

PERRINVILLE CREEK TRIBUTARY STORMWATER SAMPLING

EDMONDS, WASHINGTON

Prepared for
City of Edmonds

Prepared by
Herrera Environmental Consultants, Inc.



Note:

Some pages in this document have been purposely skipped or blank pages inserted so that this document will copy correctly when duplexed.

PERRINVILLE CREEK TRIBUTARY STORMWATER SAMPLING

EDMONDS, WASHINGTON

Prepared for
Jerry Shuster
City of Edmonds Public Works
Engineering Division
121 Fifth Avenue North
Edmonds, Washington 98020

Prepared by
Herrera Environmental Consultants, Inc.
2200 Sixth Avenue, Suite 1100
Seattle, Washington 98121
Telephone: 206/441-9080

June 27, 2013

CONTENTS

Introduction.....	1
Study Location.....	3
Methods	5
Water Sample Collection	5
Documentation of Field Sampling Activities	7
Laboratory Methods	7
Data Analysis Methods	7
Results.....	9
Conclusions	13
References	15
Appendix A	Chain of Custodies
Appendix B	Laboratory Reports
Appendix C	Consolidated Database of Results
Appendix D	Field Forms
Appendix E	Quality Assurance Review Forms

TABLES

Table 1. Water Quality Analysis Methods and Detection Limits.	8
Table 2. Water Quality Results and Statistical Comparison for Parameters Detected in at Least One Sample.	10
Table 3. Comparison of Storm Drain Water Quality Results to Regional NPDES Monitoring Results.....	10

FIGURES

Figure 1. Vicinity Map and Monitoring Stations for the Perrinville Creek Tributary Stormwater Sampling Study.	4
Figure 2. Temporal Chart of Precipitation and Sample Collection Times.....	6
Figure 3. Boxplot Comparison of P-Creek and MH-Perrinville Water Quality.....	11

INTRODUCTION

The City of Edmonds completed a drainage improvement project in the lower Perrinville Creek Basin in February of 2013. The project entailed rerouting stormwater runoff from an existing undersized storm drainage pipe that was causing flooding of private property into a new larger pipe with a different discharge point. The original discharge point for this runoff was Perrinville Creek, approximately 200 feet upstream of the Creek's mouth in Brown's Bay, Puget Sound. The new discharge point for this runoff is an existing stormwater outfall located in Brown's Bay. This existing outfall is located approximately 85 feet northeast of the mouth of Perrinville Creek. In order to verify that discharges into the existing outfall in Brown's Bay from the Talbot Road storm drain are not degrading water quality, a monitoring program was initiated in March of 2013 and completed in April of 2013.

Over this period, water quality samples were collected during three storm events from the storm drain and Perrinville Creek. Each sample was subsequently analyzed for a suite of representative pollutants in stormwater runoff. Potential water quality impacts from the drainage improvement project were assessed based on comparisons of pollutant concentrations in samples from the storm drain and Perrinville Creek, respectively. This memorandum presents the methods and results of this monitoring program.

STUDY LOCATION

The study area was located where Perrinville Creek crosses Talbot Road in Edmonds, Washington (Figure 1). The storm drain sampling location (designated MH-Perrinville) was located approximately 350 feet southwest of Perrinville Creek along Talbot Road. The Perrinville Creek sampling location (designated P-Creek) was just upstream of the culvert under Talbot Road (Figure 1). The drainage basin for the storm drain is approximately 7 acres and consists primarily of low- to medium-density residential land use. The Perrinville Creek drain basin is approximately 920 acres and drains primarily single-family residential land use.



Legend

- Sampling site
- Edmonds Stormwater Infrastructure**
- Storm pipe
- Creek
- Ditch
- Manhole
- Catchbasin
- Culvert
- Facilities

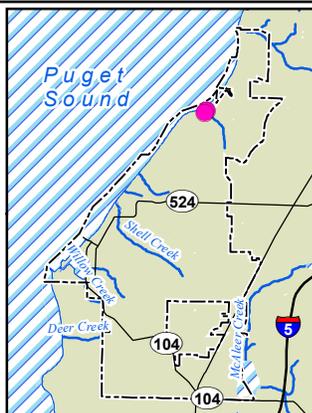
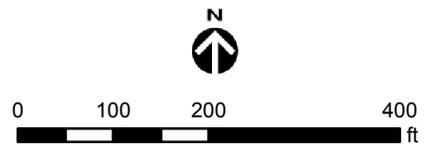


Figure 1.
Perrinville Creek Tributary
Stormwater Sampling Vicinity Map.



METHODS

This section documents methods used for water sample collection, documentation of field activities, laboratory analysis, and data analysis during this monitoring program.

Water Sample Collection

Three storm events were targeted for sampling pursuant to this monitoring program. In preparation for sampling, weather forecast information from the King 5 weather website (<http://www.king5.com/weather/>) and precipitation amount predictions from the Institute of Global Environment and Society, Center for Ocean-Land-Atmosphere Studies (<http://wxmaps.org/pix/meteograms.html>) were reviewed on a weekly basis to determine if a predicted storm event should be targeted for sampling. To evaluate precipitation conditions immediately prior to sampling, the King 5 weather website (<http://www.king5.com/weather/>) was used to observe Doppler radar results. Events with predicted precipitation totals exceeding 0.25 inches were subsequently targeted for sampling. Using this approach, storm events were sampled on the following three dates:

- March 6, 2013
- March 19, 2013
- April 7, 2013

Figure 2 shows the actual precipitation totals during each sampling date in a time series.

During each of these storm events, sampling crews timed sample collection to coincide with the peak of the storm event. More commonly, the beginning of a storm event is targeted for sampling; however, because the time of concentration was so different between the two sampling locations (a storm drain with a basin area of 7 acres and a creek with a basin area of 920 acres), the peak of the storm event was targeted to assure that storm and not base flow samples would be collected at both sampling locations.

Water samples were collected by hand from each of the sampling locations using pre-cleaned 250 mL high density polyethylene (HDPE) bottles supplied by Aquatic Research, Inc. Field personnel used aseptic techniques during the collection of water samples. Water samples were collected, without rinsing, by submerging the sample bottle to mid-depth and orienting the bottle opening upstream (against flow) while filling. The sample bottle were removed when the bottle was 90 percent full and sealed with a pre-cleaned cap. Water samples were collected from the center of the storm drain and stream channel.

The collected water samples were immediately stored in a cooler with ice at less than 6 degrees (°) Celsius. All samples were delivered to the laboratory (Aquatic Research, Inc.) within 6 hours of sample collection and analyzed within 12 hours of sample collection. A

completed chain-of-custody record was submitted with each batch of samples (Appendix A). Each sample was analyzed for the following suite of parameters:

- Total suspended solids (TSS)
- Hardness
- Dissolved cadmium
- Dissolved chromium
- Dissolved copper
- Dissolved zinc
- Total petroleum hydrocarbons
- Benzene, toluene, ethylbenzene, and xylenes (BTEX)

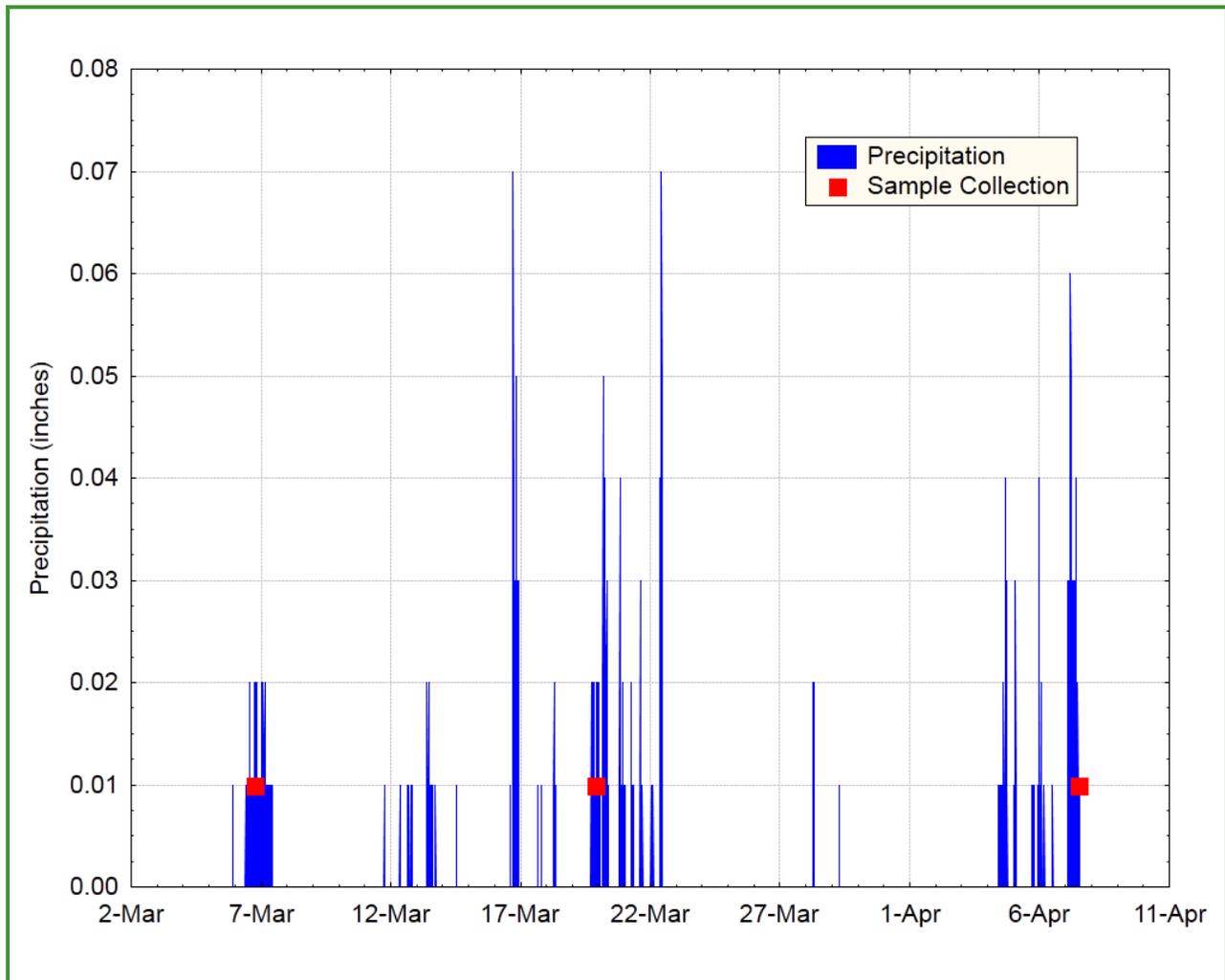


Figure 2. Temporal Chart of Precipitation and Sample Collection Times.

All laboratory data are included in Appendix B, while Appendix C provides a consolidated database of all results.

In-situ field measurements were also made for pH, dissolved oxygen, and specific conductivity using a YSI 556 hand held multi-meter. Finally, turbidity measurements were also made in the field using a Hach 2100P turbidity meter. All meters for field measurements were calibrated prior to deployment and maintained in accordance with manufacturer guidelines.

Documentation of Field Sampling Activities

Field sampling activities were recorded on custom field forms (Appendix D) during the collection of water samples. For all visits, station ID, location, sampling time, sampling date, and the sample collector's name were recorded on these forms. In addition, data from calibration measurements and estimated flow velocities at each sampling location were recorded.

Laboratory Methods

Laboratory methods, including holding times, bottle type, and reporting limits are presented in Table 1 for the parameters assessed in this study. All data were independently assessed for quality upon receipt from the laboratory. Quality assurance (QA) review forms from these assessments are presented in Appendix E.

Data Analysis Methods

Potential water quality impacts from the drainage improvement project were assessed based on statistical comparisons of pollutant concentrations in samples from the storm drain and Perrinville Creek. For these comparisons, "paired" differences in concentrations across the monitoring locations during each sampled storm event were evaluated using a Sign-Test (Helsel and Hirsch 2002). In all these comparisons, statistical significance was evaluated based on an alpha level of 0.05.

In order to contextualize the results from this monitoring program, the water quality data from the storm drain were also compared with available water quality data from regional monitoring that was conducted by King, Pierce, Clark, and Snohomish counties, as well as Seattle and Tacoma pursuant to National Pollution Discharge Elimination System (NPDES) municipal stormwater permit requirements (Ecology 2011). The data collected by these jurisdictions from representative basins for low and high-density residential development were selected for this comparison because of the similarity with the land use draining to the storm drain location (low- to medium-density residential land use).

Table 1. Water Quality Analysis Methods and Detection Limits.

Parameter	Analytical Method	Method Number ^a	Minimum Volume of Water Required for Analysis	Field Sample Container	Pre-Filtration Holding Time	Total Holding Time ^b	Field Preservation	Laboratory Preservation	Target Reporting Limit / Resolution	Units
Total suspended solids	Gravimetric	EPA 160.2	500 mL	1-L HDPE bottle	NA	7 days	Cool ≤6°C	Cool ≤6°C	1.0	mg/L
Hardness as CaCO ₃	Titration	SM 2340C	100 mL		NA	28 days		Cool ≤6°C, H ₂ SO ₄ to pH <2	1.0	mg/L
Cadmium, dissolved	ICP-MS	EPA 200.8	250 mL	250 mL HDPE Bottle	24 hours ^d	6 months		Cool ≤6°C, HNO ₃ to pH <2 ^g	0.0002	mg/L
Chromium, dissolved								Cool ≤6°C, HNO ₃ to pH <2	0.0002	mg/L
Copper, dissolved								Cool ≤6°C, HNO ₃ to pH <2 ^g	0.0001	mg/L
Zinc, dissolved								Cool ≤6°C, HNO ₃ to pH <2	0.0001	mg/L
BTEX	GC/MS	EPA 8260	100 mL	3- 40mL glass vials	7 days to extraction	40 days to analysis		Cool ≤6°C, HCL to pH <2	0.4 – 1.2	ug/L
TPH (diesel)	GC/FID	NWTPH-Dx ^c	1 L	1-L glass bottle	14 days to extraction	40 days to analysis	Cool ≤6°C, HCl to pH <2	0.05	mg/L	
TPH (motor oil)								0.1	mg/L	

^a SM method numbers are from APHA et al. (1998); EPA method numbers are from US EPA (US EPA 1983, 1984). The 18th edition of *Standard Methods for the Examination of Water and Wastewater* (APHA et al. 1992) is the current legally adopted version in the *Code of Federal Regulations*.

^b Holding time specified in US EPA guidance (US EPA 1983, 1984) or referenced in APHA et al. (1992) for equivalent method.

^c Washington State Department of Ecology methods (Ecology 1997) includes silica gel extract cleanup step.

^d US EPA requires filtering for dissolved metals and orthophosphorus within 15 minutes of the collection of the last aliquot. This goal is exceedingly difficult to meet when conducting flow-weighted sampling. A more practical proxy goal for this study is 24 hours. Both goals will be reported with the data.

C = Celsius

ICP-MS = inductively coupled plasma/mass spectrometry

GC/MS = gas chromatography/mass spectrometry

GC/FID = gas chromatography/flame ionization detection

mg/L = milligrams per liter

ug/L = microgram per liter

HDPE = High-Density Polyethylene

BTEX = benzene, toluene, ethylbenzene, and xylenes

NA = not applicable

RESULTS

Pollutant concentrations measured in the storm drain (MH-Perrinville monitoring location) and Perrinville Creek (P-Creek monitoring location) are compared in Table 2 and Figure 3. Pollutant concentrations measured in the storm drain are also compared to those from the regional NPDES monitoring data in Table 3 and Figure 3. Finally, Appendix C presents a consolidated database of all results. Note that total petroleum hydrocarbons, dissolved cadmium, dissolved chromium, benzene, ethylbenzene and xylene, were not detected in any of the collected samples; therefore, these parameters are not discussed in detail herein.

Results from the Sign Test indicated that there were no significant differences ($p < 0.05$) between pollutant concentrations measured in samples collected from the storm drain and Perrinville Creek during the three monitored storm events. As shown in Figure 3, hardness and specific conductivity were always greater in Perrinville Creek relative to the storm drain. However, because there were only three samples collected, the differences were not large enough to be statistically significant (Table 2).

Excepting hardness, the regional NPDES monitoring data shown in Table 3 indicate pollutant concentrations in runoff from high-density residential development are higher than those for low-density residential development. Comparisons of the pollutant concentrations measured in the storm drain to these data (Table 3 and Figure 3) show the following patterns:

- Average concentrations for hardness, TSS, dissolved copper, and turbidity in the storm drain fell between the averages for low-density residential development and high-density residential development.
- Average concentrations for total petroleum hydrocarbons (diesel and motor oil fractions) and dissolved zinc in the storm drain fell below the averages for both low-density residential development and high-density residential development.

Table 2. Water Quality Results and Statistical Comparison for Parameters Detected in at Least One Sample.

Date/Time	Sample Location	Hardness (mgCaCO ₃ /L)	TSS (mg/L)	Dissolved Copper (mg/L)	Dissolved Zinc (mg/L)	Toluene (µg/L)	pH	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/m)
3/6/13 17:30	MH-Perrinville	28.0	49	0.0025	0.006	0.4	6.99	36.8	12.4	45.2
3/6/13 17:50	P-Creek	67.9	13	0.0017	0.005	0.4	7.58	8.5	11.9	112.3
3/19/13 0:00	MH-Perrinville	17.0	26	0.0034	0.010	1.2	6.81	7.5	11.3	45.6
3/19/13 0:00	P-Creek	77.2	69	0.0020	0.009	1.1	7.76	8.9	11.0	176.0
4/7/13 0:00	MH-Perrinville	29.3	62	0.0024	0.007	0.4	7.23	28.5	11.2	63.7
4/7/13 0:00	P-Creek	45.3	72	0.0020	0.009	0.4	7.42	17.2	11.3	97.2
p-value from Sign-Test comparing MH-Perrinville and P-Creek concentrations		0.248	1.0	0.248	1.0	NA	0.248	1.0	1.0	0.248

Bold = result at below the reporting limit

MH-Perrinville = storm drain outfall monitoring location

P-Creek = Perrinville Creek

Table 3. Comparison of Storm Drain Water Quality Results to Regional NPDES Monitoring Results.

Data Source	Hardness (mgCaCO ₃ /L)	TSS (mg/L)	TPH Diesel (mg/L)	TPH Motor Oil (mg/L)	Dissolved Copper (mg/L)	Dissolved Zinc (mg/L)	Turbidity (NTU)
MH-Perrinville average	24.8	45.7	0.05	0.1	0.0028	0.008	24.3
2009-2010 Phase I low-density residential average	26.3	19	246	414	0.0023	0.0188	11.1
2009-2010 Phase I high-density residential average	18.5	51	363	497	0.0041	0.0322	23.8

Bold = result at below the reporting limit

MH-Perrinville = storm drain outfall monitoring location

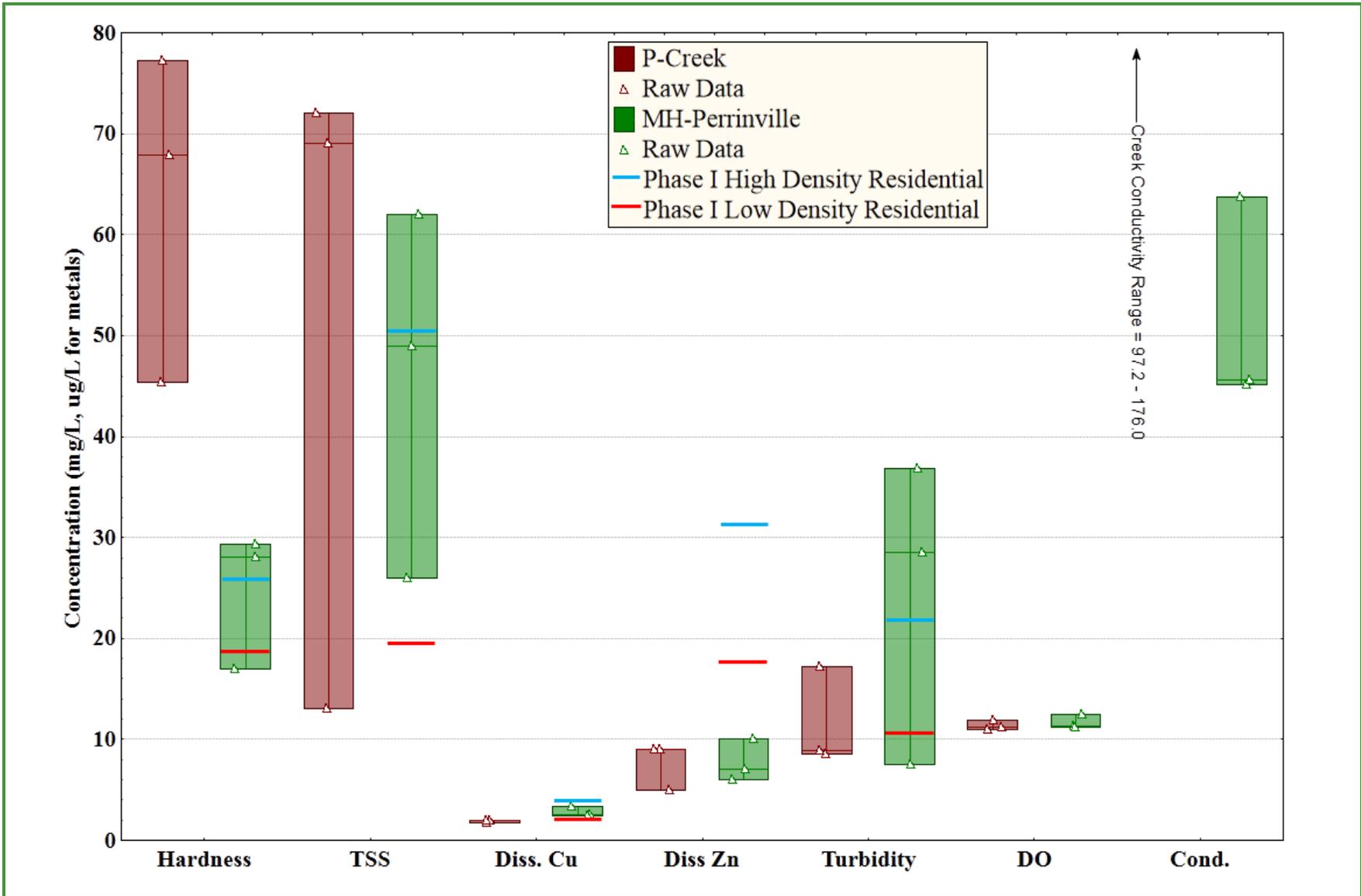


Figure 3. Boxplot Comparison of P-Creek and MH-Perrinville Water Quality.

CONCLUSIONS

The results from this study indicate pollutant concentrations measured in the runoff in the Talbot Road storm drain and in Perrinville Creek are generally similar. Furthermore, pollutant concentrations measured in the storm drain are also comparable to those from similarly developed basins across western Washington. In summary, these data indicate that moving the discharge point of the Talbot Road storm drain from near the mouth of Perrinville Creek to an outfall in Brown's Bay will not have a substantial impact on the water quality of Browns Bay.

REFERENCES

APHA, AWWA, and WEF. 1992. Standard Methods for the Examination of Water and Wastewater. 18th edition. edition. Edited by A. Greenberg, A.D. Eaton, and L. Clesceri. American Public Health Association, American Water Works Association, Water Environment Federation, Washington, D.C.

APHA, AWWA, and WEF. 1998. Standard Methods for the Examination of Water and Wastewater. 20th edition. edition. Edited by A. Greenberg, A.D. Eaton, and L. Clesceri. American Public Health Association, American Water Works Association, Water Environment Federation, Washington, D.C.

Ecology. 1997. Analytical Methods for Testing Petroleum Hydrocarbons. Publication No. ECY 97-602, Washington State Department of Ecology, Olympia, Washington.

Helsel, D.R. and R.M. Hirsch. 2002. Statistical Methods in Water Resources. Elsevier, Amsterdam.

US EPA. 1983. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020. US Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Washington, D.C.

US EPA. 1984. Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act; Final Rule and Interim Final Rule. CFR Part 136. US Environmental Protection Agency, Washington, D.C.

APPENDIX A

Chain of Custodies

Storm 1 Chain of Custody

Storm 2 Chain of Custody



:2200 Sixth Avenue, Suite 1100
 Seattle, Washington 98121
 (206) 441-9080
 FAX (206) 441-9108

HERO78.71

CHAIN OF CUSTODY RECORD

Page ___ of ___

PROJECT NAME: Redmond Biofiltration Swale					PROJECT NUMBER: 12-05434-000		CLIENT: Herrera Environmental Consultants			ANALYSES REQUESTED														
REPORT TO: Dylan Ahearn					COPY TO:					Total Suspended Solids - SM 2540D	Hardness as CaCO3 - SM 2340C	Dissolved Metals (Cd, Cr, Cu, Zn) - EPA 200.8	TPH (diesel) - NWTPH-Dx	TPH (motor oil) - NWTPH-Dx	BTEX (VOA (LOW LEVEL - 5ppb)	TURBIDITY								
SAMPLED BY: Dan Bennett					DELIVERY METHOD: Hand/ in cooler with ice																			
LABORATORY: Aquatic Research					REQUESTED COMPLETION DATE:		TOTAL # OF CONTAINERS: 12			# OF CONTAINERS:														
LAB USE:																								
SAMPLE ID:	DATE:	TIME:	SAMPLE DESCRIPTION		# OF CONTAINERS:																			
Manhole-Perrinville	3/19/13	19:30	Stormwater		6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
P-Creek	3/19/13	20:00	Creek		6	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Storm 3 Chain of Custody

APPENDIX B

Laboratory Reports

Storm 1 Lab Reports



AQUATIC RESEARCH INCORPORATED
LABORATORY & CONSULTING SERVICES
3927 AURORA AVENUE NORTH, SEATTLE, WA 98103
PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	HER078-65	PAGE 1
REPORT DATE:	03/21/13	
DATE SAMPLED:	03/06/13	DATE RECEIVED: 03/07/13
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER		
SAMPLES FROM HERRERA ENVIRONMENTAL		

CASE NARRATIVE

Two water samples were delivered to the laboratory in good condition. The samples were analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	HARDNESS (mgCaCO3/L)	TSS (mg/L)	NWTPH-DX	
			DIESEL (mg/L)	MOTOR OIL (mg/L)
MH-PERRINVILLE	28.0	49	<0.05	<0.10
P-CREEK	67.9	13	<0.05	<0.10

SAMPLE ID	DISSOLVED METALS			
	CADMIUM (mg/L)	CHROMIUM (mg/L)	COPPER (mg/L)	ZINC (mg/L)
MH-PERRINVILLE	<0.0003	<0.0010	0.0025	0.006
P-CREEK	<0.0003	<0.0010	0.0017	<0.005



AQUATIC RESEARCH INCORPORATED
LABORATORY & CONSULTING SERVICES
 3927 AURORA AVENUE NORTH, SEATTLE, WA 98103
 PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	HER078-65	PAGE 2
REPORT DATE:	03/21/13	
DATE SAMPLED:	03/06/13	DATE RECEIVED: 03/07/13
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER		
SAMPLES FROM HERRERA ENVIRONMENTAL		

QA/QC DATA WATER

QC PARAMETER	HARDNESS (mgCaCO3/L)	TSS (mg/L)	DIESEL (mg/L)	MOTOR OIL (mg/L)
METHOD	SM18 2340C	EPA 160.2	NWTPH-DX	NWTPH-DX
DATE ANALYZED	03/20/13	03/11/13	03/12/13	03/12/13
DETECTION LIMIT	2.00	0.50	0.05	0.10
DUPLICATE				
SAMPLE ID	P-CREEK	BATCH		
ORIGINAL	67.9	29		
DUPLICATE	70.4	29		
RPD	3.62%	0.00%	NA	NA
SPIKE SAMPLE				
SAMPLE ID	P-CREEK			
ORIGINAL	67.9			
SPIKED SAMPLE	86.5			
SPIKE ADDED	20.0			
% RECOVERY	93.00%	NA	NA	NA
QC CHECK				
FOUND	39.1	9.7	0.49	1.00
TRUE	40.0	10	0.50	1.00
% RECOVERY	97.75%	97.00%	98.00%	100.00%
BLANK				
	<2.00	<0.50	<0.05	<0.10

RPD = RELATIVE PERCENT DIFFERENCE.
 NA = NOT APPLICABLE OR NOT AVAILABLE.
 NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
 OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.



AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	HER078-65	PAGE 3
REPORT DATE:	03/21/13	
DATE SAMPLED:	03/06/13	DATE RECEIVED: 03/07/13
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER		
SAMPLES FROM HERRERA ENVIRONMENTAL		

QA/QC DATA WATER

QC PARAMETER	DISSOLVED METALS			
	CADMIUM (mg/L)	CHROMIUM (mg/L)	COPPER (mg/L)	ZINC (mg/L)
METHOD	EPA 200.8	EPA 200.8	EPA 200.8	EPA 200.8
DATE ANALYZED	03/11/13	03/11/13	03/11/13	03/11/13
DETECTION LIMIT	0.0003	0.0010	0.0010	0.005
DUPLICATE				
SAMPLE ID	P-CREEK	P-CREEK	P-CREEK	P-CREEK
ORIGINAL	<0.0003	<0.0010	0.0017	<0.005
DUPLICATE	<0.0003	<0.0010	0.0017	<0.005
RPD	NC	NC	0.00%	NC
SPIKE SAMPLE				
SAMPLE ID	P-CREEK	P-CREEK	P-CREEK	P-CREEK
ORIGINAL	<0.0003	<0.0010	0.0017	<0.005
SPIKED SAMPLE	0.0452	0.0441	0.0479	0.050
SPIKE ADDED	0.0500	0.0500	0.0500	0.050
% RECOVERY	90.40%	88.20%	92.40%	100.00%
QC CHECK				
FOUND	0.0502	0.0540	0.0547	0.053
TRUE	0.0500	0.0500	0.0500	0.050
% RECOVERY	100.40%	108.00%	109.40%	106.00%
BLANK	<0.0003	<0.0010	<0.0010	<0.005

RPD = RELATIVE PERCENT DIFFERENCE.

NA = NOT APPLICABLE OR NOT AVAILABLE.

NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.

OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski
Project Manager



Aquatic Research Inc.
3927 Aurora Ave. N. , Seattle, WA 98103 | (206) 632-2715

VOLATILE ORGANIC CHEMICAL REPORT

Results of Analysis by EPA Method 8260
Measurement of Purgeable Organic Compounds by Capillary Column
Gas Chromatography/Mass Spectrometry

Case File Number:	3/15/13-MB	Matrix:	Water
Sample ID No.:	Method Blank	Sample Wt/Vol. (gm/ml)	25.0
Date Collected:	n/a	Dilution Factor:	1
Date Received:	n/a	Analyst:	T. Meadows
Date Analyzed	03/15/13	Supervisor's Initials:	
Date of Report:	03/19/13	Data File Path:	C:\HPCHEM1\DATA\VOA\130315\ 0401004.D

CAS#	Name of Compound	Amount (ppb)	Flag	CAS#	Name of Compound	Amount (ppb)	Flag
71-43-2	Benzene	0.4	U		p/m-Xylene	0.8	U
108-88-3	Toluene	0.4	U	95-47-6	o-Xylene	0.4	U
100-41-4	Ethylbenzene	0.4	U		Total Xylene	1.2	U

Surrogate Recoveries	%Rec.	QC limits	
		Water	Soil
Dibromofluoromethane	85%	66-118%	66-118%
Toluene-d8	102%	51-143%	51-143%
4-Bromofluorobenzene	77%	63 - 119%	63 - 119%

FLAGS:

- U Indicates compound was analyzed for, but not detected at the specified detection limit.
- B Blank contaminated with this analyte.
- J Estimated value - compound positively identified, but below specified detection limit.
- E Estimated value - compound exceeded calibration range.
- D Compound analyzed at a secondary dilution factor of _____ from data file: _____
- PP Compound Purges Poorly, requiring elevated detection limit.

NOTE: ppb Amounts are in µg/L or µg/KG dry weight.

Storm 2 Lab Reports



AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	HER078-71	PAGE 1
REPORT DATE:	04/04/13	
DATE SAMPLED:	03/19/13	DATE RECEIVED: 03/20/13
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER		
SAMPLES FROM HERRERA ENVIRONMENTAL		

CASE NARRATIVE

Two water samples were delivered to the laboratory in good condition. The samples were analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	NWTPH-DX				
	HARDNESS (mgCaCO ₃ /L)	TSS (mg/L)	DIESEL (mg/L)	MOTOR OIL (mg/L)	TURBIDITY (NTU)
MANHOLE-PERRINVILLE	17.0	26	<0.05	<0.10	7.5
P-CREEK	77.2	69	<0.05	<0.10	8.9

SAMPLE ID	DISSOLVED METALS			
	CADMIUM (mg/L)	CHROMIUM (mg/L)	COPPER (mg/L)	ZINC (mg/L)
MANHOLE-PERRINVILLE	<0.0003	<0.0010	0.0034	0.010
P-CREEK	<0.0003	<0.0010	0.0020	0.009



AQUATIC RESEARCH INCORPORATED
LABORATORY & CONSULTING SERVICES
 3927 AURORA AVENUE NORTH, SEATTLE, WA 98103
 PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	HER078-71	PAGE 2
REPORT DATE:	04/04/13	
DATE SAMPLED:	03/19/13	DATE RECEIVED: 03/20/13
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER		
SAMPLES FROM HERRERA ENVIRONMENTAL		

QA/QC DATA WATER

QC PARAMETER	HARDNESS (mgCaCO3/L)	TSS (mg/L)	DIESEL (mg/L)	MOTOR OIL (mg/L)	TURBIDITY (NTU)
METHOD	SM18 2340C	EPA 160.2	NWTPH-DX	NWTPH-DX	EPA 180.1
DATE ANALYZED	04/04/13	03/22/13	03/26/13	03/26/13	03/20/13
DETECTION LIMIT	2.00	0.50	0.05	0.10	0.10
DUPLICATE					
SAMPLE ID	BATCH	P-CREEK			BATCH
ORIGINAL	26.4	69			0.15
DUPLICATE	26.2	62			0.16
RPD	0.74%	10.69%	NA	NA	6.45%
SPIKE SAMPLE					
SAMPLE ID	BATCH				
ORIGINAL	26.4				
SPIKED SAMPLE	45.5				
SPIKE ADDED	20.0				
% RECOVERY	95.77%	NA	NA	NA	NA
QC CHECK					
FOUND	39.5	9.7	0.49	1.00	7.8
TRUE	40.0	10	0.50	1.00	8.0
% RECOVERY	98.70%	97.00%	98.00%	100.00%	97.50%
BLANK					
	<2.00	<0.50	<0.05	<0.10	NA

RPD = RELATIVE PERCENT DIFFERENCE.
 NA = NOT APPLICABLE OR NOT AVAILABLE.
 NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
 OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.



AQUATIC RESEARCH INCORPORATED
LABORATORY & CONSULTING SERVICES
3927 AURORA AVENUE NORTH, SEATTLE, WA 98103
PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	HER078-71	PAGE 3
REPORT DATE:	04/04/13	
DATE SAMPLED:	03/19/13	DATE RECEIVED: 03/20/13
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER		
SAMPLES FROM HERRERA ENVIRONMENTAL		

QA/QC DATA WATER

QC PARAMETER	DISSOLVED METALS			
	CADMIUM (mg/L)	CHROMIUM (mg/L)	COPPER (mg/L)	ZINC (mg/L)
METHOD	EPA 200.8	EPA 200.8	EPA 200.8	EPA 200.8
DATE ANALYZED	03/21/13	03/21/13	03/21/13	03/21/13
DETECTION LIMIT	0.0003	0.0010	0.0010	0.005
DUPLICATE				
SAMPLE ID	P-CREEK	P-CREEK	P-CREEK	P-CREEK
ORIGINAL	<0.0003	<0.0010	0.0020	0.009
DUPLICATE	<0.0003	<0.0010	0.0018	0.008
RPD	NC	NC	10.53%	11.76%
SPIKE SAMPLE				
SAMPLE ID	P-CREEK	P-CREEK	P-CREEK	P-CREEK
ORIGINAL	<0.0003	<0.0010	0.0020	0.009
SPIKED SAMPLE	0.0550	0.0516	0.0568	0.067
SPIKE ADDED	0.0500	0.0500	0.0500	0.050
% RECOVERY	110.00%	103.20%	109.60%	116.00%
QC CHECK				
FOUND	0.0494	0.0512	0.0534	0.052
TRUE	0.0500	0.0500	0.0500	0.050
% RECOVERY	98.80%	102.40%	106.80%	104.00%
BLANK	<0.0003	<0.0010	<0.0010	<0.005

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski
Project Manager



VOLATILE ORGANIC CHEMICAL REPORT

Results of Analysis by EPA Method 8260
Measurement of Purgeable Organic Compounds by Capillary Column
Gas Chromatography/Mass Spectrometry

Case File Number:	3/21/13-LCS	Matrix:	Water
Sample ID No.:	3/21/13-LCS	Sample Wt/Vol. (gm/ml)	5.0
Date Collected:	n/a	Dilution Factor:	1
Date Received:	n/a		
Date Analyzed	03/21/13	Analyst:	T. Meadows
Date of Report:	3/21/2013	Supervisor's Initials:	
Data File Path:	C:\HPCHEM\1\DATA\VOA\130321\ 0501005.D		

Surrogate Recoveries	%Rec.	QC limits	
Dibromofluoromethane	86%	66%	118%
Toluene-d8	99%	51%	143%
4-Bromofluorobenzene	69%	63%	119%

Spike Recoveries	%Rec.	QC limits	
1,1-Dichloroethene	115%	75%	125%
Benzene	93%	75%	125%
Trichloroethene	117%	75%	125%
Toluene	105%	75%	125%
Chlorobenzene	104%	75%	125%

Storm 3 Lab Reports



AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	HER078-83	PAGE 1
REPORT DATE:	04/22/13	
DATE SAMPLED:	04/07/13	DATE RECEIVED: 04/07/13
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRERA ENVIRONMENTAL		

CASE NARRATIVE

Two water samples were delivered to the laboratory in good condition. The samples were analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	HARDNESS (mgCaCO ₃ /L)	TSS (mg/L)	NWTPH-DX	
			DIESEL (mg/L)	MOTOR OIL (mg/L)
MANHOLE-PERRINVILLE	29.3	62	<0.05	<0.10
P-CREEK	45.3	72	<0.05	<0.10

SAMPLE ID	DISSOLVED METALS			
	CADMIUM (mg/L)	CHROMIUM (mg/L)	COPPER (mg/L)	ZINC (mg/L)
MANHOLE-PERRINVILLE	<0.0003	<0.0010	0.0024	0.007
P-CREEK	<0.0003	<0.0010	0.0020	0.009



AQUATIC RESEARCH INCORPORATED
LABORATORY & CONSULTING SERVICES
 3927 AURORA AVENUE NORTH, SEATTLE, WA 98103
 PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	HER078-83	PAGE 2
REPORT DATE:	04/22/13	
DATE SAMPLED:	04/07/13	DATE RECEIVED: 04/07/13
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER		
SAMPLES FROM HERRERA ENVIRONMENTAL		

QA/QC DATA WATER

QC PARAMETER	HARDNESS (mgCaCO3/L)	TSS (mg/L)	DIESEL (mg/L)	MOTOR OIL (mg/L)
METHOD	SM18 2340C	EPA 160.2	NWTPH-DX	NWTPH-DX
DATE ANALYZED	04/17/13	04/12/13	04/19/13	04/19/13
DETECTION LIMIT	2.00	0.50	0.05	0.10
DUPLICATE				
SAMPLE ID	BATCH	BATCH		
ORIGINAL	18.8	60		
DUPLICATE	18.4	67		
RPD	2.15%	11.02%	NA	NA
SPIKE SAMPLE				
SAMPLE ID	BATCH			
ORIGINAL	18.8			
SPIKED SAMPLE	38.3			
SPIKE ADDED	20.0			
% RECOVERY	97.50%	NA	NA	NA
QC CHECK				
FOUND	39.1	9.6	0.49	0.94
TRUE	40.0	10	0.50	1.00
% RECOVERY	97.75%	96.00%	98.00%	94.00%
BLANK				
	<2.00	<0.50	<0.05	<0.10

RPD = RELATIVE PERCENT DIFFERENCE.
 NA = NOT APPLICABLE OR NOT AVAILABLE.
 NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
 OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.



AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	HER078-83	PAGE 3
REPORT DATE:	04/22/13	
DATE SAMPLED:	04/07/13	DATE RECEIVED: 04/07/13
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRERA ENVIRONMENTAL		

QA/QC DATA WATER

QC PARAMETER	DISSOLVED METALS			
	CADMIUM (mg/L)	CHROMIUM (mg/L)	COPPER (mg/L)	ZINC (mg/L)
METHOD	EPA 200.8	EPA 200.8	EPA 200.8	EPA 200.8
DATE ANALYZED	04/10/13	04/10/13	04/10/13	04/10/13
DETECTION LIMIT	0.0003	0.0010	0.0010	0.005
DUPLICATE				
SAMPLE ID	BATCH	BATCH	BATCH	BATCH
ORIGINAL	<0.0003	<0.0010	0.0045	0.014
DUPLICATE	<0.0003	<0.0010	0.0044	0.014
RPD	NC	NC	2.25%	0.00%
SPIKE SAMPLE				
SAMPLE ID	BATCH	BATCH	BATCH	BATCH
ORIGINAL	<0.0003	<0.0010	0.0045	0.014
SPIKED SAMPLE	0.0471	0.0435	0.0531	0.066
SPIKE ADDED	0.0500	0.0500	0.0500	0.050
% RECOVERY	94.20%	87.00%	97.20%	104.00%
QC CHECK				
FOUND	0.0486	0.0488	0.0533	0.052
TRUE	0.0500	0.0500	0.0500	0.050
% RECOVERY	97.20%	97.60%	106.60%	104.00%
BLANK	<0.0003	<0.0010	<0.0010	<0.005

RPD = RELATIVE PERCENT DIFFERENCE.

NA = NOT APPLICABLE OR NOT AVAILABLE.

NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.

OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski
Project Manager



Aquatic Research Inc.
3927 Aurora Ave. N. , Seattle, WA 98103 | (206) 632-2715

VOLATILE ORGANIC CHEMICAL REPORT

Results of Analysis by EPA Method 8260
Measurement of Purgeable Organic Compounds by Capillary Column
Gas Chromatography/Mass Spectrometry

Case File Number:	4/16/13-MB	Matrix:	Water
Sample ID No.:	Method Blank	Sample Wt/Vol. (gm/ml)	25.0
Date Collected:	n/a	Dilution Factor:	1
Date Received:	n/a	Analyst:	T. Meadows
Date Analyzed	04/16/13	Supervisor's Initials:	
Date of Report:	04/16/13	Data File Path:	C:\HPCHEM1\DATA\VOA\130416\ 0401004.D

CAS#	Name of Compound	Amount (ppb)	Flag	CAS#	Name of Compound	Amount (ppb)	Flag
71-43-2	Benzene	0.4	U		p/m-Xylene	0.8	U
108-88-3	Toluene	0.4	U	95-47-6	o-Xylene	0.4	U
100-41-4	Ethylbenzene	0.4	U		Total Xylene	1.2	U

Surrogate Recoveries	%Rec.	QC limits	
		Water	Soil
Dibromofluoromethane	114%	66-118%	66-118%
Toluene-d8	102%	51-143%	51-143%
4-Bromofluorobenzene	105%	63 - 119%	63 - 119%

FLAGS:

- U Indicates compound was analyzed for, but not detected at the specified detection limit.
- B Blank contaminated with this analyte.
- J Estimated value - compound positively identified, but below specified detection limit.
- E Estimated value - compound exceeded calibration range.
- D Compound analyzed at a secondary dilution factor of _____ from data file: _____
- PP Compound Purges Poorly, requiring elevated detection limit.

NOTE: ppb Amounts are in µg/L or µg/KG dry weight.

APPENDIX C

Consolidated Database of Results

Date/Time	Sample Location	Hardness (mgCaCO3/ L)	TSS (mg/L)	NWTPH- DX-Diesel (mg/L)		NWTPH-DX Motor Oil (mg/L)		Dissolved Cadmium (mg/L)		Dissolved Chromium (mg/L)		Dissolved Copper (mg/L)		Dissolved Zinc (mg/L)	Benzene (µg/L)	Toluene (µg/L)		Ethylbenz- ene (µg/L)		p/m- Xylene (µg/L)		o-Xylene (µg/L)		Total Xylene (µg/L)	ph	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/m)			
3/6/13 17:30	MH-Perrinville	28.0	49	0.05	U	0.10	U	0.0003	U	0.0010	U	0.0025		0.006	0.4	U	0.4	U	0.4	U	0.8	U	0.4	U	1.2	U	6.99	36.8	12.4	45.2	
3/6/13 17:50	P-Creek	67.9	13	0.05	U	0.10	U	0.0003	U	0.0010	U	0.0017		0.005	U	0.4	U	0.4	U	0.4	U	0.8	U	0.4	U	1.2	U	7.58	8.5	11.9	112.3
3/19/13 0:00	MH-Perrinville	17.0	26	0.05	U	0.10	U	0.0003	U	0.0010	U	0.0034		0.010	0.4	U	1.2		0.4	U	0.8	U	0.4	U	1.2	U	6.81	7.5	11.3	45.6	
3/19/13 0:00	P-Creek	77.2	69	0.05	U	0.10	U	0.0003	U	0.0010	U	0.0020		0.009	0.4	U	1.1		0.4	U	0.8	U	0.4	U	1.2	U	7.76	8.9	11.0	176.0	
4/7/13 0:00	MH-Perrinville	29.3	62	0.05	U	0.10	U	0.0003	U	0.0010	U	0.0024		0.007	0.4	U	0.4	U	0.4	U	0.8	U	0.4	U	1.2	U	7.23	28.5	11.2	63.7	
4/7/13 0:00	P-Creek	45.3	72	0.05	U	0.10	U	0.0003	U	0.0010	U	0.0020		0.009	0.4	U	0.4	U	0.4	U	0.8	U	0.4	U	1.2	U	7.42	17.2	11.3	97.2	
2009-2010 Phae I average Low Desnity Residential		26.3	19	246		414		0.00003				0.00226		0.0188													11.06				
2009-2010 Phae I average High Desnity Residential		18.5	51	363		497		0.00004				0.0041		0.0322													23.78				

APPENDIX D

Field Forms

Storm 1 Field Form

FIELD LOG SHEET

Location: Perrinville Creek, Edmonds, WA

Pre-Storm Checklist

Date/Time 4/7/13 12:00	Field Staff: Dan Bennett	
------------------------	--------------------------	--

Supplies

Field Sheet x
 Traffic cones x
 Manhole Puller x

Sample Bottles

TPH x
 Metals x
 VOAs x
 TSS **X**

Field Meters Calibrated

Ph Meter x
 DO Meter x
 Conductivity Meter x
 Turbidity Meter **X**

Storm Visit

Date: 4/7/2013	Field Staff: D. Bennett	Weather: Light rain
----------------	-------------------------	---------------------

Station Name: Manhole Perrinville

Sample Time 12:30
 Estimated flow dept 0.3
 Estimated flow widt 2'
 Estimated flow velo **4**
 Bottles Filled:
 TPH x
 Metals x
 VOAs x
 TSS x

Field Meter Results

Ph 7.23
 DO mg/L 11.16/95.8
 Conductivity 63.7
 Turbidity 28.5

Notes:

Station Name: P-Creek

Sample Time 13:00
 Estimated flow dept 1
 Estimated flow widt 2'
 Estimated flow velo **6**
 Bottles Filled:
 TPH x
 Metals x
 VOAs x
 TSS x

Field Meter Results

Ph Meter 7.42
 DO Meter 11.26/97.4
 Conductivity Meter 97.2
 Turbidity Meter 17.2

Notes:

Deliverd to Lab: 4/7/2013 14:30

Storm 2 Field Form

FIELD LOG SHEET

Location: Perrinville Creek, Edmonds, WA

Pre-Storm Checklist

Date/Time 3/19/13 20:30	Field Staff: Dan Bennett
-------------------------	--------------------------

Supplies

Field Sheet x
 Traffic cones x
 Manhole Puller x

Sample Bottles

TPH x
 Metals x
 VOAs x
 TSS **x**

Field Meters Calibrated

Ph Meter x 7 +10
 DO Meter x 100%
 Conductivity Meter x 84
 Turbidity Meter **x** forgot, added to lab analysis

Storm Visit

Date:	Field Staff:	Weather: hard rain
-------	--------------	------------------------

Station Name: Manhole Perrinville

Sample Time 3/19/2013 21:30
 Estimated flow dept 0.25
 Estimated flow width 1.5'
 Estimated flow velocity **2fps**
 Bottles Filled:
 TPH x
 Metals x
 VOAs x
 TSS x

Field Meter Results

Ph 6.81
 DO mg/L/% 11.32/94.6
 Conductivity 45.6
 Turbidity na-added to lab

Notes:

Station Name: P-Creek

Sample Time 3/19/2013 20:00:00 PM
 Estimated flow depth
 Estimated flow width
 Estimated flow velocity **5**
 Bottles Filled:
 TPH x
 Metals x
 VOAs x
 TSS x

Field Meter Results

Ph Meter 7.76
 DO Meter 10.99/94.2
 Conductivity Meter 176
 Turbidity Meter na-added to lab

Notes:

Delivered to Lab: 3/20/2013 10:00

Storm 3 Field Form

FIELD LOG SHEET

Location: Perrinville Creek, Edmonds, WA

Pre-Storm Checklist

Date/Time 4/7/13 12:00

Field Staff: Dan Bennett

Supplies

Field Sheet x
Traffic cones x
Manhole Puller x

Sample Bottles

TPH x
Metals x
VOAs x
TSS **X**

Field Meters Calibrated

Ph Meter x
DO Meter x
Conductivity Meter x
Turbidity Meter **X**

Storm Visit

Date: 4/7/2013

Field Staff: D. Bennett

Weather: Light rain

Station Name: Manhole Perrinville

Sample Time 12:30
Estimated flow dept 0.3
Estimated flow width 2'
Estimated flow velocity **4**
Bottles Filled:
TPH x
Metals x
VOAs x
TSS x

Field Meter Results

Ph 7.23
DO mg/L 11.16/95.8
Conductivity 63.7
Turbidity 28.5

Notes:

Station Name: P-Creek

Sample Time 13:00
Estimated flow dept 1
Estimated flow width 2' 5
Estimated flow velocity **6**
Bottles Filled:
TPH x
Metals x
VOAs x
TSS x

Field Meter Results

Ph Meter 7.42
DO Meter 11.26/97.4
Conductivity Meter 97.2
Turbidity Meter 17.2

Notes:

Delivered to Lab: 4/7/2013 14:30

APPENDIX E

Quality Assurance Review Forms

Storm 1 QA Worksheet



Data Quality Assurance Worksheet

By Gina Catarra

Project Name/No./Client: Perrinville Creek Tributary SW Sampling / 12-05434-000 / City of Edmonds

Date 05/02/2013 Page 1 of 1

Laboratory/Parameters: Aquatic Research Inc. / TSS, Hardness, TPH-Dx, BTEX, Dissolved Metals (Cd, Cr, Cu, Zn)

Checked: initials

Sample Date/Sample ID: 03/06/13 / MH-Perrinville, P-Creek

date _____

Parameter	Completeness/ Methodology	Pre-preservation Holding Times (days)		Total Holding Times (days)		Method <u>Blanks</u> Reporting Limit (mg/L)	Matrix Spikes/ Surrogate Recovery (%)		Lab Control Samples Recovery (%)		Lab Duplicates RPD (%)		Field Duplicates RPD (%)		ACTION
		Reported	Goal	Reported	Goal		Reported	Goal ¹	Reported	Goal	Reported	Goal ¹	Reported	Goal ¹	
TSS	OK	NA	NA	5	≤7	≤0.5 0.5	NA	NA	97	±10	Batch 0	≤20	NS	≤20	NONE
Hardness	OK	NA	NA	14	≤180	≤2.0 2.0	P-CREEK 93	±30	98	±10	P-Creek 3.6	≤20	NS	≤20	NONE
Dissolved Metals	OK	NA	NA	6	≤180	≤0.0003-0.005 0.0003-0.005	P-CREEK 88-100	±25	100-109	±25	P-Creek NC, 0	≤20	NS	≤20	NONE
TPH-Dx	OK	NA	NA	6	≤7	≤0.05-0.1 0.05-0.10	NA	NA	98,100	±50	NA	NA	NS	≤20	NONE
BTEX	OK	NA	NA	9	≤14	≤0.0004-0.0012 0.0004-0.0012	72-103	51-143	99-116	±25	NA	NA	NS	≤20	NONE

¹ If the sample or duplicate value is less than five times the reporting limit, the difference is calculated rather than the relative percent difference (RPD). The QA goal is a difference <2 times the detection limit instead of the number indicated in the goal column.

NA – not applicable or not available; NC – not calculable due to one or more values below the detection limit; NS – field duplicate not sampled.

Storm 2 QA Worksheet



Data Quality Assurance Worksheet

By Gina Catarra

Project Name/No./Client: Perrinville Creek Tributary SW Sampling / 12-05434-000 / City of Edmonds

Date 05/02/2013 Page 1 of 1

Laboratory/Parameters: Aquatic Research Inc. / TSS, Hardness, Turbidity, TPH-Dx, BTEX, Dissolved Metals (Cd, Cr, Cu, Zn)

Checked: initials

Sample Date/Sample ID: 03/19/13 / MH-Perrinville, P-Creek

date _____

Parameter	Completeness/ Methodology	Pre-preservation Holding Times (days)		Total Holding Times (days)		Method Blanks Reporting Limit (mg/L)	Matrix Spikes/ Surrogate Recovery (%)		Lab Control Samples Recovery (%)		Lab Duplicates RPD (%)		Field Duplicates RPD (%)		ACTION
		Reported	Goal	Reported	Goal		Reported	Goal ¹	Reported	Goal	Reported	Goal ¹	Reported	Goal ¹	
TSS	OK	NA	NA	3	≤7	≤0.5 0.5	NA	NA	97	±10	P-Creek 11	≤20	NS	≤20	NONE
Hardness	OK	NA	NA	16	≤180	≤2.0 2.0	BATCH 96	±30	99	±10	Batch 0.7	≤20	NS	≤20	NONE
Turbidity	OK	NA	NA	1	≤2	≤0.10 0.10	NA	NA	98	±10	Batch 6.5	≤20	NS	≤20	NONE
Dissolved Metals	OK	NA	NA	6	≤180	≤0.0003-0.005 0.0003-0.005	P-CREEK 103-116	±25	99-107	±25	P-Creek NC,11-12	≤20	NS	≤20	NONE
TPH-Dx	OK	NA	NA	7	≤7	≤0.05-0.1 0.05-0.10	NA	NA	98,100	±50	NA	NA	NS	≤20	NONE
BTEX	OK	NA	NA	2	≤14	≤0.0004-0.0012 0.0004-0.0012	P-CREEK 99-106 / 69-103	±25 / 51-143	93-117	±25	MH-Perrinville 8.7	≤20	NS	≤20	NONE

¹ If the sample or duplicate value is less than five times the reporting limit, the difference is calculated rather than the relative percent difference (RPD). The QA goal is a difference <2 times the detection limit instead of the number indicated in the goal column.

NA – not applicable or not available; NC – not calculable due to one or more values below the detection limit; NS – field duplicate not sampled.

Storm 3 QA Worksheet



Data Quality Assurance Worksheet

By Gina Catarra

Project Name/No./Client: Perrinville Creek Tributary SW Sampling / 12-05434-000 / City of Edmonds

Date 05/02/2013 Page 1 of 1

Laboratory/Parameters: Aquatic Research Inc. / TSS, Hardness, TPH-Dx, BTEX, Dissolved Metals (Cd, Cr, Cu, Zn)

Checked: initials

Sample Date/Sample ID: 04/07/13 / MH-Perrinville, P-Creek

date _____

Parameter	Completeness/ Methodology	Pre-preservation Holding Times (days)		Total Holding Times (days)		Method <u>Blanks</u> Reporting Limit (mg/L)	Matrix Spikes/ Surrogate Recovery (%)		Lab Control Samples Recovery (%)		Lab Duplicates RPD (%)		Field Duplicates RPD (%)		ACTION
		Reported	Goal	Reported	Goal		Reported	Goal ¹	Reported	Goal	Reported	Goal ¹	Reported	Goal ¹	
TSS	OK	NA	NA	5	≤7	≤0.5 0.5	NA	NA	96	±10	Batch 11	≤20	NS	≤20	NONE
Hardness	OK	NA	NA	10	≤180	≤2.0 2.0	BATCH 98	±30	98	±10	Batch 2.2	≤20	NS	≤20	NONE
Turbidity															NOT ANALYZED
Dissolved Metals	OK	NA	NA	3	≤180	≤0.0003-0.005 0.0003-0.005	BATCH 87-104	±25	97-106	±25	Batch NC,0-2.2	≤20	NS	≤20	NONE
TPH-Dx	OK	NA	NA	12	≤7	≤0.05-0.1 0.05-0.10	NA	NA	98,94	±50	NA	NA	NS	≤20	NONE
BTEX	OK	NA	NA	9	≤14	≤0.0004-0.0012 0.0004-0.0012	P-CREEK 101-125/ 72-115	±25 / 51- 143	101-112	±25	MH- Perrinville NC	≤20	NS	≤20	NONE

¹ If the sample or duplicate value is less than five times the reporting limit, the difference is calculated rather than the relative percent difference (RPD). The QA goal is a difference <2 times the detection limit instead of the number indicated in the goal column.

NA – not applicable or not available; NC – not calculable due to one or more values below the detection limit; NS – field duplicate not sampled.

