Annual Stormwater Discharge Monitoring Report

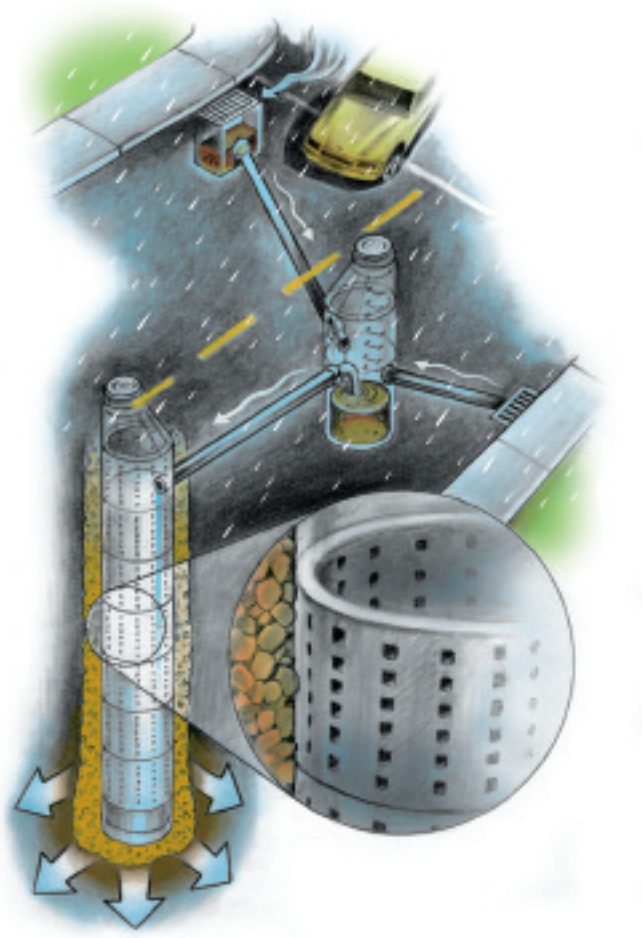
Year 3

October 2007 - May 2008

Water Pollution Control Facilities (WPCF) Permit

Class V Stormwater Underground Injection Control Systems

DEQ Permit Number 102830



July 2008

Prepared by

ENVIRONMENTAL SERVICES
CITY OF PORTLAND
working for clean rivers

— CITY OF PORTLAND —
ENVIRONMENTAL SERVICES
1120 SW Fifth Avenue, Room 1000, Portland, Oregon 97204-1912 ▪ Sam Adams, Commissioner ▪ Dean Marriott, Director

July 15, 2008

Mr. Rodney Weick
Underground Injection Control System Permit Manager
Oregon Department of Environmental Quality
2020 Southwest Fourth Avenue, Suite 400
Portland, Oregon 97201

Subject: Permit Required Submittal
City of Portland Water Pollution Control Facilities Permit No. 102830

Dear Rodney:

In accordance with the Oregon Department of Environmental Quality's (DEQ) Water Pollution Control Facilities Permit (WPCF Permit #102830 issued on June 1, 2005) for Class V Stormwater Underground Injection Control Systems (UICs), the City of Portland's Bureau of Environmental Services (City) is pleased to provide DEQ with the following document "*Annual Stormwater Discharge Monitoring Report: Year 3 – October 2007 – May 2008.*"

This report presents the results of the Year 3 (October 1, 2007 through May 31, 2008) UIC Monitoring Program. Monitoring was implemented in accordance with the final *Stormwater Discharge Monitoring Plan* (SDMP), submitted to DEQ in August 2006. The monitoring program is representative of the estimated 9,000 City-owned UICs. Forty-five UIC locations were sampled in Year 3 including:

- Thirty UICs selected to implement the required Year 3 monitoring (*i.e.*, compliance monitoring network) described in the SDMP including: 15 rotating UIC locations (Panel 3) and 15 fixed UIC locations (Panel 6).
- Five UIC locations, P1_1, P2_5, P2_7, P2_13, and P2_14, carried over from Year 2 due the annual mean pentachlorophenol concentrations exceeding the permit defined maximum allowable discharge limit (MADL) in these UICs.
- Ten supplemental UICs located near drinking water wells.

The report provides details regarding the UIC sampling program (*e.g.*, UIC locations, sampling and analysis, data quality); individual sampling events; annual mean concentrations; preliminary trend analysis, response actions, and the identification of Category 4 UICs as required by the permit.

Permit compliance is demonstrated in this report by documenting that Year 3 sampling, analyses, data evaluation, and response actions are performed in accordance with the permit, SDMP, and UIC Management Plan (submitted to DEQ in December 2006).

If you have any questions or need additional information to complete your review of this document, please call me at 503 823-5762. We look forward to continuing to work with you on implementing the City's UIC Program.

Sincerely,

Rod Struck, R.G.
UIC Program Hydrogeologist

Enclosures:

3 Copies: Annual Stormwater Discharge Monitoring Report – Year 3
(Note: Appendices and a full copy of the report are provided on a CD contained in the report)

Cc: UIC Program File
Mary Stephens, BES
Barb Atkins, BES
Mary Wahl, BES
Dave Kliewer, BES
Jan Betz, City Attorney

City of Portland, Oregon

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

Permit Number: 102830

Annual Stormwater Discharge Monitoring Report
Year 3 – October 2007 - May 2008

Underground Injection Control Systems
System Monitoring

July 2008

Prepared By:
City of Portland, Bureau of Environmental Services

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Executive Summary

The annual *Stormwater Discharge Monitoring* report is required by 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). The City is required to monitor stormwater entering City-owned Underground Injection Control (UIC) systems throughout the life of the permit and to submit this annual monitoring report.

Year 3 Monitoring Program: The City of Portland's UIC monitoring program was implemented in accordance with the final *Stormwater Discharge Monitoring Plan* (SDMP; City of Portland, 2006a), submitted to DEQ in August 2006. The monitoring program was designed to be representative of the estimated 9,000 City-owned UICs using a statistically robust method to identify a subset of UICs for monitoring. Forty-five UIC locations were sampled in Year 3 including:

- Thirty UICs selected to implement the required Year 3 monitoring (*i.e.*, compliance monitoring) described in the SDMP:
  - Panel 3 (15 rotating UIC locations sampled in permit Years 3 and 8); and
  - Panel 6 (15 fixed UIC locations sampled in permit Years 1 through 10).
- Five UIC locations, P1_1, P2_5, P2_7, P2_13, and P2_14, carried over from Year 2 monitoring because of an exceedance of the permit-defined maximum allow discharge limit (MADL) for pentachlorophenol.
- Ten supplemental UICs located near drinking water wells.

UIC monitoring network sample locations were selected on the basis of two traffic flow categories: <1,000 trips per day (TPD) and ≥1,000 TPD. Year 3 Panel locations (*i.e.*, Panels 3 and 6, Supplemental Panel 2) included 22 UIC locations in the <1,000 TPD category and 23 locations in the ≥1,000 TPD category.

Year 3 Results: Five sampling events were completed, as required, between October 2007 and May 2008. Stormwater discharge samples were analyzed for common pollutants (*e.g.*, metals, volatile organic compounds, semivolatile organic compounds, and pesticides) as defined by the permit. Year 3 field and laboratory data collected met the SDMP data quality objectives. Testing of priority pollutant screen (PPS) analytes is required in permit Years 1, 4, and 9; however, nine PPS analytes are reported in Year 3 because they are capable of being detected using U.S. Environmental Protection Agency (EPA) test methods for analysis of the common pollutants.

Twelve of 14 common pollutants and one PPS analyte (2,4-D) were detected in Year 3. Twenty-seven ancillary pollutants (*i.e.*, analytes derived from the analytical methods for common pollutants) were detected at low concentrations (generally less than 1 microgram per liter [µg/L]). The eight ancillary pollutants detected at the highest frequencies (between 24% and 98%) during the individual sampling events are polycyclic aromatic hydrocarbons (PAH). Of the PAHs detected, naphthalene had the highest concentration (1.28 µg/L).

MADL Exceedances: Four pollutants, pentachlorophenol, di(2-ethylhexyl)phthalate (DEHP), benzo(a)pyrene, and lead were detected in Year 3 at concentrations above their respective MADLs in at least one sample. Detected concentrations of other common and PPS analytes were below their respective MADLs. The City reported MADL exceedances to DEQ, as required by the permit.

Annual Mean Concentrations: Annual geometric mean concentrations for six UIC locations (P6_1, P6_4, P6_14, P2_5, P2_13, and P2_14) exceed the MADL for pentachlorophenol (1.0 µg/L); annual geometric means for these locations range from 1.1 to 1.7 µg/L, slightly above the MADL. Annual mean concentrations for DEHP, benzo(a)pyrene, and lead were less than their respective MADLs. Annual mean concentrations were not calculated for other pollutants because their concentrations were <50% of the MADL and theoretically cannot exceed the MADL.

Preliminary Trend Analysis: In general, low concentrations of common pollutants were detected in Year 1 - Year 3 data. Concentration ranges for pentachlorophenol, DEHP, and lead are similar for Years 1, 2, and 3. Concentrations are generally within narrow ranges at individual UIC locations. Concentrations for the ≥1,000 TPD traffic category appear to be slightly higher than the <1,000 TPD traffic category in Years 1, 2, and 3. Year 2 DEHP data suggest several data points may be outliers or result from laboratory contamination issues.

Year 3 Response Actions: The following actions were completed in Year 3:

- Evaluation of treated wood utility poles as a source of pentachlorophenol and evaluation of potential pentachlorophenol migration pathways. This evaluation included sample collection (pole wipe, soil, curb sediment, catch basin, and sedimentation manhole solids) to assess potential pentachlorophenol migration pathways.
- Evaluation of pentachlorophenol environmental fate and transport in accordance with the *UIC Management Plan* (UICMP; City of Portland, 2006g).
- UIC system cleaning.

Category 4 UICs: The annual mean concentration of pentachlorophenol exceeded the MADL for a second year in three of the four UICs identified in Year 2. As a result, these three locations (P2_5, P2_13, and P2_14) are identified as Category 4 UICs in accordance with the permit. Corrective actions for these UICs will be identified, evaluated, and selected in accordance with the *Corrective Action Plan* (City of Portland, 2006f).

Permit compliance is demonstrated in this report by documenting that Year 3 sampling, analyses, data evaluation, and response actions are performed in accordance with the permit, SDMP, and UICMP.

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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
CDF	cumulative distribution function
DEHP	di(2-ethylhexyl)phthalate or bis(2-ethylhexyl)phthalate
DEM	digital elevation model
DEQ	Oregon Department of Environmental Quality
DFR	daily field report
DOC	dissolved organic carbon
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

List of Acronyms (Continued)

QA	quality assurance
QAPP	Quality Assurance Project Plan
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
TOC	total organic carbon
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

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Section 1

1 Introduction and Organization

1.1 Introduction and Purpose

This annual *Stormwater Discharge Monitoring* (SDM) report presents the results of the third 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 (10 years or permit term) and to submit this annual report. For the purposes of this report, all references to "WPCF permit" 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 stormwater 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 by November 1 of each year (City of Portland, 2006e and 2007). 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, 2007, and May 31, 2008 (*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 3 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.

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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 3 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-five UIC locations were sampled in Year 3 including:

- Thirty UICs selected to implement the required Year 3 monitoring (*i.e.*, compliance monitoring) described in the SDMP:
  - Panel 3 (15 rotating UIC locations sampled in Years 3 and 8);
  - Panel 6 (15 fixed UIC locations sampled in Years 1 through 10);
- Five UIC locations (P1_1, P2_5, P2_7, P2_13, and P2_14) carried over from Year 1 and/or Year 2 monitoring because of annual mean pentachlorophenol concentrations exceeding the MADL[1] (see Section 3.1.3); and
- Ten supplemental UICs located near drinking water wells (Supplemental Panel 2; see Section 3.2.4).

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

[1] Nine UIC locations were found to exceed the MADL for their annual mean pentachlorophenol concentration in Year 2; however, four of these locations were in stationary Panel 6 (see Section 3.2 for explanation of stationary and rotating panels), and were already scheduled to be re-sampled during Year 3 by the sampling design.

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%.

Years 1, 2, and 3 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 6.6% (three UICs) and 22.2% (10 UICs) during individual Year 3 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. After 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. Because the majority of active UICs are in the <1,000 TPD category, which are predominantly in residential areas, the sample design is considered conservative. The Year 3 sampling program selected 15 locations in the <1,000 TPD category and 15 locations in the ≥1,000 TPD category, for a total of 30 locations.

UIC locations for Year 4 monitoring (*i.e.*, Panel 4) will be submitted to DEQ by September 1, 2008.

3.1.3 Carry Over Locations from Year 1 and Year 2 MADL Exceedances

General: The permit requires the annual mean concentration to meet permit specified MADLs at the end-of-pipe (EOP) discharge point. The permit further states that if the annual mean concentration of any common or PPS pollutant MADL is exceeded for two consecutive wet seasons, corrective action must be initiated to bring the annual mean MADL concentration into compliance with permit conditions, or the UIC must be decommissioned. Mean stormwater concentrations were calculated in Years 1 and 2 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. If the annual mean concentration exceeded the MADL at a given UIC, the UIC was sampled the following year. For example, the annual mean pentachlorophenol concentration estimated for UIC sampling location P1_1 for Year 1 exceeded the MADL, therefore, P1_1 was added to the list of UICs to be monitored in Year 2 (*i.e.,* carried over) to determine UIC compliance.

Year 1: 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 Years 1 or 2 at concentrations ≥50% of the MADL:

- Common pollutants[2]: pentachlorophenol, di(2-ethylhexyl)phthalate (DEHP), benzo(a)pyrene, and lead.
- Priority pollutant screen (PPS) analyte: antimony (Year 1 only).

The Year 1 annual geometric mean concentrations were below permit MADLs with the exception of pentachlorophenol. 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. These five locations were scheduled (*i.e.,* carried over) for sampling in Year 2 to determine permit compliance (Note: the Panel 6 locations are part of the "fixed" sampling panel that will be monitoring throughout the duration of the permit – therefore, this did not result in an increase in the number of sampling locations).

Year 2: The Year 2 annual geometric mean concentrations were below permit MADLs for all pollutants with the exception of pentachlorophenol. Concentrations for nine UIC locations (P1_1, P2_5, P2_7, P2_13, P2_14, P6_1, P6_2, P6_7, and P6_14) exceeded the MADL. The annual geometric means for these locations range from 1.0 to 3.2 µg/L. These nine locations were scheduled for sampling in Year 3 to determine permit compliance (Note: the Panel 6 locations are part of the "fixed" sampling panel that will be monitoring throughout the duration of the permit – therefore, this resulted in an increase in sampling of five UICs in Year 3).

[2] See Section 4.5 for an explanation of common and PPS analytes, as defined in the permit.

Four of the UIC locations (P1_1, P6_1, P6_7, and P6_14) that exceeded the annual geometric mean for pentachlorophenol in Year 1 also exceeded in Year 2 and were identified as non-compliant Category 4 UICs in the *Annual Stormwater Discharge Monitoring Report – Year 2* (City of Portland, 2007). In response, the City developed and applied a Groundwater Protectiveness Demonstration as a corrective action. The results of this evaluation demonstrated that urban stormwater discharges into these four City-owned UICs do not adversely affect the beneficial uses of groundwater, and that the discharges are protective of human health and the environment in accordance with Oregon Administrative Rules (OAR) 340-040 (GSI, 2008a, 2008b). DEQ concurred with these results and issued "No Further Action" determinations for these UICs in May 2008 (DEQ, 2008).

The Year 2 annual geometric mean concentration for one UIC, P6_1, exceeded the MADL for DEHP. It was noted in the Year 2 SDM report that the data in the calculations for this location were used "as reported" by the analytical laboratory (*i.e.*, data that were subsequently rejected because of QA/QC issues [see Section 6 and Appendix H of the *Annual Stormwater Discharge Monitoring Report - Year 2* for additional detail; City of Portland, 2007]). Subsequent evaluation of this location based on DEHP data that were determined to be valid and usable (*e.g.*, BES resampling data, laboratory reanalysis data) found that the annual geometric mean concentration of DEHP at P6_1 was approximately 88% of the MADL in Year 2. Therefore, no additional action was deemed necessary other than to continue monitoring. P6_1 will be monitored annually for the duration of the permit as part of the stationary panel.

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 during the 10-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 10 years. The other five panels of locations are rotated, so that each panel will be sampled twice during the 10-year permit term; once in Years 1 through 5, and once in Years 6 through 10. After 5 years, 75 rotating locations (five different panels *x* 15 locations per panel) will have been sampled once and after 10 years they will have been sampled twice. Using this process, a total of 90 unique locations will be monitored during the permit term (15 stationary + 75 rotating locations).

Sampling locations were randomly selected and then stratified on the basis of traffic category (<1,000 TPD, and $\geq$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 2007 before 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). Characteristics of UIC monitoring locations sampled in Year 3 are summarized in Tables 3-2 (Panel 1), Table 3-3 (Panel 2), Table 3-4 (Panel 3), and Table 3-5 (Panel 6). Year 3 sampling locations are shown in Figure 3-2.

3.2.1 Stationary Panel (Panel 6)

Fifteen UICs in the stationary panel (Panel 6) were sampled during five storm events throughout the 2007-2008 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 the *Annual Stormwater Discharge Monitoring Report – Year 1* (City of Portland, 2006e), a change in the TPD estimation methodology in Year 1 resulted in the recategorization of traffic volume for three UIC locations in Panel 6. All three UIC locations were recategorized from ≥1,000 TPD to <1,000 TPD in Year 1. Three new UIC locations in the ≥1,000 TPD traffic category were randomly selected before Year 2, 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. The three UICs location that were reselected to represent the ≥1,000 TPD traffic category were P6_2, P6_10, and P6_12 (note: sample location codes were retained).

Appendix A provides detailed maps showing individual Panel 6 UIC locations. Table 3-5 presents location information, characteristics, and maintenance information for each UIC in Panel 6.

3.2.2 Rotating Panel (Panel 3)

Fifteen UICs in the rotating panel (Panel 3) were sampled during five storm events throughout the 2007-2008 wet season. This panel will be resampled in Year 8 (2012 – 2013) of the permit. The specific UICs included in Panel 3 were randomly selected using the GRTS process described in detail in the SAP. The SAP defines Panel 3 as including seven UICs with traffic counts <1,000 trips per day and eight UICs with traffic counts ≥1,000 trips per day.

In addition to the 15 UIC locations discussed above, five additional rotating panel locations were sampled during Year 3. As discussed in Section 3.1.3, the annual geometric mean pentachlorophenol concentration at UIC locations P1_1, P2_5, P2_7, P2_13, and P2_14 exceeded the MADL for pentachlorophenol during Year 2. Therefore, these locations were included in the Year 3 compliance monitoring program.

Appendix A provides detailed maps showing individual Panels 1, 2, and 3 UIC locations. Table 3-2 through 3-4 presents location information, characteristics, and maintenance information for each UIC in Panel 1, 2, and 3, respectively.

3.2.3 Oversample Panel

An oversample panel of 85 alternate locations was generated as described in the SAP in order to develop Panels 3 and 6. This panel was used to replace four of the randomly selected Panel 3 UIC monitoring locations that were submitted to DEQ in August 2007. These four UICs were determined to be unsuitable for sampling during pre-sampling field investigations in accordance with the SDMP. 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

During the 2007-2008 monitoring season (Year 3), the City initiated voluntary sampling at 10 additional UIC locations to assess the quality of stormwater discharged to UICs located near domestic[3] or public drinking water wells; and/or within the 2-year time of travel[4] of a public water well.

Supplemental monitoring locations were taken from the list of the City-owned UICs in the *Systemwide Assessment* report (City of Portland, 2006d) 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 2-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 August and September 2007 to determine their suitability for sampling and their ability to represent the associated traffic categories. Supplemental monitoring locations were sampled during all five Year 2 storm events. Sampling and analyses were performed in accordance with the SDMP.

The statistical basis of the supplemental monitoring is presented in Section 3.3.

Information on the supplemental sampling locations is presented in Table 3-6, and locations are shown in Figure 3-2.

3.3 Supplemental UIC Monitoring Statistical Basis

The purpose of this section is to provide the statistical basis for the City's supplemental UIC monitoring program. The WPCF permit requires that stormwater discharges meet the MADLs defined in Table 1 of the permit for UICs that are located:

- Less than 500 feet from a domestic well;
- Within a 2-year time of travel of a public water well; or
- Less than 500 feet from a public water well without a delineated time of travel.

[3] 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."

[4] 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.

As used in this report, the term "domestic well" includes the categories of public and privately held wells listed above and includes wells used to supply water for purposes of drinking water or irrigation. Of the initial 9,000 UICs evaluated in the *Systemwide Assessment* report (City of Portland, 2006d), 332 UICs were identified that are within 500 feet or a 2-year time of travel of a domestic use well.

The supplemental UIC monitoring is intended to selectively monitor a subset of the overall UIC population within a 2-year time of travel or within 500 feet of a potential drinking water well (well subpopulation). The objectives of the supplemental monitoring include:

- Assess the quality of stormwater discharged to UICs located near domestic or public drinking water wells;
- Demonstrate that the results of the citywide annual compliance 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 2-year time of travel of a public water well; and
- Demonstrate through the compliance monitoring and supplemental monitoring programs that discharges to public UICs within 500 feet of domestic and irrigation wells or within a 2-year time of travel of public drinking water wells meet permit MADLs and are protective of groundwater quality.

Stormwater quality discharge limits established in the WPCF permit are designed to protect groundwater as a drinking water resource in accordance with OAR 340-040. The City's UICMP builds upon this permit requirement by implementing aggressive stormwater management strategies that prevent, minimize, and treat pollutants in stormwater before they can be discharged to a UIC.

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 composed primarily of UICs that drain public 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 2-year time of travel for domestic, irrigation, or public drinking water wells. Identified UICs have an equal chance of being selected from their assigned traffic category during panel development (see discussion below).

The supplemental monitoring program included 10 unique locations in Year 2 (2006-2007) and Year 3 (2007-2008), and will include an additional 10 locations in Year 4 (2008-2009) for a total of 30 UICs locations.

The sampling plan for the supplemental monitoring is broadly similar to the overall monitoring plan, differing only in respect to the number of panels and the sample size. The goal is to provide an independent estimate of the proportion of these UICs that have

the potential to exceed the MADLs defined in the permit, based on estimates of the cumulative distribution function (CDF) for stormwater pollutant concentrations. Another main goal of the supplemental monitoring is to compare the estimated CDFs of pollutants from the subset of wells within a 2-year time of travel or within 500 feet of a drinking water well to the rest of the population. This would identify whether a systematic difference in pollutant discharge concentrations exists between UICs locations near drinking water wells (well subpopulation) and the rest of the UIC system.

The supplemental monitoring sampling design consists of an unequal probability GRTS sample (Stevens and Olsen, 2004) of the well subpopulation of UICs. The variable used for unequal probability sampling is the same traffic category variable (<1,000 and ≥1,000) used for the stormwater discharge compliance monitoring program. The supplemental UIC sampling plan includes three panels with a sample size of 10 UICs in each panel. Thus, in 3 years of sampling, the supplemental monitoring will attain a sample size of 30, which will provide the 12% half width 90% confidence interval specified in the SDMP (see SAP for sample size calculations). A fixed supplemental panel was not selected because the chance of encountering a significant trend in pollutant concentrations during the 3-year time period is considered small. If a trend exists, it is likely small and unlikely to affect the estimated CDFs. In addition, Panel 6 (*i.e.,* compliance monitoring fixed panel) of the overall UIC monitoring program provides data to assess the accuracy of this assumption using the data from the entire population of UICs.

The planned analysis of the supplemental data consists of two main components. First, estimated CDFs for selected pollutants will be calculated and the estimated proportion of the well subpopulation that might be expected to exceed the applicable MADL(s) will be estimated. In addition, the estimated CDFs of the well subpopulation and the entire UIC population will be tested for differences according to the method of Kincaid (2000). To accomplish this analysis, the UICs from the stormwater discharge compliance monitoring program that are within a 2-year time of travel or within 500 feet of a drinking water well will be added to the supplemental monitoring data to form two mutually exclusive subpopulations:

- UICs within a 2-year time of travel or within 500 feet of a drinking water well; and
- UICs that do not meet either of those criteria.

The sampling weights for the analysis will correspond to the sampling weights from the original survey from which the data originated, corrected for the change in target population size (*e.g.,* the target population of the overall monitoring program will decrease by the number of UICs in the well subpopulation).

The goal of the supplemental monitoring is to provide separate estimates of the pollutant concentrations entering UICs near drinking water wells (*i.e.,* well subpopulation) and to perform statistical inference to test the null hypothesis that that there is no difference between the CDFs of pollutants in the well subpopulation as compared to the rest of the UIC population. This comparison will provide objective data as to whether the overall

UIC sampling program adequately describes the well subpopulation and whether observed results for the entire population can be assumed to apply to the well subpopulation.

The UIC supplemental sampling program was designed to provide a 90% confidence interval with a 12% half width in a 3-year sampling program and was not designed to assess time trends in pollutants within the well subpopulation.

The analysis outlined above, combined with an analysis of the characteristics of UICs known to affect pollutant concentrations (*e.g.,* traffic, land use) and how these differ between the well subpopulation and the rest of the UIC population will provide a large amount of information on the potential for the well subpopulation of UICs to systematically differ from the results observed for the entire UIC monitoring program.

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Section 4

4 UIC Stormwater Discharge Monitoring Plan Implementation

This section describes how key elements of the SDMP were implemented in Year 3. Five stormwater samples were collected from each designated UIC sampling location required by the permit (P1_1, P2_5, P2_7, P2_13, P2_14, and Panels 3 and 6) during five storm events occurring between October 1, 2007, and May 31, 2008. Stormwater samples also were collected from the supplemental UICs located near drinking water wells for all five storm events. Sampling results are presented in Section 5.

The Year 3 *Data Usability Report*, prepared by the City of Portland Water Pollution Control Lab (WPCL), is presented in Appendix B. The report summarizes weather conditions, describes field and laboratory quality assurance/quality control (QA/QC) procedures and samples collected, describes Year 3 QA/QC issues and their resolution, and provides copies of field sampling documentation. Field and laboratory data validation also are discussed in Section 6.

4.1 Sampling Staff

BES personnel performed Year 3 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 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; Year 1 and Year 2 carry over UIC locations (P1_1, P2_5, P2_7, P2_13, and P2_14); and 10 supplemental UICs located 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. Before initiating a sampling event, the storm forecast was evaluated against the following three target storm criteria:

- Predicted rainfall amount of ≥0.2 inch per storm;
- Predicted rainfall duration of ≥6 hours; and
- Antecedent dry period of ≥6 hours (as defined by <0.1 inch of precipitation during 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 *Data Usability Report* (see Appendix B of this report) 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. *Data Usability Report* and Section 6.4.2 describe field-sampling issues encountered during Year 3 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 *Data Usability Report* (see Appendix B). Copies of the Test America[5] (TA) COC forms are included with the analytical data reports presented in Appendix C. Field data management is discussed in Section 6.1 and data validation is discussed in Section 6.3.

4.5 Year 3 Analytical Schedule

Forty five UIC locations were sampled during five storm events between October 1, 2007, and May 31, 2008 (Year 3), and measured for the analytes listed in bold in Table 4-1, in accordance with the SDMP. The 45 samples were collected from 30 UIC compliance monitoring locations (Panels 3 and 6, selected in accordance with the SDMP); UIC carryover locations monitored in Year 3 because of annual mean pentachlorophenol concentration exceedances in Year 2 (P1_1, P2_5, P2_7, P2_13, and

[5] 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."

P2_14); and 10 supplemental UIC locations (near drinking water wells). Monitoring was conducted, to the extent practicable, in accordance with U.S. 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 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 3. 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% of their respective MADLs in Year 1. Therefore, PPS monitoring was not required in Years 2 or 3. 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 also are listed in the permit as PPS analytes are reported as PPS analytes. Nine PPS analytes are capable of being detected by the analytical methods for common pollutants and therefore were tested during Year 3. These nine PPS analytes are:

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 3. These PPS analytes were tested using the same analytical methods used for several of the common pollutants. Table 4-2 provides the list of analytical

methods used in Year 3. 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 used in Year 3. Appendix B of the QAPP contains lists of analytes detected by each method and their respective MRLs. Year 3 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 3 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 all 45 UIC monitoring locations. Samples were:
    - Collected during each sampling event at EOP for dissolved metal analyses;
    - Transported to the WPCL at the end of the sampling day;
    - Filtered by WPCL staff within 24 hours of collection using a 0.45 micron filter;
    - Preserved using nitric acid (pH < 2) before analyses; and
    - Analyzed using the EPA Methods specified in the SDMP for metals.
- In sampling Event 5, total organic carbon (TOC) was measured at the 30 UIC compliance monitoring locations (Panels 3 and 6) and dissolved organic carbon (DOC) was measured at the 15 fixed UIC compliance monitoring locations (Panel 6).

Results are discussed in Section 5.

4.6 Year 3 – 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 3 field sampling activities. At a minimum, the auditor:

- Inspected field sampling equipment before 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.*, COC forms, FDSs) to assess if they were properly and completely filled out.

Audit results are discussed in Section 6.

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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 2007–2008 wet season *(i.e.,* Year 3). Five stormwater samples were collected from each of the designated UIC sampling locations required by the permit (Panels 3 and 6) and the carryover UIC locations (P1_1, P2_5, P2_7, P2_13, and P2_14) during five storm events occurring between October 1, 2007 and May 31, 2008. Stormwater samples also were collected from the 10 Year 3 supplemental UIC locations near 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 3.

5.1 Year 3 Monitoring Results

Year 3 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 3. The appendices contain the following information:

- **Data Usability Report** (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 DFR, FDS, and 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 COC forms also are 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.

- **Stormwater Discharge Monitoring Data** (Appendix E). Analytical data and key UIC location characteristics (*e.g.,* traffic category, land use) are provided in a Microsoft Access© Database file. Key fields in this database include:
  - Permit Year;
  - Event;
  - Panel Identification;
  - Sample 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; and
  - MRL.

- **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 3 Storm Events

After 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 (HYDRA) system 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, 2, and 3:

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 2007-2008 season during discrete storms; however, if rainfall ceased before 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 3 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: 10/2/07, 10/3/07, 10/18/07, 11/10/07, 11/12/07, 11/16/07, 11/19/07
- Event 2: 11/16/07, 11/28/07, 11/29/07, 12/3/07
- Event 3: 1/2/08 – 1/4/08, 1/8/08
- Event 4: 1/29/08, 1/31/08, 2/5/08, 3/10/08, 3/13/08
- Event 5: 3/26/08, 3/28/08, 4/7/08, 4/8/08, 4/14/08, 4/22/08, 4/23/08

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 *Data Usability Report*, 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 inch 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 2007-2008 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.

5.2.2 Year 3 Regional Precipitation and Temperature Records

A summary of long-term (30-year) Year 1 (June 2005 – May 2006), Year 2 (June 2006 – May 2007), and Year 3 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, Year 2, and Year 3 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, and Year 3 received approximately 3.14 inches less precipitation than the long-term average. During the eight wet season months of Year 3, only October 2007 and December 2007 were above the long-term average mean monthly precipitation.

Four sample collection periods (out of 25 total periods) during the former part of Event 1 and the latter part 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 Access© Database in Appendix E. Appendix F (Table F-1) presents a summary of Year 3 field parameters. Summary statistics for field parameters are reported in Table 5-8.

pH. pH measurements ranged from 4.6 (Event 2) to 10.4 (Event 3) in stormwater discharge during Year 3. The mean pH readings for individual events ranged from 6.4 (Event 1) to 6.9 (Event 4).

Conductivity. Conductivity measurements ranged from 5 (Event 2) to 138 (Event 2) µmhos/cm in stormwater discharge during Year 3. The mean conductivity readings for individual sampling events ranged from 24 (Event 3) to 44 µmhos/cm (Event 1).

Temperature. Temperature measurements ranged from 2.1 (Event 5) to 16.3 (Event 1) ^{o}C in stormwater discharge during Year 3. The mean temperature measurements for individual sampling events ranged from 4.6 (Event 3) to 12.6 (Event 1) ^{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 3 Analytical Testing Results

5.4.1 Common Pollutants

All 14 common pollutants listed in Table 4-1, except benzene and ethylbenzene, were detected during Year 3. Appendix F (Table F-2) presents the Year 3 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 3 concentrations, and the maximum percent of the MADL detected (*i.e.*, maximum concentration/MADL *x* 100) during Year 3. Table 5-10 provides a summary of the frequency of detection values for common pollutants and PPS analytes in Year 3. Common pollutants detected during Year 3 are discussed below.

Arsenic. Arsenic was detected in 224 of 225 samples in Panels 1, 2, 3, and 6, and Supplemental Panel 2. Sample concentrations ranged between the QAPP target MRL of 0.045 µg/L during Event 2 and 5.46 µg/L at P3_5 during Event 4 (TPD ≥1,000). All Year 3 concentrations are below the 10 µg/L MADL for arsenic.

Cadmium. Cadmium was detected in 93 of 225 samples in Panels 1, 2, 3, and 6, and Supplemental Panel 2. Sample concentrations ranged between the QAPP target MRL of

0.1 µg/L and 1.46 µg/L (P6_2 during Event 4 [TPD ≥1,000]). All Year 3 concentrations are well below the 5.0 µg/L MADL for cadmium.

Chromium. Chromium was detected in 183 of 225 samples in Panels 1, 2, 3, and 6, and Supplemental Panel 2. Sample concentrations ranged between the QAPP target MRL of 0.4 µg/L and 25.3 µg/L (P2_14 [≥1,000 TPD], during Event 1). All Year 3 concentrations are well below the 100 µg/L MADL for chromium.

Copper. Copper was detected in all 225 samples in Panels 1, 2, 3, and 6, and Supplemental Panel 2. Sample concentrations ranged between 3.61 µg/L during Event 1 and 90.7 µg/L (P2_14 during Event 1 [TPD ≥1,000]). All Year 3 concentrations are well below the 1,300 µg/L MADL for copper.

Lead. Lead was detected in all 225 samples in Panels 1, 2, 3, and 6, and Supplemental Panel 2. Sample concentrations ranged between 0.16 µg/L during Event 2 and 105 µg/L (P2_14 during Event 1 [TPD ≥1,000]). Ten sample concentrations exceeded the 50 µg/L MADL for lead, across all five storm events (*i.e.,* one to three locations per event).

Zinc. Zinc was detected in all 225 samples in Panels 1, 2, 3, and 6, and Supplemental Panel 2. Sample concentrations ranged between 3.06 µg/L at P6_13 during Event 2 (TPD <1,000) and 977 µg/L (P6_1 during Event 3 [TPD ≥1,000]). All Year 3 concentrations are well below the 5,000 µg/L MADL for zinc.

Total Nitrogen. Total nitrogen was detected in 59 of 225 samples in Panels 1, 2, 3, and 6, and Supplemental Panel 2. Concentrations ranged between the QAPP target MRL of 0.1 mg/L to 0.49 mg/L during Event 5. All Year 3 concentrations are well below the 10,000 µg/L MADL for total nitrogen.

Pentachlorophenol. Pentachlorophenol was detected in 190 of 225 samples in Panels 1, 2, 3, and 6, and Supplemental Panel 2. Detected concentrations ranged between the QAPP target MRL of 0.04 µg/L to 3.64 µg/L (P6_14 during Event 2 [TPD ≥1,000]). Thirty-five primary sample concentrations (*i.e*., not duplicate or resampled concentrations) exceeded the 1.0 µg/L MADL for pentachlorophenol across all five storm events.

Toluene. Toluene was detected in 73 out of 225 samples in Panels 1, 2, 3, and 6, and Supplemental Panel 2. Values ranged from the QAPP target MRL of 0.5 µg/L to 26.5 µg/L (P6_3 during Event 1 [TPD <1,000]). 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 2.55 µg/L occurred at P3_12 during Event 3 (likely TPD <1,000), but is well below the 10,000 µg/L MADL. This concentration is the sum of 1.53 µg/L m,p-xylene and 1.02 µg/L o-xylene.

Benzo(a)pyrene. Benzo(a)pyrene was detected in 86 of the 225 samples in Panels 1, 2, 3, and 6, and Supplemental Panel 2. Concentrations ranged between less than 0.00962 and 0.628 µg/L (P3_9 during Event 5 [TPD ≥1,000]). One sample concentration exceeded the 0.2 µg/L MADL for benzo(a)pyrene, during Event 3 and Event 5.

DEHP. Di(2-ethylhexyl)phthalate (DEHP) was detected in 123 of the 225 samples in Panels 1, 2, 3, and 6, and Supplemental Panel 2. Concentrations ranged from between less than 0.962 µg/L to 129 µg/L (P2_7 during Event 3 [TPD ≤1,000]). Fifteen sample concentrations exceeded the 6.0 µg/L MADL for DEHP, during Events 1, 3, 4, and 5. Year 3 laboratory QC issues resulted in some DEHP data being flagged and potentially biased high. These issues are described in Section 6.

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 3. Only one of these PPS analytes was detected during laboratory analysis for common pollutants in Year 3. Appendix F (Table F-3) presents the Year 3 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 3 concentrations, and the maximum percent of the MADL detected (*i.e.*, maximum concentration/MADL *x* 100) during Year 3. Table 5-10 provides a summary of the frequency of detection for the PPS analyte detected in Year 3. Table 5-11 provides a summary of the PPS analytes that were analyzed but not detected in Year 3, including the number of samples analyzed and the range of Year 3 MRLs. The single PPS analyte detected during Year 3 is discussed in this section.

2,4-D. 2,4-D was detected in 33 of 225 samples in Panels 1-3, Panel 6, and supplemental panel 2. Sample concentrations ranged from the QAPP target MRL of 0.1 µg/L to 6.61 µg/L (P3_15 during Event 1 [TPD <1,000]). All Year 3 concentrations are well below the 70.0 µg/L MADL for 2,4-D.

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 3. 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 an Access© Database file containing the monitoring results.

Table 5-13 summarizes the individual sampling event frequencies of detection for ancillary pollutants in Year 3. All pollutants were analyzed for all five sampling events. Twenty-seven ancillary pollutants were detected in Year 3. Eleven of these were detected at a maximum frequency of less than or equal to 2% and nine were detected at maximum frequencies between 7% and 50%. The seven pollutants that were detected at the highest frequencies (between 51% and 98%) during the individual sampling events are PAHs: chrysene, phenanthrene, napthalene, pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, and fluoranthene. Of these, naphthalene had the highest concentration with a maximum of 1.28 μg/L.

The detection of PAH compounds was an expected result because of 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 24% and 49% 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 3. 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 $\geq$1,000 TPD traffic category ranged from 3% (lead) to 34% (zinc) and between 10% (lead) and 43% (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 (<1,000 TPD) to a maximum concentration of 762 (≥1,000 TPD) mg/L.

Total Organic Carbon. Table 5-16 presents the summary statistics for TOC and DOC results. TOC in stormwater was analyzed at 30 UIC locations during sampling Event 5 from Panel 3 and Panel 6 locations. DOC was analyzed at 15 UIC locations during sampling Event 5. DOC concentrations ranged from 1.73 mg/L (<1,000 TPD) to a maximum concentration of 20.8 (<1,000 TPD) mg/L. TOC concentrations ranged from 1.6 mg/L (<1,000 TPD) to a maximum concentration of 23.8 (≤1,000 TPD) mg/L.

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Section

6

6 Data Management and Validation

This section summarizes the types of information managed and maintained during Year 3 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 2007-2008 wet season (*i.e.*, Year 3). 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 2007-2008 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 2007-2008 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 *Data Usability Report* (see Appendix B) contains copies of the DFRs and FDSs. WPCL COC forms are included with the *Data Usability Report* 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 system 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 (SOP);
- 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 3 summary tables, in an electronic format, by UIC location and analytical constituent. A copy of the Access© Database containing a compilation of Year 1 through Year 3 monitoring data is included in Appendix E. Tables were checked against copies of the original final data sheets before 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 Access© Database.

Noteworthy laboratory QC 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 2007-2008 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 QC 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 Years 2 and 3 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. Deficiencies in field or analytical data, if any, are noted, as are 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 2007-2008 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 3, Panel 6, or Supplemental Panel 2 UIC locations located near drinking water that were proposed for sampling during the 2007-2008 wet season were unsuitable for sampling. The factors used in this evaluation are described in the SAP. As a result of these investigations, 10 Panel 3 locations and three proposed supplemental locations were determined to be unsuitable for sampling. This substitution was made before initiating Year 3 storm event sampling.

Site	Final Location	Original Location	Rationale for Replacement
P3_1	2810 N Buffalo St.	17423 SE Marie St.	Minimal flow into sump (observed during attempt)
P3_6	14800 NE Halsey St.	16211 SE Division St.	Leaking sedimentation manhole
P3_7	635 SE 84th Ave.	1451 NE Sumner St.	Wrong traffic category based on field observations
P3_14	1600 NE Beech St.	4540 NE 89th Ave.	No flow (observed during first Event 1 sampling attempt); no flow into first replacement site, either (11200 NE Shuyler St.), observed during additional sampling attempts

Sample Stratification. UIC monitoring locations are stratified by traffic category ($\geq$1,000 or <1,000 trips per day (TPD). Sample stratification in Year 3 meet the traffic criteria identified in the *SDMP*, the *Annual Stormwater Discharge Monitoring Report – Year 2* (City of Portland, 2007), and Section 3.1.2 of this report.

Precipitation Events. Five sampling events were successfully completed during the 2007-2008 wet season, associated with precipitation events between October 2007 and April 2008. The precipitation events sampled are described in more detail in Section 5 of this report and in the *Data Usability Report* (see 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 2007-2008 wet season.

Field Data Documentation. Field data were recorded on project-specific paperwork, as described in the SAP. Field documentation is reviewed by both the BES Field Leader and the Monitoring Coordinator to ensure that sample collection was conducted according to procedures specified in the SDMP and that documentation is complete. The Year 3 field records document:

- Adherence to SAP protocols;
- Field corrective actions tracking and inherent data uncertainties;
- Field procedures do not affect 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 3 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 3 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 3 analytical data were determined to meet the DQOs described in Section 6.2 and to be of acceptable quality. All planned data were collected and analyzed and all data are considered usable. Year 3 monitoring efforts 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 Table 6-2 as described below. Appendices B, C, and E include the following information used for data validation:

- WPCL Laboratory Analysis Reports;
- TA Laboratory Analysis Reports;
- *Data Usability Report;* and
- Year 3 Analytical Data (*e.g.*, Access© Database, 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 flags are included in the TA data reports (see Appendix C). Data qualifiers were assigned through project data validation and are defined in the *Data Usability Report* (see Appendix B). Most laboratory-assigned flags were carried through using project-specific data qualifiers, and additional qualifiers were assigned through data validation.

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 presents a summary of all laboratory QC issues identified during the 2007-2008 wet season. The WPCL QA and Monitoring Coordinators reviewed all QC issues. Only noteworthy QC issues are included in Table 6-2. These issues are discussed in the comments section of the WPCL Laboratory Analysis Reports (see Appendix C). 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). Intermittent DEHP QC issues were encountered during Year 3, though these issues were not nearly as pervasive as in Year 2 (see *Annual Stormwater Discharge Monitoring Report – Year 2* [City of Portland, 2007]). DEHP QC issues consisted primarily of method blank contamination or elevated LCS and MS/MSD recoveries resulting from laboratory-introduced contamination. These QC issues typically resulted in DEHP analytical results that were biased high. DEHP QC issues and associated data qualifiers are described in the *Data Usability Report* (see Appendix B) and in Table 6-2.

6.4 Monitoring Program Corrections

Any unusual condition that occurred during a monitoring event that could affect 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 effect 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.

One deviation from laboratory protocol was documented during Event 2. Bromomethane (EPA Method 8260) was detected in two WPCL laboratory method blanks and two associated samples slightly exceeding the MRL of 1 µg/L. Rather than qualifying the sample results, the reporting limit was raised was to 2 µg/L for those samples and the samples were reported as non-detect. The rationale for this resulted from a high level of background "noise" in VOC analyses particularly in the first half of the monitoring year. This likely resulted from the refining of analytical procedures for a new Agilent 7890A-GC 5975C-MSD volatiles instrument installed at WPCL in September 2007. Throughout Year 3, background noise in VOC analyses diminished. Subsequently, low bromomethane detects in these samples were judged by the WPCL QA Coordinator not to be valid data.

No other deviations, nonconformance, or occurrences were noted during the 2007-2008 wet season.

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 action was taken during the 2007-2008.

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. One laboratory corrective action was taken during the 2007-2008 wet season, and is summarized below and in Table 6-2.

Intermittent laboratory DEHP QC issues were encountered at TA periodically during Year 3. 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 5. DEHP QC issues and overall data usability are summarized in the *Data Usability Report* (see Appendix B).

No other issues requiring laboratory corrective action were noted during the 2007-2008 wet season.

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Section 7

7 Data Evaluation

This section of the report presents the evaluation of stormwater data collected from the UICs during the 2007-2008 wet season (*i.e.,* permit Year 3). 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 because of 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, 2008.

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. Four common pollutants (benzo(a)pyrene, pentachlorophenol, DEHP, and lead) were detected in Year 3 at concentrations above their MADLs in at least one sample, as shown on the following page:

Pentachlorophenol

P1_1 (Events 1, 3, 4, 5)
P2_5 (Events 1, 2, 3, 4)
P2_7 (Event 3)
P2_13 (Events 2, 3, 4)
P2_14 (Events 2, 3, 4)
P3_3 (Events 3, 4)
P3_5 (Event 3)
P3_9 (Event 2)
P3_15 (Events 4, 5)
P6_1 (Events 1, 2, 3, 4)
P6_4 (Events 1, 4, 5)
P6_7 (Events 2, 3)
P6_14 (Events 2, 3, 4)
P6_15 (Event 4)
SP2_8 (Event 2)

DEHP

P2_7 (Event 3)
P2_13 (Event 4)
P3_2 (Event 1)
P3_6 (Event 3)
P3_7 (Events 1, 3)
P3_8 (Event 3)
P3_9 (Event 5)
P6_1 (Event 4)
P6_3 (Event 1)
P6_4 (Event 3)
P6_10 (Event 4)
SP2_5 (Events 4, 5)
SP2_9 (Event 3)

Lead

P2_5 (Event 5)
P2_14 (Events 1, 5)
P3_1 (Events 1, 4)
P3_5 (Event 1)
P6_12 (Event 5)
SP2_9 (Event 2, 3, 4)

Benzo(a)pyrene

P3_9 (Event 5)
SP2_3 (Event 3)

Pentachlorophenol. Fifteen Year 3 UIC sample locations exceeded the MADL of 1.0 µg/L, with between one and four exceedances per location. Of these 15 locations, 10 were UICs categorized as ≥1,000 TPD, and five were UICs categorized as <1,000 TPD. By sampling event, the fewest number of exceedances (three) occurred during Event 5 and the greatest number of exceedances (10) occurred during Events 3 and 4.

DEHP. Thirteen Year 3 UIC sample locations exceeded the MADL of 6.0 µg/L for DEHP. Of these 13 sample locations, eight UICs were categorized as ≥1,000 TPD, and five UICs were categorized as <1,000 TPD. Exceedances occurred during each of Events 1, 3, 4, and 5. By sampling event, the fewest number of exceedances (zero) occurred during Event 2 and the greatest number of exceedances (six) occurred during Event 3.

Lead. Six Year 3 UIC sample locations exceeded the MADL of 50.0 µg/L for lead. Of these six locations, all UICs were categorized as ≥1,000 TPD. Exceedances occurred in all five events.

Benzo(a)pyrene. Two Year 3 UIC sample locations exceeded the MADL of 0.2 µg/L for benzo(a)pyrene. One of these locations is categorized as ≥1,000 TPD, and the other is <1,000 TPD. Exceedances occurred in Events 3 and 5.

As required by the permit, the City reported observed MADL exceedances of common pollutants from each individual sampling event to DEQ within 7 days following the receipt of validated analytical data. Exceedances were reported to DEQ in the following correspondence:

- MADL Exceedance Notification Year 3 – Event 1 – letter dated January 16, 2008;
- MADL Exceedance Notification Year 3 – Event 2 – letter dated January 18, 2008;
- MADL Exceedance Notification Year 3 – Event 3 – letter dated February 15, 2008;
- MADL Exceedance Notification Year 3 – Event 4 – letter dated May 19, 2008; and
- MADL Exceedance Notification Year 3 – Event 5 – letter dated June 3, 2008.

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 treated wood utility poles (*i.e.*, wood treatment). Poles have been observed near all UIC locations with pentachlorophenol exceedances (see Section 8.2.1). Other potential sources include: common pesticide (*e.g.*, lindane, hexachlorobenzene) breakdown products, insecticides, fungicides, herbicides, preservatives (*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 3 indicate that some data may be biased high (see Section 6 for further discussion of Year 3 DEHP QC issues).
- **Lead**. Auto batteries, tires, tire weights, etc.
- **Benzo(a)pyrene**. Incomplete combustion of organic material (*e.g.,* fuel from vehicles, wood and oil burning furnaces, and incinerators), component of coal tar, tobacco smoke, charbroiled food.

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. One PPS analyte, 2,4-D, was detected in Year 3.

No individual PPS analytes were detected at concentrations exceeding their respective MADLs. The causes of the PPS analyte detections are largely unknown. Because 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 (*i.e.,* 9.4% for 2,4-D). Year 3 concentrations were all <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 (DEQ, 2005b). 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, half of 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 3:

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

The annual mean concentrations were not calculated for arsenic (detected at approximately 54% of the MADL). The Year 3 annual geometric mean concentration estimates for DEHP, benzo(a)pyrene, lead, and pentachlorophenol are presented in Table 7-3. Table 7-3 also presents pollutant MADLs, and 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 (DEQ, 2005b).

7.2.2 Common Pollutants

Benzo(a)pyrene. The annual geometric mean concentration for benzo(a)pyrene was calculated for two UIC locations, P3_9 and SP2_3, and was 0.1 and 0.03 µg/L, respectively. These concentrations are ≤50% of the MADL of 0.2 µg/L.

Lead. The annual geometric mean concentration for lead was calculated for six UIC locations where the concentration was ≥50% of the MADL (50 µg/L) in at least one sampling event. The annual geometric means for these locations range from 12.2 to 32.4 µg/L. The geometric means were all less than 64% of the MADL for Year 3.

Pentachlorophenol. The annual geometric mean concentrations for pentachlorophenol was calculated for 15 UIC locations where the concentration was ≥50% of the MADL (1.0 µg/L) in at least one sampling event. The geometric mean concentration for six UIC locations (P2_5, P2_13, P2_14, P6_1, P6_4, and P6_14) exceeded the MADL in Year 3. The annual geometric means for these locations range from 1.1 to 1.7 µg/L, slightly exceeding the MADL of 1 µg/L. Two of these locations, P6_1 and P6_14, were identified as Category 4 UICs in the *Annual Stormwater Discharge Monitoring Report – Year 2* (City of Portland, 2007) and are discussed further in Section 8.

DEHP. The annual geometric mean concentration was estimated for 13 locations where the DEHP concentration ≥50% of the MADL (6 µg/L) in at least one sampling event using only the results of the event samples and duplicate samples. The annual geometric means for these locations range from 0.7 to 4.9 µg/L, less than the MADL for Year 3.

7.2.3 Priority Pollutant Screen Analytes

Geometric means were not calculated for PPS analytes detected in Year 3 given that their annual means cannot theoretically exceed the MADL because their concentrations were significantly <50% of the MADL.

7.3 Evaluation of Year 3 Results

This section evaluates Year 3 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 3 are introduced in Section 5.

7.3.1 Box Plots

Box plots were selected to present the results of selected analytes for Year 3. 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 allows 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 3 where the stormwater concentration in at least one sampling event was detected at a concentration ≥50% of the MADL or that were presented in the *Annual Stormwater Discharge Monitoring Report – Year 2* (City of Portland, 2007) for comparison. As identified previously in this section, four pollutants were detected in Year 3 at concentrations ≥50% the MADL: pentachlorophenol, lead, benzo(a)pyrene, and DEHP. Arsenic, cadmium, and chromium did not exceed the MADL in any samples in Year 3 and are provided for comparison to Year 2 data and general information. TSS, TOC, and DOC are provided for general information only.

Box plots showing the pollutant concentrations by traffic category were prepared using Year 3 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). Box plots of the following pollutants were prepared:

- Pentachlorophenol (Figure 7-2);
- Total lead (Figure 7-3);
- Dissolved lead (Figure 7-4)
- Benzo(a)pyrene (Figure 7-5);
- DEHP (Figure 7-6);
- Arsenic (Figure 7-7);
- Cadmium (Figure 7-8); and
- Chromium (Figure 7-9).

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.*, pentachlorophenol, dissolved lead, 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 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.*, benzo(a)pyrene, DEHP).

A box plot of Year 3 TSS concentrations is presented in Figure 7-10. The average and geometric mean were calculated for Year 3 TSS data by traffic category. The ≥1,000 TPD traffic category average and geometric mean concentrations were in general about two times higher than the concentrations in the <1,000 TPD traffic category.

Box plots of Year 3 for total lead (Figure 7-3) and dissolved lead (Figure 7-4) indicate lead occurs in narrow concentration ranges. The mean and geometric mean for dissolved lead is approximately an order of magnitude less than for total lead, suggesting lead is associated with stormwater particulates. This is consistent with the known behavior of lead in the environment and its strong affinity to sorb to soil.

Box plots of Year 3 DOC and TOC concentrations are presented in Figures 7-11 and 7-12 for Event 5. The sample sizes are smaller (15 UICs for TDC and 30 for TOC) than for the other analytes discussed in this section. These plots indicate higher mean and geometric mean concentrations in UICs in the <1,000 TPD traffic category. The concentration range of the <1,000 TPD traffic category is also wider than the high traffic category. TOC and DOC show similar pollutant concentration ranges and distribution by traffic category.

7.3.2 Individual UIC Location Concentration Data by Sampling Event

Dot plots (*i.e.*, Trellis Displays) were prepared for:

- Pentachlorophenol (Figure 7-13);
- Total lead (Figure 7-14);
- Dissolved lead (Figure 7-15)
- Benzo(a)pyrene (Figure 7-16);
- DEHP (Figure 7-17);
- Arsenic (Figure 7-18);
- Chromium (Figure 7-19); and
- TSS (Figure 7-20).

These plots depict the concentration for each UIC sampling location in Year 3 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.*, Event 1 and Event 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 MADLs.
- 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 detected only in two samples (P3_9 and SP2_3) at a concentration greater than the MADL.
- Ten UIC discharge sample concentrations exceeded the MADL for lead (50µg/L) in Year 3. Exceedances were observed in all five monitoring events and six UIC locations.
- No consistent pattern in stormwater concentration between events is observed for the seven 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 7-14.

Figure 7-20 presents the TSS concentration for each UIC sampling location in Year 3 by sampling event and traffic category. TSS appears to have higher concentrations on high traffic streets. Figure 7-20 shows that for many UIC monitoring locations that the TSS concentrations were highest in the fifth sampling event. However, there is not a consistent ordering of TSS concentrations by event in the Year 3 data.

7.3.3 Year 3 Concentration Data by Sampling Event

Box plot showing the concentrations of pentachlorophenol (Figure 7-21), total lead (Figure 7-23), DEHP (Figure 7-25), and arsenic (Figure 7-27) by sampling event were prepared using Year 3 stormwater discharge data, including non-detect values. These box plots were generated using data from 45 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 these plots:

- Event concentrations generally appear to be lognormally distributed or skewed.
- Pollutant concentration ranges and distributions between Year 3 sampling events are very similar.

- The majority of individual sample concentrations (by event and by location) are below the MADL.

7.3.4 Year 3 Concentration Data by Sampling Panel

Box plots showing the concentrations of pentachlorophenol (Figure 7-22), total lead (Figure 7-24), DEHP (Figure 7-26), and arsenic (Figure 7-28) by sampling panel were prepared using Year 3 stormwater discharge data, including non-detect values. These box plots were generated using data from each sampling event. It should be noted that the box plot for Panel 1 was created for one UIC (P1_1) using only five sample data points and the box plot for Panel 2 was created for four UICs using 20 data points. The following general observations were made regarding these plots:

- Panel concentrations generally appear to be lognormally distributed or skewed.
- DEHP concentration distributions are skewed by the non-detect values.
- Concentrations between sampling panels are very similar, with the exception of Panels 1 and 2 for pentachlorophenol. The concentrations for Panels 1 and 2 are near the MADL, which is consistent with the Year 2 data and estimated mean concentration for these UICs greater than MADL.
- 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.

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:

$$\text{Infiltration Volume (cubic feet)} = AP \times (1\text{ft}/12\text{ inches}) \times IA \times LE \qquad (1)$$

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 7-4 summarizes the total estimated stormwater infiltration volumes calculated for the city-owned UIC system for Years 1, 2, and 3.

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 Year 3 (2007-2008) 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 33.94 inches, respectively (see Table 5-7).

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 acre) 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 (June 1, 2005 through May 30, 2006);
- 474 million cubic feet (3.5 billion gallons) in Year 2 (June 1, 2006 through May 30, 2007).
- 467 million cubic feet (3.5 billion gallons) in Year 3 (June 1, 2007 through May 30, 2008).

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 also may be the result of 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 usually is 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).

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Section 8

8 Response Actions

This section presents a summary of the actions taken during the Year 3 wet season (October 2007 – May 2008) 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

No specific source investigations were conducted in Year 3 because of unanticipated stormwater discharge results or observations during UIC sampling.

8.2 Pentachlorophenol Response Actions

8.2.1 Pentachlorophenol Pathway Evaluation

Year 1 annual mean pentachlorophenol concentrations exceeded the MADL at five locations (P1_1, P6_1, P6_7, P6_8, P6_14). The permit requires the City to take response actions the following year to address the MADL exceedance in these UICs. Pentachlorophenol source investigations were initiated during Year 2 as a response action and are described in the *Annual Stormwater Discharge Monitoring Report – Year 2* (City of Portland, 2007). This section presents the findings pentachlorophenol pathway evaluation initiated in Year 2. The purpose of this evaluation was to assess potential source(s) of pentachlorophenol and potential contaminant migration pathways from the source to City-owned UICs.

Field Investigation. The basic scope of the investigation included evaluating and documenting treated wood utility poles as a source of pentachlorophenol in stormwater discharged to UICs with known MADL exceedances. The pathway analysis involved collection of samples from each of the five UIC monitoring locations with annual mean concentrations above the MADL in Year 1 (P1_1, P6_1, P6_7, P6_8, P6_14). These locations subsequently were monitored in Years 2 and 3. 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 and June 2007. Analytical results indicate treated wood utility poles are a source of the

pentachlorophenol detected in UIC stormwater samples. Pentachlorophenol was detected at elevated concentrations in treated wood utility pole wipe samples and soil samples collected at the base of the poles. Pentachlorophenol was detected in curb sediment, catch basin solids, and sedimentation manholes solids. Very low concentrations of "leachable" pentachlorophenol were detected using the toxicity characteristic leaching procedure (TCLP) run on sedimentation manhole solids. These data suggest that pentachlorophenol detection may be associated with stormwater particulates. Further discussion of these sample results is provided in Appendix G.

8.2.2 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 four locations (P1_1, P6_1, P6_7, P6_14) exceeded the MADL in two consecutive years. The permit defines Category 4 UICs as those that become non-compliant by failing to meet the annual mean MADL within one wet season after the initial exceedance. The four UICs were identified in the *Annual Stormwater Discharge Monitoring Report –Year 2* (City of Portland, 2007) as noncompliant Category 4 UICs, based on the results of the Year 2 stormwater monitoring data. The recommended corrective actions for these Category 4 UICs were identified and evaluated in accordance with the *Corrective Action Plan* (CAP; City of Portland, 2006f). The recommended corrective action for these UICs was a Groundwater Protectiveness Demonstration (*i.e.,* risk assessment).

Scope of Analyses. The fate and transport of pentachlorophenol in stormwater discharged to Category 4 UICs was assessed using a one-dimensional mathematical fate and transport equation and site-specific parameter values (*e.g.*, soil type, contaminant concentration). The analyses evaluated whether stormwater pollutant concentrations entering the UIC are reduced to levels protective of drinking water at the point the infiltrated stormwater reaches groundwater. Specific activities included:

- Preparing a conceptual site model (CSM) of potential transport pathways for pentachlorophenol discharge to a UIC; and
- Assessing the fate and transport of pentachlorophenol in unsaturated soil under a range of geologic conditions and under a range of stormwater discharge concentrations.

Results. Results of fate and transport analyses demonstrated that unsaturated subsurface soil attenuates (*i.e.,* treatment/removal) pentachlorophenol in stormwater discharges to the subject UICs to levels protective of beneficial uses of groundwater and public health and the environment as required by OAR 340-040.

The UIC monitoring data for Years 1, 2, and 3 indicate pentachlorophenol concentrations are generally present at very low concentrations and within a narrow concentration range (between 0.04 and 3 µg/L). The analyses indicated that beneficial uses of groundwater

are protected even at significantly higher pentachlorophenol concentrations (*i.e.,* pentachlorophenol would not be detected in groundwater below the UIC). Pentachlorophenol concentrations are not expected to significantly increase in the future because the likely pentachlorophenol source is strongly suspected to be leaching or weathering of treated wood utility poles.

The site-specific Groundwater Protectiveness Demonstrations were submitted for DEQ review and approval in the spring of 2008 (GSI, 2008a; 2008b). DEQ issued No Further Action (NFA) determinations for these four Category 4 UICs in a letter dated May 30, 2008 (DEQ, 2008).

8.3 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, 1997) and 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.

UIC sampling locations cleaned between July 1, 2007, and May 31, 2008, are identified in Tables 3-2 through 3-6.

Section 9

9 Preliminary Trend Analyses

9.1 General

This section presents Years 1, 2, and 3 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 3 are introduced in Section 5. Year 1 results are presented in the *Annual Stormwater Discharge Monitoring Report – Year 1* (City of Portland, 2006e) submitted to DEQ in July 2006. Year 2 results are presented in the *Annual Stormwater Discharge Monitoring Report – Year 2* (City of Portland, 2007) submitted to DEQ in July 2007.

Box plots were prepared to present the results of selected analytes for Years 1, 2, and 3. The box plots for Years 1, 2, and 3 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.

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 Years 1, 2, and 3 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 for Panel 6 (fixed panel) to allow the comparison of stormwater discharge concentrations of selected analytes by permit year (*i.e.*, Years 1, 2, and 3). Figures 9-1 through 9-6 present the box plots comparisons for pentachlorophenol, lead, benzo(a)pyrene, DEHP, TSS, and dissolved lead, respectively. The following general observations are made regarding these figures:

- Pentachlorophenol, lead, DEHP, and TSS generally appear to be lognormally distributed or skewed.
- Concentration ranges and distributions are very similar among Years 1, 2, and 3.
- Annual mean, median, and geometric mean concentrations of the compounds evaluated are, in general, <50% of their respective MADLs for all 3 years.
- DEHP and dissolved lead concentrations appear lognormal and are skewed toward the non-detect values.
- Potential outliers are present in benzo(a)pyrene and DEHP data for all 3 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, 2, and 3. Figures 9-7 through 9-10 present the box plots for pentachlorophenol, lead, benzo(a)pyrene, 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 appear to 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.
- Years 2 and 3 benzo(a)pyrene and DEHP data suggest several data points may be outliers. Several of the DEHP data points were flagged during data validation as being biased high and several were not considered representative for calculating the Year 2 annual mean concentration.
- 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 all 3 years.

9.4 Monitoring Panels

Box plots were prepared to compare the concentrations of selected analytes by monitoring panel. Years 1, 2, and 3 UIC monitoring locations are as follows:

Year 1	**Year 2**	**Year 3**
Panel 6 (15 fixed UICs)	Panel 6 (15 fixed UICs)	Panel 6 (15 fixed UICs)
Panel 1 (15 rotating UICs)	Panel 2 (15 different rotating UICs)	Panel 2 (15 different rotating UICs)
	P1_1 (carried over from Year 1)	P1_1, P2_5, P2_7, P2_13, and P2_14 (carried over from Year 2)
	Supplemental Panel 1 (10 UICs near drinking water wells)	Supplemental Panel 2 (10 different UICs near drinking water wells)

Figures 9-11 through 9-14 present box plots by panel for pentachlorophenol, lead, DEHP, and benzo(a)pyrene, respectively. The following general observations are made regarding these figures:

- In general, panels show similar concentration ranges and have similar 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 (with the exception of P1_1 in Years 2 and 3, and Panel 2 locations in Year 3 – the concentration in these UICs is higher since these locations were determined to have annual average concentrations >MADL in Years 1 and/or 2).

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Section

10

10 Findings and Conclusions

This section of the report presents the findings and conclusions for Year 3 of the UIC monitoring program.

10.1 Year 3 Monitoring Program

The UIC monitoring program was implemented in accordance with the SDMP. The Year 3 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-five UIC locations were sampled in Year 3. Sample locations are stratified on two traffic categories: <1,000 TPD and ≥1,000 TPD. No significant land use or zoning changes were noted by BES that would be expected to result in modifications to traffic volumes during the 2007-2008 monitoring season.

10.2 Year 3 Sampling Results

Five sampling events were completed between October 2007 and May 2008, 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.
- TOC at Panel 3 and Panel 6 UIC monitoring locations in Event 5.
- DOC at Panel 6 UIC monitoring locations in Event 5.

Field and laboratory data collected during Year 3 were determined to meet the DQOs described in the QAPP and to be of known and acceptable quality. All data are considered useable.

10.2.1 Common Pollutants

Twelve of 14 common pollutants defined by the permit were detected during Year 3. The permit requires that detected concentrations of common pollutants in each individual sampling event be compared to their respective MADLs. Four common pollutants, pentachlorophenol, DEHP, benzo(a)pyrene, and lead, were detected in Year 3 at concentrations above their MADLs in at least one sample.

10.2.2 Priority Pollutant Screen Analytes

One PPS analyte, 2,4-D, was detected during Year 3. The pesticide 2,4-D was detected in 2 to 27% 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 2,4-D exceeded 50% of the MADL.

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-eight ancillary pollutants were detected in Year 3. Eleven of these were detected at a maximum frequency $\leq$5% of the samples and six were detected at maximum frequencies between 10% and 41% of the samples. The 11 remaining pollutants detected at the highest frequencies (between 51% and 98%) during the individual sampling events are PAHs. PAHs detected 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 1.28 µg/L.

10.3 Individual Sampling Event MADL Exceedances

Four common pollutants exceeded MADL concentrations during individual sampling events in Year 3 including:

Pentachlorophenol. Thirty-five sample concentrations from 15 UIC locations exceeded the MADL of 1.0 µg/L, including the Year 1 P1_1 location and Year 2 P2_5, P2_13, and P2_14 locations. Exceedances occurred during all five sampling events.

DEHP. Fifteen sample concentrations from 13 UIC locations exceeded the MADL of 6.0 µg/L for DEHP. Exceedances occurred during Events 1, 3, 4, and 5.

Lead. Ten sample concentrations from six UIC locations exceeded the MADL of 50.0 µg/L for lead. Exceedances occurred during all events.

Benzo(a)pyrene. Two sample concentrations from two UIC locations exceeded the MADL of 0.2 µg/L for benzo(a)pyrene. Exceedances occurred during Events 3 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 3 stormwater concentrations, in at least one sampling event, were detected at a concentration ≥50% of the MADL. Annual mean concentrations were calculated for pentachlorophenol, DEHP, benzo(a)pyrene, and lead.

Year 3 annual geometric mean concentrations for six UIC locations (P2_5, P2_13, P2_14, P6_1, P6_4, and P6_14) exceeded the MADL for pentachlorophenol. The annual geometric means for these locations ranges from 1.0 to 1.7 µg/L, slightly above the MADL of 1.0 µg/L. The annual geometric mean values for benzo(a)pyrene and lead were generally <50% of their respective MADLs for all individual UIC locations.

Year 3 annual geometric mean concentrations for DEHP ranged between 0.7 and 4.9 µg/L, all less than 80% of the MADL.

10.5 Preliminary Trend Analysis – Traffic Categories

Year 1, Year 2, and Year 3 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, Year 3);
- Traffic categories (*i.e.*, <1,000 TPD; ≥1,000 TPD); and
- Sample panels (*e.g.*, Panels 1-3, Panel 6, Supplemental Panels 1 and 2).

In general, the box plots prepared for Year 1, Year 2, and Year 3 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. 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 2 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;
  - Presence of treated wood utility poles and pentachlorophenol;
  - 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[6] UICs.

The Year 2 annual mean concentration of pentachlorophenol exceeded the MADL in the following UIC locations (see *Annual Stormwater Discharge Monitoring Report – Year 2*; City of Portland, 2007):

- P1_1;
- P2_5;
- P2_7;
- P2_13;
- P2_14;
- P6_1;
- P6_2;
- P6_7; and

[6] 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.

- P6_14.

The Year 3 annual mean concentration of pentachlorophenol exceeded the MADL for a second consecutive year in five of the nine UICs identified in Year 2. Two of these UICs were identified as Category 4 UICs in Year 2 and are discussed below. The remaining three UICs are identified as Year 3 Category 4 UICs in Table 10-1, along with UIC location information. Figure 10-1 shows the locations the Year 3 Category 4 UICs.

Table 10-1: Category 4 UICs Identified in Year 3

Location Code	Approximate Address	BES UIC No.	Traffic Category (Trips per Day)	Separation Distance [a] (ft)	Year 2 Annual Geometric Mean Pentachlorophenol Concentration (µg/L)	Year 3 Annual Geometric Mean Pentachlorophenol Concentration (µg/L)
P2_5	10150 SE Ankeny St.	ADR885	≥ 1,000	158	3.2	1.7
P2_13	4107 SE Reedway St.	ADU790	≥ 1,000	58	1.9	1.1
P2_14	8409 N. Woolsey Ave.	AAH289	≥ 1,000	55	2.5	1.3

Notes:

a 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.

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

Corrective actions for the Year 3 Category 4 UICs will be identified, evaluated, and selected in accordance with the CAP (City of Portland, 2006f). The proposed corrective action for these Category 4 UICs is a groundwater protectiveness demonstration (*i.e.*, "risk assessment"), performed in accordance with the *Decision Making Framework for Groundwater Protectiveness Demonstrations* (City of Portland, 2008). Category 4 UIC corrective actions for the UIC identified in Table 10-1 will be initiated in FY2008/09 and completed in accordance with the permit schedules.

The Year 3 annual mean concentration of pentachlorophenol exceeded the MADL for a third consecutive year in two (P6_1, P6_14) of the four UICs identified in Year 2 as non-compliant Category 4 UICs (P1_1, P6_1, P6_7, and P6-14). Geometric mean concentrations for two of these UICs are less than 0.6 µg/L (P1_1, P6_7). As discussed in Section 8.2.2, the approved corrective action for these UICs was a Groundwater Protectiveness Demonstration. The Year 3 results for these UICs are consistent with Year 1 and Year 2 results verifying the assumptions used in the Groundwater Protectiveness Demonstrations. The Year 2 Category 4 UICs are summarized in Table 10-2, along with UIC location information.

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

Location Code	Approximate Address	BES UIC No.	Traffic Category (TPD)	Separation Distance [a] (ft)	Year 1 Annual Geometric Mean Pentachlorophenol Concentration (µg/L)	Year 2 Annual Geometric Mean Pentachlorophenol Concentration (µg/L)	Year 3 Annual Geometric Mean Pentachlorophenol Concentration (µg/L)
P1_1	6940 N. Macrum Ave.	AAG769	< 1,000	64	1.1	1.2	0.5
P6_1	3500 SE 112th Ave.	ADW577	≥ 1,000	62	1.2	1.0	1.3
P6_7	608 NE 87th Ave.	AMU771	< 1,000	147	2.0	1.8	0.6
P6_14	4289 NE Prescott St.	AD1252	≥ 1,000	162	1.5	1.4	1.5

Notes:

a 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.

Section 11

11 References

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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 3 Panel 1 Table 3-3 - Year 3 Panel 2 Table 3-4 - Year 3 Panel 3 Table 3-5 - Year 3 Panel 6 Table 3-6 Supplemental Panel 2
(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 3 Panel 1 Table 3-3 - Year 3 Panel 2 Table 3-4 - Year 3 Panel 3 Table 3-5 - Year 3 Panel 6 Table 3-6 Supplemental Panel 2
(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 3 Panel 1 Table 3-3 - Year 3 Panel 2 Table 3-4 - Year 3 Panel 3 Table 3-5 - Year 3 Panel 6 Table 3-6 Supplemental Panel 2 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 3 Panel 1 Table 3-3 - Year 3 Panel 2 Table 3-4 - Year 3 Panel 3 Table 3-5 - Year 3 Panel 6 Table 3-6 Supplemental Panel 2
(10) The estimated total volume of recharge to the aquifer by public UICs.	Section 7.4 Table 7-4

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

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 3-2 Appendix A (UIC monitoring location maps) Systemwide Assessment Report (July 2006)
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
(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 3 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 3 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 3 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

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

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
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, 3.3 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
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 analysis was missed and (if applicable) any corrective actions to prevent the occurrence from happening again.	Not applicable for Year 3 (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 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;	

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

(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.	
k. In the event the Permittee undertakes groundwater monitoring, the Permittee must provide the following:	
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;	Not applicable for Year 3. Groundwater monitoring was not performed in Year 3.
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 for Year 3. Need for groundwater Corrective Action was not identified in Year 3.
(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:	Sections 3 and 10

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

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	None
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)

Notes:

[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 3, 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 [c]	Date of Last Maintenance	Maintenance Performed	Sediment Level (feet) [d]
P1-1	6940 N. MACRUM AVE	325	SFR [f]	2235	AAG769	45.58146	-122.73663	31	Sed MH [e]	61	9/13/2007	Cleaned UIC & Sed MH	1.5

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 upon 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. Separation distances are based on April 2007 USGS depth to groundwater data (Snyder, in press).

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

e Sed MH = Sedimentation manhole

f SFR = Single Family Residential

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

Location Code	Approximate Address [a]	Estimated Trips per Day (TPD)	Predominant Land Use [b]	DEQ UIC No.	BES UIC No. [c]	Latitude	Longitude	UIC Depth (feet)	Pretreatment System	Separation Distance [d]	Date of Last Maintenance	Maintenance Performed	Sediment Level (feet)[e]
P2_5	10150 SE Ankeny St.	22,430	IND	8329	ADR885	45.5217	-122.55862	14	Sed MH [f]	158	4/28/2008	Cleaned UIC & Sed MH [f]	4.5
P2_7	7930 SE Henry St.	407	SFR	5587	ADV064	45.47687	-122.58187	26	Sed MH	42	10/10/2007	Cleaned UIC & Sed MH	6.5
P2_13	4107 SE Reedway St.	2,420	SFR	5599	ADU790	45.48122	-122.62053	31	Sed MH	58	9/6/2007	Cleaned UIC & Sed MH	5.7
P2_14	8409 N. Woolsey Ave.	4,012	SFR	2380	AAH289	45.58422	-122.71348	30	Sed MH	55	10/23/2007	Cleaned UIC & Sed MH	3

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 SFR = Single Family Residential IND = Industrial

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

d 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. Separation distances are based on April 2007 USGS depth to groundwater data (Snyder, in press).

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

f Sed MH = Sedimentation manhole

Table 3-4: UIC Summary Information – Rotating Panel, Year 3, Panel 3

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 (feet) [d]
P3_01	2810 N BUFFALO	5,988	SFR	2657	ADP171	45.57539	-122.6957	30	Sed MH [f]	75	9/25/2007	Cleaned UIC & Sed MH	3
P3_02	11759 SE TAYLOR ST	140	SFR	7653	ADT035	45.51546	-122.5416	30	Sed MH	93	10/24/2005	Cleaned UIC & Sed MH	2.5
P3_03	4940 N WILLIS BLVD	3,828	SFR	2373	ADN715	45.58408	-122.7182	20	Sed MH	70	8/18/2007	Cleaned UIC & Sed MH	4
P3_04	3150 NE REGENTS DR	1,199	SFR	3683	ADQ687	45.55198	-122.6339	33	Sed MH	181	8/10/2005	Cleaned UIC & Sed MH	3
P3_05	5518 N CAMPBELL AVE	5,155	COM	4422	ADP547	45.56283	-122.6864	30	Sed MH	87	10/23/2001	Cleaned UIC & Sed MH	3
P3_06	14800 NE HALSEY ST	16,483	POS	8445	ADV705	45.53363	-122.5104	0 [e]	No Sed MH	106	9/16/2001	Cleaned UIC & Sed MH	4.5
P3_07	635 SE 84TH AVE	1,230	MFR	112	AMP362	45.51781	-122.5771	25	Sed MH	134	2/16/2008	Cleaned UIC & Sed MH	2
P3_08	4320 SE 101ST AVE	394	SFR	6271	ADT366	45.49091	-122.5598	31	Sed MH	48	2/16/2008	Cleaned UIC & Sed MH	NA [g]
P3_09	2321 SE 122ND AVE	22,938	COM	7444	ADS268	45.50567	-122.5377	0	Sed MH	67	4/29/2002	Cleaned UIC & Sed MH	4
P3_10	6310 SE FRANKLIN ST	391	SFR	6944	ADU095	45.49890	-122.5983	30	Sed MH	102	11/28/2007	Cleaned UIC & Sed MH	4.9
P3_11	315 N HOLLAND ST	291	SFR	2568	ADP299	45.57583	-122.6698	30	Sed MH	63	1/7/2008	Cleaned UIC & Sed MH	7
P3_12	7346 SE 46TH AVE	459 [h]	SFR	5149	ADT782	45.46961	-122.6150	26	Sed MH	73	1/7/2008	Cleaned UIC & Sed MH	4.2
P3_13	6738 NE 22ND AVE	3,651	SFR	2687	AAL151	45.57173	-122.6435	25	Sed MH	62	8/27/2007	Cleaned UIC & Sed MH	4
P3_14	1600 NE BEECH ST	412	SFR	3708	ADQ643	45.54945	-122.6496	36	Sed MH	103	10/3/2005	Cleaned UIC & Sed MH	4
P3_15	8003 SE 11TH AVE	735	SFR	4962	ADU050	45.46558	-122.6550	31	Sed MH	43	9/5/2007	Cleaned UIC & Sed MH	6.5

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 upon 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. Separation distances are based on April 2007 USGS depth to groundwater data (Snyder, in press).

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

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

f Sed MH = sedimentation manhole

g NA = information not available

h No traffic count available. Values estimated from nearby street(s).

MFR = Multifamily Residental SFR = Single Family Residential COM = Commercial POS = Parks & Open Space

Table 3-5: UIC Summary Information – Stationary Panel, Year 3, 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 (feet) [d]
P6_1	3500 SE 112th Ave.	25,838	COM	6707	ADW577	45.49676	-122.54801	23	Sed MH[e]	58	04/26/08	Cleaned UIC & Sed MH	5
P6_2 [g]	3740 SE 104th Avenue	2,354	POS	662	ADT394	45.49511	-122.55601	29	Sed MH	62	10/09/07	Cleaned UIC & Sed MH	3
P6_3	4541 NE 80th Ave.	130 [h]	SFR	3192	ADQ337	45.55605	-122.58071	30	Sed MH	80	04/20/07	Raise UIC/sed system to grade (apprx.8")	18
P6_4	9090 SE Claybourne St.	393	SFR	5070	ADT961	45.47471	-122.56991	30	Sed MH	12	09/30/00	Cleaned UIC & Sed MH	NA [f]
P6_5	2513 SE 153rd Ave.	36,904	MFR	6590	ADS740	45.5041	-122.50598	30	Sed MH	25	08/05/04	Cleaned UIC & Sed MH	3.1
P6_6 [i]	5201 N. Emerson Dr.	<100 [h]	SFR	3311	ADV395	45.56048	-122.69658	19	No Sed MH	18	01/09/06	Cleaned UIC	6
P6_7 [j]	640 NE 87th Ave.	729	MFR	256	AMU771	45.52784	-122.57361	30	Sed MH	143	04/23/07	Cleaned UIC & Sed MH	12
P6_8	10064 SE Woodstock Blvd.	795	IND	5448	ADV169	45.57613	-122.56014	26	Sed MH	5	03/24/06	Cleaned UIC & Sed MH	2
P6_9	3617 SE 168th Ave.	557	SFR	6117	ADT531	45.49604	-122.48968	30	Sed MH	31	11/24/03	Cleaned UIC & Sed MH	3.2
P6_10 [g]	5502 NE 13th Ave.	12,028	MFR	3074	ADP732	45.56285	-122.65206	31	Sed MH	139	03/18/07	Cleaned UIC & Sed MH	3.3
P6_11	1406 NE Skidmore St.	648	SFR	3605	AAU014	45.5544	-122.65157	30	Sed MH	156	03/07/02	Cleaned UIC & Sed MH	NA
P6_12 [g]	550 SE 130th Ave.	3,536	SFR	7667	ADT061	45.51824	-122.52998	29	Sed MH	82	10/17/05	Cleaned UIC & Sed MH	4.8
P6_13	14350 NE Knott St.	291	SFR	4296	ADW213	45.45245	-122.5143	20	No Sed MH	97	03/25/00	Cleaned UIC	9.6
P6_14	4289 NE Prescott St.	8,100	COM	3510	ADQ252	45.55559	-122.61931	31	Sed MH	155	09/14/07	Cleaned UIC & Sed MH	2
P6_15	13500 NE Glisan St.	19,380	POS	8422	ADR767	45.52646	-122.52461	29	Sed MH	101	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 upon 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. Separation distances are based on April 2007 USGS depth t groundwater data (Snyder, in press).

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

e Sed MH = Sedimentation manhole

f NA = Information not available

g 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.

h No traffic count available. Value estimated from nearby street(s).

i A sedimentation manhole (ANS741) was added to this sump system in November 2007. A second UIC sump (ANS742) was installed between the new sedimentation manhole and the original sump (ADV395). The new sump was installed to a depth of 30 feet. The new sump (ANS742) is designed to overflow into the original sump (ADV395). The sampling point was moved to the new sump after installation.

j UIC (ADV645) was decommissioned and converted to a sedimentation manhole in the summer of 2007. The sedimentation manhole retained the ADV645 label. A new UIC (AMU771) was installed to a total depth of 30 feet. The depth of the former UIC sump (ADV645) prior to conversion was 21 feet. The sedimentation manhole (ADV645) provides pretreatment to the new UIC (AMU771).

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

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

Table 3-6: UIC Summary Information – Supplemental Panel, Year 3

Location Code	Approximate Address [a]	Estimated Trips per Day (TPD)	Predominant Land Use [b]	DEQ UIC No.	BES UIC No. [c]	Latitude	Longitude	UIC Depth (feet)	Pretreatment System [d]	Separation Distance [e]	Date of Last Maintenance	Maintenance Performed	Sediment Level (feet) [f]	Distance to Nearest Well (feet) [g]	Within Two-year Time of Travel from public drinking water well? [g]
SP2_1	8036 SE GRAND AVE	4,095	MFR	10	ADU052	45.46521	-122.6610	21	Sed MH	12	2/17/2001	Cleaned UIC & Sed MH	4.25	382	No
SP2_2	15000 NE KLICKITAT ST	195	MFR	4318	ABA071	45.54715	-122.5074	30	Sed MH	33	2/15/2007	Cleaned UIC & Sed MH	3	174	No
SP2_3	14746 SE RHONE ST	352	SFR	6343	ADT484	45.49613	-122.5111	30	Sed MH	29	11/21/2005	Cleaned UIC & Sed MH	4.75	1,621	Yes
SP2_4	13400 SE RAYMOND ST	314	MFR	5952	ACK566	45.48595	-122.5256	30	Sed MH	8	10/2/2007	Cleaned UIC & Sed MH	3	160	No
SP2_5	4549 SE 122ND AVE	12,589	MFR	5884	ADW254	45.48884	-122.5376	21	No Sed MH	5	12/19/1999	Cleaned UIC only	NA	326	No
SP2_6	3024 SE 154TH AVE	228	SFR	1176	ADS747	45.50043	-122.5051	30	Sed MH	30	9/26/2003	Cleaned UIC & Sed MH	3.5	463	No
SP2_7	3905 SE 147TH AVE	90	SFR	372	ADT501	45.49384	-122.5119	30	Sed MH	34	4/8/2002	Cleaned UIC & Sed MH	NA [h]	899	Yes
SP2_8	4406 SE 136TH AVE	9,961	SFR	558	AMX688	45.49027	-122.5236	23	Sed MH	-5	9/28/2007	Cleaned UIC & Sed MH	4	647	Yes
SP2_9	11847 SE POWELL BLVD	21,526	MFR	890	ADW597	45.49702	-122.5410	19	No Sed MH	46	11/12/1997	Cleaned UIC & Sed MH	NA	374	No
SP2_10	6112 SE CLATSOP ST	2,470	SFR	4800	ADU221	45.46142	-122.5999	24	Sed MH	94	9/26/2007	Cleaned UIC & Sed MH	4.5	446	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 SFR = Single Family Residential MFR = Multifamily Residential

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

d Sed MH = sedimentation manhole

e 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. Separation distances are based on April 2007 USGS depth to groundwater data (Snyder, in

f Sediment level represents "feet of sediment removed" from UIC as measured prior to cleaning.

g Information obtained from *Systemwide Assessment* (City of Portland, 2006)

h NA = information not available/unknown

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 3.
[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
Pentachlorophenol	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 3 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 [1] Data Year 3, 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	
10/1/2007	[2]			0.01		0.04										0.01								0.01	0.07 [3]
10/2/2007																0.01	0.07	0.01	0.12	0.04					0.25
10/3/2007							0.03	0.04					0.01		0.06	0.01		0.01	0.07		0.01	0.01	0.01		0.25
10/4/2007		0.01	0.04																						0.05
10/5/2007																									0.00
10/6/2007																									0.01
10/7/2007																0.02	0.06	0.05	0.04	0.03	0.08				0.27
10/8/2007																									0.00
10/9/2007																								0.01	0.01
10/10/2007	0.02	0.01	0.01	0.01	0.01	0.01						0.05	0.04		0.01										0.17
10/11/2007																								0.01	0.02
10/12/2007	0.01																								0.01
10/13/2007																									0.00
10/14/2007																									0
10/15/2007																	0.01								0.02
10/16/2007									0.02	0.06	0.04	0.01		0.02										0.01	0.16
10/17/2007	0.02	0.01								0.01		0.01	0.01		0.03	0.04						0.01		0.01	0.14
10/18/2007	0.01	0.03	0.02	0.07	0.08	0.04	0.02													0.04	0.14	0.07	0.1	0.03	0.64
10/19/2007	0.03	0.03	0.02		0.03		0.07					0.01	0.01	0.01					0.02	0.01	0.02	0.01	0.03	0.09	0.41
10/20/2007	0.01			0.02		0.06	0.04	0.15	0.11	0.01	0.06	0.09	0.03		0.01			0.01						0.01	0.62
10/21/2007		0.01																							0.01
10/22/2007																									0
10/23/2007																									0
10/24/2007													0.01	0.03	0.04	0.03									0.12
10/25/2007																									0.01
10/26/2007	[4]																								0
11/8/2007																									0
11/9/2007				0.01									0.01								0.03	0.06	0.05	0.04	0.21
11/10/2007	0.01			0.03	0.03	0.01																			0.09
11/11/2007		0.02																							0.02
11/12/2007								0.03	0.03	0.04	0.02		0.01		0.01	0.01									0.16
11/13/2007																									0
11/14/2007																									0
11/15/2007																		0.03	0.03			0.01		0.01	0.09
11/16/2007		0.04	0.02	0.03	0.01		0.01	0.04	0.05	0.04	0.05	0.05	0.04	0.08	0.08	0.04	0.04	0.03	0.02	0.02	0.02	0.01	0.01		0.74
11/17/2007		0.02	0.09	0.1	0.12	0.06	0.05	0.03	0.04	0.01	0.04	0.09	0.03												0.67
11/18/2007							0.04	0.05	0.03	0.04	0.03	0.04	0.05	0.06	0.06	0.05	0.04	0.04	0.06	0.05	0.05	0.03	0.01		0.73
11/19/2007							0.03	0.05	0.01	0.01			0.02	0.04	0.05						0.02	0.05	0.03	0.01	0.31

Notes:

[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.

[4] No recorded rainfall between 10/27/07 and 11/8/07

Table 5-10: Summary of Frequency of Detection for Common and PPS Pollutants[1] – Year 3

> 75 %	> 50 - 75 %	≤ 50 %
Common Pollutants		
Arsenic (98 - 100%)	Cadmium (31 – 49%)	**B(a)P (24 - 49 %)**
Copper (100%)	**DEHP** (42 - 69%)	Xylenes (0 – 2%)[2]
Lead (100%)[3]	Total Nitrogen (11 - 42%)	
Zinc (100%)		
Chromium (71 - 87%)		
Pentachlorophenol (76 – 91%)		
Toluene (13 – 51%)		
Priority Pollutants		
		2,4-D (2 -27%)

Notes:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel No. 2. This table does not include the results of duplicate samples or laboratory reanalyses.

[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).

Table 5-11: Summary [1] of Non-Detect Priority Pollutant Stormwater Monitoring Data - Year 3

Analyte	MADL (µg/L)	Event	MRL Exceeds MADL	Number of Non-Detections	Number of Samples	Minimum MRL (µg/L)	Maximum MRL (µg/L)
Common Pollutants [2]							
Benzene	5.0	1	0	45	45	0.2	0.2
		2	0	45	45	0.2	0.2
		3	0	45	45	0.2	0.2
		4	0	45	45	0.2	0.2
		5	0	45	45	0.2	0.2
Ethylbenzene	700.0	1	0	45	45	0.5	0.5
		2	0	45	45	0.5	0.5
		3	0	45	45	0.5	0.5
		4	0	45	45	0.5	0.5
		5	0	45	45	0.5	0.5
Priority Pollutant Screen [2,3]							
Dinoseb	7.0	1	0	45	45	0.1	0.1
		2	0	45	45	0.1	1
		3	0	45	45	0.1	0.1
		4	0	45	45	0.1	0.1
		5	0	45	45	0.1	0.1
Picloram	500.0	1	0	45	45	0.4	0.4
		2	0	45	45	0.4	4
		3	0	45	45	0.4	0.4
		4	0	45	45	0.4	0.4
		5	0	45	45	0.4	0.4
1,2,4-Trichlorobenzene	70.0	1	0	45	45	0.5	0.5
		2	0	45	45	0.5	0.5
		3	0	45	45	0.5	0.5
		4	0	45	45	0.5	0.5
		5	0	45	45	0.5	0.5
1,3-Dichlorobenzene	5.5	1	0	45	45	0.5	0.5
		2	0	45	45	0.5	0.5
		3	0	45	45	0.5	0.5
		4	0	45	45	0.5	0.5
		5	0	45	45	0.5	0.5
Carbon tetrachloride	5.0	1	0	45	45	0.2	0.2
		2	0	45	45	0.2	0.2
		3	0	45	45	0.2	0.2
		4	0	45	45	0.2	0.2
		5	0	45	45	0.2	0.2

Table 5-11: Summary [1] of Non-Detect Priority Pollutant Stormwater Monitoring Data - Year 3

Analyte	MADL (µg/L)	Event	MRL Exceeds MADL	Number of Non-Detections	Number of Samples	Minimum MRL (µg/L)	Maximum MRL (µg/L)
Chlorobenzene	100.0	1	0	45	45	0.2	0.2
		2	0	45	45	0.2	0.2
		3	0	45	45	0.2	0.2
		4	0	45	45	0.2	0.2
		5	0	45	45	0.2	0.2
o-Dichlorobenzene [4]	600.0	1	0	45	45	0.5	0.5
		2	0	45	45	0.5	0.5
		3	0	45	45	0.5	0.5
		4	0	45	45	0.5	0.5
		5	0	45	45	0.5	0.5
p-Dichlorobenzene [5]	75.0	1	0	45	45	0.5	0.5
		2	0	45	45	0.5	0.5
		3	0	45	45	0.5	0.5
		4	0	45	45	0.5	0.5
		5	0	45	45	0.5	0.5

Notes:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel No. 2. This table does not include the results of duplicate samples or laboratory reanalyses.

[2] Table 5-9 provides a summary of common pollutants and PPS analytes detected in Year 3.

[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 3

Analyte	Method	Event	Number of Detections	Number of Samples	Frequency of Detection (%)	Minimum concentration [2] (µg/L)	Maximum Concentration (µg/L)
Ancillary Pollutants Detected by Required Analyses							
2,4,5-TP (Silvex)	EPA 515.3	1	1	45	2	< 0.1 [3]	0.113
		2	0	45	0	< 0.1	< 1
		3	0	45	0	< 0.1	< 0.1
		4	0	45	0	< 0.1	< 0.1
		5	0	45	0	< 0.1	< 0.1
Dicamba	EPA 515.3	1	1	45	2	< 0.2	2.12
		2	0	45	0	< 0.2	< 2
		3	0	45	0	< 0.2	< 0.2
		4	0	45	0	< 0.2	< 0.2
		5	1	45	2	< 0.2	0.521
1,2,4-Trimethylbenzene	EPA 8260	1	1	45	2	< 0.5	0.7
		2	0	45	0	< 0.5	< 0.5
		3	0	45	0	< 0.5	< 0.5
		4	0	45	0	< 0.5	< 0.5
		5	0	45	0	< 0.5	< 0.5
2-Butanone	EPA 8260	1	0	45	0	< 5	< 5
		2	0	45	0	< 5	< 5
		3	0	45	0	< 5	< 5
		4	1	45	2	< 5	5.81
		5	0	45	0	< 5	< 5
4-Isopropyltoluene	EPA 8260	1	6	45	13	< 0.5	1.3
		2	4	45	9	< 0.5	1.53
		3	0	45	0	< 0.5	< 0.5
		4	1	45	2	< 0.5	0.96
		5	2	45	4	< 0.5	2.98
Acetone	EPA 8260	1	3	45	7	< 20	27.1
		2	1	45	2	< 20	30.8
		3	1	45	2	< 20	82.5
		4	0	45	0	< 20	< 20
		5	3	45	7	17	22.2
Chloroform	EPA 8260	1	0	45	0	< 0.2	< 0.2
		2	1	45	2	< 0.2	0.73
		3	1	45	2	< 0.2	3.34
		4	1	45	2	< 0.2	1.09
		5	1	45	2	< 0.2	0.63
Tetrachloroethene	EPA 8260	1	1	45	2	< 0.5	1.68
		2	0	45	0	< 0.5	< 0.5
		3	0	45	0	< 0.5	< 0.5
		4	0	45	0	< 0.5	< 0.5
		5	1	45	2	< 0.5	1.25
Acenaphthene	EPA8270M-SIM	1	1	45	2	< 0.0192	< 0.0971
		2	0	45	0	< 0.0192	< 0.0962
		3	1	45	2	< 0.0192	< 0.196
		4	1	45	2	< 0.0192	< 0.0392
		5	0	45	0	< 0.0192	< 0.0971
Acenaphthylene	EPA8270M-SIM	1	5	45	11	< 0.0192	< 0.24
		2	5	45	11	< 0.0192	< 0.0962
		3	11	45	24	< 0.0192	< 0.196
		4	2	45	4	< 0.0192	0.0677
		5	4	45	9	< 0.0192	0.127

Table 5-12: Summary of Detected Ancillary Pollutants [1] - Year 3

Analyte	Method	Event	Number of Detections	Number of Samples	Frequency of Detection (%)	Minimum concentration [2] (µg/L)	Maximum Concentration (µg/L)
Anthracene	EPA8270M-SIM	1	1	45	2	< 0.0192	< 0.0971
		2	1	45	2	< 0.0192	< 0.24
		3	7	45	16	< 0.0192	< 0.196
		4	2	45	4	< 0.0192	0.142
		5	0	45	0	< 0.0192	< 0.155
Benzo(a)anthracene	EPA8270M-SIM	1	11	45	24	< 0.00962	0.0907
		2	10	45	22	< 0.00962	0.0591
		3	21	45	47	< 0.00962	0.226
		4	16	45	36	< 0.00962	0.119
		5	17	45	38	< 0.00962	0.4
Benzo(b)fluoranthene	EPA8270M-SIM	1	20	45	44	< 0.00962	0.0823
		2	17	45	38	< 0.00962	0.13
		3	28	45	62	< 0.00962	0.351
		4	26	45	58	< 0.00962	0.182
		5	30	45	67	< 0.00962	0.561
Benzo(ghi)perylene	EPA8270M-SIM	1	18	45	40	< 0.0192	0.0773
		2	12	45	27	< 0.0192	< 0.155
		3	22	45	49	< 0.0192	0.262
		4	21	45	47	< 0.0192	< 0.194
		5	26	45	58	< 0.0192	0.538
Benzo(k)fluoranthene	EPA8270M-SIM	1	13	45	29	< 0.00962	0.0786
		2	10	45	22	< 0.00962	0.0817
		3	22	45	49	< 0.00962	0.227
		4	19	45	42	< 0.00962	0.106
		5	18	45	40	< 0.00962	0.411
Butyl benzyl phthalate	EPA8270M-SIM	1	0	45	0	< 0.962	< 24.3
		2	0	45	0	< 0.962	< 0.99
		3	1	45	2	< 0.962	< 24.3
		4	0	45	0	< 0.962	< 1.96
		5	0	45	0	< 0.962	< 1.94
Chrysene	EPA8270M-SIM	1	26	45	58	< 0.00962	0.11
		2	24	45	53	< 0.00962	0.131
		3	34	45	76	< 0.00962	0.39
		4	29	45	64	< 0.00962	0.209
		5	33	45	73	< 0.00962	0.656
Di-n-butyl phthalate	EPA8270M-SIM	1	0	45	0	< 0.962	< 1.11
		2	1	45	2	< 0.962	1.84
		3	0	45	0	< 0.962	< 1.96
		4	0	45	0	< 0.962	< 1.96
		5	1	45	2	< 0.962	< 1.94
Di-n-octyl phthalate	EPA8270M-SIM	1	1	45	2	< 0.962	3.6
		2	1	45	2	< 0.962	< 3.92
		3	0	45	0	< 0.962	< 4.9
		4	0	45	0	< 0.962	< 3.92
		5	0	45	0	< 0.962	< 4.85
Dibenzo(a,h)anthracene	EPA8270M-SIM	1	3	45	7	< 0.00962	0.0379
		2	2	45	4	< 0.00962	< 0.0583
		3	6	45	13	< 0.00962	0.0693
		4	3	45	7	< 0.00962	< 0.0971
		5	4	45	9	< 0.00962	0.144

Table 5-12: Summary of Detected Ancillary Pollutants [1] - Year 3

Analyte	Method	Event	Number of Detections	Number of Samples	Frequency of Detection (%)	Minimum concentration [2] (µg/L)	Maximum Concentration (µg/L)
Diethyl phthalate	EPA8270M-SIM	1	0	45	0	< 0.962	< 1.11
		2	1	45	2	< 0.962	5.39
		3	1	45	2	< 0.962	2.23
		4	0	45	0	< 0.962	< 1.96
		5	0	45	0	< 0.962	< 1.94
Dimethyl phthalate	EPA8270M-SIM	1	0	45	0	< 0.962	< 1.11
		2	1	45	2	< 0.962	2.85
		3	0	45	0	< 0.962	< 1.96
		4	0	45	0	< 0.962	< 1.96
		5	0	45	0	< 0.962	< 1.94
Fluoranthene	EPA8270M-SIM	1	13	45	29	< 0.0192	0.229
		2	17	45	38	< 0.0192	0.287
		3	35	45	78	< 0.0192	0.938
		4	29	45	64	< 0.0192	0.564
		5	21	45	47	< 0.0192	< 1.36
Fluorene	EPA8270M-SIM	1	2	45	4	< 0.0192	0.127
		2	3	45	7	< 0.0192	< 0.0962
		3	8	45	18	< 0.0192	< 0.196
		4	1	45	2	< 0.0192	0.151
		5	1	45	2	< 0.0192	0.278
Indeno(1,2,3-cd)pyrene	EPA8270M-SIM	1	10	45	22	< 0.00962	0.052
		2	8	45	18	< 0.00962	0.0764
		3	22	45	49	< 0.00962	0.212
		4	19	45	42	< 0.00962	< 0.0971
		5	21	45	47	< 0.00962	0.356
Naphthalene	EPA8270M-SIM	1	11	45	24	< 0.0192	0.207
		2	19	45	42	< 0.0192	< 0.485
		3	41	45	91	< 0.0198	0.207
		4	20	45	44	< 0.0192	0.685
		5	32	45	71	< 0.0194	1.28
Phenanthrene	EPA8270M-SIM	1	23	45	51	< 0.0192	0.33
		2	28	45	62	< 0.0192	0.139
		3	44	45	98	< 0.0198	0.262
		4	30	45	67	< 0.0192	0.416
		5	31	45	69	< 0.0192	0.36
Pyrene	EPA8270M-SIM	1	22	45	49	< 0.0192	0.372
		2	25	45	56	< 0.0192	0.225
		3	36	45	80	< 0.0192	0.473
		4	30	45	67	< 0.0192	0.278
		5	30	45	67	< 0.0192	0.55

Notes:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel No. 2. This table does not include the results of duplicate samples or laboratory reanalyses.

[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.

Table 5-13: Summary of Frequency of Detection for Ancillary Pollutants[1] – Year 3

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						
1,2,4-Trimethylbenzene	0-2% [3]					X
2-Butanone	0-2%					X
2,4,5-TP (Silvex)	0-2%					X
4-Isopropyltoluene	0-13%				X	
Acenaphthene	0-2%					X
Acenaphthylene	4-24%				X	
Acetone	0-7%					X
Anthracene	2-16%				X	
Benzo(a)anthracene	22-47%			X		
Benzo(b)fluoranthene	38-67%		X			
Benzo(ghi)perylene	27-58%		X			
Benzo(k)fluoranthene	22-49%			X		
Butyl benzyl Phthalate[4]	0-2%					X
Chloroform	0-2%					X
Chrysene	53-76%		X			
Dibenzo(a,h)anthracene	4-13%				X	
Dicamba	0-2%					X
Diethyl phthalate[4]	0-2%					X
Dimethyl phthalate	0-2%					X
Di-n-butyl phthalate[4]	0-2%					X
Fluoranthene	29-78%	X				
Fluorene	2-18%				X	
Indeno(1,2,3-cd) pyrene	18-49%			X		
Naphthalene	24-91%	X				
Phenanthrene	51-98%	X				
Pyrene	49-80%	X				
Tetrachloroethene	0-2%					X

Notes:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel No. 2. This table does not include the results of duplicate samples or laboratory reanalyses.

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

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

Table 5-14: Summary of Total and Dissolved Metal Results - Year 3

Metal	Traffic Category (TPD)	MADL (ug/L)	Number of Samples	Number of Detections	Total (ug/L) Average [1] (ug/L)	Geometric Mean [1] (ug/L)	Minimum (ug/L)	Maximum	Ratio of Dissolved Average/Total Average
Common Pollutants									
Arsenic (total)	<1000	10.0	105	104	0.45	0.33	< 0.045	1.9	NA
	>1000		115	115	0.64	0.49	0.14	5.46	
Cadmium (total)	<1000	5.0	105	15	0.08	0.06	< 0.1	1.16	NA
	>1000		115	77	0.20	0.13	< 0.1	1.46	
Chromium (total)	<1000	100	105	69	1.23	0.64	0.11	8.84	NA
	>1000		115	109	3.37	2.04	< 0.4	25.3	
Copper (total)	<1000	1,300	105	105	6.12	4.54	0.81	35.3	<1000 43%
	>1000		115	115	16.31	12.26	1.68	90.7	≥1000 28%
Copper (dissolved)	<1000	NA	105	105	2.61	1.90	0.32	13	
	>1000		115	115	4.57	3.69	0.79	16.3	
Lead (total)	<1000	50.0	105	105	4.50	2.04	0.16	49.8	
	>1000		115	115	16.89	9.14	0.69	105	<1000 10%
Lead (dissolved)	<1000	NA	105	54	0.44	0.13	< 0.1	14	≥1000 3%
	>1000		115	113	0.51	0.38	0.1	4.3	
Zinc (total)	<1000	5,000	105	105	34.52	20.51	3.06	476	
	>1000		115	115	93.69	63.60	9.55	977	<1000 37%
Zinc (dissolved)	<1000	NA	105	105	12.87	8.11	0.77	144	≥1000 34%
	>1000		115	115	31.63	21.66	3.15	740	
Priority Pollutant Screen									
Mercury (dissolved)	<1000	NA	105	92	0.00	0.00	< 0.001	0.014	NA
	>1000		115	101	0.00	0.00	< 0.001	0.0074	

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 for estimation of the mean and geometric mean. Duplicate sample results were not included.

Table 5-15: Summary of Total Suspended Solids (TSS) Results [1] - Year 3

	Number of Samples	Total (mg/L)			
		Average	Geometric Mean	Minimum	Maximum
<1,000 Trips per Day (TPD)					
TSS	105	35	17	2	257
≥ 1,000 TPD					
TSS	115	72	39	4	762

Note:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel No. 2. This table does not include the results of duplicate samples or laboratory reanalyses.

Table 5-16: Summary of Total and Dissolved Organic Carbon Results [1] - Year 3

	Number of Samples	Total (mg/L)			
		Average	Geometric Mean	Minimum	Maximum
<1,000 TPD					
Dissolved	8	6.8	4.7	1.73	20.8
Total	15	8.6	6.1	1.6	23.8
≥ 1,000 TPD					
Dissolved	7	4.8	4.3	2.3	9.65
Total	15	6.5	5.3	1.86	22.5

Note:

[1] This table summarizes the results of the original UIC stormwater samples for Event 5. This table includes the results of Total Organic Carbon (TOC) for Panel 3 and Panel 6 and dissolved organic carbon (DOC) from Panel 6.

Table 5-2: City of Portland HYDRA Rain Gage [1] Data Year 3, 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	
11/12/2007	[2]							0.03	0.03	0.04	0.02		0.01		0.01	0.01									0.16 [3]
11/13/2007																									0.00
11/14/2007																									0.00
11/15/2007																		0.03	0.03			0.01		0.01	0.09
11/16/2007		0.04	0.02	0.03	0.01		0.01	0.04	0.05	0.04	0.05	0.05	0.04	0.08	0.08	0.04	0.04	0.03	0.02	0.02	0.02	0.01	0.01		0.74
11/17/2007		0.02	0.09	0.1	0.12	0.06	0.05	0.03	0.04	0.01	0.04	0.09	0.03												0.67
11/18/2007							0.04	0.05	0.03	0.04	0.03	0.04	0.05	0.06	0.06	0.05	0.04	0.04	0.06	0.05	0.05	0.03	0.01		0.73
11/19/2007							0.03	0.05	0.01	0.01			0.02	0.04	0.05						0.02	0.05	0.03	0.01	0.31
11/20/2007	0.01	0.01																							0.02
11/21/2007																									0.00
11/22/2007																									0.00
11/23/2007																									0.00
11/24/2007																									0.00
11/25/2007																									0.00
11/26/2007																	0.07	0.12	0.09	0.02					0.30
11/27/2007							0.01		0.02					0.03	0.01	0.01									0.09
11/28/2007														0.07	0.05	0.02	0.03	0.1	0.07	0.05	0.02	0.01			0.43
11/29/2007								0.01		0.01		0.02	0.06	0.05	0.02			0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.27
11/30/2007	0.02	0.02																							0.05
12/1/2007											0.01					0.02	0.06	0.02	0.01	0.01	0.01	0.01		0.04	0.20
12/2/2007	0.06	0.04	0.05	0.05	0.05	0.06	0.07	0.03	0.05	0.08	0.12	0.13	0.12	0.12	0.07	0.04	0.05	0.04	0.09	0.14	0.09	0.08	0.1	0.09	1.82
12/3/2007	0.12	0.1	0.1	0.09	0.06	0.08	0.1	0.09	0.09	0.11	0.05	0.05	0.06	0.12	0.17	0.15	0.05	0.04	0.07	0.08	0.02	0.07	0.01	0.05	1.93

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 [1] Data Year 3, 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	
12/29/2007	0.02	0.02	0.01	[2]								0.03	0.03	0.01	0.01	0.01	0.02	0.08	0.01				0.01	0.01	0.26 [3]
12/30/2007		0.03				0.02	0.01	0.02			0.01	0.04	0.01	0.07	0.01										0.23
12/31/2007																									0.01
1/1/2008																									0.00
1/2/2008			0.01	0.05	0.04	0.05	0.05	0.04	0.06	0.06	0.04	0.04	0.04	0.05	0.04	0.06	0.06	0.03	0.05	0.03	0.02	0.01	0.01		0.84
1/3/2008							0.01					0.01	0.05	0.1			0.04	0.02							0.24
1/4/2008							0.01	0.07	0.08											0.01	0.03	0.06	0.04	0.04	0.36
1/5/2008	0.04	0.01	0.02	0.04	0.08	0.06	0.01	0.01			0.02	0.01	0.01												0.32
1/6/2008			0.02	0.01				0.01	0.02								0.03	0.05	0.01	0.02	0.01	0.03		0.01	0.22
1/7/2008			0.01																			0.01	0.03	0.04	0.09
1/8/2008	0.07	0.06	0.06	0.04	0.04	0.02	0.03	0.03	0.03	0.03	0.04	0.01	0.03	0.08	0.1	0.03			0.02	0.01	0.01		0.02		0.77

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 [1] Data Year 3, 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	
1/25/2008	[2]																								0.00 [3]
1/26/2008										0.02	0.06	0.04	0.06	0.06	0.06	0.07	0.05	0.09	0.07	0.04	0.01		0.02	0.02	0.68
1/27/2008	0.02			0.01	0.01	0.02																			0.09
1/28/2008		0.01	0.01	0.01					0.01	0.01															0.05
1/29/2008	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.01	0.01			0.01	0.03	0.02	0.03	0.04	0.05	0.01	0.01						0.35
1/30/2008			0.02	0.03	0.03	0.01	0.01											0.01	0.01		0.01	0.03	0.01		0.18
1/31/2008		0.03	0.1	0.11	0.05	0.05	0.01		0.04		0.01		0.03		0.01	0.04	0.01	0.11	0.01	0.01	0.02	0.02	0.01	0.01	0.68
2/1/2008	0.01		0.01	0.01													0.04		0.03	0.02		0.01	0.01	0.01	0.17
2/2/2008	0.02	0.02		0.01	0.02	0.03	0.05	0.05	0.06	0.07	0.06	0.06	0.08	0.06	0.07	0.04	0.04	0.01	0.01			0.01	0.01	0.01	0.79
2/3/2008	0.01												0.01	0.01	0.01										0.05
2/4/2008															0.01	0.02	0.01								0.04
2/5/2008	0.01	0.01				0.02	0.03	0.01	0.02					0.03	0.01										0.14
2/6/2008	0.04														0.01	0.01	0.04	0.08	0.04	0.06	0.08	0.07	0.18	0.11	0.74
2/7/2008	0.02	0.03	0.04	0.01			0.01						0.01			0.01					0.01				0.15
2/8/2008			0.01			0.01	0.04	0.04	0.03	0.03	0.03	0.01	0.01						0.01						0.23
2/9/2008																									0.00
2/10/2008			0.01				0.01																		0.02
2/11/2008																									0.00
2/12/2008																	0.01	0.01							0.03
2/13/2008			0.01											0.02	0.03										0.07
2/22/2008	[4]																								0.00
2/23/2008																								0.01	0.01
2/24/2008	0.03	0.02																							0.06
2/25/2008		0.01																							0.02
2/26/2008																									0.00
2/27/2008																									0.00
2/28/2008																									0.00
2/29/2008																0.01	0.06	0.06	0.01						0.14
3/1/2008									0.01			0.02	0.01			0.02	0.01								0.07
3/2/2008																									0.01
3/3/2008										0.02	0.01	0.01													0.05
3/4/2008																									0.00
3/5/2008																									0.00
3/6/2008																									0.00
3/7/2008																						0.02	0.14	0.1	0.25
3/8/2008	0.1	0.04		0.01	0.01																				0.17
3/9/2008																									0.00
3/10/2008																	0.01	0.02	0.02	0.01					0.07
3/11/2008		0.01		0.04	0.01																				0.07
3/12/2008																				0.02	0.07	0.08	0.03	0.04	0.24
3/13/2008	0.03	0.02	0.04	0.04	0.06	0.02	0.04	0.02	0.01	0.01	0.01	0.04	0.02	0.01	0.01					0.05	0.02	0.03	0.12	0.04	0.65

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.

[4] No recorded rainfall > 0.01 inches per hour between 2/14/08 and 2/22/08

Table 5-5: City of Portland HYDRA Rain Gage [1] Data Year 3, 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	
3/22/2008	[2]																								0.01 [3]
3/23/2008					0.01	0.03	0.06	0.02	0.03	0.03	0.03	0.02	0.01	0.03	0.03										0.29
3/24/2008																									0.00
3/25/2008																		0.02				0.04	0.02	0.02	0.10
3/26/2008	0.01	0.06	0.08								0.11	0.06	0.01	0.01								0.01	0.01		0.37
3/27/2008												0.01	0.01						0.01						0.04
3/28/2008					0.01	0.04	0.06	0.04	0.05	0.03			0.01		0.01										0.26
3/29/2008								0.01							0.03	0.03	0.02	0.01	0.01						0.12
3/30/2008														0.01		0.02	0.01	0.01	0.01						0.05
3/31/2008							0.01	0.01				0.01													0.03
4/1/2008																									0.00
4/2/2008																									0.00
4/3/2008																									0.00
4/4/2008							0.01	0.03	0.09	0.01							0.01	0.01							0.15
4/5/2008						0.01							0.01	0.01	0.01	0.01		0.01							0.09
4/6/2008				0.01									0.02	0.03	0.01										0.08
4/7/2008				0.01								0.01	0.01	0.06	0.03		0.01								0.15
4/8/2008										0.01		0.01					0.03								0.09
4/9/2008			0.01	0.01	0.03	0.03	0.02	0.01						0.01	0.01	0.01	0.02	0.01							0.17
4/10/2008												0.01	0.01												0.02
4/11/2008																									0.00
4/12/2008																									0.00
4/13/2008																						0.01	0.02		0.03
4/14/2008											0.02	0.03			0.01	0.01	0.01								0.07
4/15/2008												0.02							0.01	0.02	0.02	0.01		0.01	0.09
4/16/2008	0.01																								0.02
4/17/2008																									0.00
4/18/2008																									0.01
4/19/2008													0.01	0.02				0.01							0.04
4/20/2008																	0.01	0.01		0.01					0.03
4/21/2008														0.03	0.01	0.02			0.01		0.01	0.01	0.02	0.02	0.14
4/22/2008		0.01		0.05	0.03	0.01	0.01							0.01		0.04	0.07	0.02	0.02	0.16		0.14	0.08	0.01	0.65
4/23/2008															0.01	0.02	0.01	0.01		0.01	0.01				0.08

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: UIC Permit Year 3 Stormwater Sampling Rainfall Data

Event	Start date of sampled storm	Daily		Individual sampled storm		
		Predicted rainfall [1] (inches)	Actual daily rainfall total [2] (inches)	Antecedent dry period [3] (hours)	Duration (hours)	Intensity (inches)
1	10/2/2007	0.34 - 0.47+	0.25	>48	5	0.25
	10/3/2007	0.38 - 0.52+	0.25	18	2	0.07
	10/18/2007	0.68 - 0.91+	0.64	12	8	0.28
	11/10/2007	0.22 - 0.37+	0.09	5	3	0.07
	11/12/2007	0.48 - 0.61+	0.16	55	4	0.12
	11/19/2007	0.09 - 0.22+	0.31	6	3	0.11
1 and 2 [4]	11/16/2007	0.47 - 0.76+	0.74	5	17	0.63
2	11/28/2007	0.26 - 0.41+	0.43	42	9	0.42
	11/29/2007	0.08 - 0.14+	0.27	14	6	0.16
	12/3/2007	1.55 - 2.12+	1.93	6	49	3.99
3	1/2/2008	0.18 - 0.31+	0.84	63	21	0.84
	1/3/2008	0.38 - 0.52+	0.24	16	7	0.13
	1/4/2008	0.48 - 0.68+	0.36	18	3	0.16
	1/8/2008	0.65 - 0.80+	0.77	26	19	0.78
4	1/29/2008	0.53 - 0.71	0.35	9	19	0.35
	1/31/2008	0.42 - 0.61	0.68	20	12	0.43
	2/5/2008	0.42 - 0.58	0.14	12	3	0.04
	3/10/2008	0.47 - 0.62+	0.07	65	4	0.07
	3/13/2008	0.33 - 0.51+	0.65	47	20	0.62
5	3/26/2008	0.32 - 0.44	0.37	8	4	0.19
	3/28/2008	0.37 - 0.56	0.26	43	6	0.23
	4/4/2008	0.17 - 0.23+	0.15	> 72	4	0.14
	4/7/2008	0.14 - 0.23+	0.15	44	4	0.11
	4/8/2008	0.17 - 0.31+	0.09	24	2	<.02
	4/9/2008	0.07 - 0.12+	0.17	48	6	0.11
	4/14/2008	0.08 - 0.15+	0.07	> 72	7	0.08
	4/22/2008	0.33 - 0.42+	0.65	12	5	0.31
	4/23/2008	0.22 - 0.38+	0.08	17	4	0.05

Notes:

[1] Predicted rainfall from Extended Range Forecasting, Inc. daily reports

[2] Rainfall totals average of 13 rain gauges (see Section 3.0, Year 3 Data Usability Report presented in Appendix B)

[3] Antecedent dry period = < 0.1" in 6 hours

[4] Some UICs were sampled on 11/16 during Event 1 and some were sampled during Event 2.

Table 5-7: Climate Data Summary - Years 1, 2, 3 and Long-term Average

Long-term Average			Year 1 Data				Year 2 Data				Year 3 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]	Month	Average Temperature (F)[3]	Permit Year 3 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	Jun-07	62.8	1.08	-0.51
July	68.1	0.72	Jul-05	70.3	0.41	-0.31	Jul-06	71.0	0.47	-0.25	Jul-07	70.7	0.55	-0.17
August	68.5	0.93	Aug-05	70.7	1.05	0.12	Aug-06	69.2	0.10	-0.83	Aug-07	68.3	0.46	-0.47
September	63.2	1.65	Sep-05	62.5	1.71	0.06	Sep-06	65.2	0.86	-0.79	Sep-07	62.4	2.04	0.39
October	54.5	2.88	Oct-05	56.3	3.40	0.52	Oct-06	54.0	1.40	-1.48	Oct-07	53.1	3.26	0.38
November	46.1	5.62	Nov-05	44.0	4.98	-0.64	Nov-06	47.4	11.92	6.30	Nov-07	44.8	4.25	-1.37
December	40.2	5.71	Dec-05	39.8	7.52	1.81	Dec-06	40.0	5.86	0.15	Dec-07	40.9	7.57	1.86
January	39.6	5.07	Jan-06	45.5	10.92	5.85	Jan-07	38.1	2.74	-2.33	Jan-08	38.8	4.71	-0.36
February	43.4	4.18	Feb-06	42.0	2.15	-2.03	Feb-07	44.2	3.47	-0.71	Feb-08	44.9	2.19	-1.99
March	47.3	3.71	Mar-06	46.1	2.96	-0.75	Mar-07	50.1	3.20	-0.51	Mar-08	45.4	3.71	0.00
April	50.9	2.64	Apr-06	53.1	2.46	-0.18	Apr-07	51.7	2.01	-0.63	Apr-08	48.5	2.09	-0.55
May	57.1	2.38	May-06	59.8	3.00	0.62	May-07	58.6	1.45	-0.93	May-08	58.9	2.03	-0.35
Year	53.5	37.08	Year	54.3	42.77	5.69	Year	54.7	34.41	-2.67	Year	53.3	33.94	-3.14

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.

[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.

Shaded area indicates permit "wet season"

Table 5-8: Field Parameter Summary Statistics [1] - Year 3

Field Parameter	Units	Event	Number of Samples	Minimum	Median	Mean	Maximum
Conductivity - specific	umhos/cm	1	47	17	43	44	106
		2	45	5	19	26	138
		3	45	7	19	24	96
		4	45	12	26	31	109
		5	45	8	27	34	116
pH	Units	1	47	5.5	6.5	6.4	7.9
		2	45	4.6	6.8	6.7	7.6
		3	45	6	6.6	6.7	10.4
		4	45	6	6.9	6.9	7.8
		5	45	5.6	6.6	6.6	9.3
Temperature	°C	1	47	7.8	13	12.6	16.3
		2	45	5.5	11.8	11.2	13.2
		3	45	2.8	4.4	4.6	7.0
		4	45	2.4	5.7	6.6	11.2
		5	45	2.1	8.8	8.1	11.7

Note:

[1] This table summarizes the results of the original UIC stormwater samples for each event. This table includes the results of Panel 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel No. 2. This table does not include the results of duplicate samples or laboratory reanalyses.

Table 5-9: Frequency of Detected [1] Common and Priority Pollutant Screen Analytes [2] - Year 3

Analyte	MADL (µg/L)	Event	Exceedances 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	45	45	100	0.18	3.24	32.4
		2	0	44	45	98	< 0.045 [3]	1.13	11.3
		3	0	45	45	100	0.096	2.26	22.6
		4	0	45	45	100	0.087	5.46	54.6
		5	0	45	45	100	0.125	2.16	21.6
Cadmium (total)	5.0	1	0	20	45	44	< 0.1	1.2	24
		2	0	14	45	31	< 0.1	1.46	29.2
		3	0	19	45	42	< 0.1	0.68	13.6
		4	0	18	45	40	< 0.1	0.98	19.6
		5	0	22	45	49	< 0.1	1.16	23.2
Chromium (total)	100	1	0	37	45	82	< 0.4	25.3	25.3
		2	0	32	45	71	0.15	15.9	15.9
		3	0	36	45	80	< 0.4	13	13
		4	0	39	45	87	0.11	12.2	12.2
		5	0	39	45	87	< 0.4	18.3	18.3
Copper (total)	1,300	1	0	45	45	100	3.61	90.7	7.0
		2	0	45	45	100	0.81	85	6.5
		3	0	45	45	100	0.99	49	3.8
		4	0	45	45	100	1.2	49.6	3.8
		5	0	45	45	100	1.94	60.8	4.7
Lead (total)	50.0	1	**3** [4]	45	45	100	0.48	**105**	**210**
		2	**1**	45	45	100	0.16	**51.8**	**103.6**
		3	**1**	45	45	100	0.37	**71.6**	**143.2**
		4	**2**	45	45	100	0.23	**104**	**208**
		5	**3**	45	45	100	0.38	**95.1**	**190.2**

Table 5-9: Frequency of Detected [1] Common and Priority Pollutant Screen Analytes [2] - Year 3

Analyte	MADL (µg/L)	Event	Exceedances 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] (%)
Zinc (total)	5,000	1	0	45	45	100	9.2	419	8.4
		2	0	45	45	100	3.06	196	3.9
		3	0	45	45	100	8.3	977	19.5
		4	0	45	45	100	5.91	476	9.5
		5	0	45	45	100	7.9	466	9.3
Total Nitrogen	10,000	1	0	19	45	42	< 0.1	0.45	0.005
		2	0	5	45	11	< 0.1	0.16	0.002
		3	0	8	45	18	< 0.1	0.41	0.004
		4	0	12	45	27	< 0.1	0.17	0.002
		5	0	15	45	33	< 0.1	0.49	0.005
Pentachlorophenol	1.0	1	**4**	41	45	91	< 0.04	**2.3**	**230**
		2	**8**	40	45	89	< 0.04	**3.64**	**364**
		3	**10**	36	45	80	< 0.04	**2.45**	**245**
		4	**10**	34	45	76	< 0.04	**2.94**	**294**
		5	**3**	39	45	87	< 0.04	**1.64**	**164**
Xylenes	10,000	1	0	0	45	0	< 1.5	< 1.5	NA
		2	0	0	45	0	< 1.5	< 1.5	NA
		3	0	1	45	2	< 1.5	2.55	0.03
		4	0	0	45	0	< 1.5	< 1.5	NA
		5	0	0	45	0	< 1.5	< 1.5	NA
Toluene	1,000	1	0	20	45	44	< 0.5	26.5	2.7
		2	0	12	45	27	< 0.5	8.02	0.8
		3	0	6	45	13	< 0.5	1.28	0.1
		4	0	12	45	27	< 0.5	9.87	1.0
		5	0	23	45	51	< 0.5	21.6	2.2

Table 5-9: Frequency of Detected [1] Common and Priority Pollutant Screen Analytes [2] - Year 3

Analyte	MADL (µg/L)	Event	Exceedances 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	14	45	31	< 0.00962	0.0844	42.2
		2	0	11	45	24	< 0.00962	0.0842	42.1
		3	**1**	20	45	44	< 0.00962	**0.236**	**118.0**
		4	0	19	45	42	< 0.00962	0.117	58.5
		5	**1**	22	45	49	< 0.00962	**0.628**	**314**
Di(2-ethylhexyl) phthalate	6.0	1	**3**	19	45	42	< 0.962	**92.9**	**1548.3**
		2	0	20	45	44	< 0.962	5.59	93.2
		3	**6**	28	45	62	< 0.962	**129**	**2150**
		4	**4**	31	45	69	< 0.962	**8.08**	**134.7**
		5	**2**	25	45	56	< 0.962	**6.56**	**109.3**
Priority Pollutant Screen									
2,4-D	70.0	1	0	12	45	27	< 0.1	6.61	9.4
		2	0	6	45	13	< 0.1	< 1	NA
		3	0	4	45	9	< 0.1	3.58	5.1
		4	0	1	45	2	< 0.1	0.108	0.2
		5	0	10	45	22	< 0.1	5.91	8.4

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 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel No. 2. This table does not include the results of duplicate samples or laboratory reanalyses.

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

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

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: Laboratory QC Issues for Permit Year 3

Event	Method	Issue	Affected Samples	Cause	Actions Taken	Usability
1	200.8	Field duplicate RPD failures: P6_7 cadmium 5.11/6.33 (21.3%), SP2_1 copper 7.36/9.86 (29.0%)	P6_7 (cadmium), SP2_1 (copper)	Non-homogeneous samples, low concentrations	Values qualified with “J”, no other QC issues, no other action taken.	Usable with qualifiers
	8270-SIM	Missed hold time for sample reanalysis (sample reanalysis conducted independently by TA in response to QC issues)	None (P6_1 RE)	Sample re-analyzed due to DEHP method blank contamination in sample original batch	Original data used, reanalysis performed eleven days after extraction hold time expired, data not used.	Reanalysis data not used
	8270-SIM	DEHP method blank contamination (9.02 ug/l) in batch 7101066	P3_6, P6_1	Laboratory contaminant	DEHP values qualified with "UB" for reported sample values < blank concentration.	Usable with qualifiers
	8270-SIM	Fluorene-d10 surrogate recovery slightly high (132%) for sample FDBLANK	None	Analytical difficulties	None, no analytes detected.	Usable
	8270-SIM	LCS (130%) and MS (270%) fluorene recoveries high (130%) for batch 7100228	P6_6	Analytical difficulties	Fluorene sample value qualified with "JH".	Usable with qualifiers
	8270-SIM	DEHP MS2/MSD2 (-75.7%, -83.7%) under-recovered, MS1/MSD1 RPD failed (63.7%) for batch 7100228	P3_7	Analytical difficulties (laboratory contamination?)	Source sample (P3_7) qualified with "JH", no other QC issues, no other action taken.	Usable with qualifiers
	8270-SIM	Benzo(a)pyrene field duplicate RPD failed 0.0184/ <0.01 ug/l (59.2%)	SP2_1	Non-homogenous samples, low concentrations	Values less than 5x MRL, no action taken.	Usable
	8260	Surrogate recoveries slightly high (120-130%) for dibromofluoromethane	None	Analytical difficulties	No hits for represented analytes in associated samples [P2_7, P3_2, P3_3 (Resample), P3_9, P6_2, P6_14, P6_15, P6_15MS, P6_15MSD, SP2_3, SP2_7, SP2_10, TRIP (P6_1), and V17_Blank (method blank)], no action taken.	Usable
	515.3	Pentachlorophenol dilution run extracted 5 days past extraction hold time	P1_1	Initial run within hold time, dilution run outside hold time	Pentachlorophenol value consistent with historic data but qualified with a “J” for estimated.	Usable with qualifiers
	515.3	Pentachlorophenol method blank contamination (0.0277 ug/l) in batch 7101087	P3_8	Laboratory contaminant	Pentachlorophenol value qualified with "JB" for estimated due to blank contamination, other associated samples non-detect or > 5x blank concentration.	Usable with qualifiers
	515.3	Bentazon (180%, 258%), 2,4-D (147%, 161%), 2,4-DB (168%, 172%), dicamba (141%), 3,5-dichlorobenzoic acid (138%), dichlorprop (143%), picloram (149%, 134%), and 2,4,5-T (136%) were over-recovered in most MS/MSD samples for batch 7100228. RPDs failed for bentazon, dicamba, 3,5-dichlorobenzoic acid.	P6_7, P6_7 DUP, P6_13, SP2_2	Matrix effects	Based on MS/MSD recoveries and gross RPD field duplicate RPD failures, all 2,4-D detects qualified with “JH” for estimated, potential high bias. Other than pentachlorophenol, no other analytes detected, therefore, no other action was taken.	Usable with qualifiers
	515.3	2,4-D (-202%, 148%, -208%), dinoseb (67.1%, 67.0%, 62.2%), pentachlorophenol (3.50%, -15.4%, -1.15%, 8.15%), picloram (141%, 136%, 136%), 2,4,5-T (140%), and 2,4,5-TP (68.9%) were under- or over-recovered in most MS1/MS2/MSD1/MSD2 samples for batch 7100483. RPDs failed for bentazon (MSD1), 2,4,5-T (MSD2), and 2,4,5-TP (MSD2).	P2_14, P3_3, P3_12, P3_15, P6_10, SP2_1, SP2_1 DUP, SP2_8	Matrix effects	Based on MS/MSD recoveries and gross RPD field duplicate RPD failures, all 2,4-D detects qualified with “JH” for estimated, potential high bias. Pentachlorophenol source sample results too high for spike recovery assessment. No other action was taken.	Usable with qualifiers
	515.3	2,4-D (210%) and picloram (132%, 135%), were over-recovered in MS/MSD samples for batch 7101087. RPD failed for 2,4-D (54.3%).	P3_6, P6_1	Matrix effects	2,4-D detects qualified with “JH” for estimated, potential high bias. Picloram not detected, no other issues, no other action taken.	Usable with qualifiers
	515.3	Bentazon (131%,), 3,5-dichlorobenzoic acid (215%, 197%), dichlorprop (139%), and picloram (187%, 156%) were over-recovered in most MS/MSD samples for batch 7110517. No RPD failures.	None	Matrix effects	Analytes not detected, no action taken.	Usable
	515.3	Pentachlorophenol field duplicate RPD failed 0.0712/< 0.04 ug/l (56.1%)	P6_6	Non-homogenous samples, low concentrations	Values less than 5x MRL, no action taken.	Usable
	515.3	2,4-D field duplicate RPDs failed 3.78/< 0.1 ug/l (189.7%), 0.425/3.93 ug/l (161.0%)	P6_7, SP2_1	Non-homogenous samples, low concentrations	All batch data qualified due to MS/MSD over-recoveries and field duplicate RPD failures (see above).	Usable with qualifiers
1/2*	8270-SIM	DEHP MSD over-recovered (4100%, sample value < 1, spike amount 3.88 ug/l, 159 ug/l recovered), RPD failed (193%) for batch 7110816	None	Analytical difficulties (laboratory contamination?)	All sample values for this batch < 5 ug/l, no other QC issues, no action taken.	Usable
	515.3	3,5-dichlorobenzoic acid over-recovered (155%) in LCS sample for batch 7110944	None	Analytical difficulties	Analyte not detected in associated samples, no action taken.	Usable
	515.3	Bentazon (131%,), dicamba (134%, 137%), 3,5-dichlorobenzoic acid (169%, 177%), dinoseb (69.8%), dichlorprop (167%, 196%), pentachlorophenol (154%), and picloram (256%, 233%) were under- or over-recovered in most MS/MSD samples for batch 7110944. No RPD failures.	None	Matrix effects	Analytes not detected, no action taken.	Usable
	515.3	2,4-DB (60.0%), 3,5-dichlorobenzoic acid (138%, 176%, 139%, 167%), pentachlorophenol (-621%, -621%), and picloram (135%) were over- or under-recovered in most MS1/MS2/MSD1/MSD2 samples for batch 7111028. No RPD failures. Pentachlorophenol MS2/MSD2 results exceeded linear range and not available for reporting.	None	Matrix effects	Most analytes not detected, no action taken. All other pentachlorophenol QC acceptable, no action taken.	Usable

Table 6-2: Laboratory QC Issues for Permit Year 3

Event	Method	Issue	Affected Samples	Cause	Actions Taken	Usability
2	200.8	Field duplicate RPD failure; chromium 90.9%, copper 21.2%	P3_11	Non-homogeneous samples, low concentrations	Chromium values < 5x MRL, no qualifiers, copper values qualified with “J”. No other QC issues, no other action taken.	Usable with qualifiers
	8270-SIM	Missed hold time for sample reanalysis (batch 7120197--sample reanalysis conducted independently by TA in response to QC issues)	Various (see MS/MSD issues for same sample batch)	Samples re-analyzed due to LCS and MS/MSD issues in sample original batch	Original data used, reanalysis performed eleven days after extraction hold time expired, data not used.	Reanalysis data not used
	8270-SIM	Surrogate recovery for fluorene-d10 slightly high (132%) for sample FDBLANK	None	Analytical difficulties	None, no analytes detected.	Usable
	8270-SIM	DEHP LCS (202%, spike amount 4.00 ug/l, 8.08 ug/l recovered) and MSD (sample value 2.36 ug/l, spike amount 3.88 ug/l, 61.6 ug/l recovered) over-recovered, MS/MSD RPD failed (178%) for batch 7120197	3RA_3, P2_7, P3_9, P3_10, P3_15, P6_4, P6_8, SP2_10	Likely laboratory contamination	Reanalysis results provided by TA though all reanalyses performed outside of hold time. Reanalysis results similar to original results (some results higher, some lower) with none varying more than by a factor of 2.75 or 0.5. Original results used and all qualified with “JH” for potential high bias.	Usable with qualifiers
	8270-SIM	Fluorene (158%, 131%) over-recovered, no RPD failures, for batch 7120116	None	Analytical difficulties	Few fluorene detects, all slightly above MRL. All other QC acceptable, no action taken.	Usable
	8270-SIM	Benzo(a)pyrene field duplicate RPD failed 0.0286/ 0.014 ug/l (66.0%)	P6_15	Non-homogenous samples, low concentrations	Values less than 5x MRL, no action taken.	Usable
	515.3	Surrogate recoveries high for various samples in batch 7120208	3RA_3, P2_7, P3_10, P6_3, P6_15 DUP, SP2_3, SP2_5, SP2_9	Analytical difficulties	All pentachlorophenol (all samples listed) and 2,4-D (SP2_3, SP2_5) detects qualified with “JH” for estimated, probable high bias. No other analytes detected.	Usable with qualifiers
	515.3	Surrogate recoveries high for various samples in batch 7120328	P3_9, SP2_8, SP2_10	Analytical difficulties	All pentachlorophenol detects qualified with “JH” for estimated, probable high bias. No other analytes detected.	Usable with qualifiers
	515.3	Surrogate recovery high for sample P6_6	None	Analytical difficulties	No analytes detected, no action taken.	Usable
	515.3	2,4-D over-recovered (241%) in LCS sample for batch 7120208	None	Analytical difficulties	Analyte not detected in associated samples, no action taken.	Usable
	515.3	Dicamba (152%), 3,5-dichlorobenzoic acid (305%), and pentachlorophenol (177%) over-recovered in LCS sample for batch 7120328	(See below)	Analytical difficulties	No analytes detected except for pentachlorophenol. No action taken except as noted under MS/MSD results.	Usable
	515.3	Dicamba (152%, 142%, 153%, 152%), 3,5-dichlorobenzoic acid (305%, 297%, 359%, 330%), and pentachlorophenol (177%, 147%, 136%, 219%) were over-recovered in most MS1/MS2/MSD1/MSD2 samples for batch 7120328. No RPD failures.	P3_9, P3_15, P6_10, P6_14, SP2_4, SP2_4 DUP, SP2_6, SP2_8, SP2_10	Matrix effects	Most analytes not detected, no action taken. Pentachlorophenol results qualified with “JH” for estimated, probable high bias.	Usable with qualifiers
	515.3	3,5-dichlorobenzoic acid (188%, 229%), pentachlorophenol (135%, 190%), picloram (148%), and 2,4,5-T (134%) were over-recovered in most MS/MSD samples for batch 7120208. No RPD failures.	None	Matrix effects	Attributed by TA to matrix effects, no analytes other than pentachlorophenol detected. Most detects already qualified due to high surrogate recoveries, no additional action taken.	Usable with qualifiers
	515.3	Pentachlorophenol field duplicate RPD failed 0.168/0.12 ug/l (33.3%)	SP2_4	Non-homogenous samples, low concentrations	Values less than 5x MRL, no qualifiers assigned.	Usable
	515.3	2,4-D field duplicate RPD failed 0.2/< 0.1 ug/l (66.7%)	P3_11	Non-homogenous samples, low concentrations	Values less than 5x MRL, no qualifiers assigned.	Usable
3	200.8	Dissolved mercury laboratory replicate RPD failure	P6_10	Non-homogeneous samples, low concentrations	None, concentrations < 5x MRL.	Usable
	200.8	Field duplicate RPD failure; zinc 36.5%	P6_13	Non-homogeneous samples, low concentrations	Zinc values qualified with “J”, no other QC issues, no other action taken.	Usable with qualifiers
	8270-SIM	Missed hold time for sample reanalysis (sample reanalysis conducted independently by TA in response to QC issues)	P2_7, P6_4 (reanalysis data used only for comparison)	Samples re-analyzed due to DEHP method blank contamination in batch 8010385	Some concentrations dropped significantly despite extraction four days later and analysis two days later than original analyses. Original data qualified with “JH” for estimated, potential high bias.	Usable with qualifiers
	8270-SIM	DEHP method blank contamination (0.819 ug/l) in batch 8010385	P3_12, P3_15, P6_8, P6_14	Laboratory contaminant	DEHP values qualified with "JB" for reported sample values < 10x blank concentration.	Usable with qualifiers
	8270-SIM	DEHP field duplicate RPD failed <0.971/6.37 ug/l (147.1%)	P3_8	Laboratory contamination?	Primary sample qualified with “UJ”, duplicate qualified with “JH”, no other QC issues, no other action taken.	Usable with qualifiers
	515.3	Acifluorfen (140%,), 2,4-DB (168%, 151%), dicamba (172%, 149%), 3,5-dichlorobenzoic acid (201%, 160%), dichlorprop (146%), pentachlorophenol (69.6%), 2,4,5-T (148%, 131%), and 2,4,5-TP (158%, 134%) were over-recovered in most MS/MSD samples for batch 8010392. No RPD failures.	None	Matrix effects	Most analytes not detected, no action taken. All other QC for pentachlorophenol acceptable, no action taken.	Usable
	515.3	2,4-D (140%), dicamba (137%), 3,5-dichlorobenzoic acid (136%, 132%), and picloram (146%, 147%) were over-recovered in most MS/MSD samples for batch 8010334. No RPD failures.	None	Matrix effects	Analytes not detected, no action taken.	Usable
	515.3	Pentachlorophenol (-22.1%, 14.8%), picloram (139%, 145%, 142%, 142%), 2,4,5-T (144%), and 2,4,5-TP (62.2%) were under- or over-recovered in most MS1/MS2/MSD1/MSD2 samples for batch 8010219. No RPD failures.	None	Matrix effects	Pentachlorophenol MS2/MSD2 source sample results too high for spike recovery assessment. All other QC acceptable, no action taken.	Usable

Table 6-2: Laboratory QC Issues for Permit Year 3

Event	Method	Issue	Affected Samples	Cause	Actions Taken	Usability
	515.3	2,4-D field duplicate RPD failed 0.206/< 0.1 ug/l (69.3%)	P6_9	Non-homogenous samples, low concentrations	Values less than 5x MRL, no qualifiers assigned.	Usable
	EPA 8260	Chlorobenzene detected in trip blank (FO080395) at 0.20 ug/l (= to MRL)	None	Unknown	Chlorobenzene not detected in associated samples, no action taken.	Usable
	EPA 8260	Low MS recoveries and high RPDs (50-60%) for 3/13/08 Batch 2	None	No mixing beads added during analysis	MSD recoveries acceptable, data judged not to be affected.	Usable
	8270-SIM	Missed hold time for sample reanalysis (sample reanalysis conducted independently by TA in response to QC issues)	None (reanalysis data used only for comparison)	Samples re-analyzed due to DEHP method blank contamination in batch 8020090	Reanalysis extractions performed 18 days after extraction holding time expired, data not used for final data set due to gross holding time exceedence.	Original data usable with qualifiers
	8270-SIM	DEHP method blank contamination (0.538 ug/l) in batch 8020090	P1_1, P2_14, P3_1, P3_1 DUP, P3_3, P3_11, P3_13, P3_15, P6_5, SP2_9	Laboratory contaminant	DEHP values qualified with "JB" for reported sample values < 10x blank concentration.	Usable with qualifiers
	8270-SIM	Missed hold time for sample reanalysis (sample reanalysis conducted independently by TA in response to QC issues)	None (reanalysis data used only for comparison)	Samples re-analyzed due to DEHP method blank contamination in batch 8011065	Reanalysis extractions performed eight days after extraction holding time expired, data not used for final data set due to partially comparable results.	Original data usable with qualifiers
	8270-SIM	DEHP method blank contamination (1.27 ug/l) in batch 8011065	P2_5, P3_5, P3_8, P3_9, P6_6, P6_11, P6_12, P6_13	Laboratory contaminant	DEHP values qualified with "JB" for reported sample values < 10x blank concentration and "UB" for sample values < method blank concentration.	Usable with qualifiers
	8270-SIM	Missed hold time for sample reanalysis (sample reanalysis conducted independently by TA in response to QC issues)	None (reanalysis data used only for comparison)	Samples re-analyzed due to DEHP method blank contamination in batch 8030496	Reanalysis extractions performed 14 days after extraction holding time expired, data not used for final data set due to partially comparable results.	Original data usable with qualifiers
	8270-SIM	DEHP method blank contamination (5.57 ug/l) in batch 8030496	P3_6, P3_6 DUP, P6_4, P6_14, P6_15, SP2_3, SP2_3 DUP, SP2_10	Laboratory contaminant	DEHP values qualified with "JB" for reported sample values < 10x blank concentration and "UB" for sample values < method blank concentration.	Usable with qualifiers
	8270-SIM	Missed hold time for sample reanalysis (sample reanalysis conducted independently by TA in response to QC issues)	None (reanalysis data used only for comparison)	Samples re-analyzed due to DEHP method blank contamination in batch 8030552	Reanalysis extractions performed 14 days after extraction holding time expired, data not used for final data set due to partially comparable results.	Original data usable with qualifiers
	8270-SIM	DEHP method blank contamination (10.2 ug/l) in batch 8030552	P3_2, P3_7, P3_14, P6_2, P6_3, SP2_2, SP2_5, SP2_6, SP2_8	Laboratory contaminant	DEHP values qualified with "UB" for sample values < method blank concentration.	Usable with qualifiers
	8270-SIM	Missed hold time for sample reanalysis (initial run reported as "seriously compromised", reanalysis conducted independently by TA in response)	P6_8	Sample re-analyzed due to QC issues	Reanalysis extractions performed 14 days after extraction holding time expired, all sample values qualified with "J" for estimated.	Usable with qualifiers
	8270-SIM	Pyrene method blank contamination (0.0286 ug/l) in batch 8030375	SP2_4 DUP	Laboratory contaminant	Internal standard failed for SP2_4 DUP reanalysis failed, original value qualified with "UB"; all other samples reanalyzed within hold time.	Usable with qualifiers
	8270-SIM	DEHP LCS (LCS 171%/LCSD 294%, spike amount 4.00 ug/l, 6.85/11.8 ug/l recovered) over-recovered for batch 8030552	all detects already qualified due to method blank contamination	Likely laboratory contamination	No additional action taken.	Usable with qualifiers
	8270-SIM	LCS benzo(ghi)perylene over-recovered (129%)	P3_6 DUP, P6_4, P6_14, P6_15, SP2_3, SP2_3 DUP, SP2_10	Analytical difficulties	Associated samples qualified with "JH".	Usable with qualifiers
4	8270-SIM	DEHP (-77.4%, -70.0%) under-recovered in MS/MSD sample (sample value 8.08, spike amount 3.88/3.96 ug/l, 5.07/5.36 ug/l recovered) for batch 8020090	P2_13, P6_1, P6_10	Analytical difficulties (laboratory contamination?)	Most sample values qualified due to method blank contamination. Remaining detects, including MS source sample, qualified with “JH”.	Usable
	8270-SIM	DEHP (199%) over-recovered in MSD sample (sample value 1.61, spike amount 3.96 ug/l, 9.48 ug/l recovered) for batch 8030496	P3_6, P3_6 DUP, P6_4, P6_14, P6_15, SP2_3, SP2_3 DUP, SP2_10	Analytical difficulties (laboratory contamination?)	All detects already qualified due to method blank contamination.	Usable with qualifiers
	8270-SIM	Benzo(a)pyrene field duplicate RPD failed 0.028/0123 ug/l (76.4%)	P3_1	Non-homogenous samples, low concentrations	Values less than 5x MRL, no action taken.	Usable
	8270-SIM	DEHP field duplicate RPDs failed 5.95/3.4 (54.5%), 3.21/1.42 (77.3%)	P3_6, SP2_3	Laboratory contamination?	All associated DEHP sample data already qualified due to method blank contamination, no other action taken.	Usable with qualifiers
	8260	Chlorobenzene detected in trip blank.	None	Field contamination?	None, not detected in associated samples (P3_6, P3_6 DUP, P6_15).	Usable
	8260	Low MS recoveries and high MS/MSD RPDs	P6_4	Failure to add mixing beads during analysis	None, MSD recoveries acceptable, no other issues, samples judged not to be affected (Note: source sample used for this analytical batch from non-UIC project).	Usable
	515.3	Picloram over-recovered (148%) in LCS sample for batch 8030691	None	Analytical difficulties	Analyte not detected in associated samples, no action taken.	Usable
	515.3	Acifluorfen (192%, 215%, 162%, 190%), 2,4-D (144%, 134%), 2,4-DB (154%, 158%, 139%, 146%), dicamba (131%), 3,5-dichlorobenzoic acid (156%, 147%, 144%, 141%), dichlorprop (132%), pentachlorophenol (66.4%), picloram (163%, 187%, 183%, 168%), and 2,4,5-T (159%, 151%, 143%, 143%) were over- or under-recovered in most MS1/MS2/MSD1/MSD2 samples for batch 8020137. No RPD failures.	None	Matrix effects	No analytes detected except for pentachlorophenol. All other QC acceptable, no action taken.	Usable

Table 6-2: Laboratory QC Issues for Permit Year 3

Event	Method	Issue	Affected Samples	Cause	Actions Taken	Usability
	515.3	Acifluorfen (137%), 2,4-DB (158%, 144%), pentachlorophenol (282%, 140%), picloram (131%), and 2,4,5-T (581%, 304%) were over-recovered in most MS/MSD samples for batch 8020263. No RPD failures.	None	Matrix effects	No analytes detected except for pentachlorophenol. All other QC acceptable, no action taken.	Usable
	515.3	Pentachlorophenol (66.6%) under-recovered in MSD sample for batch 8020435, no RPD failures.	None	Matrix effects	All other QC acceptable, no action taken.	Usable
	515.3	2,4-D (145%), 2,4-DB (188%, 183%), 3,5-dichlorobenzoic acid (135%), pentachlorophenol (-254%, -256%), picloram (142%, 171%), and 2,4,5-T (154%, 166%) were over- or under-recovered in most MS/MSD samples for batch 8030523. No RPD failures except for 3,5-dichlorobenzoic acid (30.3%). Pentachlorophenol MS/MSD results exceeded linear range and not available for reporting.	None	Matrix effects	Most analytes not detected, no action taken. All other pentachlorophenol QC acceptable, no action taken.	Usable
	515.3	Bentazon (186%), 2,4-D (134%), pentachlorophenol (56.6%), picloram (170%, 159%), and 2,4,5-T (155%, 140%) were over- or under-recovered in most MS/MSD samples for batch 8030691. No RPD failures except for bentazon (40.0%) and 3,5-dichlorobenzoic acid (39.2%).	None	Matrix effects	Most analytes not detected, no action taken. All other pentachlorophenol QC acceptable, no action taken.	Usable
	515.3	Pentachlorophenol field duplicate RPD failed 0.04/0247 ug/l (144.3%)	P3_1	Non-homogenous samples, low concentrations	Duplicate value > 5x MRL, both values qualified with “J”, no other QC issues, no other action taken.	Usable with qualifiers
	300	Failed to run laboratory duplicate for one nitrate-nitrogen analytical batch.	None	Vial cap failure on laboratory instrument overnight run, reanalysis could not be completed within hold time	No other QC issues, no action taken.	Usable
5	200.8	Field duplicate RPD failure; lead 22.1%	SP2_1	Non-homogeneous samples, low concentrations	Lead values qualified with “J”, no other QC issues, no other action taken.	Usable with qualifiers
	8270-SIM	DEHP and naphthalene method blank contamination (concentrations not reported) in batch 8041159	None	Laboratory contaminant	Samples reanalyzed within hold time, no QC issues with reanalyses, only reanlaysis results reported by TA.	Usable
	8270-SIM	DEHP method blank contamination (0.560 ug/l) in batch 8040973	SP2_2 DUP	Laboratory contaminant	DEHP value qualified with "JB", all other samples non-detect or reanalyzed within hold time.	Usable with qualifiers
	8270-SIM	DEHP method blank contamination (0.681 ug/l) in batch 8041045	None	Laboratory contaminant	None, all samples non-detect or reanalyzed within hold time.	Usable
	515.3	Surrogate recovery high	SP2_5	Analytical difficulties	Pentachlorophenol only analyte detected, qualified with “JH” for estimated, probable high bias.	Usable with qualifiers
	515.3	Aciflourfen (138%), dicamba (135%), and picloram (184%) over-recovered in LCS sample for batch 8040642	None	Analytical difficulties	No analytes detected except for pentachlorophenol. No action taken except as noted under MS/MSD results.	Usable
	515.3	2,4-D (146%), picloram (215%, 217%, 224%, 218%), and 2,4,5-T (158%, 162%, 169%, 162%) were over-recovered in most MS/MSD samples for batch 8040976. No RPD failures.	None	Matrix effects	Only 2,4-D, dicamba, and pentachlorophenol detected, no other QC issues, no action taken.	Usable
	515.3	Bentazon (132%, 132%), 2,4-D (178%), 2,4-DB (143%, 137%), dicamba (141%, 153%), 3,5-dichlorobenzoic acid (176%, 177%), pentachlorophenol (-215%, -181%), picloram (162%, 183%), and 2,4,5-T (159%, 164%) were over- or under-recovered in most MS/MSD samples for batch 8040642. No RPD failures except for 2,4-D (33.3%).	None	Matrix effects	Most analytes not detected, no action taken. Pentachlorophenol MS/MSD analyses required sample dilution due to elevated source sample concentration and matrix effects, spike amount too low for evaluating matrix effects. All other pentachlorophenol QC acceptable, no action taken.	Usable
	515.3	3,5-dichlorobenzoic acid (132%) and picloram (219%, 192%) were over-recovered in most MS/MSD samples for batch 8040106. No RPD failures.	None	Matrix effects	Analytes not detected, no action taken.	Usable
	515.3	Pentachlorophenol field duplicate RPD failed 0.0847/0.127 ug/l (40.0%)	SP2_1	Non-homogenous samples, low concentrations	Values less than 5x MRL, no action taken.	Usable
	515.3	2,4-D field duplicate RPDs failed < 0.1/0.189 ug/l (61.6%), < 0.1/0.207 ug/l (69.7%)	SP2_1, SP2_7	Non-homogenous samples, low concentrations	Values less than 5x MRL, no action taken.	Usable

Notes:

* = Some samples from Events 1 and 2 analyzed as part of the same analytical batches by TA
Batch numbers are included in Laboratory Reports presented in Appendix C of the *Annual Stormwater Discharge Monitoring Report – Year 3*, July 2008.
CCV = continuing calibration verification
DEHP = di(2-ethylhexyl)phthalate
DUP = field duplicate
LCS = laboratory control sample
MDL = method detection limit
MRL = method reporting limit
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control
RPD = relative percent difference
TA = TestAmerica

Table 7-1: Summary of Year 3 MADL Exceedances - Common Pollutants

Analyte	Location Code	Traffic Category (TPD)	MADL (ug/L)	Event (concentration (µm/L)) [1]				
				1	2	3	4	5
Benzo(a)pyrene	P3_9	≥1000	0.2	<0.00971	0.0271	0.0383	0.117	**0.628**
	SP2_3	<1000		0.0334	0.0238	**0.236** [2]	0.0108, 0.00985 [3]	0.0428
Di(2-ethylhexyl) phthalate	P2_13	≥1000	6.0	<0.971	<0.962	<0.99, 1.43	**7.16**	<0.98
	P2_7	<1000		5.26	1.6	**129**	<0.98	<0.99
	P3_2	<1000		**92.9**	<0.971	<0.971	3.32	3.82
	P3_6	≥1000		<1	1.19	**8.78**	3.4, 5.95	1.88
	P3_7	≥1000		**7.65**	1.54, 1.23	**13**	1.3	1.81
	P3_8	<1000		<1	<0.962	**6.37**, <0.971	<0.98	<0.971, <0.971
	P3_9	≥1000		<0.971	2.36	2.27	3.43	**6.07**
	P6_1	≥1000		4.75	1.5	3.67	**8.08**	3.42
	P6_10	≥1000		1.51	1.26	2.22	**7.93**	2.79
	P6_3	<1000		**11.6**	<0.971	<0.971	<0.98	<0.99
	P6_4	<1000		<0.962	1.02	**91.9**	1.61	<0.971
	SP2_5	≥1000		4	3.05	5.25	**6.42**	**6.56**
	SP2_9	≥1000		1.16	<0.971	**31**	2.93	1.13
Lead (total)	P2_14	≥1000	50.0	**105**	2.96	2.74	11.1	**52.7**
	P2_5	≥1000		14.9	11.7	18.4	20.5	**75.6**
	P3_1	≥1000		**50.7**	8.99	26.1	**107, 104**	8.7
	P3_5	≥1000		**64.6**	14	7.58	37	19
	P6_12	≥1000		7.19	5.95	4.67	14.2	**95.1**
	SP2_9	≥1000		6.64	**51.8**	**71.6**	**57.8**	40.8

Table 7-1: Summary of Year 3 MADL Exceedances - Common Pollutants

Analyte	Location Code	Traffic Category (TPD)	MADL (ug/L)	Event (concentration (µm/L)) [1]				
				1	2	3	4	5
Pentachlorophenol	P1_1	<1000		**1.17**	<0.04	**1.21**	**1.01**	**1.22**
	P2_13	≥1000		0.54	**1.27**	**1.34, 1.24**	**2.25**	0.696
	P2_14	≥1000		0.529	**2.2**	**1.79**	**2.18**	0.784
	P2_5	≥1000		**2.3**	**1.24**	**2.34**	**2.94**	0.744
	P2_7	<1000		0.998	0.881	**2.05**	0.685	0.598
	P3_15	<1000		0.665	0.962	0.578	**1.41**	**1.38**
	P3_3	≥1000		0.539	0.883	**1.02**	**1.08**	0.72
	P3_5	≥1000		0.483	0.643	**1.13**	0.574	0.47
	P3_9	≥1000		0.705	**1.21**	0.742	0.409	0.28
	P6_1	≥1000		**1.11**	**2.52**	**1.3**	**1.24**	0.845
	P6_14	≥1000		1	**3.64**	**2.45**	**1.72**	0.504
	P6_15	≥1000		0.354	0.184, 0.211	0.287	**1.2**	0.268
	P6_4	<1000		**1.41**	0.633	0.511	**2.05**	**1.64**
	P6_7	<1000		0.631, 0.526	**1.11**	**1.06**	0.4	0.456
	SP2_8	≥1000		0.793	**1.15**	0.684	0.747	0.777

Notes:

[1] This table includes only those analytes detected at concentrations ≥ the MADL during at least one sampling event.

[2] Bolded numbers exceed the MADL.

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

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 3 Annual Mean Concentrations - Common Pollutants

Analysis	MADL	Location Code [1]	Traffic Category (TPD)	Average [2] (µg/L)	Geometric Mean [2] (µg/L)	Minimum [3] (µg/L)	Maximum [3] (µg/L)
Benzo(a)pyrene	0.2	P3_9	≥1000	0.2	0.1	< 0.004855	0.628
		SP2_3	<1000	0.1	0.03	0.00985	0.236
Di(2-ethylhexyl) phthalate	6.0	P2_13	≥1000	1.8	0.9	< 0.481	7.16
		P2_7	<1000	27.4	3.0	< 0.49	129
		P3_2	<1000	20.2	3.1	< 0.4855	92.9
		P3_6	≥1000	3.6	2.4	< 0.5	8.78
		P3_7	≥1000	4.4	2.8	1.23	13
		P3_8	<1000	1.3	0.7	< 0.481	6.37
		P3_9	≥1000	2.9	2.2	< 0.4855	6.07
		P6_1	≥1000	4.3	3.7	1.5	8.08
		P6_10	≥1000	3.1	2.5	1.26	7.93
		P6_3	<1000	2.7	0.9	< 0.4855	11.6
		P6_4	<1000	19.1	2.0	< 0.481	91.9
		SP2_5	≥1000	5.1	4.9	3.05	6.56
		SP2_9	≥1000	7.3	2.3	< 0.4855	31
Lead (total)	50.0	P2_14	≥1000	34.9	13.8	2.74	105
		P2_5	≥1000	28.2	21.8	11.7	75.6
		P3_1	≥1000	50.9	32.4	8.7	107
		P3_5	≥1000	28.4	21.7	7.58	64.6
		P6_12	≥1000	25.4	12.2	4.67	95.1
		SP2_9	≥1000	45.7	35.7	6.64	71.6
Pentachlorophenol	1.0	P1_1	<1000	0.9	0.5	< 0.02	1.22
		P2_13	≥1000	1.2	**1.1** [4]	0.54	2.25
		P2_14	≥1000	1.5	**1.3**	0.529	2.2
		P2_5	≥1000	1.9	**1.7**	0.744	2.94
		P2_7	<1000	1.0	0.9	0.598	2.05
		P3_15	<1000	1.0	0.9	0.578	1.41
		P3_3	≥1000	0.8	0.8	0.539	1.08
		P3_5	≥1000	0.7	0.6	0.47	1.13
		P3_9	≥1000	0.7	0.6	0.28	1.21
		P6_1	≥1000	1.4	**1.3**	0.845	2.52
		P6_14	≥1000	1.9	**1.5**	0.504	3.64
		P6_15	≥1000	0.4	0.3	0.184	1.2
		P6_4	<1000	1.2	**1.1**	0.511	2.05
		P6_7	<1000	0.7	0.6	0.4	1.11
		SP2_8	≥1000	0.8	0.8	0.684	1.15

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] Bold, shaded text indicates pollutant concentration geometric mean exceeds the MADL.

Table 7-4: 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, h] (ft^3)	Year 2 Annual Infiltration Volume[i] (ft^3)	Year 3 Annual Infiltration Volume[j] (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	467,680,308
BGS	20	- [d]	-	-	-	-	-	-	-	-	-	-
Fire	21	-	-	-	-	-	-	-	-	-	-	-
Parks	188	-	-	-	-	-	-	-	-	-	-	-
Water	37	-	37,150	-	0.9	-	37,150	-	0.9	97,983	78,830	77,754
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	467,758,062
Average per UIC[e]	-	94,188	32,704	2.2	0.8	-	-	-	-	NA	NA	NA
Adjusted Average per UIC	-	-	-	-	-	81,561	28,942	1.87	0.66	76,334	61,414	60,575

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)

[h] 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

[i] 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)

[j] 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

Tables

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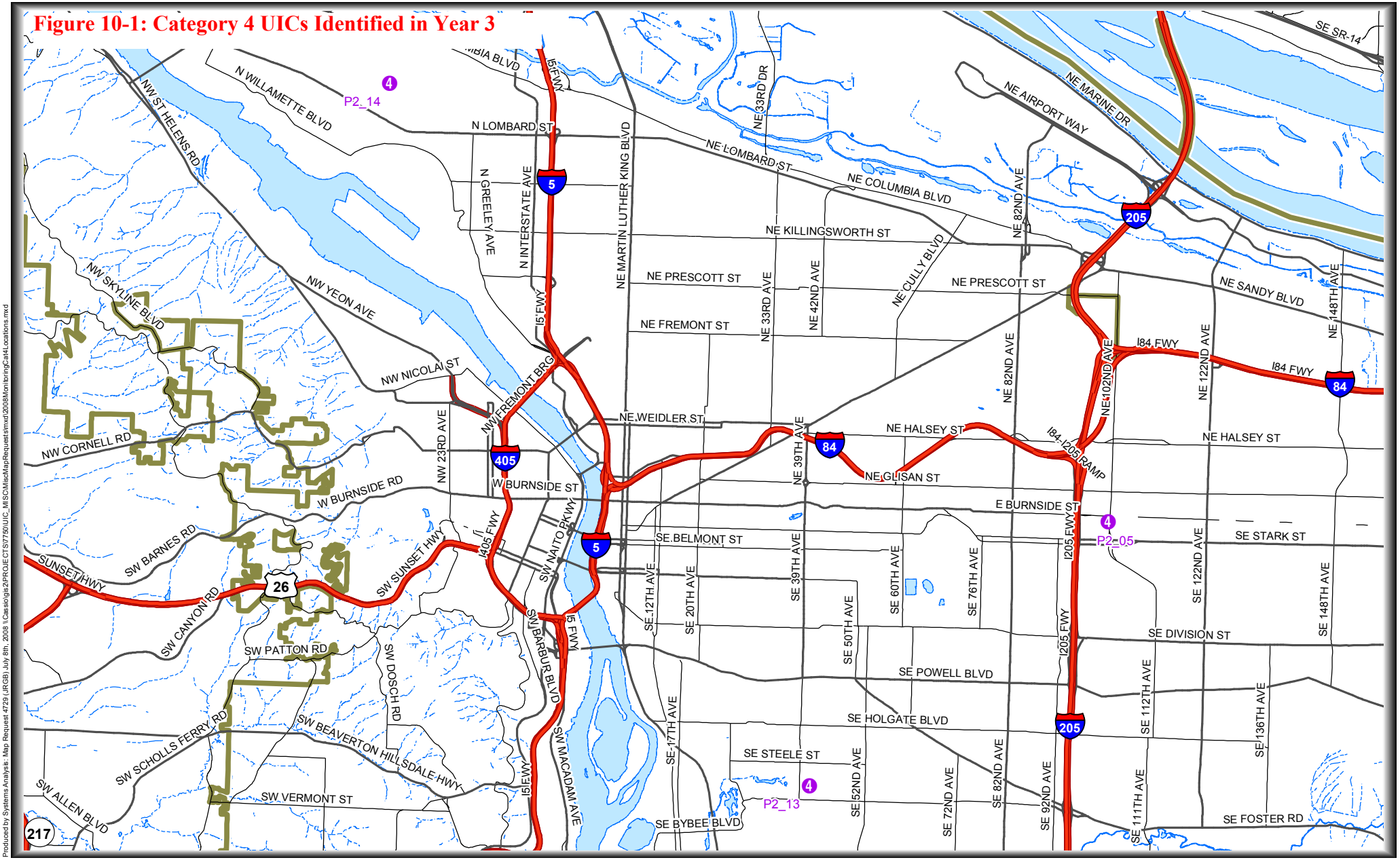
Figure 10-1: Category 4 UICs Identified in Year 3



Produced by Systems Analysis - Map Request 4729 (JRGB) July 8th, 2008 \\Cassio\gis2\PROJECTS\7750\UIC_MISC\MiscMapRequests\mxd\2008MonitoringCat4Locations.mxd

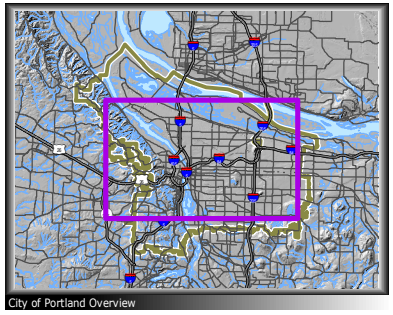
Figure 10-1

2007-2008 UIC
Year 3 Category 4 Locations

0 1 2 Miles

Legend

- City of Portland
- Rivers and Lakes
- Stream Lines
- 4 Cat-4 UIC Location


City of Portland Overview

State of Oregon Overview

City of Portland
Environmental Services
Systems Analysis
Spatial Analysis and Modeling

This map was produced in support of the City of Portland's Water Pollution Control Facilities Permit #102830 for Class V Stormwater Underground Injection Control Systems, issued by Oregon Department of Environmental Quality on June 1, 2005.
Data were compiled from various sources. This product was developed through digital means and may be updated without notification. No warranty is made by the City of Portland Bureau of Environmental Services as to the accuracy, reliability, or completeness of these data. Data shown are to be used for reference purposes only; maps should not be used to determine jurisdictional authority, ownership, or operations and maintenance responsibilities.

Printing Date : Jul 8, 2008

Figure 3-1: City of Portland UIC Locations

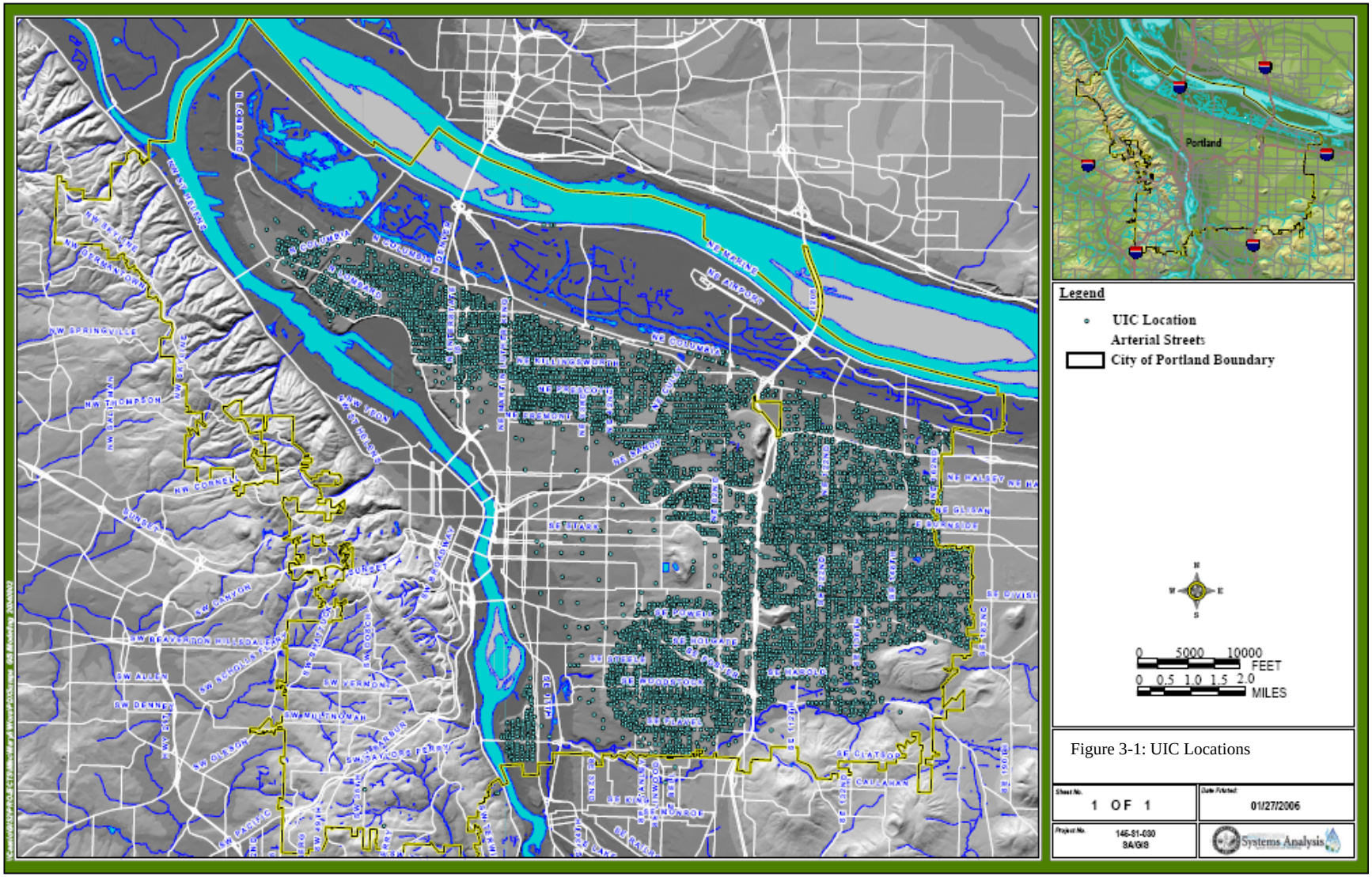
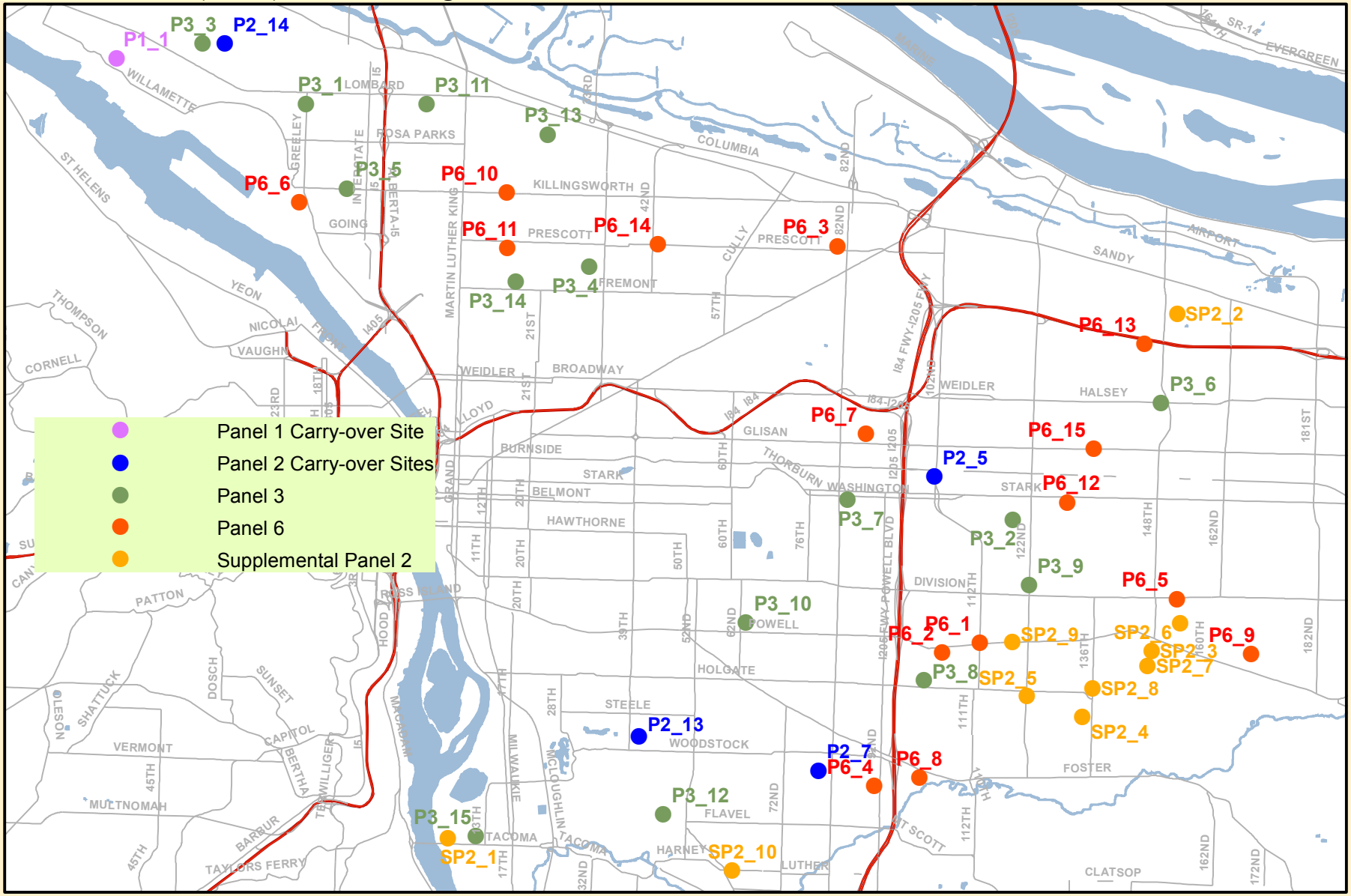


Figure 3-2: 2007-2008 (Year 3) UIC Monitoring Locations



2007-08 (Year 3) UIC Monitoring Locations

Investigations & Monitoring Services
Bureau of Environmental Services

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

Figure 5-1: Year 3 Event 1 Hydrograph

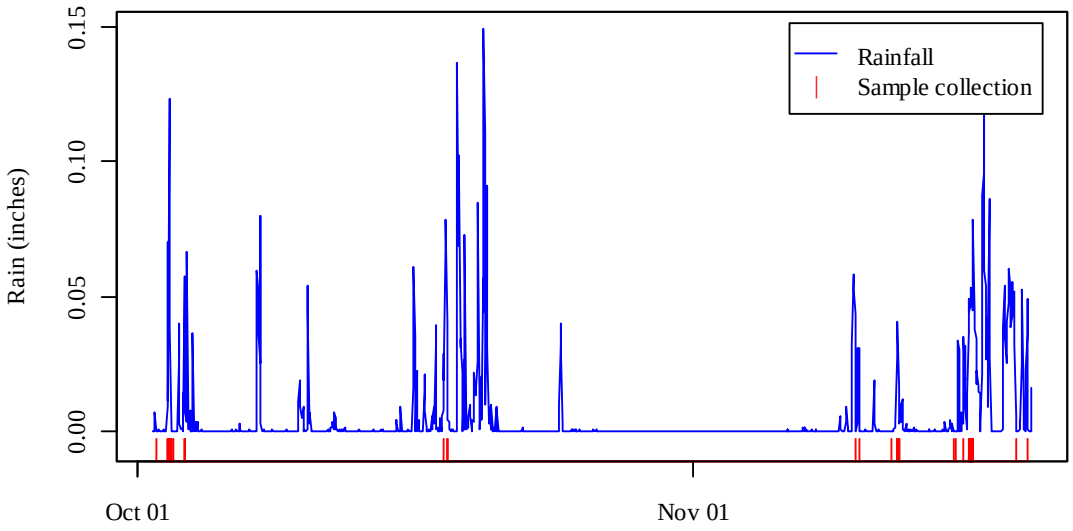


Figure 5-2: Year 3 Event 2 Hydrograph

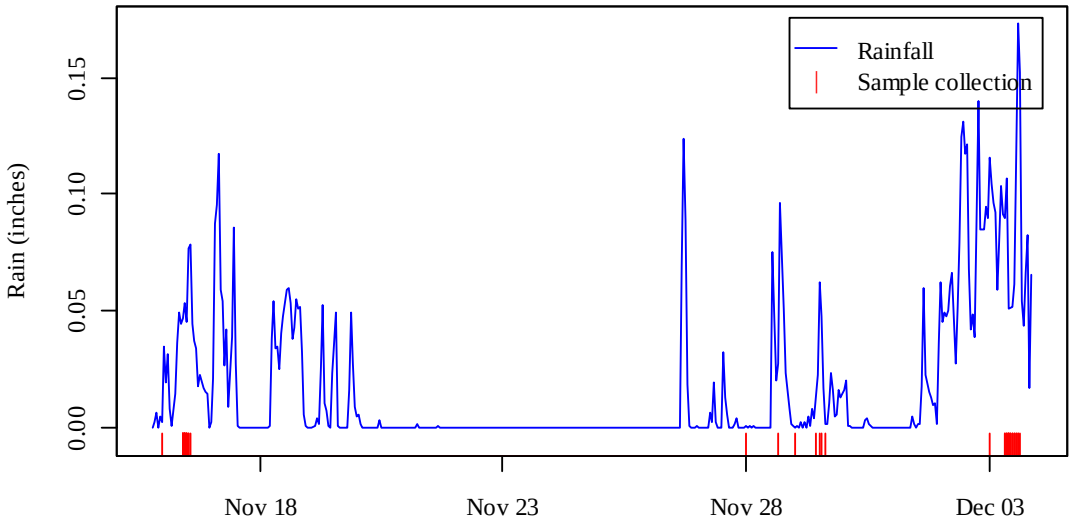


Figure 5-3: Year 3 Event 3 Hydrograph

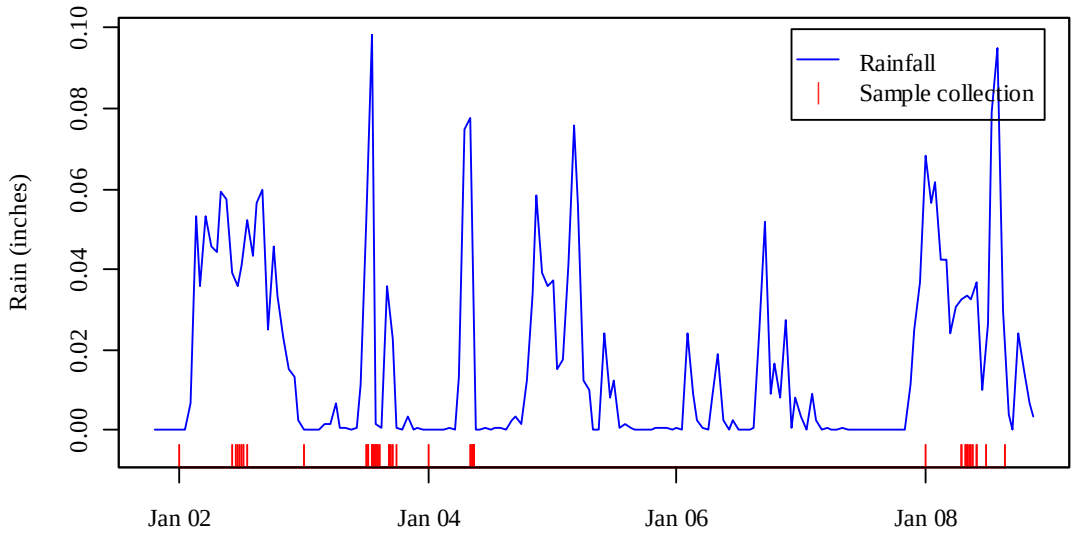


Figure 5-4: Year 3 Event 4 Hydrograph

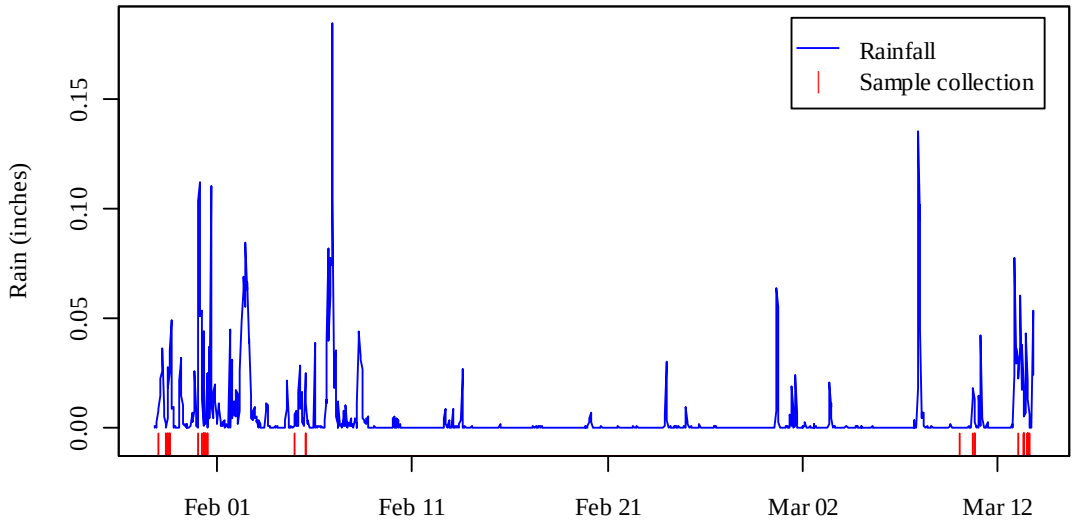


Figure 5-5: Year 3 Event 5 Hydrograph

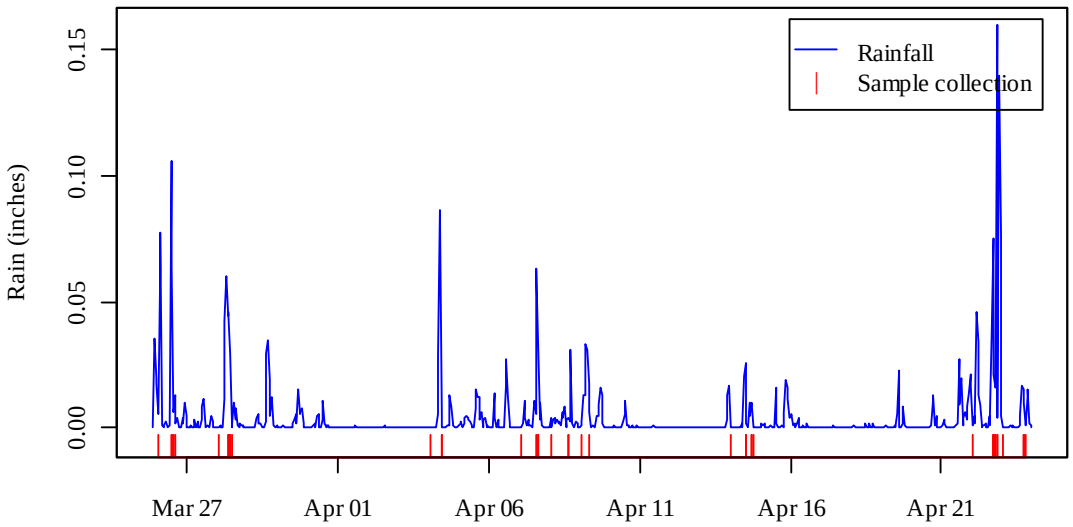
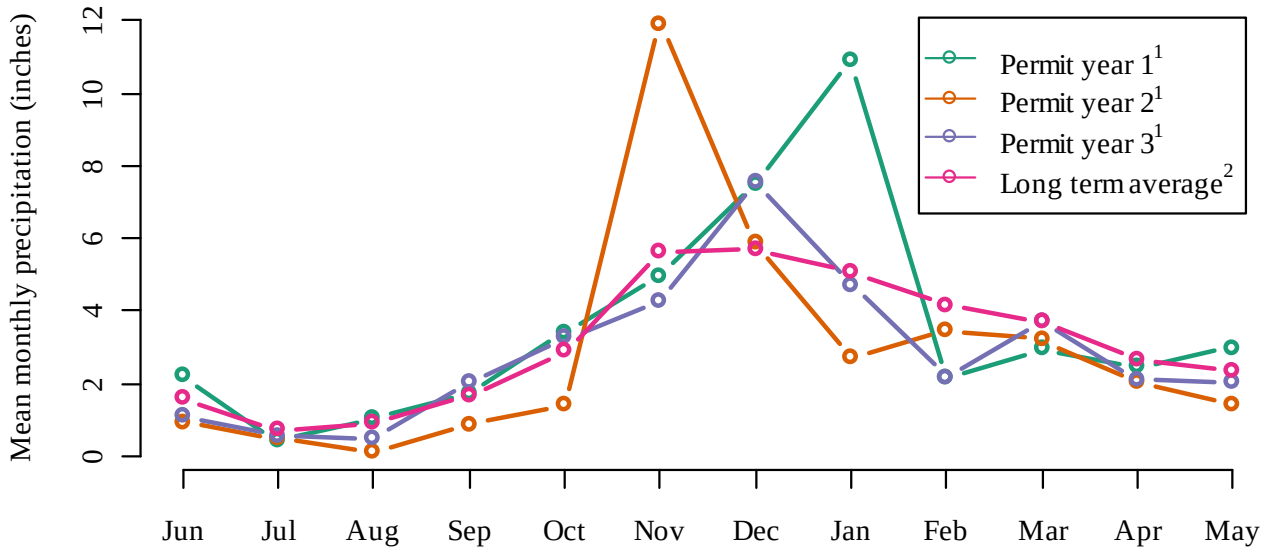


Figure 5-6: Regional Precipitation Data



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 7-1: Definition of a Box Plot

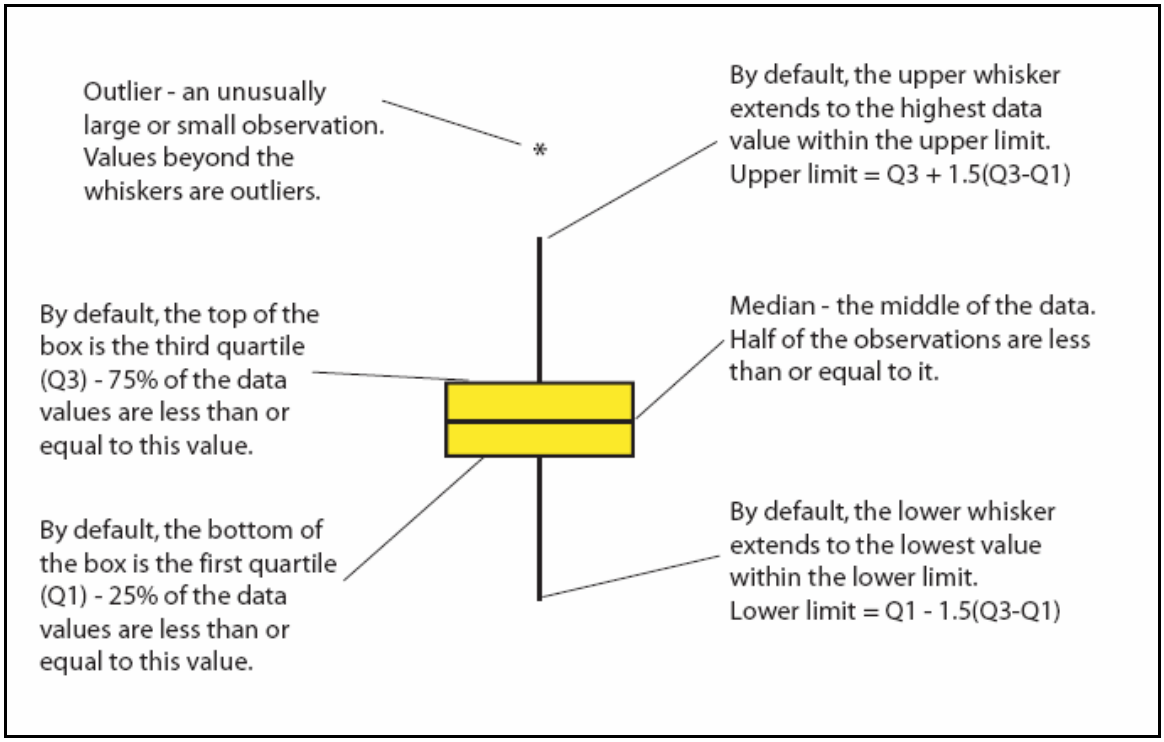


Figure note:
From Minitab®, version 14, 2006

Figure 7-10: Year 3 Total Suspended Solids Concentrations by Traffic Category

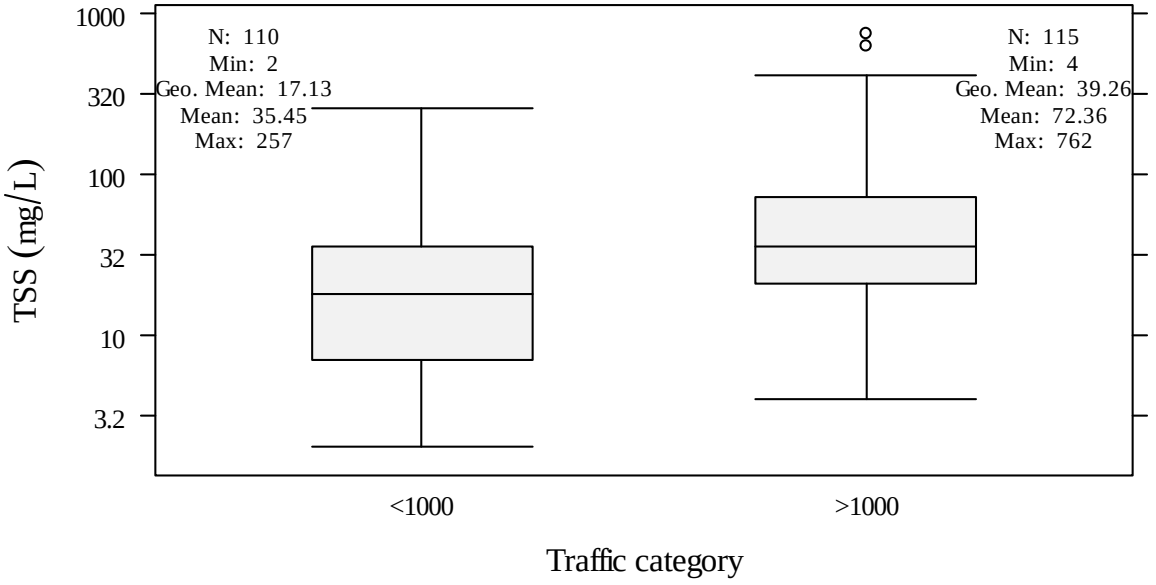
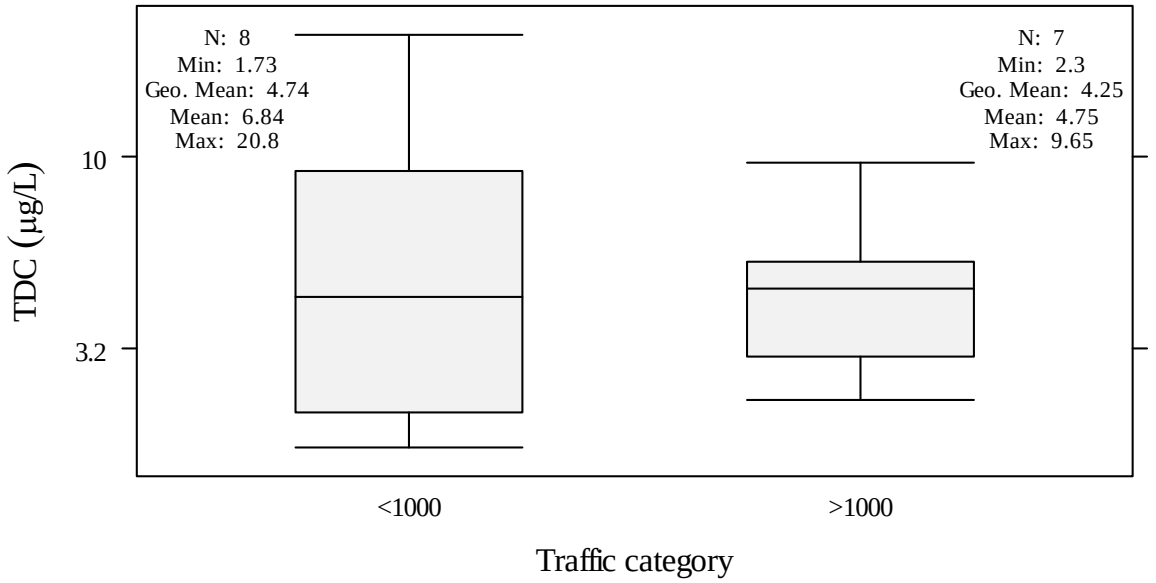


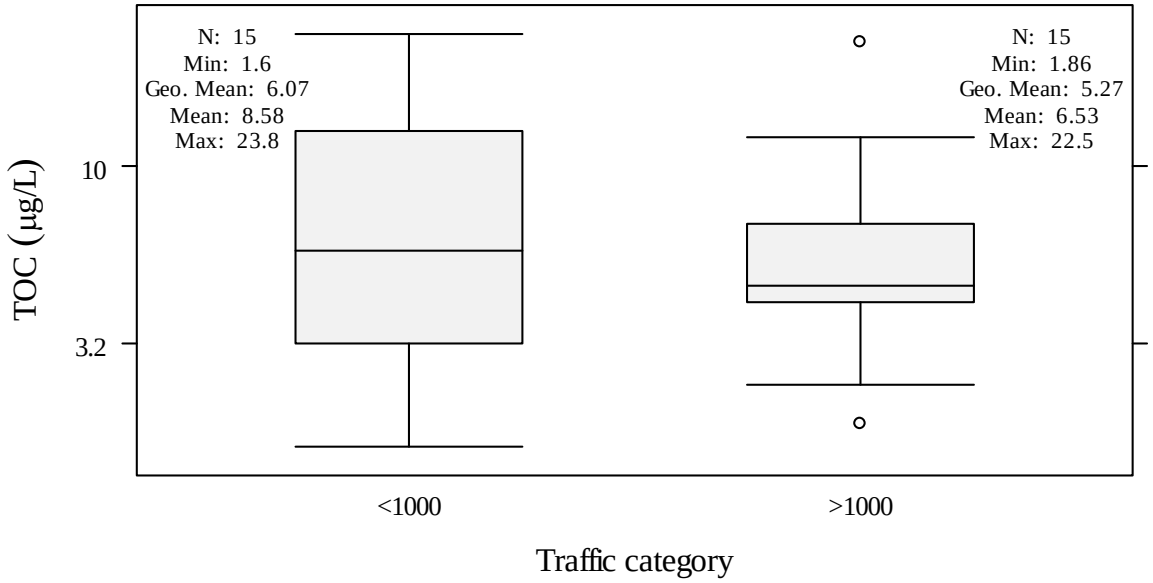
Figure 7-11: Year 3 Total Dissolved Carbon Concentrations by Traffic Category



Notes:
These figures:

1) Summarize the results of the original UIC stormwater samples collected in Year 3;
2) Include the results of Panel 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel 2;
3) Do not include duplicate sampling results; and
4) Plot sample concentrations < MRL at the MRL.

Figure 7-12: Year 3 Total Organic Carbon Concentrations by Traffic Category

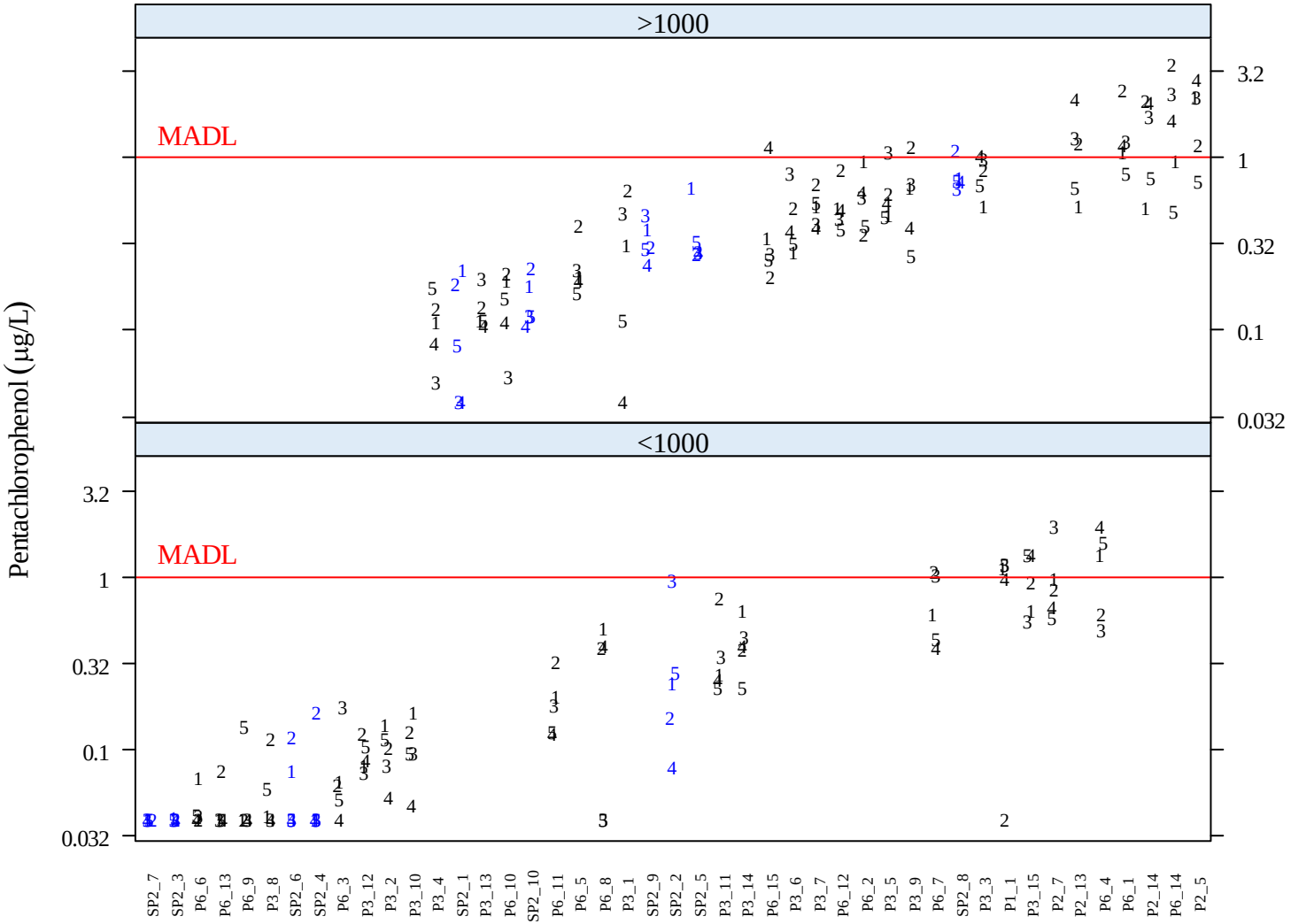


Notes:

These figures:

1) Summarize the results of the original UIC stormwater samples collected in Year 3;
2) Include the results of Panel 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel 2;
3) Do not include duplicate sampling results; and
4) Plot sample concentrations < MRL at the MRL.

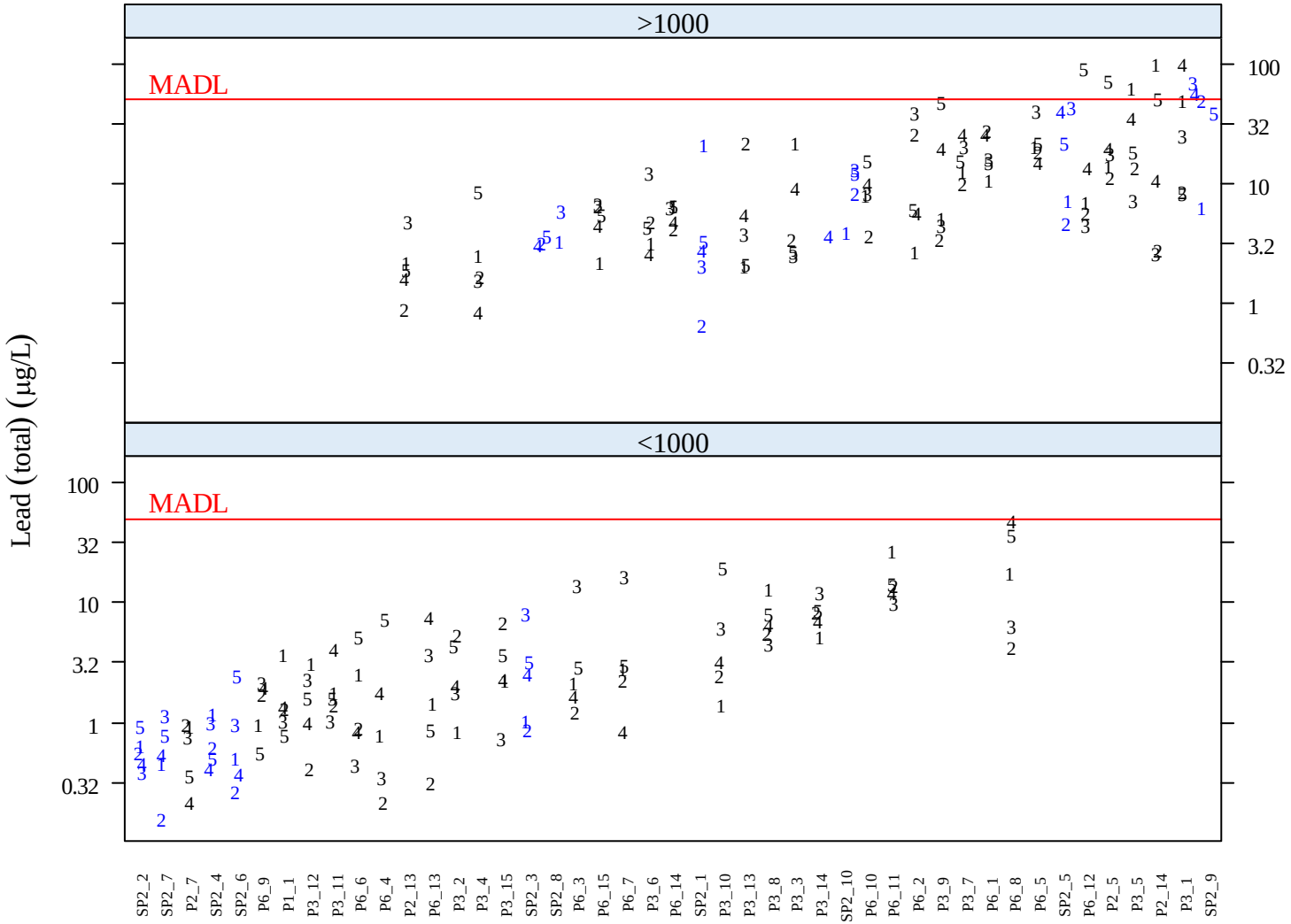
Figure 7-13: Year 3 Pentachlorophenol Concentrations by Sampling Event and Traffic Category



Notes:

(1, 2, 3, 4, 5) indicates Year 3 sampling event number.
<1000, >1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

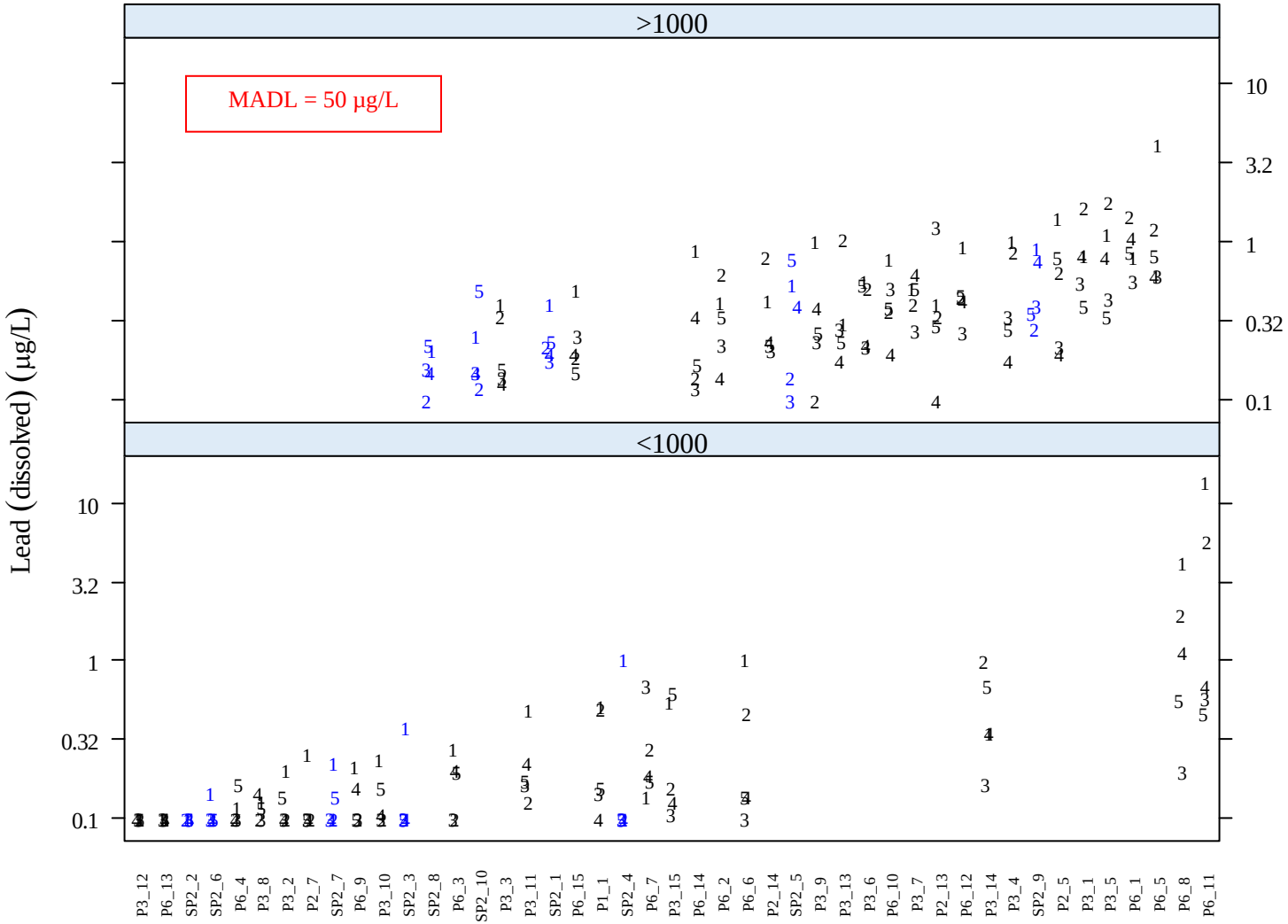
Figure 7-14: Year 3 Total Lead Concentrations by Sampling Event and Traffic Category



Notes:

(1, 2, 3, 4, 5) indicates Year 3 sampling event number.
<1000, >1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

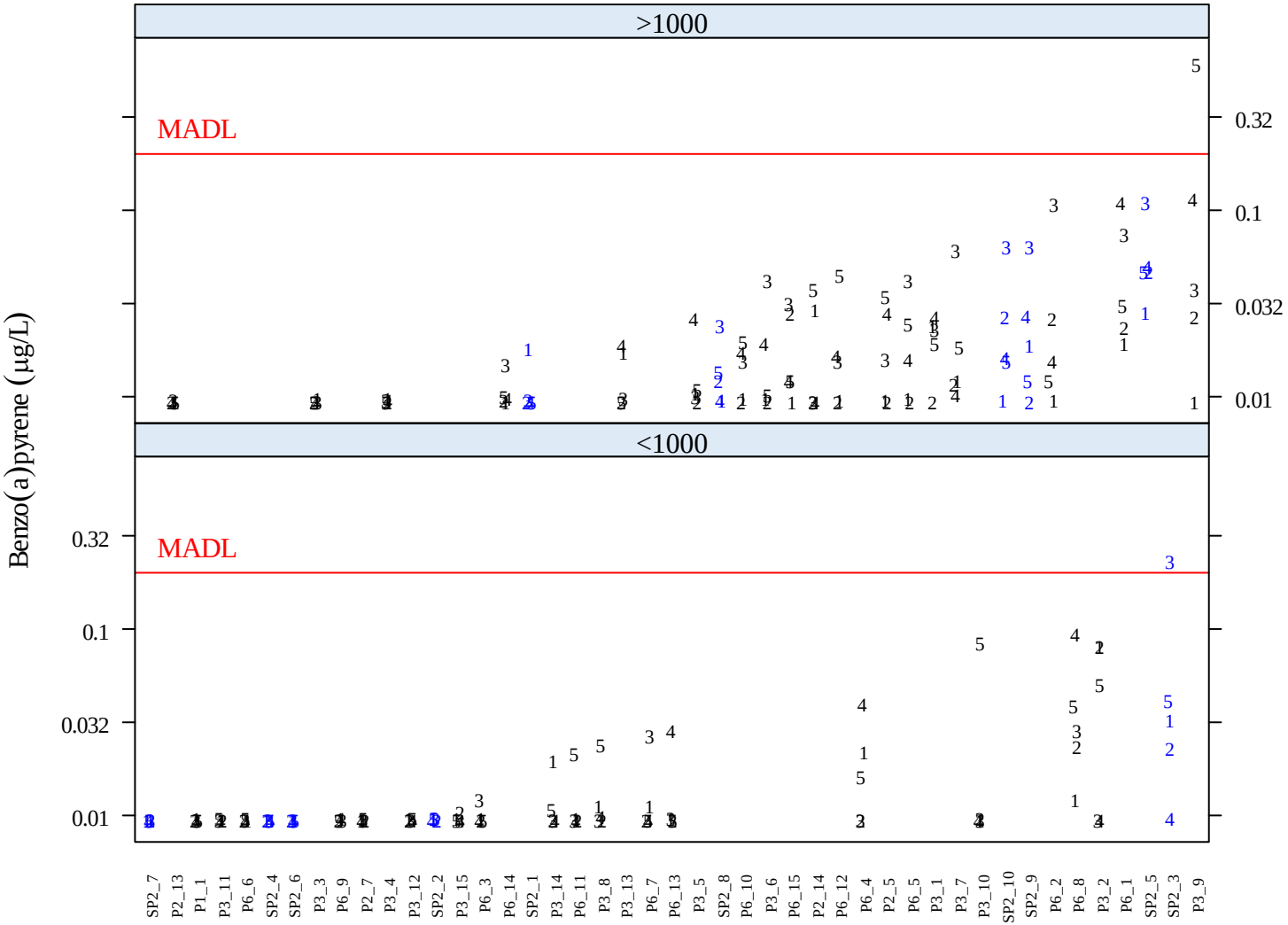
Figure 7-15: Year 3 Dissolved Lead Concentrations by Sampling Event and Traffic Category



Notes:

(1, 2, 3, 4, 5) indicates Year 3 sampling event number.
<1000, >1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

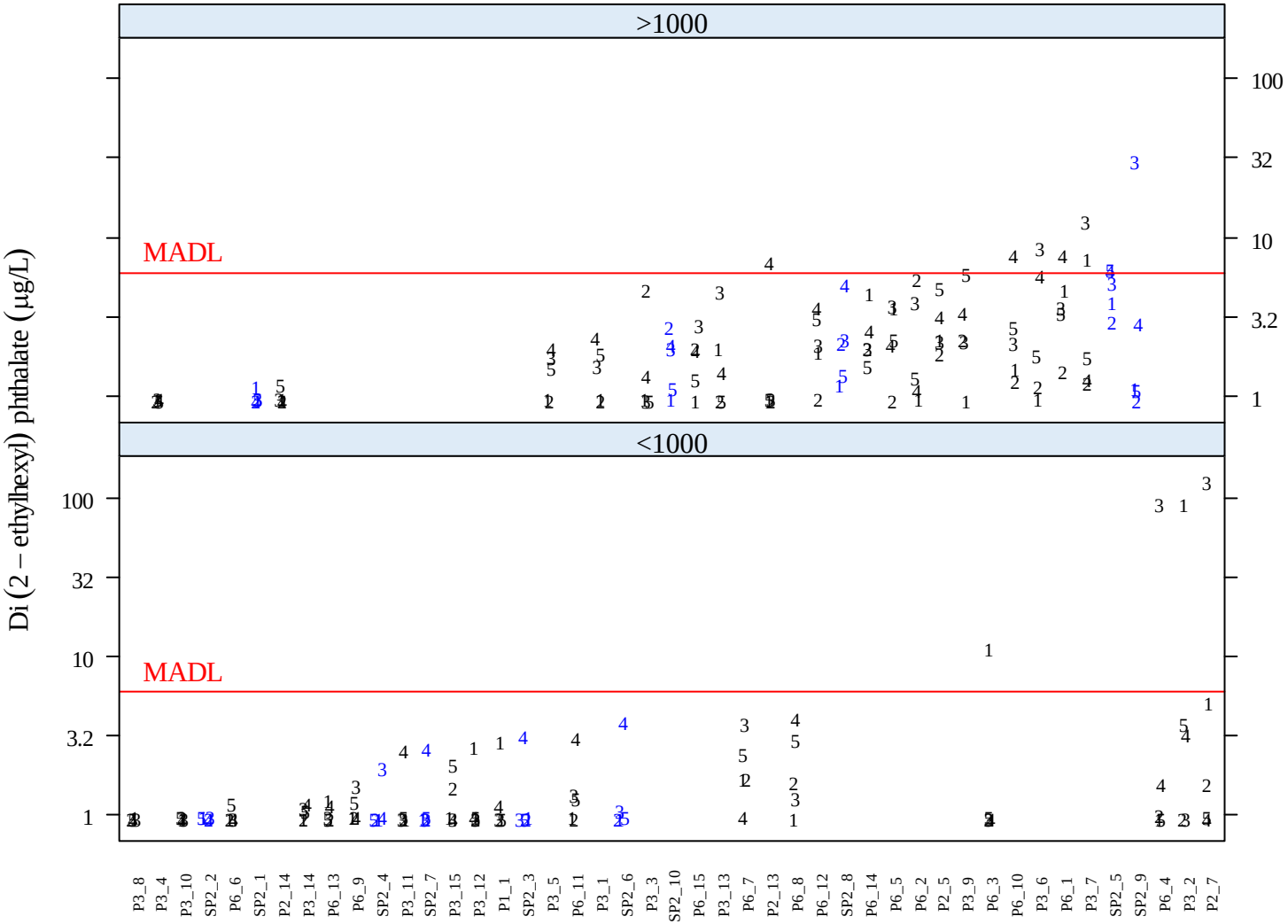
Figure 7-16: Year 3 Benzo(a)pyrene Concentrations by Sampling Event and Traffic Category



Notes:

(1, 2, 3, 4, 5) indicates Year 3 sampling event number.
<1000, >1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

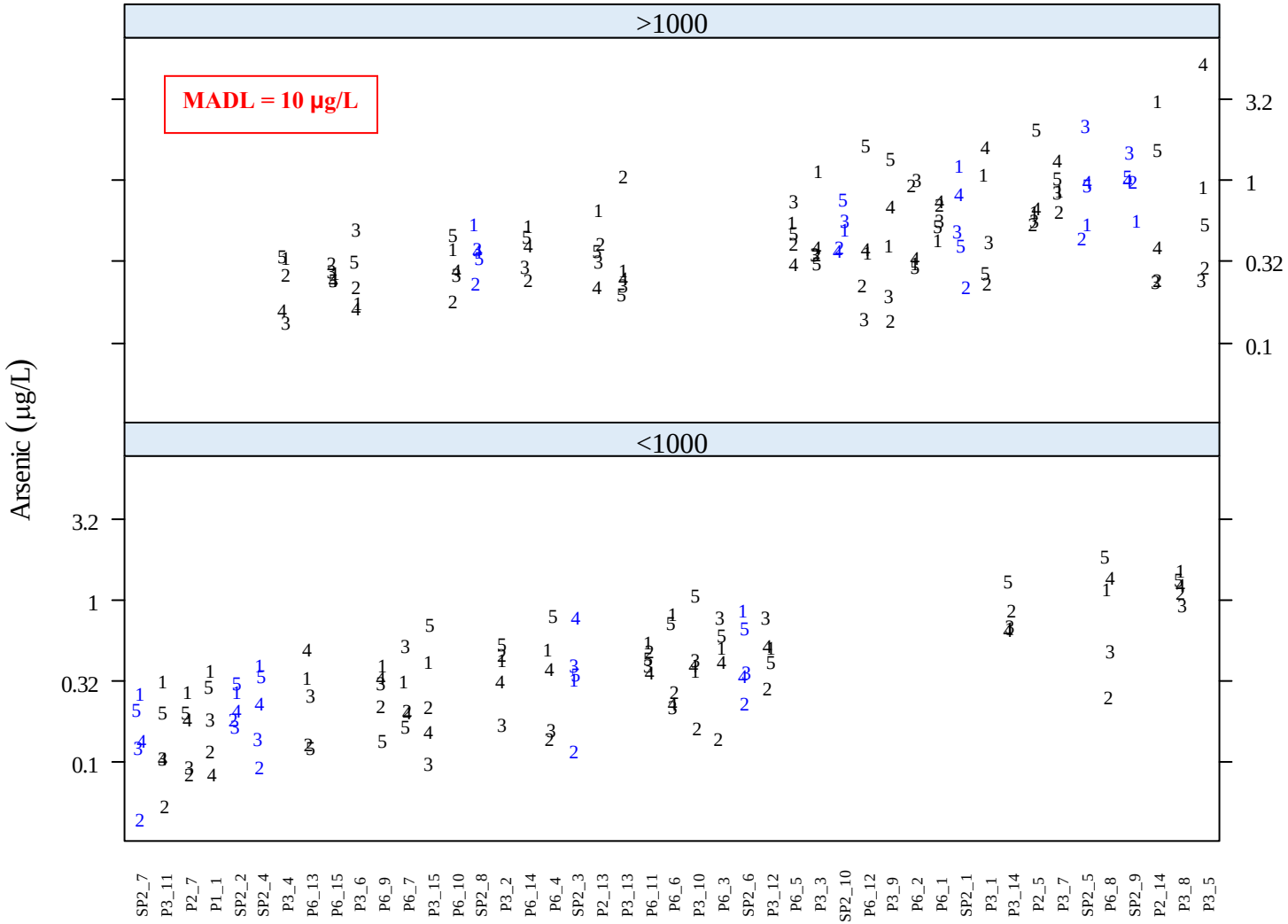
Figure 7-17: Year 3 Di(2-ethylhexyl)phthalate Concentrations by Sampling Event and Traffic Category



Notes:

(1, 2, 3, 4, 5) indicates Year 3 sampling event number.
<1000, >1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

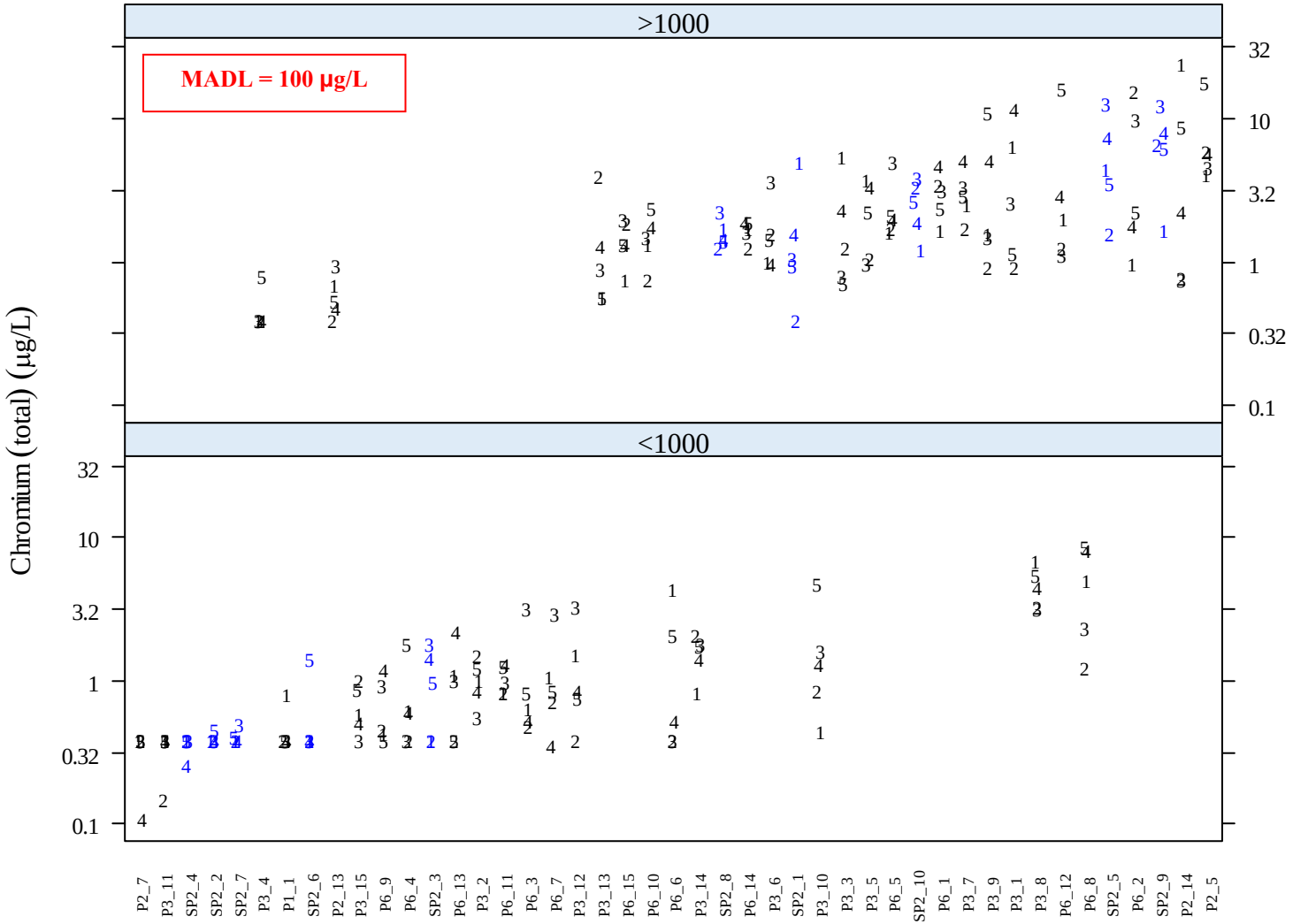
Figure 7-18: Year 3 Arsenic Concentrations by Sampling Event and Traffic Category



Notes:

(1, 2, 3, 4, 5) indicates Year 3 sampling event number.
<1000, >1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

Figure 7-19: Year 3 Chromium Concentrations by Sampling Event and Traffic Category



Notes:

(1, 2, 3, 4, 5) indicates Year 3 sampling event number.
<1000, >1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

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

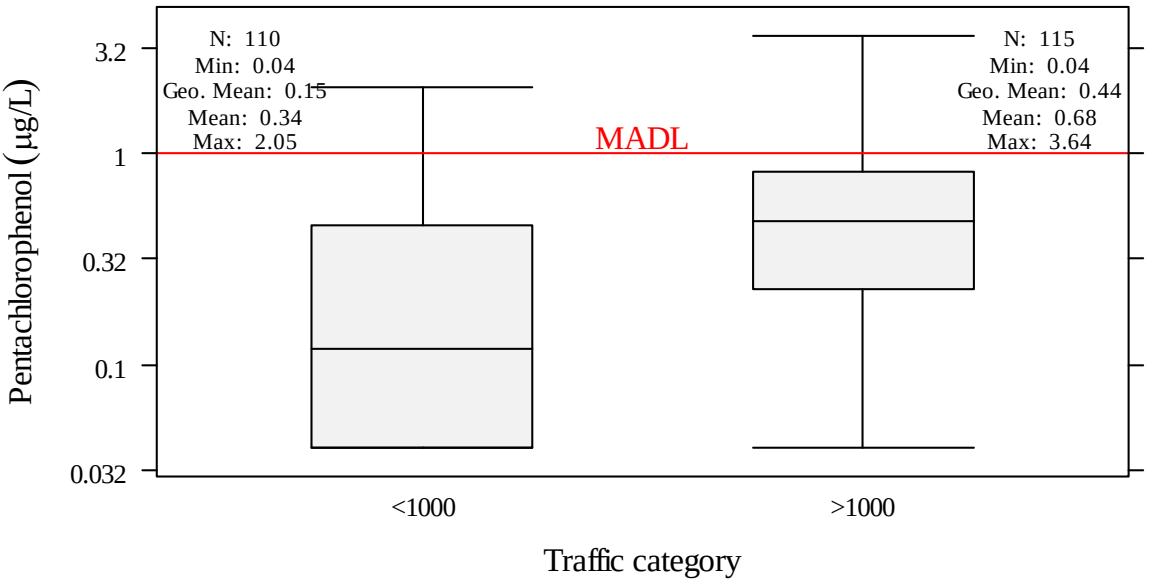
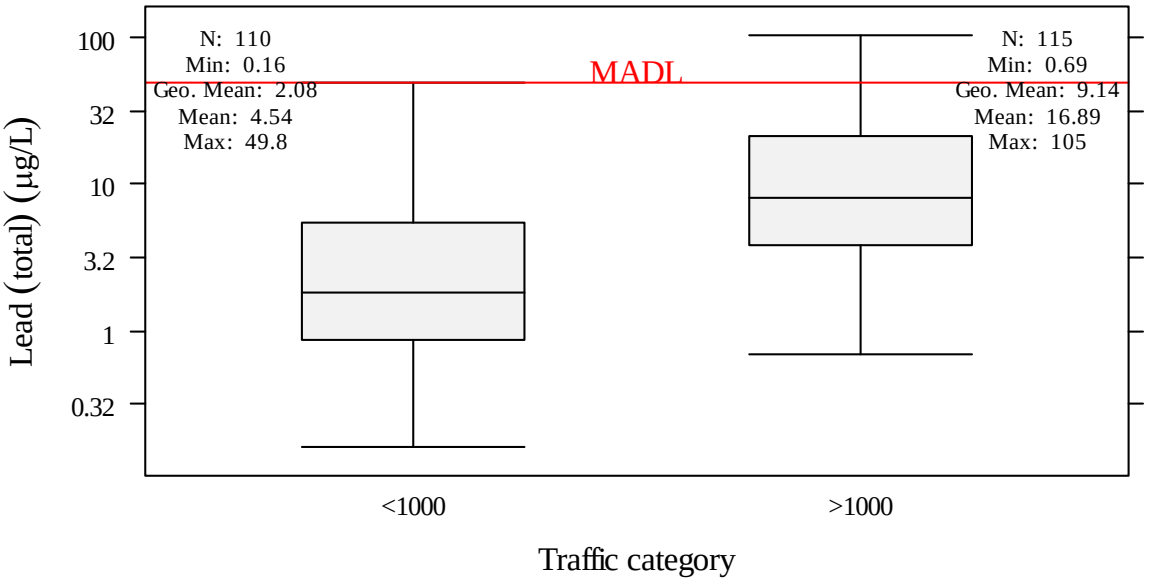


Figure 7-3: Year 3 Total Lead Concentrations by Traffic Category

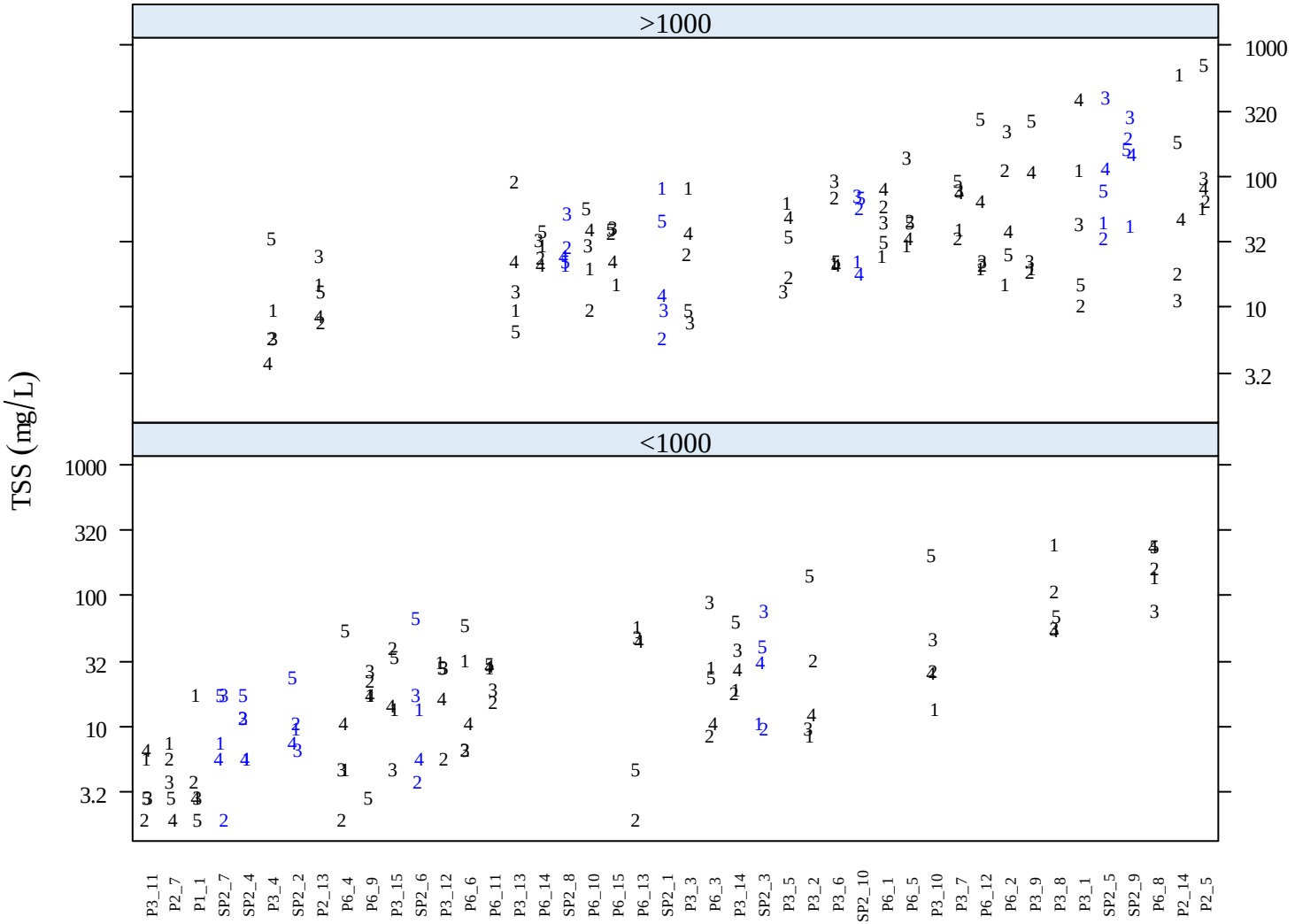


Notes:

These figures:

1) Summarize the results of the original UIC stormwater samples collected in Year 3;
2) Include the results of Panel 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel 2;
3) Do not include duplicate sampling results; and
4) Plot sample concentrations < MRL at the MRL.

Figure 7-20: Year 3 Total Suspended Solids Concentrations by Sampling Event and Traffic Category



Notes:

(1, 2, 3, 4, 5) indicates Year 3 sampling event number.
<1000, >1000 indicates traffic category by estimated trips per day (TPD).
Concentrations are plotted on a logarithmic scale.
Data shown in blue are supplemental UIC monitoring locations.

Figure 7-21: Year 3 Pentachlorophenol Concentrations by Sample Event

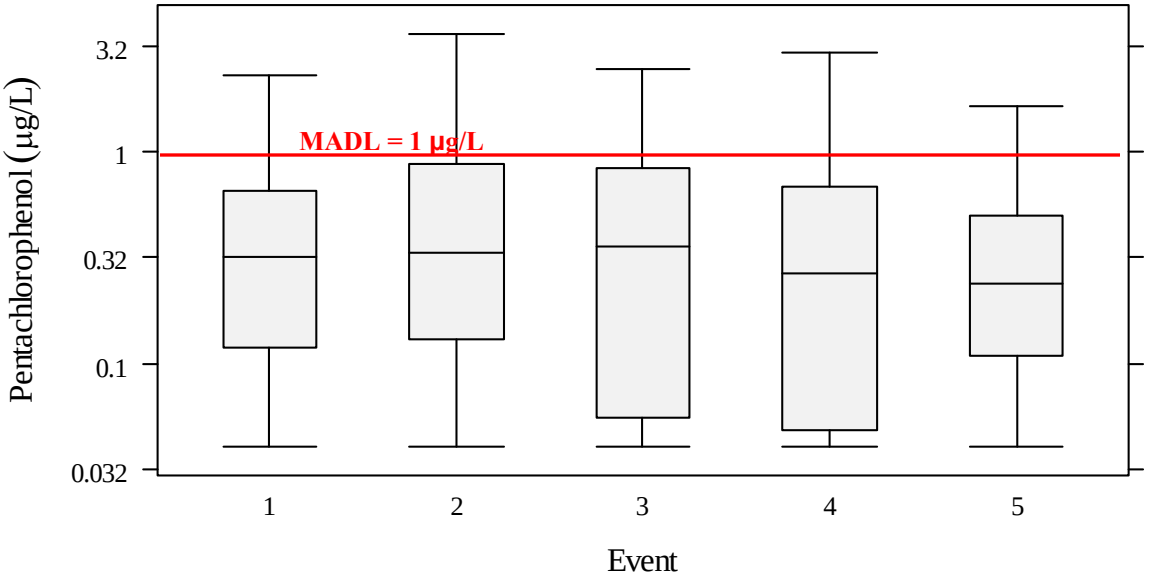


Figure 7-22: Year 3 Pentachlorophenol Concentrations by Sample Panel

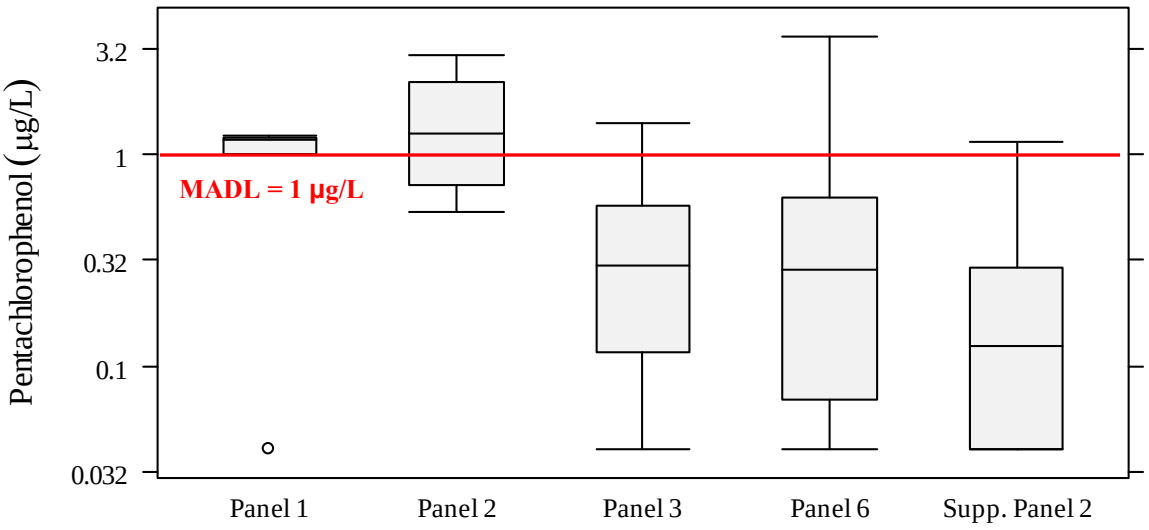


Figure 7-25: Year 3 Di(2-ethylhexyl)phthalate Concentrations by Sample Event

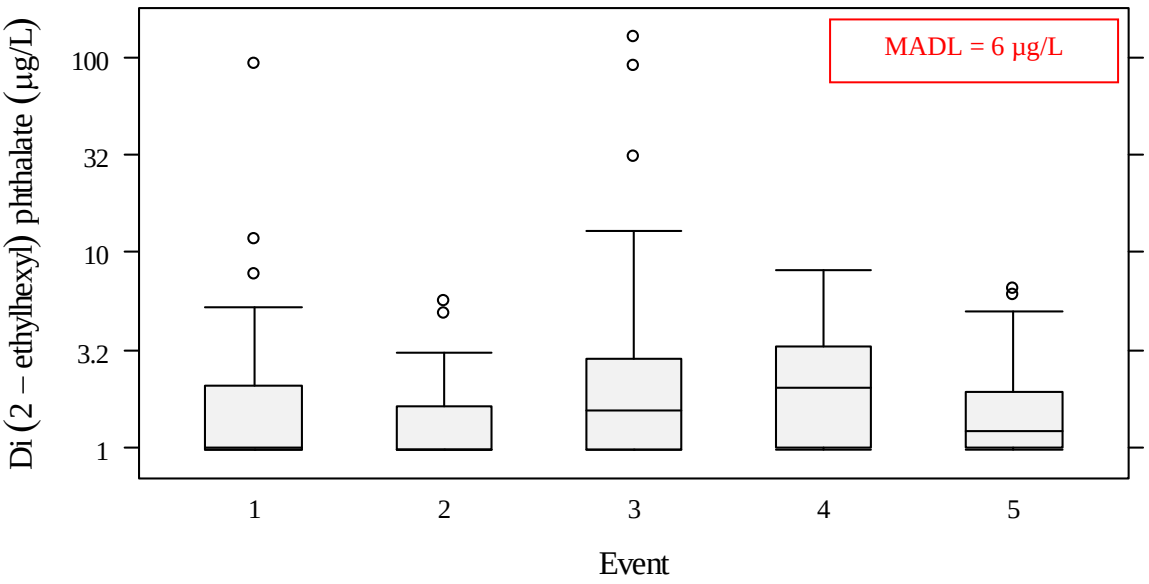


Figure 7-26: Year 3 Di(2-ethylhexyl)phthalate Concentrations by Sample Panel

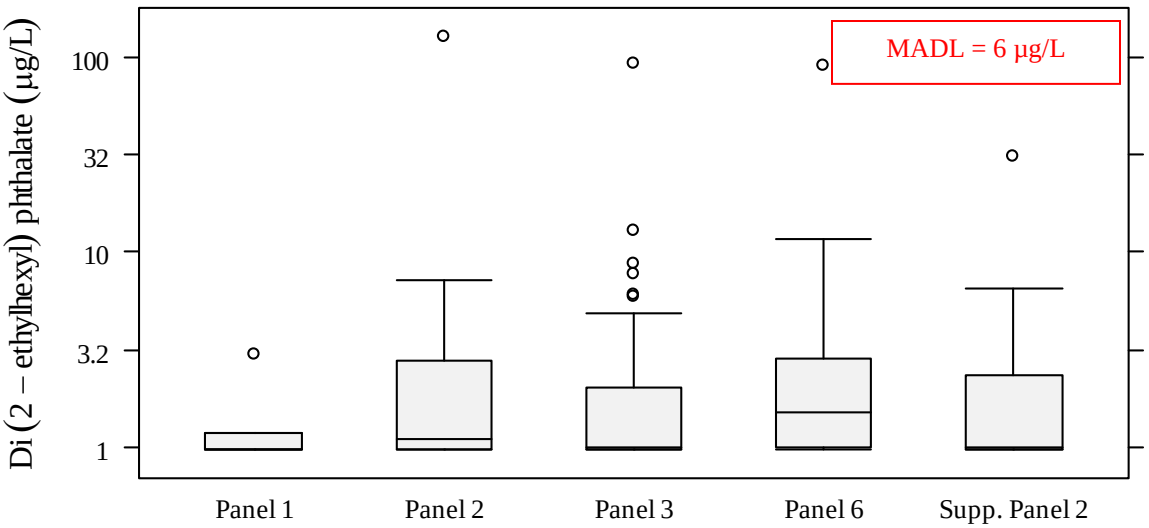


Figure 7-27: Year 3 Arsenic Concentrations by Sample Event

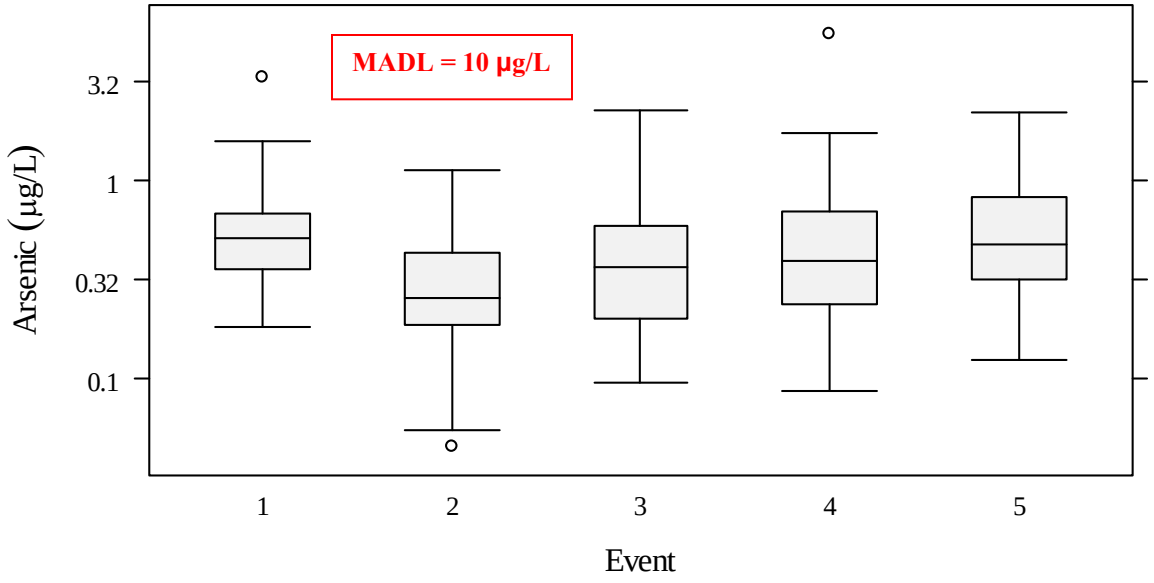


Figure 7-28: Year 3 Arsenic Concentrations by Sample Panel

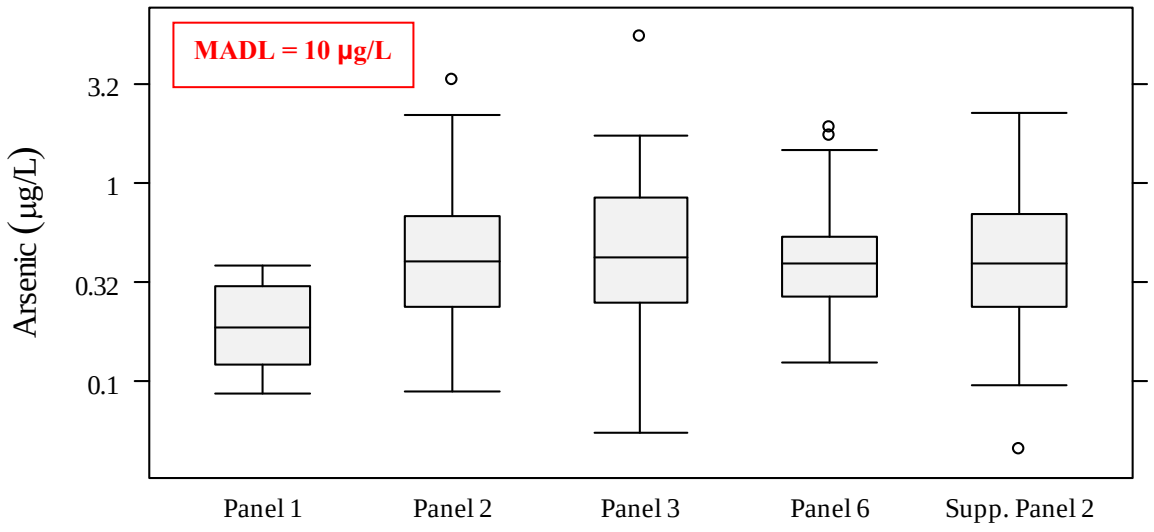


Figure 7-4: Year 3 Dissolved Lead Concentrations by Traffic Category

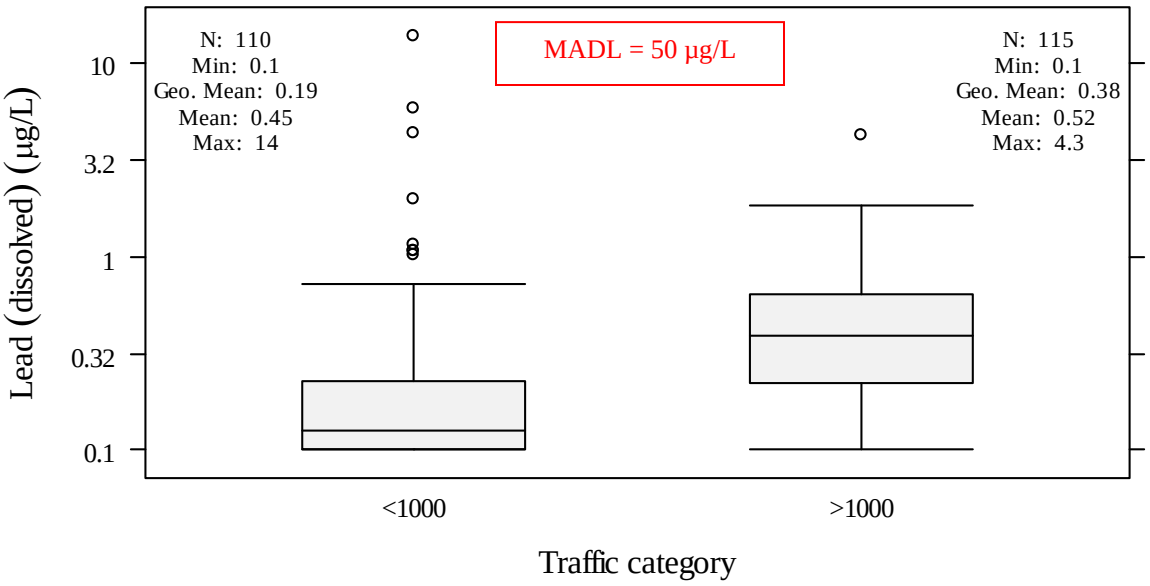
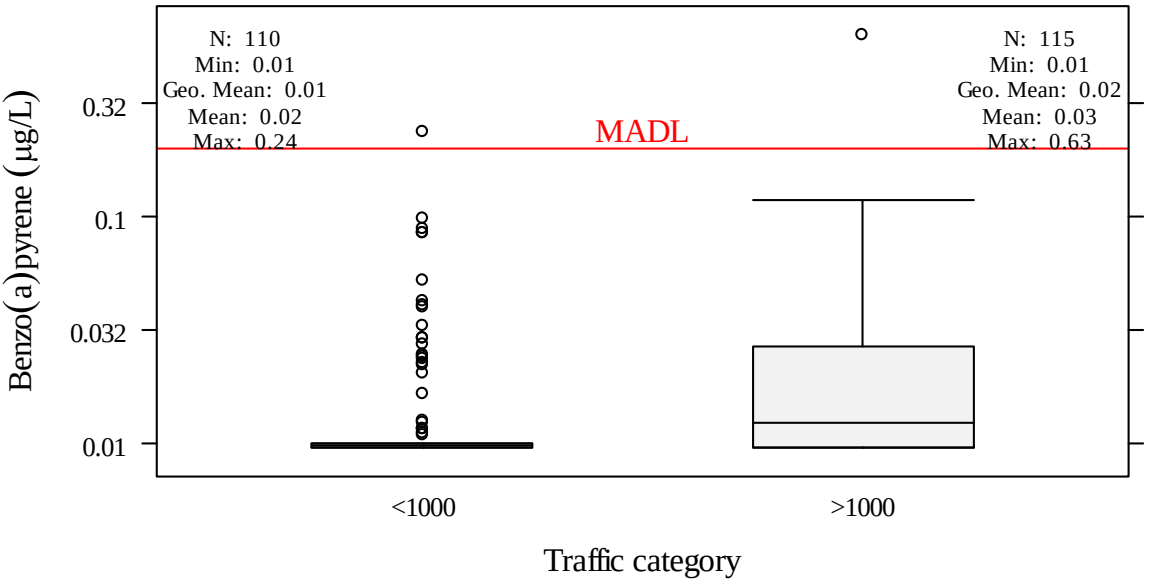


Figure 7-5: Year 3 Benzo(a)pyrene Concentrations by Traffic Category



Notes:
These figures:

1) Summarize the results of the original UIC stormwater samples collected in Year 3;
2) Include the results of Panel 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel 2;
3) Do not include duplicate sampling results; and
4) Plot sample concentrations < MRL at the MRL.

Figure 7-6: Year 3 Di(2-ethylhexyl)phthalate Concentrations by Traffic Category

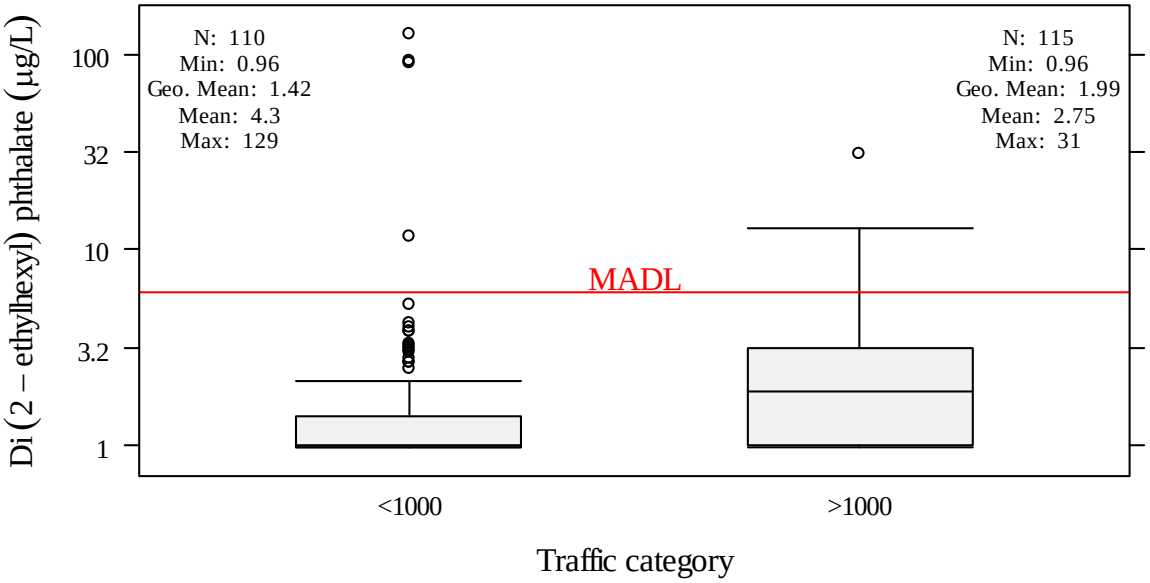
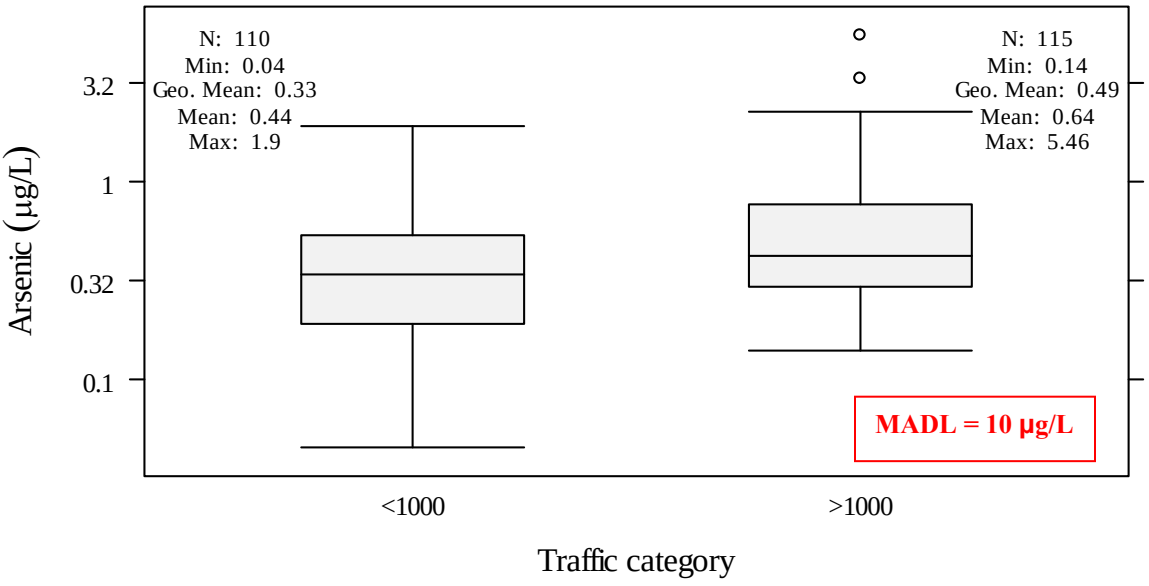


Figure 7-7: Year 3 Arsenic Concentrations by Traffic Category



Notes:
These figures:

1) Summarize the results of the original UIC stormwater samples collected in Year 3;
2) Include the results of Panel 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel 2;
3) Do not include duplicate sampling results; and
4) Plot sample concentrations < MRL at the MRL.

Figure 7-8: Year 3 Cadmium Concentrations by Traffic Category

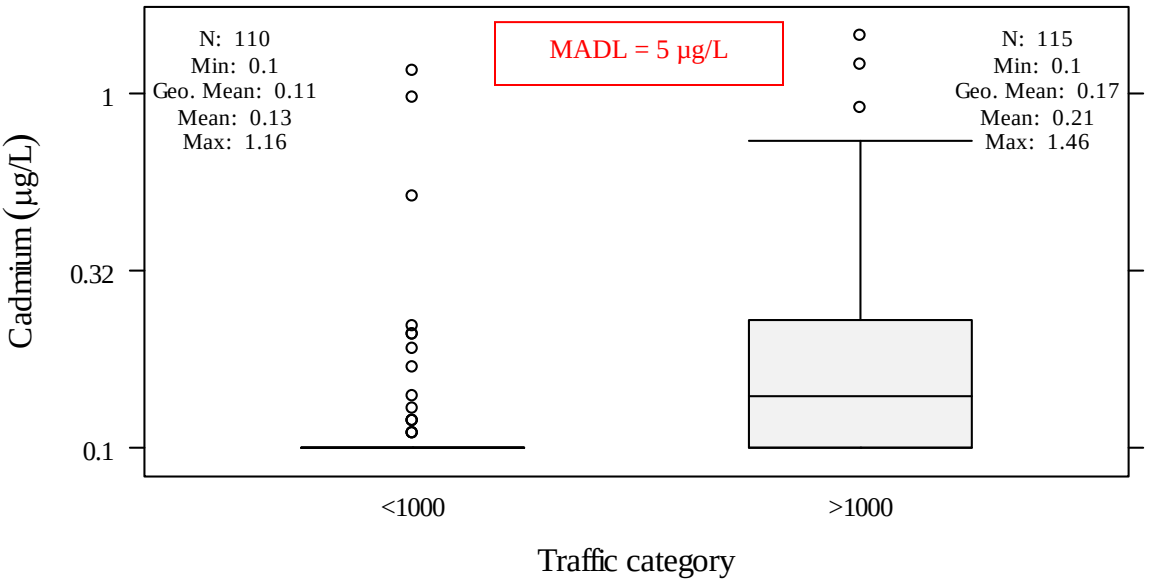
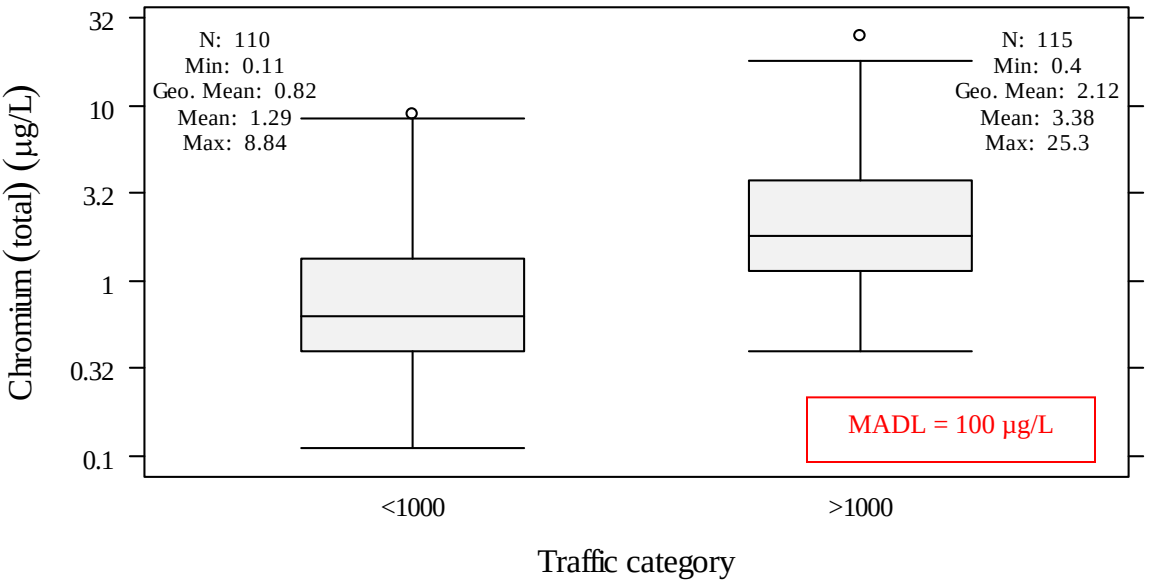


Figure 7-9: Year 3 Chromium Concentrations by Traffic Category



Notes:
These figures:

1) Summarize the results of the original UIC stormwater samples collected in Year 3;
2) Include the results of Panel 1, Panel 2, Panel 3, Panel 6, and Supplemental Panel 2;
3) Do not include duplicate sampling results; and
4) Plot sample concentrations < MRL at the MRL.

Figure 7-23: Year 3 Total Lead Concentrations by Sample Event

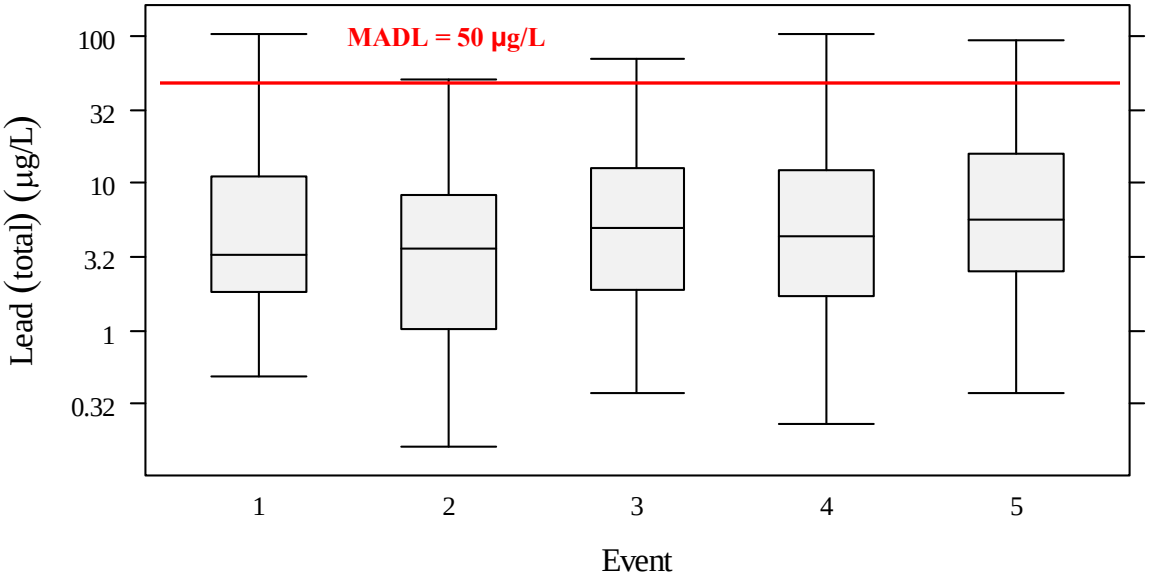


Figure 7-24: Year 3 Total Lead Concentrations by Sample Panel

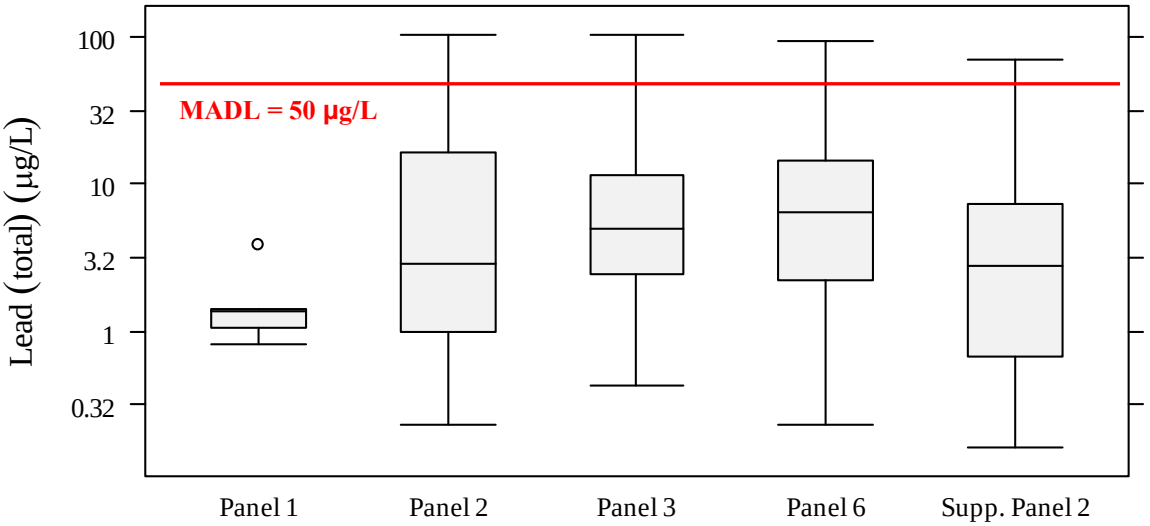


Figure 9-1: Comparison of Pentachlorophenol Concentrations for Years 1 – 3: Panel 6

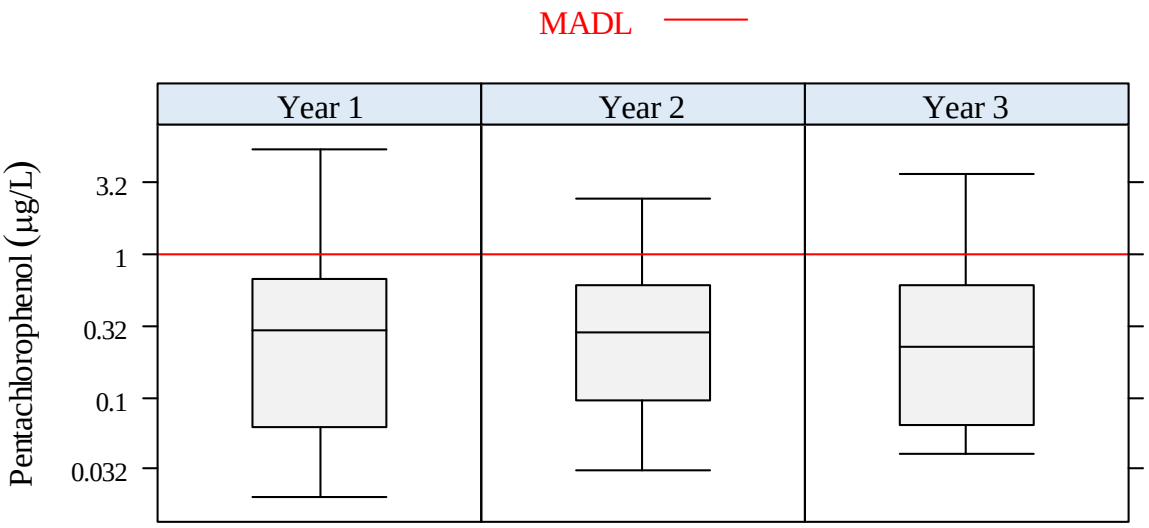


Figure 9-2: Comparison of Lead (Total) Concentrations for Years 1 – 3: Panel 6

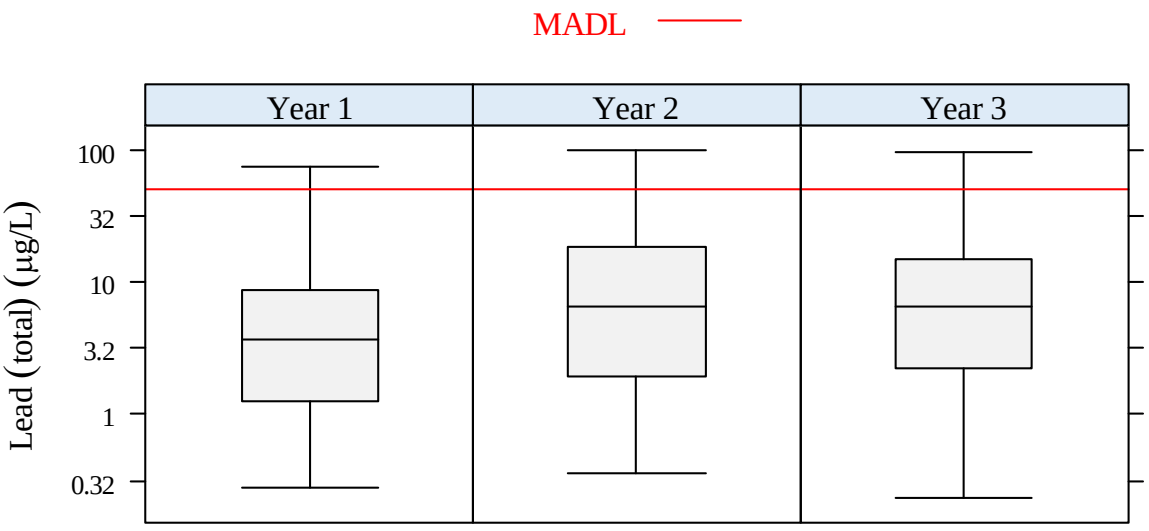
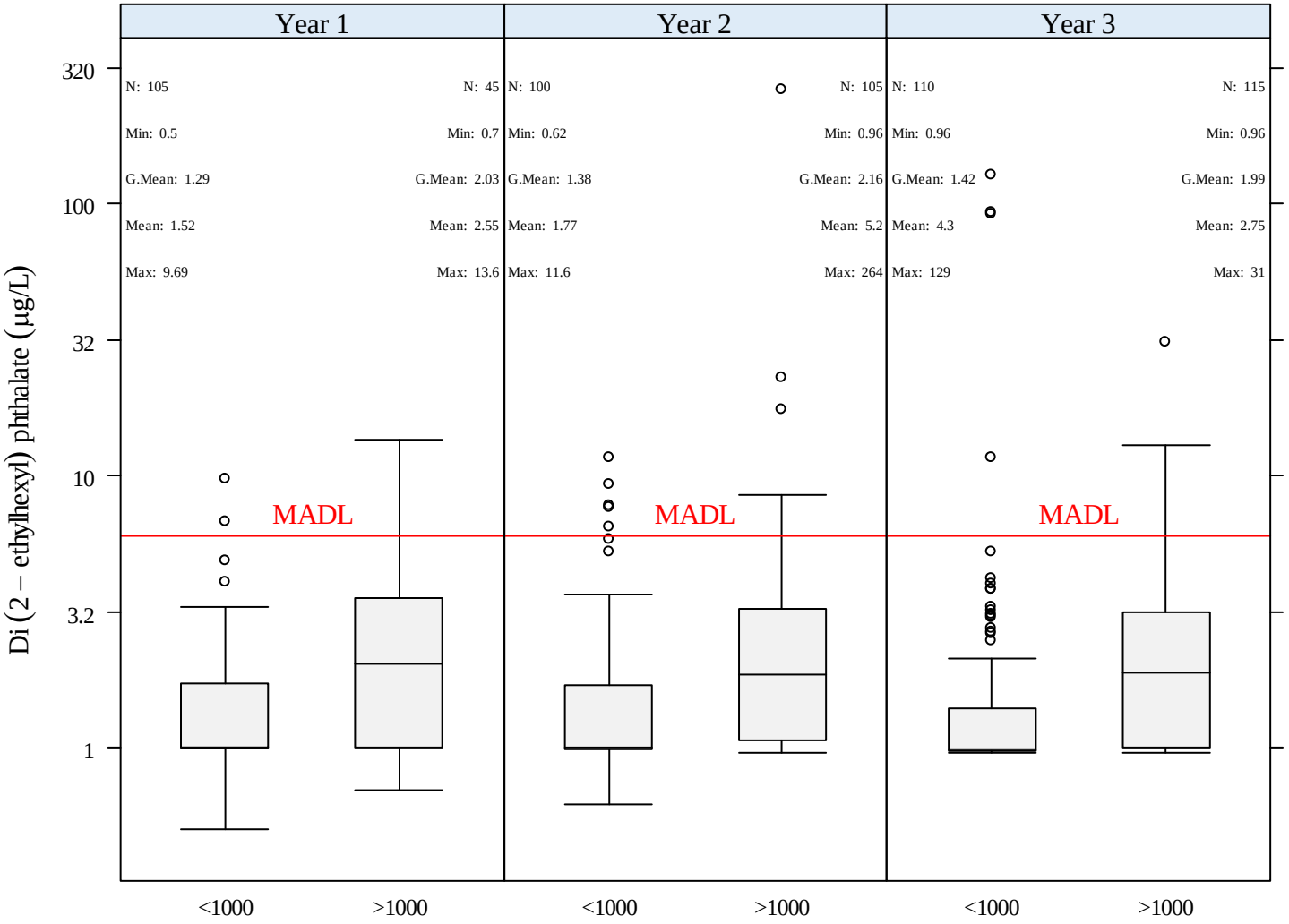


Figure 9-10: Comparison of Di(2-ethylhexyl)phthalate Concentrations by Year and Traffic Category



Notes:
G. Mean = geometric mean

Figure 9-11: Comparison of Pentachlorophenol Concentrations by Year and Sample Panel

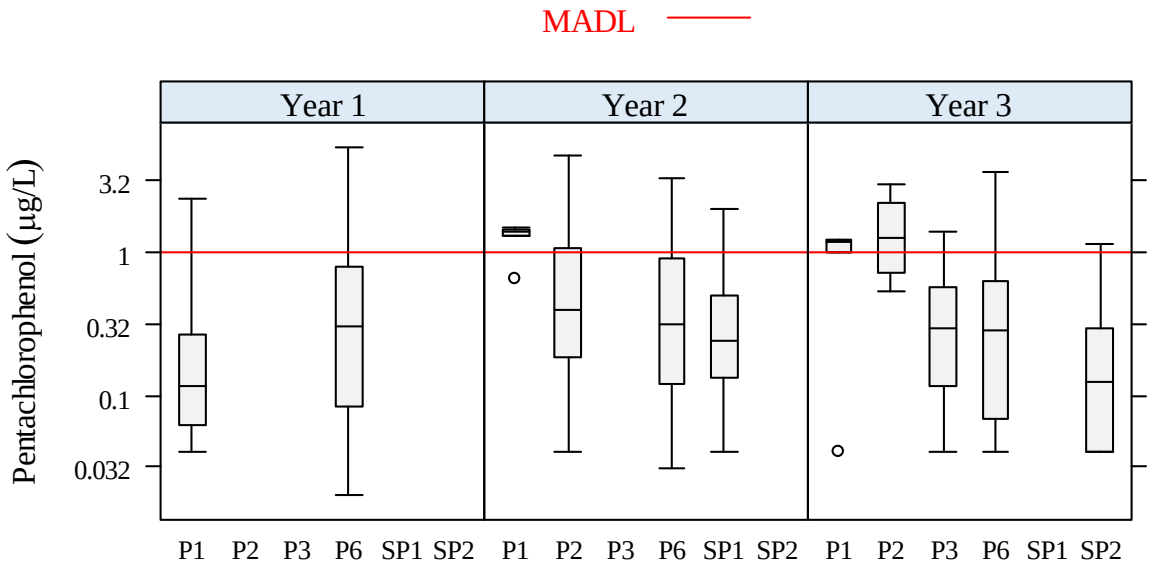


Figure 9-12: Comparison of Total Lead Concentrations by Year and Sample Panel

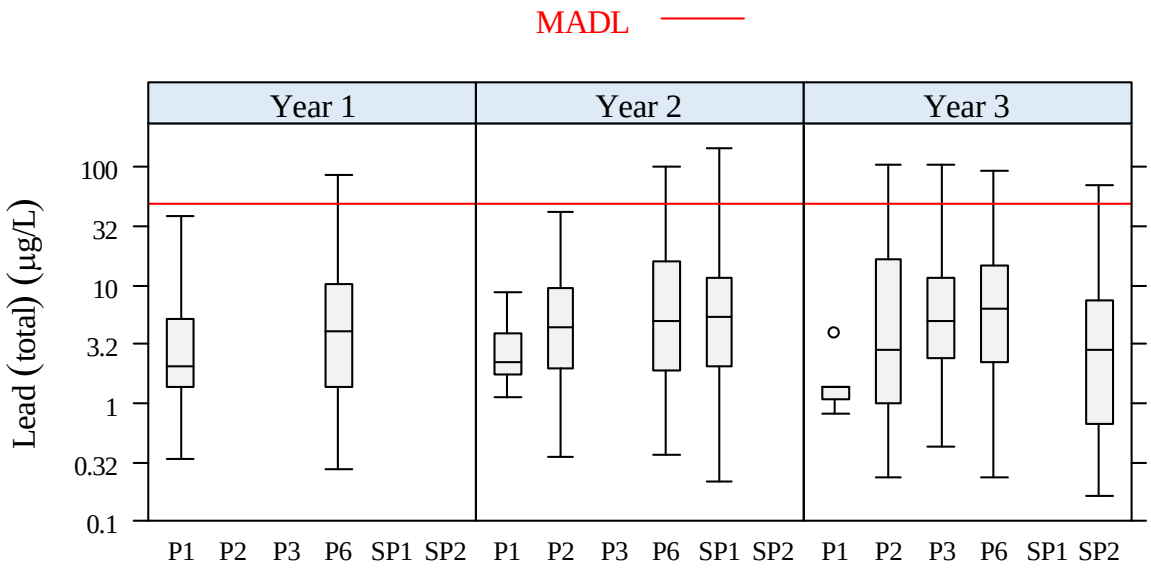


Figure 9-13: Comparison of Di(2-ethylhexyl)phthalate Concentrations by Year and Sample Panel

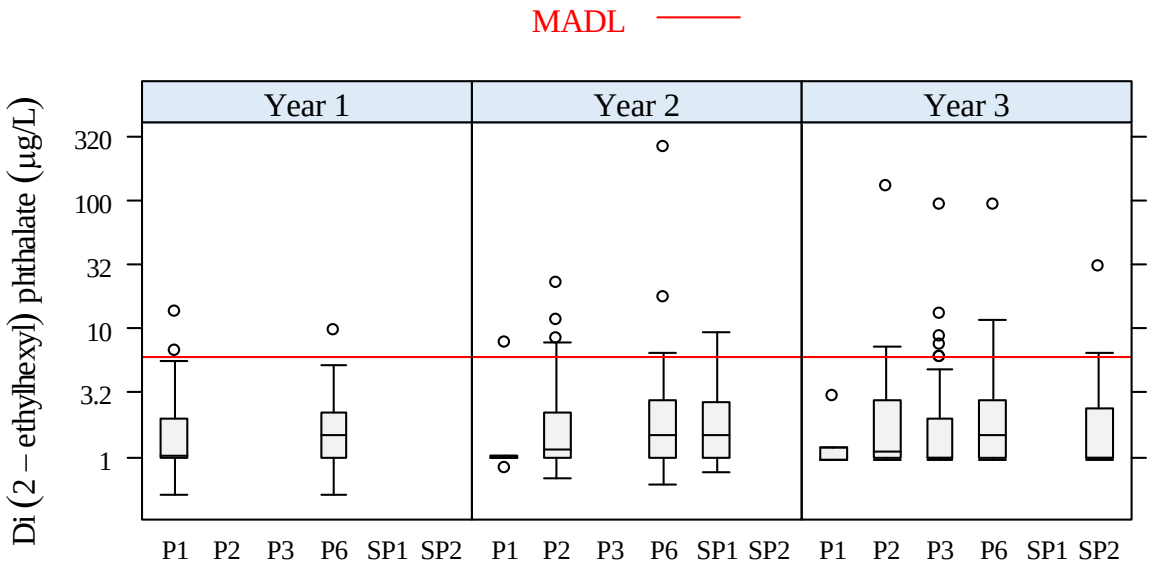


Figure 9-14: Comparison of Benzo(a)pyrene Concentrations by Year and Sample Panel

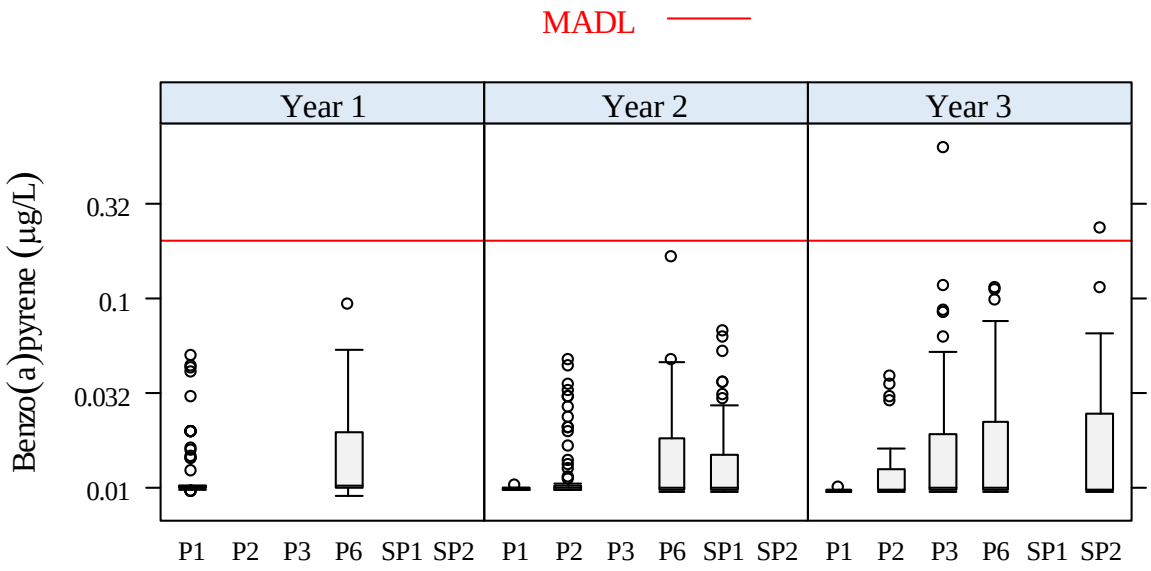


Figure 9-3: Comparison of Benzo(a)pyrene Concentrations for Years 1 – 3: Panel 6

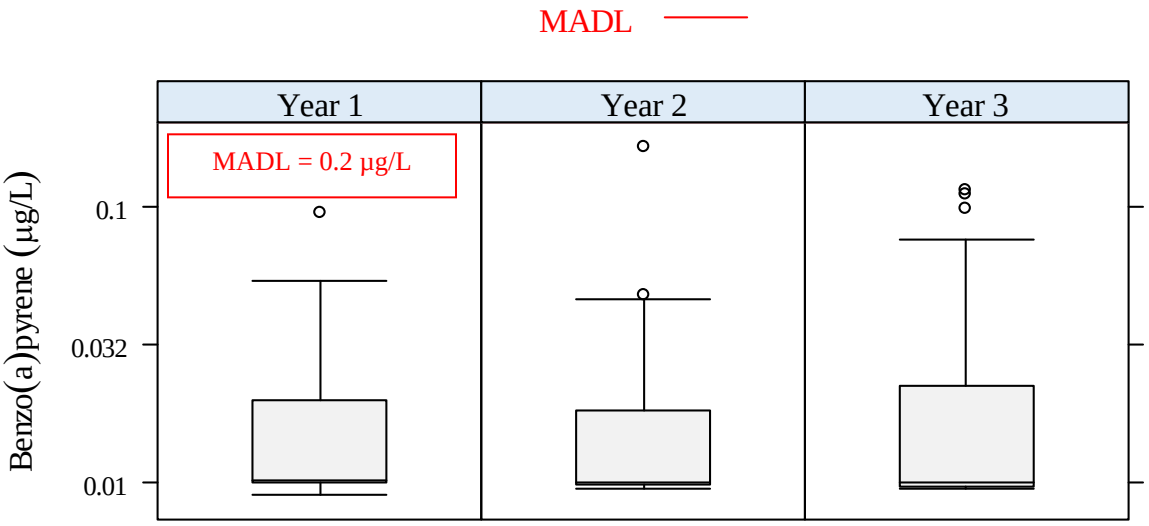


Figure 9-4: Comparison of Di(2-ethylhexyl)phthalate Concentrations for Years 1 – 3: Panel 6

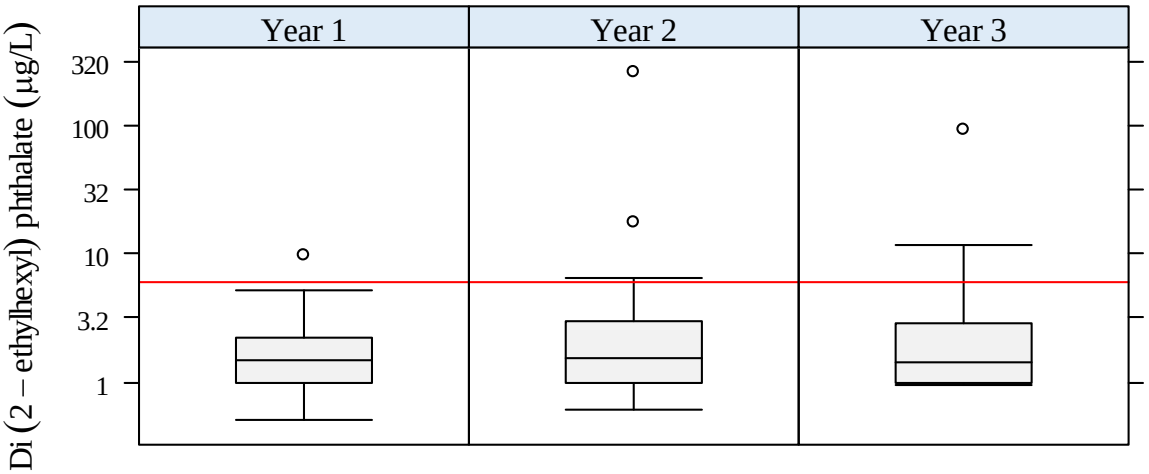


Figure 9-5: Comparison of Total Suspended Solids Concentrations for Years 1 – 3: Panel 6

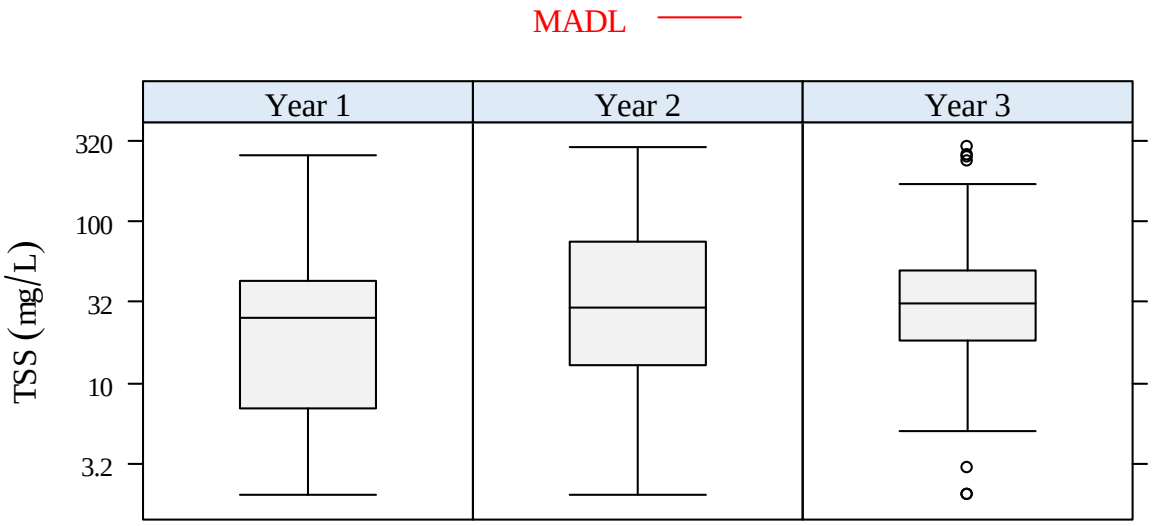


Figure 9-6: Comparison of Lead (Dissolved) Concentrations for Years 1 – 3: Panel 6

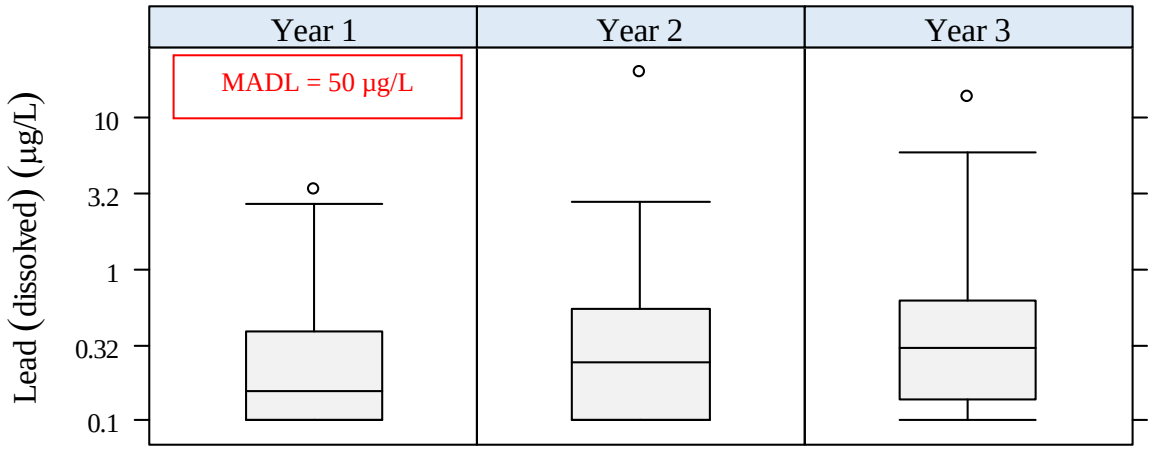
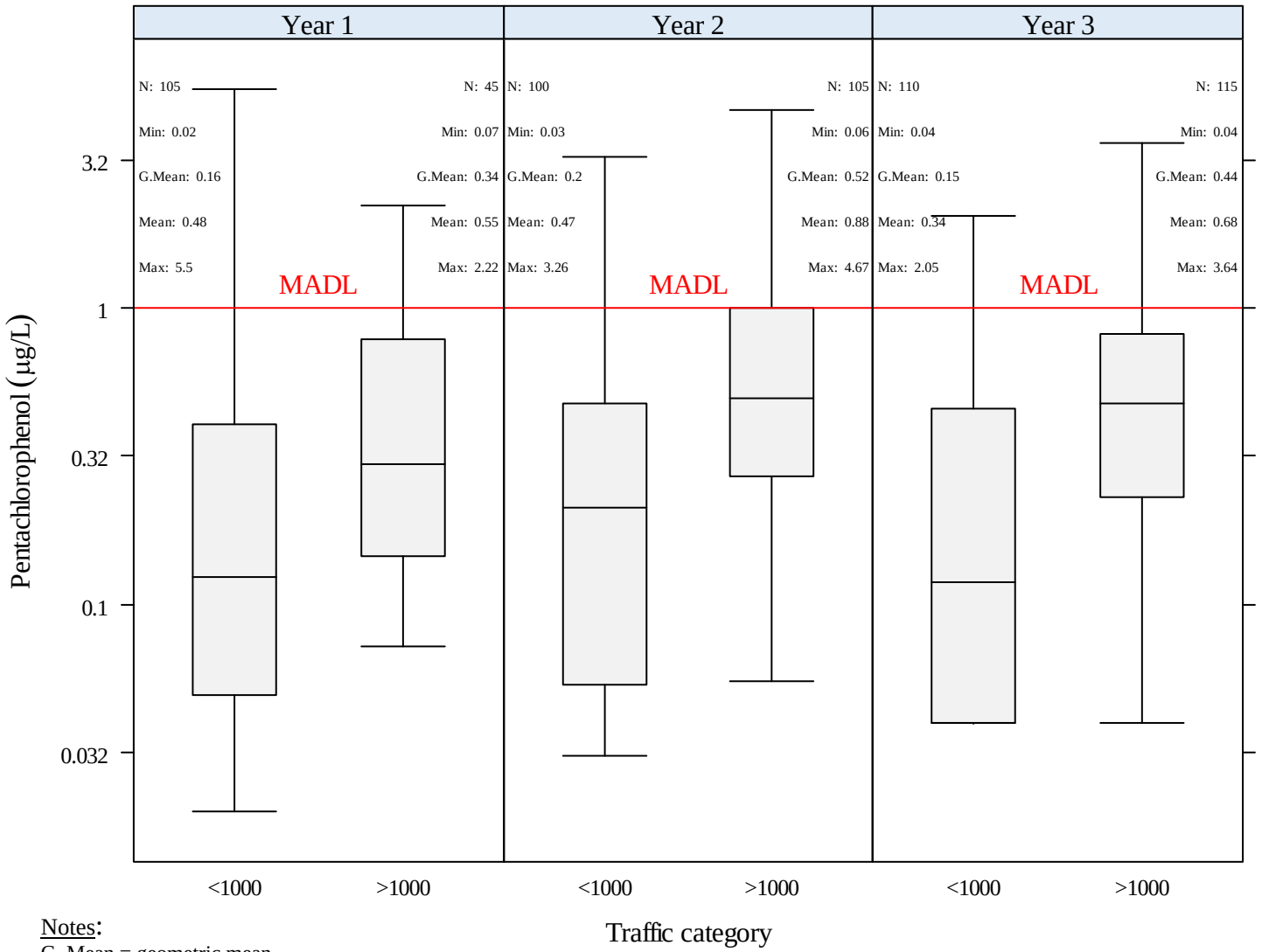
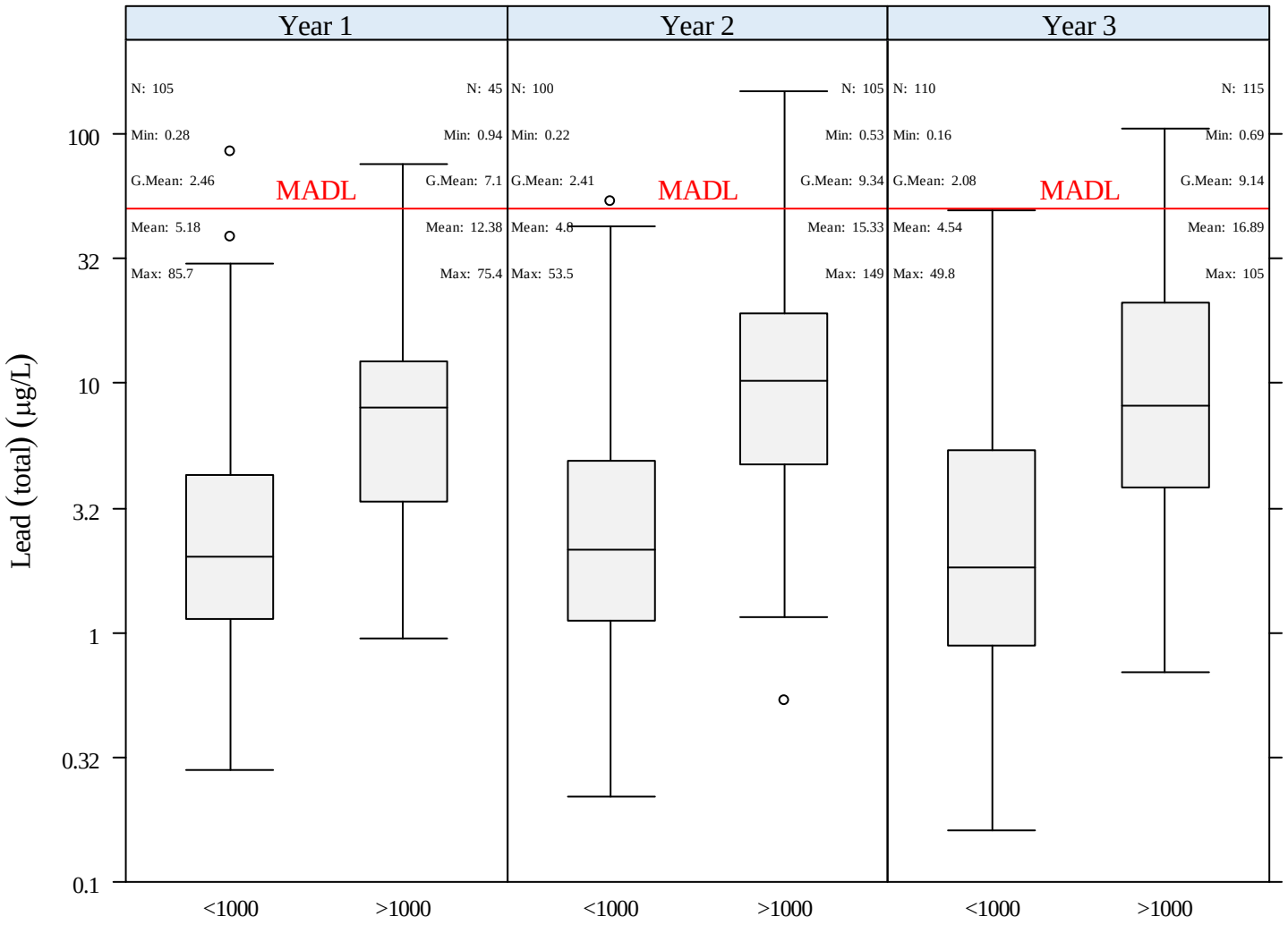


Figure 9-7: Comparison of Pentachlorophenol Concentrations by Year and Traffic Category



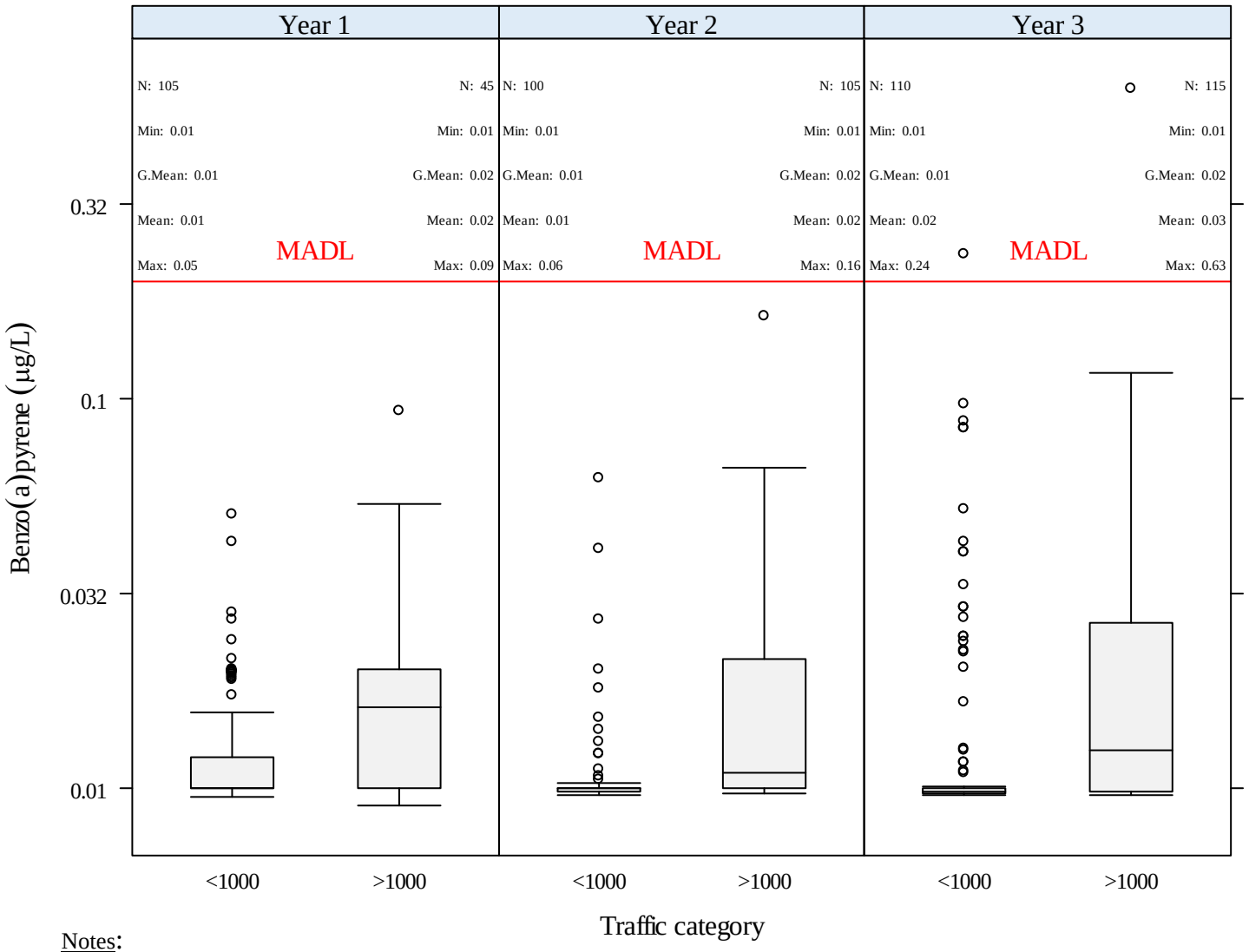
Notes:
G. Mean = geometric mean

Figure 9-8: Comparison of Total Lead Concentrations by Year and Traffic Category



Notes:
G. Mean = geometric mean

Figure 9-9: Comparison of Benzo(a)pyrene Concentrations by Year and Traffic Category



Notes:
G. Mean = geometric mean

Figures

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