
APPENDIX F

Water Quality Monitoring Plan

Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

WATER QUALITY MONITORING PLAN

Enhanced Natural Recovery/Activated Carbon Pilot Study

Lower Duwamish Waterway

FINAL

Prepared for:

The U.S. Environmental Protection Agency
Region 10
Seattle, Washington

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December 7, 2015

Project No. LY15160310

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Figure 1 Pilot Plot Areas

ATTACHMENT

CWA Section 401 Water Quality Memorandum

ABBREVIATIONS AND ACRONYMS

AC	activated carbon
BMP	best management practice
Ecology	Washington State Department of Ecology
ENR	enhanced natural recovery
ENR+AC	enhanced natural recovery with activated carbon
EPA	U.S. Environmental Protection Agency
FE	Field engineer
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
Order	Administrative Order on Consent
PE	Project engineer

WATER QUALITY MONITORING PLAN

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1.0 INTRODUCTION

The Lower Duwamish Waterway Group will conduct the Pilot Study of an innovative sediment technology in the field to evaluate the potential effectiveness of the technology in the Lower Duwamish Waterway (LDW). The study will determine if Enhanced Natural Recovery (ENR) amended with granular activated carbon (ENR+AC) can be successfully applied to reduce the bioavailability of remediated contaminated sediment in the LDW. The study will compare the effectiveness of ENR+AC against ENR without added activated carbon (AC) in three areas in the LDW: intertidal, subtidal, and subtidal potential scour area plots. For the purposes of this project, ENR involves the placement of a thin layer of clean material (sand or gravelly sand) over subtidal or intertidal sediments. ENR+AC involves placement of a thin layer of clean material augmented with activated carbon over subtidal or intertidal sediments. The purpose of the ENR and ENR+AC treatments are to reduce the exposure of aquatic organisms to contaminants of concern. Figure 1 shows the locations for the Pilot Study.

A Pilot Study was specified under the Second Amendment (July 2014) to the Administrative Order on Consent (Order) for Remedial Investigation/Feasibility Study for the Lower Duwamish Waterway, CERCLA Docket No. 10-2001-0055, issued on December 20, 2000. This Water Quality Monitoring Plan details the water quality monitoring that will be conducted during construction of the pilot study plots.

A barge-mounted, fixed-arm excavator with a clamshell bucket is expected to be used for the submerged placement of ENR and ENR+AC. Submerged release of the ENR and ENR+AC several feet above the substrate will minimize the loss of AC as the ENR+AC descends through the water column and will also prevent or minimize turbidity plumes that may result as fine material in the ENR and ENR+AC becomes suspended in the water column upon its release and descent to the sediment bed. The ENR+AC will be preblended to meet the target concentration of AC and will be presoaked prior to placement. Presoaking of the ENR+AC will help to minimize the loss of AC as the ENR+AC descends through the water column during placement. The target thickness of the ENR and ENR+AC is between 6 and 9 inches.

Precision navigation, as well as offset and staggered placement, will be used to ensure precise placement of the ENR and ENR+AC at each of the three pilot plots.

Construction of the pilot plots is expected to be completed during the authorized 2016–2017 in-water work window for the LDW during which listed salmonid species are least likely to be present in the area. The construction activities are expected to be completed within one to two months.

Prior to construction of the pilot study plots, a test of the placement methods will be conducted. This demonstration placement will be used to calibrate and verify bucket volume, placement area and thickness of the material in designated demonstration areas prior to placement in pilot study test plots. There will be two demonstration placements conducted; one with sand+AC and one with gravely sand+AC. The two areas will be approximately 40 by 60 feet in size (Figure 1). The sand+AC demonstration plot will be located downstream of the intertidal pilot study plots and the gravely sand+AC demonstration plot will be located within the gravely sand+AC pilot study plot (Figure 1). The demonstration placements is expected to take 2 days.

During both the demonstration placement and construction of the pilot study plots the ENR+AC material will be pre-soaked within a flooded, water tight barge for a minimum of 12 hours prior to placement. As the ENR+AC material is removed from the barge, the overlying water will be pumped to the Duwamish Waterway through a 1 micron bag filter to control turbidity.

Water quality monitoring for turbidity will be conducted during the in-water placement of the ENR and ENR+AC. Water samples will not be collected for chemical analysis because the ENR material will be obtained from a clean quarry source, and the AC will be virgin.

The objectives of the water quality monitoring and management activities are as follows:

- Ensure that the water quality performance criteria prescribed by the 401 Water Quality Memo (Attachment 1) developed by EPA are met during implementation of the remedial action.
- Establish contingency measures and corrective actions in the unlikely event that unacceptable conditions are detected.

These monitoring and management objectives will be achieved by means of the following activities, as described in this plan:

- The Lower Duwamish Waterway Group (LDWG) consulting team will conduct water quality monitoring during placement of the ENR and ENR+AC materials.
- Monitoring stations will be selected to demonstrate compliance with the water quality objectives.

Written reports documenting compliance with the performance standards will be prepared by the LDWG consultant team for submittal to the EPA as required in the 401 Water Quality Memo.

2.0 WATER QUALITY MONITORING

Water quality monitoring will be conducted during the demonstration placement and construction of the pilot study plots. Compliance with the performance standards will be demonstrated with the use of data from the compliance stations and a corresponding ambient station for each monitoring event. The ambient station will be located outside the area of influence of the construction activities. During ebb tide, the ambient station will likely be located upstream of the construction activities. During flood tide, surface water flows at the scour and subtidal plots will be predominantly downstream (freshwater surface flow) and bottom flows will be upstream (in the salt wedge); therefore the ambient station may be located in a lateral direction from the construction activities or at least 1,000 feet upstream of the construction activities.

At each monitoring station and ambient station, turbidity will be measured at approximately 2-foot intervals from 2 feet below the water surface to no closer than 3 feet above the sediment surface. Turbidity measurements will not be recorded closer to the bottom than 3 feet to minimize the potential for resuspended sediment disturbed by the water quality instrument and the weight attached to the retrieval line from influencing the near-bottom readings.

During each round of monitoring an ambient station with a depth range similar to the proposed monitoring stations will be selected. Monitoring stations will be established 75 feet (early warning station) and 150 feet (compliance station) from the in-water work. Monitoring at the 75-foot station will not be conducted if the positioning of construction equipment precludes safe access. Water quality monitoring of the in-water work during demonstration placement and construction of the pilot study plots will be conducted both downstream and upstream of the activity. Monitoring will be conducted twice per day during daylight hours when construction is being conducted.

Compliance with the performance standards will be demonstrated with the use of data from the compliance stations and a corresponding ambient station for each pilot plot. The turbidity at each depth interval sampled at the compliance stations (150 feet) will be compared to the equivalent depth interval sampled at ambient stations and evaluated for compliance with the turbidity marine numeric criterion for excellent quality waters designated by Washington State Department of Ecology (Ecology) (Washington Administrative Code, Section 173-201A-210)), as indicated in the following table.

Parameter	Excellent Quality – Water Quality Standards Marine Numeric Criteria
Turbidity	If background <50 NTU, <5 NTU greater than background If background >50 NTU, <10% increase

Abbreviations:

NTU = nephelometric turbidity unit

If there is an apparent exceedance of the turbidity criterion at a compliance station, the sampling team will conduct additional monitoring as described below.

If an exceedance is observed, the LDWG sampling team will immediately notify the project engineer (PE) and the King County Project Representative (Project Representative), and EPA will be notified within 6 hours. The PE, Project Representative, and contractor will assess the exceedance and determine appropriate modifications to operations and/or best management practices (BMPs).

The standard BMPs to be followed are described in the construction quality assurance project plan and will be described in the contractor’s work plan. If there is a confirmed exceedance of the turbidity compliance criterion during construction monitoring, the construction team may institute the following or other BMPs:

- Review the documented operations at the time of the exceedance; specifically determine whether the in-water placement of ENR or ENR+AC or a non-project-related activity was occurring at the time of the exceedance.
- Inspection of the material barge to determine whether there are significant leaks that could contribute to the exceedance of the turbidity criterion.
- The contractor may modify operations per direction from the Project Representative. Potential modifications may include an adjustment to the placement process, including the following:
 - Decreasing the velocity of the bucket through the water column
 - Pausing the bucket above the sediment surface before opening it
 - Stopping work temporarily or increasing cycle time
 - Modifying the position of barges to reduce potential grounding or scour from the tugs

In response to an exceedance of the turbidity criterion at any depth interval at the 150 foot compliance stations, an attempt will be made to determine the areal extent of elevated turbidities. In the direction of the exceedance (either upstream or downstream depending on the direction of the water flow), turbidity readings (with measurements made at 2-foot depth intervals) will be

collected at approximately 150-foot intervals from the construction. Every 150 feet, paired profiles (inshore and offshore) of the water column will be collected to determine the width of the “plume”. Stations will be occupied every 150 feet in the direction of the exceedance until turbidities are below the water quality criterion.

2.1 DEMONSTRATION PLACEMENT

It is expected that the demonstration placement will take 2 days to complete. For the duration of the demonstration placement, monitoring will be conducted twice daily with at least 2 hours between monitoring events. In the event that there is a confirmed exceedance of the turbidity criterion during the first monitoring event of the day, the second sampling event may not be conducted if sampling is being conducted to determine the areal extent of the turbidity plume or there is insufficient daylight time complete a round of sampling.

2.2 PILOT STUDY PLOT CONSTRUCTION

During the first 2 days of the construction of each of the pilot study plots (i.e., intertidal, subtidal, and subtidal potential scour plots) water quality monitoring will be conducted twice daily with at least 2 hours between monitoring events. The first 2 days of plot construction will be during the time that the ENR+AC material is being placed which would have the greatest potential for turbidity exceedances. If during the first 2 days of monitoring there are no exceedances of the turbidity criterion, then water quality monitoring will not be conducted for the duration of that plot’s construction. If there is a turbidity criterion exceedance, then monitoring will be conducted until there are two consecutive days without a turbidity exceedance or for the remainder of the plot construction. If there are exceedances on 2 consecutive days during placement of the ENR+AC material within a plot (i.e., intertidal, subtidal, and subtidal potential scour), then monitoring of the ENR only subplots may be conducted to provide information about the relative difference in turbidity generated with placement of the different material types.

The duration or frequency of monitoring may be changed in consultation with EPA.

2.3 WATER DISCHARGE FROM BARGE

Monitoring of the discharge of the water used for the presoaking of the ENR+AC will not be conducted if the water is discharged through a 1 micron bag filter. If for any reason the water cannot be discharged through a 1 micron bag filter, EPA will be consulted to determine if any monitoring beyond that already conducted at the early warning and compliance stations is required.

2.4 VISUAL TURBIDITY PLUME

If a gross turbidity plume is observed during placement of the ENR or ENR+AC material during days when active water quality monitoring is not being conducted, EPA will be consulted as soon as practicable to determine an appropriate course of action.

2.5 RELOCATION OF AC + ENR MATERIAL

In the unlikely event that over placement of ENR or ENR+AC material requires the material to be relocated to the perimeter of a subplot, the decision on whether turbidity monitoring will be required during material relocation will be determined in consultation with EPA.

3.0 WATER QUALITY COMPLIANCE MONITORING METHODS

In situ monitoring of turbidity will be conducted using a submersible multiparameter water quality measurement and data collection system. A YSI Model 6820 or 6920 data sonde connected by a cable to a YSI Model 650 Multiparameter Display System, or an equivalent submersible multiparameter water quality instrument, will be used for monitoring.

Before the monitoring activities for the pilot study begin, the water quality instrument will be calibrated using the manufacturer's recommended procedures, and the calibration documentation will be recorded for the project files. In addition, before the beginning of each round of monitoring, the pressure transducer (or another type of equipment or instrument for measuring water depth) will be adjusted to compensate for the current barometric pressure.

Each round of water quality compliance monitoring will include the collection of data at an ambient station and at the 75- and 150-foot stations located directly downstream and upstream of the in-water construction activity. The sampling boat will be positioned at each sampling station by means of a laser rangefinder. Turbidity and depth data (at approximately 2-foot intervals) will be collected at each early warning (75 feet) or compliance station (150 feet) unless the total water depth is less than 8 feet.

If the water depth at the early warning or compliance station is 8 feet or less, readings (including depth) will be recorded at the mid-depth (at least 2 feet below the surface but less than or equal to 4 feet below the surface) after allowing any sediments potentially resuspended by the water quality instrument to dissipate.

At each station where the total water depth is greater than 8 feet, the data sonde will be lowered to 2 feet below the surface. The reading displayed on the Multiparameter Display System will be allowed to stabilize for approximately 30 seconds, and the values for turbidity will be recorded on a

field form. The data sonde will then be lowered an additional 2 feet, allowed to stabilize, and the turbidity readings recorded. This process of data collection will continue at each station until the data sonde is 3 to 4 feet above the sediment surface (a weight will be suspended approximately 4 feet below the bottom of the instrument probes) after allowing any sediment potentially resuspended by the water quality instrument to dissipate at the deepest depth. A comparison of the turbidity readings recorded at a compliance station (150 feet) with those recorded at the ambient station (nearest comparable water depth reading) will indicate if the turbidity criteria have been exceeded at each recorded depth interval.

If there are no exceedances of the turbidity criterion during 2 full rounds of monitoring (downstream and upstream, if required), additional rounds of monitoring are not required that day. An exceedance of the turbidity criterion at 150 feet will require additional monitoring to determine the areal extent of the elevated turbidities. Additional rounds of water quality monitoring will also be conducted until there are no additional exceedances or until approaching dusk requires that the monitoring be discontinued until the next workday, or as directed otherwise by the EPA. If an exceedance is identified, the sampling team will immediately notify the Project Engineer and the King County Project Representative. The EPA will be notified within 6 hours.

4.0 DELIVERABLES AND SUBMITTALS

The LDWG consultant team will prepare a daily water quality monitoring report for submission to the field engineer (FE) and the EPA. The daily report will include a description of the water quality monitoring and in-water activities conducted and the field measurements collected. It will be submitted to the EPA within 48 hours if no confirmed water quality exceedances occurred.

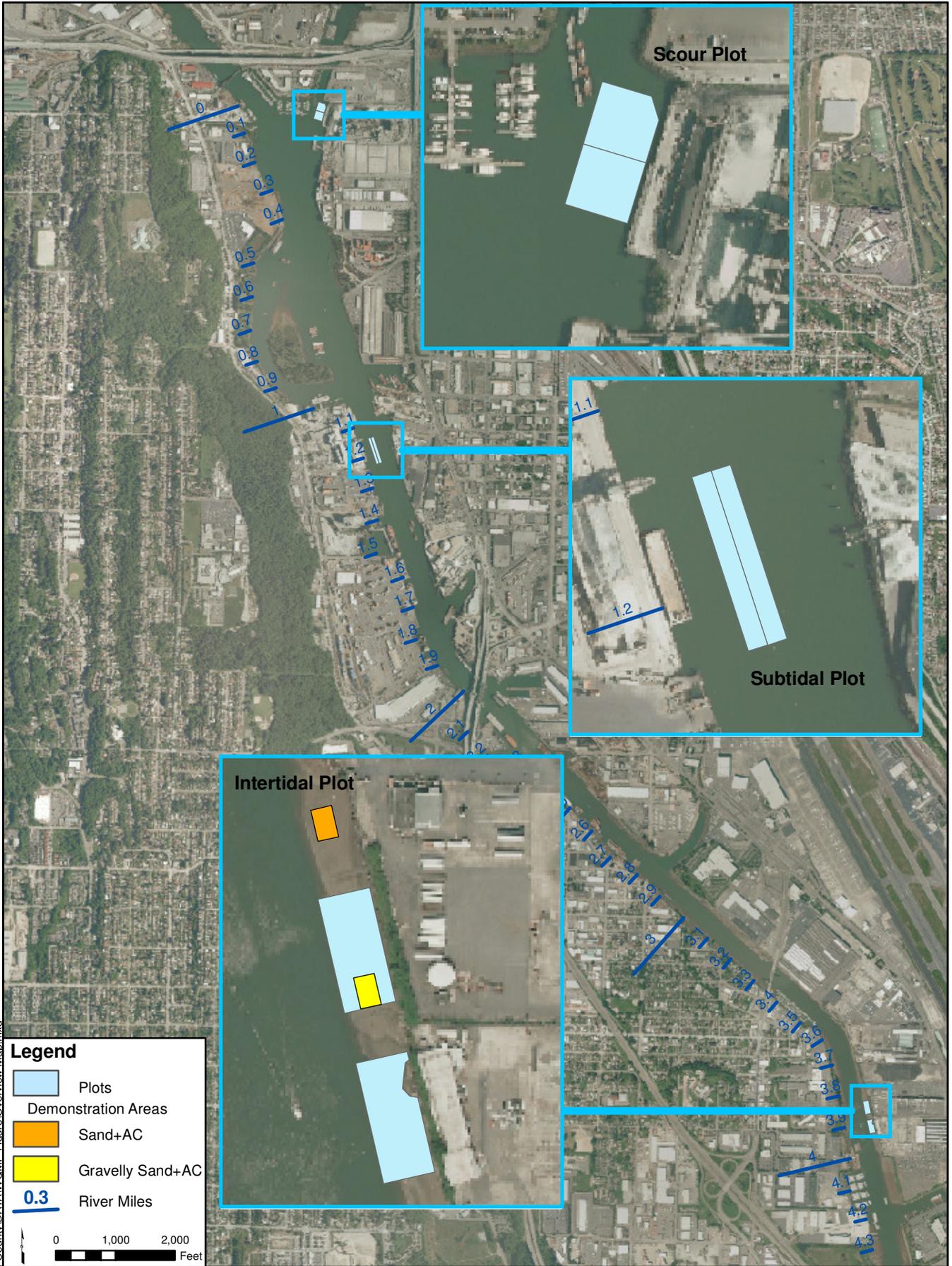
In the event of a confirmed exceedance, the FE will provide the daily report to the EPA within 24 hours of the exceedance. In addition to the daily report, the FE will provide the purported cause of the exceedance, the specific corrective measures initially implemented, the rationale for those measures, and the results of follow-up readings.

A summary of the water quality monitoring program will be included in the construction report¹. This summary will include a description of the field effort (e.g., procedures, sampling locations and depths, and observations), descriptions and rationale for any deviations from the water quality monitoring plan or the 401 Water Quality Memo, a detailed discussion of any data quality issues, tabulated field data with comparisons to criteria and to background (ambient station) levels, and

¹ The construction report will be submitted to the EPA and Ecology as part of the Year 1 monitoring report.

any corrective actions (e.g., changes in BMPs or stopped work) implemented as a result of these data.

FIGURE



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Legend

- Plots
- Demonstration Areas
- Sand+AC
- Gravelly Sand+AC
- 0.3 River Miles

0 1,000 2,000
Feet

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ENR/AC Pilot Study
 Water Quality Monitoring Plan

Figure 1
 Pilot Plot Areas

ATTACHMENT 1

CWA Section 401 Water Quality Memorandum
(When EPA completes the Section 401 Memorandum, it will be included as Attachment 1)