01	0.08		0.01		0.02			0.02	0.07	0.22
2/11/2007	0.04	0.06	0.03	0.01										0.01	0.01	0.01		0.01	0.01				0.01		0.21
2/12/2007																									0.01
2/13/2007									0.01																0.03
2/14/2007													0.05	0.09	0.04	0.01	0.01								0.20
2/15/2007	0.01	0.01					0.01	0.05	0.03	0.03	0.02	0.04	0.07	0.06	0.03	0.02	0.04	0.01							0.44

Notes:

Sample Collection Period

[1] Average of 13 rain gages in N, NE, and SE Portland, reported in inches

[2] Blank cells indicate less than one rain gage bucket tip per hour. One bucket tip = 0.01 inches of rainfall.

[3] Gage data for each hour has been reported to the nearest hundredth of an inch. Daily totals may not reflect the sum of hourly data due to rounding.

Table 5-4: City of Portland HYDRA Rain Gage Data [1] Year 2, Event 4

Date	Hours																								Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
2/26/2007	[2]	0.01	0.02		0.02	0.01							0.01					0.01	0.01	0.07	0.01				0.17 [3]
2/27/2007								0.01	0.07	0.08	0.03	0.03	0.03	0.03	0.04	0.02	0.01								0.34
2/28/2007						0.05	0.02	0.03	0.01																0.12
3/1/2007															0.01		0.02	0.02	0.01	0.01					0.08
3/2/2007						0.01	0.04	0.06	0.07	0.06	0.05	0.05	0.03	0.04	0.05	0.06	0.05	0.05	0.05	0.05	0.06	0.07	0.04	0.03	0.92
3/3/2007	0.01	0.03	0.04	0.01	0.01	0.01	0.01	0.01																	0.11
3/4/2007																									0.01
3/5/2007																									0.00
3/6/2007																									0.00
3/7/2007					0.01	0.05	0.03		0.03	0.03	0.01		0.01	0.03	0.03										0.23
3/8/2007																									0.00
3/9/2007										0.02	0.03			0.01						0.01	0.02			0.01	0.11
3/10/2007	0.01	0.01												0.01	0.01										0.06
3/11/2007																									0.01
3/12/2007				0.09	0.04	0.05	0.01				0.02	0.01	0.01												0.23
3/13/2007																									0.00
3/14/2007																									0.00
3/15/2007																									0.00
3/16/2007																									0.00
3/17/2007																									0.00
3/18/2007																									0.00
3/19/2007														0.01	0.07	0.07	0.05	0.07	0.04	0.01		0.02		0.01	0.36

Notes:

Sample Collection Period

[1] Average of 13 rain gages in N, NE, and SE Portland, reported in inches

[2] Blank cells indicate less than one rain gage bucket tip per hour. One bucket tip = 0.01 inches of rainfall.

[3] Gage data for each hour has been reported to the nearest hundredth of an inch. Daily totals may not reflect the sum of hourly data due to rounding.

Table 5-5: City of Portland HYDRA Rain Gage [1] Data Year 2, Event 5

Date	Hours																								Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
4/12/2007	[2]							0.01	0.01	0.01															0.04 [3]
4/13/2007																								0.01	0.01
4/14/2007	0.02	0.02	0.02				0.04	0.03									0.03								0.17
4/15/2007																									0.00
4/16/2007									0.01	0.02		0.01	0.01	0.01				0.01		0.01					0.09
4/17/2007			0.01	0.02	0.01						0.01	0.02	0.1	0.02		0.04	0.09	0.01	0.01						0.34
4/18/2007													0.02	0.07	0.02		0.06	0.08	0.02	0.01					0.29
4/19/2007																									0.00
4/20/2007																									0.00
4/21/2007													0.05	0.09	0.06	0.04	0.06								0.30
4/22/2007																									0.00
4/23/2007																									0.00
4/24/2007																									0.01
4/25/2007																									0.01
4/26/2007																									0.00
4/27/2007																									0.00
4/28/2007																									0.00
4/29/2007																									0.00
4/30/2007																									0.00
5/1/2007																						0.05	0.03	0.03	0.11
5/2/2007	0.09		0.01	0.03	0.01						0.05	0.02	0.02	0.09			0.02	0.02	0.01						0.40
5/3/2007	0.01	0.01			0.03	0.02											0.01	0.04	0.05						0.18
5/4/2007									0.01			0.02		0.03	0.02										0.11
5/5/2007																									0.00
5/6/2007																									0.00
5/7/2007																									0.00
5/8/2007																									0.00
5/9/2007																									0.00
5/10/2007																									0.00
5/11/2007																									0.00
5/12/2007																		0.01	0.05	0.02	0.01	0.01	0.01	0.01	0.11
5/13/2007																									0.01
5/14/2007																									0.00
5/15/2007																									0.00
5/16/2007																									0.00

5/17/2007								0.01																0.01
5/18/2007																				0.01	0.01		0.02		0.04
5/19/2007																									0.01
5/20/2007					0.01			0.01	0.02	0.02	0.01	0.01		0.01	0.02	0.03	0.06	0.03					0.01		0.23

Notes:

Sample Collection Period

[1] Average of 13 rain gages in N, NE, and SE Portland, reported in inches

[2] Blank cells indicate less than one rain gage bucket tip per hour. One bucket tip = 0.01 inches of rainfall.

[3] Gage data for each hour has been reported to the nearest hundredth of an inch. Daily totals may not reflect the sum of hourly data due to rounding.

Table 5-6: Sampled Storm Event Summary

Sampling Event	Number of Individual Storms Sampled	Individual Sampled Storm Duration (hours)	Sampled Storm Intensity (inches)	Antecedent Dry Period before Sampled Storm Event (hours)[a]
1	6	2 – 23	0.03 – 1.18	1-89
2	3	4 – 12	0.16 – 0.97	1 – 3
3	4	2 – 25	0.02 – 1.35	4 - 27
4	4	3 – 27	0.05 – 1.05	1 - 167
5	8	3 – 9	0.05 – 0.30	1 - 63

Notes:

[a] This column was referred to as "Time Between Individual Rainfall Events" in *Stormwater Discharge Sampling Report - Year 1*.

Table 5-7: Climate Data Summary - Years 1 and 2 and Long-term Average

Long-term Average			Year 1 Data				Year 2 Data			
Month	Mean Average Temperature (F)[1]	Mean Monthly Precipitation (inches)[2]	Month	Average Temperature (F)[3]	Permit Year 1 Monthly Precipitation (inches)[3]	Difference in Precipitation (Permit Year - Monthly Mean) (inches)[4]	Month	Average Temperature (F)[3]	Permit Year 2 Monthly Precipitation (inches)[3]	Difference in Precipitation (Permit Year - Monthly Mean) (inches)[4]
June	63.3	1.59	Jun-05	62.0	2.21	0.62	Jun-06	66.4	0.93	-0.66
July	68.1	0.72	Jul-05	70.3	0.41	-0.31	Jul-06	71.0	0.47	-0.25
August	68.5	0.93	Aug-05	70.7	1.05	0.12	Aug-06	69.2	0.10	-0.83
September	63.2	1.65	Sep-05	62.5	1.71	0.06	Sep-06	65.2	0.86	-0.79
October	54.5	2.88	Oct-05	56.3	3.40	0.52	Oct-06	54.0	1.40	-1.48
November	46.1	5.62	Nov-05	44.0	4.98	-0.64	Nov-06	47.4	11.92	6.30
December	40.2	5.71	Dec-05	39.8	7.52	1.81	Dec-06	40.0	5.86	0.15
January	39.6	5.07	Jan-06	45.5	10.92	5.85	Jan-07	38.1	2.74	-2.33
February	43.4	4.18	Feb-06	42.0	2.15	-2.03	Feb-07	44.2	3.47	-0.71
March	47.3	3.71	Mar-06	46.1	2.96	-0.75	Mar-07	50.1	3.20	-0.51
April	50.9	2.64	Apr-06	53.1	2.46	-0.18	Apr-07	51.7	2.01	-0.63
May	57.1	2.38	May-06	59.8	3.00	0.62	May-07	58.6	1.45	-0.93
Year	53.5	37.08	Year	54.3	42.77	5.69	Year	54.7	34.41	-2.67

Notes:

[1] Mean Monthly temperatures at Portland Airport from www.ocs.oregonstate.edu/index.html

[2] Monthly Totals/Averages. Portland International Airport. Period 1971 - 2000. From NOWData - NOAA Online Weather Data at http://nowdata.rcc-acis.org/PQR/pubACIS_results.
The source of the long-term average precipitation was changed in Year 2 to be consistent with the values reported with the Year 1 and Year 2 monthly precipitation values.

[3] Preliminary Local Climatological Data - Portland Oregon. From http://www.weather.gov/climate/index.php?wfo=pqr

[4] A positive values indicates that the measured precipitation total for that month exceeds the monthly mean.

Table 5-8: Field Parameter Summary Statistics[1] - Year 2

Field Parameter	Units	Event	Number of Samples	Minimum	Median	Mean	Maximum
Conductivity	umhos/cm	1	42	13	35.5	46.3	146
		2	41	6	17	23.1	122
		3	46	8	15.6	24.0	83
		4	41	7	17	19.8	74
		5	41	4	21	23.3	55
pH	Units	1	42	4.2	6.2	6.2	8.3
		2	41	4.9	6.1	6.2	8
		3	46	4.2	6.2	6.0	7.3
		4	41	5.7	6.3	6.3	7.1
		5	41	5.4	6.2	6.2	7.5
Temperature	Degrees Celsius	1	42	5.9	12.5	10.6	14.5
		2	41	7.3	8.5	8.8	11.4
		3	46	7.9	8.8	9.1	11.8
		4	41	4.6	7.6	8.0	13.1
		5	41	9.3	11.6	11.8	15.3

Note:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 2, Panel 6, the Supplemental Panel, P1_1, and SPO_3 (Event 1 only). This table does not include the results of duplicate samples, laboratory reanalysis, BES resampling events, or pentachlorophenol baseline samples (Event 3 only).

Table 5-9: Frequency of Detected[1] Common and Priority Pollutant Screen Analytes[2] - Year 2

Analyte	MADL (µg/L)	Event	Exeedances of MADL[2]	Number of Detections[2]	Number of Samples[2]	Frequency of Detection	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Maximum Percent of MADL Detected (Maximum concentration/MADL) (%)
Common Pollutants									
Arsenic (total)	10.0	1	0	42	42	100	0.13	1.4	14
		2	0	41	41	100	0.095	1.4	14
		3	0	41	41	100	0.11	2.99	30
		4	0	41	41	100	0.148	4.64	46
		5	0	41	41	100	0.175	1.51	15
Cadmium (total)	5.0	1	0	13	42	31	0.1	0.48	10
		2	0	17	41	41	< 0.1[3]	1.22	24
		3	0	18	41	44	< 0.1	0.87	17
		4	0	20	41	49	< 0.1	2.56	51
		5	0	23	41	56	< 0.1	0.38	8
Chromium (total)	100	1	0	28	42	67	< 0.4	6.9	7
		2	0	30	41	73	< 0.4	16.8	17
		3	0	34	41	83	< 0.4	38.6	39
		4	0	35	41	85	0.24	50.9	51
		5	0	37	41	90	< 0.4	6.08	6
Copper (total)	1300	1	0	42	42	100	1.66	28.1	2
		2	0	41	41	100	1.54	75.2	6
		3	0	41	41	100	1.65	86.8	7
		4	0	41	41	100	1.56	212	16
		5	0	41	41	100	2.24	34.5	3
Lead (total)	50.0	1	0	42	42	100	0.39	43	86
		2	0	41	41	100	0.45	38.2	76
		3	**2**[4]	41	41	100	0.53	**101**	**202**
		4	**1**	41	41	100	0.27	**149**	**298**
		5	**2**	41	41	100	0.22	**53.9**	**108**
Zinc (total)	5000	1	0	42	42	100	3.21	212	4
		2	0	41	41	100	4.53	214	4
		3	0	41	41	100	4.04	433	9
		4	0	41	41	100	7.25	1120	22
		5	0	41	41	100	6.21	168	3

Table 5-9: Frequency of Detected[1] Common and Priority Pollutant Screen Analytes[2] - Year 2

Analyte	MADL (µg/L)	Event	Exeedances of MADL[2]	Number of Detections[2]	Number of Samples[2]	Frequency of Detection	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Maximum Percent of MADL Detected (Maximum concentration/MADL) (%)
Total Nitrogen	10000	1	0	30	42	71	< 0.1	0.66	0
		2	0	1	41	2	< 0.1	< 0.1	NA
		3	0	7	41	17	< 0.1	0.32	0
		4	0	8	41	20	< 0.1	0.46	0
		5	0	18	41	44	< 0.1	0.51	0
Pentachlorophenol	1.0	1	**10**	41	42	98	0.0307	**4.31**	**431**
		2	**9**	37	41	90	< 0.04	**4.29**	**429**
		3	**8**	37	41	90	< 0.04	**4.67**	**467**
		4	**10**	37	41	90	< 0.04	**3.59**	**359**
		5	**3**	36	41	88	< 0.04	**2.17**	**217**
Benzene	5.0	1	0	0	42	0	< 0.2	< 0.2	NA
		2	0	0	41	0	< 0.2	< 0.2	NA
		3	0	3	41	7	< 0.2	1.1	22
		4	0	0	41	0	< 0.2	< 0.2	NA
		5	0	0	41	0	< 0.2	< 0.2	NA
Ethylbenzene	700	1	0	1	42	2	< 0.5	1.27	0
		2	0	0	41	0	< 0.5	< 0.5	NA
		3	0	1	41	2	< 0.5	1.1	0
		4	0	0	41	0	< 0.5	< 0.5	NA
		5	0	0	41	0	< 0.5	< 1	NA
Toluene	1000	1	0	27	42	64	< 0.5	280	28
		2	0	10	41	24	< 0.5	1.65	0
		3	0	14	41	34	< 0.5	17.2	2
		4	0	13	41	32	< 0.5	8.7	1
		5	0	23	41	56	< 0.5	19.5	2
Xylenes	10000	1	0	0	42	0	< 1.5	< 1.5	NA
		2	0	0	41	0	< 1.5	< 1.5	NA
		3	0	1	41	2	< 1.5	9.62	0
		4	0	0	41	0	< 1.5	< 1.5	NA
		5	0	0	41	0	< 1.5	< 3	NA

Table 5-9: Frequency of Detected[1] Common and Priority Pollutant Screen Analytes[2] - Year 2

Analyte	MADL (µg/L)	Event	Exeedances of MADL[2]	Number of Detections[2]	Number of Samples[2]	Frequency of Detection	Minimum Concentration (µg/L)	Maximum Concentration (µg/L)	Maximum Percent of MADL Detected (Maximum concentration/MADL) (%)
Benzo(a)pyrene	0.2	1	0	2	42	5	< 0.0098	< 0.0202	NA
		2	0	19	41	46	< 0.00962	0.0363	18
		3	0	16	41	39	< 0.00962	0.164	82
		4	0	15	41	37	< 0.00971	0.0667	33
		5	0	13	41	32	< 0.00971	0.0628	31
Di(2-ethylhexyl) phthalate[5]	6.0	1	**1**	19	42	45	0.683	**264**	**4400**
		2	**6**	34	41	83	< 0.962	**23.1**	**385**
		3	0	31	41	76	< 0.962	4.69	78
		4	**4**	34	41	83	0.621	**11.6**	**193**
		5	**1**	25	41	61	0.757	**6.17**	**103**
Priority Pollutant Screen									
2,4-D	70.0	1	0	21	42	50	< 0.1	32.3	46
		2	0	2	41	5	< 0.1	0.402	1
		3	0	4	41	10	< 0.1	0.478	1
		4	0	3	41	7	< 0.1	8.69	12
		5	0	8	41	20	< 0.1	2.47	4
Chlorobenzene	100.0	1	0	0	42	0	< 0.2	< 0.2	NA
		2	0	0	41	0	< 0.2	< 0.2	NA
		3	0	1	41	2	< 0.2	0.213	0
		4	0	0	41	0	< 0.2	< 0.2	NA
		5	0	0	41	0	< 0.2	< 0.4	NA

Notes:

[1] This table includes only those common or priority pollutants that were detected in one or more samples.

[2] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 2, Panel 6, the Supplemental Panel, P1_1, and SPO_3 (Event 1 only). This table does not include the results of duplicate samples, laboratory reanalysis, BES resampling events, or pentachlorophenol baseline samples (Event 3 only). Duplicate samples are included in Appendix F Tables F-2 and F-3.

[3] "<" Indicates the laboratory reporting limit.

[4] Bold text indicate pollutant concentration exceeds the MADL.

[5] Laboratory QC issues were encountered for DEHP in Year 2 (See Section 6 and Appendix H). Some data has been rejected and some data identified as being biased high. Refer to Appendix H prior to using phthalate data.

Table 5-11 provides summary of non-detect priority pollutant stormwater monitoring data.

Table 6-1: Overall Data Quality Objectives

Compound Class	Precision	Accuracy	Completeness
Volatile Organic Compounds (VOCs)	± 25%	Per method/per analyte	95%
Polynuclear Aromatic Hydrocarbons (PAHs)	± 50%	Per method/per analyte	95%
Semivolatile Organic Compounds (SVOCs)	± 50%	Per method/per analyte	95%
Herbicides/Pesticides	± 30%	± 30%	95%
Total Metals	± 20%	± 25%	95%
Conventionals	± 20%	± 25%	95%

Table 6-2: Di(2-ethylhexyl)phthalate (DEHP) QC Issues for Year 2 UIC Monitoring

Event	Analytical Batch[1]	Issue	Affected Samples	Comments	BES Actions
1	6110361	Method blank contamination at 3.8 µg/l	P6_4	5 non-detect results and 1 detect (P6_4). A P6_4 field duplicate was analyzed as part of a separate analytical batch and the RPD was 11%.	No qualifiers for non-detect results. No qualifier for sample P6_4 result since field duplicate RPD was acceptable. Consider data usable.
	6101225	RPD for P6_7 sample and field duplicate outside acceptable range	P6_7 DUP	Sample results were 0.705 µg/l for the parent and 6.24 µg/l for the field duplicate	Qualify duplicate with "JH" for potential high bias.
		P6_1 = 264 µg/l	P6_1	Anomalously high result based on past data for all UIC monitoring to date.	Conducted follow-up investigation and resampled site. Data point will be evaluated to determine if it is an outlier and should be included in calculation of the annual mean concentration.
2	6120438	Method Blank contamination at 0.764 µg/l	P2_4, P2_11, P2_12, P2_15, P2_15 DUP, P6_1, P6_4, P6_5, P6_8, P6_9, P6_13, SP1_1, SP1_3, SP1_4, SP1_6	Entire batch re-extracted and re-analyzed. Re-analysis data not reported by lab due to repeated blank contamination.	Corresponding sample results for DEHP for batch 6120438 were qualified as follows (EPA 2005): • Non-detected results were not qualified. • Concentrations greater than the MDL but less than the blank concentration were qualified with "UB" at the reported sample concentration (usually reported sample concentrations are qualified with "UB" and replaced with the value reported for the method blank. Sample concentrations were not changed since laboratory contamination appeared to be at random concentrations rather than a consistent, uniform source of contamination. • Concentrations less than 5x the blank concentration were qualified with "JB". • Concentrations greater than 5x the blank concentration were qualified with "JH" due to LCS recovery failure. For field duplicates, about half of the results were already qualified due to blank contamination. Remaining duplicate data and data above the MDL for batch 6120498 were qualified with
		LCS = 79.7 µg/l (1590% recovery)	P2_3, P2_13, SP1_7, SP1_9	Non-detect results for this batch considered valid; however, results above MDL could have high bias.	
		RPD for P2_15 sample and field duplicate outside acceptable range	P2_15, P2_15 DUP	Sample results were 2.01 µg/l for the parent and 0.805 µg/l for the field duplicate.	
		RPD for SP1_9 sample and field duplicate outside acceptable range	SP1_9, SP1_9 DUP	Sample results were 9.33 µg/l for the parent and 0.916 µg/l for the field duplicate.	
		Entire batch re-analyzed by TA as a result of pervasive QC issues	all	Re-analysis results not reported due to repeated blank contamination	

Table 6-2: Di(2-ethylhexyl)phthalate (DEHP) QC Issues for Year 2 UIC Monitoring

Event	Analytical Batch[1]	Issue	Affected Samples	Comments	BES Actions
	6120498	MS/MSD results outside acceptable range (-200% & -310%)	P1_1, P2_1, P2_6, P2_7, P2_10, P6_1 DUP, P6_3, P6_7, P6_10, P6_11, P6_11 DUP, SP1_2, SP1_10	Results attributed by lab to non-homogenous sample matrix. Original sample (P2_10) result was 23.1 µg/l—second highest concentration reported to date. MS/MSD recoveries suggest values of 2.8 or 8.4 µg/l for this sample.	"JH". The non-detect results were not qualified. Resampling event conducted based on blank contamination, LCS results, and poor field duplicate precision. Phthalate resampling conducted for 17 UIC locations plus 2 duplicates and one field decontamination blank. Samples collected from: • 6 locations >MADL; • 5 locations ≥ 70 % MADL; • 4 locations > MRL and < 70% MADL; and • 2 locations < MRL.
		RPD for P6_11 sample and field duplicate outside acceptable range	P6_11, P6_11 DUP	Sample results were 6.46 µg/l for the parent and < 0.526 µg/l for the field duplicate.	
3	7010228	LCS = 23.9 µg/l (478% recovery)	P2_3, P2_3 DUP, P2_4, P2_5, P2_6, P2_7, P2_10, P2_10 DUP, P2_11, P2_13, P6_5, P6_6, P6_7, P6_11, P6_12, P6_12 DUP, SP1_1, SP1_5	All samples re-extracted, both data reported by lab, except as noted for batch 7010495 below. RPDs for several result "pairs" > 50%.	Corresponding sample results for DEHP for batch 701028 (18 samples) were qualified as follows: • Non-detected results were not qualified. • All detects were qualified with "JH" for potential high bias due to LCS and MS/MSD recovery failures. • No action was taken for field blank contamination as this appeared to have been introduced in the laboratory.
		MS2 recovery = 224%, MS2/MSD2 RPD = 126%			
		DEHP detected at 2.05 µg/l in field decontamination blank	None	Due to lab QC issues, sample reanalyzed by TA 2 days outside hold time. Reanalysis result < 0.526 µg/l	
	7010386	LCS = 9.68 µg/l (198% recovery)	P2_10 DUP	Sample was a re-extract from previous batch due to sample surrogate recovery failure. Re-extract batch LCS failed.	P2_10 DUP sample result qualified with "JH". No additional action was taken as a result of holding time exceedence.
		Exceeded holding time for extraction			
	7010495	Batch is re-extracts and were extracted outside the holding time for extraction	P2_3, P2_5, P2_6, P2_10, P2_10 DUP, P2_11,	Results of re-analysis not reported by lab for 3 samples (P2_3 DUP, P2_4, and P2_7)	All reanalysis results qualified with "J" for estimated due to holding time exceedence.

Table 6-2: Di(2-ethylhexyl)phthalate (DEHP) QC Issues for Year 2 UIC Monitoring

Event	Analytical Batch[1]	Issue	Affected Samples	Comments	BES Actions
		Some results not reported by lab. Batch is re-extract and reanalysis for batch 7010228 as a result of QC issues.	P2_13, P6_5, P6_6, P6_7, P6_11, P6_12, P6_12 DUP, SP1_1, SP1_5	as results were more than 10x batch 7010228 results for those samples. All QC criteria met for this batch, though LCS/LCSD data reported as insufficient sample volume was available for additional MS/MSDs.	
2 (re-)	7020844, 7020993	(7020844) LCS = 32.4 µg/l (810% recovery), LCSD = 7.45 µg/l (186% recovery), RPD = 125%	P1_1, P1_1 DUP, P6_2, SP1_4, SP1_9	Samples re-extracted and re-analyzed. LCS results for re-analysis also failed (see below).	All data above MDL were qualified with "JH".
		(7020993) LCS = 16.3 µg/l (408% recovery), LCSD = 7.98 µg/l (198% recovery), RPD = 69.3%		Batch 7020993 is a re-extract of batch 7020884, LCS results also failed	
		Samples FO070224 (P1_1) and FO070225 (P1_1 DUP) are field duplicates. RPDs/RSD did not meet acceptance criteria.		Since samples were re-extracted and re-analyzed, 4 results are provided for the same sample location for the same Event (parent sample & field duplicate plus 2 re-analyses). The four results are 2.16, 6.13, 0.761, and 81.7 µg/l. Results for the 3 other samples re-analyzed are paired in parentheses: (4.94, 6.27), (1.89, 1.54), and (23.6, 8.15)	Original data qualified with "JH". Reanalysis data were qualified with "R" for rejected. SP1_9 resample was rejected due to QC issues and gross RPD failure.
4	7030178	One MS sample (156%) exceeded acceptance criteria	None (?)	Two MS/MSD samples analyzed and all other criteria were met.	No action was taken as all other criteria were met.
		Field decontamination blank detection at 0.570 µg/l	None (?)	Result only slightly above MDL	No action taken due to pervasive laboratory QC issues during this event
	7030179	MS/MSD results outside acceptable range (-118% & -129%), RPD acceptable	P2_11	Original sample result 7.68 µg/l (P2_11), no narrative or qualifier assigned in lab report.	Source sample (P2_11) was qualified with "JH" due to potential high bias.

Table 6-2: Di(2-ethylhexyl)phthalate (DEHP) QC Issues for Year 2 UIC Monitoring

Event	Analytical Batch[1]	Issue	Affected Samples	Comments	BES Actions
		RPD for P2_13 sample and field duplicate outside acceptable range	P2_13, P2_13	Sample results were 2.73 µg/l for the parent and 1.08 µg/l for the field duplicate.	Both values were qualified with "J". Considered qualifying all data for this batch due to MS/MSD and duplicate RPD failures; however, none of the other sample results were elevated, thus no additional action was taken.
	7030394	Method Blank contamination at 1.44 µg/l	P1_1, P2_9, P2_14, P6_5, P6_6, P6_6 DUP, P6_9, P6_12, P6_13, SP1_4, SP1_8, SP1_9	Entire batch re-extracted and re-analyzed. Only two re-analysis sample results reported by lab due to repeated blank contamination (see below).	Corresponding sample results for DEHP for batches 7030394 and 7030870 were qualified as follows (EPA 2005): • Non-detected results were not qualified. • Concentrations greater than the MDL but less than the blank concentration were qualified with "UB" at the reported sample concentration (usually reported sample concentrations are qualified with "UB" and replaced with the value reported for the method blank. Sample concentrations were not changed since laboratory contamination appeared to be at random concentrations rather than a consistent, uniform source of contamination). • Concentrations less than 5x the blank concentration were qualified with "JB". Two samples (P2_5 and P2_10) were selected for resampling since these locations exceeded the MADL and no re-analysis results were provided by TA for these samples.
		MSD results outside acceptable range (100% & 417%), RPD 123%			
		RPD for P6_6 sample and field duplicate outside acceptable range		Sample results were 1.51 µg/l for the parent and 0.778 µg/l for the field duplicate (< 5x MDL).	
	7030756	Method blank contamination at 3.87 µg/l	--	This batch is a re-extract and analysis for batch 7030394. Only two re-analysis samples reported by lab due to repeated blank contamination.	
	7030870	Method blank contamination at 10.9 µg/l	P2_15, P6_2, SP1_6, SP1_7	Entire batch re-extracted and re-analyzed.	
	7031090	LCS = 26.0 µg/l (650% recovery)	--	This batch is a re-extract and analysis for batch 7030870.	
5	7041074	Field decontamination blank detection at 0.512 µg/l	None (?)	Result only slightly above MDL	No action was taken since value is only slightly above MDL (0.511 µg/l).

Notes:

[1] Analytical batch numbers are included on Laboratory Reports presented in Appendix C of the *Annual Stormwater Discharge Monitoring Report – Year 2*, July 2007

DEHP = di (2-ethylhexyl) phthalate (aka BEHP or bis (2-ethylhexyl) phthalate)
LCS/LCSD = Laboratory Control Spike/Laboratory Control Spike Duplicate
MADL = Maximum Allowable Discharge Limit
MDL = Method Detection Limit
MRL = Method Reporting Limit
MS/MSD = Matrix Spike/Matrix Spike Duplicate
RPD = Relative Percent Difference
RSD = Relative Standard Deviation
TA = TestAmerica
UB = Estimated method reporting limit, due to blank contamination
JB = Estimated concentration, due to blank contamination
JH = Estimated concentration, possible/probable high bias due to QC failure
R = Rejected
U = Not detected above the method detection limit

Table 6-3: Remaining Laboratory QC Issues for Year 2 UIC Monitoring

Event	Method	Issue	Affected Samples	Cause	Actions Taken	Usability
1	EPA 200.8	Zinc detected in field decontamination blank at 0.68 ug/l	P6_3	Potential field contaminant	All sample values > 5x the method blank except P6_3 which was qualified with "JB".	Usable with qualifiers
	EPA 8270	Extracted 6 days past EPA recommended holding time for extraction	P2_5	Low surrogate recovery for first analysis, no analytes detected. Re-extracted and 7 analytes detected	Measured concentrations qualified with "J", non-detects qualified with "UJ".	Usable with qualifiers
	EPA 515.3	Dicamba, pentachlorophenol, and 2,4,5-T method blank contaminantion for batch 6101260. All detects in method blank above MDL but below MRL	P6_7, P6_7 DUP, P6_13, SP1_8	Laboratory contaminant	Non-detects and results > 5x the method blank conc. were not qualified. Four samples (P6_7, P6_7DUP, P6_13, SP1_8) with dicamba results < 5x the method blank concentration were qualified with "JB".	Usable with qualifiers
	EPA 515.3	Dinoseb, pentachlorophenol, and 2,4,5-T method blank contaminantion for batch 6101260. All detects in method blank above MDL but below MRL	P2_10, P2_15, P6_9, SP1_9	Laboratory contaminant	Non-detects and results > 5x the method blank conc. were not qualified. Four samples (P2_10, P2_15, P6_9, SP1_9) with pentachlorophenol results < 5x the method blank concentration were qualified with "JB".	Usable with qualifiers
	EPA 515.3	For batch 6101260, MS/MSD recoveries were above acceptance criteria for bentazon, 2,4-DB, dicamba, 3,5-dichlorobenzoic acid, picloram, and 2,4,5-TP (Silvex)	None	Matrix interference	None of these analytes detected in associated samples except dicamba. Dicamba results already qualified due to blank contamination.	Usable with qualifiers
	EPA 515.3	For batch 6110210, MS/MSD recoveries were above acceptance criteria for acifluoren and 3,5-dichlorobenzoic acid	None	Matrix interference	No action taken, neither of these analytes detected in associated samples.	Usable
	EPA 515.3	For batch 6110514, MS/MSD recoveries were above acceptance criteria for 3,5-dichlorobenzoic acid	None	Matrix interference	No action taken, this analyte not detected in associated samples.	Usable
2	EPA 200.8	Zinc detected in field decontamination blank at 0.66 ug/l	None	Potential field contaminant	All sample values > 5x the method blank, no action taken.	Usable
	EPA 200.8	P2_15 sample and field duplicate RPD failure for arsenic	None	Non-homogenous samples, low concentrations	Both concentrations were less than five times the MRL, therefore, no action was taken.	Usable
	EPA 515.3	For batch 6120527, MS/MSD recoveries were above acceptance criteria for 2,4-DB and 3,5-dichlorobenzoic acid	None	Matrix interference	No action taken, neither of these analytes detected in associated samples.	Usable

Table 6-3: Remaining Laboratory QC Issues for Year 2 UIC Monitoring

Event	Method	Issue	Affected Samples	Cause	Actions Taken	Usability
2	EPA 515.3	For batch 6120527, LCS recoveries were slightly above acceptance criteria for picloram	None	Analytical difficulties	No action taken, analyte not detected in associated samples.	Usable
	EPA 515.3	For batch 6120415, CCVs over-responded for dicamba and 3,5-dichlorobenzoic acid	P6_13	Analytical difficulties	3,5-dichlorobenzoic acid not detected in associated samples, therefore, no action taken. Dicamba results greater than the MDL (one sample) qualified with "JH" for potential high bias.	Usable with qualifiers
	EPA 515.3	Extraction holding time exceeded for three samples by several days	P2_5, P2_14, P6_14	Pentachlorophenol results for these samples were outside the calibration range for the initial run	Pentachlorophenol results for these samples were qualified with "J".	Usable with qualifiers
3	EPA 515.3	For batch 7010197, one additional matrix spike was analyzed as initial MS recovery for pentachlorophenol (152%) was outside control limits	None	Sample concentration too high (>3x) relative to spike amount	Different sample selected for MS/MSD. Subsequent recoveries/RPDs within control limits. No action was taken.	Usable
	EPA 515.3	For batch 7020668, MS/MSD recoveries were above acceptance criteria for bentazon (144%), 3,5-dichlorobenzoic acid (180%, 198%, and 186%), pentachlorophenol (155% and 67.5%) and picloram (166%, 155%, and 154%)	None	Matrix interference	Bentazon, 3,5-dichlorobenzoic acid, and picloram were not detected in any of the associated samples, therefore, no action was taken. All other criteria for pentachlorophenol were met, therefore, pentachlorophenol recoveries were judged not to affect any of the data and no action was taken	Usable
	EPA 8260	4-isopropyltoluene was detected at 2.73 ug/l in a laboratory QA duplicate but not in the parent sample (0.5 ug/l--P6_7)	P6_7	Unknown	4-isopropyltoluene was not detected in any of the other samples in this analytical batch, therefore, no action was taken.	Usable
	EPA 8270	For batch 7010386, insufficient volume was available at the lab for MS/MSD analysis	None	QC failures for DEHP resulted in reanalysis and use of all MS/MSD sample volume provided.	QC was for sample reanalysis because all three surrogates were below acceptance criteria. All MS/MSD sample volume had already been used for initial sample analysis. Analytical accuracy was not judged to be affected and no additional action was taken.	Usable
	EPA 8270	For batch 7020672, insufficient volume was available at the lab for MS/MSD analysis	None	Long gap (45 days) between beginning and end of Event 3. Samples provided to lab for MS/MSD analyses were outside hold time	LCS duplicate analyzed by TA and resutls were within control limits. Since no elevated sample concentrations were reported for this batch, analytical accuracy was not judged to be affected, therefore, no action was taken.	Usable

Table 6-3: Remaining Laboratory QC Issues for Year 2 UIC Monitoring

Event	Method	Issue	Affected Samples	Cause	Actions Taken	Usability
4	EPA 200.8	Zinc detected in field decontamination blank at 0.82 ug/l	None	Field contaminant	All sample values > 5x the method blank, no action was taken.	Usable
	EPA 200.8	P6_6 sample and field duplicate RPD failure for chromium, copper, lead, and zinc	P6_6, P6_6 DUP	Non-homogenous samples	For chromium concentrations, both concentrations were less than five times the MRL, therefore, no action was taken. All other data with RPD failures qualified with "J".	Usable with qualifiers
	EPA 8260	P2_13 sample and field duplicate RPD failure for toluene	None	Unknown, possible non-homogeneous samples	Toluene detection for P2_13 was only slightly above MRL (duplicate was <MRL), therefore, no action was taken.	Usable
	EPA 8270	For batches 7030756 (reanalysis), 7030870, and 7031090 (reanalysis), no MS/MSD samples were analyzed	None	Extra sample volume consumed through sample reanalyses and duplicate MS/MSD samples as a result of DEHP QC issues	All other criteria for all analytes except DEHP were met, therefore, no action was taken. Much of the DEHP data for this Event was qualified due to laboratory QC issues.	Usable
	EPA 515.3	For batch 7030196, MS/MSD recoveries were above acceptance criteria for dicamba (141%, 134%), 3,5-dichlorobenzoic acid (150%, 166%), and picloram (152%, 154%)	None	Matrix interference	None of these analytes were detected in any of the associated samples, therefore, no action was taken.	Usable
	EPA 515.3	For batch 7030461, MS/MSD recoveries were above acceptance criteria for acifluorfen (142%, 139%, 139%, 145%), bentazon (152%, 134%, 144%, 137%), 2,4-D (133%, 132%, 137%, 136%), 2,4-DB (152%, 166%, 149%, 158%), picloram (141%, 134%, 139%, 140%), and 2,4,5-T (133%) (two sets analyzed for this batch)	None	Matrix interference	None of these analytes were detected in any of the associated samples, therefore, no action was taken.	Usable
	EPA 515.3	For batch 7030573, MS/MSD recoveries were above acceptance criteria for bentazon (146%, 164%), and 2,4-D (134%)	None	Matrix interference	Bentazon was not detected in any of the associated samples and all other criteria for 2,4-D were met, therefore, no action was taken.	Usable

Table 6-3: Remaining Laboratory QC Issues for Year 2 UIC Monitoring

Event	Method	Issue	Affected Samples	Cause	Actions Taken	Usability
4	EPA 515.3	For batch 7030982, MS/MSD recoveries were above acceptance criteria for bentazon (150%, 161%), 2,4-D (148%, 152%), dicamba (135%, 137%), 3,5-dichlorobenzoic acid (163%, 152%), and picloram (134%, 135%)	None	Matrix interference	None of these analytes were detected in any of the associated samples, therefore, no action was taken.	Usable
5	EPA 200.8	Zinc detected in field decontamination blank at 0.82 ug/l	None	Potential field contaminant	All sample values > 5x the method blank, no action was taken.	Usable
	EPA 200.8	Sample and field duplicate RPD failures for P2_14 (chromium, lead), P6_7 (cadmium, zinc), and SP1_1 (arsenic, cadmium, chromium, copper, lead, zinc)	P2_14, P2_14 DUP, P6_7, P6_7 DUP, SP1_1, SP1_1 DUP	Non-homogenous samples	For P6_7 cadmium concentrations, both concentrations were less than five times the MRL, therefore, no action was taken. All other data with RPD failures were qualified with "J".	Usable with qualifiers
	EPA 8260	Low surrogate recovery for 4-bromofluorbenzene in the P2_15 QA duplicate (78%) and the associated trip blank (80%)	5/20/07 trip blank (FO070637)	Unknown, sample could not be reanalyzed within hold time	All other data were within control limits and RPDs were met for sample P2_15 and the QA duplicate. None of the target compounds were detected in the trip blank, thus, associated target compounds in the trip blank were qualified with "UJ" .	Usable
	EPA 8270	Di-n-octyl phthalate method blank contaminantion for batch 7040948 (0.57 ug/l)	P2_4, P6_3, P6_11	Laboratory contaminant	Sample results were qualified with "JB".	Usable with qualifiers
	EPA 8270	Di-n-octyl phthalate method blank contaminantion for batch 7050294 (0.546 ug/l)	P2_11, P2_13, P6_1 (resample), P6_7, P6_7 DUP, P6_14, SP1_1, SP1_1 DUP, SP1_6, SP1_7, SP1_10	Laboratory contaminant	Sample results were qualified with "JB".	Usable with qualifiers
	EPA 8270	MS/MSD samples not analyzed for most analytical bacthes for this event	43 of 46 samples	Laboratory error	TA analyzed LCS duplicates with each batch and all results were within control limits. All other relevant QC were within acceptance criteria including field duplicates, therefore, analytical accuracy was judged not to be affected. Corrective Action Report was prepared by TA.	Usable
	EPA 8270	P2_14 sample and field duplicate RPD failure for benzo(a)pyrene	None	Unknown, possible non-homogeneous samples	Benzo(a)pyrene detection for P2_14 was less than 5x MDL (duplicate was <MDL), therefore, no action was taken.	Usable

Table 6-3: Remaining Laboratory QC Issues for Year 2 UIC Monitoring

Event	Method	Issue	Affected Samples	Cause	Actions Taken	Usability
5	EPA 515.3	For batch 7041201, LCS recoveries were above acceptance criteria for dicamba (150%) and 3,5-dichlorobenzoic acid (400%)	None	Analytical difficulties	Neither of these analytes were detected in the associated samples, therefore, no action was taken.	Usable
	EPA 515.3	For batch 7040707, MS/MSD recoveries were above acceptance criteria for bentazon (168%, 166%), 2,4-D (160%, 146%), 2,4-DB (145%, 136%), dicamba (142%, 132%), 3,5-dichlorobenzoic acid (200%, 198%), pentachlorophenol (137%), and picloram (140%, 132%)	None	Matrix interference	All other criteria for pentachlorophenol were met and none of the other analytes were detected in any of the associated samples, therefore, no action was taken.	Usable
	EPA 515.3	For batch 7041201, MS/MSD recoveries were above acceptance criteria for bentazon (149%, 136%), dicamba (173%, 161%) and 3,5-dichlorobenzoic acid (451%, 422%)	None	Matrix interference	None of these analytes were detected in any of the associated samples, therefore, no action was taken	Usable
	EPA 515.3	For batch 7050521, MS/MSD recoveries were above acceptance criteria for picloram (139%, 136%)	None	Matrix interference	Picloram was not detected in any of the associated samples therefore, no action was taken.	Usable
	EPA 515.3	For batch 7041265, MS/MSD recoveries were above acceptance criteria for bentazon (137%, 136%), 2,4-DB (134%, 140%), and picloram (132%, 146%) and below acceptance criteria for pentachlorophenol (25%)	None	Matrix interference	For pentachlorophenol, the spike amount was less than one fifth of the sample concentration, thus, analytical accuracy was judged not to be affected. None of the other analytes were detected in any of the associated samples, therefore, no action was taken.	Usable
	EPA 515.3	For batch 7060029, MS/MSD recoveries were above acceptance criteria for bentazon (141%), 2,4-D (147%, 150%), 2,4-DB (146%, 159%), dicamba (131%), dichlorprop (132%), pentachlorophenol (138%), picloram (148%, 152%), and 2,4,5-T (149%)	None	Matrix interference	All other criteria for pentachlorophenol were met and none of the other analytes were detected in any of the associated samples, therefore, no action was taken.	Usable

Notes:

Batch numbers are included in Laboratory Reports presented in Appendix C of the*Annual Stormwater Discharge Monitoring Report – Year 2* , July 2007.

CCV = continuing calibration verification

LCS = laboratory control sample

(notes continued on page 6)

Table 6-3: Remaining Laboratory QC Issues for Year 2 UIC Monitoring

(notes continued from previous page)
MDL = method detection limit
MRL = method reporting limit
MS/MSD = matrix spike/matrix spike duplicate
RPD = relative percent difference
TA = TestAmerica
UB = Estimated method reporting limit, due to blank contamination
JB = Estimated concentration, due to blank contamination
JH = Estimated concentration, possible/probable high bias due to QC failure
R = Rejected
U = Not detected above the method detection limit

Table 7-1: Summary of Year 2 MADL Exceedances - Common Pollutants

Analyte	Location Code	Traffic Category (TPD)	MADL (µg/L)	Event (concentration (µg/L)) [1]				
				1	2	3	4	5
Di(2-ethylhexyl) phthalate	P1_1	<1000	6.0	<1.02	**7.79** [2]	<1	0.814	<0.99
	P2_10	≥1000		0.963	**23.1**	1.98, 1.6 [3]	1.73	0.986
	P2_11	<1000		<1.03	1.65	1	**7.68**	<0.99
	P2_15	<1000		0.722	<1, 2.01	2.09	**11.6**	1.2
	P2_2	≥1000		3.24	1.87	2.38	3.27, 4.93	**6.17**
	P2_5	≥1000		1.94	2.38	3.36	**8.47**	2.99
	P6_1	≥1000		**264**	1.51, 1.46	4.69	2.99	2.57
	P6_11	<1000		<1	**6.46**, <1	1.24	<0.971	1.15
	P6_12	≥1000		2.25	**17.6**	2.27, 2.07	1.4	2.78, 1.85
	P6_15	≥1000		<0.99	**6.61**	2.51	3.23	<0.99
	P6_7	<1000		**6.24**, <0.98	1.23	<1	2.57	1.02, <0.99
	SP1_7	≥1000		2.48	5.34	3.39	**7.13**	1.63
	SP1_9	<1000		5.84	<1, **9.33**	<0.962	1.21	1.01
Lead (total)	P6_1	≥1000	50.0	13.6	13, 13.2	**101**	26.6	14.3
	P6_11	<1000		43	14.9, 13.5	18.7	13.5	**53.5**
	P6_5	≥1000		22.8	24.7	15.6	22.5	**53.9**
	SP1_7	≥1000		5.75	12.7	**79.4**	**149**	8.25
Pentachlorophenol	P1_1	<1000	1.0	**1.29**	**1.47**	**1.45**	**1.39**	0.662
	P2_13	≥1000		**1.15**	**2.44**	**3.87**	**2.74, 2.56**	0.797
	P2_14	≥1000		**4.31**	**2.03**	**1.79**	**2.44**	**2.47, 2.17**
	P2_3	≥1000		0.877	0.801	0.902, 0.929	**1.55**	0.356
	P2_5	≥1000		**3.05**	**4.29**	**4.67**	**3.59**	**1.52**
	P2_7	<1000		**2.25**	**1.86**	**1.77**	**1.35**	0.982
	P6_1	≥1000		1	**1.06**, 0.817	0.597	**1.72**	0.741
	P6_14	≥1000		**2.48**	**1.02**	0.982	**2.34**	0.934
	P6_2	≥1000		**1.31**	0.573	**1.46**	**1.01**	**1.12**
	P6_4	<1000		**1.55, 1.62**	0.431	**2.2**	0.414	0.431
	P6_7	<1000		**1.33, 1.22**	**3.26**	**2.66**	**3.06**	0.222, 1
	SP1_1	≥1000		**1.68, 2**	0.933	0.705	0.758	0.431, 0.438
	SP1_7	≥1000		0.987	**1.58**	0.0956	0.18	0.18

Notes:

[1] This table includes only those analytes detected at concentrations ≥ the MADL during at least one sampling event. This table does not include the results of laboratory reanalyses, BES resampling events or pentachlorophenol baseline samples (Event 3 only).

[2] Bolded numbers exceed the MADL.

[3] Duplicate samples reported as: sample concentration, duplicate concentration.

Table 7-10: Summary of Sampling Panel Injection Volume Estimates

Parameter	Panel 1		Panel 2		Panel 6		Supplemental Panel	
	Range	Average	Range	Average	Range	Average	Range	Average
Individual UIC Characteristics (See Tables 7-5 through 7-8 for more information)								
Total Drainage Individual UIC Areas (sq ft)	8,934 –242,875	79,605	3,893 – 202,819	55,857	12,280 – 581,610	115,759	14,948 - 146,311	60,465
Total Drainage Individual UIC Impervious Area (sq ft)	5,265 – 132,163	30,605	1,446 – 115,351	40,673	2,751 – 277,637	49,347	6,681 - 91,296	54,938
Individual UIC % Impervious Area	28% – 59%	39%	18% - 61%	40%	22% - 84%	44%	8% - 95%	40%
General Year 2 UIC Sampling Panel Characteristics								
Total Panel Drainage Area (sq feet)	1,194,071		1,199,416		1,736,382		1,148,829	
Total Panel Impervious Drainage Area (sq feet)	459,075		473,108		740,212		305,873	
Approximate Panel % Impervious	38%		39%		43%		27%	
Estimated Injection Volume of Year 2 Sampling Panels (cubic feet)								
Long-term[a]	1,049,721		1,081,809		1,692,569		699,409	
Year 1[b]	1,210,803		1,247,814		1,952,297		806,735	
Year 2[c]	974,134		1,003,912		1,570,693		649,047	
Average[d]	1,092,468		1,125,863		1,761,495		727,891	

Notes:

[a] Infiltration estimated using the annual "Long-term Average Monthly Precipitation" of 37.08 inches presented in Table 5-7.

[b] Infiltration estimated using the Year 1 annual precipitation of 42.77 inches presented in Table 5-7.

[c] Infiltration estimated using the Year 2 annual precipitation of 34.41 inches presented in Table 5-7.

[d] Average infiltration based on Year 1 and Year 2 volumes.

Table 7-2: Priority Pollutant Screen Analyte Action Levels

Annual Mean Concentration Action Level	Compliance Response Action
≤ 50 % MADL	No further action. Return to PPS sampling frequency specified in the permit.
> 50 % MADL, but < MADL	Continue monitoring UIC at frequency of 5 sampling events per wet season, or request permit modification to return to normal PPS sampling frequency specified in permit
≥ MADL	Implement compliance response in accordance with permit

Table 7-3: Year 2 Annual Mean Concentrations - Common Pollutants

Analysis	MADL	Location Code[1]	Traffic Category (Trips per Day)	Average[2] (µg/L)	Geomean[2] (µg/L)	Minimum[3] (µg/L)	Maximum (µg/L)
Benzo(a)pyrene	0.2	P6_1	>1000	0.06	0.04	0.02	0.16
Di(2-ethylhexyl) phthalate (DEHP)[5]	6.0	P6_1	>1000	55.1[3]	**6.8**[4]	1.5	**264**
		P2_10	>1000	5.7	2.3	1.0	**23.1**
		P6_12	>1000	5.1	3.1	1.4	**17.6**
		SP1_7	>1000	4.0	3.5	1.6	**7.1**
		P2_5	>1000	3.8	3.3	1.9	**8.5**
		P6_14	>1000	3.6	3.4	2.3	5.3
		P2_2	>1000	3.6	3.3	1.9	**6.2**
		P2_15	<1000	3.4	1.9	0.7	**11.6**
		P6_2	>1000	3.1	2.3	0.5	5.8
		SP1_9	<1000	2.7	1.8	0.5	5.8
		P6_15	>1000	2.7	1.7	0.5	**6.6**
		SP1_3	>1000	2.5	2.3	1.4	4.3
		P6_10	>1000	2.4	2.0	0.5	4.3
		P2_4	>1000	2.3	1.8	0.5	3.7
		P2_11	<1000	2.3	1.3	0.5	**7.7**
		SP1_1	>1000	2.1	1.8	0.5	3.6
		P1_1	<1000	2.0	1.0	0.5	**7.8**
		P6_8	<1000	2.0	1.9	1.0	3.5
		P6_5	>1000	2.0	1.8	1.1	3.4
		P2_13	>1000	2.0	1.2	0.5	5.9
		P2_3	>1000	1.9	1.4	0.5	4.1
		P6_7	<1000	1.7	1.3	0.5	3.4
		P6_6	<1000	1.7	1.1	0.5	5.3
		P6_13	<1000	1.6	1.3	0.5	3.7
		P6_11	<1000	1.4	1.0	0.5	3.5
		SP1_10	<1000	1.4	1.1	0.5	3.0
		P2_6	<1000	1.2	0.9	0.5	3.5
		SP1_4	<1000	1.1	0.8	0.5	3.0
Lead (total)	50.0	P2_14	>1000	10.0	7.7	4.3	27.6
		P2_2	>1000	19.3	16.0	4.7	33.9
		P2_3	>1000	12.4	9.1	2.7	27.1
		P2_5	>1000	20.0	16.1	7.3	42.3
		P2_8	>1000	12.7	8.5	2.6	32.6
		P6_1	>1000	33.7	23.3	13.1	101
		P6_10	>1000	14.3	12.0	3.6	25.7
		P6_11	<1000	28.6	24.2	13.5	53.5
		P6_12	>1000	13.8	10.3	4.3	31.4
		P6_2	>1000	15.8	11.3	3.4	38.2
		P6_5	>1000	27.9	25.4	15.6	**53.9**
		P6_8	<1000	10.8	6.9	2.6	31.6
		SP1_3	>1000	10.2	6.8	3.0	29.4
		SP1_5	>1000	17.4	13.4	6.7	41.7
		SP1_7	>1000	51.0	23.5	5.8	**149**

Analysis	MADL	Location Code[1]	Traffic Category (Trips per Day)	Average[2] (µg/L)	Geomean[2] (µg/L)	Minimum[3] (µg/L)	Maximum (µg/L)
Pentachlorophenol	1.0	P1_1	<1000	1.3	**1.2**	0.7	1.47
		P2_12	<1000	0.5	0.5	0.3	0.765
		P2_13	>1000	2.2	**1.9**	0.8	3.87
		P2_14	>1000	2.6	**2.5**	1.8	4.31
		P2_2	>1000	0.4	0.4	0.3	0.573
		P2_3	>1000	0.9	0.8	0.4	1.55
		P2_4	>1000	0.5	0.4	0.2	0.917
		P2_5	>1000	3.4	**3.2**	**1.5**	**4.7**
		P2_6	<1000	0.3	0.3	0.2	0.6
		P2_7	<1000	1.6	**1.6**	**1.0**	**2.3**
		P2_8	>1000	0.6	0.6	0.3	0.8
		P6_1	>1000	1.2 [6]	**1.1** [6]	0.6	**1.7**
		P6_12	>1000	0.6	0.6	0.3	0.9
		P6_14	>1000	1.6	**1.4**	0.9	**2.5**
		P6_2	>1000	1.1	**1.0**	0.6	**1.5**
		P6_4	<1000	1.0	0.8	0.4	**2.2**
		P6_5	>1000	0.4	0.3	0.2	0.5
		P6_7	<1000	2.2	**1.8**	0.6	**3.3**
		SP1_1	>1000	0.9	0.8	0.4	**1.8**
		SP1_10	<1000	0.4	0.3	0.1	0.5
		SP1_2	>1000	0.4	0.4	0.2	0.5
		SP1_3	>1000	0.4	0.4	0.3	0.6
		SP1_6	<1000	0.5	0.4	0.2	0.7
		SP1_7	>1000	0.6	0.3	0.1	**1.6**

Notes:

[1] Table includes only those UIC monitoring locations where the concentration was ≥50% of the MADL in at least one sample.

[2] Most concentrations are rounded to one decimal place.

[3] Minimum concentrations may be either MRL or MDL values (i.e., < symbol not shown).

[4] DEHP calculations do not include resample results or laboratory reanalyses results. These values should be considered estimates only.

[5] DEHP mean and geometric mean concentrations are recalculated in Table 7-4 and Section 7.2.2 using all validated data.

[6] Average includes result of Event 1 resample. If resample result is not included, annual geometric mean concentration is 0.9 µg/L.

Table 7-4: Focused Di(2-ethylhexyl)phthalate (DEHP) Annual Mean Calculation

Location[1]	Event 1 (µg/L)		Event 2 (µg/L)		Event 3 (µg/L)				Event 4 (µg/L)			Event 5 (µg/L)				Resample Event (1, 2, & 4) (µg/L)				Geomean[2] (µg/L)	Mean[2] (µg/L)
					Event 3		Reanalysis		Event 4		Reanalysis	TestAmerica		DEQ Lab		Res 2+4		Reanalyses			
	Original	Dup	Original	Dup	Original	Dup	ORA	DRA	Original	Dup	ORA	Original	Dup	Orig	Dup	Orig	Dup	RRA	RDRA		
P2_2	3.24		1.87		2.38				4.93	3.27		**6.17**								3.4	3.7
P2_5	1.94		2.38		3.36		3.48		**8.47**			2.99				1.70	1.98			2.8	3.3
P2_10	0.963		**23.10**		1.6	1.98	1.66		1.73			0.99				0.647				1.9	5.7
P2_15	0.72		2.01	0.805	2.09				**11.60**		3.38	1.20								2.1	3.1
P6_1	**264.00**		1.51	1.46	4.69				2.99			2.57		4.00		1.57				5.3	**39.8**
P6_2	0.516		4.68		2.28				5.75		1.86	2.06		3.00		4.94		**6.27**		2.5	3.2
P6_12	2.25		**17.60**		2.07	2.27	3.11	7.23	1.40			1.85	2.78	3.00	2.00	2.22				2.9	5.0
P6_14	2.33		4.60		2.62				5.26			2.98		4.90		2.72				3.3	3.4
SP1_7	2.48		5.34		3.39				**7.13**		2.88	1.63				2.76				3.3	3.7

Notes:

Shaded cells indicate value used calculation of annual means.

Bold text indicates value exceeds the MADL.

[1] This table include only those locations where the estimated annual mean concentration was ≥ 50% of the MADL using unvalidated (i.e., "as reported") data (See Table 7-3 and Section 7.2.2).

[2] Annual geomean and mean concentrations were calculated using only the validated and recommended data in Appendix H.

Original = Original sample analysis

Dup = Field duplicate analyses

ORA = Original sample re-extracted and re-analyzed by TestAmerica as a result of lab QC failure for DEHP

DRA = Field duplicate sample re-extracted and re-analyzed as described above

RRA = Event 2 resample event sample re-extracted and re-analyzed as described above

RDRA = Event 2 resample event field duplicate sample re-extracted and re-analyzed as described above

RSD = Relative standard deviation

Res 2+4 = Resampling for both Events 2 and 4

Table 7-5: UIC Stormwater Discharge Volume[a]

Ownership	Total of UICs [b]	Sum of Total UIC Catchment Area [c] (ft^2)	Sum of Total Impervious Area Drainage[c] (ft^2)	Sum of Total UIC Catchment Area[c] (acre)	Sum of Total Impervious Area Drainage[c] (acre)	Adjusted Sum of TOTAL UIC Catchment Area[f] (ft^2)	Adjusted Sum of Impervious Area Drainage[f] (ft^2)	Adjusted Sum of TOTAL UIC Catchment Area [f] (acre)	Adjusted Sum of Impervious Area Drainage[f] (acre)	Year 1 Annual Infiltration Volume[g] (ft^3)	Year 2 Annual Infiltration Volume[h] (ft^3)
BES	8,598	727,322,185	252,502,028	16,697	5,797	629,816,774	223,453,300	14,459	5,130	589,354,355	474,156,730
BGS	20	- [d]	-	-	-	-	-	-	-	-	-
Fire	21	-	-	-	-	-	-	-	-	-	-
Parks	188	-	-	-	-	-	-	-	-	-	-
Water	37	-	37,150	-	0.9	-	37,150	-	0.9	97,983	78,830
Sum:	8,864	727,322,185	252,539,178	16,697	5,798	629,816,774	223,490,450	14,459	5,131	589,452,337	474,235,560
Average per UIC[e]:	-	94,188	32,704	2.2	0.8	-	-	-	-	NA	NA
Adjusted Average per UIC	-	-	-	-	-	81,561	28,942	1.87	0.66	76,334	61,414

Notes:

[a] The volume of stormwater infiltrated estimated to discharge into the City's UIC is based on unverified subcatchment delineations. These delineations are likely to change due to refined mapping or modeling, or due to changes in the field.

[b] Approximately 481 BES UICs are identified in the UIC database to have a service status of "ABAN" (Abandoned); these were not included in the catchment/impervious area calculation or discharge volume estimation.

[c] Non-BES UICs with "Unknown" or "N/A" impervious/catchment drainage areas were given values of zero. In addition, 699 BES UICs were not included in calculation because they were identified as being inside a catchment area with at least one other UIC (e.g., UICs constructed in series)

[d] Denotes no UIC Catchment Area/Impervious Area Drainage reported for this classification of UIC.

[e] Average values for UICs with reported catchment areas > 0.

[f] Adjusted average values calculated by inserting "average" catchment areas for those reported as 0. In addtion, several UIC catchment areas and impervious area outlier values appeared anomalous (> +2 standard deviations). These values were also changed to average values: 94,188 and 32,704 square feet, respectively.

[g] Infiltration volume = Annual Precipitation (inches) * 1ft/12in *Imprevious Area (ft^2)*(1-Evaporative Loss Factor)

Based on estimated Year 1 precipitation total of 42.77 inches (See Table 5-7). Preliminary monthly National Weather Service climatological for Portland International Airport see http://www.weather.gov/climate/index.php?wfo=pqr

Infiltration volume calculation assumes that 26 percent of precipitation falling on impervious surfaces is lost to evaporation and 74 percent drains to the UIC (Snyder, D.T. and Others, 1994)

[h] Based on estimated Year 2 precipitation total of 34.41 inches (See Table 5-7). Preliminary monthly National Weather Service climatological for Portland International Airport see

Table 7-6: Year 2 Estimated Total Volume of Stormwater Infiltrated by Rotating Panel 1 UICs*

Location Code	Address	BES UIC No. [a]	Traffic Category (trips per day)	Predominant Land Use [b]	Impervious Surface Drainage Area (sq ft)	Total Drainage Area (sq ft)	Approximate % Impervious Area	Average Annual Infiltration Volume [c] (cubic ft)
P1-1	6940 N. Macrum Ave.	AAG769	< 1000	SFR	34,291	96,935	35%	72,764
				Average	34,291	96,935	35%	72,764

Notes:

* Infiltration volume is estimated in this table only for those UICs included in the Year 2 UIC Monitoring Program.

[a] The BES UIC number is obtained from the BES Hansen database.

[b] SFR = single family residential

[c] Infiltration volume = Annual Precipitation (inches) * 1ft/12in *Imprevious Area (ft^2)*(1-Evaporative Loss Factor)
Based on estimated Year 2 precipitation total of 34.41 inches (See Table 5-7). Preliminary monthly National Weather Service climatological for Portland International Airport see http://www.weather.gov/climate/index.php?wfo=pqr
Infiltration volume calculation assumes that 26 percent of precipitation falling on impervious surfaces is lost to evaporation and 74 percent drains to the UIC (Snyder, D.T. and Others, 1994)

Table 7-7: Year 2 Estimated Volume of Stormwater Infiltrated by Rotating Panel 2 UICs

Location Code	Address	BES UIC No. [a]	Traffic Category (trips per day)	Predominant Land Use [b]	Impervious Surface Drainage Area (sq ft)	Total Drainage Area (sq ft)	Approximate % Impervious Area	Annual Infiltration Volume [c] (cubic ft)
P2-1	4335 NE Alameda St	ADR102	≥ 1000	SFR	19,954	46,941	43%	42,341
P2-2	5015 NE Killingsworth St.	ADV361	≥ 1000	MFR	18,812	47,765	39%	39,918
P2-3	12220 SE Holgate Blvd.	ADU749	≥ 1000	COM	2,622	4,267	61%	5,564
P2-4	490 NE 106th Ave.	ADR922	≥ 1000	MFR	14,906	27,900	53%	31,630
P2-5	10150 SE Ankeny St.	ADR885	≥ 1000	IND	115,351	202,819	57%	244,769
P2-6	1337 NE Shaver St.	ADQ450	< 1000	SFR	44,436	102,404	43%	94,291
P2-7	7930 SE Henry St.	ADV064	< 1000	SFR	1,446	3,893	37%	3,068
P2-8	3938 SE 130th Ave.	ADT436	≥ 1000	SFR	12,035	68,533	18%	25,538
P2-9	2905 SE 143rd Ave.	ADS687	< 1000	SFR	17,272	81,746	21%	36,650
P2-10	5934 NE Cleveland Ave.	ADP605	≥ 1000	SFR	66,134	177,656	37%	140,333
P2-11	5003 SE 58th Ave.	ADT613	< 1000	SFR	60,402	174,712	35%	128,170
P2-12 *	7003 NE Everett	AMP946	< 1000	SFR	25,859	67,614	38%	54,872
P2-13	4107 SE Reedway St.	ADU790	≥ 1000	SFR	21,183	64,523	33%	44,949
P2-14	8409 N. Woolsey Ave.	AAH289	≥ 1000	SFR	46,501	111,755	42%	98,673
P2-15	13075 NE Weidler St.	ADV587	< 1000	SFR	6,195	16,888	37%	13,145
				Average	31,541	79,961	40%	34,618

Notes:

[a] The BES UIC number is obtained from the BES Hansen database.

[b] SFR = single family residential; MFR = mulltifamily residential; IND = industrial; COM = commericial

[c] Infiltration volume = Annual Precipitation (inches) * 1ft/12in *Imprevious Area (ft^2)*(1-Evaporative Loss Factor)
Based on estimated Year 2 precipitation total of 34.41 inches (See Table 5-7). Preliminary monthly National Weather Service climatological for Portland International Airport see http://www.weather.gov/climate/index.php?wfo=pqr
Infiltration volume calculation assumes that 26 percent of precipitation falling on impervious surfaces is lost to evaporation and 74 percent drains to the UIC (Snyder, D.T. and Others, 1994)

Table 7-8: Year 2 Estimated Volume of Stormwater Infiltrated by Stationary Panel 6 UICs

Location Code	Address	BES UIC No. [a]	Traffic Category (trips per day)	Predom-inant Land Use [b]	Impervious Surface Drainage Area (sq ft)	Total Drainage Area (sq ft)	Approx-imate % Impervious Area	Annual Infiltration Volume [c] (cubic ft)
P6-1	3500 SE 112th Ave.	ADW577	≥ 1000	COM	43,353	102,341	42%	91,993
P6-2 *	3740 SE 104th Avenue	ADT394	< 1000	POS	2,751	12,503	22%	5,837
P6-3	4541 NE 80th Ave.	ADQ337	< 1000	SFR	10,858	28,874	38%	23,040
P6-4	9090 SE Claybourne St.	ADT961	< 1000	SFR	6,643	15,631	42%	14,096
P6-5	2513 SE 153rd Ave.	ADS740	≥ 1000	MFR	25,450	50,298	51%	54,004
P6-6	5201 N. Emerson Dr.	ADV395	< 1000	SFR	14,316	28,981	49%	30,378
P6-7	608 NE 87th Ave.	ADV645	< 1000	MFR	277,637	581,610	48%	589,132
P6-8	10064 SE Woodstock Blvd.	ADV169	< 1000	IND	53,048	63,485	84%	112,565
P6-9	3617 SE 168th Ave.	ADT531	< 1000	SFR	36,781	78,006	47%	78,047
P6-10 *	5502 NE 13th Ave.	ADP732	≥ 1000	MFR	7,426	12,280	60%	15,758
P6-11	1406 NE Skidmore St.	AAU014	< 1000	SFR	29,323	63,505	46%	62,222
P6-12 *	550 SE 130th Ave.	ADT061	≥ 1000	SFR	73,422	160,677	46%	155,798
P6-13	14350 NE Knott St.	ADW213	< 1000	SFR	101,815	307,444	33%	216,046
P6-14	4289 NE Prescott St.	ADQ252	≥ 1000	COM	47,486	196,729	24%	100,763
P6-15	13500 NE Glisan St.	ADR767	≥ 1000	POS	9,903	34,018	29%	21,014
				Average	49,347	115,759	44%	104,713

Notes:

* Indicates UIC was replaced for Year 2 sampling. Three Panel 6 locations were replaced due to reestimation of the traffic category during Year 1 sampling activities. See Section 4.2 of the SAP (August 2006) for additional information.

[a] The BES UIC number is obtained from the BES Hansen database.

[b] SFR = single family residential; MFR = mulltifamily residential; IND = industrial; COM = commericial

[c] Infiltration volume = Annual Precipitation (inches) * 1ft/12in *Imprevious Area (ft^2)*(1-Evaporative Loss Factor)
Based on estimated Year 2 precipitation total of 34.41 inches (See Table 5-7). Preliminary monthly National Weather Service climatological for Portland International Airport see http://www.weather.gov/climate/index.php?wfo=pqr
Infiltration volume calculation assumes that 26 percent of precipitation falling on impervious surfaces is lost to evaporation and 74 percent drains to the UIC (Snyder, D.T. and Others, 1994).

Table 7-9: Year 2 Estimated Volume of Stormwater Infiltrated by Supplemental Panel UICs

Location Code	Address	BES UIC No. [a]	Traffic Category (trips per day)	Predom-inant Land Use[b]	Impervious Surface Drainage Area (sq ft)	Total Drainage Area (sq ft)	Approx-imate % Impervious Area	Annual Infiltration Volume[c] (cubic ft)
SP1_1 *	6400 SE 137th Ave.	ADT732	≥ 1000	SFR	6,681	38,785	17%	14,177
SP1_2	5436 SE 108TH Ave.	ADW228	≥ 1000	SFR	41,005	146,311	28%	87,011
SP1_3	13140 NE Glisan St.	ADS022	≥ 1000	SFR	20,112	45,189	45%	42,677
SP1_4	15424 SE Tibbets St.	ADS759	< 1000	SFR	34,414	115,232	30%	73,025
SP1_5	13743 NE San Rafael St.	ADR367	≥ 1000	SFR	17,993	76,821	23%	38,180
SP1_6	6002 SE 140TH Ave.	AMY013	< 1000	SFR	7,532	90,443	8%	15,983
SP1_7	1520 NE 141ST Ave.	ADR345	≥ 1000	SFR	10,259	14,948	69%	21,769
SP1_8	14814 SE Rhone St.	ADT485	< 1000	SFR	19,676	55,327	36%	41,751
SP1_9	15913 SE Grant St.	AMZ732	< 1000	SFR	91,296	96,176	95%	193,726
SP1_10	4312 NE Emerson St.	ADQ217	< 1000	SFR	56,905	113,655	50%	120,750
				Average	30,587	79,289	40%	64,905

Notes:

* Location changed after BES submittal of "*Supplemental Stormwater Discharge Monitoring Locations"* on September 28, 2006 so that location is representative of traffic category.

[a] The BES UIC number is obtained from the BES Hansen database.

[b] SFR = single family residential

[c] Infiltration volume = Annual Precipitation (inches) * 1ft/12in *Imprevious Area (ft^2)*(1-Evaporative Loss Factor)
Based on estimated Year 2 precipitation total of 34.41 inches (See Table 5-7). Preliminary monthly National Weather Service climatological for Portland International Airport see http://www.weather.gov/climate/index.php?wfo=pqr
Infiltration volume calculation assumes that 26 percent of precipitation falling on impervious surfaces is lost to evaporation and 74 percent drains to the UIC (Snyder, D.T. and Others, 1994).

Table 8-1: SP1_1[1] Sedimentation Manhole Water Grab Sample Results

Analysis[2]	Result	Units	Method
Common Pollutants			
o-Xylene	5.14	µg/L	EPA 8260
Toluene	1,540	µg/L	
Di(2-ethylhexyl) phthalate	**15.5** [3]	µg/L	EPA8270M-SIM
Pentachlorophenol	0.501	µg/L	EPA 515.3
Ancillary Pollutants			
1,2,4-Trimethylbenzene	14.9	µg/L	EPA 8260
1,3,5-Trimethylbenzene	6.90	µg/L	
4-Isopropyltoluene	6.41	µg/L	
Acetone	951	µg/L	
Methylene Chloride	2,170	µg/L	
Naphthalene	7.22	µg/L	EPA8270M-SIM
Other Analyses			
Gasoline Range Hydrocarbons	4,090	µg/L	NWTPH-Gx
Motor Oil	617	mg/L	NWTPH-Dx
Oil & Grease, Non-Polar	297	mg/L	EPA 1664
Oil & Grease, Polar	52	mg/L	
Oil & Grease, Total	349	mg/L	EPA 1665

Notes:

[1] Sample collected on September 15, 2006. This sample was designated SPO_3SM and collected due to the observation, during the pre-sampling inspections of Year 2 UIC monitoring locations, that paint thinner was disposed of in the UIC inlet. Upon discovery, the UIC system was sampled and subsequently cleaned. This location was originally intended to be part of the Supplemental Panel. However, it was determined this UIC did not receive drainage from a >1,000 TPD right-of-way and was replaced by the oversample panel location.

[2] Only those analytes detected at concentrations above method reporting limits are included in this table.

[3] Indicates concentration exceeds applicable permit MADL.

Table 8-2: SP1_1[1] Stormwater Discharge Monitoring Results - Event 1

Analysis[2]	Result	Units	Method
Common Pollutants			
Arsenic	0.66	µg/L	EPA 200.8
Cadmium	0.17	µg/L	
Chromium	1.62	µg/L	
Copper	9.59	µg/L	
Copper, Dissolved	4.71	µg/L	
Lead	38.9	µg/L	
Lead, Dissolved	6.29	µg/L	
Zinc	57.8	µg/L	
Zinc, Dissolved	33.8	µg/L	
Total Nitrogen	0.46	mg/L	
Pentachlorophenol	0.41	µg/L	EPA 515.3
Di(2-ethylhexyl) phthalate	1.09	µg/L	EPA 8270M-SIM
Priority Screen Pollutants			
Mercury, Dissoloved	0.0012	µg/L	EPA 200.8
2,4-D	0.582	µg/L	EPA 515.3
Ancillary Pollutants			
Benzo(b)fluoranthene	0.0184	µg/L	EPA 8270M-SIM
Benzo(ghi)perylene	0.0271	µg/L	
Benzo(k)fluoranthene	0.011	µg/L	
Chrysene	0.0235	µg/L	
Fluoranthene	0.0319	µg/L	
Indeno(1,2,3-cd)pyrene	0.0124	µg/L	
Naphthalene	0.0214	µg/L	
Phenanthrene	0.0269	µg/L	
Pyrene	0.0339	µg/L	
Other Analyses			
Total Suspended Solids	84	mg/L	SM 2540 D

Notes:

[1] Sample collected on October 15, 2006 during Year 2 Event 1. This sample was desingated SPO_3EV1 and was collected due to the observations during the field inspection of Year 2 samples. It appeared that a small volume of paint thinner was disposed of in the UIC inlet. Upon discovery, the UIC system was cleaned. This location was sampled to assess system condition after cleaning. This location was originally intended to be part of the Supplemental Panel, however was determined not receive drainage from a >1,000 TPD right-of-way and was replaced by the oversample panel location.

[2] Only those analytes detected at concentrations above method reporting limits are included in this table.

Table 8-3: SP1_5[1] Stormwater Discharge Monitoring Results - Event 1

Analysis[2]	Qualifier	Result	Units	Method
Common Pollutants				
Arsenic		0.67	µg/L	EPA 200.8
Cadmium		0.12	µg/L	
Chromium		1.75	µg/L	
Copper		9.14	µg/L	
Copper, dissolved		3.78	µg/L	
Lead		6.67	µg/L	
Lead, Dissolved		0.26	µg/L	
Zinc		28	µg/L	
Zinc, Dissolved		5.77	µg/L	
Total Nitrogen		0.12	mg/L	EPA 300.0
Pentachlorophenol		0.162	µg/L	EPA 515.3
Priority Screen Pollutants				
Mercury, Dissoved		0.0028	µg/L	EPA 200.8
Ancillary Pollutants				
Pyrene		0.0219	µg/L	EPA 8270M-SIM
Polychlorinated Biphenyls (PCBs)				
Aroclor 1016	<	0.5	µg/L	EPA 8082
Aroclor 1221	<	1	µg/L	
Aroclor 1232	<	0.5	µg/L	
Aroclor 1242	<	0.5	µg/L	
Aroclor 1248	<	0.5	µg/L	
Aroclor 1254	<	0.5	µg/L	
Aroclor 1260	<	0.5	µg/L	
Other				
Total Suspended Solids		18	mg/L	SM 2540 D

Notes:

[1] Sample collected on October 19, 2006 during Year 2 Event 1. Sample was collected due to a leaking transformer observed near a UIC inlet during the field inspection of Year 2 sample locations. BES worked with the local utility company to replace the transformers and to clean up the nearby soils and right-of-way.

[2] Only those analytes detected at concentrations above method reporting limits are included in this table.

Table 8-4: P6_1[1] Sedimentation Manhole Water Sample Results

Analysis[2]	Result (µg/L)	Method
Common Pollutants		
Pentachlorophenol	**1.06** [3]	EPA 515.3
Benzo(a)pyrene	0.0135	EPA8270M-SIM
Di(2-ethylhexyl) phthalate (DEHP)	1.31	
Ancillary Pollutants		
Benzo(a)anthracene	0.0149	EPA8270M-SIM
Benzo(b)fluoranthene	0.0164	
Benzo(ghi)perylene	0.0296	
Benzo(k)fluoranthene	0.0125	
Chrysene	0.0246	
Dibenzo(a,h)anthracene	0.0123	
Fluoranthene	0.0743	
Indeno(1,2,3-cd)pyrene	0.0204	
Naphthalene	0.0322	
Phenanthrene	0.0799	
Pyrene	0.0986	

Notes:

[1] Sedimentation manhole water grab sample was collected December 27, 2006. Sample was collected due to a detection of DEHP of 264 µg/l in P6_1 in Event 1. The sample was collected to assess if the Event 1 UIC sample result was anomalous, or if other response actions were needed.

[2] Only those analytes detected at concentrations above method reporting limits are included in this table.

[3] Concentration exceeds permit MADL.

Table 8-5: P6_1[1] Stormwater Discharge Resample Results - Event 1

Analysis[2]	Qualifier	Result (µg/L)	Method
Common Pollutants			
Arsenic		0.415	EPA 200.8
Chromium		0.84	EPA 200.8
Copper		8.08	EPA 200.8
Lead		7.03	EPA 200.8
Zinc		47.4	EPA 200.8
Mercury Dissolved		0.0012	EPA 200.8
Copper, Dissolved		5.73	EPA 200.8
Lead, Dissolved		0.96	EPA 200.8
Zinc, Dissolved		33.1	EPA 200.8
Total Nitrogen		0.14	EPA 300.0
Pentachlorophenol		2.38	EPA 515.3
Benzo(a)pyrene		0.027	EPA 8270M-SIM
Di(2-ethylhexyl) phthalate (DEHP)		1.57	EPA 8270M-SIM
Toluene		3.19	EPA 8260
Priority Screen Pollutants			
2,4-D		0.875	EPA 515.3
Ancillary Pollutants			
Dicamba		0.445	EPA 515.3
Benzo(a)anthracene		0.0258	EPA 8270M-SIM
Benzo(b)fluoranthene		0.037	EPA 8270M-SIM
Benzo(ghi)perylene		0.0604	EPA 8270M-SIM
Benzo(k)fluoranthene		0.0262	EPA 8270M-SIM
Chrysene		0.0673	EPA 8270M-SIM
Fluoranthene		0.117	EPA 8270M-SIM
Indeno(1,2,3-cd)pyrene		0.0273	EPA 8270M-SIM
Naphthalene		0.0314	EPA 8270M-SIM
Phenanthrene		0.0814	EPA 8270M-SIM
Pyrene		0.149	EPA 8270M-SIM
Other			
Total Suspended Solids		26	SM 2540 D

Notes:

[1] P6_1 was resampled on May 2, 2007 due to a detection of DEHP of 264 µg/l in P6_1 during Event 1. This sample was collected so that if the anomalous DEHP concentration was rejected or determined to be an outlier, the minimum five samples needed would be available to estimate the annual mean concentration. Sampling was delayed until the end of the year due to competing sampling demands (e.g., Events 2 - 5).

[2] Only those analytes detected at concentrations above method reporting limits are included in this table.

Table 8-6: Summary of P6_3[1] Sample Results

Analysis[2]	Qualifier	Result	Units	Method
Event 5 Stormwater Discharge Monitoring Results - April 18, 2007				
Arsenic		0.497	µg/L	EPA 200.8
Cadmium		0.12	µg/L	
Chromium		1.85	µg/L	
Copper		9.12	µg/L	
Copper, Dissolved		4.53	µg/L	
Lead		5.07	µg/L	
Lead, Dissolved		0.14	µg/L	
Mercury, Dissolved		0.0047	µg/L	
Zinc		40.4	µg/L	
Zinc, Dissolved		19.3	µg/L	
Pentachlorophenol		0.0619	µg/L	EPA 515.3
1,2,4-Trimethylbenzene		1.9	µg/L	EPA 8260
1,3,5-Trimethylbenzene		0.588	µg/L	
Toluene		19.5	µg/L	
Naphthalene		0.408	µg/L	EPA 8270M-SIM
Phenanthrene		0.0219	µg/L	
Pyrene		0.0229	µg/L	
Total Suspended Solids		46	mg/L	SM 2540 D
Sedimentation Manhole Grab Sample Results - April 19, 2007				
Arsenic		0.477	µg/L	EPA 200.8
Chromium		0.62	µg/L	
Copper		8.12	µg/L	
Lead		3.16	µg/L	
Zinc		34.7	µg/L	
TPH - Gasoline		84	mg/L	NWTPH-HCID
Naphthalene		0.52	µg/L	EPA 8270M-SIM
1,2,4-Trimethylbenzene		2.23	µg/L	EPA 8260
1,3,5-Trimethylbenzene		0.856	µg/L	
4-Isopropyltoluene		0.532	µg/L	
o-Xylene		0.543	µg/L	
Toluene		17.9	µg/L	

Notes:

[1] Sedimentation manhole grab water sample was collected due to the petroleum odor in the Event 5 UIC discharge sample and observed paint in a UIC inlet. UIC system was cleaned on April 19, 2007 following collection of the sample.

[2] Only those analytes detected at concentrations above method reporting limits are included in this table.

Table 8-7: DEQ Di(2-ethylhexyl)phthalate Event 5 Split Samples

Location Code	TestAmerica		DEQ Lab		RPD [3]
	Original [1] (µg/L)	Dup [2] (µg/L)	Original [1] (µg/L)	Dup [2] (µg/L)	
P6_1	2.57		4.00		43.5%
P6_2	2.06		3.00		37.2%
P6_3	< 0.516		1.00		118.0%
P6_4	1.56		1.40		-10.8%
P6_5	1.16		3.00		88.5%
P6_6	< 0.521		0.80		81.7%
P6_7	0.939 J [4]	1.02	4.50	1.60	102.8%
P6_8	1.04		**25.00** [5]		184.0%
P6_9	0.741 J		1.40		61.6%
P6_10	3.05		5.00		48.4%
P6_11	1.15		2.10		58.5%
P6_12	1.85	2.78	3.00	2.00	29.4%
P6_13	0.889 J		1.30		37.6%
P6_14	2.98		4.90		48.7%
P6_15	< 0.521		1.40		137.2%

Notes:

[1] Original = original sample analysis

[2] Dup = field duplicate

[3] RPD = relative percent difference = (DEQ Split Concentration - Test America Concentration)/((DEQ Split Concentration + Test America Concentration)/2)

[4] J = estimated

[5] Exceeds MADL

Table 8-8: Pentachlorophenol Baseline Sampling Results

Location Code[1]	Location Description	Traffic Category (Trips per Day)	Predominant Land Use	Analysis[2]	Result (µg/L)
PBP1_1	15110 SE Gladstone	< 1000	SFR		ND [3]
PBP1_2	10145 SE Mill Court	< 1000	SFR	Phenanthrene	0.0204
				Pyrene	0.0264
PBP1_3	12532 SE Long St.	< 1000	SFR	Benzo(a)anthracene	0.014
				Benzo(a)pyrene	0.0191
				Benzo(b)fluoranthene	0.0262
				Benzo(ghi)perylene	0.0419
				Benzo(k)fluoranthene	0.0162
				Di(2-ethylhexyl) phthalate	1.11
				Chrysene	0.0316
				Fluoranthene	0.06
				Indeno(1,2,3-cd)pyrene	0.025
				Naphthalene	0.0205
				Phenanthrene	0.0632
				Pyrene	0.0701
PBP1_4	3660 NE 133rd Ave.	< 1000	SFR	Di(2-ethylhexyl) phthalate	2.13
PBP1_4 DUP	Field Duplicate	< 1000	SFR	Di(2-ethylhexyl) phthalate	2.69
				Naphthalene	0.0206
PBP1_5	14304 NE Beech St.	< 1000	SFR		ND
P2_15	13075 NE Weidler St.	< 1000	SFR	Di(2-ethylhexyl) phthalate	2.09
				Chrysene	0.0125
				Fluoranthene	0.0213
				Phenanthrene	0.0344
				Pyrene	0.0275
P6_6	5201 N Emerson Dr.	< 1000	SFR	Benzo(a)anthracene	0.0112
				Benzo(a)pyrene	0.0122
				Benzo(b)fluoranthene	0.0157
				Benzo(ghi)perylene	0.0216
				Benzo(k)fluoranthene	0.0121
				Chrysene	0.0221
				Fluoranthene	0.0543
				Indeno(1,2,3-cd)pyrene	0.0128
				Naphthalene	0.0301
				Phenanthrene	0.0797
				Pyrene	0.0591

Notes:

[1] UICs were identified during field reconnaissance not to contain treated wood utility poles in drainage catchments.

[2] Only those analytes detected using EPA Method 8270-SIM are included in this table.

[3] ND = not detected

Table 8-9: Filtered Stormwater Sample Results for Pentachlorophenol

Location Code[1]	Location Description	Traffic Category (Trips Per Day)	Predominant Land Use	Analysis[2]	Type of Sample	Result (µg/L)	Ratio [3]
P1_1	6940 N Macrum Ave.	< 1000	SFR	Pentachlorophenol	unfiltered	0.662	100%
P1_1_FF					filtered	0.662	
P2_5	10150 SE Ankeny St.	> 1000	IND	Pentachlorophenol	unfiltered	1.52	75%
P2_5				2,4-D	unfiltered	0.291	
P2_5_FF				Pentachlorophenol	filtered	1.14	
P6_7	608 NE 87th Ave.	< 1000	MFR	Bentazon	unfiltered	0.492	207%
P6_7				Pentachlorophenol	unfiltered	1	
P6_7_FF					filtered	1.02	

Notes:

[1] Samples were collected during Event 5. Samples designated as PX_X are the primary sample (unfiltered), and samples designated as PX_X_FF were field filtered.

[2] Samples were analyzed for chlorinated herbicides using EPA Method 515.3. Only those results detected in one or more samples are reported in this table.

[3] Ratio of filtered to unfiltered pentachlorophenol concentrations (%)

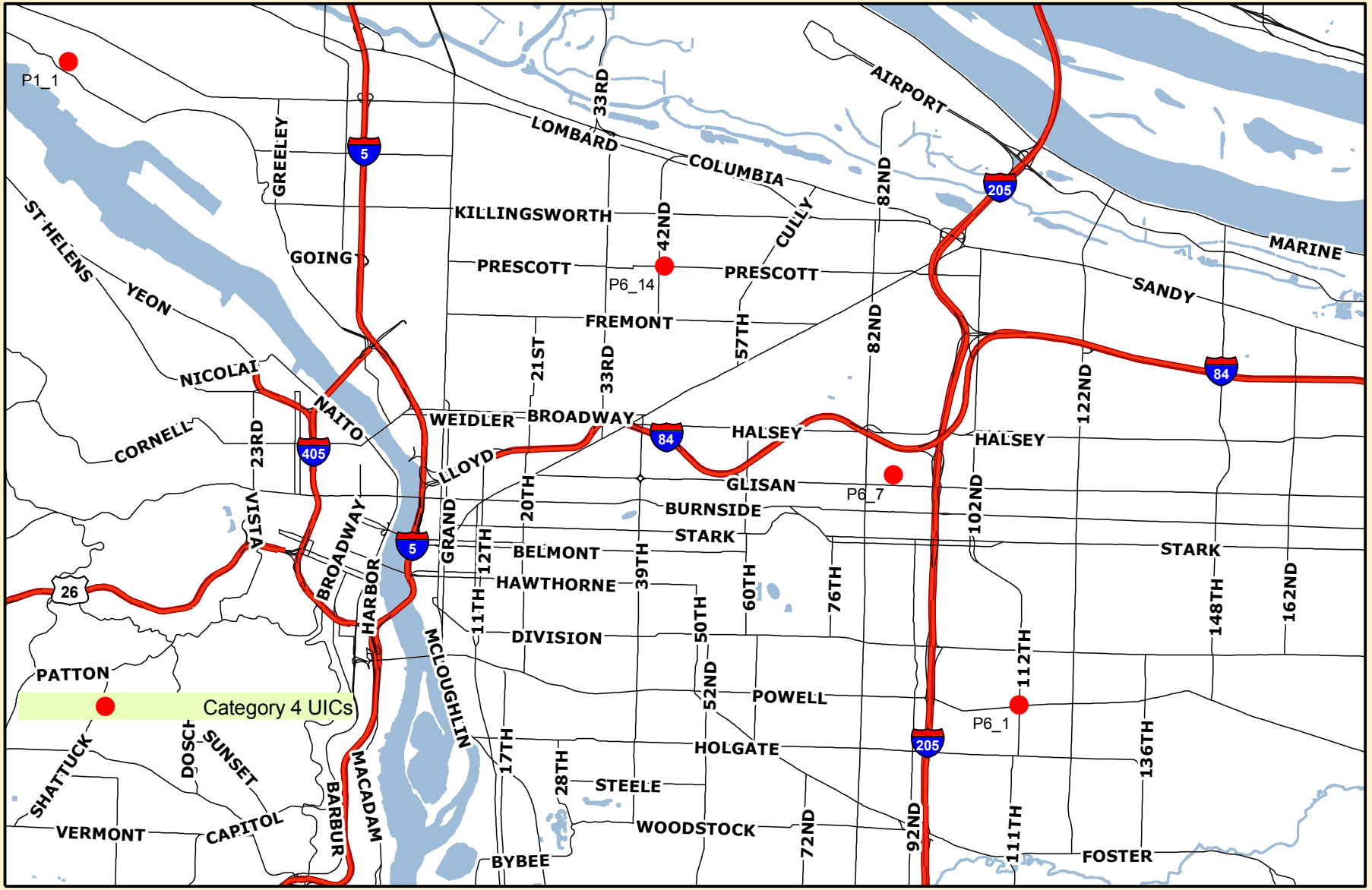
SFR = Single family residential

IND = Industrial

MFR = Multifamily residential

Figures

Figure 10-1: Category 4 UICs Identified in Year 2



2006-07 UIC Monitoring
Year 2 : Category 4 Locations

Investigations & Monitoring Services
Bureau of Environmental Services

Source: ESRI Data & Maps CD
Created in ArcGIS 8 using ArcMap

Figure 3-1: City of Portland UIC Locations

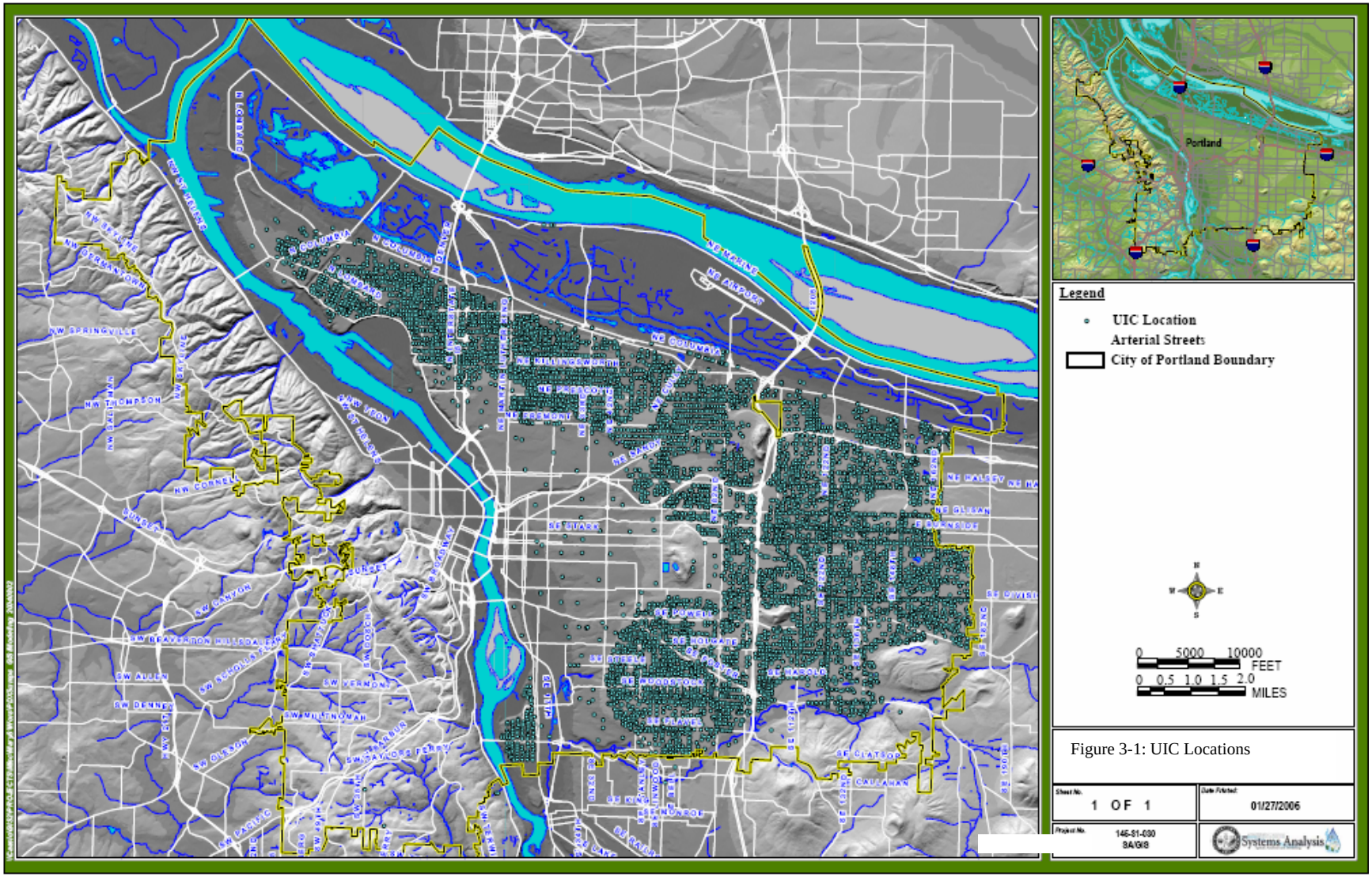
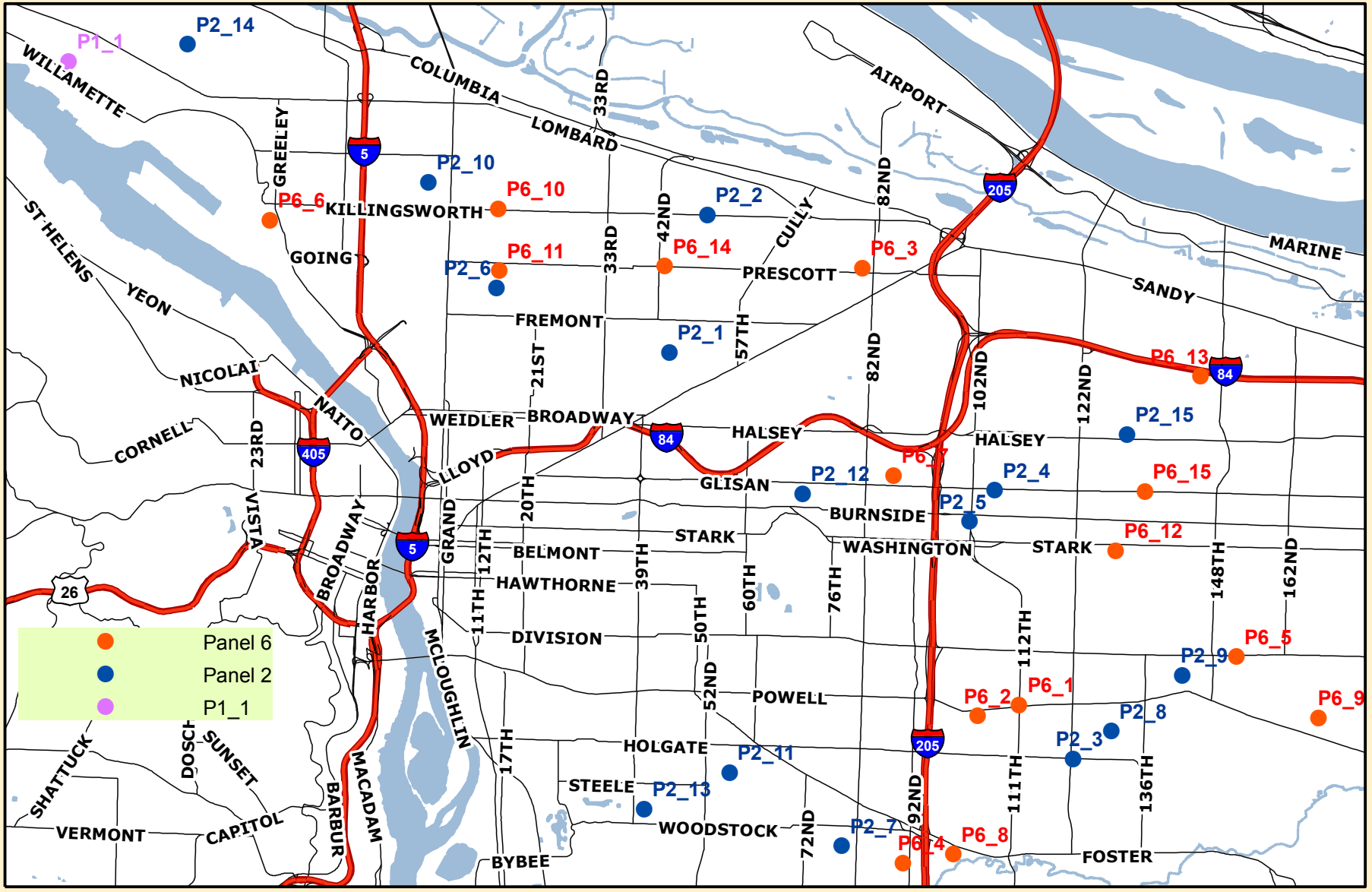


Figure 3-2: 2006-2007 (Year 2) UIC Monitoring Locations - Panels 2 and 6

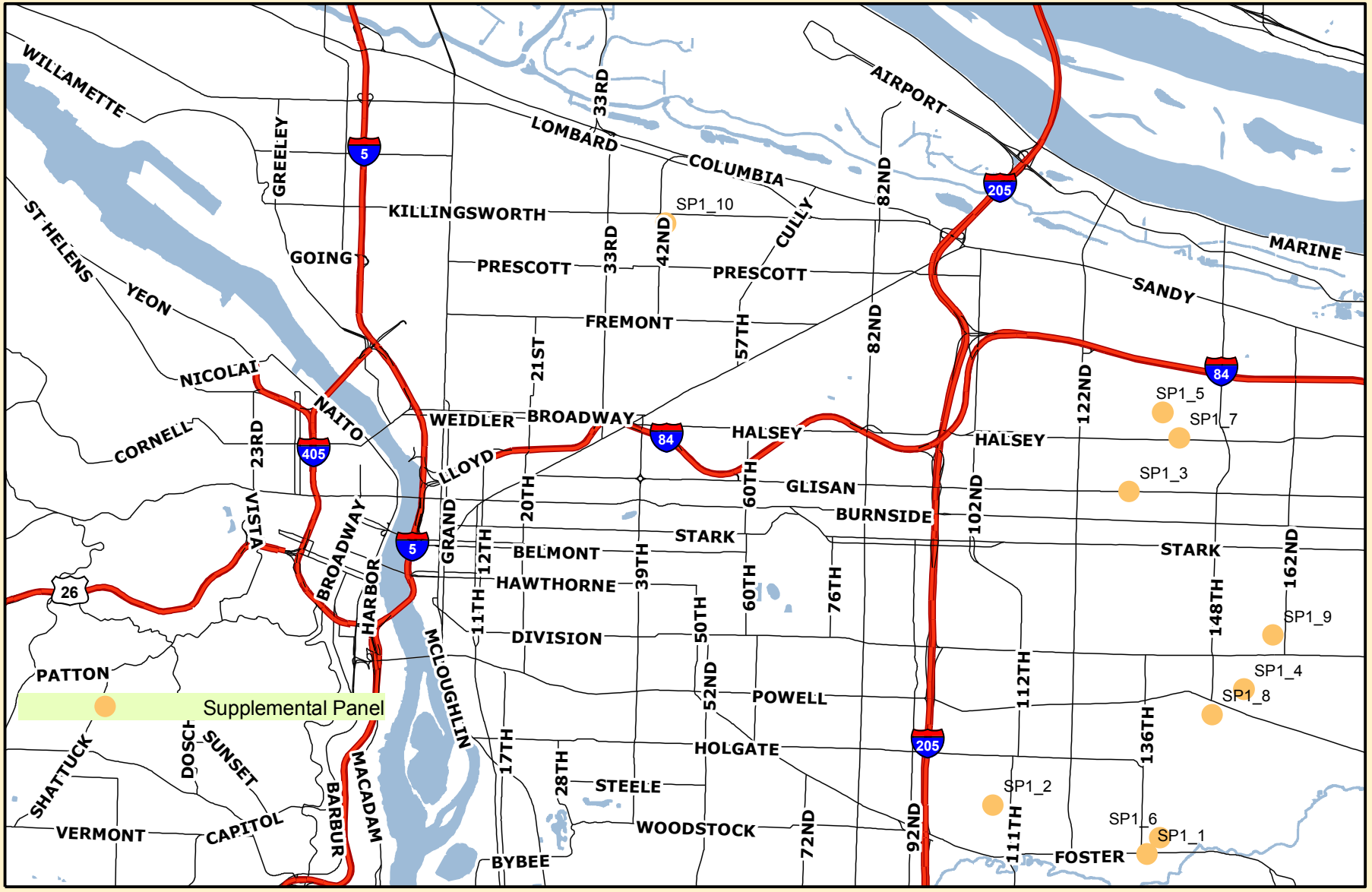


2006-07 UIC Monitoring Locations
Year 2 : Panels 2 and 6

Investigations & Monitoring Services
Bureau of Environmental Services

Source: ESRI Data & Maps CD
Created in ArcGIS 8 using ArcMap

Figure 3-3: 2006-2007 (Year 2) UIC Monitoring Locations - Supplemental Panel

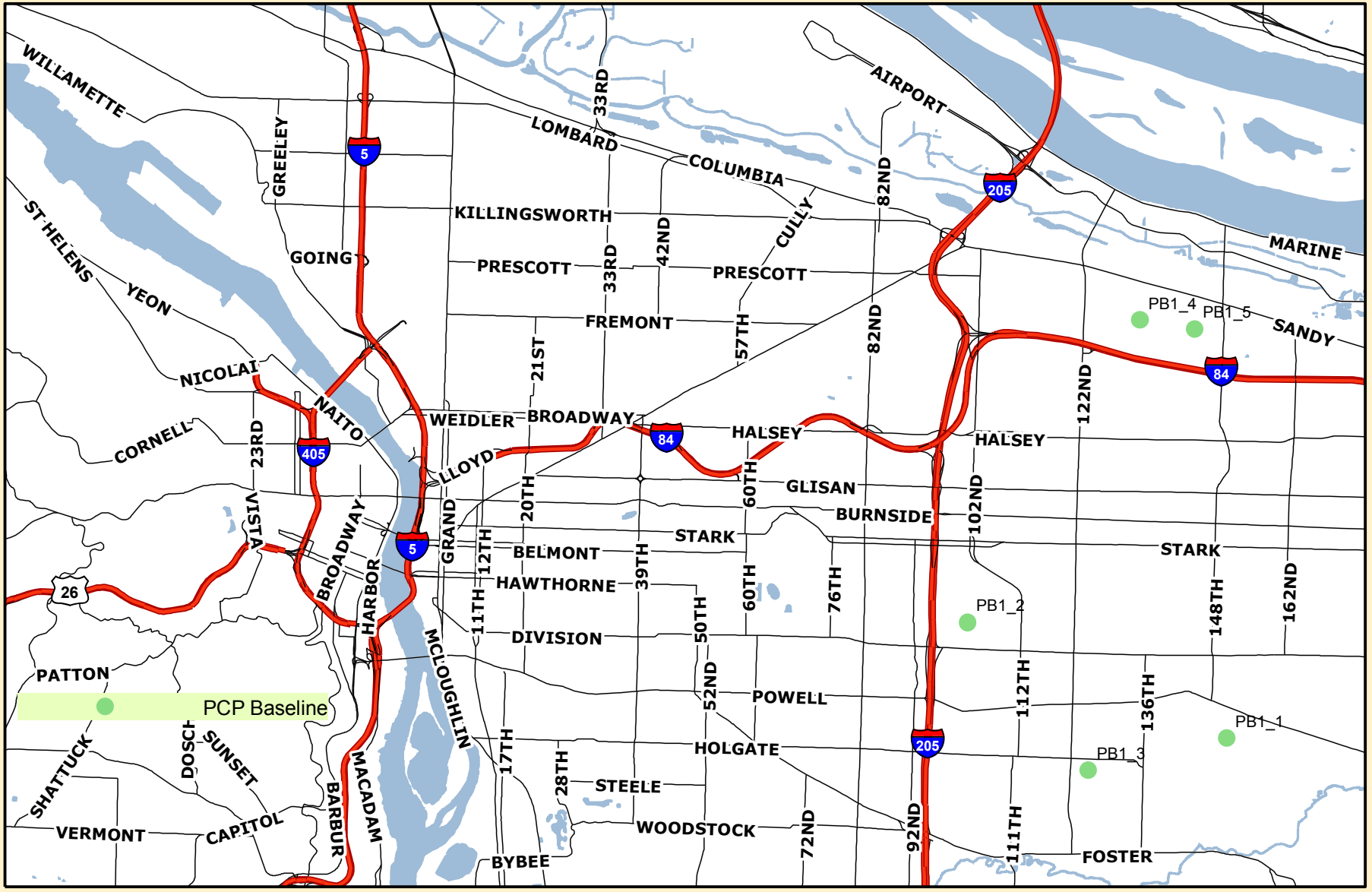


2006-07 UIC Monitoring
Year 2 : Supplemental Monitoring Locations

Investigations & Monitoring Services
Bureau of Environmental Services

Source: ESRI Data & Maps CD
Created in ArcGIS 8 using ArcMap

Figure 3-4: 2006-2007 (Year 2) UIC Monitoring Locations - Pentachlorophenol Baseline



2006-07 UIC Monitoring Locations
Year 2 : Pentachlorophenol Baseline

Investigations & Monitoring Services
Bureau of Environmental Services

Source: ESRI Data & Maps CD
Created in ArcGIS 8 using ArcMap

Figure 5-1: Year 2 Event 1 Hydrograph

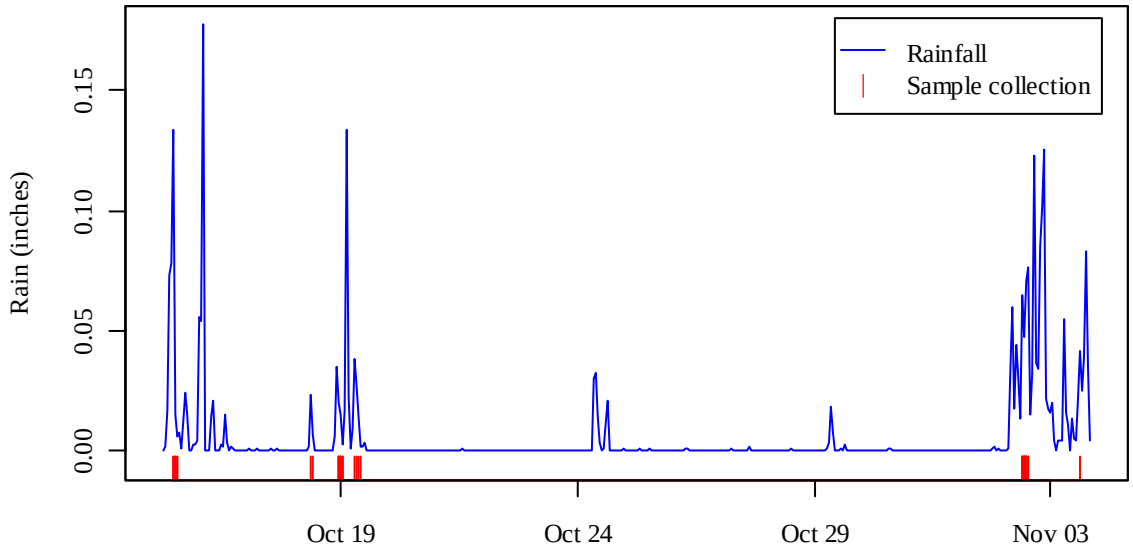


Figure 5-2: Year 2 Event 2 Hydrograph

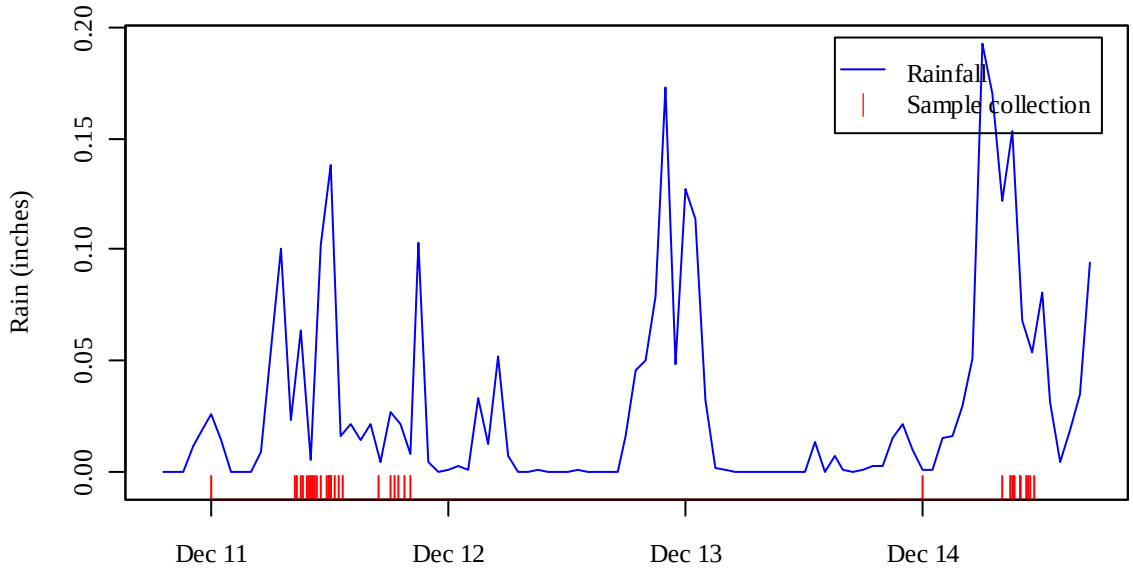


Figure 5-3: Year 2 Event 3 Hydrograph

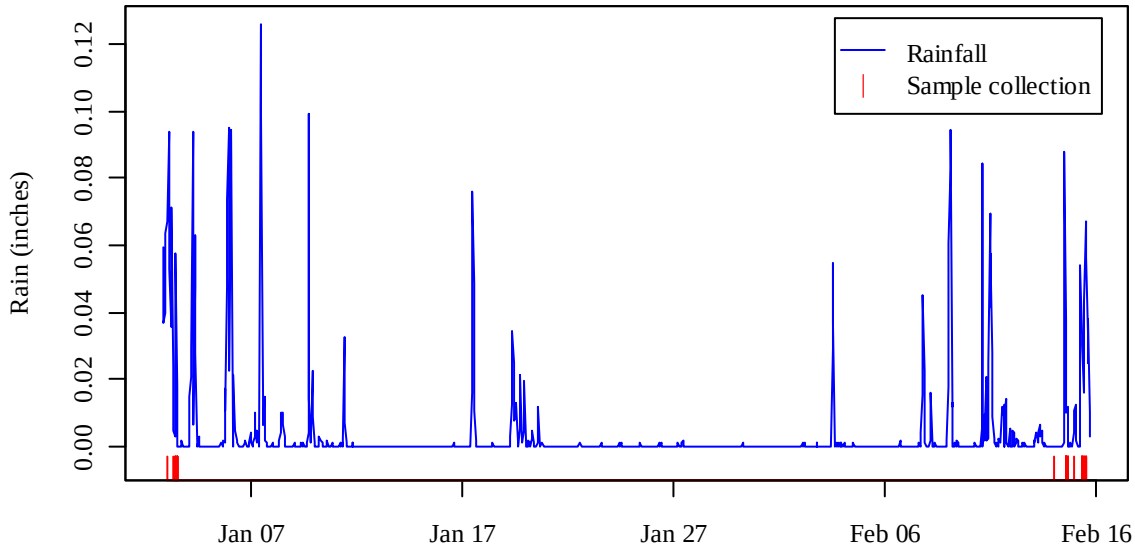


Figure 5-4: Year 2 Event 4 Hydrograph

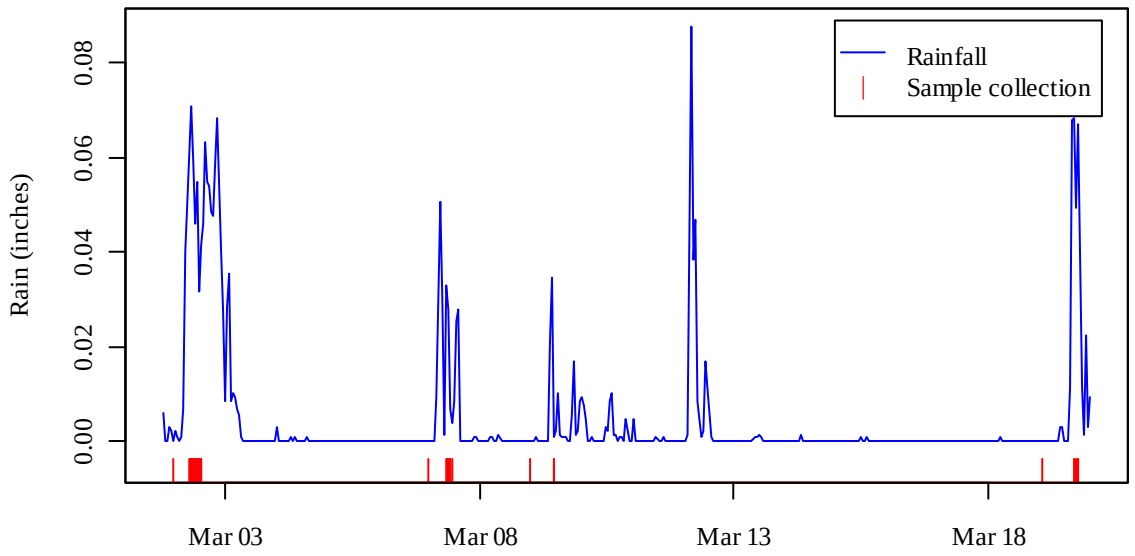
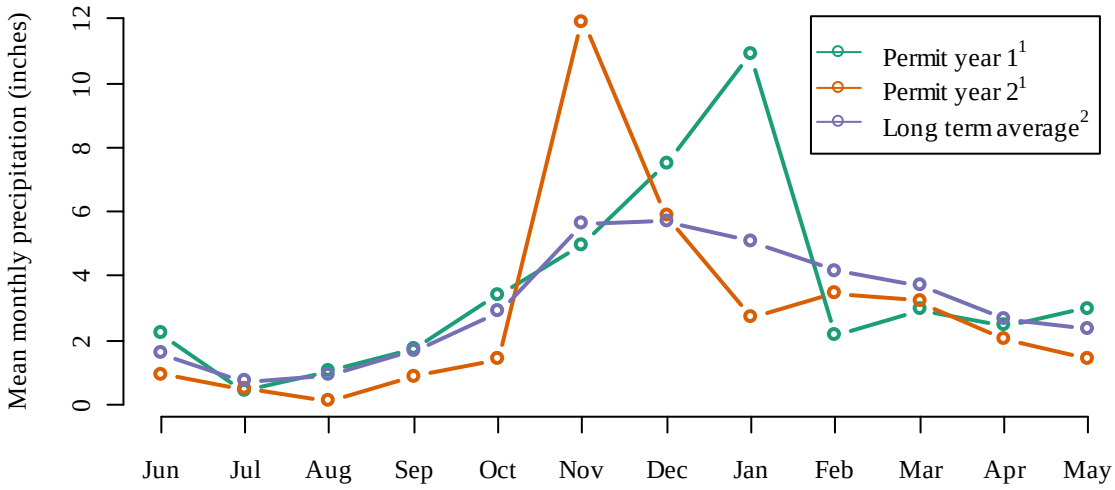


Figure 5-6: Regional Precipitation Data



1) Data source: Local Climatological Data - Portland Oregon.
From http://www.weather.gov/climate/index.php?wfo=pqr
2) Data source: Portland International Airport. Period 1971 - 2000.
From NOWData - NOAA Online Weather Data at http://nowdata.rcc-acis.org/PQR/pubACIS_results

Figure 5-5: Year 2 Event 5 Hydrograph

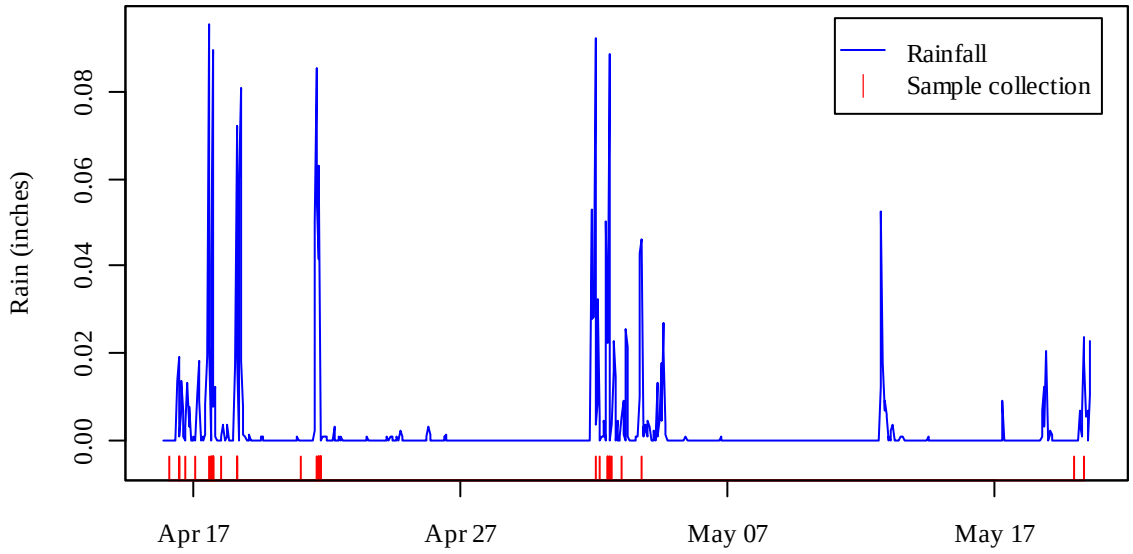


Figure 7-1: Definition of a Box Plot

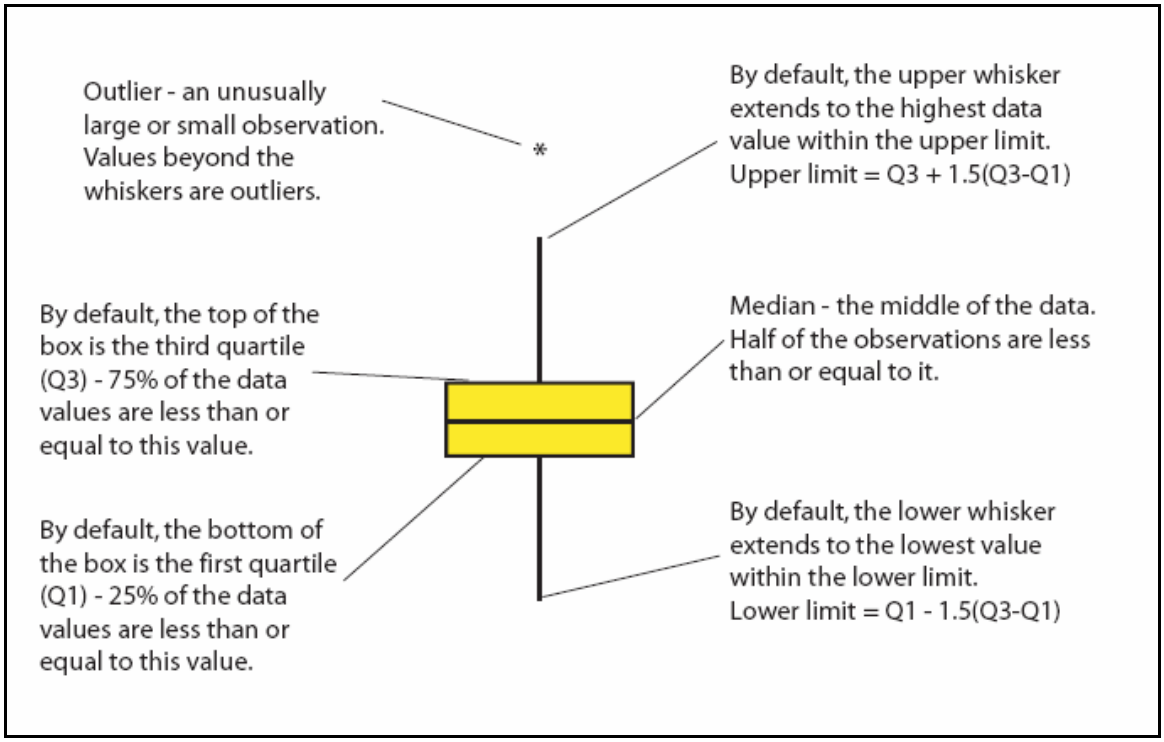
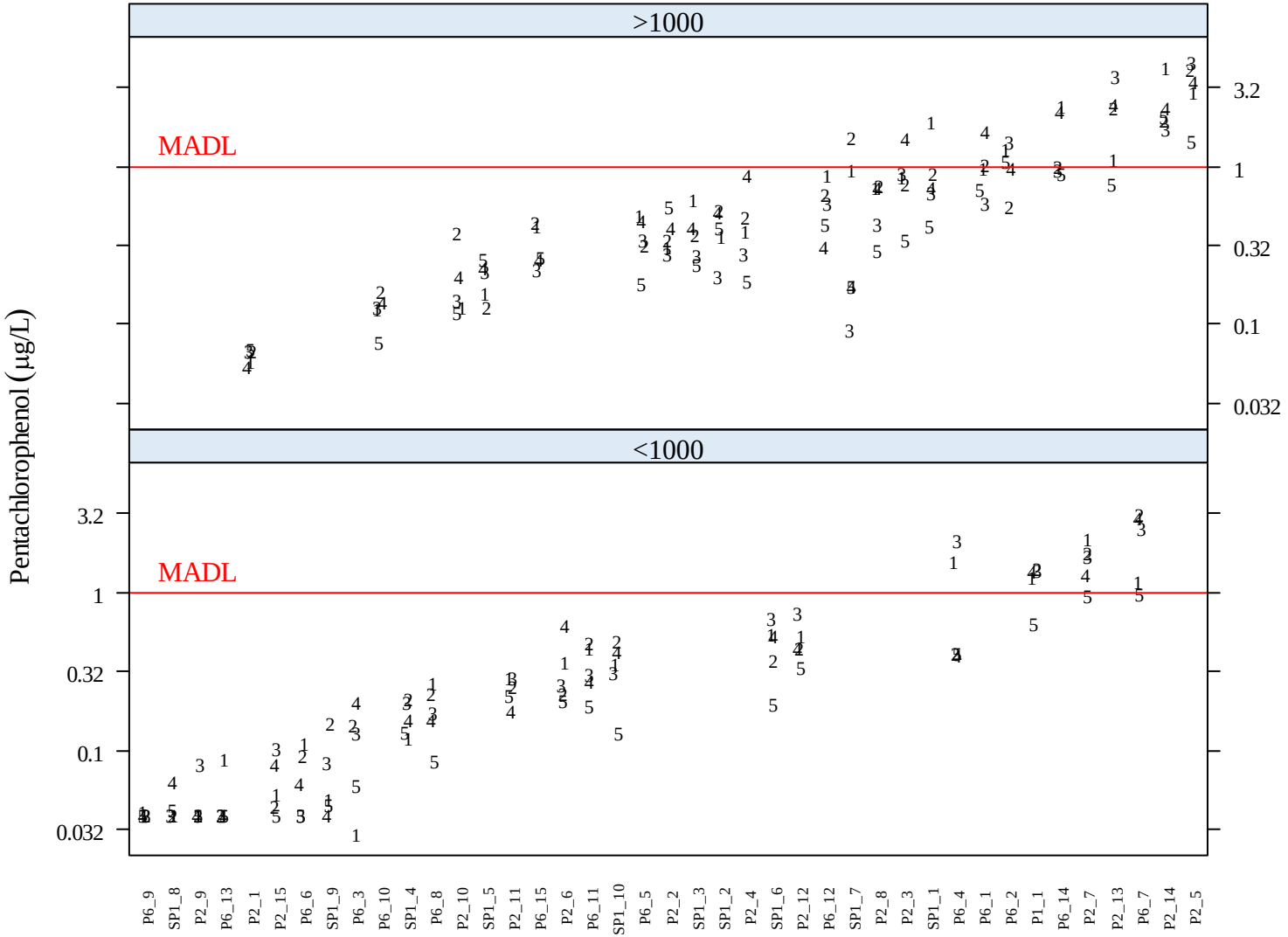


Figure note:
From Minitab®, version 14, 2006

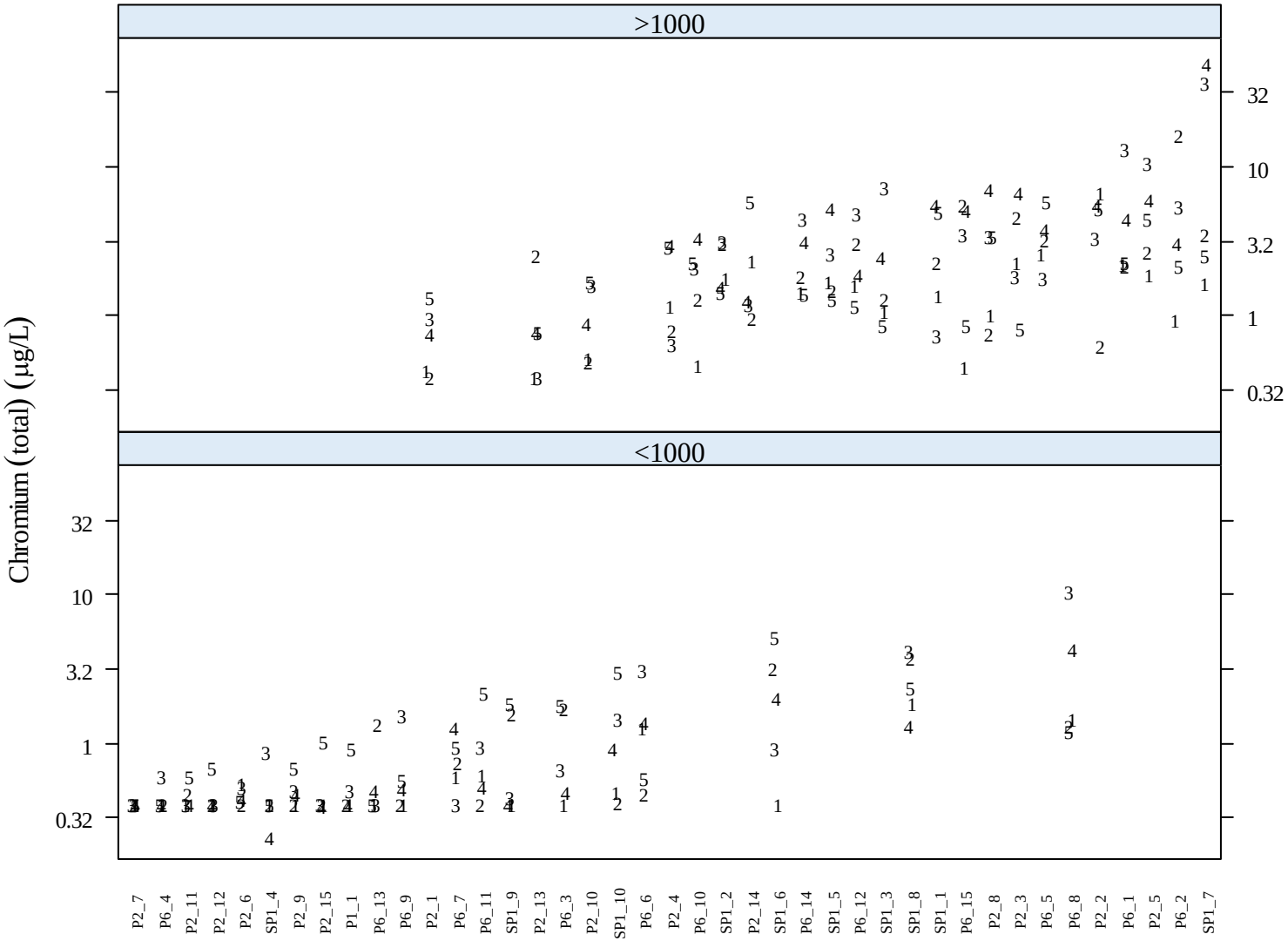
Figure 7-10: Year 2 Pentachlorophenol Concentrations by Sampling Event and Traffic Category



Notes:

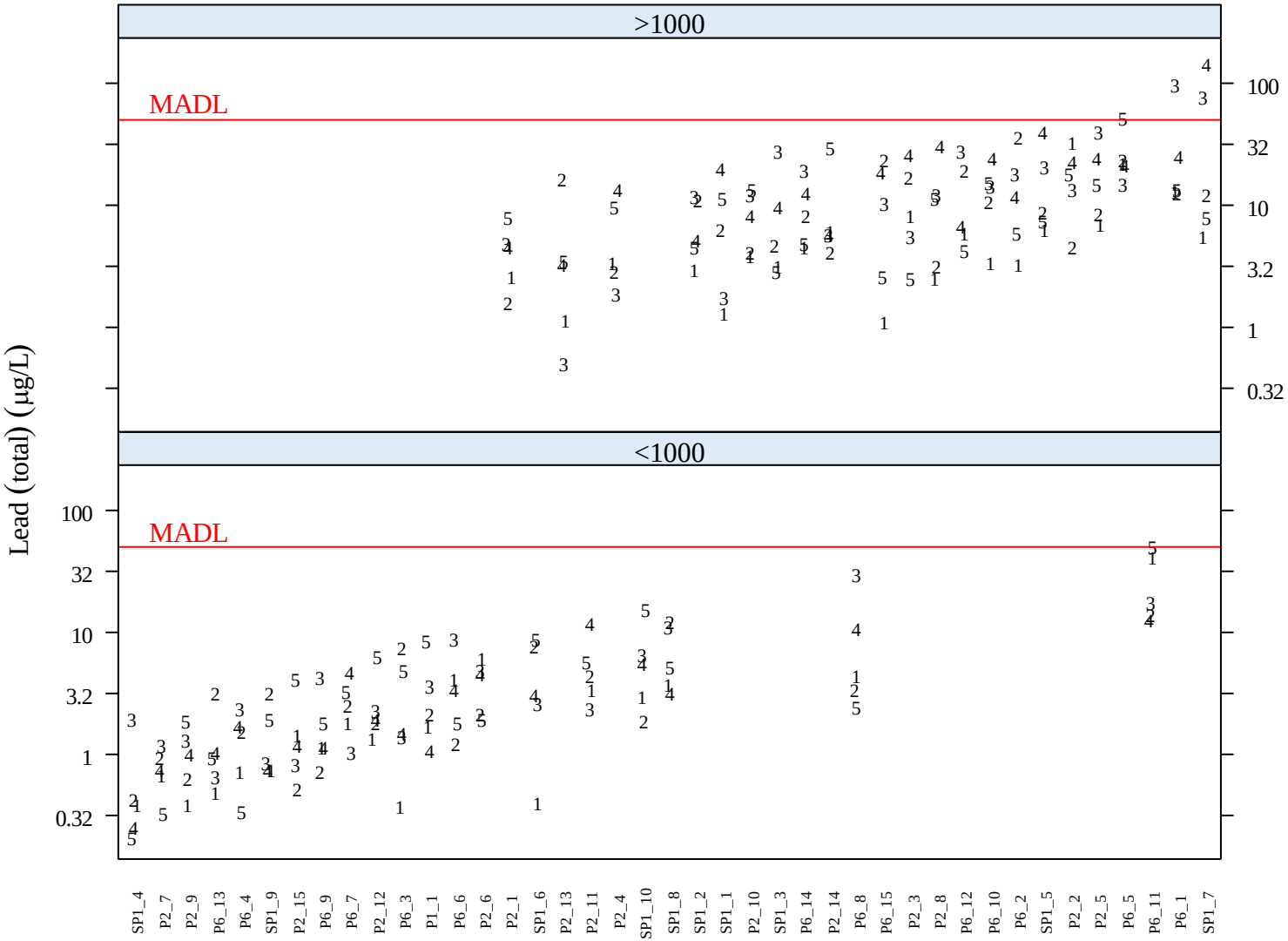
(1, 2, 3, 4, 5) indicates Year 2 sampling Event number.
<1000, >1000 indicates traffic category.
Concentrations are plotted on a logarithmic scale.

Figure 7-11: Year 2 Chromium Concentrations by Sampling Event and Traffic Category



Notes:
(1, 2, 3, 4, 5) indicates Year 2 sampling Event number.
<1000, >1000 indicates traffic category.
Concentrations are plotted on a logarithmic scale.

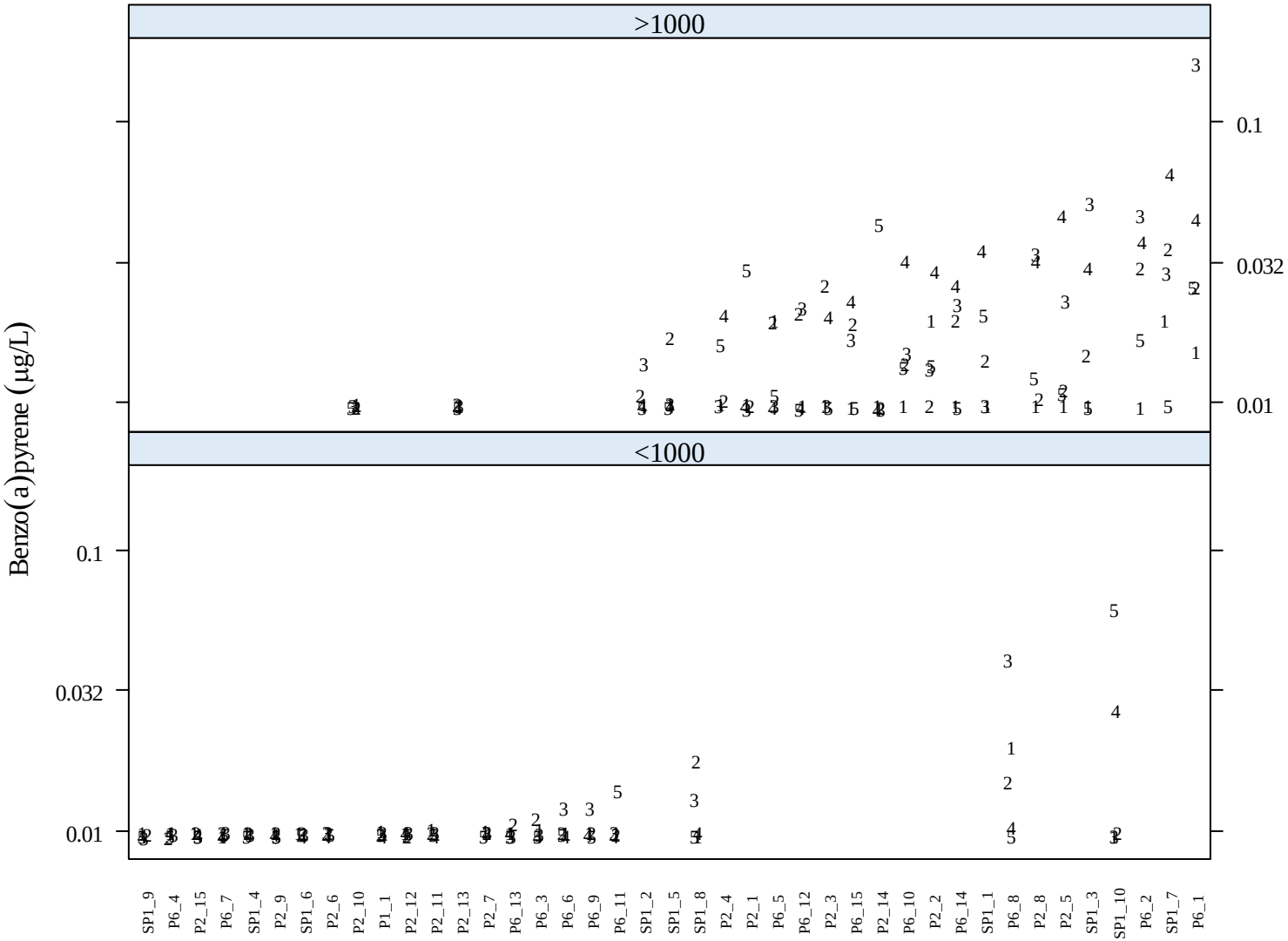
Figure 7-12: Year 2 Total Lead Concentrations by Sampling Event and Traffic Category



Notes:

(1, 2, 3, 4, 5) indicates Year 2 sampling Event number.
<1000, >1000 indicates traffic category.
Concentrations are plotted on a logarithmic scale.

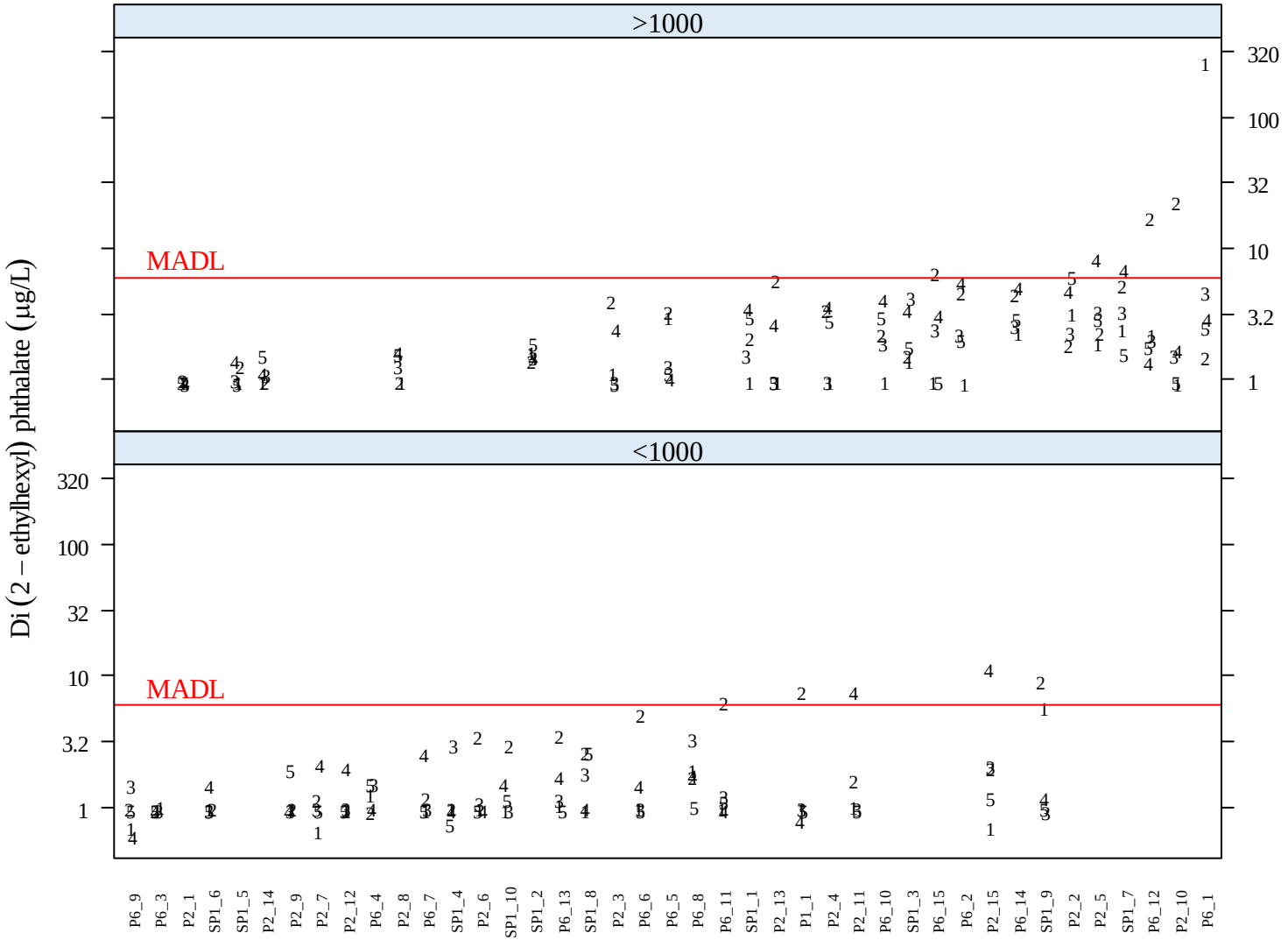
Figure 7-13: Year 2 Benzo(a)pyrene Concentrations by Sampling Event and Traffic Category



Notes:

(1, 2, 3, 4, 5) indicates Year 2 sampling Event number.
<1000, >1000 indicates traffic category.
Concentrations are plotted on a logarithmic scale.

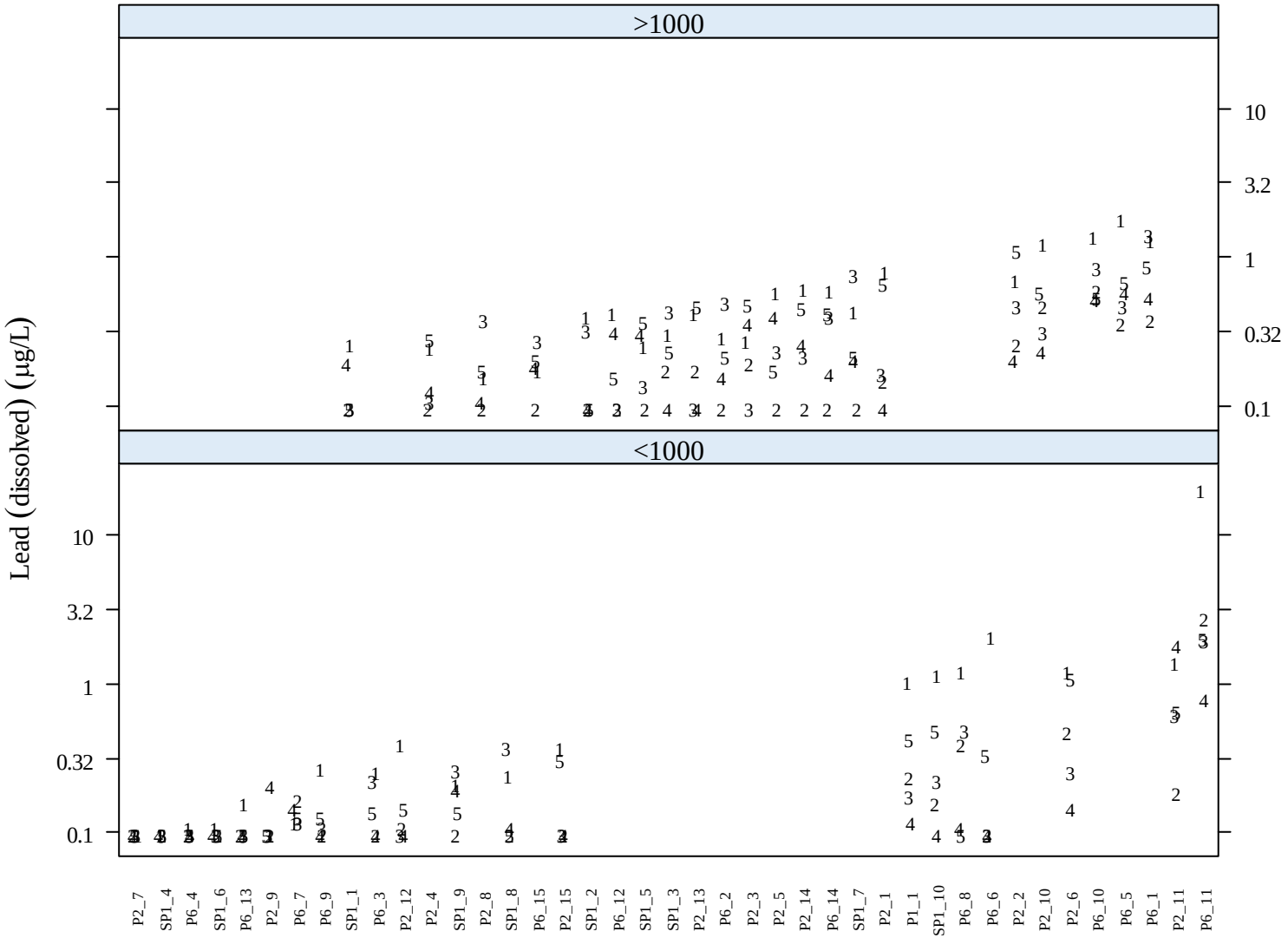
Figure 7-14: Year 2 Di(2-ethylhexyl)phthalate (DEHP) Concentrations by Sampling Event and Traffic Category



Notes:

(1, 2, 3, 4, 5) indicates Year 2 sampling Event number.
<1000, >1000 indicates traffic category.
Concentrations are plotted on a logarithmic scale.
Laboratory QC issues were encountered for DEHP in Year 2 (See Section 6 and Appendix H). Some data has been rejected and some data identified as being biased high. Refer to Appendix H prior to using phthalate data.

Figure 7-15: Year 2 Dissolved Lead Concentrations by Sampling Event and Traffic Category



Notes:

(1, 2, 3, 4, 5) indicates Year 2 sampling Event number.
<1000, >1000 indicates traffic category.
Concentrations are plotted on a logarithmic scale.

Figure 7-16: Year 2 Pentachlorophenol Concentrations by Sample Event

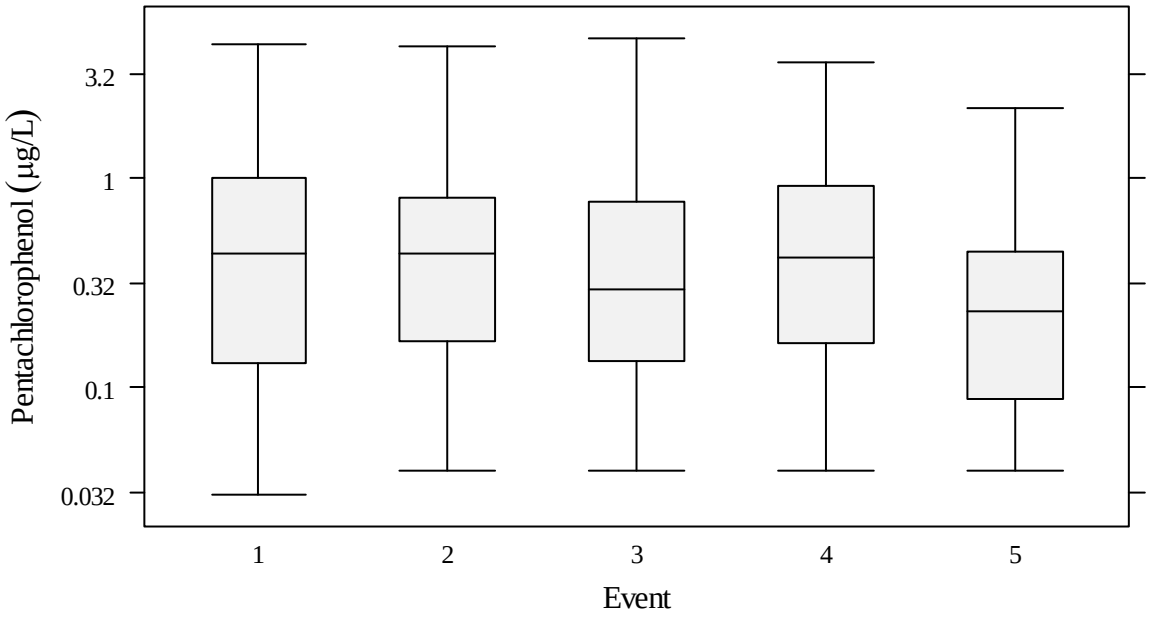


Figure 7-17: Year 2 Pentachlorophenol Concentrations by Sample Panel

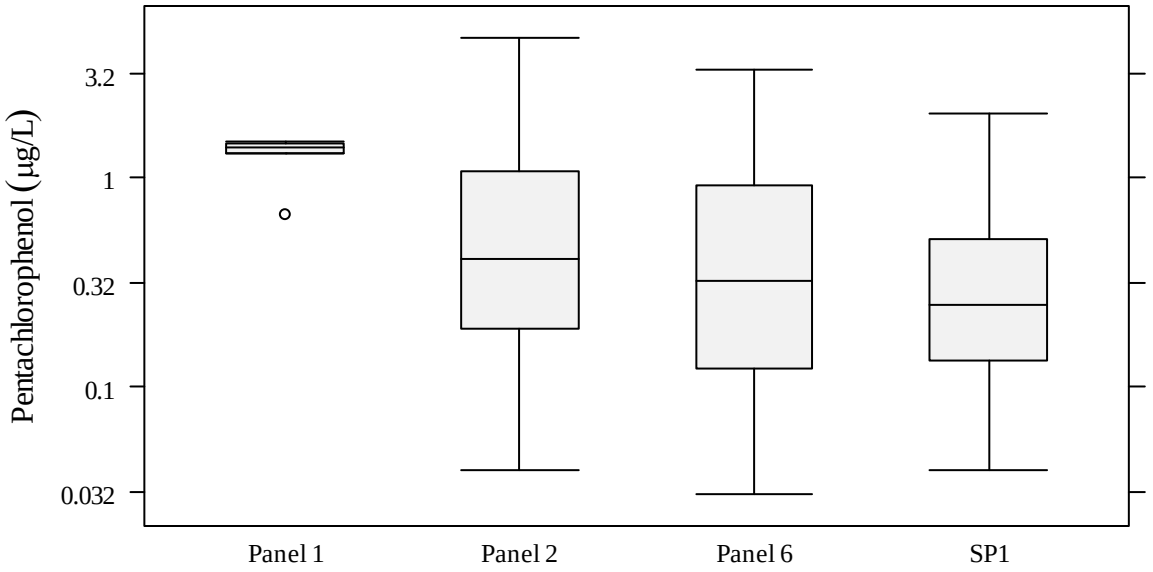


Figure 7-18: Year 2 Total Lead Concentrations by Sample Panel

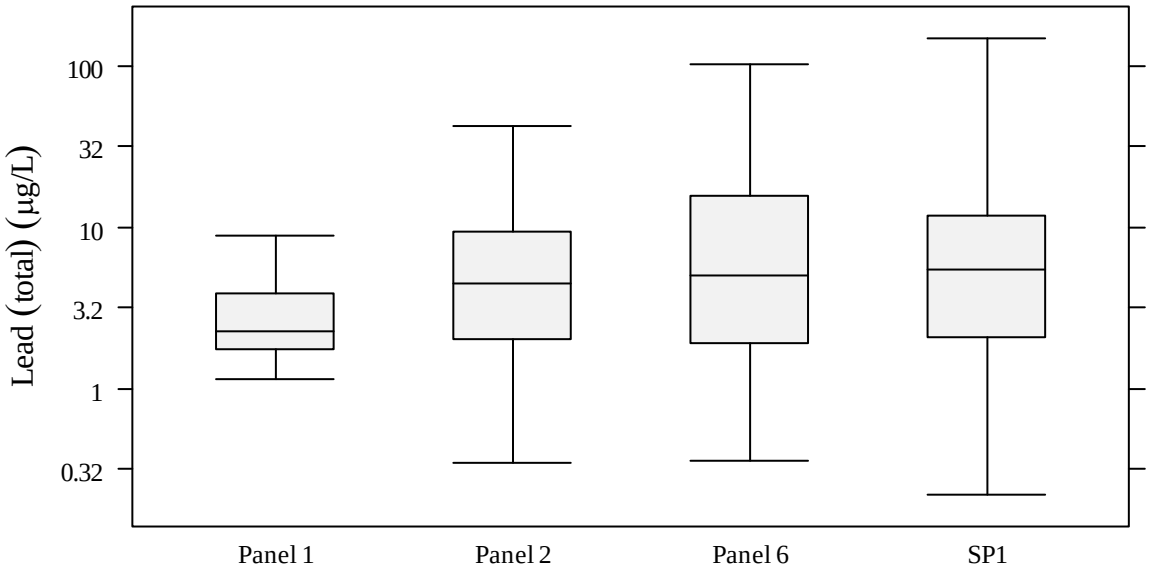
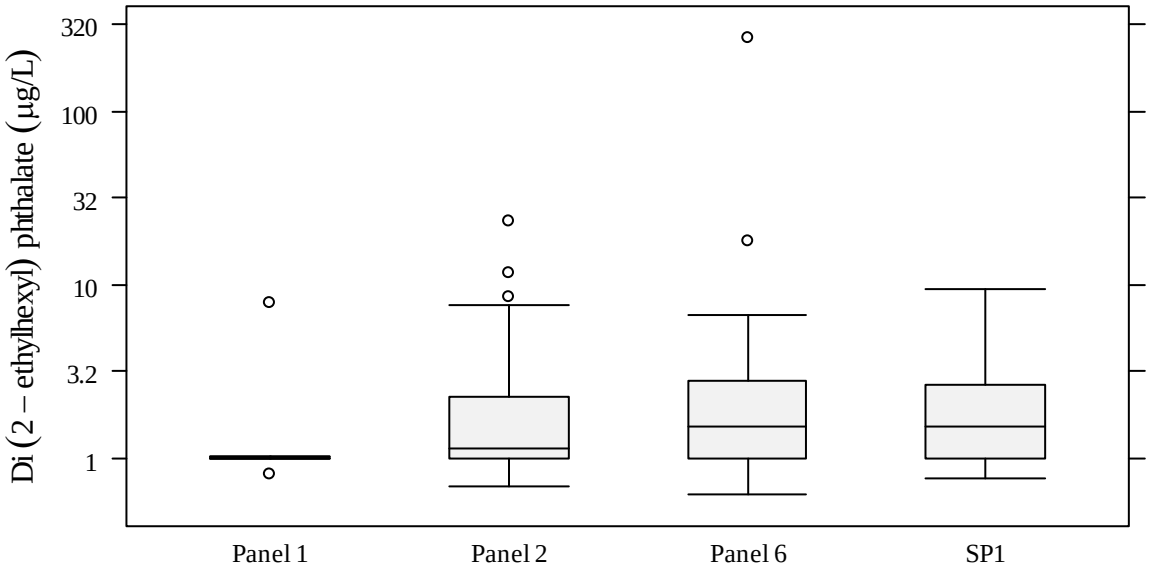


Figure 7-19: Year 2 Di(2-ethylhexyl)phthalate (DEHP) Concentrations by Sample Panel



Note:
See DEHP discussion in Section 6.0.

Figure 7-2: Year 2 Pentachlorophenol Concentrations by Traffic Category

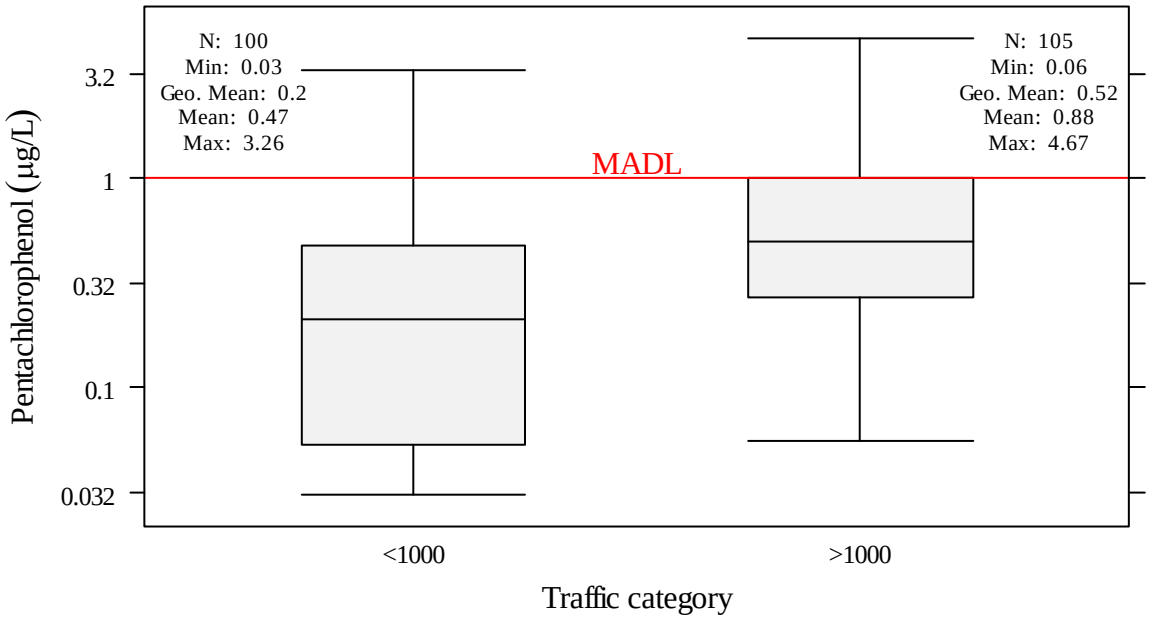


Figure 7-3: Year 2 Cadmium Concentrations by Traffic Category

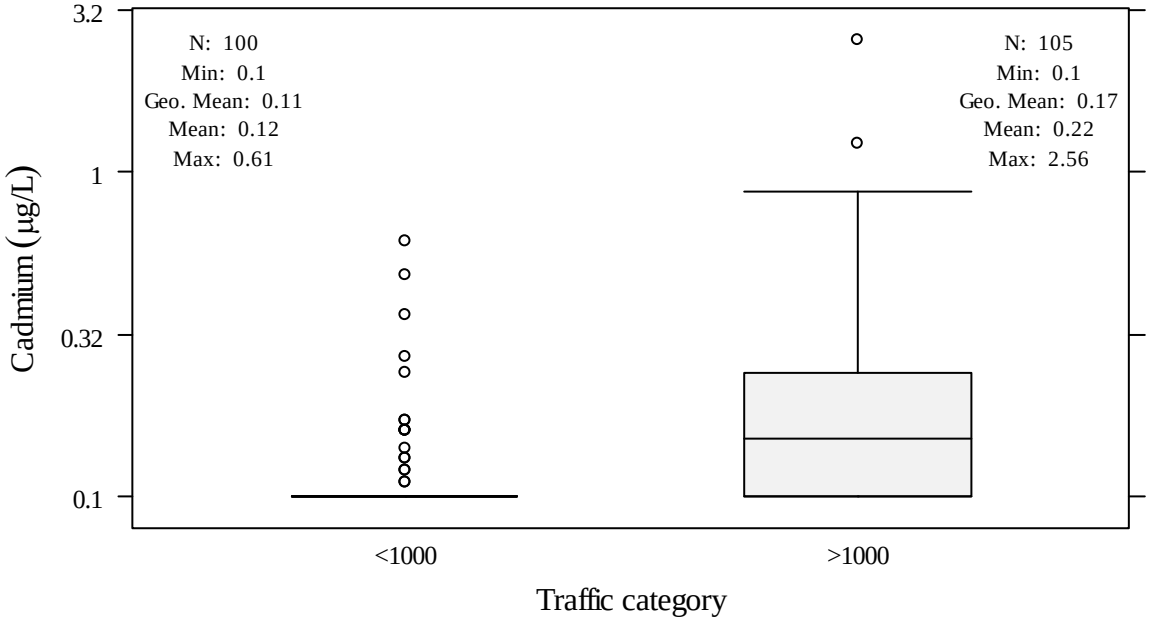


Figure 7-4: Year 2 Chromium Concentrations by Traffic Category

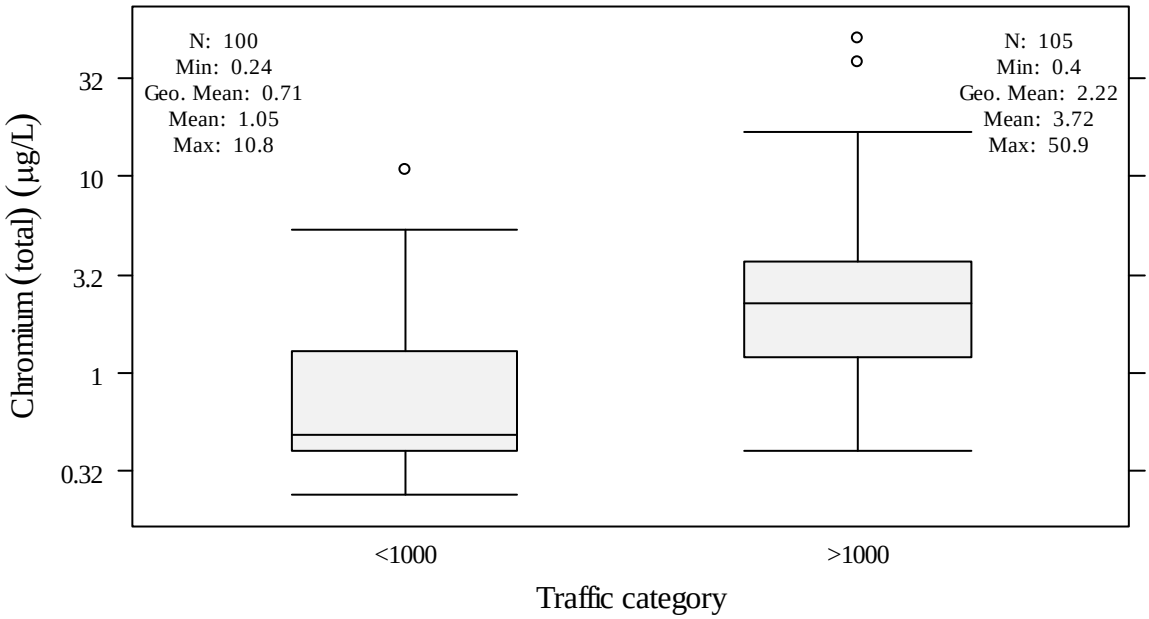


Figure 7-5: Year 2 Total Lead Concentrations by Traffic Category

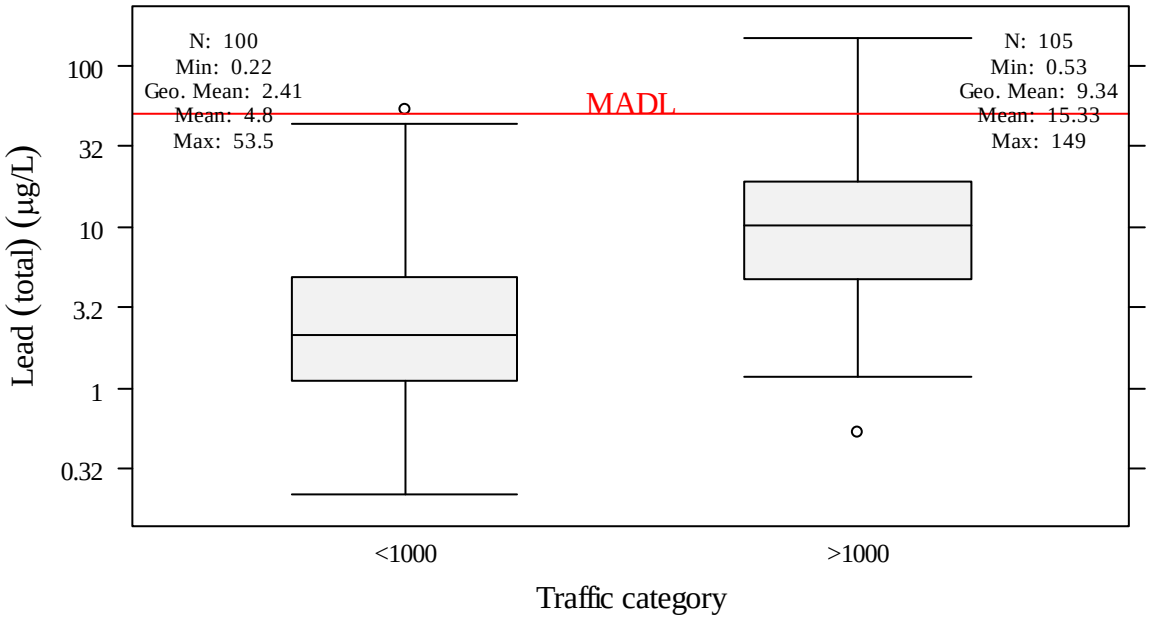


Figure 7-6: Year 2 Benzo(a)pyrene Concentrations by Traffic Category

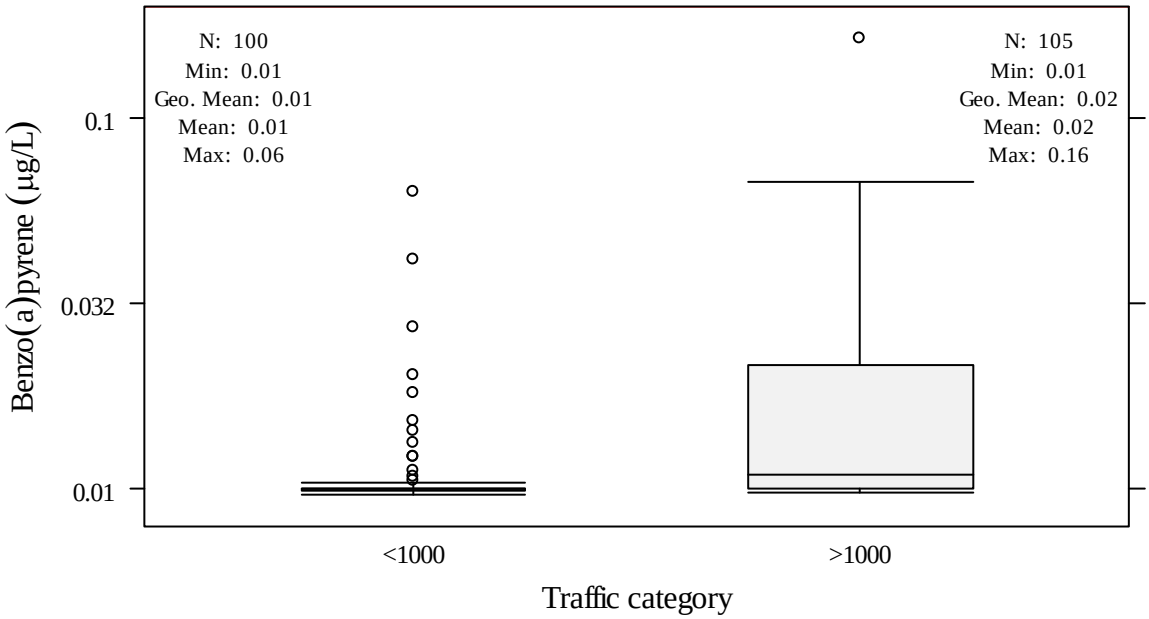


Figure 7-7: Year 2 Di(2-ethylhexyl)phthalate Concentrations by Traffic Category

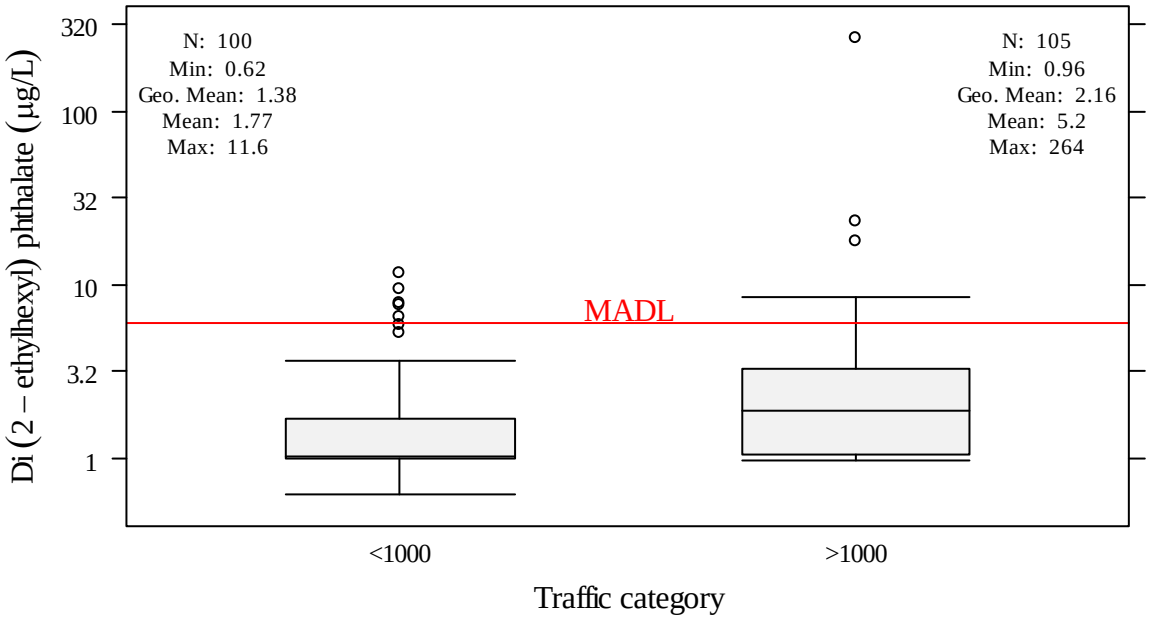


Figure 7-8: Year 2 Total Suspended Solids Concentrations by Traffic Category

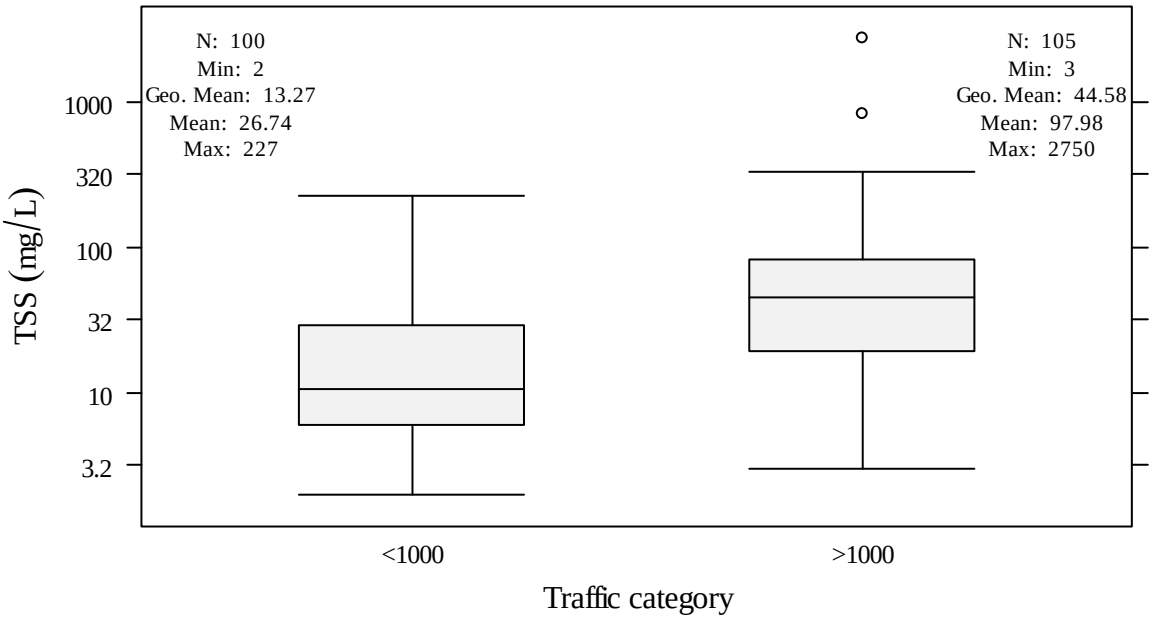


Figure 7-9: Year 2 Dissolved Lead Concentrations by Traffic Category

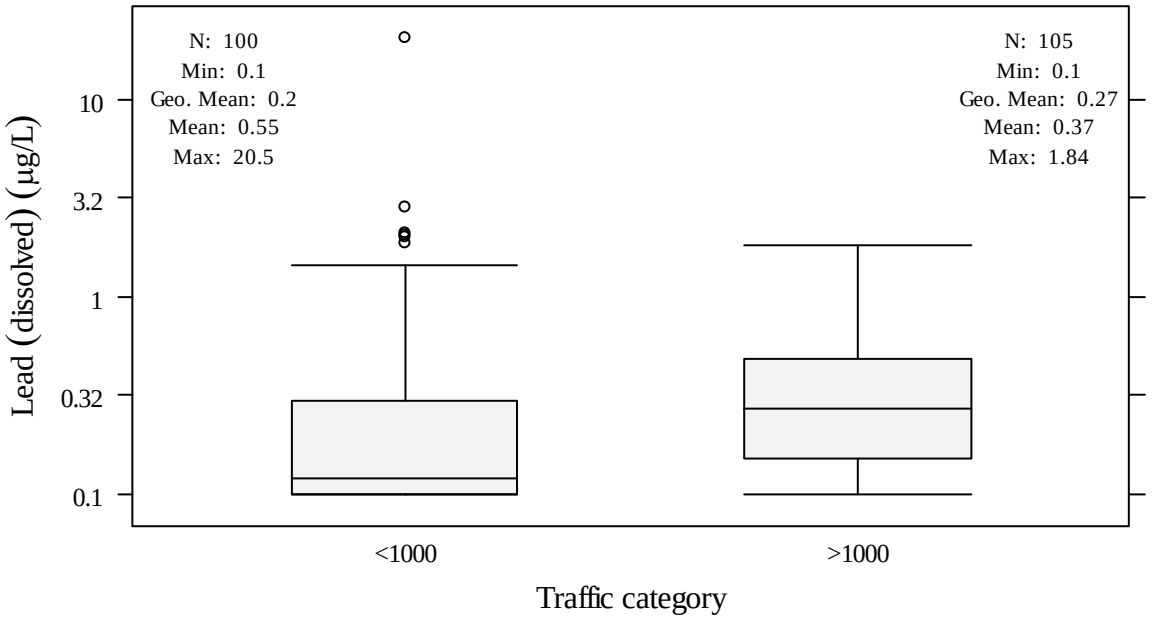


Figure 9-1: Comparison of Pentachlorophenol Concentrations for Year 1 and Year 2

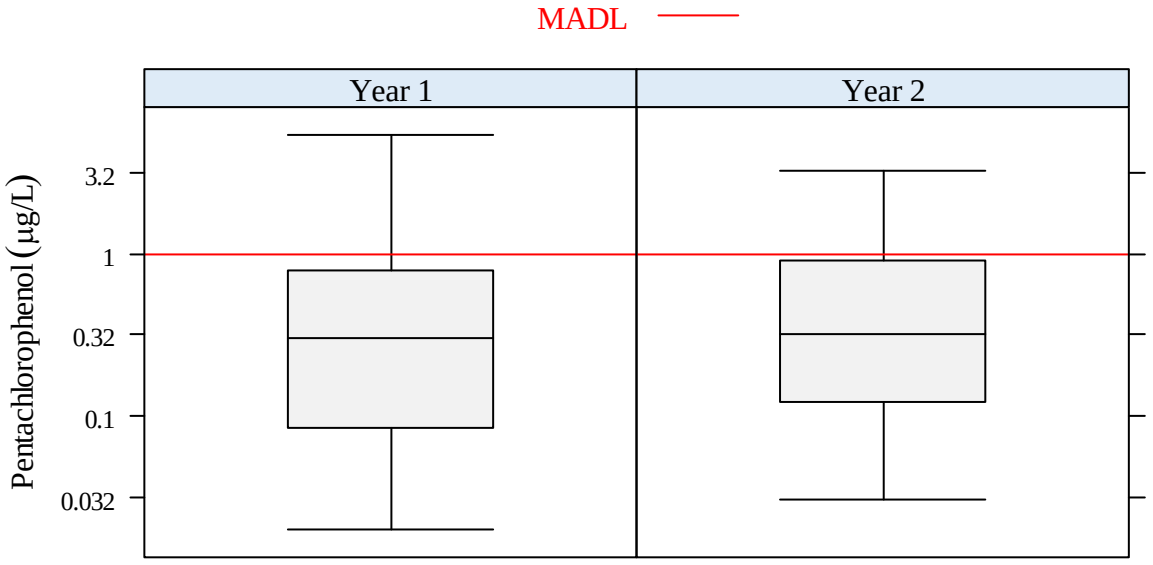


Figure 9-2: Comparison of Total Lead Concentrations for Year 1 and Year 2

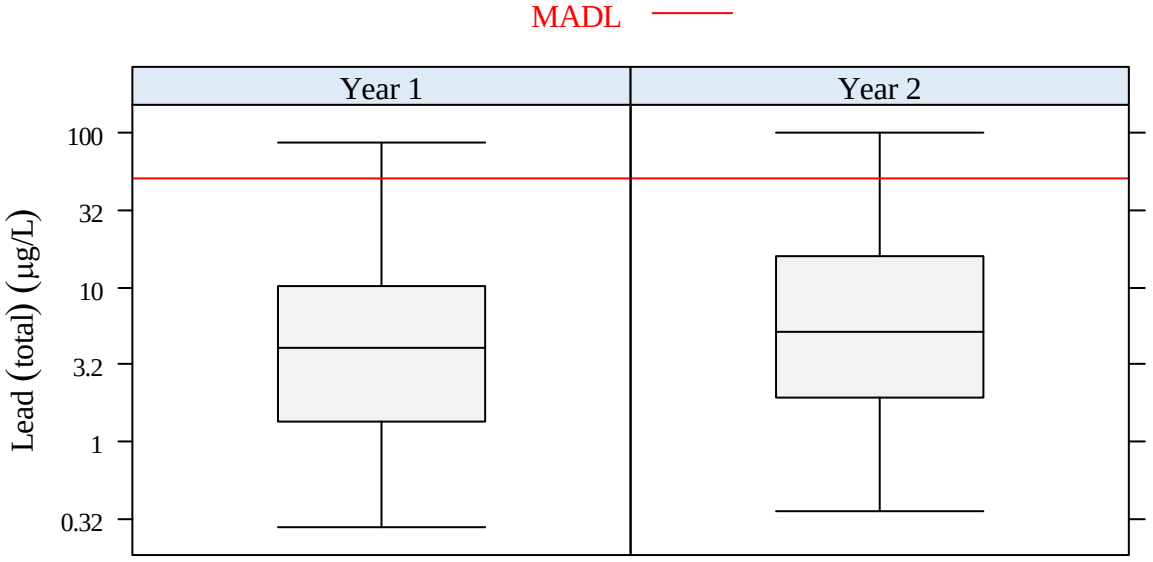


Figure 9-11: Comparison of Di(2-ethylhexyl)phthalate Concentrations by Year and Sample Panel

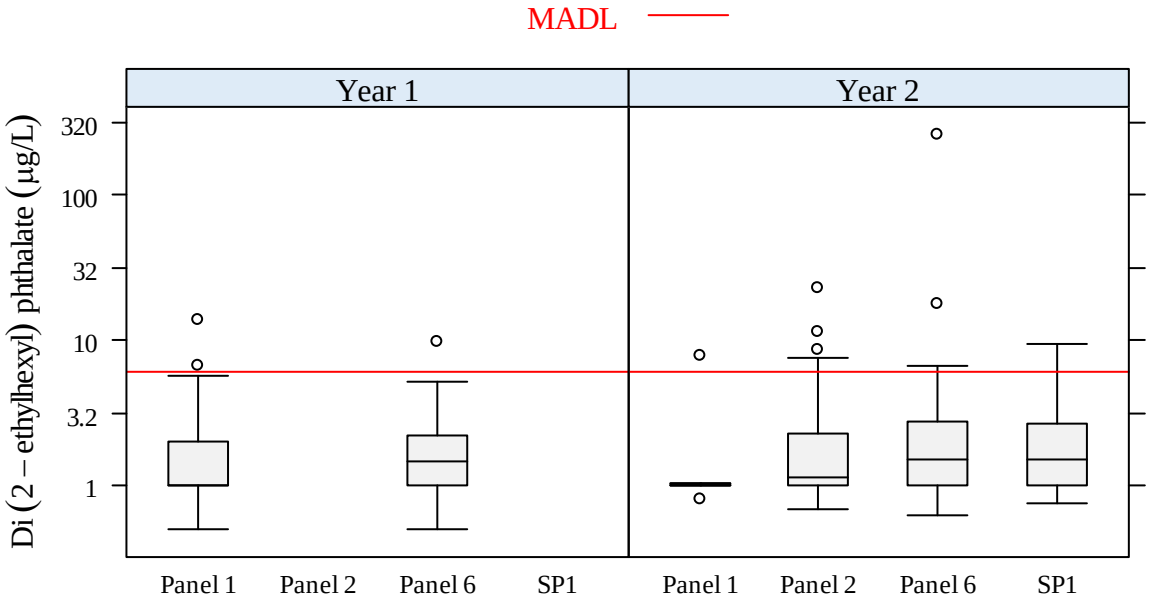


Figure 9-3: Comparison of Di(2-ethylhexyl)phthalate Concentrations for Year 1 and Year 2

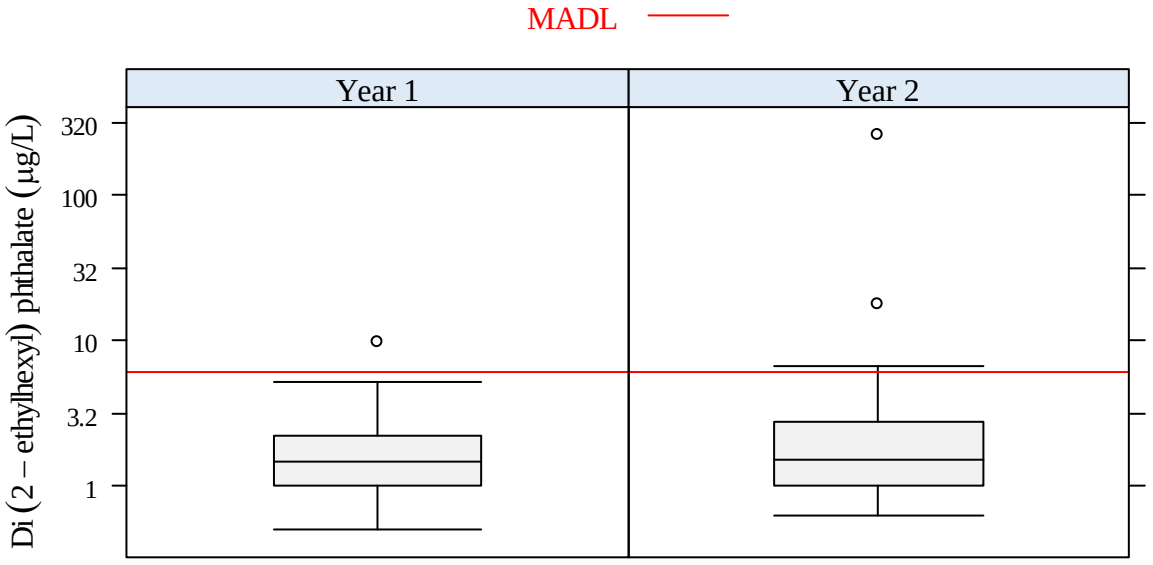


Figure 9-4: Comparison of Total Suspended Solid Concentrations for Year 1 and Year 2

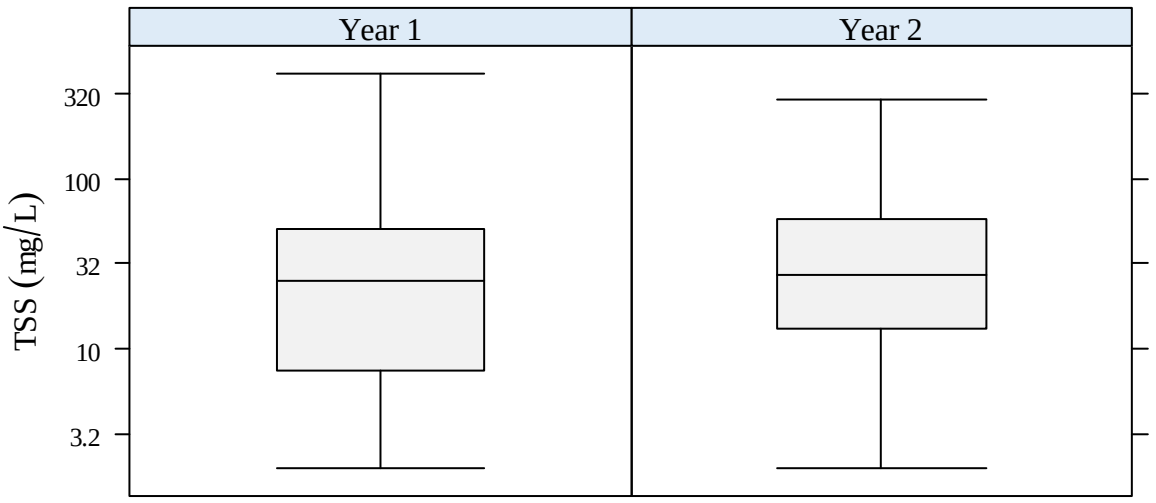


Figure 9-5: Comparison of Dissolved Lead Concentrations for Year 1 and Year 2

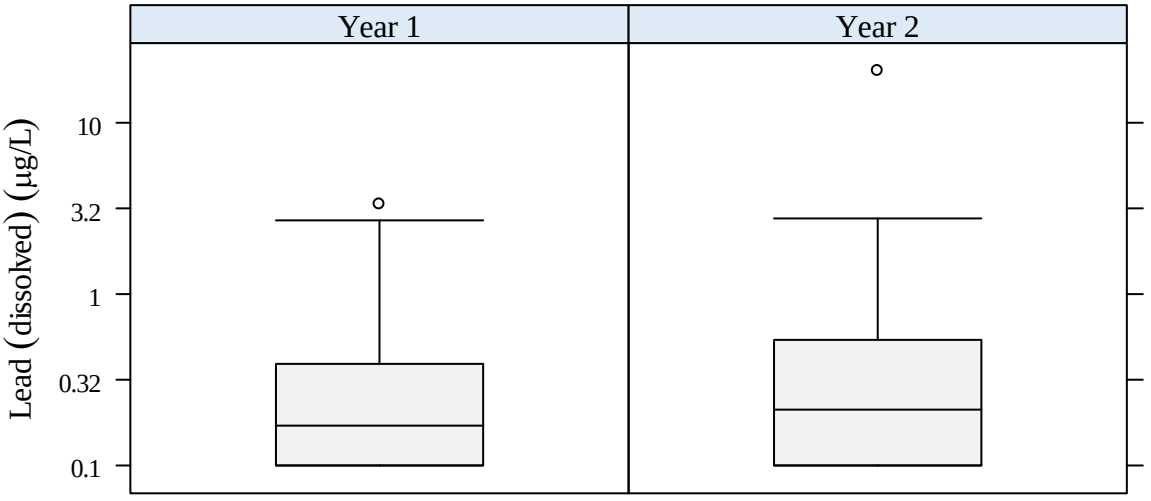


Figure 9-6: Comparison of Pentachlorophenol Concentrations by Year and Traffic Category

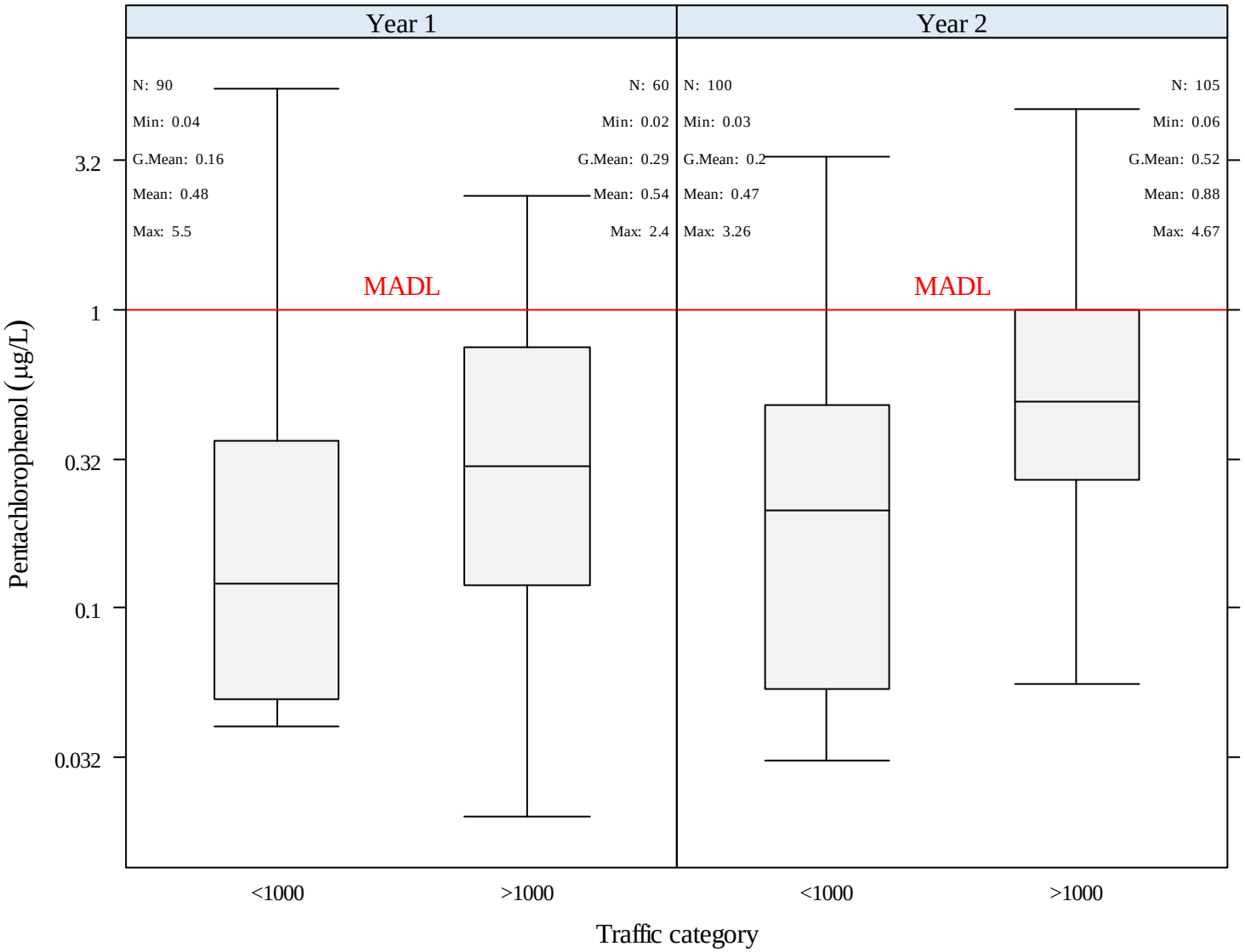


Figure 9-7: Comparison of Total Lead Concentrations by Year and Traffic Category

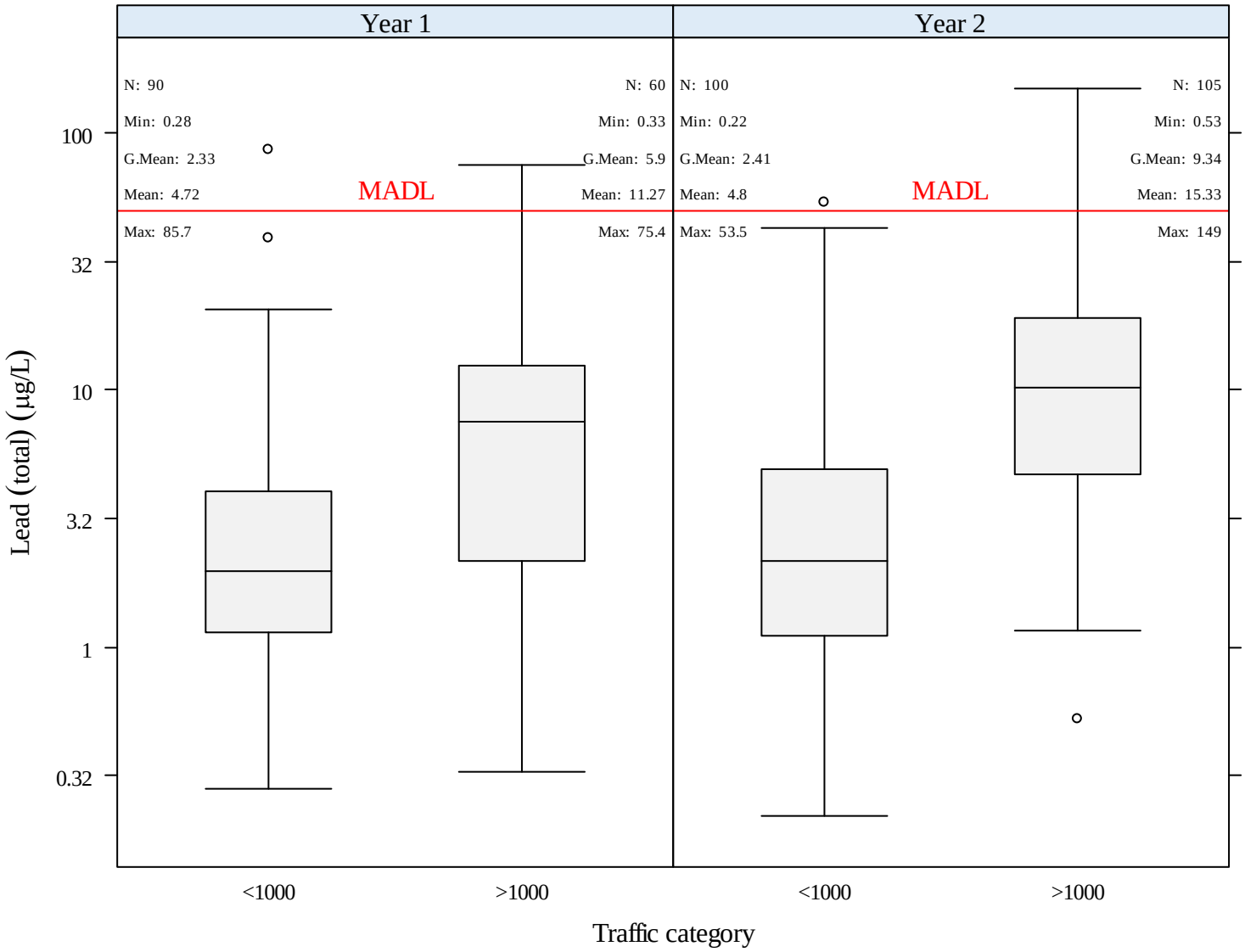


Figure 9-8: Comparison of Di(2-ethylhexyl)phthalate Concentrations by Year and Traffic Category

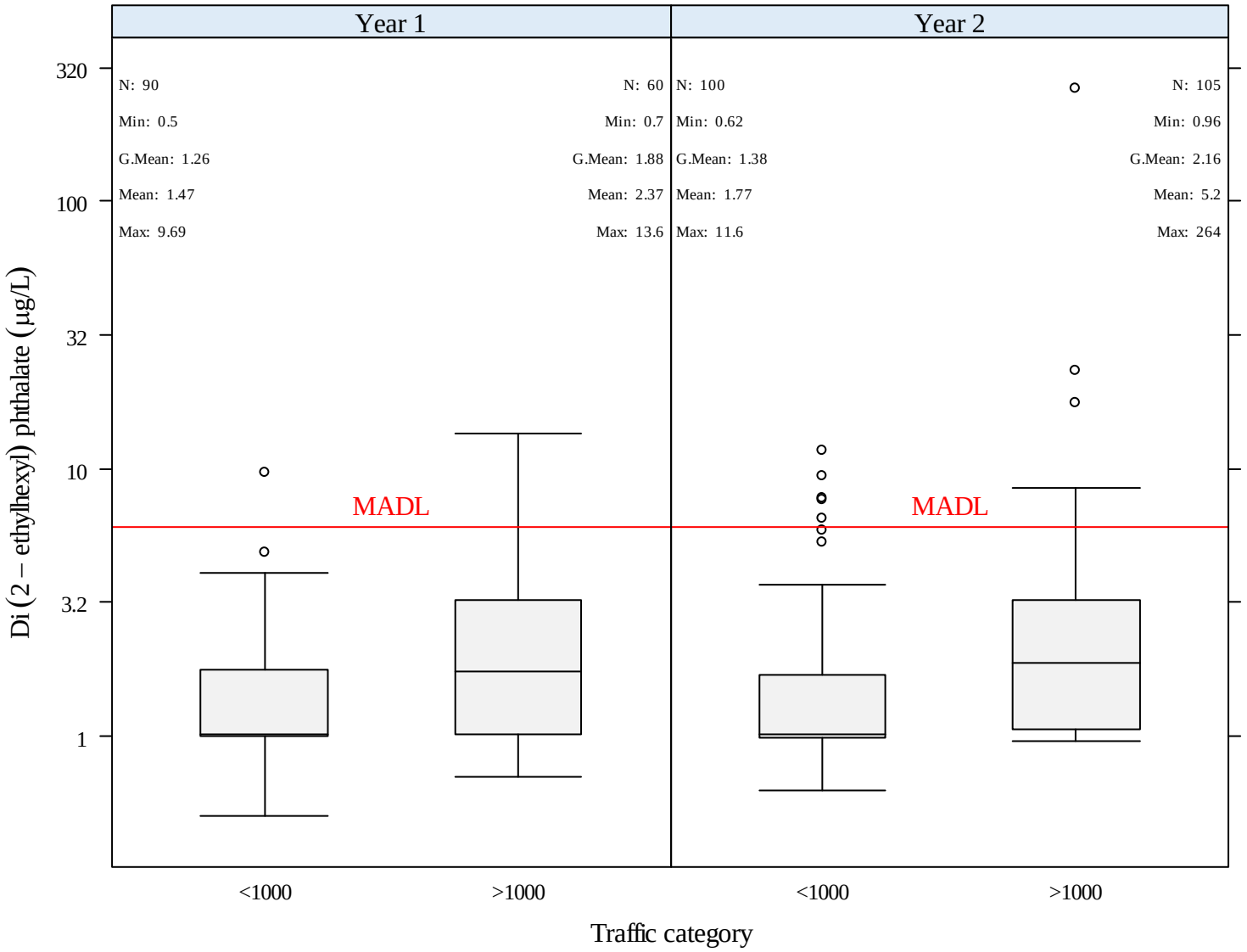


Figure 9-9: Comparison of Pentachlorophenol Concentrations by Year and Sample Panel

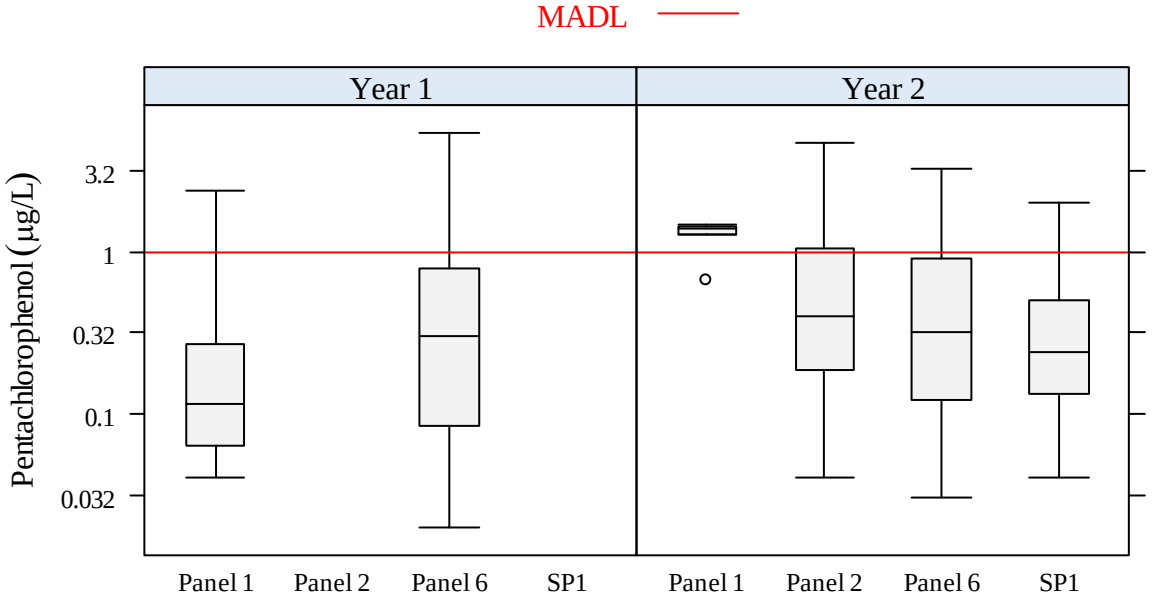
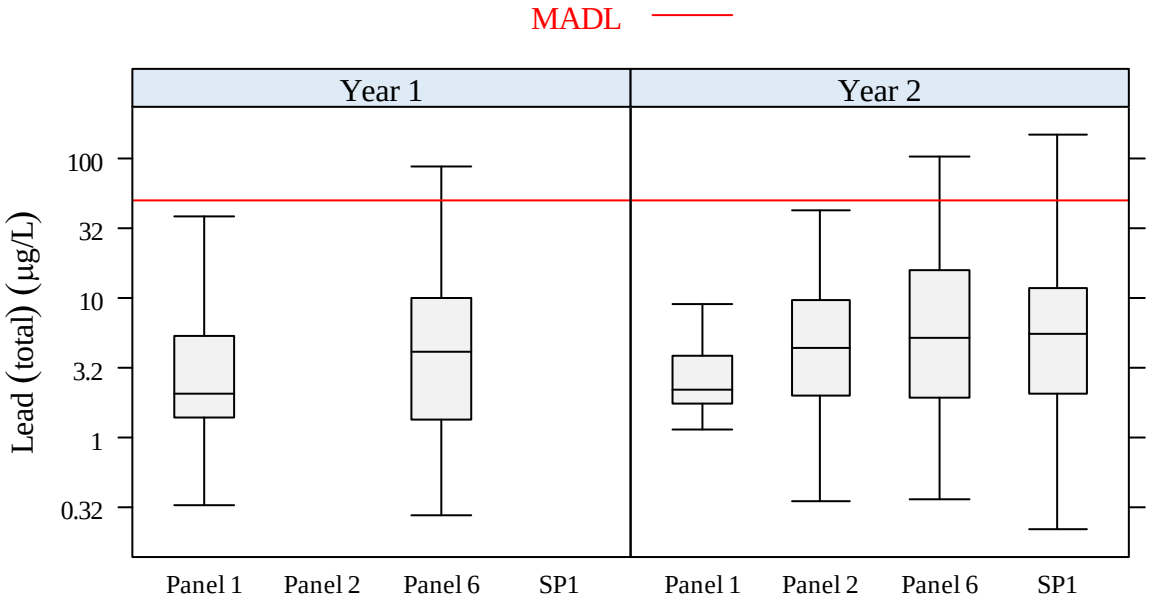


Figure 9-10: Comparison of Total Lead Concentrations by Year and Sample Panel



Figures