HERRERA

TECHNICAL MEMORANDUM

Date: June 8, 2022

To: Brandi Lubliner, Washington State Department of Ecology

Copy to: Jessica Atlakson, City of Redmond

From: Katie Sweeney, Dylan Ahearn, John Lenth; Herrera Environmental Consultants, Inc.

Subject: Addendum 1 to the Quality Assurance Project Plan for the Redmond Paired Watershed Study

CONTENTS

TABLES

SIGNATURE PAGE

Approved by: Date

Jessica Atlakson
City Project Manager
City of Redmond

Brandi Lubliner
Stormwater Action Monitoring Program Manager
Washington State Department of Ecology

John Lenth
Herrera Project Manager; Water Quality and Biological Monitoring Lead
Herrera Environmental Consultants, Inc.

Elizabeth Sosik
King County Project Manager
King County

David Baumeister
Laboratory Project Manager for Polycyclic Aromatic Hydrocarbon Analysis
OnSite Environmental, Inc.

Tim Fitzpatrick
Laboratory Project Manager for 6PPD-Quinone
SGS AXYS Analytical Services Ltd.

INTRODUCTION

This addendum provides detailed data collection, quality assurance and control, management, and analysis for the Tosh Creek Watershed Street Sweeping project, in accordance with Section 6.3 of the Quality Assurance Project Plan for the Redmond Paired Watershed Study (RPWS).

Monitoring for the study initiated in 2016 and is anticipated to continue for a 10-year timeframe. Trend analyses reports are being prepared at regular intervals to summarize analyses that were performed to detect potential improving trends in receiving water conditions. The first trend analysis report was prepared after four years of study implementation (Herrera 2021). This report documented a significant decrease in total suspended solids (TSS) and total copper concentrations in the Monticello Creek that appeared related to a City project that progressively increased street sweeping frequency in the associated watershed. These results were consistent with another study that was implemented by Seattle (SPU 2018).

To validate the effectiveness of streets sweeping for improving water quality, the City has obtained grant funding from King County to progressively increase street sweeping in the Tosh Creek watershed. The City also intends to evaluate whether street sweeping can be effective at removing other pollutants of concern that are associated with roadway runoff. Specifically, the City will collect samples for evaluating concentrations of 6PPD-quinone (6PPD-Q) and polycyclic aromatic hydrocarbons (PAHs) during the routine water quality monitoring that is conducted for the RPWS. A widely used antioxidant in rubber tires, 6PPD-Q is an emerging contaminant in stormwater that was recently linked to acute mortality of coho salmon. PAHs are a common type of organic pollutant found in stormwater runoff that are known or probable human carcinogens and toxic to aquatic life.

This amendment to the Quality Assurance Project Plan (QAPP) for the RPWS (Herrera 2015) was prepared to document the following information for this additional sampling:

- Street sweeping program description
- Project organization and schedule
- Measurement quality objectives
- Experimental design
- Sampling procedures
- Measurement procedures

Unless explicitly described in this addendum, all other data collection, processing, management, and analysis procedures will be consistent with those identified in the QAPP.

Street Sweeping Program Description

City staff will sweep all public roads (3.54 miles) in the Tosh Creek watershed within Redmond city limits one time per month from October 2022 through September 2023, and two times per month from October 2023 through September 2024. This will be in addition to the regularly scheduled quarterly street sweeping.

Sweeping will be performed using a regenerative street sweeper. The street sweeper will clean curb to curb including the crown of the road, with the intention to clean all surfaces possible during sweeping events. City staff will use a counter to determine how many cars are parked on the road to estimate area of road missed.

City staff will carry equipment onboard the street sweeper and know how to use such equipment in the event of a spill or mechanical breakdown that results in fluids (i.e., oil, hydraulic fluid, gasoline, diesel, etc.) leaking from the street sweeper.

Project Organization and Schedule

Key personnel that will be involved in this effort are identified below with their respective roles:

City of Redmond
15670 Northeast 85th Street
Redmond, Washington 98503
425-556-2874
Jessica Atlakson, City Project Manager

Washington State Department of Ecology
Headquarter Office
P.O. Box 47600
Olympia, WA 98504-7600
360-407-7140
Brandi Lubliner, Stormwater Action Monitoring Program Manager

Herrera Environmental Consultants, Inc.
2200 Sixth Avenue, Suite 1100
Seattle, WA 98121
206-441-9080
John Lenth, Herrera Project Manager
Dylan Ahearn, Ph.D., Monitoring Coordinator
Gina Catarra, Data Quality Assurance Officer

King County
Department of Natural Resources and Parks
Water and Land Resources Division
201 South Jackson Street – Suite 600
Seattle, WA 98104-3855
206-296-0100
Elizabeth Sosik, King County Project Manager
Dave Funke, Hydrologic Monitoring Lead

OnSite Environmental, Inc.
201 South Jackson Street – Suite 600
Seattle, WA 98104-3855
206-296-0100
David Baumeister, Laboratory Project Manager for PAHs Analysis

SGS AXYS Analytical Services Ltd.
2045 Mills Road W
Sidney, BC, Canada, V8L 5X2
250-655-5800
Tim Fitzpatrick, Laboratory Project Manager for 6PPD-Q Analysis

Monitoring for this phase will begin July 1, 2022 and continue to September 2024. The following monitoring activities will continue on the indicated annual schedule, as described in the QAPP:

- Hydrologic Monitoring: Year-round
- Water Quality Monitoring: Year-round
- Physical Habitat Monitoring: July through September
- Sediment Quality Monitoring: May through June
- Biological Monitoring: July through August

MEASUREMENT QUALITY OBJECTIVES

Quality assurance indicators for discrete water quality data are expressed in terms of precision, bias, representativeness, completeness, and comparability as described in the QAPP (Herrera 2015). The specific measurement quality objectives (MQOs) for 6PPD-Q and PAHs identified for this supplemental sampling were provided from the respective laboratories. These MQOs are summarized in Table 1.

Experimental Design

Water quality monitoring in each of the study watersheds will continue as described in the QAPP, supplemented by sampling and analysis for 6PPD-Q and PAHs beginning July 1, 2022 and ending September 30, 2024 in the Tosh Creek watershed (an Application basin) and the Country Creek watershed (a Control basin). In each watershed, the additional sampling for 6PPD-Q and PAHs will occur at the station located at the creek mouth and at the upstream station located mid-watershed (see Figures 4 and 7 in the QAPP). This additional sampling will inform our further evaluations of the effectiveness of street sweeping in these basins.

Sample Procedures

Water quality sampling procedures will follow those identified in the QAPP. Table 2 shows applicable sample collection requirements that will be used for 6PPD-Q and PAHs including analytical methods, sample containers, holding times, sample preservation, and reporting limits. Note that ascorbic acid (500 mg/L) will be added to 6PPD-Q samples in the field to reduce analyte degradation. For 6PPD-Q and PAHs, sample exposure to ambient light, heat and oxygen/ozone will also be minimized by using amber bottles, filling sample containers to eliminate headspace, and immediately storing samples.

Table 1. Measurement Quality Objectives for Water Quality Data.

Parameter	Analytical Method	Reporting Limit Target	Laboratory Method Blank[a]	Control Standard Recovery	Matrix Spike Recovery	Laboratory Duplicate RPD	Field Duplicate RPD
6PPD-quinone (6PPD-Q)	MLA-118	0.1 ng/mL	<RL	70-130%	70-130%	<40%	<50%
Polycyclic Aromatic Hydrocarbons (PAHs) (ng/mL)							
2-Methylnaphthalene	EPA 8270E-SIM	0.10	≤ RL	NA	NA	<30%	<35%
Acenaphthene	EPA 8270E-SIM	0.10	≤ RL	33-99%	33-99%	<26%	<35%
Acenaphthylene	EPA 8270E-SIM	0.10	≤ RL	35-107%	35-107%	<26%	<35%
Anthracene	EPA 8270E-SIM	0.10	≤ RL	47-101%	47-101%	<21%	<35%
Benzo(a)anthracene	EPA 8270E-SIM	0.011	≤ RL	57-114%	57-114%	<21%	<35%
Benzo(a)pyrene	EPA 8270E-SIM	0.010	≤ RL	54-119%	54-119%	<22%	<35%
Benzo(b)fluoranthene	EPA 8270E-SIM	0.010	≤ RL	56-125%	56-125%	<26%	<35%
Benzo(g,h,i)perylene	EPA 8270E-SIM	0.010	≤ RL	55-117%	55-117%	<22%	<35%
Benzo(k)fluoranthene	EPA 8270E-SIM	0.010	≤ RL	53-124%	53-124%	<22%	<35%
Chrysene	EPA 8270E-SIM	0.010	≤ RL	55-119%	55-119%	<21%	<35%
Dibenz(a,h)anthracene	EPA 8270E-SIM	0.010	≤ RL	56-118%	56-118%	<23%	<35%
Fluoranthene	EPA 8270E-SIM	0.10	≤ RL	51-115%	51-115%	<23%	<35%
Fluorene	EPA 8270E-SIM	0.10	≤ RL	43-95%	43-95%	<24%	<35%
Indeno(1,2,3-cd)pyrene	EPA 8270E-SIM	0.010	≤ RL	55-118%	55-118%	<23%	<35%
Naphthalene	EPA 8270E-SIM	0.10	≤ RL	25-82%	25-82%	<39%	<40%
Phenanthrene	EPA 8270E-SIM	0.10	≤ RL	49-100%	49-100%	<20%	<35%
Pyrene	EPA 8270E-SIM	0.10	≤ RL	53-117%	53-117%	<24%	<35%

[a] If criteria is not met, project sample data within 5 times the blank concentration are flagged with a J.

NA = not applicable.

RL = reporting limit. RPD = relative percent difference.

MEASUREMENT PROCEDURES

Laboratory analytical procedures will follow US Environmental Protection Agency (EPA) (US EPA 2014) approved methods for the analysis of PAHs. There currently is currently no US EPA approved laboratory analytical procedures for the analysis of 6PPD-Q; hence, an experimental procedure that has been developed by SGS AXYS Analytical Services will be used for this parameter. These methods provide reporting limits that allow low-level pollutant concentrations in water samples to be compared to applicable state and federal regulatory criteria or guidelines, where relevant. The preservation methods, analytical methods, reporting limits, and sample holding times are presented in Table 2.

Table 2. Sample Collection Requirements.

Parameter	Analytical Method	Method Number[a]	Sample Container	Pre-Extraction Holding Time	Analytical Holding Time[b]	Sample Preservation	Reporting Limit	Units
Water Analyses								
6PPD-quinone (6PPD-Q)	Liquid chromatography/mass spectrometry (UHPLC-MS/MS)	MLA-118	500 mL amber glass	14 days	28 days	Ascorbic acid at collection, cool to ≤6°C, dark	0.1	ng/mL
Polycyclic Aromatic Hydrocarbons (PAHs)	Gas chromatography/mass spectrometry (GC/MS)	EPA 8270D	1000 mL amber glass[c]	7 days	40 days	Cool to ≤ 6°C, dark	0.01-0.1	µg/L

[a] EPA method numbers are from US EPA (2014, 2018).

[b] Holding time specified in US EPA guidance (US EPA 2018). Sample hold times for 6PPD-Q are not established; laboratory guidelines shown here instead.

[c] sample containers should be glass with polytetrafluoroethylene (PTFE)-lined septa.

C = Celsius.
GC/MS = gas chromatography/mass spectrometry.
UHPLC-MS/MS = ultra-high-performance liquid chromatography/ mass spectrometry
mL = milliliter.
ng/mL = nanograms per milliliter.
µg/L = micrograms per liter.

REFERENCES

Herrera. 2015. Quality Assurance Project Plan: Redmond Paired Watershed Study. Prepared for the City of Redmond by Herrera Environmental Consultants, Inc., Seattle, Washington. December 31.

Herrera. 2021. Redmond Paired Watershed Study Trend Analysis Report: Water Years 2016-2019. Prepared for the City of Redmond by Herrera Environmental Consultants, Inc., Seattle, Washington. February 19.

SPU. 2018. NPDES Phase I Municipal Stormwater Permit: Street Sweeping Water Quality Effectiveness Study Final Report. Seattle Public Utilities, Seattle, Washington.

US EPA. 2014. Method 8270E (SW-846): Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS). Washington, DC.

US EPA. 2018. Chapter Four: Recommended Sample Containers, Preservation Techniques, and Holding Times. Washington, DC.