Quality Assurance Project Plan Addendum

6PPD-q in Highway Runoff, BMP Effectiveness, and Field Protocol Development

Prepared for
Washington Department of Ecology

Prepared by
Herrera Environmental Consultants, Inc.

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Science + Planning + Design

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Prepared for
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February 2024

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PROJECT TEAM SIGNATURE PAGE

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Published February 2024

Approval signatures indicate that each key member of the project team has reviewed this Quality Assurance Project Plan (QAPP) and agree to follow the methods and quality assurance (QA) procedures contained herein.

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1. ABSTRACT

This Quality Assurance Project Plan (QAPP) Addendum describes changes to the original QAPP (Herrera 2023) including:

- Analysis of 6PPD-q removal efficiency at up to two stormwater technologies installed in Test Bays 1 and 2 at the Stormwater Technology Testing Center (STTC) through paired untreated and treated stormwater runoff samples. Importantly, the unit installed in STTC Test Bay 2 may not be fully installed and ready to sample until the end of the current wet season and may need to be skipped entirely. Sampling will be attempted for as many events as feasible at STTC Test Bay 2 depending on the final installation date.
- Analysis of two additional rounds of field protocol sampling at the Ship Canal Testing Facility with modified experimental groups from the QAPP.

To accomplish the above, we will:

- Analyze 6PPD-q concentrations and assess removal efficiency in paired untreated and treated stormwater runoff samples for each evaluated stormwater technology at the Ship Canal Testing Facility (SCTF) in Seattle, Washington, and the STTC in Portland, Oregon. The untreated samples can be used to characterize stormwater runoff.
- Analyze differences in 6PPD-q concentrations collected through varying field equipment collection techniques from multiple stratified and split samples of untreated stormwater runoff. Further, a set of split samples will also be analyzed by a secondary laboratory to evaluate inter-laboratory differences.

2. BACKGROUND

No changes.

3. PROJECT DESCRIPTION

No changes

4. ORGANIZATION AND SCHEDULE

4.1. Key Individuals and Their Responsibilities

No changes.

4.2. Special Training and Certifications

No changes.

4.3. Organization Chart

No changes.

4.4. Proposed Project Schedule

Table 1 lists key activities, due dates, and lead staff for this project. Note that the BMP installation in the STTC Test Bay 2 may not be complete by the end of the monitoring period and may need to be omitted or sampled for fewer than five events.

Table 1. Proposed Schedule for Completing Field and Laboratory Work, Data Management, and Reports.

Field and Laboratory Work	Due Date	Lead Staff
Field work	April 2024	Nicholas Harris and Sam Nilsson
Laboratory analyses	May 2024	Meghan Elkey
Data Management and Analysis		
Data Uploaded and QC'd	May 2024	Nicholas Harris and Sam Nilsson
Statistical Analysis	June 2024	Timothy Clark
Final Report and Field Protocol Recommendation Memo		
Author Lead/Support Staff		Timothy Clark/Sam Nilsson
Schedule		
Internal draft	Early August 2024	
Draft to client	Late August 2024	
Final report to client	September 2024	

4.5. Budget and Funding

The project is funded through a proviso passed in Engrossed Substitute Senate Bill 5092, Section 302 (23) to the Washington State Department of Ecology.

The number of proposed and previously analyzed samples by King County Environmental Laboratory and Manchester Environmental Laboratory are summarized in Table 2 below.

Table 2. Summary of the Number of Laboratory Samples.

Study Component	Receiving Laboratory	Samples per Event	Number of Events	Total Number of Samples	Total Number of Duplicates
Completed Events					
SCTF Highway and BMP Evaluation (Test Bay 1)	KCEL	4	4	16	1
SCTF Highway and BMP Evaluation (Test Bay 2.5)	KCEL	4	3	12	1
SCTF Highway and BMP Evaluation (Test Bays 2 and 4)	KCEL	8	1	8	1
STTC Highway (Gravity Line 2)	KCEL	2	2	4	1
Field Protocol Evaluation	KCEL	84	1	84	NA
	MEL	10	1	10	NA
Pending Events					
SCTF Highway and BMP Evaluation (Test Bay 1)	KCEL	4	1	4	0
SCTF Highway and BMP Evaluation (Test Bay 2.5)	KCEL	4	2	8	0
SCTF Highway and BMP Evaluation (Test Bays 2 and 4)	KCEL	8	4	32	2
STTC Highway and BMP Evaluation (Test Bays 1 and 2)	KCEL	8	5	40	2
Field Protocol Evaluation	KCEL	86	2	172	NA
	MEL	10	2	20	NA

BMP: Best management practice

KCEL: King County Environmental Laboratory

MEL: Manchester Environmental Laboratory

SCTF: Ship Canal Test Facility

STTC: Stormwater Technology Testing Center

The QAPP initially specified analysis 164 6PPD-q samples at KCEL, of which 128 have been completed. In addition to the remaining 36 samples from the original QAPP, 224 samples additional proposed samples would need to be received and analyzed by KCEL. MEL would receive an additional 20 samples to the ten that have already been submitted and analyzed.

5. QUALITY OBJECTIVES

No changes.

6. STUDY DESIGN

6.1. Study Boundaries

No changes

6.2. Field Data Collection

No changes.

6.2.1. Sampling Locations and Frequency

6.2.1.1. Highway Runoff Characterization and BMP Assessment

At the installed test units at the SCTF and STTC, water quality grab samples will be collected from the untreated test unit influent and treated test unit effluent. The upstream sampling station will be designated as [Facility]-[TestBay#]-IN (e.g., SCTF-TB1-IN). The downstream sampling station will be designated as [Facility]-[TestBay#]-IN (e.g., SCTF-TB1-OUT). During each wet-weather event, samples will be collected approximately two to three hours apart.

Table 3 below describes the stormwater technologies that will be monitored at the SCTF and STTC. Manufacturers have granted permission for 6PPD-q effluent samples with the understanding that their product name will not be shared in the presentation of the data.

Table 3. Description of Stormwater Technologies Monitored.

Sampling Station	Type of Stormwater Technology	Hydraulic Loading Rate (gpm/ft^2)	Events Sampled as of Nov. 22, 2023	Events Remaining
SCTF-TB1	High flow rate biofilter	3.1	4 (Oct. 24, Nov 1, Nov 5, Nov. 21)	1
SCTF-TB2	Membrane filter	1.0	1 (Nov. 21)	4
SCTF-TB2.5	Horizontal bed media filter	7.1	3 (May 5, Nov 1, Nov. 21)	2
SCTF-TB4	Cartridge-based media filter	1.5	1 (May 5)	4
STTC-G2 (untreated)	No BMP	–	2 (June 18; Aug. 31)	0
STTC-TB1	Horizontal bed media filter		0	5
STTC-TB2	High flow rate biofilter		0	5

To date, there have been between one and four sampling events for four stormwater treatment technologies installed at the SCTF and two sampling events of untreated influent at the STTC. Additional samples will be collected so that a total of five events are sampled for each stormwater treatment technology. Stormwater treatment technology testing will be expanded to the STTC Test Bays 1 and 2, however, sampling may be infeasible in Test Bay 2 due to delays in completing the BMP installation.

6.2.1.2. Field Protocol Evaluation

During two additional wet-weather event, untreated stormwater runoff will be collected in a 14-liter churn splitter, homogenized, and split into various samples (summarized in Table 4 and further described in Table 5). Over the course of each of these storms, 10 collections and splits will occur. The churn splitter will be field rinsed three times with source water prior to filling. The collections will be separated by approximately 15 minutes each. The bottles will be filled in the order described in Table 4. The initial field protocol sampling event was conducted in July 2023.

For this study component, paired differences between each of the split samples and the control for the same churn splitter collection will be examined. Additionally, trends in those differences over time (between the 10 collections during the target event) will be identified for the tubing groups, because those materials will be reused between churn splitter collections. If 6PPD-q is sorbed to the material, the loss coefficient may be expected to lessen with each sample as sorption area is saturated, or the material may leach 6PPD-q relative to the control. The tubing will be purged with DI water between sample sets. The tubing will then be purged with source water. Rinsate blanks will be taken for the three tubing or autosampler experimental groups before sampling commences and after the last sample is collected.

Table 4. Experimental Groups for Field Protocol Development (Phase II).

	Tubing[a]			Intermediary Bottle (held for 24 hours)[b]				
Group Code	None	PTFE Tubing to Silicone	Used PTFE Tubing to Silicone	None	250mL Amber HDPE	Used 250mL Amber HDPE	Used 1L Clear HDPE	Used 20L HDPE
CONT	✓			✓				
PTFE_TUB		✓		✓				
PTFE_TUB_OLD			✓	✓				
HDPE_24	✓				✓			
HDPE_OLD	✓					✓		
HDPE_24_20L	✓							✓
AUTO_OLD			✓				✓	
LAB	✓			✓				
FD	✓			✓				

[a] PTFE tubing will be 10 feet connected to 32.5 inches of silicone. Used PTFE and silicone tubing will be previously used for stormwater sampling and be back-flushed with deionized water prior to sample collection.

[b] Used HDPE sample bottles will be previously used for stormwater sampling and cleaned using Liquinox and acid-washed by the laboratory.

Table 5. Description of Experimental Groups for Field Protocol Development.			
Group Code	**Group Name**	**Description**	**Sampling Priority**
CONT	Control sample	250-mL amber glass bottle filled directly from the churn splitter.	1
PTFE_TUB	PTFE tubing	PTFE tubing (10-feet) attached to silicone tubing (32.25-inch) within a peristaltic pump will be used to pump water from the spout of the churn splitter to completely fill a 250-mL amber glass sample bottle	2
PTFE_TUB_OLD	**PTFE used tubing**	Used PTFE tubing (10-feet) attached to used silicone tubing (32.25-inch) within a peristaltic pump will be used to pump water from the spout of the churn splitter to completely fill a 250-mL amber glass sample bottle. Used tubing must have been previously used for stormwater sampling and backflushed with at least three liters of deionized water prior to sample collection.	**3**
HDPE_24	HDPE 250 mL sample	250-mL amber HDPE sample bottle completely filled directly from churn splitter, held in the HDPE bottle for 24 hours prior to transfer to amber glass bottle at laboratory.	4
HDPE_24_20L	**HDPE large "carboy" sample**	20-L used HDPE carboy filled with approximately 2 liters of sample volume directly from churn splitter, held in the 20-L carboy for 24 hours and out of sunlight prior to transfer to a 250-mL amber glass bottle at laboratory by manually agitating the carboy and pouring sample volume directly into the final amber glass bottle. All 20L carboys have been used for stormwater sampling previously and will be cleaned with Liquinox and acid-washed by the laboratory.	5
HDPE_OLD	**HDPE used "carboy" sample**	250-mL used amber HDPE sample bottle completely filled directly from the churn splitter, held in the HDPE bottle for 24 hours prior to transfer to a 250-mL amber glass bottle at laboratory. Used sample bottle will have been previously used for stormwater sampling and cleaned with Liquinox and acid-washed by the laboratory.	6

Table 5 (continued). Description of Experimental Groups for Field Protocol Development.			
Group Code	**Group Name**	**Description**	**Sampling Priority**
AUTO_OLD	**Autosampler "used" sample**	Used PTFE tubing (10 feet) attached to used silicone tubing (32.25-inch) within a peristaltic pump will be used to pump water from the spout of the churn splitter to fill a used 1-liter clear HDPE sample bottle with approximately 250 mL of sample volume. The sample volume will be held in the 1-liter HDPE bottle for 24 hours and out of sunlight prior to transfer to a 250-mL amber glass bottle at the laboratory. Used tubing must have been previously used for stormwater sampling and backflushed with at least three liters of deionized water prior to sample collection. Used sample bottles will have been previously used for stormwater sampling and cleaned with Liquinox and acid-washed by the laboratory.	7
LAB	Laboratory split sample	250-mL amber glass bottle filled directly from the churn splitter.	8
FD	Field duplicate sample	250-mL amber glass bottle filled directly from the churn splitter.	9
Removed Experimental Groups			
SILI_TUB	Silicone tubing	Silicone tubing (2-feet) within a peristaltic pump will be used to pump water from the spout of the churn splitter to completely fill a 250-mL amber glass sample bottle	NS
HDPE_FT	HDPE bottle sample	250-mL HDPE sample bottle completely filled directly from churn splitter, held in the HDPE bottle until transfer to amber glass bottle at laboratory immediately prior to analysis.	NS
FLPE_FT	FLPE bottle sample	250-mL FLPE sample bottle completely filled directly from churn splitter, held in the HDPE bottle until transfer to amber glass bottle at laboratory immediately prior to analysis.	NS
FLPE_24	FLPE "carboy" sample	250-mL FLPE sample bottle completely filled directly from churn splitter, held in the HDPE bottle for 24 hours prior to transfer to amber glass bottle at laboratory.	NS

Bold indicates a new test group proposed for the second round.

NS: Not sampled

As indicated in Table 5, four field protocol experimental groups sampled during the first round will be removed from the monitoring program. These groups and the rationale for their removal in the second round of field protocol sampling are detailed below.

- SILI_TUB. The silicone tubing experimental group was collected by pumping stormwater directly from the churn splitter through two feet of silicone tubing using a peristaltic pump to fill an amber glass sample bottle. Silicone tubing is typically used in a number of potential field sampling methods and understanding loss associated with this material is important. However, use of silicone tubing as the primary sample intake line is uncommon, and more common smaller sections of silicone tubing are included in the PTFE_TUB and AUTO experimental groups. In addition, preliminary results from the first round of field protocol sampling suggest that 6PPD-q loss for this

group was relatively minimal and the loss was comparable to that of the PTFE_TUB experimental group.

- HDPE_FT. The HDPE bottle sample experimental group was collected by directly filling a HDPE sample bottle from the churn splitter and holding the sample in the HDPE bottle until laboratory analysis. This experimental group was selected in the first round to help characterize losses associated with HDPE which is a common material for sample bottles and carboys. Holding the sample volume in an HDPE container until laboratory analysis provided context for how loss to HDPE sample containers may change over time compared to the 24-hour group but is not consistent with how samples would typically be processed by a laboratory during an actual monitoring program. Samples, if collected in an HDPE bottle or carboy, would be transferred to amber glass bottles shortly after receipt by the laboratory. In addition, preliminary results from the first round of field protocol sampling suggest that 6PPD-q loss for this group was relatively minimal and the loss was comparable to that of the HDPE_24 experimental group.
- FLPE_FT and FLPE_24. The FLPE bottle sample (FLPE_FT) and "carboy" sample (FLPE_24) experimental groups were collected by directly filling a FLPE sample bottle from the churn splitter and either holding the sample in the same bottle until laboratory analysis or transferring the sample volume to an amber glass bottle after 24 hours, respectively. These experimental groups were selected in the first round to help characterize losses associated with FLPE sample containers. However, FLPE is not a commonly used material for sample bottles or carboys, and preliminary results suggest that 6PPD-q loss is greater in FLPE containers than in HDPE. Because HDPE is a more common container material and the preliminary results, no FLPE test groups are proposed for the second round of field protocol sampling.

As indicated in Table 5, four new field protocol experimental groups are proposed for the second round of the monitoring program. These groups and the rationale for their inclusion are detailed below.

- PTFE_TUB_OLD. The PTFE used tubing experimental group will be collected by pumping stormwater from the churn splitter through ten feet of "used" PTFE sample tubing and 32.25 inches of "used" silicone tubing using a peristaltic pump to fill a clean 250-mL amber glass sample bottle. The "used" tubing will be acquired from decommissioned sampling equipment at the SCTF and the approximate length of deployment and physical condition of the length of tubing will be noted on field sheets. This experimental group will help characterize losses or potential contamination from previously used PTFE and silicone material.
- HDPE_OLD. The HDPE used "carboy" sample experimental group will be collected by directly filling a 250-milliliter previously used amber HDPE sample bottle directly from the churn splitter. The previously used bottle will be cleaned by the laboratory using a Liquinox detergent rinse and acid wash prior to sample collection. The sample will be held in the HDPE bottle for 24 hours before being transferred to an amber glass bottle at the laboratory. Amber HDPE bottles will be used for this experimental group due to laboratory availability. This experimental group will help characterize losses or potential contamination from previously used HDPE material that has undergone laboratory decontamination similar to a standard HDPE stormwater carboy.
- HDPE_24_20L. The HDPE large "carboy" sample experimental group will be collected by directly filling a 20-liter HDPE carboy with approximately 2 liters of sample volume directly from the churn

splitter. The sample will be held in the HDPE carboy for 24 hours before being transferred to an amber glass bottle at the laboratory. The HDPE carboy will be covered with foil to protect the sample volume from sunlight and potential photodegradation of 6PPD to 6PPD-q. The sample volume will be transferred by agitating and swirling the carboy to mobilize settled particles before pouring the sample volume into the amber glass container. This experimental group will help characterize losses associated with increased sample container surface area to sample volume ratio and headspace. Stormwater composite samples are often collected in HDPE carboys which are only partially full. The headspace and proportion of HDPE material to sample volume in this experimental group is intended to be more representative of actual field conditions.

- AUTO_OLD. The autosampler "used" tubing sample experimental group will be collected by pumping stormwater from the churn splitter through ten feet of "used" (as defined below) PTFE sample tubing and 32.25 inches of "used" silicone tubing using a peristaltic pump to fill a used 1-L clear HDPE sample bottle with approximately 250 mL of sample volume. The sample will be held in the HDPE bottle for 24 hours before being transferred to an amber glass bottle at the laboratory. The HDPE sample bottle will be covered with foil to protect the sample volume from sunlight and potential photodegradation. The "used" tubing will be acquired from decommissioned sampling equipment at the SCTF and the approximate length of deployment and physical condition of the length of tubing will be noted on field sheets. The "used" tubing is intended to emulate conditions where dedicated sample tubing is installed at a long-term monitoring station and used across multiple sampling events in combination with the temporary hold in a HDPE "carboy" bottle. The previously used bottle will be cleaned by the laboratory using a Liquinox detergent rinse and acid wash prior to sample collection.

6.2.2. Field Parameters and Laboratory Analytes to be Measured

No changes.

6.3. Modeling and Analysis Design

For the Field Protocol Evaluation, a series of study questions were developed to guide the assessment and statistical analysis. The questions and relevant comparisons between groups are listed in Table 6. The study questions provided here are only related to the groups that will be collected as part of this QAPP addendum.

Table 6. Field Protocol Assessment Phase II Questions and Comparisons between Groups.						
		Comparison				
Study Question	**Statistical Comparison**	**Tubing**	**New/Old Tubing**	**Bottle Type**	**New/Old Bottle**	**Bottle Size/ Headspace**
What loss, if any, occurs due to sorption to sampling tubing typically used in automated sampler set-ups?	PTFE_TUB vs. CONT	✓				
	PTFE_TUB_OLD vs. CONT	✓				
What loss, if any, occurs due to sorption or degradation in an HDPE bottle held for 24 hours?	HDPE_24 vs. CONT			✓		
	HDPE_OLD vs. CONT			✓		
	HDPE_24_20L vs. CONT			✓		✓
Is there a difference in the loss, if any, for never-used versus used-but-cleaned HDPE bottles?	HDPE_OLD vs. HDPE_24				✓	
Is there a difference in the loss, if any, due to increased headspace and volume-to-surface-area ratio?	HDPE_24_20L vs. HDPE_OLD					✓
	HDPE_24_20L vs. CONT			✓		✓
Is there a difference in loss, if any, when previously used tubing is used?	PTFE_TUB vs. PTFE_TUB_OLD		✓			
What loss, if any, occurs from the combined impact of using typical automated sampling equipment and procedures for stormwater sampling including used tubing, used HDPE sample containers, and HDPE carboys with excess headspace?	AUTO_OLD vs. CONT	✓		✓		✓
Is there a difference in laboratory reported values?	LAB vs. CONT					
Is there a difference in duplicate samples due to either heterogeneity in sample water delivered from the churn splitter or laboratory variability?	FD vs. CONT					

6.4. Assumptions of Study Design

No changes.

6.5. Possible Challenges and Contingencies

The monitoring locations proposed for this project were designed for collecting automated and grab stormwater samples and minimize many of the typical issues with these methods. However, potential challenges are discussed in the sections below.

6.5.1. Logistical Problems

Due to uncertainties in weather conditions, grab stormwater sampling can pose a substantial challenge. Primary potential logistical problems are detailed below.

- Dry season. The project schedule in this QAPP Addendum proposes completion of field sampling in April 2024. Extended periods of dry weather may occur which would delay the overall project schedule and require additional sampling at the start of the next wet season. Delays in early planning phases of this project including QAPP Addendum review and approval may exacerbate this potential issue.

Availability of stormwater treatment devices at the SCTF and STTC pose an additional potential challenge as stormwater BMP manufacturer priorities may change and sampling may be halted unexpectedly. Sampling at the BMP installed in Test Bay 2 of the STTC may be omitted or the number of events reduced due to installation delays by the manufacturer.

6.5.2. Practical Constraints

No changes.

6.5.3. Schedule Limitations

Potential challenges detailed above may delay the proposed field data collection schedule and in turn delay final data analysis and reporting schedules. This is partly accounted for in the project schedule as additional samples may be collected in Spring 2024, if necessary. Risk of schedule delay is partly limited because grab sampling activities are already underway for different monitoring projects at the SCTF and are scheduled to begin imminently at the STTC, so mobilization times are expected to be minimal. Delays related to the installation of the BMP in STTC Test Bay 2 may mean that sampling this BMP is infeasible within the monitoring period of this project.

7. FIELD PROCEDURES

7.1. Invasive Species Evaluation

No changes.

7.2. Measurement and Sampling Procedures

7.2.1. Highway Runoff and BMP Evaluation Procedures

The following procedures will be used to collect stormwater influent and effluent grab samples at the STTC during a targeted TAPE monitoring event:

- Open the test vault and effluent sump covers so that the sample points are accessible for each unit targeted.
- Collect the influent sample by dipping the sample bottle into the stormwater flow at the invert of the influent sample hose above where it is discharging onto the STTC influent sample point as specified in the Ecology SOP.
- Collect the effluent sample by dipping the sample bottle into the stormwater flow at the outlet of the effluent sample hose where it is discharging into the STTC effluent sample point as specified in the Ecology SOP. The effluent sample point is typically located out of reach in the effluent sump so the bottle may need to be attached to a sample pole and lowered into the stormwater flow.
- Field duplicate sample volume will be collected immediately after the sample volume.
- Close the test vault and effluent sump covers after completion of the sampling event.

7.2.2. Field Protocol Evaluation Procedures

- Rinse all segments of tubing by backflushing three liters of lab-provided DI water through them using the automated sampler. Collect one pre-sample rinsate blank from each segment of tubing using the automated sampler.
- Place the churn splitter directly in the stream of stormwater and collect the full sample volume required directly into the churn splitter. Full volume is typically 13 liters for 14-liter splitters, and 7 liters for 8-liter splitters. If the samples are collected from a Test Bay with grab sample ports installed, open the port and allow stormwater to flow for at least 10 seconds to clear any settled solids prior to sampling.
- Place the churn splitter on a clean and level surface and insert the churn paddle into the splitter. Ensure there is sufficient clearance beneath the churn splitter sample port to fill sample bottles.

- Pre-mix the sample volume prior to collection of sample bottles by smoothly raising and lowering the churn paddle at a rate of approximately nine inches per second at least ten times. The churn paddle should reach the bottom of the splitter each stroke but should not break the surface of the water. Note that as sample bottles are filled, the volume remaining in the splitter will decrease and the churn stroke length must decrease to prevent breaking the water surface.
- Fill the sample bottles while consistently churning the sample volume. The bottles will be filled in the order described in Table 5. For the tubing experimental groups, one end of the tubing segment will be fitted onto the churn splitter spout and a peristaltic autosampler will be used to fill the sample bottle.
- Upon collection of each set of samples, rinse the churn splitter with at least three times the target sample volume of source water and repeat the previous steps until all sample sets are collected.
- Upon collection of all 10 sets of samples and while it is still wet, rinse the churn splitter with DI water and return it to the laboratory for decontamination.
- Rinse all segments of tubing by backflushing three liters of lab-provided DI water through them using the automated sampler. Collect one post-sample rinsate blank from each segment of tubing using the automated sampler.

7.3. Containers, Preservation Methods, Holding Times

Table 7 presents the sample containers, preservation, and holding times. Additionally, the carboy and autosampler groups will be transferred from their respective 250-mL, 1-L, or 20-L HDPE containers after 24 hours into a 250 mL amber glass container. The transfer will be via manually agitating and hand-pouring from the HDPE containers to the amber glass containers.

Table 7. Sample Containers, Preservation, and Holding Times.

Parameter	Matrix	Minimum Quantity Required	Container	Preservative	Holding Time
6PPD-quinone (Most samples)	Stormwater	250 mL	250 mL amber glass	4°C (wet ice) in dark. Minimize head space, do not freeze	4 weeks
6PPD-quinone (HDPE_24_20L)	Stormwater	2 L	Used 20 L clear HDPE carboy, covered in foil	4°C (wet ice) in dark. Do not freeze	4 weeks
6PPD-quinone (AUTO_OLD)	Stormwater	250 mL	Used 1 L clear HDPE, covered in foil	4°C (wet ice) in dark. Do not freeze	4 weeks
6PPD-quinone (HDPE_24)	Stormwater	250 mL	250 mL amber HDPE	4°C (wet ice) in dark. Minimize head space, do not freeze	4 weeks
6PPD-quinone (HDPE_24_OLD)	Stormwater	250 mL	Used 250 mL amber HDPE	4°C (wet ice) in dark. Minimize head space, do not freeze	4 weeks

7.4. Equipment Decontamination

No changes.

7.5. Sample ID

No changes.

7.6. Chain of Custody

No changes.

7.7. Field Log Requirements

No changes.

7.8. Other Activities

No changes.

8. LABORATORY PROCEDURES

No changes.

9. QUALITY CONTROL PROCEDURES

No changes.

10. DATA MANAGEMENT PROCEDURES

No changes.

11. AUDITS AND REPORTS

No changes.

12. DATA VERIFICATION

No changes.

13. DATA QUALITY (USABILITY) ASSESSMENT

No changes.

14. REFERENCES

Herrera. 2023. Quality Assurance Project Plan—6PPD-q in Highway Runoff, BMP Effectiveness, and Field Protocol Development. Prepared for Washington Department of Ecology by Herrera Environmental Consultants, Inc., Seattle, Washington. May.