FIFTH FIVE-YEAR REVIEW REPORT FOR MCCORMICK & BAXTER CREOSOTING COMPANY SUPERFUND SITE MULTMOMAH COUNTY, OREGON

Prepared by

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LIST OF ABBREVIATIONS & ACRONYMS

ACB	articulated concrete block
ACL	alternate concentration limit
ACZA	ammoniacal copper zinc arsenate
ARAR	applicable or relevant and appropriate requirement
AWQC	ambient water quality criteria
bgs	below ground surface
BNSF	BNSF Railway Co.
CDF	combined distribution function
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
City	City of Portland
COC	constituents of concern
CPA	central processing area
CSF	cancer slope factor
cPAH	carcinogenic PAH
DEQ	Oregon Department of Environmental Quality
DGT	diffusive gel transport
DNAPL	dense non-aqueous phase liquid
E&E	Ecology & Environment, Inc.
EES	Easement and Equitable Servitude
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Difference
f_{oc}	fraction organic carbon
f_{om}	fraction organic matter
FWDA	former waste disposal area
FYR	Five-Year Review
GSI	GSI Water Solutions, Inc.
Hart Crowser	Hart Crowser, a division of Haley & Aldrich
HDPE	high density polyethylene
HI	Hazard Index
IC	institutional control
LDPE	low density polyethylene
LNAPL	light non-aqueous phase liquid
M&B	McCormick & Baxter Creosoting Company
MCL	maximum contaminant level
MDL	method detection limit
µg/L	microgram per liter
mg/kg	milligram per kilogram
mg/L	milligram per liter
ng/L	nanogram per liter
NAPL	non-aqueous phase liquid
NAVD	North American Vertical Datum
NCP	National Contingency Plan
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List

LIST OF ABBREVIATIONS & ACRONYMS CONTINUED

NRWQC	National Recommended Water Quality Criteria
O&F	operational and functional
O&M	operation and maintenance
ODSL	State of Oregon Department of State Lands
OHW	ordinary high water
ORS	Oregon Revised Statute
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCP	pentachlorophenol
PDMS	polydimethylsiloxane
PEF	Potency Equivalency Factor
PM	Project Manager
PSD	passive sampling device
RAO	remedial action objective
RCM	reactive core mat
RCRA	Resource Conservation and Recovery Act
RDL	reported detection limit
RNA	Regulated Navigational Area
ROD	Record of Decision
RPM	Remedial Project Manager
SAP	sampling and analysis plan
Site	McCormick & Baxter Creosoting Company Superfund Site
SOP	Standard Operating Procedure
SPME	solid phase micro-extraction
SSC	Superfund State Contract
TBC	to be considered
TCDD	2,3,7,8-TCDD
TEQ	toxicity equivalent
TFA	tank farm area
TOC	total organic carbon
TRM	Turf Reinforcement Mat
TTU	Texas Tech University
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
UU/UE	unlimited use/unrestricted exposure

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The Oregon Department of Environmental Quality (DEQ) and U.S. Environmental Protection Agency (EPA) prepared this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] § 300.430(f)(4)(ii)) and considering EPA policy.

This is the fifth FYR for the McCormick & Baxter Creosoting Company (M&B) Site (Site). The triggering action for this statutory review is the fourth FYR, which was issued on September 29, 2016. This FYR has been prepared because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of three (3) Operable Units (OUs), all of which will be addressed in this FYR. OU1 addresses the soil, OU2 addresses sediment, and OU3 addresses groundwater.

This M&B Site FYR was led by Sarah Miller, Oregon DEQ, and Anne Christopher, EPA Region 10, and was supported by DEQ's Contractors, Hart Crowser, a division of Haley & Aldrich (Hart Crowser), and GSI Water Solutions, Inc. (GSI). DEQ holds a first mortgage security interest, in the property as security for repayment of investigation and cleanup costs. The current owner and BNSF Railway Co. (BNSF) were notified of the initiation of this FYR.

Site Background

The Site includes the former M&B wood-treating facility located on the east bank of the Willamette River at 6900 N. Edgewater St., in Portland, Oregon (see Figure I-1). The Site sits on a terrace of imported sand fill (dredged material placed in the early 1900s) within the historic flood plain of the Willamette River and encompasses 40.1 acres of land and an additional 23 acres of contaminated river sediments. A detailed description of the Site setting, history, and regulatory history can be found in Appendix B and a chronology of major Site events is provided in Table I-1.

The Site is currently vacant except for a paved parking area, small shop building, and associated utilities. DEQ decommissioned the field trailers in 2017. Figure I-2 shows the current Site layout and features from an aerial photograph. Figure I-3 depicts the current Site layout and features on a topographic map of the sediment and terrestrial surface elevations.

The University of Portland borders the Site to the southeast and there is currently construction to develop sports fields. A residential area is located above the Site on the adjacent bluff. A BNSF track crosses the northwest portion of the Site, and Union Pacific Railroad tracks border the Site to the northeast below the bluff. Willamette Cove, an open space, owned by Metro Regional Government, is located northwest of the Site across the BNSF track. The upland perimeter of the M&B property is fenced and posted with warning signs.

As discussed in the Second FYR, under a grant from EPA, a Site Reuse Assessment to help the local governments make zoning or land acquisition decisions was conducted between February 2000 and June

2001 by the City of Portland (City), Bureau of Planning, under a grant from EPA. In developing reuse recommendations, the City analyzed the Site's redevelopment potential and engaged stakeholders and the interested public in learning about, proposing, and jointly considering what uses would best fit the Site. The City's findings were presented in a final report dated June 2001 and endorsed by the Portland City Council on July 25, 2001. The Reuse Assessment concluded that the Site is best suited for open space/recreational use, but there was not consensus whether that use should be for an interim period or permanently. In January 2018, EPA issued a 'Ready for Reuse' announcement for the Site. In 2018, EPA provided additional assistance to assist with reuse efforts, which included preparing a survey map, completing a Site appraisal, identifying other state and local property interests, and coordination with the property owner and prospective purchaser interest inquiries. In 2020, the City updated its 2035 Comprehensive Master Plan, which changed Site zoning from Heavy Industrial to EG2-General Employment. EG-2 zoning is more flexible and includes parks and open spaces, educational institutions, along with traditional occupational uses.

FIFTH FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: McCormick & Baxter Creosoting Company		
EPA ID: ORD009020603		
Region: 10	**State:** OR	**City/County:** Portland/Multnomah
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the Site achieved construction completion?** Yes.	
REVIEW STATUS		
Lead agency: State Oregon Department of Environmental Quality (DEQ)		
Author name (Federal or State Project Manager): Sarah Miller (State) /Anne Christopher (EPA)		
Author affiliation: Oregon DEQ		
Review period: 9/29/2016 - 9/28/2021		
Date of Site inspection: 5/20/2021		
Type of review: Statutory		
Review number: 5		
Triggering action date: 9/28/2016		
Due date: 9/28/2021		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Site investigations have revealed many releases of wood-treating chemical compounds to soils, groundwater, and sediments as a result of wood-treating plant operations and spills.

Contaminants detected include polycyclic aromatic hydrocarbons (PAHs, comprising 85 percent of the creosote), pentachlorophenol (PCP), arsenic, chromium, copper, zinc, and dioxins/furans. Additionally, remedial investigations identified two large non-aqueous phase liquid (NAPL) plumes migrating to the river and impacting surface water and sediments. Subsequent monitoring identified another NAPL plume migrating under the BNSF right of way toward Willamette Cove. A detailed description of the company's operation history, documented spills, identified chemicals of concerns, and regulatory history is included in Appendix B.

Site Receptors and Exposure Pathways

Human health receptors and exposure pathways prior to remediation included:

- Direct contact with contaminated surface soil through incidental ingestion, inhalation, and dermal contact for future Site residents, workers, visitors, or trespassers;
- Incidental ingestion of and dermal contact with contaminated sediment related to recreational uses of the beachfront;
- Consumption of fish and crayfish caught by recreational anglers in the area of contaminated sediment; and
- Potential exposure to groundwater as a drinking water source.

Ecological receptors include crayfish, clams, and numerous fish species; shorebirds; and mammals. Exposure pathways prior to remediation included contact with contaminated sediment, interstitial porewater, and the water column. Major exposure routes for aquatic receptors included dermal exposure, exposure through respiratory structures and ingestion, as well as exposure through ingestion of contaminated prey by higher trophic level species.

Response Actions

Removal Actions

Removal actions were completed by DEQ under State of Oregon cleanup regulations prior to listing on the NPL and under CERCLA authority between Site listing and issuance of the ROD. A list of these removal actions is provided in the document titled Preliminary Close-Out Report (EPA, 2005). A summary of the response actions is included in Appendix B.

Creosote (NAPL) recovery began in July 1989 as a Removal Action to remove creosote from five monitoring wells at the Site. Approximately 450 gallons of creosote were recovered by November 1991 when recovery efforts expanded to include more extraction wells. By February 1995, approximately 2,250 gallons of creosote had been extracted. In 1998, an automated system was installed for continuous operation and switched to manual extraction in 2000 as it was more cost effective. Extraction continued through July 2011 with an approximate total of 6,500 gallons of creosote extracted.

Remedy Selection and Modifications

In March 1996, EPA and DEQ issued one ROD for the Site to address contaminated soil, groundwater, stormwater, and Willamette River sediment. The ROD was amended in 1998 for the soil remedy, and an ESD was issued in 2002 to implement the contingent remedy for groundwater.

The selected remedy requires the following media-specific actions to mitigate the principal threats at the Site:

- Soil
  - Completion of demolition and off-Site disposal of recycling (except for concrete rubble) of above-ground structures and debris, and of underground structures that interfere with soil excavation;
  - Excavation, to a maximum depth of approximately 4 feet, of contaminated soil that exceeds action levels for arsenic, PAHs, and PCP established in the ROD;
  - Use of engineering controls during excavation and transportation, such as dust suppression with water sprays, truck washing prior to leaving the Site, lining and covering trucks and/or rail cars during loading and transport, and planning truck routes and schedules to minimize potential adverse impacts on the surrounding community;
  - Off-Site treatment of excavated soil that exceeds the toxicity characteristic leaching procedure hazardous waste criteria for arsenic, chromium and/or PCP, established under the Resource Conservation and Recovery Act (RCRA);
  - Off-Site disposal of excavated soil at a RCRA-permitted hazardous waste disposal facility, following any required treatment;
  - Excavation of any soil beyond the property boundary with Site-related contaminant concentrations above the cleanup goals, and placement of that soil onto the Site property to be capped;
  - Backfilling of existing in-ground concrete sumps, vaults, etc. with concrete rubble from above-ground demolition activities, and backfilling of soil excavations with clean imported fill soil;
  - Placement of a two-foot thick, clean soil cap over the entire Site, as described in the ROD, followed by long term monitoring and maintenance; and
  - Establishment of institutional controls, as described in the ROD, including but not limited to, deed notices containing information on the levels and location of contamination on the property, and deed restrictions, such as environmental easements or restrictive covenants prohibiting future uses of the Site that are not consistent with the level of protectiveness achieved by the cleanup.
- Groundwater
  - Passive extraction of NAPL;
  - Enhanced extraction of NAPL through pumping of contaminated groundwater;
  - On-Site treatment of contaminated groundwater;
  - Discharge of treated groundwater to the Willamette River or the Site as part of an enhanced NAPL recovery system;
  - Off-Site disposal or recycling of recovered NAPL and other groundwater treatment system residuals;
  - A contingent remedy invoked in the ESD to install a fully encompassing, impermeable subsurface barrier wall to meet the RAO of minimizing NAPL discharges to the Willamette River; and
  - Long-term monitoring and institutional controls.

- Sediment
  - Capping of approximately 15 acres of near-shore contaminated sediment; and
  - Long-term monitoring, operation and maintenance, and institutional controls.

Remedial Action Objectives (RAOs) and Cleanup Levels

The Site was divided into three OUs to facilitate and manage remedy costs, implementation, and construction. The overall remedy is designed to function as an integrated containment system. The entire Site is capped; the upland cap extends to the riparian area along the shoreline where it meets the sediment cap. The capping works in conjunction with the subsurface groundwater barrier wall, as a complementary system, to meet the Site Remedial Action Objectives (RAOs) and prevent contaminated groundwater from adversely impacting the Willamette River. A summary of the RAOs for each OU is provided below and a table listing the associated cleanup levels by media and analyte at the time of the ROD is provided as Table II-1 and are also provided in the text of Appendix B along with non-numeric goals.

OU 1: Soil Remedy

The soil remedy is composed of three primary components: removal of highly contaminated soil within 4 feet of the ground surface, capping, and ICs.[1] The RAOs for the soil remedy are:

- Prevent human exposure through direct contact (ingestion, inhalation, or dermal contact) to contaminated surface and near-surface soil that would result in an excess lifetime cancer risk above $1x10^{-6}$ for individual compounds, above $1x10^{-5}$ for additive carcinogenic compounds, or above a Hazard Index (HI) of 1 for noncarcinogenic compounds in an industrial land use scenario.
- Prevent stormwater runoff that contains contaminated soil from reaching the Willamette River.

OU 2: Sediment Remedy

The sediment remedy is composed of two primary components: ICs and a sediment cap. The RAOs for the sediment cap are:

- Prevent humans and aquatic organisms from direct contact with contaminated sediments.
- Minimize releases of contaminants from sediment that might result in contamination of the Willamette River in excess of federal and state ambient water quality criteria.[2]

[1] To improve readability in this Five-Year Review, the ICs for the soil, sediment, and groundwater remedies have been consolidated and will be described later in this section.

[2] During meetings in August 2007 between stakeholders (DEQ, EPA, National Oceanic and Atmospheric Administration (NOAA), Confederated Tribes of Warm Springs, and Yakama Nation), it was agreed that for comparison purposes, five criteria would be included in the analytical results summary tables and subsequent operation and maintenance (O&M) reports including:

- Two ambient water quality criteria (AWQCs) in effect at the time the ROD was issued (1996 criteria for chronic effects to aquatic life and for human health based on fish consumption).
- Two 2007 National Recommended Water Quality Criteria's (NRWQCs) - one for chronic effects to aquatic life and one for human health via consumption of organisms (subsequent FYRs included NRWQCs updated in 2011 and the current FYR includes NRWQCs updated in 2017).
- Current maximum contaminant levels (MCLs).

The first RAO is designed to prevent human exposure under a recreational scenario from direct contact with contaminated sediments and to prevent exposure of benthic organisms to sediment contamination above known toxicity levels.[3]

OU 3: Groundwater Remedy

The groundwater remedy has four components: ICs, a subsurface barrier wall, NAPL recovery, and evaluation of innovative technologies for NAPL recovery. The RAOs for the groundwater remedy are:

- Prevent human exposure to or ingestion of groundwater with contaminant concentrations in excess of federal and state drinking water standards or protective levels.
- Minimize further vertical migration of NAPL to the deep aquifer.
- Prevent groundwater discharges to the Willamette River that contain dissolved contaminants that would result in contaminant concentrations within the river in excess of background concentrations[4] or in excess of water quality criteria for aquatic organisms.
- Minimize NAPL discharges to the Willamette River beach and adjacent sediment.
- Remove mobile NAPL to the extent practicable to reduce the continuing source of groundwater contamination and the potential for discharge to Willamette River sediment.

[3] At the time of the ROD, no state or federal sediment quality criteria existed. However, bioassay results indicated that a substantial area of near-shore sediment contamination was toxic to sedentary benthic invertebrates (bioassay testing measured organism survival and weight, see Sediment Cap Basis of Design). These areas coincided with areas that exceeded human risk-based goals. Sediment with concentrations above levels protective of human health or toxic to benthic organisms (based on sediment bioassay tests resulting in impaired survival and growth (weight)) were capped.

[4] There is an issue associated with this RAO that relates to Alternate Concentration Limits (ACLs) defined in the ROD. This issue is further discussed in Sections VIII and IX of the 2006 Second Five-Year Review Report.

ROD Cleanup Goals

Table II-1: ROD Cleanup Goals by Media

Soil Remedy Cleanup Goals	
Analyte	**Cleanup Goal (mg/kg)**
Arsenic	8
Pentachlorophenol	50
Total Carcinogenic PAHs	1
Dioxins/Furans	0.00004

Sediment Remedy Cleanup Goals for Sediment	
Analyte	**Cleanup Goal (mg/kg)**
Arsenic	12
Pentachlorophenol	100
Total Carcinogenic PAHs	2
Dioxins/Furans	0.00008
Sediment Remedy Cleanup Goals for Water[5]	
Analyte	**Cleanup Goal (µg/L)**
Arsenic	190
Chromium III	210
Copper	12
Zinc	110
Pentachlorophenol	13
Acenaphthene	520
Fluoranthene	54
Naphthalene	620
Total Carcinogenic PAHs	0.031
Dioxins/Furans	$1x10^{-5}$ ng/L
Groundwater Remedy	
Analyte	**Cleanup Goal (µg/L)**
Arsenic	1,000
Chromium III	1,000
Copper	1,000
Zinc	1,000
Pentachlorophenol	5,000
Total PAHs	43,000
Dioxins/Furans	0.2 ng/L

Abbreviations:
mg = milligram
kg = kilogram
L = liter
µg = microgram
ng = nanogram

[5] These values represent the Ambient Water Quality Criteria at the time of the ROD in 1996.

IC Summary Table

Table II-2: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Soil	Yes	Yes	Soil Operable Unit	Physical restrictions, warning signs, and safety measures until completion of the remedies to prevent contact with Site.	Warning signs posted on fence that surrounds the upland perimeter of the M&B property and restricts public access to the Site.
Sediment	Yes	Yes	Sediment Operable Unit	Controls on future uses of the property so that they are consistent with the level of protectiveness achieved by the cleanup	State of Oregon Department of State Lands Easement No. 31530-EA to the Oregon DEQ, May 2004 (ODSL 2004)
Sediment	Yes	Yes	Sediment Operable Unit	Notice to mariners and navigation restrictions in order to prevent damage to the sediment cap	Docket No. USCG-2008-0121: McCormick & Baxter Regulated Navigation Area, Willamette River, Portland, OR, March 2009
Soil	Yes	Yes	Soil Operable Unit	Controls on future uses of the property so that they are consistent with the level of protectiveness achieved by the cleanup	March 2005; License between DEQ and BNSF
Soil, Groundwater	Yes	Yes	Soil and Groundwater Operable Units	Controls on future uses of the property so that they are consistent with the level of protectiveness achieved by the cleanup	Two Easement and Equitable Servitudes (EES) to be implemented with BNSF and Prospective Purchaser expected 2025

Status of Implementation

The Site was divided into three OUs to facilitate and manage remedy costs, implementation, and construction. The overall remedy is designed to function as an integrated containment system. The entire

Site is capped; the combined upland capping extends to the riparian area along the shoreline where it meets the sediment cap. The capping has worked in conjunction with the barrier wall, as a complementary system, and has met the groundwater RAOs and prevent contaminated groundwater from adversely impacting the Willamette River. In September 2005, the McCormick & Baxter Superfund Site achieved the construction completion milestone.

Soil Remedy:
Soil excavation activities were performed from February through May 1999, and effectively eliminated the presence of the contaminated soils above removal action levels in the surficial 4 feet. In several major source areas, excavation proceeded to depths of 8 to 10 feet; although, large volumes of deeper soil still contain NAPL and high concentrations of Site contaminants. Contaminated soil and debris were excavated and disposed of off-Site at permitted landfills and clean sand was used as backfill.

Construction activities for the upland soil cap were performed between March and September 2005 and included the following major components: demolition and off-Site disposal of existing structures and infrastructure; reinstallation of key support facilities; construction of a 15-acre impermeable cap within the perimeter of the subsurface barrier wall with a subsurface drainage system; and construction of an earthen soil cap outside of the impermeable cap (which was completed in 2004 as part of the sediment cap construction). A 6-foot-high, chain-link fence topped with barbed wire also was reinstalled and warning signs were placed along the McCormick & Baxter Property perimeter.

Several thousand native trees and shrubs were planted throughout the drainage swale and riparian zone in February 2006, and a temporary, aboveground irrigation system was installed in May 2006.

Sediment Remedy:

Construction of the sediment cap occurred in two separate phases: June through November 2004[6] and August through October 2005.

Construction activities in 2004 consisted of the following major components:

- Removal of approximately 1,630 pilings, bulkhead, dock remnants, in-water debris, a derelict barge in Willamette Cove, and other Willamette Cove features
- Construction of a multi-layer sediment cap using sand, organophilic clay, and armoring
- Monitoring well abandonment and modification
- Bank regrading and capping
- Disposal and demobilization

Construction activities in 2005 included the installation of Organoclay™ reactive core mats (RCMs) as a corrective measure to address releases of NAPL sheens discovered during weekly inspections following cap construction in 2004. The Organoclay™ RCMs were placed in three areas along the shoreline: under the BNSF Bridge; downstream of the previously Organoclay™-capped TFA seep; and upstream of the previously Organoclay™-capped TFA seep. The Organoclay™ RCMs were covered with sand and rock armoring.

[6] This phase of the sediment cap construction also included regrading and capping of the riverbank to create the 6-acre riparian zone. Although construction of the riparian bank cap is described as part of the sediment cap remedy, long-term operation and maintenance of the riparian zone will be conducted as part of the upland soil cap.

Groundwater Remedy:

Creosote (NAPL) recovery began in 1989 as a Removal Action and was included as a component of the ROD. NAPL recovery continued through July 2011.

The subsurface barrier wall was constructed from April through September 2003 to fully encompass 18 acres of NAPL-impacted groundwater and the main contaminant source areas at the Site, including the TFA and FWDA, with the exception of eight sheet piles that met refusal before achieving design depth. The resulting gaps were pressure grouted in July 2004.

Engineering and Institutional Controls

The ROD specifies ICs for the soil, groundwater, and sediment remedies:

- Physical restrictions[7] (fencing), warning signs, and safety measures until completion of the remedies.
- Controls on future uses of the property so that they are consistent with the level of protectiveness achieved by the cleanup.
- Prohibition on any use of the shallow and intermediate aquifers and prohibition on drinking water use of the deep aquifer.
- Prohibition on disturbance of the sediments.

DEQ currently maintains an upland perimeter fence around the McCormick & Baxter Property, has warning signs posted, and restricts public access to the upland portion of the Site. Public access to the beach is not restricted. Although not all monitoring wells are located within the fence, all wells have locked, steel monuments. These physical Site restrictions will be maintained into the foreseeable future. DEQ also has obtained a permanent easement for the sediment cap from the Oregon Department of State Lands (ODSL). This easement prohibits the anchoring and grounding of non-recreational vessels and the use of all motor propelled vessels and specifies that the sediment cap may be closed to all public uses if DEQ determines that the area poses a threat to public health or the environment.

DEQ installed permanent buoys in August 2011 along the perimeter of the sediment cap warning boaters of navigational hazards. DEQ worked with the U.S. Coast Guard (USCG) to establish a Regulated Navigational Area (RNA) in and around the sediment cap pursuant to 33 C.F.R. Part 165 (USGS 2009). On February 4, 2009, the USCG published the final rulemaking formally establishing the RNA for the McCormick & Baxter Site sediment cap (docket number USCG-2008-0121; Attachment 1 to the Third FYR). This rule became effective on March 6, 2009.

Restrictions through proprietary controls are planned to be completed. These restrictions will prohibit development within the 6-acre riparian zone along the riverbank as required by the Endangered Species Act Biological Opinion issued by the National Marine Fisheries Service (NMFS); prohibit use of Site groundwater as specified by the ROD; and limit excavation of Site soils unless authorized by DEQ. Conditions to prohibit future uses of the Site will be completed to achieve the level of long-term remedy protectiveness required by the ROD.

A License or Access Agreement, completed in March 2005 between DEQ and BNSF, requires BNSF to notify DEQ in the event planned construction or maintenance activities in the right-of-way that could potentially cause damage to the portion of the upland soil cap located in the BNSF right-of-way. The

[7] EPA has since clarified that physical restrictions are considered engineering controls, not institutional controls.

License is a contract between DEQ and BNSF that is expected to restrict BNSF's activities in the right-of-way and serve as one of the layers of ICs for protection of the soil cap remedy. The License does not restrict groundwater use or contain provisions to protect any wells installed for the McCormick & Baxter Site in the BNSF right-of-way. DEQ and EPA plan to work with BNSF to complete the required IC for groundwater beneath the BNSF property.

Systems Operations/Operation and Maintenance

DEQ conducted Site activities in accordance with the Final Operation and Maintenance (O&M) Plan (DEQ/EPA, 2014), prepared by DEQ and approved by EPA. The O&M Manual (last revised Hart Crowser/GSI, 2018b) specifies the sampling and monitoring procedures, quality assurance and quality control, and technical information needed to implement the Final O&M Plan. Site O&M activities completed since the Fourth FYR (DEQ/ EPA, 2016) are summarized in Table II-3 and Annual O&M reports were completed each year, documenting the activities. Performance comparison criteria for the soil, sediment, and groundwater remedies are presented in Table II-4 and included in Appendix B.

Soil Remedy

Ongoing monitoring activities for the soil cap (including the riparian zone) include visual inspections of the cap surface, stormwater conveyance system, security fencing, and warning signs. The soil cap is designed to be generally maintenance free, except for maintaining the native vegetation. Routine maintenance includes semi-annual manual removal of invasive plants and targeted application of herbicides. Non-routine maintenance may include repairs of the fence, replacement of vandalized locks, replacement of warning signs, repairs of the gravel roads, filling of animal burrows, removal of sediment from manholes, removal of trees impacting fence integrity, and replanting unsuccessful trees and shrubs.

Non-routine maintenance performed since the Fourth FYR in 2016 included fire damage inspections after a manmade July 2018 riparian area fire and a September 2018 grass fire; installation of vaults for two gas vents missing vault boxes (GV-1 and GV-4) in March 2019; removal of abandoned homeless encampments within the riparian area in January 2021; as needed repairs to damage in the fence; and a subsidence monitoring assessment in 2019. A land survey with particular focus of the area of known subsidence around wells EW-1s and MW-23d and a storm sewer video inspection were performed in August and October 2019, respectively, for the subsidence monitoring (these results are provided in Section IV). Routine maintenance of equipment and providing for Site utility service are also included as elements of soil O&M.

Sediment Remedy

Monitoring activities for the sediment cap since the fourth FYR in 2016 included quarterly visual inspections of near-shore areas and performing repairs to the shoreline as needed. This included filling in voids in the articulated concrete block (ACB) mats in September 2017 and December 2020. A sediment cap performance assessment was performed in 2020 and included the collection and analysis of surface water, inter-armoring and sub-armoring porewater samples from 12 compliance monitoring locations, four early warning locations, and one downstream location in 2020. This was the twelfth comprehensive sampling event since the sediment cap was installed in 2004/2005. As part of the cap performance assessment, crayfish tissue samples were collected and analyzed from five locations on the sediment cap.

A bathymetry evaluation was performed by comparing April 2006 bathymetry data to June 2018 bathymetry data collected during the Portland Harbor Superfund Site[8] Pre-Design Investigation to identify significant changes in river bottom conditions (results provided in Section IV below). Although the sediment cap is designed to be generally maintenance free, unplanned or non-routine maintenance is needed. During the fourth quarterly 2020 Site Inspection, a derelict 24ft sailing vessel was abandoned on the sediment cap in December 2020. Removal notification activities were initiated in June 2021 and removal is expected to be completed by the end of 2021. During the first and second quarterly Site inspections in 2021, three permanent warning buoys were missing, and replacement activities were initiated in May 2021 and are expected to be completed by the end of 2021.

Groundwater Remedy

Site activities in the past five years for the groundwater remedy have included annual monitoring for the presence and thickness of NAPL, groundwater elevation monitoring, and groundwater sampling of MW-59s, which monitors groundwater downgradient of the stormwater infiltration pond. MW-59s sampling monitors the potential for mobilization of Site contaminants due to the infiltration of stormwater. Groundwater performance monitoring in 2020 included sampling 11 monitoring wells and analyzing groundwater for Site contaminants. Concentrations are primarily detected in areas where residual NAPL is present, and these concentrations are not expected to change over short periods of time. Additional groundwater monitoring for Site contaminants will be evaluated and determined, if necessary, prior to the next FYR. Routine maintenance of transducers is also included as elements of groundwater O&M.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the last FYR as well as the recommendations from the last FYR and the current status of those recommendations.

[8] The Portland Harbor Superfund Site (PHSS) addresses Willamette River sediments from RM 1.9 to RM 11.8. McCormick & Baxter Superfund Site is located between RM 6.9 and 7.4. PHSS surrounds M&B Site. PHSS includes in-water and upland portions of the Willamette River and contains contamination from many chemical groups including heavy metals, polychlorinated biphenyls, PAHs, dioxin/furans, and organochlorine pesticides. The PHSS ROD was issued January 2017.

Table III-1: Protectiveness Determinations/Statements from the 2016 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1 – Soil	Short-term Protective	The remedy for the soil OU is currently protective of human health and the environment because the upland soil cap and engineering controls required by the ROD have been implemented and are working as intended. However, in order for the remedy to be protective in the long-term, DEQ and EPA need to implement the ICs required by the ROD for the soil cap remedy.
2 – Sediment	Protective	The remedy for the sediment OU is protective of human health and the environment because the remedy required by the ROD has been implemented and is working as intended.
3 – Groundwater	Short-term Protective	The remedy for the groundwater OU is currently protective of human health and the environment because the soil, sediment, and groundwater remedies have been implemented and the RAOs in the ROD have been met. However, the EPA determined that Alternate Concentration Limits (ACLs) as calculated at this Site are not appropriate as substitutes for Maximum Contaminant Levels (MCLs) in groundwater (this issue was originally identified in the 2006 FYR). In order for the remedy to be protective in the long term, the following actions need to be taken: formally replace the ACLs with revised cleanup goals and identify the associated points of compliance for the groundwater remedy in a ROD Amendment or ESD, and implement ICs required by the ROD for the groundwater remedy.
Sitewide	Short-term Protective	The remedies for soil, sediment, and groundwater currently protect human health and the environment, because the soil and sediment caps, barrier wall, sediment ICs, and engineering controls required by the ROD have been implemented. However, in order for the remedies to be protective in the long-term, the following actions need to be taken: evaluate the cleanups goals for consistency with the Portland Harbor Superfund Site ROD and, if necessary, issue a ROD Amendment or ESD that establishes new cleanup goals and points of compliance for the groundwater remedy, and implement the ICs required by the ROD for the soil and groundwater remedies.

Table III-2: Status of Recommendations from the 2016 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
3 – Groundwater	Need to formally replace the ACLs with revised cleanup goals and identify the associated points of compliance for the groundwater remedy.	1. Prepare a ROD Amendment or ESD to replace ACLs with revised cleanup goals and identify associated points of compliance.	Under Discussion	The ACLs have not been replaced with revised groundwater cleanup goals. It was anticipated that after the Portland Harbor ROD was final (January 2017) EPA and DEQ would determine the next steps to address changes to the M&B ROD goals. Since that Portland Harbor ROD was finalized in 2017, EPA and DEQ determined that the groundwater, porewater and surface water data collected in 2020 will now be used in the decision-making process to replace the ACLs. This will be documented in an updated decision document.	N/A
1/3 – Soil/Groundwater	ICs have not been implemented as required by the ROD for the Site groundwater and soil cap remedies.	2. Establish and implement an IC Implementation and Assurance Plan and record EESs with property owners	Under Discussion	ICs have been drafted but have not been implemented as required. Discussions with the current Site owner and BNSF were put on hold pending the potential transfer of the property to a new owner. The ICs will be implemented upon negotiations with property owners or sale of the property. The property is currently under the control of Oregon DEQ; land use over the past five years was consistent with IC restrictions.	N/A

The following issues do not affect overall protectiveness, but were identified in the last FYR and were expected to require additional follow-up actions:

- ACB Unconformity in Willamette Cove – While the sampling in 2015 showed these areas to be protective, there is a need to continue to monitor porewater in areas where the sand cap is thinner than the specified design thickness; DEQ will conduct this monitoring in 2020 in order for the results to be incorporated into the Fifth FYR. Significant additional settling is not expected because the organophilic clay has already lost approximately 16 percent of the carbon through

degradation and there is only approximately 8 percent remaining to degrade. A decision as to continue monitoring beyond 2020 will be determined in the Fifth FYR.

- Soil Cap Subsidence – Soil cap subsided by approximately 1 foot between the cap emplacement and 2009. DEQ will conduct quarterly monitoring through December 2020.
- Sediment Cap Monitoring – DEQ will improve future DGT sampling for metals by using a stick format which is more durable or create a suspension system within the passive sampler to limit the DGT's direct contact during deployment, which fouled multiple 2015 samples.

Summary of actions for issues that do not affect protectiveness but were expected to require potential action:

ACB Unconformity: The extent of Willamette Cove ACB buckling observed in 2020 appeared similar to that observed in 2009 when an investigation was conducted to determine whether the buckling compromised the sediment cap. Based on that study and the recent passive sampling, the buckling of the ACB is not compromising the integrity of the sediment cap. Visual observation of the ACB unconformity will continue along with routine porewater monitoring every five years and will be included in the Site's O&M and monitoring plans.

Soil Cap Subsidence: Upland soil cap subsidence near wells EW-1s and MW-23d is currently stable. A Land survey and storm sewer video inspection were performed in August and October 2019, respectively. Results were similar to the 2009 surveys. This area will continue to be monitored quarterly for five years by taking inner and outer casing measurements at well MW-23d; by monitoring stormwater flow at the outfall during quarterly inspections; and by collecting and reviewing transducer data from EW-1s that measures groundwater temperature and elevation. The Site O&M Manual will be updated to include a storm sewer camera line evaluation and subsidence survey with schedule. Monitor intensity will be revisited during the Sixth FYR.

Sediment Cap Monitoring: DEQ and its contractor used a different porewater sampling method for metals collection during the 2020 sampling event to alleviate DGT technology concerns. Metals were sampled in 2020 using a diffusive membrane cell preloaded with deionized water and a tracer compound to measure equilibration rates. Following deployment, dissolved metals in porewater passed through the diffusive membrane until equilibration was reached with water in the cell. This alleviated the issue of fouling encountered by the DGT media used for the 2015 sampling event where sediment adhered to the gel membrane and compromised the sampler.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification & Involvement

Since the fourth FYR, there have been limited community involvement activities associated with this Site because all components of the remedy are in place and the focus of the Site work has been long-term maintenance and monitoring. Both DEQ and EPA respond to public records requests and inquiries through phone calls and e-mails. In general, during the past several years, the number of inquiries from the local community has been very low. Therefore, no interviews were specifically scheduled for this review. EPA presented updates about the sampling efforts for the FYR to the Portland Harbor Community Advisory Group meeting on September 16, 2020, and solicited information from the public about the Site pertinent for the FYR, with a deadline of May 31, 2021. This notice informed the public that there is an opportunity to contact EPA with information or questions. On May 11, 2021, EPA emailed the Portland Harbor listserv to remind them to submit any pertinent info for the FYR. Additionally, EPA updated the Site profile page (link below) with information about the FYR and opportunities to provide information. EPA will email the Portland Harbor listserv to inform the public

that a FYR Report at the McCormick & Baxter Superfund Site will be released in September 2021. The report and other key documents will be available on the McCormick & Baxter EPA website: https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=1000339 and on the DEQ website: https://www.deq.state.or.us/Webdocs/Forms/Output/FPController.ashx?SourceIdType=11&SourceId=74.

Data Review

Sampling conducted in the past five years was associated with O&M activities as outlined in the 2014 Final O&M Plan and the 2016 and 2018 updates of the O&M Manual and based on outstanding issues described in the fourth FYR (DEQ/EPA 2016). The inspections and resolution of the outstanding issues are summarized in Section III Progress Since the Last Review. Data collected as part of the O&M activities are summarized below. Data provided in Tables IV-1 through IV-4 along with Site inspections demonstrate that the upland soil cap, the subsurface barrier wall, and the sediment cap work as an integrated system to contain contamination on the Site and prevent contaminants from adversely impacting the Willamette River. Further interpretation of these data is carried forward in Section V. A summary of key activities relevant to the recommendations noted in the table above are provided below.

Groundwater Conditions

Groundwater data were collected over the last five years to assess remedy performance. The monitoring programs that were conducted since the last FYR include groundwater flow and gradient monitoring, NAPL monitoring, Site-wide groundwater quality assessment, and infiltration pond assessment. The following sections discuss the findings of these programs.

Groundwater Flow Direction and Gradient Assessment (2016 – 2020)

Site-wide manual measurements of static groundwater levels were collected semi-annually from 2016 through 2020. Figure IV-1 shows the locations of groundwater monitoring wells monitored in 2020. Groundwater levels also were measured continuously using pressure transducers in select monitoring wells along the interior and exterior of the barrier wall during this period. Results of these activities are documented in Annual O&M Reports from 2016 through 2020 (Hart Crowser/GSI, 2017, 2018a, 2019, 2020b, and 2021).

Observations based on the groundwater monitoring data collected since 2016 include the following:

- Shallow horizontal groundwater elevations and gradients have remained generally consistent since the barrier wall was installed in 2003. Horizontal groundwater gradients inside the barrier wall remain flat and generally to the southwest, while outside and upgradient of the wall, gradients are steeper and shallow groundwater flow is diverted around the barrier wall to the west and south. This demonstrates that the barrier wall has effectively cut off the hydraulic connection between the shallow groundwater zone inside and outside of its boundaries. Horizontal gradients outside the barrier wall are generally the greatest during periods of high precipitation and decrease during periods of low precipitation. This is also the case in horizontal gradients inside the barrier wall.
- Historically, the net downward gradient has been greater inside the barrier wall because the shallow groundwater elevation inside the barrier wall is slightly elevated when compared with the net river stage. The net vertical gradient outside the barrier wall on the river side (MW-45s to MW-45d) is typically smaller and varies upward and downward according to the trends of the Willamette River. Neutral or upward vertical gradients occur during periods of peak flow in the Willamette River (e.g., February and June 2020), when groundwater levels within the northwest

corner of the barrier wall increase and cause a partial gradient reversal. This partial reversal is caused by a deep hydraulic connection through sand at the base of the western edge of the barrier wall; when the river level exceeds the groundwater level within the barrier wall area, an upward vertical gradient results.

- The Willamette River stage directly influences groundwater elevations in the nearshore areas. However, the oscillations in the shallow interior wells are delayed and muted. The muted amplitude or nonexistent response of interior shallow wells compared with the deep-zone wells indicates a hydraulic disconnect between the shallow aquifer within the barrier wall and the deeper water-bearing zones. This disconnect is due to the presence of the barrier wall and the confining silt layer between the shallow and intermediate zones throughout most of the barrier wall area (the exception being the northwest corner of the barrier wall, where there is no aquitard).
- The net flux in wells at the base of the barrier wall is near zero. Therefore, while contaminants within the barrier wall may move with tidal oscillations, the flux toward the river is minimal and, therefore, contaminants will not reach the river from within the barrier wall if the integrity of the wall remains intact.
- Although precipitation in the Willamette River watershed ultimately affects the stage of the river, direct precipitation near the Site appears to play a minor role in determining the water levels of wells within the barrier wall and along the river. Although some infiltration occurs along the fringes of the soil cap and within the riparian zone, the volume of infiltration is minimal. Between the barrier wall and the river, precipitation inputs are overshadowed by the response of groundwater to variations in river stage.

Based on the observations made through the 2020 reporting period, it appears the barrier wall and impermeable soil cap are functioning as designed; groundwater flow and rainwater infiltration are diverted around source areas contained within the barrier wall, and NAPL contained within the barrier wall is prevented from migrating to the Willamette River.

NAPL Gauging and Monitoring Assessment

A NAPL data gap investigation, including monitoring of the post-extraction NAPL thicknesses in select wells, was conducted in the former waste disposal area (FWDA) in 2011 (Hart Crowser/GSI, 2011b). The results supported the regulatory decision to discontinue NAPL extraction in 2011 after determining that residual NAPL in the FWDA is isolated and stable and does not pose a risk to the Willamette River. To validate the decision to discontinue NAPL extraction and to continue to assess the performance of the barrier wall and soil cap, the presence and thickness of NAPL continues to be monitored twice a year. Results of these activities are documented in Annual O&M Reports (Hart Crowser/GSI, 2017, 2018, 2019, 2020b, and 2021).

NAPL is routinely observed outside of the northwest corner of the barrier wall that encompasses the FWDA. From 2016 through 2020, small and non-recoverable quantities of dense NAPL (DNAPL) were observed in four wells (EW-10s, MW-20i, MW-Ds, and MW Gs) in this area. The DNAPL thicknesses measured in these wells in 2020 are generally consistent with measurements made since NAPL recovery was discontinued in 2011. There were also uncharacteristic observations of trace light NAPL (LNAPL) in 2019 from wells with no history of trace LNAPL detections, which were likely associated with equipment malfunction. Equipment malfunction during LNAPL measurements may occur due to interface probe prism fouling and poor conductance leading to unrepeatable detections or false detections with no accumulated thickness. Trace LNAPL was also noted outside the barrier wall during

the 2020 monitoring events in three wells (EW-10s, MW-Ds, and MW-Gs) and are consistent with past trace LNAPL detections in these wells.

Measurable LNAPL was present in four wells inside the barrier wall during the 2020 monitoring events (EW-15s, EW-23s, MW-23d, MW-56s), and measurable DNAPL was observed in four wells inside the barrier wall during the 2020 monitoring event (EW-1s, EW-8s, EW-18s, MW-22i). LNAPL thickness is generally greater when the groundwater elevation is low; this pattern has been consistent since mid-2006, when LNAPL ceased being recovered inside of the barrier wall. Although the LNAPL thickness varies cyclically with changes in the groundwater elevation, the overall LNAPL thickness in these wells has remained relatively stable, with slight increases during low groundwater levels. Approximately 2 feet of DNAPL is consistently present within the sump of well EW-8s, with occasional spikes in the DNAPL thickness up to approximately 6 feet, as observed during the June 2020 monitoring event.

Based on the evaluation of groundwater data from 2005 through 2020, both LNAPL and DNAPL appear to be stable except for the DNAPL at EW-8s; however, the behavior of DNAPL in EW-8s is consistent with historical patterns, which vary seasonally. There continues to be no evidence of either mobility across the barrier wall or to the Willamette River. These data support the conclusion that the barrier wall and impermeable soil cap are functioning as designed to divert groundwater flow around and prevent rainwater infiltration into NAPL source areas contained within the barrier wall, and NAPL contained within the barrier wall is prohibited from migrating to the Willamette River.

Groundwater Quality Assessment

Groundwater sampling was conducted at the Site in May 2020 to document post-remedial action groundwater concentrations of Site contaminants outside the barrier wall. The wells included in the water quality sampling event are shown on Figure IV-1. Groundwater samples were collected from 11 wells (EW-19s, MW-35r, MW-37s, MW-37i, MW-37d, MW 39s, MW-41s, MW-47s, MW-55s, MW-53s, and MW-58s) on May 26 and 27, 2020, and analyzed for total metals (arsenic, chromium, copper, and zinc), PCP, and PAHs. The results of these analyses are presented in Table IV-1.

With the exception of arsenic, groundwater quality monitoring results from 2020 are generally consistent with historical data or show reductions in contaminant concentrations when compared to the results from the 2010 sampling event presented in the 2010 O&M Report (Hart Crowser/GSI, 2011a). PAHs were detected in each well sample, with LPAHs being detected more frequently than HPAHs. Total PAHs were always at least two orders of magnitude below the ACL. Two shallow wells and one intermediate well (EW-19s, MW-37s, and MW-37i) outside the barrier wall in the FWDA contained relatively high concentrations of PAHs. These detections are not unexpected given the presence of NAPL in the FWDA. PCP was detected in shallow well MW-53s, located upgradient and to the east of the barrier wall, but it was not detected in any other well.

In 2020, arsenic concentrations were orders of magnitude below the ACL of 1,000 µg/L in all in wells. Contaminant concentrations from 2020 are presented in Table IV-1. All other metals were either non-detect or present at similar concentrations as in 2010, with the exception of arsenic and zinc in MW-58s. Arsenic concentrations increased from 0.6 µg/L in 2010 to 50.9 µg/L in 2020 in MW-58s. The cause of this increase is unknown. A review of historical sampling data collected from other wells between 2006 and 2010 indicates that arsenic concentrations have varied by approximately 20 to 30 µg/L in the past. Zinc was detected in MW-58s at 86 µg/L in 2020, and previously detected at 2.90 µg/L in 2010. Chromium was only detected in well MW-55s at an estimated concentration of 1.56 µg/L, just above the

detection limit. Copper was detected at two wells (MW-55s and MW-58s), also just above the detection limit. Chromium, copper, and zinc were all orders of magnitude below their respective ACLs.

In summary, groundwater outside of the subsurface barrier wall has frequent arsenic and PAHs detections, with infrequent detections of PCP, chromium, copper, and zinc. Inside the barrier wall, groundwater gradients confirm that groundwater is contained within the barrier wall and is not migrating to the river. Outside the barrier wall, residual product within the FWDA results in elevated PAH concentrations and the presence of localized NAPL in groundwater. Despite the groundwater contamination in this area, monitoring of downgradient wells, surface water, and the sediment cap (inter-armoring, sub-armoring, and porewater in the organophilic clay) has demonstrated that the groundwater remedy is performing as designed and that groundwater is not adversely affecting the river.

Infiltration Pond, MW-59s Groundwater Quality Assessment (2016 – 2020)

The infiltration pond at the southwestern corner of the Site is a component of the upland remedy, which was constructed to collect surface water runoff from a portion of the upland cap. A groundwater monitoring well, MW-59s, was installed downgradient from the infiltration pond in 2005 to monitor changes in contaminant levels in groundwater. Figure IV-1 shows the location of the infiltration pond and monitoring well MW-59s.

Groundwater samples are collected from MW-59s to evaluate the potential for subsurface contaminants to be mobilized by the infiltration pond. A total of seven samples were collected from MW-59s through 2010 and analyzed for PAHs and total metals including arsenic, chromium, copper, iron, and zinc. Following the 2010 sampling, the O&M plan prescribed sampling at MW-59s every five years. MW-59s was sampled for metals, PCP, and PAHs in 2020. All results for MW-59s are presented in Table IV-2.

No analyte was detected above its ACL in 2020, although arsenic concentrations have increased since 2006. Figure IV-2 presents a time series plot of arsenic concentrations in MW-59s. Arsenic concentrations in MW-59s are still increasing. Despite this, there does not currently appear to be a risk of significant subsurface contaminant mobilization by the infiltration pond. Porewater results from locations A and B, which are downgradient of MW-59s and the infiltration pond, are below the 1996 and updated AWQCs and indicate that arsenic is not being mobilized into the Willamette River. It is unclear whether the source of arsenic is naturally occurring or related to historical releases at the Site. Concentrations of other contaminants in MW-59s appear to be stable. However, monitoring should continue every five years to determine whether arsenic concentrations start to increase downgradient of the infiltration pond.

Surface, Inter-Armoring, and Sub-Armoring Water Assessment

In August and September 2020, DEQ and EPA used passive sampling methods to characterize surface water and porewater at the Site because these sampling results represent the potentially mobile and biologically available fraction of Site contaminants. The methods used in 2020 used solid phase micro extraction fibers coated with a sorbent polydimethylsiloxane (PDMS) polymer media for PAH and PCP analysis. Diffusive membranes covering cells were used to characterize dissolved metals concentrations. These two passive sampling techniques were integrated into a passive sampling device (PSD) with discrete sampling intervals to represent the following:

- Surface water (6 inches above mudline)
- Inter-armoring porewater (6 inches below armor surface)
- Sub-armoring porewater (18 inches below armor surface)

The ROD states that surface water will be used to assess protectiveness of the sediment cap, with specific monitoring program details to be determined during remedial design and further refined in the O&M Plan (EPA, 1996). The DEQ- and EPA-approved technical memorandum O&M Sampling Approach for the McCormick & Baxter Sediment Cap included in the O&M Plan (DEQ/EPA, 2014) describes the sampling approach. Surface water and inter-armoring porewater samples are used to evaluate cap performance in comparison to the ROD cleanup criteria, while sub-armoring porewater samples are used to assess the potential for future contaminant breakthrough across the monitoring area.

The water samples collected in 2020 were used to assess the cap's compliance with the ROD. Compliance samples were collected at 12 locations (A through L) at all depths to ensure the cap is functioning as intended. Compliance monitoring horizontal positions are statistically generated and change each sampling event. Samples were also collected at four early warning locations (5, 12, 13, and 16) from all depths. Two surface water reference locations (1 and 27) were also targeted for sampling to assess concentrations in surface water and porewater outside of the Project Area; unfortunately, the PSD at location 1 was missing at the time of retrieval. Details about the locations sampled in 2020 are provided in Table IV-3, and the sampling locations are shown on Figure IV-3. Additional information about the methods used can be found in the SAP (Hart Crowser/GSI, 2020a).

Chemical analyses of the samples were completed at the TTU laboratory as described in the SAP (Hart Crowser/GSI, 2020a). The specific target analytes and analytical methods for this event included the following:

- Dissolved metals (arsenic, chromium, copper, and zinc) by EPA Method 200.8
- PAHs by EPA Method 8270
- PCP by EPA Method 8270

Results of the organics analyses required the conversion of reported concentrations to water concentrations based on each chemical's partitioning coefficient. The results of the diffusive membrane cell analyses for metals are direct representations of environmental concentrations. The fully converted organics results and metals concentrations used for comparison purposes are provided in Table IV-4. Additional information regarding the field and analytical methods can be found in the SAP (Hart Crowser/GSI, 2020a) and the 2020 Annual O&M Report (Hart Crowser/GSI, 2021).

Analytical results were screened against the 1996 ambient water quality criteria (AWQC) established for assessing the RAOs for the in-water cap in the ROD (EPA, 1996) and the current AWQCs developed by DEQ. These contaminants and their associated 1996 and current AWQC values include the following:

- Arsenic – 1996 AWQC = 0.19 mg/L (Aquatic Life); current AWQC = 0.15 mg/L (Aquatic Life) and 2.1 mg/L (Human Health).
- Chromium – 1996 AWQC = 0.21 mg/L (Aquatic Life); current AWQC = 0.024 mg/L (Aquatic Life).
- Copper – 1996 AWQC = 0.012 mg/L (Aquatic Life); the current copper AWQC is hardness based and was not assessed since no supporting hardness data were collected.
- Zinc – 1996 AWQC = 0.11 mg/L (Aquatic Life); current AWQC = 0.036 mg/L (Aquatic Life) and 2,600 mg/L (Human Health).
- PCP – 1996 AWQC = 13 µg/L (Aquatic Life); current AWQC = 0.3 µg/L (Human Health)

- Acenaphthene – 1996 AWQC = 520 µg/L (Aquatic Life); current AWQC = 99 µg/L (Human Health).
- Anthracene – No 1996 AWQC; current AWQC = 4,000 µg/L (Human Health).
- Fluoranthene – 54 µg/L (Human Health); current AWQC = 14 µg/L (Human Health).
- Fluorene - No 1996 AWQC; current AWQC = 530 µg/L (Human Health).
- Naphthalene – 620 µg/L (Aquatic Life); no current AWQC.
- Carcinogenic PAHs (cPAHs) – 1996 AWQC = 0.031 µg/L (Human Health) (calculated as the sum of detections plus one-half the method detection limit for non-detects); current AWQC = 0.0018 µg/L (Human Health) for each of the individual PAHs that contribute to the cPAH summation including benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, and indeno[1,2,3-c,d]pyrene. These updated AWQC values have not been corrected for the 2015 revision to the cancer slope factor (CSF) for benzo[a]pyrene or the potency equivalent factor (PEF) of each individual cPAH compound.

The current AWQC serve as the comparison criteria for the assessment of performance of the remedy at the Site, since they represent the potential for unacceptable impacts to the Willamette River. These AWQC represent updates since the time of the ROD; the results will also be compared to the 1996 AWQC that were in place when the ROD was issued. For these reasons, the analytes listed above will be the focus of the data screening, summarization, and comparisons made in this FYR.

To assess long-term trends in the concentrations of contaminants with 1996 and current AWQC values, data from the following events were used: Fall 2005; Spring and Fall 2006; Spring and Fall 2007; Spring and Fall 2008; Spring and Fall 2009, Spring 2010; Fall 2015; and Fall 2020.

These sampling events used a variety of methods to characterize water concentrations within the compliance monitoring area. For example, metals screened during previous monitoring work were typically representative of the total concentration, but more recent events using PSDs are most representative of the dissolved fraction. Total metals results that were screened in previous FYRs in 2011 (DEQ/EPA, 2011) as well as the dissolved metals results from 2016 and 2020 were used in this assessment. This variability should be considered when interpreting and comparing results.

2020 Results

To assess the cap's compliance with the ROD, surface water and inter-armoring porewater samples were screened against the 1996 and current AWQC values. Samples from the sub-armoring layer were also screened against the 1996 and current AWQC values to serve as an early warning indicator of the potential for chemical breakthrough across the compliance monitoring area.

Table IV-4 provides the screened analytical results from 2020. Metals (arsenic, chromium, copper, and zinc) and several PAHs/cPAHs had detectable concentrations in 2020. Table IV-5 provides summary statistics for the 2020 sampling event. PCP was not detected in any of the samples despite having an MDL of 0.11 µg/L, approximately two orders of magnitude lower than the 1996 AWQC (13.0 µg/L) and approximately 3 times lower than the current AWQC. Since there are no PCP detections or AWQC exceedances in 2020, PCP was not assessed as part of the summaries and figures.

The results from 2020 at locations within the compliance monitoring area (Figure IV-3) were compared to those from the "downstream" location 27 for the purposes of determining whether concentrations were consistent with other nearby areas of the Willamette River. Note that this segment of the lower

Willamette River is subject to reverse tidal flow, which is most noticeable during late summer and early fall.

To allow for comparisons by depth interval (surface water, inter-armoring, and sub-armoring), box plots of contaminant concentrations from the 2020 sampling event were prepared. Figures IV-4 through IV-11 present box plots of arsenic, chromium, copper, zinc, acenaphthene, fluoranthene, naphthalene, and cPAH concentrations by depth interval. These figures and Table IV-5 used data collected within the M&B compliance monitoring area including duplicates but excluded the data collected at location 27, since it was downstream and outside of the compliance monitoring area. The figures also include reference to each contaminant's 1996 and current AWQC, which show that there were no exceedances.

The following is a summary of the depth interval comparisons:

- Arsenic (Figure IV-4) – Arsenic concentrations were lowest in the surface water depth interval and increased with depth, with the highest concentrations present in the sub-armoring depth interval. Arsenic concentrations were orders of magnitude below the 1996 AWQC in all depth intervals and did not exceed the current aquatic life AWQC (0.15 mg/L) in any depth interval.
- Chromium (Figure IV-5) – Chromium concentrations were lowest in the surface water depth interval and were comparable in the inter-armoring and sub-armoring depth intervals. Chromium concentrations were orders of magnitude below the 1996 AWQC in all depth intervals and did not exceed the current AWQC (0.02 mg/L) in any depth interval.
- Copper (Figure IV-6) – Copper concentrations were highest in the surface water depth interval and were comparable in the inter-armoring and sub-armoring depth intervals. Copper concentrations were orders of magnitude below the 1996 AWQC in all depth intervals. The current AWQC were not assessed since paired hardness data were not collected.
- Zinc (Figure IV-7) – Zinc concentrations decreased with depth, with the surface water and inter-armoring depth intervals having comparable concentrations. Zinc concentrations were orders of magnitude below the 1996 AWQC in all depth intervals and did not exceed the current AWQC (0.04 mg/L) in any depth interval.
- Acenaphthene (Figure IV-8) – Acenaphthene concentrations were lowest in the surface water depth interval and increased slightly with depth with the highest overall concentrations present in the sub-armoring depth interval. Acenaphthene concentrations were orders of magnitude below the 1996 AWQC in all depth intervals and did not exceed the current AWQC (99 µg/L) in any depth interval.
- Anthracene – Anthracene concentrations were generally lowest in the surface water depth interval and increased slightly with depth with the highest overall concentrations present in the sub-armoring depth interval. Anthracene concentrations were several orders of magnitude below the current AWQC in all depth intervals.
- Fluoranthene (Figure IV-9) – Fluoranthene concentrations were comparable across depth intervals, but the highest concentrations were in the inter-armoring and sub-armoring depth intervals where concentrations increased slightly with depth. Fluoranthene concentrations were orders of magnitude below the 1996 AWQC in all depth intervals and did not exceed the current AWQC (14 µg/L) in any depth interval.
- Fluorene – Fluorene concentrations generally increased with depth or were stable. Fluorene concentrations were orders of magnitude below the current AWQC in all depth intervals.
- Indeno[1,2,3-cd]pyrene – Indeno[1,2,3-cd]pyrene was not detected in any depth interval.
- Naphthalene (Figure IV-10) – Naphthalene concentrations were comparable across depth intervals, but the highest concentrations were in the inter-armoring and sub-armoring depth

intervals, where concentrations increased slightly with depth. Naphthalene concentrations were orders of magnitude below the 1996 AWQC in all depth intervals. There is no current AWQC for comparison.

- cPAHs (Figure IV-11) – cPAH concentrations were comparable across depth intervals, but the highest concentrations were in the inter-armoring and sub-armoring depth intervals where concentrations increased slightly with depth. Total cPAH concentrations were an order of magnitude below the 1996 AWQC in all depth intervals. However, benz[a]anthracene and chrysene concentrations in several locations exceeded the updated AWQC for these compounds. It should be noted, however, that the current AWQC have not been adjusted to account for the revised benzo[a]pyrene CSF and different PEFs of each individual cPAH.

The following sections summarize the 2020 sampling results. Figures IV-4 to IV-11 provide box plots of COCs detected in 2020 with the appropriate 1996 AWQC and current AWQC.

Surface Water

No metals were detected above the 1996 or current AWQC values in surface water samples collected in 2020. Several PAHs with current AWQC were detected in surface water samples, but only chrysene was detected above its current AWQC (locations G, K, and L). However, the updated AWQC for cPAHs have not been adjusted to account for the updated CSF for benzo[a]pyrene of PEFs for each individual cPAH, which would significantly raise the AWQC for chrysene.

Inter-Armoring Water

No metals were detected above the 1996 or current AWQC values in inter-armoring water samples collected in 2020. Several PAHs with current AWQC were detected in inter-armoring water samples, but only chrysene (locations 12, 27, D, E, and I) and benz[a]anthracene (locations 12, 27, D, and E) were detected above the current AWQC in inter-armoring water. However, the updated AWQC for cPAHs have not been adjusted to account for the updated CSF for benzo[a]pyrene of PEFs for each individual cPAH, which would significantly raise the AWQC for benz[a]anthracene and chrysene.

Sub-Armoring Water

No metals were detected above the 1996 or current AWQC values in sub-armoring water samples collected in 2020. Several PAHs with current AWQC values were detected in sub-armoring water samples, but only chrysene (locations 12, 27, B, D, J, and L) and benz[a]anthracene (locations 12, 27, and J) were detected above current AWQC values in sub-armoring water. However, the updated AWQC for cPAHs have not been adjusted to account for the updated CSF for benzo[a]pyrene or PEFs for each individual cPAH, which would significantly raise the AWQC for benz[a]anthracene and chrysene. There were no instances of sub-armor layer cPAH concentrations being significantly higher than the inter-armor layer concentrations.

Long-Term Trends

To evaluate trends in contaminant concentrations across the different depth intervals, plots of the mean concentrations of contaminants with 1996 AWQC (arsenic, chromium, copper, zinc, acenaphthene, fluoranthene, naphthalene, and cPAHs) from each historical post-remedy monitoring event were prepared as shown on Figures IV-12 through IV-19 (fall 2005 to fall 2020). Plots for PCP were not prepared as there have been no detections since 2010. Figures used data collected within the compliance monitoring area, including duplicates. Data collected outside of the compliance monitoring area are not included. Samples from the inter-armoring depth interval were not collected during the fall 2005 event. Sub-armoring samples were only collected from the early warning locations during the 2015 event.

These sampling events used a variety of methods to characterize water concentrations within the compliance monitoring area. This variability should be considered when interpreting and comparing results. Historical sample results are included in Table IV-6.

Surface Water

Trends in mean concentrations of contaminants in post-remedy surface water are shown on Figures IV-12 through IV-19 and are summarized in Table IV-6. The following is a summary of the trends for each contaminant with a 1996 AWQC in surface water:

- Metals: arsenic, chromium, copper, and zinc (Figures IV-12 through IV-15) – All metals concentrations have remained well below their respective AWQC in surface water samples since 2005. Prior to 2010, there was some variability in the results, but general concentration trends are decreasing.
- PAHs (Figures IV-16 through IV-19) – With the exception of cPAH, PAH concentrations have remained below their respective AWQC in surface water samples since 2005. Prior to 2010, there was some variability in the results, but general concentration trends are decreasing. cPAHs have some early AWQC exceedances in surface waters between 2005 and 2010, but these concentrations are reduced in samples collected since 2010 and are now less than the 1996 and current AWQC values. Additionally, cPAH concentrations have historically been calculated as a summed total using the full value of the detected concentration. In 2015, EPA updated the National Recommended Ambient Water Quality Criteria to correct concentrations of individual cPAHs for their cancer potency relative to benzo[a]pyrene (EPA, 2015).

Inter-Armoring Water

Trends in mean concentrations of contaminants in post-remedy inter-armoring water are shown on Figures IV-12 through IV-19. The following is a summary of the trends for each contaminant with a 1996 AWQC value in inter-armoring water:

- Metals: arsenic, chromium, copper, and zinc (Figures IV-12 through IV-15) – All metals concentrations have remained below their respective 1996 AWQC in inter-armoring water samples since 2005. Prior to 2010, there was some variability in the copper and zinc results, but general concentration trends are decreasing. The exception to this is arsenic, which increased slightly in inter-armoring water during the 2020 sampling event.
- PAHs: acenaphthene, fluoranthene, naphthalene, and cPAHs (Figures IV-16 through IV-19) – All PAH concentrations except the cPAH summation have remained below their respective 1996 AWQC in inter-armoring water samples since 2005. Prior to 2010, there was some variability in the results. Except for acenaphthene, which increased since the last sampling round, general concentration trends are decreasing. The cPAH total has some early AWQC exceedances in inter-armoring waters between 2005 and 2010, but these concentrations have been reduced in samples collected since 2010 and are now below the 1996 AWQC.

Sub-Armoring Water

Trends in mean concentrations of contaminants in post-remedy sub-armoring water can be seen on Figures IV-12 through IV-19. The following is a summary of the trends for each contaminant with an AWQC in sub-armoring water:

- Metals: arsenic, chromium, copper, and zinc (Figures IV-12 through IV-15) – All metals concentrations have remained below their respective AWQC values in inter-armoring water

samples since 2005. Prior to 2010, there was some variability in the copper (one AWQC exceedance in 2007) and zinc results, but general concentration trends are decreasing. The exception to this downward trend is arsenic, which increased in sub-armoring water during the 2020 sampling event.

- PAHs: acenaphthene, fluoranthene, naphthalene, and cPAHs (Figures IV-16 through IV-19) – All PAH concentrations except the cPAH summation have remained below their respective AWQC values in sub-armoring water samples since 2005. Prior to 2010, there was some variability in the results. Except for acenaphthene, which increased since the last sampling round, general concentration trends are decreasing. The cPAH total showed some early AWQC exceedances in sub-armoring waters between 2005 and 2010, but these concentrations have been decreased in samples collected since 2010 and are now below the 1996 AWQC.

Summary

The collection of surface water, inter-armoring, and sub-armoring water samples using PSDs loaded with PDMS fibers and diffusive membrane cells provided data suitable for the assessment of remedy performance at the Site. Previous work used a variety of methods to collect surface water and porewater data in support of performance monitoring efforts; consequently, individual results are not always directly comparable and may not always represent the same chemical fraction. Passive sampling methods measure only the dissolved fraction, while whole water samples may include the contribution from suspended particulates. Despite these differences, the following trends are observed:

- Surface, inter-armoring, and sub-armoring water samples collected in 2020 are all below the relevant 1996 and current AWQC values except for chrysene and benz[a]anthracene. However, current chrysene and benz[a]anthracene AQWC have not been updated to account for the change in the benzo[a]pyrene CSF or use of PEFs for individual cPAHs. If the AWQC did account for these changes, concentrations would be orders of magnitude below the corrected AWQC. These results indicate that the remedy is performing as intended and that there has been no chemical breakthrough at the locations monitored.
- Chemical concentrations (except for copper and zinc) increase with depth in most locations.
- Historical trends in concentrations of contaminants with 1996 AWQC values are decreasing, with the exception of arsenic. Trends for arsenic indicate increasing concentrations in the inter-armoring and sub-armoring layers, while arsenic concentrations in surface water remain stable. Concentrations of copper, zinc, and PAHs exhibited variability early in the monitoring period, but are now consistently less than their respective AWQC except for chrysene and benz[a]anthracene, which exceeded the current AWQC.

Based on the results of the 2020 surface water, inter-armoring, and sub-armoring monitoring, the sediment cap continues to function as designed and remains protective of human and environmental health. The review of historical data and trends also indicates that conditions within the cap area are stable and that there is no breakthrough.

Crayfish Tissue Assessment

Crayfish tissue sampling was conducted in 2020 to assess dioxins, as passive porewater technologies were unable to reach applicable dioxin detection limits. These locations are shown on Figure IV-20 along with the areas where other historical M&B crayfish tissue samples were collected. The locations sampled in 2020 were all co-located with compliance monitoring locations used to assess sediment cap performance. Details of the 2020 crayfish sample locations are presented in Table IV-7.

Sampling activities targeted a crayfish species (*Pacifastacus leniusculus*) because they are endemic to the area, are old enough to have had exposure to COCs, if present, and are consumed by humans. Crayfish collected for analyses were processed as whole-body samples. Tail-only samples were not run because sufficient sample volumes were not obtained. Sampling was performed in compliance with Section 4d of the Endangered Species Act and in accordance with the SAP (Hart Crowser/GSI, 2020a). Additional details about the sampling event itself can be found in the 2020 O&M Annual Report (Hart Crowser/GSI, 2021).

Chemical analyses on whole body tissue were performed as described in the SAP (Hart Crowser/GSI, 2020a). Additionally, analyses were conducted on bait used for trapping the crayfish. The specific target analytes and analytical methods for this event include the following:

- Dioxins/furans by EPA Method 1613B
- PAHs by EPA Method 8270D
- PCP by EPA Method 8270D-SIM
- Total metals including arsenic, zinc, chromium, and copper by EPA Method 6020A
- Percent lipid content by NOAA Lipid Method

Crayfish tissue data were validated to ensure they were of high quality and usable for assessment purposes. No significant quality issues were noted. The 2020 O&M Annual Report (Hart Crowser/GSI, 2021) provides additional details on the data quality.

2020 Crayfish Tissue Results

This section describes the 2020 crayfish tissue sampling results for dioxins/furans, which are provided in Table IV-8. Dioxin/furan congeners were detected in all specimens analyzed. More congeners and higher concentrations were detected in the duplicate sample collected at location 04 than those collected at the other locations. Detectable concentrations were generally present at values less than laboratory practical quantitation limits (J-flagged values). 2,3,7,8-TCDD (TCDD) toxicity equivalents (TEQ) concentrations were relatively similar across the Site and ranged from 0.34 ng/kg (location 01) to 0.54 ng/kg (location 05), the exception being at location 04, where the duplicate sample result was 8.7 ng/kg. The TCDD TEQ for the primary sample from location 4 is 0.386 ng/kg. The primary sample and a field duplicate from location 4 were collected with separate crayfish from the same location and submitted to the laboratory for tissue processing. The difference in TCDD TEQ concentrations between the primary and field duplicate sample is likely due to concentration variability between the crayfish specimens comprising the samples.

Crayfish Tissue Comparison

There are no cleanup levels or performance standards associated with crayfish tissue results, but a comparative assessment of historical M&B Site and Portland Harbor Superfund Site crayfish tissue dioxin/furan concentrations was completed as part of this FYR for informational purposes. The comparative assessment was done through the development of boxplots (Figure IV-21) for the TCDD TEQ. On this plot, data from the following sampling events at the M&B Site (Hart Crowser/GSI, 2008 and 2021) and Portland Harbor Superfund Site (EPA, 2016) are shown:

- 1991 McCormick & Baxter (yellow) (tail only)
- 2002 Portland Harbor (black)

- 2003 McCormick & Baxter (green)
- 2006 McCormick & Baxter (red)
- 2007 Portland Harbor (black)
- 2008 McCormick & Baxter (blue)
- 2020 McCormick & Baxter (purple)

The 2002 and 2007 Portland Harbor data were aggregated to provide a more comprehensive data set for comparison. The 1991 through 2020 M&B data sets were grouped independently to allow for an assessment of crayfish tissue trends. All samples except those collected at M&B in 1991 were whole body. The locations where historic M&B crayfish tissue data were collected can be seen in Figure IV-20. Samples from 1991 and 2003 were collected prior to the implementation of the remedy.

The TCDD TEQ concentrations in crayfish tissue at M&B (Figure IV-21) were highest in 1991, prior to remedy implementation. Since 1991, TCDD TEQ concentrations in crayfish tissue at the M&B Site have declined and are now comparable with the low end of Portland Harbor-wide crayfish tissue concentrations from 2002 and 2007. One sample (MBCFGB1020-04 DUP) in 2020 had a concentration of 8.7 ng/kg, an order of magnitude above the other samples collected from the M&B Site. This result was from a duplicate sample and was not replicated in the primary sample.

Summary

The results of the 2020 crayfish tissue monitoring and comparison to historical Portland Harbor crayfish tissue dioxin/furan concentrations provide insight into tissue concentrations pre- and post-remedy at the M&B Site and context for how Site-specific tissue concentrations may differ from those in the surrounding Portland Harbor Superfund Site. The results indicate that concentrations of dioxin/furans in crayfish tissue at the Site have been reduced through the implementation of the remedy and are generally comparable to the 2002 and 2007 tissue concentrations within the greater Portland Harbor Superfund Site.

Bathymetry Evaluation

Bathymetry data were collected in April 2006 shortly after construction of the sediment cap was completed in October 2005. Bathymetry data were recently collected from the Willamette River for the Portland Harbor Pre-Design Investigation in June 2018 and included the sediment cap area at the M&B Site. The recent elevation contours for the river bottom are shown on Figure I-3 along with the various cap components. Mudline elevations were compared and the change in elevation between the two data sets were plotted on Figure IV-29. Changes in mudline elevations ranged from 3 feet or less of sediment erosion to up to 4.5 feet of deposition.

The bathymetry evaluation indicates that deposition of approximately 0 to 2 feet has occurred throughout the tidal flat area with isolated areas of deposition up to approximately 4.5 feet. The location that received the highest accumulation of sediment was around the organoclay mat below the BNSF railroad. Other areas that received greater amounts of deposition compared to the rest of the tidal flats, were the locations of organoclay mats along the Willamette River where approximately 3 to 4.5 feet of deposition occurred. The additional deposition occurred due to sand and gravel material (that was placed on the shoreline for habitat enhancement) washing down the slope and accumulating on top of the organoclay mat areas. The bathymetry evaluation indicates that 6-inch, 12-inch, and 24-inch rock armoring layer design thicknesses have been maintained and the sediment cap continues to meet the performance standards of the ROD.

Soil Cap Subsidence Monitoring

Subsidence monitoring was performed in August and October 2019 with the results detailed in the "Technical Memorandum – Subsidence Monitoring and Evaluation" included in the 2020 O&M Report (Hart Crowser/GSI, 2021). The subsidence monitoring compared land survey elevations from August 2008 (from September 2009 for wells EW-1s, MW-23d, and MW-50s) to measure changes in ground surface elevation as shown on Figure IV-30. The results of the survey comparison indicated a decrease in elevation of 0.56 feet and 0.22 feet for EW-1s and MW-23d, respectively, in the localized area of observed subsidence. Throughout the entire Site, slight uplift or subsidence was observed with elevation changes of plus or minus 0 to 0.5 feet. As well sealing activities for EW-1s were performed in 2009, the elevation differences noted include pre-stabilized conditions for the localized area of subsidence around those wells. Inner and outer casing elevation measurements since 2011 indicate that no additional subsidence has occurred as measurements have consistently been 2.75 inches.

Additionally, two areas of increased subsidence were noted including up to 1.5 to 2.5 feet in a narrow strip along the southeastern perimeter fence and up to 1.5 to 2 feet along downslope of the TRM to and ACB edge transition in the riparian area. Subsidence along the southeastern perimeter fence may be due to less rigorous soil compaction during cap placement in the area due to the linear nature of the subsidence feature as there are no known causes of erosion for this area. Subsidence in the riparian area may be due to slumping of the riparian area slope. Some erosion from higher up on the slope has been observed in select areas, but accumulation lower on the slope does not account for the amount of uplift identified.

In addition to the land survey, a video inspection of the storm water conveyance piping was performed to monitor two previously identified sags in the conveyance piping. No additional sagging was observed in those two sags, and no additional sags were identified.

Based on the results of subsidence monitoring, no repair activities were warranted; however, continued monitoring will be performed every ten years to determine if additional subsidence or erosion has occurred and whether that may affect the integrity or function of the soil cap. The subsidence monitoring has indicated subsidence occurring in areas of the Site; however, it has not affected the thickness of the soil cap, infiltration rates of the soil cap, or vegetation health. The soil cap continues to meet the performance standards of the ROD.

Site Inspection

The inspection of the Site was conducted on May 20, 2021. In attendance were Anne Christopher (EPA Remedial Project Manager [RPM]), Sarah Miller (DEQ Project Manager [PM]), and DEQ consultants Kevin Woodhouse (Hart Crowser) and Ben Johnson (GSI). The purpose of the inspection was to assess the protectiveness of the remedy. The inspection included a walk around the perimeter of the Site starting at the northwestern corner of the M&B property along the Willamette River, continued in a counterclockwise direction around the Site perimeter, then across the Site interior and the earthen and impermeable caps, and concluded at Willamette Cove.

Navigational and pedestrian warning signs along with the upland perimeter fence remain in place, though some signs had minor amounts of graffiti on them. No ebullition was observed above the granular organoclay along the Willamette River shoreline and in Willamette Cove during the inspection. Minor amounts of trash were observed from pedestrians or that washed up on shore. A derelict sailing

vessel that was first observed in December 2020 is present on the shoreline in the vicinity of the stormwater outfall. Hart Crowser was in the process of initiating removal activities at the time of the inspection. A pedestrian was observed camping on the shoreline at the south end of the Site along the Willamette River. The pedestrian was cooking food over a campfire. The pedestrian was asked to douse the campfire due to fire hazard risks and informed that they were on a Superfund site and advised not to use river water for cooking.

Vegetation across the Site generally appeared healthy. Groundwater well locations were also observed, and cap subsidence was measured. Monitoring well MW-23d continues to register the same height difference between the inner and outer casing (2.75 inches) that has been measured since 2011. The stormwater drainage system within the impermeable RCRA-type soil cap is functioning as designed. Minor amounts of moss were cleared from the duckbill outlet cover on the stormwater outfall during the inspection.

One animal burrow was observed in the impermeable soil cap in the vicinity of monitoring well MW 48s that appeared to extend beyond 1 foot below the ground surface. The burrow will be filled during the next O&M visit to the Site. An approximate 4- or 5-inch diameter plastic riser pipe and cap was also observed protruding from the ground in the vicinity of the burrow and MW-48s. The pipe and cap are presumed to be stormwater conveyance piping cleanout CL-4 which should be protected by a high-density polyethylene (HDPE) vault as the record drawings indicate. Additionally, only one riser was observed, whereas the record drawings indicate two risers per cleanout. No HDPE vaults were observed for the other cleanouts. Vaults will be procured for six cleanouts and installed during the next O&M Site visit. Cuts in the fence and missing warning buoys that were first identified during previous Site inspections were in the process of being repaired at the time of the inspection.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Yes. According to the data reviewed and Site inspection results, the remedy is functioning as intended by the ROD, as modified by the ROD amendment and the ESD. There have been no changes in the physical conditions of the Site that would affect the protectiveness of the remedy.

Question A Summary: The soil remedy, sediment remedy, groundwater remedy, and engineering and ICs are functioning as intended by the ROD, as modified by the Amended ROD and the ESD. Section II summarizes the soil, sediment, and groundwater components of the remedy, and a detailed description is presented in Appendix B. This section presents the lines of evidence that demonstrate that the remedy is functioning as intended and meeting the RAOs defined in the ROD and the performance standards defined in the Final O&M Plan.

Soil Remedy

The soil cap, and DEQ's temporary control of the Site achieve the RAOs to eliminate potential exposures to contaminated soil and minimize the potential for stormwater to infiltrate through contaminated soils to groundwater. Regular inspections and maintenance activities are performed to ensure that the cap continues to function as designed. The following lines of evidence support the determination that the soil cap is functioning as intended:

- The soil cap provides physical separation between contaminated soil and Site receptors and effectively eliminates the potential for humans or ecological receptors to be exposed to

contaminants. Ongoing inspections (results described in Section III) demonstrate that the soil cap and its associated stormwater conveyance system are intact and functioning as intended.

- Potential exposure is minimized by restricting access to authorized personnel and controlling potential Site trespassing with chain-link security fences and gates. The security fence around the McCormick & Baxter Property is intact and in good repair (cut sections identified during the site inspection have been repaired), and warning signs are in place.
- Long-term access and land use are controlled through engineering and institutional controls, including future proprietary controls entered into with M&B or a new owner and BNSF to ensure the integrity and protectiveness of the cap are maintained.
- Stormwater runoff is prevented from encountering contaminated soil. Stormwater from the clean impermeable cap is collected and conveyed directly to the Willamette River for discharge. Stormwater from the remaining cap is conveyed via stormwater swales to an on-Site vegetated infiltration pond. Groundwater monitoring, downgradient from the pond, demonstrates stormwater infiltration has not resulted in subsurface contaminant mobilization. Although increases in arsenic concentrations have been observed in the downgradient monitoring well, arsenic concentrations in the sub-armoring, inter-armoring, and surface water of the nearest compliance monitoring location in the sediment cap (Location A) do not indicate that the arsenic is migrating to the river.

O&M annual costs are consistent with original estimates.

Potential O&M issues with the soil remedy are described below:

- A few small areas showed evidence of small animals burrowing into the soil cap. The burrows were repaired and are not believed to have fully penetrated the soil cap, and therefore do not affect protectiveness. The task of soil cap inspection and repair of small animal burrows is performed as needed throughout the year.
- A small, localized area of cap subsidence near extraction well EW-1s. Soil cap subsidence was not measurable on MW-23d from inner and outer casing measurements between 2011 and May 2021. The lack of additional subsidence is believed to be the result of the placement of an airtight seal on well EW-1s and the stabilization of water levels within the barrier wall. The impermeable cap stormwater drainage system continues to operate effectively following rain events. The subsidence most likely was associated with subsurface degradation of wood chips due to the decrease in groundwater elevation within the barrier wall and introduction of oxygenated air through the open well casing. The observed subsidence has not affected the effectiveness or protectiveness of the soil cap. Based on the data from the last five years, upland soil cap subsidence near wells EW-1s and MW-23d is currently stable. This area will continue to be monitored during quarterly Site inspections between 2021 and 2025 by taking inner and outer casing measurements at well MW-23d; by monitoring stormwater flow at the outfall during quarterly inspections; and by collecting and reviewing transducer data from EW-1s that measures groundwater elevation and temperature. Subsidence along the southeastern perimeter fence and along the top of the riparian area have not impacted the functionality of the soil cap and are likely due to further settling of the soil following soil cap construction. These areas will continue to be monitored during periodic land surveys of the Site to determine if further subsidence occurs that would warrant additional action.

Quarterly inspection and maintenance of the soil cap is sufficient to maintain its integrity and protectiveness.

DEQ retains control of the McCormick & Baxter Property and is prohibiting groundwater use and other unacceptable uses consistent with IC requirements in the ROD. Formal ICs through proprietary restrictions in the form of an EES will be recorded for the McCormick & Baxter Property and BNSF property. These restrictions will prohibit development within the 6-acre riparian zone along the riverbank, as required by the Endangered Species Act Biological Opinion issued by the NMFS, prohibit use of Site groundwater as specified by the ROD, and limit disturbance of Site soils. In the event of transfer of any part of the property owned by McCormick & Baxter to a future owner, for DEQ to agree to release its lien on the property, DEQ and EPA will require proprietary ICs in the form of an EES to be recorded.

Sediment Remedy

The sediment cap and ICs effectively achieve the RAOs to eliminate potential exposures to contaminated sediment beneath the cap and minimize the potential for contaminants to be released to the Willamette River. Quarterly inspections and maintenance activities are performed to ensure that the cap continues to function as designed. The following lines of evidence support that the sediment cap is functioning as intended and meeting RAOs and performance standards:

- The sediment cap provides physical separation between contaminated sediment and human or ecological receptors and effectively eliminates potential contaminant exposures. The cap is intact and operating as intended and has survived several high-flow events, as confirmed by the bathymetry evaluation and shoreline inspections.
- The sediment cap was designed to chemically isolate Site contaminants in groundwater discharging through sediments and NAPL. Sediment cap monitoring has been conducted since the sediment cap was completed in 2005 to verify design assumptions and cap effectiveness. Analytical results were compared to 1996 AWQCs, as well as current AWQCs. COC concentrations in surface water and inter-armoring water are consistently below comparison criteria with the exception of benz[a]anthracene and chrysene, which exceeded the updated AWQCs in several samples. However, the new CSF for benzo[a]pyrene toxicity factors have not been incorporated into the updated AWQCs, which would increase the AWQCs for cPAHs above the exceedances for benz[a]anthracene and chrysene. Therefore, the sediment cap remains protective of human health.
- The inter-armoring metal results for the PSDs were below comparison criteria and provide assurance that the sediment cap is protective. COC concentrations in the sub-armoring water are generally below comparison criteria. Except for arsenic and acenaphthene, COC concentration trends appear to be stable or decreasing. Based on sampling of surface, inter-armor, and sub-armor water, the sediment cap appears to be protective and functioning as designed.
- Visible discharges of NAPL to the river have been effectively eliminated through:
    - The installation of the subsurface groundwater barrier wall. The barrier wall contains primary NAPL source areas and reduces groundwater migration from upland source areas to the river thereby reducing contaminant flux to the river. No NAPL seeps have been observed since installation of the barrier wall.
    - NAPL extraction from wells located outside the barrier wall, permanently reducing the volume and potential mobility of NAPL.
    - Supplementing the cap by placing organoclay RCMs in ebullition-induced sheen areas and bulk organophilic clay in potential seep areas to minimize the potential for contaminant migration.

- Sediment cap inspections and the bathymetry evaluation confirmed the cap is intact and stable and did not identify significant indications of any difficulties with the remedy. Minor armoring repairs were conducted in the past five years as presented in Table II-2. It was observed that sand, deposited by both natural riverine processes and placed during cap construction, covers a portion of the ACB armoring over some areas of the shoreline, and significant amounts of large driftwood regularly move through the Site to help create wildlife habitat. The sand and woody debris do not affect the protectiveness of the remedy.
- Additional investigations (described in Appendix B) have been performed to evaluate the effectiveness and overall protectiveness of the cap including:
    - Bulk organophilic clay Core Study
    - DNAPL Investigation
    - Crayfish Sampling Assessment
    - Bathymetric Differencing Images
    - Willamette Cove ACB
    - Ebullition Investigation
    - Sheen Investigations

Annual costs for sediment cap activities are consistent with original estimates.

The only sediment cap issue identified was the reduced sand cap thickness in areas of uneven ACB (unconformities) that were observed in Willamette Cove. This issue was investigated by conducting a review of relevant data and porewater sampling within the two observed areas with ACB unconformities. The results of pore water sampling within the sand portion of the sediment cap beneath the unconformities were consistent with the results of sub-armoring sampling in other areas of the sediment cap. Additional monitoring of this area, where the sediment cap is thinner than design thickness, is recommended for the long-term monitoring plan.

The ICs include implementing dredging restrictions and notifying U.S. Army Corps of Engineers (USACE) and State of Oregon Department of State Lands (ODSL). Warning buoys are in place to prevent damage to the sediment cap. Procurement to replace missing warning buoys is in process and will be completed by the end of 2021. A Regulated Navigational Area (RNA) in and around the sediment cap pursuant to 33 C.F.R. Part 165 was established in March 2009. No additional ICs are warranted based on current conditions.

Groundwater Remedy

The groundwater remedy and DEQ control of the McCormick & Baxter Property effectively achieve the RAOs to eliminate potential exposures to contaminated groundwater and minimize the potential for groundwater contaminants and NAPL to be released to the Willamette River. Regular inspections and maintenance activities are performed to ensure that the cap continues to function as designed. Based on observations made between 2006 and 2020, the subsurface groundwater barrier wall, impermeable soil cap, sediment cap, and ICs are functioning in conjunction with one another as intended, and are meeting the goal of minimizing the migration of groundwater contaminants and NAPL into the Willamette River, as follows:

- NAPL recovery efforts have been successful and have permanently reduced the mass, volume, and potential mobility of NAPL. The thickness of NAPL is not increasing in any of the monitoring wells inside or outside the barrier wall (except for well EW-1s inside the barrier wall

where DNAPL entered the well in the past five years). NAPL recovery was discontinued in 2011 and, therefore, no NAPL was recovered during this last five-year period.
    - Presence of creosote along the shoreline has not been observed since construction of the barrier wall was completed.
    - LNAPL was not recovered from any wells at the Site since 2006 because the criteria for recovery was not met. Although the thickness of LNAPL varies seasonally with groundwater elevation, the accumulated volume is not increasing, either inside or outside the barrier wall. DNAPL was extracted up through 2011 from wells that met the criteria for DNAPL extraction.
    - Approximately 6,500 gallons of NAPL (LNAPL and DNAPL) were extracted from Site wells up through April 2011 when NAPL recovery was discontinued. No supplemental NAPL recovery activities (pumping or bailing NAPL from individual wells) have been performed since, including during the last five-year period.
- NAPL source areas are contained within the barrier wall, and NAPL is prevented from migrating to the Willamette River.
- Shallow groundwater within the barrier wall is isolated from groundwater outside the barrier wall based on the independent groundwater elevations, flow directions, and gradients.
- Groundwater samples were collected from all Site wells in 2006 and from 11 wells in 2010 and 2020. Samples were analyzed for total metals, PCP, and PAHs. 2010 sample results were less than or similar to 2006 results and 2020 results were similar to 2010 results with the exception that arsenic increased in concentration in several wells. Even though arsenic concentrations have increased in several wells, the sub-armor, inter-armor, and surface water concentrations meet the current AWQC.
- The impermeable cap prevents stormwater from eroding contaminated soil or leaching contaminants from contaminated soil or NAPL source areas to groundwater. Precipitation falling on impermeable cap is collected through perforated collection piping and conveyed directly to the Willamette River for discharge (see Figure I-3). Stormwater runoff on the remaining cap is conveyed via stormwater swales to an on-Site vegetated infiltration pond.
- Additional investigations (as described in the Third FYR) were performed between 2005 and 2010 to evaluate the effectiveness and overall protectiveness of the groundwater remedy including:
    - DNAPL Investigation
    - Ebullition Investigation
    - Sheen Investigations

Annual costs for groundwater remedial activities are consistent with original estimates. No issues have been identified with the groundwater remedy.

DEQ controls access to the McCormick & Baxter Property at the Site and is prohibiting groundwater use and other Site uses consistent with IC requirements in the ROD. Although institutional controls are not yet in place, contaminated groundwater in the shallow water-bearing zone is not used for human consumption or for any industrial purpose. The fencing around the McCormick & Baxter Property at the Site restricts access to the upland capped areas except for the riverbank where residual contamination is being managed in place. All access points to the McCormick & Baxter Property are secured with locking gates and signs. In addition, a Site Health and Safety Plan is in place, is properly implemented, and is sufficient to protect Site workers from potential Site risks during routine Site activities. Groundwater beneath the McCormick & Baxter Property and beneath the property owned by BNSF

north of the McCormick & Baxter property will require restrictions to ensure long-term protectiveness consistent with the ROD. DEQ and EPA plan to complete groundwater ICs.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?
No.

Question B Summary:
The RAOs and cleanup goals for soil and sediment are protective of current and anticipated future land use. However, in the second FYR, EPA determined that ACLs were not appropriate as cleanup goals in groundwater.

Changes in Standards and To Be Considereds (TBCs)
The ROD identifies Site-specific ACLs as cleanup goals for shallow groundwater. EPA has determined that the use of ACLs is not appropriate and will evaluate revisions to the cleanup goals selected for this Site. As discussed in the last FYR, DEQ adopted new ambient water quality criteria in 2011, the most substantial changes were to criteria for the protection of human health by adopting a fish consumption rate of 175 g/day compared to a rate of 17.5 g/day used previously.

Changes in Toxicity and Other Contaminant Characteristics
The 1996 AWQC for cPAHs in the ROD was based on the assumption that all cPAHs have the same cancer potency as benzo[a]pyrene. In June 2015, among other changes, EPA updated their national recommended ambient water quality criteria for cPAHs, incorporating the use of PEFs.

In January 2017, EPA's Integrated Risk Information System (IRIS) finalized revised toxicity values for benzo[a]pyrene. The new oral slope factor is 1 per mg/kg-day versus the previous assessment of 7.3 per mg/kg-day. As a result of this change, human health cleanup goals for cPAHs would be higher by a factor of 7 compared to those set in the 1996 ROD, assuming the same degree of protectiveness and exposure. Therefore, the cleanup goals for human health in soil and sediment remain protective. Neither EPA nor DEQ have updated water quality criteria to account for updated toxicity values for benzo[a]pyrene. Accounting for the revised cancer slope factor for benzo[a]pyrene and the proper use of PEFs, AWQC increase by a factor of 7 to 7,000. Thus, the current requirement to meet AWQC remains protective.

Changes in Risk Assessment Methods
There have been no substantive changes to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

Changes in Exposure Pathways
There have been no changes in physical conditions of the Site that would affect the exposure pathways, assumptions, or the protectiveness of the remedy. The majority of the McCormick & Baxter Property is currently vacant and access is controlled by DEQ. In the event of changes in ownership or land use related to the McCormick & Baxter Property, future land and groundwater use will be controlled through an institutional control to ensure the remedy is protective.

QUESTION C: Has any **other** information come to light that could call into question the protectiveness of the remedy?
No.

Question C Summary:
No new information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the FYR:
OU 2 (Sediment Remedy)

Issues and Recommendations Identified in the FYR:

OU-3 (Groundwater Remedy):	**Issue Category: Other** ***Revision of Cleanup Goals***			
	Issue: Need to formally revise the groundwater cleanup goals at this Site.			
	Recommendation: Prepare a ROD Amendment or ESD to revise cleanup goals and identify associated points of compliance.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	9/30/2022

OU-1 (Soil Remedy) and OU-3 (Groundwater Remedy)	**Issue Category: Institutional Controls**			
	Issue: ICs have not been implemented as required by the ROD for the Site groundwater and soil cap remedies			
	Recommendation: Establish and implement an IC Implementation and Assurance Plan and record two EESs with property owners.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	State	EPA/State	9/30/2025

OTHER FINDINGS

In addition, the following are recommendations that were identified during the FYR and may require continued monitoring or additional follow-up actions, but do not affect current or are expected to affect future protectiveness:

- ACB Unconformity in Willamette Cove – While sampling performed in 2015 and 2020 showed these areas to be protective, there is a need to continue to monitor porewater in areas where the sand cap is thinner than the specified design thickness. EPA and DEQ will conduct this monitoring in 2025 in order for the results to be incorporated into the Sixth FYR in 2026. Should results of 2025 sampling indicate the cap continues to be protective during the Sixth FYR, additional monitoring to focus on this area would not be necessary.
- Soil Cap Subsidence and Small Animal Burrows – DEQ will conduct quarterly monitoring through December 2025. A subsidence monitoring event (land surveying and storm sewer conveyance pipe inspection) will be included in the O&M Manual and performed every 10 years with the next event to be performed in 2029. A subsidence evaluation will be included in the Seventh FYR to be completed in 2031. If the Site is redeveloped and there is more activity on-Site with the redevelopment efforts, a cap survey may be needed more regularly to assess the impact of the redevelopment on the integrity of the cap.
- Sediment Cap Monitoring – The ROD does not specify applicable fish, invertebrate, or aquatic life tissue screening criteria for crayfish tissue results. However, crayfish sampling could provide a line of evidence for sediment cap performance. DEQ and EPA will further explore the utility of ongoing crayfish tissue sampling and document in the O&M plan as appropriate.
- Site Housekeeping – Pedestrian access to areas immediately outside the Site and to unenclosed areas along the shoreline have resulted in two fires at the Site and multiple instances of trash being dumped on-Site. Continued housekeeping will be required to address trash dumping and use of a debris removal subcontractor will be performed as needed. If future fires occur, damage inspections will be performed during quarterly Site visits and if needed, new vegetation will be planted as needed to replace burned vegetation.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
Operable Unit: OU 1 (Soil)	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy for the soil OU is currently protective of human health and the environment because the upland soil cap and engineering controls required by the ROD have been implemented and are working as intended. However, in order for the remedy to be protective in the long-term, DEQ and EPA need to implement the ICs required by the ROD for the soil cap remedy.	

Protectiveness Statement(s)	
Operable Unit: OU 2 (Sediment)	*Protectiveness Determination:* Protective
Protectiveness Statement: The remedy for the sediment OU is protective of human health and the environment because the remedy required by the ROD has been implemented and is working as intended.	

Protectiveness Statement(s)	
Operable Unit: OU 3 (Groundwater)	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy for the groundwater OU is currently protective of human health and the environment because the soil, sediment, and groundwater remedies have been implemented and the RAOs in the ROD have been met. However, the EPA determined that ACLs as calculated at this Site are not appropriate in groundwater (this issue was identified in the previous three FYRs). In order for the remedy to be protective in the long term, the following actions need to be taken: formally replace the ACLs with revised cleanup goals and identify the associated points of compliance for the groundwater remedy in a ROD Amendment or ESD, and implement ICs required by the ROD for the groundwater remedy.	

Sitewide Protectiveness Statement
Protectiveness Determination: Short-term Protective
Protectiveness Statement: The remedies for soil, sediment, and groundwater currently protect human health and the environment, because the soil and sediment caps, barrier wall, sediment ICs, and engineering controls required by the ROD have been implemented. However, in order for the remedies to be protective in the long-term, the following actions need to be taken: evaluate the cleanups goals for the Groundwater OU and issue a ROD Amendment or ESD that establishes new cleanup goals and points of compliance for the groundwater remedy, and implement the ICs required by the ROD for the soil and groundwater remedies.

VIII. NEXT REVIEW

The next FYR report for the M&B Site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

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EPA, 2016. Feasibility Study Report. Portland Harbor RI/FS. U.S. Environmental Protection Agency Region 10, Seattle, WA. June 2016.

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EPA/DEQ, 1996. *Record of Decision*: McCormick & Baxter Creosoting Company Portland Plant, Portland, Oregon. U.S. Environmental Protection Agency and Oregon Department of Environmental Quality, March 1996.

EPA/DEQ, 1998. *Amended Record of Decision*: McCormick & Baxter Creosoting Company Portland Plant, Portland, Oregon. U.S. Environmental Protection Agency and Oregon Department of Environmental Quality, March 1998.

EPA/DEQ, 2002. *Explanation of Significant Difference (OU3 – Final Groundwater)*: McCormick & Baxter Creosoting Company Superfund Site, Portland, Multnomah County, Oregon. U.S. Environmental Protection Agency and Oregon Department of Environmental Quality, August 2002.

Hart Crowser, 2020. *Technical Memorandum – Subsidence Monitoring and Evaluation*. Hart Crowser, January 21, 2020.

Hart Crowser/GSI, 2008. *Operation and Maintenance Report January 2008 to December 2008*: McCormick and Baxter Superfund Site Portland, Oregon. Hart Crowser, Inc. and GSI Water Solutions, Inc., May 22, 2009.

Hart Crowser/GSI, 2011a. *Operation and Maintenance Report January 2010, to December 2010*: McCormick & Baxter Superfund Site, Portland, Oregon. Hart Crowser, Inc. and GSI Water Solutions, Inc., June 27, 2011.

Hart Crowser/GSI 2011b. *DNAPL Data Gap Investigation Report*, McCormick & Baxter Creosoting Company site, Portland, Oregon. Prepared for Oregon Department of Environmental Quality. July 11, 2011.

Hart Crowser/ GSI 2016. Operation and Maintenance Report January 2016 to December 2016, McCormick and Baxter Superfund Site Portland, Oregon ECSI Site ID: No. 74. Hart Crowser, Inc. and GSI Water Solutions, Inc., June 3, 2016.

Hart Crowser/GSI 2017. *Operation and Maintenance Report January 2016 to December 2016,* McCormick & Baxter Superfund Site Portland, Oregon ECSI Site No. 74. Hart Crowser, Inc. and GSI Water Solutions, Inc., March 23, 2017.

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U.S. Coast Guard (USGS) Regulated Navigation Area Final Rule 33 C.F.R. Part 165, February 2009

APPENDIX B – BACKGROUND INFORMATION

Site History

Much of the Site was created from dredged materials in the early 1900s. At that time, a sawmill operated in the southeast portion of the property. McCormick & Baxter Creosoting Company (M&B) was founded in 1944 to produce treated wood products, including lumber, piling, timbers, and railroad ties during World War II. The wood-treating operations continued until October 1991.

Four retorts were located in the central processing area (CPA) at the Site and were used for various pressure treating processes, which included the use of creosote, pentachlorophenol (PCP), chromium, ammoniacal copper arsenate, ammoniacal copper zinc arsenate (ACZA), and Cellon (PCP in diesel oil, liquid butane, and isopropyl ether). Also present at the Site were a 750,000-gallon creosote product storage tank and a tank farm area (TFA) with several additional tanks for storing wood-treatment chemicals.

From 1950 to 1965, waste oil containing creosote and/or PCP was applied to the Site soil for dust suppression in the CPA. Liquid process wastes reportedly were discharged to a low area near the TFA before 1971.

Between 1945 and 1969, the plant's wastewater from the retorts' oil/water separators, along with the boiler blowdown and condenser cooling water were directly discharged to the Willamette River. Three stormwater outfalls were also present along the river. Two of the outfalls were permitted under the National Pollutant Discharge Elimination System. Following plant shutdown, Oregon Department of Environmental Quality (DEQ) placed earthen berms around stormwater collection sumps at the Site as an early response action to minimize off-Site discharge. The stormwater outfalls were removed as part of the first phase of the soil remedial action in 1999.

Two major spills reportedly occurred at the Site: a 50,000-gallon creosote release in the TFA in approximately 1950; and a large spill of an unspecified volume of creosote from a tank car near the TFA in 1956.

Sludge from on-Site processes was disposed of at an unknown off-Site location until 1968. From 1968 to at least 1973, residues from the retorts, oil/water separators, and evaporators were disposed of on-Site in the former waste disposal area (FWDA) in the western portion of the Site. Beginning in 1972, wood preservative sludge was placed in metal containers that were stored on Site in the FWDA. After 1978, wood preservative sludge was shipped to Chem-Security System, Inc., a permitted hazardous waste disposal facility near Arlington, Oregon. In 1981, the hazardous waste storage area was secured with a fence and lock, and a manifest system was implemented to comply with hazardous waste regulations.

Concrete walls and slabs were built around the ACZA process and storage facilities in 1980 to prevent spills from entering the soil. The retorts and retort openings were lined with concrete, but the integrity of the concrete was not verified. The creosote lines and other pipelines passed through a concrete underground walkway that extended from the TFA to the retort building. In 1985, 2 feet of soil and sludge were excavated from the TFA and were shipped to a hazardous waste landfill. Visibly contaminated soil remained at the TFA.

Chemicals of Concern and Affected Media

Site investigations have revealed many releases of wood-treating chemical compounds to soils, groundwater, and sediments as a result of these operations. Contaminants detected include polynuclear aromatic hydrocarbons (PAHs, comprising 85 percent of the creosote), PCP, arsenic, chromium, copper, zinc, and dioxins/furans. Three main contaminant sources existed at the Site: the FWDA, which was located in the western corner of the Site adjacent to the Willamette River and was characterized by a large depression where waste oils, retort sludges, and wastewater were disposed of over a period of several years; the CPA, which was located in the center portion of the Site and was where retorts, PCP mixing shed, and ACZA storage areas formerly were located; and the TFA, which was located in the south-central portion of the Site and was the former location of the main tank farm, creosote storage tank, and several other wood treatment process-related tanks or process areas. Releases from these source areas (particularly in the TFA and FWDA) in the form of insoluble wood-treating contaminants or non-aqueous phase liquids (NAPL) have significantly impacted subsurface soils, groundwater, and sediment. Remedial investigations identified two large NAPL plumes migrating to the river and impacting surface water and sediments. Subsequent monitoring identified another NAPL plume migrating under the BNSF Railway Company (BNSF) right-of-way toward Willamette Cove. An additional investigation was conducted in the northern corner of the Site to determine the nature and extent of NAPL associated with monitoring well MW-1s. This investigation found only trace amounts of NAPL apparently composed of weathered crude or bunker oil.

Regulatory History

M&B began environmental investigations of its property in 1983. Based on those investigations, DEQ entered into a Stipulated Order with M&B in 1987 requiring the implementation of corrective actions. Corrective actions included the installation and operation of a groundwater extraction and treatment system, construction of drip pads in retort areas, construction of covered storage areas for treated wood, and collection and treatment of stormwater. In December 1988, M&B filed for Chapter 11 bankruptcy; in 1990, DEQ assumed responsibility for completing the investigations and cleanup activities at the Site. In October 1991, M&B ceased operations.

DEQ began the Remedial Investigation and Feasibility Study in 1990 and issued a public notice of a proposed cleanup plan in January 1993. DEQ elected not to finalize the proposed remedial actions at the Site due to the proposed addition of the Site to the National Priorities List (NPL) by U.S. Environmental Protection Agency (EPA) in June 1993. The Site was added to the NPL on June 1, 1994. DEQ completed a revised Feasibility Study in 1995.

DEQ and EPA entered into a Superfund State Contract (SSC) in May 1996. The SSC documents the responsibilities of DEQ as the lead agency and EPA as the support agency during the remedial action. Among other items, the SSC specifies cost sharing between DEQ and EPA as well other required assurances. The SSC was most recently amended in February 2005.

Construction Completion

In September 2005, the M&B Superfund Site achieved the construction completion milestone. This milestone indicates that all physical construction required for the cleanup of the entire site has been completed as required by the Record of Decision (ROD), the ROD Amendment, and the Explanation of Significant Difference (ESD), and is documented in a Preliminary Close-Out Report. Since that time, the soil and sediment Operable Units (OUs) have been determined to be operational and functional (O&F). The O&F determination has not been made for the groundwater OU.

Additional regulatory background information on the M&B Superfund Site can be found in the following documents:

- *Record of Decision*, McCormick & Baxter Creosoting Company Portland Plant, Portland, Oregon, EPA and DEQ, March 1996.
- *Amended Record of Decision*, McCormick & Baxter Creosoting Company Portland Plant, Portland, Oregon, EPA and DEQ, March 1998.
- *First Five-Year Review Report,* McCormick & Baxter Creosoting Company Superfund Site, Portland, Multnomah County, Oregon, September 2001.
- *Second Five-Year Review Report,* McCormick & Baxter Creosoting Company Superfund Site, Portland, Multnomah County, Oregon, September 2006.
- *Third Five-Year Review Report,* McCormick & Baxter Creosoting Company Superfund Site, Portland, Multnomah County, Oregon, September 2011.
- *Fourth Five-Year Review Report,* McCormick & Baxter Creosoting Company Superfund Site, Portland, Multnomah County, Oregon, September 2016.
- *Explanation of Significant Difference (OU3 – Final Groundwater)*, McCormick & Baxter Creosoting Company Superfund Site, Portland, Multnomah County, Oregon, EPA and DEQ, August 2002.

Background of pre-NPL listing

Removal Actions

Removal actions were completed by DEQ under the State of Oregon cleanup regulations prior to listing on the NPL and under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authority between Site listing and issuance of the ROD. A list of these removal actions is provided in the document titled Preliminary Close-Out Report (EPA, 2005).

These actions included:

- Installation of a fence around the M&B Property to control access.
- Placement of warning buoys along the river and posting or warning signs on the fence.
- Mitigation of potential off-Site migration of contaminated airborne particulates through dust control measures, such as grass seeding and limitation of Site traffic.
- Stormwater containment through diversion and collection of stormwater in retort sumps.
- Maintenance, sale, and transfer of remaining wood-treating chemicals.
- Demolition and off-Site disposal of several Site structures and materials, including the sale and removal of salvageable equipment and materials from the Site.
- Removal of asbestos material from retorts and buildings and recycling or disposal of chemicals stored in the laboratory.
- Disposal of 151 drums of wood-treating process waste.
- Treatment of approximately 400,000 gallons of stormwater collected from retort sumps and discharge to the Willamette River.
- Collection and analysis of approximately 650 soil samples to identify the most highly contaminated areas for initial removal actions.
- Excavation and off-Site disposal of approximately 377 tons of contaminated soil from three "hot spot" areas.
- Installation of an interceptor trench downgradient of the TFA to recover light NAPL (LNAPL).
- Dismantling of chemical storage tanks, retorts, and several buildings, and off-Site disposal of sludges.

- Installation and monitoring of 21 new wells to further delineate the extent of NAPL contamination.
- Recovery of NAPL from monitoring and extraction wells. Starting in 1989, creosote was purged every week from five monitoring wells at the Site. Approximately 450 gallons were recovered between July 1989 and November 1991. By February 1995, more extraction wells had been added to the system and approximately 1,800 additional gallons of creosote had been removed.
- Installation of a fully automated pilot-scale wastewater treatment system to separate NAPL and treat groundwater removed through total fluid extraction efforts in the TFA. Wells in the FWDA were used for pure-phase NAPL extraction and were not connected to this treatment system. The treatment system in the FWDA consisted of an oil/water separator, an in-line anthracite/clay filter, two granulated activated carbon units, and a metals treatment unit.
- Modification in 1994 of the fully automated TFA system to a 40-hour per week system. The fully automated system required constant monitoring and temporary shutdown of the extraction system to minimize recovery of groundwater. Field data collected between 1992 and 1994 indicated that weekly pumping yielded as much NAPL as the fully automated system.

Detailed Implementation Information

The Site was divided into three OUs to facilitate and manage remedy costs, implementation, and construction. The overall remedy is designed to function as an integrated containment system. The entire Site is capped; the combined upland capping extends to the riparian area along the shoreline where it meets the sediment cap. The capping works in conjunction with the barrier wall, as a complementary system, to meet the Site Remedial Action Objectives (RAOs) and prevent contaminated groundwater from adversely impacting the Willamette River.

Soil Remedy

The purpose of the soil remedy was to eliminate the potential for future human contact with soil less than 4 feet in depth that has contaminant concentrations above removal action levels. Removal action levels for contaminated soils were defined for excavation and off-Site disposal for arsenic, PCP, and total carcinogenic PAHs. These action levels indirectly address the removal of dioxins/furans because of their presence predominantly in areas where elevated concentrations of PCP or PAHs were found in soil.

Soil excavation activities were performed from February through May 1999, and effectively eliminated the presence of the contaminated soils above removal action levels in the surficial 4 feet. In several major source areas, excavation proceeded to depths of 8 to 10 feet; although, large volumes of deeper soil still contain NAPL and high concentrations of Site contaminants. Approximately 32,604 tons of contaminated soil and debris were excavated and disposed of off-Site at permitted landfills. A total of 33,128 tons of clean sand was imported from an off-Site quarry to backfill the excavation pits.

Documentation, record drawings, and a detailed summary of the soil removal construction activities are provided in the document titled Phase 1 Soil Remedial Action Summary Report (Ecology & Environment, Inc. [E&E], 1999).

The selected soil remedy requires capping upland areas where residual soil contamination remains above human health and ecological risk-based protective levels. Documentation, record drawings, and a detailed summary of the upland soil cap construction activities are provided in the document titled Upland Cap Construction Summary Report (E&E, 2006).

Construction activities for the upland soil cap were performed between March and September 2005 and included the following major components: demolition and off-Site disposal of existing structures and infrastructure; reinstallation of key support facilities; construction of a 15-acre impermeable cap within the perimeter of the subsurface barrier wall; and construction of an earthen soil cap outside of the impermeable cap.

Demolition and removal were conducted from May through June 2005 and included the removal of all remaining structures and disposal of the generated waste in a State-approved disposal facility. All existing water, gas, and electrical utilities were removed or abandoned. Most fire hydrants were removed, any associated piping was grouted to prevent preferential flow paths, and water lines were capped. Demolition items were salvaged, scrapped, or disposed of as nonhazardous waste or hazardous waste. Concrete, creosote-contaminated steel, and asbestos-containing water pipe also were buried on-Site. All on-Site burial locations were surveyed. Twenty groundwater monitoring wells were abandoned.

Support facility construction was conducted from March to July 2005 and included the reinstallation of a 1-acre paved entrance road and parking area, construction of a 25-foot by 40-foot shop building, and reinstallation of electrical, telephone, and water services.

A 15-acre Resource Conservation and Recovery Act (RCRA)-type impermeable cap was constructed within the 18-acre area inside of the barrier wall. The only part of the 18-acre area within the barrier wall that does not have a RCRA-type cap is the riparian zone that borders the river. Capping of the riparian zone with an earthen cap was completed in 2004 as part of the sediment cap construction.

The purpose of the impermeable cap is to minimize infiltration of rainwater into the contaminated areas within the wall. The impermeable cap is composed of the following materials, listed in order from bottom to top and is shown on Figure II-1.

- 8,000 cubic yards of sand used as a leveling layer about 4 inches thick.
- 72,000 square yards of high-density polyethylene (HDPE) geomembrane liner, which prevents water from flowing vertically into the contaminated aquifer.
- 72,000 square yards of a geocomposite plastic 'fabric' drainage layer that allows water to flow to the stormwater drainage system.
- 47,000 cubic yards of sand of varying depths to allow for drainage.
- 12,000 cubic yards of 4-inch-minus crushed rock, forming a screened biotic barrier layer approximately 6 inches thick.
- 72,000 square yards of geotextile filter fabric.
- 24,000 cubic yards of topsoil placed approximately 9 to 12 inches in depth.
- 20 species of native grasses to provide a diverse and sustainable herbaceous cover, thus minimizing surface erosion.

The impermeable cap has a minimum thickness of 29 inches; the thickness varies because of varying subgrade and the final grade of the Site. The sand drainage layer increases in depth to create the grades necessary to achieve Site drainage. The maximum thickness of the cap is approximately 7 feet, which includes a 4-inch-thick sand leveling layer, a 62-inch-thick sand drainage layer, a 6-inch-thick rock biotic barrier, and 12 inches of topsoil.

The impermeable cap also consists of a subsurface drainage system above the HDPE liner to collect stormwater percolating through upper soil, rock, and sand layers of the cap. Stormwater is collected in the geocomposite fabric and perforated piping and conveyed by gravity flow through conveyance piping

to an outfall structure, which daylights at approximately the ordinary high water (OHW)[9] level of the Willamette River.

An earthen soil cap, consisting of a 2-foot-thick layer of imported topsoil, was installed over 19 acres of the Site outside of the barrier wall area, excluding the gravel entrance road and parking area (1 acre). An additional 6 acres of earthen cap were installed over the riparian zone during construction of the sediment cap. The total area of earthen cap is 25 acres and includes some of the BNSF right-of-way. The purpose of the earthen cap is to prevent direct contact with low-level contamination remaining in the soils throughout the rest of the Site. The soil layer is underlain with a demarcation layer consisting of orange HDPE safety fencing to provide a distinction between the clean soil cap and contaminated soil. The earthen soil cap was seeded with native herbaceous vegetation.

A stormwater management system was constructed to minimize stormwater runoff from the Site to neighboring properties and the Willamette River. This system consists of a swale that conveys stormwater directly to an on-Site retention/infiltration pond. Except for the 6-acre riparian zone, the surface of the upland soil cap (including both the earthen and impermeable caps) is constructed with sloped surfaces (approximately 1 percent slope) to direct surface water runoff toward the drainage swale. Rainwater falling onto the riparian zone, which generally has a slope of 25 percent, flows overland toward the river and/or infiltrates into Site soil and groundwater.

A 6-foot-high, chain-link fence topped with barbed wire also was reinstalled along the McCormick & Baxter Property upland perimeter. Along the riverfront, the fence is located 35 feet inland from the top of bank. Gravel access ways and roads were constructed around the perimeter of the McCormick & Baxter Property (except along the north side where the drainage swale is located), with spurs that cross the interior area to allow monitoring and maintenance of the Site in those locations. Warning signs were placed along the perimeter of the McCormick & Baxter Property.

Several thousand native trees and shrubs were planted throughout the drainage swale and riparian zone in February 2006, and a temporary, aboveground irrigation system was installed in May 2006. No trees are planted overtop the impermeable cap within the barrier wall. The purpose of this vegetation, along with the native grasses, is to help stabilize the soil against stormwater erosion and river flood erosion, and to reduce rainwater percolation into groundwater by evapotranspiration.[10] See Appendix B Photographs for current vegetative cover and recent aerial photograph.

Sediment Remedy

The selected sediment remedy consists of capping areas that contain contaminant concentrations above human health and ecological risk-based protective levels or that exhibit significant toxicity to benthic organisms within the upper sediments. Construction of the sediment cap occurred in two separate phases: June through November 2004[11] and August through October 2005. Documentation, record drawings, and a detailed summary of the sediment cap construction activities are provided in the documents titled Remedial Action Construction Summary Report Sediment Cap (June 2004 through

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[9] OHW at the Site is +20 feet NAVD. OHW is defined at Oregon Revised Statute (ORS) 274.005.

[10] Restoration and maintenance of the riparian zone is required by the Biological Opinion issued by the National Marine Fisheries Service, pursuant to Section 7 of the Endangered Species Act.

[11] This phase of the sediment cap construction also included regrading and capping of the riverbank to create the 6-acre riparian zone. Although construction of the riparian bank cap is described as part of the sediment cap remedy, long-term operation and maintenance of the riparian zone will be conducted as part of the upland soil cap.

November 2004) and Remedial Action Construction Summary Report Sediment Cap Completion (August 2005 through October 2005), both prepared by E&E for DEQ and EPA in May 2006.

Construction activities in 2004 consisted of the following major components:

- Removal of approximately 1,630 pilings, bulkhead, dock remnants, in-water debris, a derelict barge in Willamette Cove, and other Willamette Cove features
- Construction of a multi-layer sediment cap using sand, organophilic clay, and armoring
- Monitoring well abandonment and modification
- Bank regrading and capping
- Disposal and demobilization

The sediment cap footprint constructed in 2004 encompassed approximately 22 acres. Its shoreward boundary extends along the shoreline from the south end of the property downstream into Willamette Cove to the north. Its riverward boundary at the farthest offshore location extends into the Willamette River to an approximate elevation of -40 feet North American Vertical Datum (NAVD), outside of the limits of the U.S. Army Corps of Engineers (USACE) designated navigational channel, and to -16 feet NAVD in Willamette Cove. The cap consists of a 2-foot-thick layer of sand over most of the cap footprint with a 5-foot-thick layer of sand over several more highly contaminated areas. Approximately 131,000 tons of sand were placed from July 7 through October 28, 2004.

Within the cap footprint were areas of known NAPL migration (e.g., seep areas). In the Willamette Cove and TFA NAPL seep areas, the cap incorporated 600 tons of organophilic clay to prevent breakthrough of NAPL through the cap. Organophilic clay is bentonite or hectorite clay that has been modified to be hydrophobic and to have an affinity for organic compounds. The AquaTechnologies ET-1 organophilic clay (ET-1) was applied in bulk and in the form of Organoclay™ RCMs.

The sediment cap incorporated different types of armoring to prevent erosion of the sand and organophilic clay layers. The specific armoring material and where it was installed depended on the expected hydraulic and physical environments (currents, wave energy, erosive energies, etc.). ACB mats were installed along the shore and in shallow water where erosive forces would be the greatest because of wave action. ACB is composed of individually formed, interlocking concrete blocks. Rock armor included 6-inch-minus, 10-inch-minus, and riprap. All shallow water 10-inch-minus and ACB armoring layers were underlain with a woven geotextile fabric and a 4-inch-thick layer of 3-inch-minus filter rock. This fabric and rock layer was installed to hinder the migration of the sand through the larger and more porous armoring layer or layers. A cross-sectional view of the sediment cap is shown on Figure II-2.

ACB installation began on July 7, 2004 and proceeded from the downstream end of the Site in Willamette Cove to the upstream work limits. Installation of ACB mats was allowed only after the subgrade, including sand cap and gravel filter layer, was verified by DEQ's construction oversight contractor. ACB installation was completed on October 28, 2004.

The 6-inch-minus rock was basalt and/or andesite. Approximately 23,250 tons of 6-inch-minus cobble were placed over the sand cap and as edge treatment where the 6-inch-minus cobble areas abutted the ACB. The 10-inch-minus rock used as armoring also is composed of angular basalt and/or andesite. Approximately 23,300 tons of 10-inch-minus rock were placed in the near-shore embayment. The riprap material used for construction of the boulder clusters and the rock mound is composed of durable

angular boulders less than 3 feet in diameter.[12] Approximately 558 tons of riprap were placed along the shoreline and on an offshore shoal between the embayment and the river at the Site. Each boulder cluster consisted of six to seven boulders.

Eighteen monitoring wells located within the 6-acre riparian zone were abandoned (boreholes were over drilled and grouted with bentonite), and 36 monitoring wells were modified in accordance with Oregon Water Resources Department requirements (e.g., well casing added to and surface casing raised to accommodate soil cap thickness).

The 6-acre riparian zone was created by regrading of the riverbank, placement of a demarcation layer, placement and grading of a 2-foot-thick layer of imported clean fill (topsoil), placement of a turf reinforcement mat, and hydroseeding with native grasses.

During initial construction of the sediment cap, two City of Portland (City) pressurized sewer lines were found exposed within the sediment capping area. The City was informed of the situation, and a no-work zone was established along a 120-foot swath of the sewer lines. These lines were stabilized by the City in July 2005. Construction of this remaining 1-acre sediment cap was resumed in August 2005, completed in September 2005, and consisted of placement of the following major components[13]: 8,950 tons of sand; 460 tons of 3-inch-minus filter rock; 1,711 tons of riprap; 2,850 tons of 6-inch-minus rock; and 1,240 tons of 10-inch-minus rock. The riprap material was used in place of the ACB to provide stability against wave action along steep portions of the shoreline, between elevations of approximately +8 NAVD and -2 NAVD.

Construction activities in 2005 also included the installation of 24,150 square feet of Organoclay™ RCMs as a corrective measure to address releases of NAPL sheens discovered during weekly inspections following cap construction in 2004. The Organoclay™ RCMs were placed in three areas along the shoreline: under the BNSF Bridge (6,000 square feet); downstream of the previously Organoclay™-capped TFA seep (150 square feet); and upstream of the previously Organoclay™-capped TFA seep (18,000 square feet). The Organoclay™ RCMs were covered with sand and rock armoring.

Groundwater Remedy

The selected groundwater remedy consists of creosote recovery, subsurface barrier wall installation, and engineering and institutional controls as described in the following sections.

Creosote Recovery

Creosote (NAPL) recovery began in 1989 as a Removal Action. Approximately 450 gallons were recovered between July 1989 and November 1991. By February 1995, more extraction wells had been added to the system, and approximately 1,800 additional gallons of NAPL had been removed. Since the issuance of the ROD in March 1996, NAPL recovery continued through July 2011. Approximately 6,500 gallons have been recovered from the Site since 1989.

Since the M&B ceased operations in 1991, various extraction methods have been attempted to optimize NAPL recovery. The goal of extraction is to remove and deplete NAPL pools to residual levels to

[12] The boulder clusters are intended to provide aquatic habitat diversity while the rock mound is intended to lower hydraulic energy within the shallow water embayment area.

[13] These quantities include construction associated with the corrective measures performed in August and October 2005 as discussed in the following paragraph.

minimize or prevent migration into the Willamette River. Key NAPL extraction activities are summarized below:

- 1998: The treatment system in the TFA was modified again. Previously, total fluids extracted from three wells were conveyed to the former pilot treatment system and treated by a dissolved air flotation system. This system required extensive oversight and was expensive to operate (e.g., chemical costs). The system operated 40 hours per week (Monday through Friday) when a technician was on-Site to perform operation and maintenance activities. To allow for continuous operation and to reduce costs and operator requirements, the system was replaced with one resembling that employed in the FWDA; this consisted of an oil/water separator, an in-line anthracite/clay filter, two granulated activated carbon units, and a metals treatment unit.
- 1999 and 2000: The volume of NAPL extracted by the automated systems was found to be similar to the volume removed via manual extraction using skimmers. In addition, it was determined that manual extraction could be conducted for approximately half the cost of operating the automated systems. Therefore, the FWDA and TFA NAPL extraction systems were shut down in September 2000, and NAPL extraction was continued manually.
- 2004 – 2011: Select wells inside and outside the barrier wall were monitored weekly for the presence and thickness of NAPL. NAPL was extracted weekly from these wells if the NAPL thickness within the well was sufficient for recovery (0.4 foot for LNAPL and 1.5 feet for dense NAPL [DNAPL]).

Subsurface Barrier Wall

As required by the ESD, a fully encompassing, impermeable subsurface barrier wall was designed and installed to meet the RAO of minimizing NAPL discharges to the Willamette River. More specifically, the barrier wall was designed to cut off much of the upgradient sources of DNAPL and LNAPL in the TFA and FWDA, and to reduce NAPL migration from these areas to the river. The subsurface barrier wall was designed to surround as much of the TFA, former CPA, and FWDA as practical. Before construction began, the wall had to be moved to avoid the City's high-pressure sewer main along the BNSF right-of-way and the location of the Willamette River resulting in an area with subsurface mobile creosote in the FWDA being stranded outside the barrier wall. With respect to the Willamette River, the barrier wall was placed as close to the river as possible while not resulting in an (aboveground) bulkhead or an overly steep bank treatment when grading and capping the riverbank to cover the barrier wall. On average, following grading and capping of the riverbank, the river-front segment of the barrier wall is located at approximately 30 feet landward from OHW. The top elevation of the barrier wall along the river-front segment is approximately 23 feet NAVD (3 feet above OHW and 2 feet below the 10-year flood elevation).

The subsurface barrier wall was constructed from April through September 2003, with the exception of eight sheet piles that met refusal before achieving design depth. The resulting gaps were pressure grouted in July 2004. The construction of the barrier wall is documented in the report titled *Remedial Action Construction Summary Report; Combined Sheet Pile and Soil-Bentonite Barrier Wall* (E&E, 2004).

The barrier wall was constructed to fully encompass 18 acres of NAPL-impacted groundwater and the main contaminant source areas at the Site, including the TFA and FWDA. The total length of the wall is 3,792 linear feet, and the depth varies from approximately -25 to -45 feet NAVD (45 to 80 feet below ground surface [bgs]) to account for differences in the topography and soil profile at the Site. This depth (-45 feet NAVD) is below the depth of the Willamette River adjacent to the Site.

A 1,440-foot-long segment of the barrier wall along the bank of the Willamette River was constructed using steel sheet piles. Installation methods involved a panel-driving technique, which consisted of setting and partially driving six to eight sheet pile pairs (a panel).

A 2,355-foot-long segment of soil-bentonite barrier wall was installed to depths of up to 80 feet bgs to the side and upgradient of the primary contaminant source areas. The excavated trench was held open using a slurry mix of bentonite and water, which was later displaced by the denser soil-bentonite mixture. The mixing operation occurred concurrently with excavation within the wall's perimeter. The soil-bentonite mixture consisted of soil excavated from the trench, slurry from the trench, imported clayey soil, and dry bentonite. The mixing and placement were accomplished by an excavator and bulldozer.

The segment of wall between the Willamette River and the TFA (approximately 900 linear feet) is keyed into a silt aquitard and extends to a depth of approximately 70 to 80 feet bgs. The segment of barrier wall between the Willamette River, Willamette Cove, and the FWDA (approximately 1,100 linear feet) is a "hanging wall" because deeper soil in this area consists of interbedded sand and silt lenses with no continuous, competent aquitard to key into. This segment of the wall extends to a depth of 70 to 80 feet bgs. The segment of the wall located upgradient and cross-gradient of the TFA and FWDA (1,800 linear feet) is keyed into the silt aquitard and has a depth of 45 feet bgs.

Although the barrier wall segment located downgradient of the FWDA does not key into a continuous, competent aquitard, the depth of this segment of the wall serves to increase the distance between the DNAPL source and the river, thereby reducing the potential for continued flow of mobile NAPL.

Engineering and Institutional Controls

The ROD specifies ICs for the soil, groundwater, and sediment remedies:

- Physical restrictions[14] (e.g., fencing), warning signs, and safety measures until completion of the remedies
- Controls on future uses of the property so that they are consistent with the level of protectiveness achieved by the cleanup
- Prohibition on any use of the shallow and intermediate aquifers and prohibition on drinking water use of the deep water aquifer
- Prohibition on disturbance of the sediments

DEQ currently maintains an upland perimeter fence around the McCormick & Baxter Property and warning signs, and restricts public access to the upland portion of the Site. Public access to the beach is not restricted. Although not all monitoring wells are located within the fence, all wells have locked, steel monuments. These physical Site restrictions will be maintained into the foreseeable future. DEQ also has obtained a permanent easement for the sediment cap from the Oregon Department of State Lands (ODSL). This easement prohibits the anchoring and grounding of non-recreational vessels and the use of all motor propelled vessels, and specifies that the sediment cap may be closed to all public uses if DEQ determines that the area poses a threat to public health or the environment.

DEQ initially placed temporary buoys along the perimeter of the sediment cap warning boaters of navigational hazards. Permanent buoys were installed in August 2011. DEQ worked with the U.S. Coast Guard (USCG) to establish a Regulated Navigational Area (RNA) in and around the sediment cap

[14] EPA has since clarified that physical restrictions are considered engineering controls.

pursuant to 33 C.F.R. Part 165 (USGS 2009). On February 4, 2009, the USCG published the final rulemaking formally establishing the RNA for the McCormick & Baxter Site sediment cap (docket number USCG-2008-0121; Attachment 1 to the Third FYR). This rule became effective on March 6, 2009.

Restrictions through proprietary control are planned to be completed. These restrictions will prohibit development within the 6-acre riparian zone along the riverbank as required by the Endangered Species Act Biological Opinion issued by the National Marine Fisheries Service (NMFS); prohibit use of Site groundwater as specified by the ROD; and limit excavation of Site soils unless authorized by DEQ. Conditions to prohibit future uses of the Site will be completed to achieve the level of long-term remedy protectiveness required by the ROD.

A License or Access Agreement, completed in March 2005 between DEQ and BNSF, requires BNSF to notify DEQ in the event planned construction or maintenance activities in the right-of-way that could potentially cause damage to the portion of the upland soil cap located in the BNSF right-of-way. The License is a contract between DEQ and BNSF that is expected to restrict BNSF's activities in the right-of-way and serve as one of the layers of ICs for protection of the soil cap remedy. The License does not restrict groundwater use or contain provisions to protect any wells installed for the McCormick & Baxter Site in the BNSF right-of-way. DEQ and EPA plan to complete the required IC for groundwater beneath the BNSF property.

Additional Details of Systems Operations/Operation and Maintenance

The DEQ conducted Site activities in accordance with the Final Operational and Maintenance (O&M) Plan (DEQ/EPA, 2014), prepared by DEQ and approved by EPA. The O&M Manual (last revised by Hart Crowser/GSI, 2018b) specifies the sampling and monitoring procedures, quality assurance and quality control, and technical information needed to implement the Final O&M Plan. Site O&M activities completed since the Fourth FYR (DEQ/EPA, 2016) are summarized in Table II-3.

Soil Remedy

The soil remedy consists of contaminated soil removal and construction of an upland soil cap on approximately 40 acres of the Site and ICs. The soil cap remedy was completed in September 2005. Long-term monitoring is necessary because soils beneath the cap remain contaminated with arsenic, PCP, PAHs, dioxins, and NAPL. The performance standards for the soil cap are specified in the Final O&M Plan and are as follows:

- Maintain contaminant concentrations in surface soil below the following risk-based clean-up goals, as specified in the ROD (EPA/DEQ, 1996):
  - Arsenic – 8 milligrams per kilogram (mg/kg)
  - PCP – 50 mg/kg
  - Total cPAHs – 1 mg/kg
  - Dioxins/furans TCDD equivalent – 0.00004 mg/kg
- Maintain the topsoil layer to within 50 percent of its design specification:
  - Area over impermeable geomembrane cap – maintain thickness of at least 6 inches
  - All areas, except over impermeable geomembrane cap – maintain thickness of at least 12 inches
- Minimize infiltration of rainwater within the subsurface barrier wall by maintaining a subsurface stormwater conveyance system.
- Minimize stormwater erosion and surface water ponding by maintaining Site grading, surface stormwater conveyance, and native vegetation.

- Maintain native vegetation within the 6-acre riparian zone for compliance with the NMFS Biological Opinion (National Oceanic and Atmospheric Administration [NOAA], 2004).

Monitoring activities for the soil cap (including the riparian zone) include visual inspections of the cap surface, stormwater conveyance system, security fencing, and warning signs. The soil cap is designed to be generally maintenance free, except for maintaining the native vegetation. Routine maintenance includes semi-annual manual removal of invasive plants and targeted application of herbicides. Non-routine maintenance may include repairs of the fence, replacement of warning signs, repairs of the gravel roads, filling of potential animal burrows, removal of sediment from manholes, replanting of unsuccessful trees and shrubs, removal of trash and debris, and monitoring damage caused by fires. Routine maintenance of equipment and providing for Site utility service are also included as elements of soil O&M.

Sediment Remedy

The sediment remedy consists of a 23-acre cap over contaminated sediments within the Willamette River and ICs. The sediment cap remedy was completed in September 2005. Long-term monitoring and maintenance are necessary because sediments beneath the cap remain contaminated with arsenic, PCP, PAHs, dioxins, and NAPL. The performance standards for the sediment cap, specified in the Final O&M Plan, are as follows:

- Maintain contaminant concentrations in surface sediments below the following risk-based cleanup goals, as specified in the ROD (EPA/DEQ, 1996):
  - Arsenic – 12 mg/kg, dry weight
  - PCP – 100 mg/kg, dry weight
  - cPAHs – 2 mg/kg, dry weight
  - Dioxins/furans – 8×10^{-5} mg/kg, dry weight
  - Protection of benthic organisms based on sediment bioassay tests, resulting in impaired survival and growth
- Prevent visible discharge of creosote to the Willamette River.
- Minimize releases of contaminants from sediment that might result in contamination of the Willamette River in excess of the following federal and state ambient water quality criteria (AWQCs) in effect at the time of the ROD, 1996:
  - Arsenic (III) – 190 micrograms per liter (µg/L)
  - Chromium (III) – 210 µg/L
  - Copper – 12 µg/L
  - Zinc – 110 µg/L
  - PCP – 13 µg/L
  - Acenaphthene – 520 µg/L
  - Fluoranthene – 54 µg/L
  - Naphthalene – 620 µg/L
  - Total cPAHs – 0.031 µg/L
  - Dioxins/furans – 1×10^{-5} nanogram per liter (ng/L)
- Maintain the armoring layer to within 50 percent of the design specification:
  - 6-inch rock armoring – maintain thickness of at least 6 inches
  - 12-inch rock armoring – maintain thickness of at least 7.5 inches
  - 24-inch rock armoring – maintain thickness of at least 12 inches
- Maintain uniformity and continuity of ACB armoring.
- Maintain at least 20 percent excess sorption capacity of the organophilic clay cap.

The AWQCs listed above are the surface water criteria in effect at the time of the ROD; however, since completion of the ROD, additional recommended EPA water quality criteria have been published. During meetings in August 2007 between stakeholders (DEQ, EPA, NOAA, Warm Springs Tribe, and Yakama Nation), it was agreed that for comparison purposes, five additional criteria would be included in analytical results summary tables in the Annual O&M Reports:

- Two AWQCs in effect at the time the ROD was issued:
  - 1996 criteria for chronic effects to aquatic life
  - 1996 criteria for human health, based on fish consumption
- Two 2007 National Recommended Water Quality Criteria (NRWQCs - one for chronic effects to aquatic life and one for human health via consumption of organisms (subsequent FYRs included NRWQCs updated in 2011 and the current FYR includes NRWQCs updated in 2017):
- Current 2015 maximum contaminant levels (MCLs).

The comparison criteria are listed in Table II-4.

Monitoring activities for the sediment cap since the 2016 FYR included quarterly visual inspections of near-shore areas and performing repairs to the shoreline as needed. This included filling in voids in the ACB mats in September 2017 and December 2020. A sediment cap performance assessment was performed in 2020 and included the collection and analysis of surface water, inter-armoring and sub armoring porewater samples from 12 compliance monitoring locations, 4 early warning locations, and 1 downstream location in 2020. This was the 12th sampling event since the sediment cap was installed in 2004/2005. As part of the cap performance assessment, crayfish tissue samples were also collected and analyzed from 5 locations on the sediment cap.

A bathymetry evaluation was performed by comparing the April 2006 bathymetry survey to June 2018 bathymetry survey from the Portland Harbor Pre-Design Investigation to identify significant changes in river bottom conditions. Although the sediment cap is designed to be generally maintenance free, unplanned or non-routine maintenance may be needed. Warning buoys are present to protect the sediment cap and during the first and second quarterly Site inspections in 2021, three permanent warning buoys were missing and replacement activities were initiated in May 2021.

Groundwater Remedy

The groundwater remedy consists of groundwater monitoring, NAPL recovery[15], a subsurface barrier wall surrounding approximately 18 acres within the upland soil cap, and ICs. The barrier wall was completed in July 2004. Long-term monitoring is necessary because groundwater both inside and outside of the subsurface barrier wall remains contaminated with metals, PCP, PAHs, dioxins, and NAPL. The performance standards for the subsurface barrier wall and NAPL recovery, as stated in the Final O&M Plan, are as follows:

- Continue to recover NAPL from outside the subsurface barrier wall until recovery rates become minimal, alternative pumping strategies have been examined and/or field tested with poor results, and remaining NAPL does not pose a threat to the Willamette River and its sediments.
- Maintain contaminant concentrations in shallow, downgradient compliance wells (or sediment pore water) below ACLs set forth in the ROD:
  - Arsenic (III) – 1,000 µg/L
  - Chromium (III) – 1,000 µg/L

[15] NAPL recovery was discontinued April 20, 2011 after an investigation that demonstrated that the NAPL outside the barrier wall was primarily in residual NAPL and not expected to migrate to the river (DEQ/EPA, 2011).

    - Copper – 1,000 µg/L
    - Zinc – 1,000 µg/L
    - PCP – 5,000 µg/L
    - Total PAHs – 43,000 µg/L
    - Dioxins/furans – 0.2 ng/L
- Minimize the transport of NAPL and communication of groundwater zones across the subsurface barrier wall.
- Minimize further vertical migration of creosote to the deep groundwater aquifer.
- Minimize visible discharge of creosote to the Willamette River.
- Maintain contaminant concentrations in the Willamette River below background concentrations or less than the sediment cap performance standards for surface water.

The ROD specified Site-specific ACLs for the Site. In the Second FYR, EPA determined that ACLs were not properly established as cleanup goals in groundwater at this site. This also affects whether the groundwater RAOs derived from the provisions in CERCLA for using ACLs remain valid for the Site. As a result of this determination, DEQ and EPA anticipate that amended groundwater cleanup goals for the Site will be established in a ROD Amendment to be consistent with CERCLA and the National Contingency Plan (NCP).

APPENDIX C – Photograph Documentation

Photograph 1: Cable loops from ACB mats that were cut during maintenance activities to remove trip hazard, October 2016.

Photograph 2: Shoreline conditions along Willamette River, October 2016.

Photograph 3: Removal of the jobsite trailer from the paved storage area, February 2017.

Photograph 4: Aerial view of the site from UAS survey, February 2017.

Photograph 5: Invasive weed after being sprayed with blue dyed herbicide, May 2017.

Photograph 6: Vegetation coverage (lupines in foreground) of the impermeable soil cap, May 2017.

Photograph 7: Fir tree in riparian area experiencing stress from drought conditions, Nov 2017.

Photograph 8: High-river stage conditions along Willamette River shoreline at BNSF railroad, May 2018.

Photograph 8: Condition of the northern end of the Willamette River shoreline after the July 2018 riparian area fire, July 2018.

Photograph 9: Watering vegetation stressed by the July 2018 riparian fire area, August 2018.

Photograph 10: Burned grass area from September fire along the northwestern perimeter fence adjacent to the Union Pacific railroad.

Photograph 11: Separation of ACB mats results in voids, October 2018.

Photograph 12: Trash dumpsite in the riparian area, October 2018.

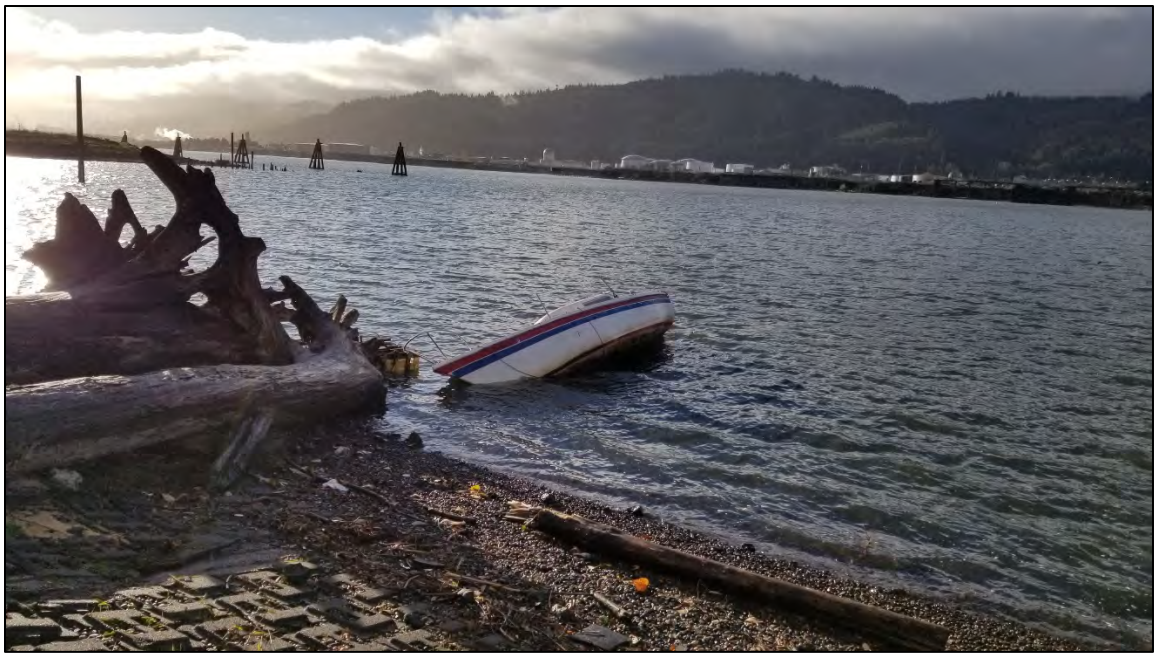
Photograph 13: Trimming MW-59s well casing to maintain well box lid functionality due to subsided well box, August 2019.

Photograph 14: Storm sewer video inspection using a remote crawler during subsidence monitoring evaluation, October 2019.

Photograph 15: Retrieval of in-water PSDs by EPA dive team, September 2020.

Photograph 16: Retrieval of PSD by TTU personnel from location 12 in Willamette Cove, September 2020.

Photograph 17: Crayfish specimen processing during sediment cap performance sampling, September 2020.



Photograph 18: Derelict sailing vessel along the Willamette River shoreline near the stormwater outfall, December 2020.

Photograph 19: Replacement signpost with warning sign, January 2021.

Photograph 20: Willamette River Shoreline conditions with abundant driftwood, March 2021.

APPENDIX D – Soil and Sediment Cap Inspection Forms September 2016 through May 2021

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Wednesday 7/21/2016
9:00 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Phil Cordell
Attendees:	Sarah Miller	Project Officer	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Erin Hughes	Hydrogeologist	GSI
	Anne Christopher	Project Manager	EPA

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on Thursday, July 21, 2016. The next inspection is scheduled for October 2016.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.

Gravel from the shoreline enhancement task (completed in October 2012) remains settled in the voids of the ACB armoring. Tidal fluctuations have distributed gravel from the top of the ACB, where it was originally applied, to where it has settled along the toe of the bank. Gravel has not settled into the mid-bank portion of the ACB armoring in areas where the slope is steeper; however, vegetation was observed to be growing in the ACB voids.

The Willamette River at the time of inspection (between 9:00 AM and 11:30 AM) was between 4.95 and 4.06 feet COP (or 9.95 – 9.06 NAVD88). Low tide was at approximately 4:15 PM with a tide of approximately 2.55 feet COP (or 7.55 NAVD88). All buoys were visible.

Discharge from the outfall was estimated at <1 gallon per minute. The outfall is in good condition, but moss is covering much of it.

Six derelict boats anchored within Willamette Cove were observed during the site walk. The river level was relatively high, but the ACB in Willamette Cove and along the Willamette River was exposed and relatively clean and free of debris; however, a large amount of drift wood has been deposited along the Willamette River shoreline.

Little ebullition was observed in the area above the granular organoclay along the Willamette River shoreline and in Willamette Cove during the inspection; however, moderate ebullition was observed in the Willamette River later in the day when the river level was lower.

Wildlife spotted along the shoreline included Canada geese.

In December 2015, shoreline repairs were completed in certain areas where soil had eroded from beneath the turf-reinforced matting (TRM) above the ACB. The repairs involved pulling up the TRM, placing new soil, and planting shrubs in areas where erosion was observed. The repairs look good, but the willows planted at the top of the ACB appear to have perished or have gone dormant. The other vegetation seemed to be relatively healthy, but appeared slightly stressed from lack of water. Hart Crowser watered the newly planted shoreline vegetation following the site inspection.

Red-brown iron staining was observed on gravel along the Willamette River shoreline that extended north approximately 200 feet from the southern COP outfall. This is consistent with previous observations of staining in this area.

ACB wire loops were exposed in the southern portion of the ACB. Hart Crowser will cut these during a future O&M site visit.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal sized burrows). A few large burrows (~1 foot deep) were observed along the gravel roads. Minor damage to the perimeter fence was observed along the east fence line. Repairs were made on July 27, 2016.

Little stormwater drainage was observed by opening manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements. The inspection team decided that the TOC elevation of MW-23d and EW-2s should be re-surveyed by Hart Crowser to confirm that settlement in the area has slowed or ceased.

Various small birds and scat were spotted in the upland portion of the cap. Lots of animal burrows were observed around the site and coyotes have been recently spotted.

The job trailer leaks were repaired this winter, but birds have already made new holes in the trailer and are living in the walls. The trailers are rapidly deteriorating and plans to remove them, the storage container, and other unnecessary equipment are being overseen by the DEQ.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Survey MW-23d and EW-1s	Phil Cordell	Summer 2016
■ Watering events	Phil Cordell	As needed
■ Fill large burrows along perimeter fence and interior of the site	Phil Cordell	Summer 2016
■ Repair perimeter fence	Phil Cordell	Completed July 2016
■ Low Tide Monitoring	Phil Cordell	October 2016
■ Coordinated trailer/surplus equipment removal and organize trailer/shop.	Sarah Miller/Phil Cordell	Summer/Fall 2016
■ Publish public notification of the Five Year Review on Oregon Live prior to issuing the Report.	Annie Christopher	Summer 2016

Site Activities / Miscellaneous Field Activities

- The low-tide monitoring occurred in June 2016.
- The vegetation inspection occurred in June 2016.
- The EW-2s transducer cable was replace in June 2016.

Deliverables

The 2015 Annual Report and the revised O&M Manual was submitted in June 2016. The draft Five Year Review was also submitted to the DEQ in June 2016.

Action Item:	Person Responsible:	Deadline:
Hart Crowser and GSI will continue to assist the DEQ with the Five Year review	Phil Cordell/Erin Hughes	Ongoing – Due September 2016

Budget Status: April 2016 through June 2016 were at/or below the anticipated budget.

Meeting Status:

Date / Time	TBD – October 2016	
Location	McCormick & Baxter Facility	Site Office

Table 3.2
Example Sediment Inspection Form
McCormick and Baxter Creosoting Company
Portland, Oregon

Date: 7/21/2016 Time: 09:00

Site Observations Form - Sediment Cap
Quarterly

tbl_site_observations

Category	Observation
gate conditions (weekly)	All locked and secure
high temp (weekly)	81 deg F
low temp (weekly)	58 deg F
wind (weekly)	<5mph
precipitation (weekly)	0.02 inches (7/17/16-4/23/16)
Sheen Observations (low tide)	None observed
Size and Location	None observed
Source (gas bubble, debris, etc.)	None observed
ACB and Riprap Armoring	Good
Changes in Location	None observed
Displaced blocks	None observed
Vandalism	None observed
River relative to top of ACB	
Organoclay Mats (extreme low water)	None observed
Edges of mats visible?	None observed
Overlying Armoring conditions	Good
Evidence of movement?	None observed
WC OC/Seep Area	Good
TFA OC/Seep Area	Good
Wildlife	
Fish / Crayfish / clams	None observed
Other	Birds
Warning Signs Condition	Good
Buoy Condition / Location	Good
cove shoreline (general)	Good
FWDA shoreline (general)	Good
bulkhead shoreline (general)	Good
TFA shoreline (general)	Good
observations or notes	
Follow Up Inspection	☐ Yes ☒ No Date:

Table 3.1
Example Soil Inspection Form
McCormick and Baxter Creosoting Company
Portland, Oregon

Date: 7/21/2016 Time: 09:00

Site Observations Form - Soil Cap
Quarterly

tbl_site_observations

Category	Observation
Gate Conditions (weekly)	All locked and secure
perimeter fence (weekly)	Good
trespassers, entry point	None observed
High temp (weekly)	81 deg F
Low temp (weekly)	58 deg F
Wind (daily)	Light <5mph
Precipitation (weekly)	0 02 inches (7/17/16-4/23/16)
Erosion	
Around Manholes	None observed
Headway retention pond	None observed
Eastern edge of property	None observed
Spillway area	None observed
Outfall area	None observed
Animal burrows / disturbance	Fair - some burrows observed, but none determined to compromise the cap
Manhole conditions	
Debris, flow, general condition	No debris, low <1 gpm
Flow in collection piping	Low <1 gpm
Outfall and Spillway	
Note approx. flow volume	Low <1 gpm
Vegetation Conditions	Fair
Wildlife	Canada Geese
Daily activities	Site inspection
Observations or notes	
Follow Up Inspection	☐ Yes ☒ No Date

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Wednesday 11/17/2016
9:00 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Phil Cordell
Attendees:	Sarah Miller	Project Officer	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Erin Hughes	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on Thursday, November 17, 2016. The next inspection is scheduled for January or February 2017.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.

Gravel from the shoreline enhancement task (completed in October 2012) remains settled in the voids of the ACB armoring. Tidal fluctuations have distributed gravel from the top of the ACB, where it was originally applied, to where it has settled along the toe of the bank. Gravel has not settled into the mid-bank portion of the ACB armoring in areas where the slope is steeper; however, vegetation was observed to be growing in the ACB voids.

The Willamette River at the time of inspection (between 1:30 PM and 300 PM) was between 5.70 and 5.55 feet COP (or 10.70 – 10.55 NAVD88). Low tide was at approximately 3:30 PM with a tide of approximately 5.20 feet COP (or 10.20 NAVD88). All buoys were visible.

Discharge from the outfall was estimated at 15 gallons per minute. The outfall is in good condition, but moss is covering much of it.

Eleven derelict boats anchored within Willamette Cove were observed during the site walk. The river level was relatively high, but the upper sections of ACB in Willamette Cove was exposed and relatively clean and free of debris; however, a large amount of drift wood has been deposited along the Willamette River shoreline.

Little ebullition was observed in the area above the granular organoclay along the Willamette River shoreline and in Willamette Cove during the inspection.

Wildlife spotted along the shoreline included Canada geese.

In December 2015, shoreline repairs were completed in certain areas where soil had eroded from beneath the turf-reinforced matting (TRM) above the ACB. The repairs involved pulling up the TRM,

placing new soil, and planting shrubs in areas where erosion was observed. The repairs look good, but much of the vegetation planted along the top of the bank has perished; however, native grasses, shrubs, and weeds have started growing and the area appears to have stabilized (no erosion evident).

Red-brown iron staining was observed on gravel along the Willamette River shoreline that extended north approximately 200 feet from the southern COP outfall. This is consistent with previous observations of staining in this area.

ACB wire loops were exposed in the southern portion of the ACB. Hart Crowser will cut these during a future O&M site visit.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal sized burrows). A few larger burrows (~0.5 foot deep) were observed along the gravel roads but only appear to be providing a point of access for the coyote that is frequently observed at the site.

Stormwater drainage at approximately 15 gpm was observed by opening manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

Various small birds and scat were spotted in the upland portion of the cap. Lots of animal burrows were observed around the site and coyotes have been recently spotted.

The job trailer leaks were repaired this winter, but birds have already made new holes in the trailer and are living in the walls. The trailers are rapidly deteriorating and plans to remove them are progressing.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Draft Annual Report	Phil Cordell/Erin Hughes	February 2017
■ Coordinated trailer/surplus equipment removal and organize trailer/shop.	Sarah Miller/Phil Cordell	January-February 2017
■ Transducer replacement and winter download.	Phil Cordell	Completed December 2016

Site Activities / Miscellaneous Field Activities

- The low-tide monitoring occurred in October 2016.
- The vegetation inspection occurred in October 2016.
- Backflow preventer testing occurred on September 26, 2016.

Deliverables
The final Five Year Review was submitted to the DEQ on September 29, 2016.

Action Item:	**Person Responsible:**	**Deadline:**
Hart Crowser and GSI will prepare the 2016 Annual Report.	Phil Cordell/Erin Hughes	February 2017

Budget Status: June 2016 through November 2016 were at/or below the anticipated budget.

Meeting Status:

Date / Time	TBD – January - February 2016	
Location	McCormick & Baxter Facility	Site Office

Table 3.2
Example Sediment Inspection Form
McCormick and Baxter Creosoting Company
Portland, Oregon

Date: 11/17/2016 Time: 09:00

Site Observations Form - Sediment Cap
Quarterly

tbl_site_observations

Category	Observation
gate conditions (weekly)	All locked and secure
high temp (weekly)	81 deg F
low temp (weekly)	58 deg F
wind (weekly)	<5mph
precipitation (weekly)	1.4 (11/13/16-11/19/16)
Sheen Observations (low tide)	None observed
Size and Location	None observed
Source (gas bubble, debris, etc.)	None observed
ACB and Riprap Armoring	Good
Changes in Location	None observed
Displaced blocks	None observed
Vandalism	None observed
River relative to top of ACB	
Organoclay Mats (extreme low water)	None observed
Edges of mats visible?	None observed
Overlying Armoring conditions	Good
Evidence of movement?	None observed
WC OC/Seep Area	Good
TFA OC/Seep Area	Good
Wildlife	
Fish / Crayfish / clams	None observed
Other	Birds
Warning Signs Condition	Good
Buoy Condition / Location	Good
cove shoreline (general)	Good
FWDA shoreline (general)	Good
bulkhead shoreline (general)	Good
TFA shoreline (general)	Good
observations or notes	
Follow Up Inspection	☐ Yes ☒ No Date:

Table 3.1
Example Soil Inspection Form
McCormick and Baxter Creosoting Company
Portland, Oregon

Date: 11/17/2016 Time: 09:00

Site Observations Form - Soil Cap
Quarterly

tbl_site_observations

Category	Observation
Gate Conditions (weekly)	All locked and secure
perimeter fence (weekly)	Good
trespassers, entry point	None observed
High temp (weekly)	81 deg F
Low temp (weekly)	58 deg F
Wind (daily)	Light <5mph
Precipitation (weekly)	1.4 (11/13/16-11/19/16)
Erosion	
Around Manholes	None observed
Headway retention pond	None observed
Eastern edge of property	None observed
Spillway area	None observed
Outfall area	None observed
Animal burrows / disturbance	Fair - some burrows observed, but none determined to compromise the cap
Manhole conditions	
Debris, flow, general condition	No debris,~15 gpm, good condition.
Flow in collection piping	~15 gpm
Outfall and Spillway	
Note approx. flow volume	~15 gpm
Vegetation Conditions	Fair
Wildlife	Canada Geese
Daily activities	Site inspection
Observations or notes	
Follow Up Inspection	☐ Yes ☒ No Date

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Friday 1/27/2017
8:30 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Phil Cordell
Attendees:	Sarah Miller	Project Officer	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Erin Hughes	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on Friday, January 27, 2017. The next inspection is scheduled for April 2017.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.

Gravel from the shoreline enhancement task (completed in October 2012) remains settled in the voids of the ACB armoring. Tidal fluctuations have distributed gravel from the top of the ACB, where it was originally applied, to where it has settled along the toe of the bank. Gravel has not settled into the mid-bank portion of the ACB armoring in areas where the slope is steeper; however, vegetation was observed to be growing in the ACB voids.

The Willamette River at the time of inspection (between 8:30 PM and 10:30 PM) was between 5.14 and 4.69 feet COP (or 10.14 – 9.69 NAVD88). Low tide was at approximately 12:45 PM with a tide of approximately 4.26 feet COP (or 9.36 NAVD88). All buoys were visible.

Discharge from the outfall was estimated at 10-15 gallons per minute. The outfall is in good condition, but moss is covering much of it.

Ten derelict boats anchored within Willamette Cove were observed during the site walk. The river level was relatively high, but the upper sections of ACB in Willamette Cove was exposed and relatively clean and free of debris; however, a large amount of drift wood has been deposited along the Willamette River shoreline.

Little ebullition was observed in the area above the granular organoclay along the Willamette River shoreline and in Willamette Cove during the inspection.

Wildlife spotted along the shoreline included Canada geese.

In December 2015, shoreline repairs were completed in certain areas where soil had eroded from beneath the turf-reinforced matting (TRM) above the ACB. The repairs involved pulling up the TRM,

placing new soil, and planting shrubs in areas where erosion was observed. The repairs look good, but much of the vegetation planted along the top of the bank has perished; however, native grasses, shrubs, and weeds have started growing and the area appears to have stabilized (no erosion evident).

A lot of garbage and debris has been deposited along the shoreline due to high river levels. The amount of debris will be assessed during the spring inspection, after river levels have receded, and a determination made on whether a beach trash removal event is warranted.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal sized burrows). A few larger burrows (~0.5 foot deep) were observed along the gravel roads but only appear to be providing a point of access for the coyote that is frequently observed at the site.

Stormwater drainage at approximately 15 gpm was observed by opening manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is consistent with recent measurements.

Various small birds and scat were spotted in the upland portion of the cap. Lots of animal burrows were observed around the site and coyotes have been recently spotted.

The job trailer leaks were repaired during the winter of 2015, but birds have made new holes in the trailer and are living in the walls. The trailers are scheduled to be removed February 9, 2017.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Draft Annual Report	Phil Cordell/Erin Hughes	February 2017
■ Coordinated trailer/surplus equipment removal and organize trailer/shop.	Sarah Miller/Phil Cordell	February 2017
■ Vegetation Management Firm Procurement for spring spraying	Phil Cordell	February/March 2017

Site Activities / Miscellaneous Field Activities

- The last two replacement transducers were installed in December 2016 and water levels from the existing transducers was downloaded.

Deliverables		
No deliverables were submitted since the last site inspection.		
Action Item:	**Person Responsible:**	**Deadline:**
Hart Crowser and GSI will prepare the 2016 Annual Report.	Phil Cordell/Erin Hughes	February 2017
The DEQ may prepare a memorandum detailing the potential impacts the Portland Harbor ROD has on the M&B ROD.	DEQ w/ assistance from HC/GSI	TBD

Budget Status: November 2016 through January 2017 were at/or below the anticipated budget. A BAP covering costs associated with the trailer removal was submitted to the DEQ in December 2016 and a task order amendment was issued on January 19, 2017.

Meeting Status:		
Date / Time	TBD – January - April 2017	
Location	McCormick & Baxter Facility	Site Office

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Friday 4/21/2017
1:00 P.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Phil Cordell
Attendees:	Sarah Miller	Project Officer	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Erin Hughes	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on Friday, April 21, 2017. The next inspection is scheduled for July 2017.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.

Gravel from the shoreline enhancement task (completed in October 2012) was scoured from many areas of the upper ACB and deposited further down the bank. High river levels and tidal fluctuations were likely responsible for the gravel erosion. Some gravel within the ACB voids has been removed in scattered areas, especially along the seams between the ACB mats, leaving 2-4 wide inch voids where the geotextile fabric underlayment is exposed (see attached picture). Gravel was still observed in most of the upper- and mid-bank portion of the ACB armoring; however, the areas where the ACB gravel has been eroded present a tripping hazard.

Areas of TRM were also disturbed by the high-water levels. River levels appear to have crested 2 to 4 feet above the elevation of the TRM, resulting in driftwood that caused damage to the TRM in scattered areas. The high water resulted in the TRM separating from ACB in a few areas, the TRM tearing in at least one area, and swaths of topsoil being eroded from above the TRM along portions of the upper bank.

The Willamette River at the time of inspection (between 1:00 PM and 2:30 PM) was between 10.66 and 10.84 feet COP (or 15.66– 15.84 NAVD88). Low tide was at approximately 11:00 AM with a tide of approximately 10.48 feet COP (or 10.59 NAVD88). All buoys were visible.

Discharge from the outfall was estimated at 10 gallons per minute. The outfall is in good condition, but moss is covering much of it. Roughly 30-40% of the rock armoring below the outfall was washed away from the drainage channel.

Three derelict boats anchored within Willamette Cove were observed during the site walk. The river level was high, so the ACB in Willamette Cove was not exposed.

No ebullition was observed in the area above the granular organoclay along the Willamette River shoreline. The area above the granular organoclay in Willamette Cove could not be observed during the inspection.

Wildlife spotted along the shoreline included Canada geese and a red tailed hawk near the contractor area.

Much of the soil and plantings placed during the shoreline repairs in December 2015 were washed away by high river levels.

A lot of garbage and debris has been deposited along the shoreline due to high river levels. A trash removal event is warranted because the accumulated trash is likely to remain in place through the summer.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal sized burrows). A few larger burrows (~0.5 foot deep) were observed along the gravel roads but only appear to be providing a point of access for the coyote that is observed at the site.

Stormwater drainage at approximately 10 gpm was observed by opening manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

Animal burrows were frequently observed around the site.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Vegetation Management	Phil Cordell	May 2017
■ Low-tide monitoring	Phil Cordell	June 2017
■ Coordinate shoreline repairs	Phil Cordell/Sarah Miller	Spring/Summer 2017

Site Activities / Miscellaneous Field Activities

- Transducer data will be downloaded during the June 2017 low-tide monitoring event.

Deliverables		
Final 2016 Annual Report - April 6, 2017.		
Action Item:	**Person Responsible:**	**Deadline:**
No deliverables scheduled for 2nd quarter 2017.		
Budget Status: January 2017 through April 2017 were at/or below the anticipated budget. We will begin preparing a new BAP for O&M activities from June 2017 through December 2017 in May.		
Meeting Status:		
Date / Time	TBD – July 2017	
Location	McCormick & Baxter Facility	Site Office

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Thursday 10/23/2017
8:30 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Phil Cordell
Attendees:	Sarah Miller	Project Officer	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Erin Hughes	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on October 23, 2017. The next inspection is scheduled for January 2018.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.

September 2017 shoreline ACB repairs appear to be in good condition and will be monitored throughout the winter.

Areas of TRM were also disturbed by the spring high-water levels. River levels appear to have crested 2 to 4 feet above the elevation of the TRM, resulting in driftwood accumulation that caused damage to the TRM in scattered areas. The high water resulted in the TRM separating from ACB in a few areas, the TRM tearing in at least one area, and areas of topsoil being eroded from above the TRM along portions of the upper bank. Sedimentation and deposited debris appear to be securing loose TRM in most places. This will continue to be monitored and additional repairs may be needed if further damage occurs during the 2017/2018 winter.

The Willamette River at the time of inspection (between 8:30 AM and 10:00 AM) was between 3.0 and 3.2 feet COP (or 8.0 – 8.2 NAVD88). Low tide was at approximately 1:00 PM with a tide of approximately 2.2 feet COP (or 7.2 NAVD88). All buoys were visible.

Discharge from the outfall was estimated at 10-15 gallons per minute. The outfall is in good condition, but moss is covering much of it. Roughly 30-40% of the rock armoring below the outfall was washed away from the drainage channel.

Four derelict boats anchored within Willamette Cove were observed during the site walk. The river level was high, so the ACB in Willamette Cove was exposed and appeared to be in good condition.

Little ebullition was observed in the area above the granular organoclay along the Willamette River shoreline or in Willamette Cove.

Garbage and debris was removed by Hart Crowser following the September shoreline repairs.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact, with some areas of burrowing identified (small mammal sized burrows). A few larger burrows (~0.5 foot deep) were observed along the gravel roads but only appear to be providing a point of access for the coyote that frequents the site.

Stormwater drainage at approximately 15 gpm was observed by opening manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

Animal burrows were frequently observed around the site.

The warning sign located in the SE corner of the site has fallen down and needs to be repaired.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Vegetation Management	Phil Cordell	Fall monitoring
■ Low-tide monitoring	Phil Cordell	September 2017
■ Coordinate shoreline repairs	Phil Cordell/Sarah Miller	August/September 2017
■ Repair perimeter sign	Phil Cordell	Winter 2017
■ Annual Report	Phil Cordell	December 2017/January 2018

Site Activities / Miscellaneous Field Activities

- Transducer batteries were replaced in October 2017 following the site inspection.

Deliverables		
None.		
Action Item:	**Person Responsible:**	**Deadline:**
Annual Report	Phil Cordell	December 2017/January 2018
Budget Status: July 2017 through October 2017 we are at/or below the anticipated budget. New budget requests will be prepared in December 2017.		
Meeting Status:		
Date / Time	TBD – January 2018	
Location	McCormick & Baxter Facility	Site Office

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Thursday 2/8/2018
2:30 P.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Phil Cordell
Attendees:	Sarah Miller	Project Officer	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Erin Hughes	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on February 8, 2018. The next inspection is scheduled for April 2018.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.

September 2017 shoreline ACB repairs appear to be in good condition and will be monitored throughout the winter.

River levels crested 2 to 4 feet above the elevation of the TRM in spring of 2017, resulting in driftwood accumulation that caused damage to the TRM in scattered areas. Deposited sediment and debris appear to be securing loose TRM in most areas; however, two areas of TRM need to be secured with new anchors driven into the ACB.

The Willamette River at the time of inspection (between 2:30 PM and 4:00 PM) was between 7.24 and 7.03 feet COP (or 12.24 – 12.03 NAVD88). Low tide was at approximately 9:30 PM with a tide of approximately 6.53 feet COP (or 11.53 NAVD88). All buoys were visible.

Discharge from the outfall was estimated at 5-10 gallons per minute. The outfall is in good condition, but moss is covering much of it. Roughly 50% of the rock armoring below the outfall was washed away from the drainage channel, but the ACB and overlying filter fabric remains in place and erosion of the cap doesn't appear to be a concern. No repairs are planned.

One derelict boat was anchored within Willamette Cove during the site walk. The river level was high, so the ACB in Willamette Cove was not exposed.

No ebullition was observed in the area above the granular organoclay along the Willamette River shoreline or in Willamette Cove.

Scattered debris was observed along the shoreline.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact. Animal burrows were frequently observed around the site, but are generally less than 6 inches deep and don't require repairs. A few larger burrows (~0.5 foot deep) were observed along the perimeter gravel roads, but only appear to be providing a point of access for the coyote that frequents the site. One fence post is damaged and the fence is sagging along the east perimeter.

Stormwater drainage at approximately 10 gpm was observed by opening manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

The warning sign located in the SE corner of the site has fallen down and needs to be repaired.

Old drums located in the drum storage area are rusting and need to be recycled.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Vegetation Management	Phil Cordell	June 2018 monitoring
■ Low-tide monitoring	Phil Cordell	June 2018
■ Repair perimeter sign and fence	Phil Cordell	Winter/Spring 2018
■ Transducer download	Phil Cordell	February 2018
■ Drum recycling	Phil Cordell	Spring 2018

Site Activities / Miscellaneous Field Activities

- A drone operated by Verizon crashed on the site and was recovered in early January 2018.

Deliverables		
None.		
Action Item:	**Person Responsible:**	**Deadline:**
Annual Report	Phil Cordell	February 2018

Budget Status: November 2017 through February 2018 we are at/or below the anticipated budget. New budget requests will be prepared in February 2018.

Meeting Status:		
Date / Time	TBD – April 2018	
Location	McCormick & Baxter Facility	Site

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Thursday 5/23/2018
9:00 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Phil Cordell
Attendees:	Sarah Miller	Project Officer	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Erin Hughes	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on May 23, 2018. The next inspection is scheduled for July 2018.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.

September 2017 shoreline ACB repairs appear to be in good condition and will be monitored throughout the year.

River levels crested 2 to 4 feet above the elevation of the TRM in spring of 2017, resulting in driftwood accumulation that caused damage to the TRM in scattered areas. Deposited sediment and debris appear to be securing loose TRM in most areas; however, two areas of TRM need to be secured with new anchors driven into the ACB. One of these areas was observed to now be covered with driftwood during the May 2018 inspection, the other area will be secured during the summer of 2018. River conditions appear to have not crested above the TRM in 2018, but additional driftwood was observed to be accumulating at the top of the ACB.

The Willamette River at the time of inspection (between 9:00 AM and 11:00 AM) was between 14.92 and 14.98 feet COP (or 19.92 – 19.98 NAVD88). Low tide was at approximately 8:00 AM with a tide of approximately 14.89 feet COP (or 19.89 NAVD88). No buoys were visible, but that is typical of higher water levels.

Discharge from the outfall was estimated at 3-5 gallons per minute. The outfall is in good condition, but moss is covering much of it. Roughly 50% of the rock armoring below the outfall was washed away from the drainage channel, but the ACB and overlying filter fabric remains in place and erosion of the cap doesn't appear to be a concern. No repairs are planned.

One derelict boat was anchored within Willamette Cove during the site walk. The river level was high, so the ACB in Willamette Cove was not exposed.

No ebullition was observed in the area above the granular organoclay along the Willamette River shoreline or in Willamette Cove.

Scattered debris was observed along the shoreline.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact. Animal burrows were frequently observed around the site, but are generally less than 6 inches deep and don't require repairs. A few larger burrows (~0.5-foot-deep) were observed along the perimeter gravel roads, but only appear to be providing a point of access for the coyote that frequents the site. The damaged fence and toppled sign noted during the winter site walk repaired.

Stormwater drainage at approximately 3-5 gpm was observed by opening manhole SDMH-B. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

Drums located in the drum storage area were removed this past winter.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Phil Cordell	Quarterly
■ Vegetation Management	Phil Cordell	June & Oct 2018
■ Low-tide monitoring	Phil Cordell	June 2018
■ Transducer download	Phil Cordell	June 2018

Site Activities / Miscellaneous Field Activities

- None noted.

Deliverables

None.

Action Item:	Person Responsible:	Deadline:
Annual Report	Phil Cordell	January 2019

Budget Status: February 2018 through May 2018 we are at/or below the anticipated budget. New O&F budget requests will be prepared in August 2018.

Meeting Status:

Date / Time	TBD – July 2018	
Location	McCormick & Baxter Facility	Site

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Thursday 8/2/2018
9:00 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Phil Cordell Kaylan Smyth
Attendees:	Sarah Miller	Project Officer	DEQ
	Phil Cordell	Site Manager	Hart Crowser
	Kaylan Smyth	Site Manager	Hart Crowser
	Erin Carroll Hughes	Hydrogeologist	GSI
	Rodrigo Prugue	Hydrogeologist	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on August 2, 2018. The next inspection is scheduled for October 2018.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.
- Fire damage along Willamette River shoreline.

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will be monitored throughout the year.

The Willamette River at the time of inspection (between 9:00 AM and 11:00 AM) was between 4.34 and 3.62 feet COP (or 9.34 – 8.62 NAVD88). Low tide was at approximately 6:00 AM with a tide of approximately 2.26 feet COP (or 7.26 NAVD88). The five buoys were visible and appeared to be in good condition and functional.

River levels crested 2 to 4 feet above the elevation of the TRM in spring of 2017, resulting in driftwood accumulation that caused damage to the TRM in scattered areas. Deposited sediment and debris appear to be securing loose TRM in most areas; however, two areas of TRM need to be secured with new anchors driven into the ACB. One of these areas was observed to now be covered with driftwood during the May 2018 inspection, the other area will be secured during the summer of 2018. The river did not crest above the TRM in 2018, but additional driftwood has accumulated at the top of the ACB.

Discharge from the outfall was estimated to be less than a gallon per minute. The outfall is in good condition, but moss is covering much of it. Roughly 50% of the rock armoring below the outfall was washed away from the drainage channel, but the ACB and overlying filter fabric remains in place and erosion of the cap doesn't appear to be a concern. No repairs are planned.

Three derelict boat was anchored within Willamette Cove during the site walk. The boats did not appear to be anchored on top of the ACB in Willamette Cove.

Some ebullition was observed in the area above the granular organoclay along the Willamette River shoreline or in Willamette Cove. No sheen was observed with the ebullition.

A brush fire burned approximately 1 acre of the of the riparian area vegetation (Photo 1) as shown on the attached figure. Larger/mature trees may have survived as their bark did not appear to be chard; however smaller trees, brush and grass was burned. Wells in the vicinity of the fire were inspected and remain in good condition (Photo 2). The fire did appear to burn several holes (~3 inch diameter) in the TRM.

Scattered debris was observed along the shoreline and two active tent camp sites were observed. The Portland police were notified.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.

The site perimeter fence was intact. Locks and gates were damaged during the fire department response. Perimeter locks have been replaced with combination locks to allow the fire department better access to the riparian area. Animal burrows were frequently observed around the site, but are generally less than 6 inches deep and don't require repairs. A few larger burrows (~0.5 foot deep) were observed along the perimeter gravel roads, but only appear to be providing a point of access for the coyote that frequents the site.

Stormwater drainage observed at manhole SDMH-B was estimated at less than 1 gpm. This coupled with the discharge from the stormwater outfall indicate that the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

A few plastic drums and a stack of plastic buckets are still present in the storage area.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kaylan Smyth	Quarterly
■ Monitor burned holes (`3 inch diameter) in the TRM in brush fire area.	Kaylan Smyth	Quarterly
■ Vegetation Management (Watering)	Kaylan Smyth	August/September 2018
■ Riparian Area Repair Memorandum	Kaylan Smyth	August/September 2018
■ Low-tide monitoring	Kaylan Smyth	October 2018
■ Transducer download	Kaylan Smyth	October 2018
■ Site Inspections	Kaylan Smyth	Quarterly
■ Annual Report	Kaylan Smyth Erin Carroll Hughes	February 2019

Site Activities / Miscellaneous Field Activities

- None noted.

Deliverables

None.

Action Items:	Person Responsible	Deadline
■ Annual Report	Kaylan Smyth Erin Carroll Hughes	February 2019

Budget Status: February 2018 through July 2018 we are at/or below the anticipated budget. New O&F budget requests will be prepared in August 2018.

Meeting Status:

Date / Time	TBD – October 2018
Location	McCormick & Baxter Facility

Photos:

P oto 1 –View of fire dama a ng the service road in the r arian area.

Photo 2 – Northwest view of fire damage surrounding monitoring wells (MW-40i, MW-40s, MW-40d, MW-41i, MW-41s, and MW-41d).

ATTACHMENT 1

LEGEND

- Groundwater Monitoring Wells
- Groundwater Monitoring Wells with Transducers
- Subsurface Barrier Wall

Notes from 7/24/2018
HC Rep: KS
Wx: Clear, Hot (90 degrees F)

NOTE:
Aerial photo taken on September 22, 2006.

0 200 400
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Monitoring Well Location Map

12/15

HARTCROWSER GSI Water Solutions, Inc.

Figure
4-1

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McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Friday 10/19/2018
8:30 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kaylan Smyth
Attendees:	Sarah Miller	Project Officer	DEQ
	Kaylan Smyth	Site Manager	Hart Crowser
	Erin Carroll Hughes	Hydrogeologist	GSI
	Stephanie Rawson	Metro's RID program	Metro

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on October 19, 2018. Stephanie Rawson from Metro attended the meeting to assist with the inspection of homeless activity in the riparian area and along the Willamette River shoreline. The next inspection is scheduled for January or February 2019.

Site Walk – Shoreline

The following items were inspected during both the shoreline site walk and inspection:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.
- Gate fence damage.
- Fire damage along Willamette River shoreline and at the northeast end of the property near the railroad.

Several gaps (2- to 4-inch-wide, 4 to 8 feet long) in the ACB were noted along the shoreline in Willamette Cove at the northwestern end of the site (see Photo 1). The gaps were visible due to the low Willamette River water surface elevation conditions (end of summer, low tide) at the time of inspection. The September 2017 shoreline ACB repairs continue to appear to be in good condition and will be monitored throughout the year.

The Willamette River at the time of inspection (between 9:00 AM and 11:00 AM) was between 3.35 and 2.97 feet COP (or 8.45 and 8.08 NAVD88). Low tide was at approximately 10:45 AM with a tide of approximately 2.97 feet COP (or 8.07 NAVD88). The five buoys were visible and appeared to be in good condition and functional.

In the spring of 2017, river levels crested 2 to 4 feet above the elevation of the TRM, resulting in driftwood accumulation that caused damage to the TRM in scattered areas. The deposited sediment and debris appear to be securing loose TRM in most areas; however, two areas of TRM will need to be secured with new anchors driven into the ACB. One of these areas was observed to now be covered with driftwood during the May 2018 inspection and the other area requires additional monitoring/inspection. The river did not crest above the TRM in 2018, but additional driftwood has accumulated at the top of the ACB.

There was no discharge from the stormwater discharge outfall. The outfall is in good condition, but moss is covering much of it. Roughly 50% of the rock armoring below the outfall was washed away from the drainage channel, but the ACB and overlying filter fabric remains in place and erosion of the cap doesn't appear to be a concern. No repairs are planned.

Four derelict boat were anchored within Willamette Cove during the site walk. The boats did not appear to be anchored on top of the ACB in Willamette Cove.

No ebullition was observed in the area above the granular organoclay along the Willamette River shoreline or in Willamette Cove.

A brush fire burned approximately one acre in the riparian area on August 18, 2018. Larger/mature trees may have survived as their bark did not appear to be charred; however smaller trees, brush and grass were burned. Vegetation appears to be thriving with evident signs of grass spouting in the undergrowth and new buds appearing on existing brush. The fire appeared to burn several holes (~3-inch diameter) in the TRM in the riparian area. The TRM will be monitored in future inspections.

Scattered debris was observed along the shoreline and multiple abandoned camp sites were observed (see Photo 2). Metro and DEQ discussed plans for removing debris from the abandoned camps. No active camps we observed.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.
- Fire damage at the northeast end of the site.

The site perimeter fence was intact. Locks damaged during the fire department response have been replaced with combination locks to allow access for the fire department. A two by two foot cut in a northwester gate was noted on September 21, 2018. The cut was repaired on October 23, 2018 by a fencing contractor (Photo 3). Animal burrows were frequently observed around the site but are generally less than 6 inches deep and don't require repairs. A few larger burrows (~0.5-foot-deep) were observed along the perimeter gravel roads, but only appear to be providing a point of access for the coyote that frequents the site.

There was no stormwater drainage observed at manhole SDMH-B. This outfall, coupled with the discharge from the stormwater outfall will be monitored in the future to determine if the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

A few plastic drums and a stack of plastic buckets are still present in the storage area.

A brush fire burned approximately one acre on the northeast end of the site near the railroad on September 24, 2018 (Photo 4). The brush had been burned, but it appears there was no damage to the cap. Vegetation is thriving with evident signs of spouting grass.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kaylan Smyth	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kaylan Smyth	Quarterly
■ Site Inspections	Kaylan Smyth	Quarterly
■ Annual Report	Kaylan Smyth Erin Carroll Hughes	February 2019

Site Activities / Miscellaneous Field Activities

- None noted.

Deliverables

- A Task Order (72-18-6) was authorized on September 26, 2018 to continue Groundwater Operational and Functional activities.

Action Items:	Person Responsible	Deadline
■ Annual Report	Kaylan Smyth Erin Carroll Hughes	February 2019

Budget Status: Currently at/or below the anticipated budget.

Meeting Status:

Date / Time	TBD – January or February 2019
Location	McCormick & Baxter Facility

Photos:

Photo 1 –View of separation gaps in the ACB along the Willamette Cove Shoreline.

Photo 2 –View of debris left from dump site in the riparian area.

Photos:

Photo 3 – View of repaired gate fence that was damaged from a 2-foot by 2-foot cut in the chain link fence.

Photo 4 – View of the fire damage at the northeastern end of the site along the railroad.

McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Thursday 02/07/2019
1:00 P.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kaylan Smyth
Attendees:	Sarah Miller	Project Officer	DEQ
	Kaylan Smyth	Site Manager	Hart Crowser
	Erin Carroll Hughes	Hydrogeologist	GSI
	Tess Lydick	Staff Geologist	Hart Crowser

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on February 7, 2019. The next inspection is scheduled for April/May 2019. Site photos and descriptive map are included at the end of this summary.

Site Walk – Shoreline

The following items were inspected along the shoreline:

- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Willamette River and Willamette Cove shoreline conditions.
- Ebullition from sediment cap.
- Shoreline vegetation repairs.
- Fire damage along Willamette River shoreline in the riparian area.

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will be monitored throughout the year. Wildlife (geese, seagulls) were observed along the Willamette River shoreline during site walk (Photo 1).

The Willamette River tides at the time of inspection (between 1:00 PM and 4:00 PM) were at 3.50 and 3.18 feet COP (or 8.50 and 8.28 NAVD88). Daily low tides were at 3:45 AM and 3:30 PM with a tide of approximately 2.85 feet COP (or 7.95 NAVD88) and 3.02 COP (or 8.12 NAVD88), respectively. The five buoys were visible and appeared to be in good condition and functional.

There was discharge from the stormwater discharge outfall (Photo 3) at approximately 5 gallons per minute. The outfall is in good condition. Roughly 50% of the rock armoring below the outfall was washed away from the drainage channel, but the ACB and overlying filter fabric remains in place and erosion of the cap doesn't appear to be a concern. No repairs are planned.

Four derelict boat were anchored within Willamette Cove during the site walk. The boats did not appear to be anchored on top of the ACB in Willamette Cove.

No ebullition was observed in the area above the granular organoclay along the Willamette River shoreline or in Willamette Cove.

A brush fire in August 2018 burned approximately one acre in the riparian area. Larger/mature trees may have survived as their bark did not appear to be charred; however smaller trees, brush and grass were burned. Vegetation appears to be thriving with evident signs of grass spouting in the undergrowth and

new buds appearing on existing brush (Photo 3). The fire appeared to burn several holes (~3 inch diameter) in the TRM in the riparian area. The TRM appeared to be in good condition, further monitoring will be conducted in future inspections.

Scattered debris was observed along the shoreline and multiple abandoned dump sites were observed along the riparian area (see Photo 4). Metro and DEQ discussed plans for removing debris from the dump sites. No active houseless camps were observed.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes).
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.
- Fire damage at the northeast end of the site.
- Verify the water supply sources at the site and identify backflow values

The site perimeter fence was intact. The lock at the north entrance gate (Edgewater Rd) had been cut. A fire department lock had been put on the south entrance gate. A new lock was installed on the north entrance gate. Animal burrows were frequently observed around the site, but are generally less than 6 inches deep and don't require repairs. A few larger burrows (~0.5 foot deep) were observed along the perimeter gravel roads.

The manhole SDMH-B was not inspected during this meeting. This outfall, coupled with the discharge from the stormwater outfall will be monitored in the future to determine if the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The two coyotes were observed roaming on the soil cap during the site inspection.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

The brush fire in September 2018 burned approximately one acre on the northeast end of the site near the railroad. The brush had been burned, but it appears there was no damage to the cap. Vegetation is thriving with evident signs of spouting grass.

A few plastic drums and a stack of plastic buckets are still present in the storage area. There was flooding at the storage area due to pump being unplugged (Photo 5). The pump started up again shortly after being plugged in. The pump will be monitored in future inspections.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kaylan Smyth	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kaylan Smyth	Quarterly
■ Quarterly Site Inspections	Kaylan Smyth	Quarterly
■ Site Maintenance – Replace locks with hardened steel combo padlocks, fill-in burrows along the fence line and shop maintenance (e.g. mouse traps, check equipment)	Kaylan Smyth Tess Lydick	February/March 2019
■ Draft Annual Report	Kaylan Smyth Erin Carroll Hughes	February 2019
■ Final Annual Report	Kaylan Smyth Erin Carroll Hughes	March 2019
■ Vegetation Inspection	Tim Walters	June 2019
■ Low-tide monitoring and transducer download (Task Order 72-18-6)	Kaylan Smyth Tess Lydick Dan Knapp	June 2019
■ Riparian area watering events	Tess Lydick Dan Knapp	August/September 2019
■ Plan activities for the Five-Year Review Report	Erin Carroll Hughes Sarah Miller Kaylan Smyth	May through September 2019

Site Activities / Miscellaneous Field Activities

- DEQ is coordinating with Metro to cleanup the dumpsites in the riparian area along the Willamette River shoreline before the end of February 2019.
- DEQ is in discussions with the City of Portland's contractor to use the site as a staging area for construction equipment.

Deliverables

- A Budget and Assumption Proposal was submitted on February 5, 2019 to continue Groundwater Operational and Maintenance activities. It is currently being reviewed.

Budget Status: Currently at/or below the anticipated budget.

Meeting Status:

Date / Time	TBD – April/May 2019
Location	McCormick & Baxter Facility

Photos:

Photo 1 –View of the bird wildlife along the Willamette River Shoreline.

Photo 2 –View of stormwater discharge outfall at approximately 5 gallons per minute.

Photo 3 –View of returning vegetation in the riparian area after the fire in August 2018.

Photo 4 –View of debris from dump site in the riparian area.

Photo 5 –View of the pondin
a the si e outdoor storage
a ea. Pump was reset.

LEGEND

- Groundwater Monitoring Wells
- Groundwater Monitoring Wells with Transducers
- Subsurface Barrier Wall

Notes from 02/07/2019
HC Rep: KS + TL
Wx: Clear, Cool (40 degrees F)

Location of dump site

NOTE:
Aerial photo taken on September 22, 2006.

0 200 400
Scale in feet

McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Monitoring Well Location Map

12/15

HARTCROWSER GSI Water Solutions, Inc.

Figure
4-1

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McCormick & Baxter Operational & Functional Determination Period Status Meeting Report

Thursday 04/03/2019
9:00 P.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kaylan Smyth/Tess Lydick
Attendees:	Sarah Miller	Project Officer	DEQ
	Rick Ernst	Program Manager	Hart Crowser
	Kaylan Smyth	Site Manager	Hart Crowser
	Tess Lydick	Staff Geologist	Hart Crowser
	Erin Carroll Hughes	Hydrogeologist	GSI
	Andrew Davidson	Engineer	GSI

Site Status Meeting Notes

Site Walk and Inspection

The attendees completed a thorough inspection of the entire site on April 3, 2019. The next inspection is scheduled for June/July 2019. Andrew Davidson will be taking over Erin Carroll Hughes responsibilities starting mid-April, 2019. Site photos are included at the end of this summary.

Site Walk – Shoreline

The following items were inspected along the shoreline:

- Willamette River and Willamette Cove shoreline conditions.
- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Derelict boats
- Ebullition from sediment cap.
- Shoreline vegetation
- Fire damage along Willamette River shoreline in the riparian area.
- Debris and dumpsites

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will be monitored throughout the year. Erosion is present underneath the TRM in the riparian area and DEQ requested for voids to be filled in with soil (Photo 1). Multiple one to three inch diameter holes (Photo 2) and approximately six-inch patches (Photo 3) in the TRM are visible in the lower end of the riparian area as a result of last year's riparian fire. Monitoring will be performed to see if vegetation fills in the damaged areas.

The Willamette River tides at the time of inspection (between 9:00 AM and 12:00 PM) were at 4.79 and 3.90 feet COP (or 9.79 and 8.90 NAVD88). Daily high and low tides were at 5:30 AM and 1:30 PM with a tide of approximately 5.90 feet COP (or 10.90 NAVD88) and 3.64 COP (or 8.64 NAVD88), respectively. The five buoys were visible and appeared to be in good condition and functional.

There was discharge from the stormwater discharge outfall (Photo 4) at approximately 5 gallons per minute. The outfall is in good condition. Roughly 50% of the rock armoring below the outfall was washed away from the drainage channel, but the ACB and overlying filter fabric remains in place and erosion of the cap doesn't appear to be a concern. No repairs are planned.

Four derelict boat were anchored within Willamette Cove during the site walk. The boats did not appear to be anchored on top of the ACB in Willamette Cove.

Sporadic ebullition was observed during the site walk in the area above the granular organoclay along the in Willamette Cove. No Ebullition was observed along the Willamette River shoreline.

A brush fire in August 2018 burned approximately one acre in the riparian area. Larger/mature trees may have survived as their bark did not appear to be charred; however smaller trees, brush and grass were burned. Vegetation appears to be thriving with evident signs of grass spouting in the undergrowth and new buds appearing on existing brush (Photo 5).

A cleanup effort was done by Metro and DEQ in removing dump sites. Scattered debris was observed along the shoreline along the riparian area. No active houseless camps or dump sites were observed.

Site Walk – Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes) – Manhole SDMH-B
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.
- Fire damage at the northeast end of the site.
- Inspect MW-59s (maintenance)
- Inspect Gas Vents (maintenance)

The site perimeter fence was intact. A new lock was installed on the east entrance gate. Animal burrows were frequently observed around the site, but are generally less than 6 inches deep and don't require repairs. A few larger burrows (~0.5 foot deep) were observed along the perimeter gravel roads.

The manhole SDMH-B was not inspected during this meeting. This outfall, coupled with the discharge from the stormwater outfall will be monitored in the future to determine if the stormwater drainage system within the RCRA-style soil cap is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

The brush fire in September 2018 burned approximately one acre on the northeast end of the site near the railroad. The brush had been burned, but it appears there was no damage to the cap. Vegetation is thriving with evident signs of spouting grass.

The MW-59s well casing protrudes too high for the monument lid to be installed (Photo 6). It was agreed between DEQ and Hart Crowser that the well casing should be cut down 3-inches. A survey will be completed before and after cutting the well casing.

Gas vents, G-1 and G-4, currently do not have plastic protective covers. Protective covers will be installed during the next site maintenance visit.

A few plastic drums and a stack of plastic buckets are still present in the storage area.

Action Items:	Person Responsible	Deadline
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kaylan Smyth	Quarterly
■ Monitor burned holes (approximately 1 to 3-inch diameter) and 6 inch patches in the TRM in brush fire area.	Kaylan Smyth	Quarterly
■ Quarterly Site Inspections	Kaylan Smyth	Quarterly
■ Vegetation Inspection	Tim Walters	June 2019
■ Low-tide monitoring and transducer download (Task Order 72-18-6)	Kaylan Smyth Tess Lydick Dan Knapp	June 2019
■ Site Maintenance – Cut MW-59s well casing, install G-1 and G-2 gas vent covers, fill-in burrows along the fence line and shop maintenance	Kaylan Smyth Tess Lydick	June 2019
■ Riparian area watering events	Tess Lydick Dan Knapp	August/September 2019
■ Plan activities for the Five-Year Review Report	Andrew Davidson Sarah Miller Kaylan Smyth	May through September 2019

Site Activities / Miscellaneous Field Activities

- DEQ is in discussions with the City of Portland's contractor to use the site as a staging area for construction equipment.

Deliverables

- A Budget and Assumption Proposal was submitted on February 5, 2019 and signed on February 15, 2019.

Budget Status: Currently at/or below the anticipated budget.

Meeting Status:

Date / Time	TBD – June/July 2019
Location	McCormick & Baxter Facility

Photos:

Photo 1 –View of the erosion under the TRM along the riparian area.

Photo 2 –View of one to three-inch diameter holes in the TRM caused by the 2018 fire in the riparian area.

Photo 3 –View of six-inch diameter patches in the TRM as a result of the 2018 fire in the riparian area.

Photo 4 –View of stormwater discharge outfall at approximately 5 gallons per minute.

Photo 5 –View of returning vegetation in the riparian area after the fire in August 2018.

Photo 6 –View of the inner casing protruding past the monument in MW-59s.

McCormick & Baxter Operational & Functional Determination Period Status Meeting Summary

Thursday 7/18/2019
9:00 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kevin Woodhouse
Attendees:	Sarah Miller	Project Officer	DEQ
	Kevin Woodhouse	Site Manager	Hart Crowser
	Tim Walters	Biologist	Hart Crowser
	Andrew Davidson	Engineer	GSI

Site Status Meeting Notes

Site Walk and Inspection

Attendees Sarah Miller, Kevin Woodhouse, and Andrew Davidson performed a thorough inspection of the site from 09:45 until approximately 11:00 on July 18, 2019. Tim Walters was onsite performing a follow up inspection of the herbicide application to evaluate treatment efficacy but did not participate in the full site inspection. Trang Lam from the University of Portland planned to attend the site inspection, however was ultimately unable to attend.

Shoreline Inspection

The following items were inspected near the shoreline:

- Willamette River and Willamette Cove shoreline conditions.
- Buoy locations.
- Derelict boats
- Debris and dumpsites
- Gravel overlay on ACB.
- Stormwater discharge.
- Ebullition from sediment cap.
- Shoreline vegetation
- Fire damage along Willamette River shoreline in the riparian area.

The Willamette River tides at the time of inspection (between 09:45 and 11:00) were at 3.65 COP (8.65 NAVD88) and 3.37 feet COP (8.47 NAVD88). Daily high and low tides were at 06:00 and 15:00 with a tide of approximately 5.02 feet COP (10.12 NAVD88) and 1.98 COP (7.08 NAVD88), respectively. The five buoys were visible and appeared to be in good condition and functional.

Four derelict boats anchored in Willamette Cove during previous site inspections were observed to still be present. None appeared to be anchored on the ACB shoreline of Willamette cove. A single tent was observed just north of the pathway leading down to Willamette Cove parallel to the Burlington Northern rail line (Photo 1). The area around the tent will continue to be monitored for signs of further encampment and potential trash/ debris dumping. No other trash, dump sites, or homeless encampments were observed. As the inspection progressed along the riparian area shoreline, a fishing boat with two occupants were observed fishing just outside the buoys in the Willamette River (Photo 2).

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will continue to be monitored throughout the year. Patches of river rock were present along the lower edge of the shoreline along the riparian area. The presence gravel was very sparse to not present higher up on the shoreline near the base of the TRM (Photo 3). Some small erosional depressions (Photo 4) were observed at seams along the TRM. The depressions will be monitored and filled in with soil if observed

to increase in size. Some areas along the toe of the TRM have been shredded by wood trunks or debris that have washed up on the shoreline. Damage occurred on portions of the TRM covering the ACB and did not affect the coverage over soil portions. Damage will be monitored and pieces will be cut off as necessary to prevent it from ripping off later and mobilizing as trash in the river.

No stormwater discharge was observed from the outfall during the site inspection. The outfall is in good condition. Vegetation is growing between the rock armoring near the outfall and may need to be pruned in the future. No change to the outfall armoring since the last inspection were observed. No repairs are planned and the armoring will be monitored during the rainy season for signs of additional scouring or erosion.

No ebullition was observed from the organoclay layers in Willamette Cove or the Willamette River.

A brush fire in August 2018 burned approximately one acre in the riparian area. Groundcover in the area has recovered with grasses and some noxious weeds present. Larger trees and shrubs show signs of recovery with new leaf development. Most evergreen species of trees have yet to show signs of new growth from charred trunks (Photo 5).

Vegetation in the riparian area did not show signs of drought stress to necessitate the need to schedule a watering event. The vegetation will continue to be monitored and watering events will be scheduled as needed.

Site Walk Upland

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes) – Manhole SDMH-B
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.
- Fire damage at the northeast end of the site.

The site perimeter fence was intact. No cut locks were found and no animal burrows greater than 6 inches deep requiring filling were observed.

The manhole SDMH-B was not inspected during this meeting. The stormwater drainage system will be video scoped to visually inspect integrity of the system during future site maintenance activities to ensure the system is functioning as designed.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

The brush fire in September 2018 burned approximately one acre on the northeast end of the site near the railroad. Grass vegetation has recovered in the area and no visible burn area remains.

The MW-59s well casing protrudes too high for the monument lid to be installed. It was agreed between DEQ and Hart Crowser that the well casing should be cut down 3-inches. Cutting of the well casing will be performed during the land survey so the well can be measured pre and post well casing modification.

A few plastic drums and a stack of plastic buckets are still present in the storage area.

Action Items and Schedule:	Person Responsible	Deadline
■ Site Maintenance – Replace locks if any found to be cut, fill-in burrows along the fence line, perform shop maintenance (e.g. mouse traps, check equipment)	Kevin Woodhouse	Quarterly
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kevin Woodhouse	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kevin Woodhouse Dan Knapp Tess Lydick	Quarterly
■ Quarterly Site Inspections	Kevin Woodhouse	Quarterly
■ Plan activities for the Five-Year Review Report	Andrew Davidson Kevin Woodhouse	April through September 2019
■ Topographic and site features survey	Kevin Woodhouse	July/ August 2019
■ Well casing modification on MW-59s	Kevin Woodhouse	July/ August 2019
■ Riparian area watering events	Kevin Woodhouse	August/ September 2019
■ Low-tide monitoring and transducer download (Task Order 72-18-6)	Kevin Woodhouse Dan Knapp Tess Lydick	September 2019

Site Activities / Miscellaneous Field Activities

- Clean storage building and perform maintenance as needed.
- Inspect herbicide application effectiveness on noxious weeds.

Deliverables

- No deliverables were submitted subsequent to the last site visit.

Budget Status: Hart Crowser will prepare a BAP to cover herbicide application, surveying work, and video scoping of the drainage system. Task 2 is currently overbudget as it includes costs for herbicide application. The overbudget costs will be covered by the forthcoming BAP.

Meeting Status:

Date / Time	TBD – October 2019
Location	McCormick & Baxter Facility

Photos:

Photo 1 –View of encampment along Willamette Cove shoreline

Photo 2 –View of fisherman fishing outside buoy boundary on Willamette River

Photo 3 –View of riparian area shoreline with gravel and ACB coverage.

Photo 4 –View of small erosional pocket between seam of TRM.

Photo 5 –View of new foliage on tree trunks charred by the August 2018 brush fire.

McCormick & Baxter Operational & Functional Determination Period Status Meeting Summary

Wednesday 10/16/2019
9:00 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kevin Woodhouse
Attendees:	Sarah Miller Kevin Woodhouse Andrew Davidson	Project Officer Site Manager Environmental Engineer	DEQ Hart Crowser GSI

Meeting Summary

Site Walk and Inspection

Attendees Sarah Miller, Kevin Woodhouse, and Andrew Davidson performed an inspection of the site from 0945 to approximately 1130 on October 16, 2019. Weather conditions during the inspection ranged from a light rain at the beginning of the inspection to heavy rain at the end.

Shoreline Inspection

The following items were inspected along the shoreline:
Shoreline:

- Willamette River and Willamette Cove shoreline conditions.
- Gravel overlay on ACB.
- Buoy locations.
- Stormwater discharge.
- Derelict boats
- Ebullition from sediment cap.
- Shoreline vegetation
- Fire damage along Willamette River shoreline in the riparian area.
- Debris and dumpsites

The Willamette River tides at the time of inspection (between 09:45 and 11:30) were at 2.81 COP (8.23 NAVD88) and 2.27 feet COP (7.37 NAVD88). Daily low and high tides were at 04:05 and 07:55 with a tide of approximately 0.95 feet COP (6.05 NAVD88) and 4.13 COP (9.23 NAVD88), respectively. The five buoys were visible and appeared to be in good condition and functional.

Three derelict boats were observed to be anchored in Willamette Cove. None appeared to be anchored on the ACB shoreline of Willamette cove. The tent observed along the Willamette Cover shoreline during the last quarterly inspection was no longer present. No trash, dump sites, or homeless encampments were observed.

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will continue to be monitored throughout the year. Patches of river rock were present along the lower edge of the shoreline along the riparian area. Some small erosional depressions were observed at seams along the TRM during the last site inspection. Along the northern edge of the TRM along the dirt path from the cap area to the shoreline, an erosional depression was observed beneath the edge of the TRM. The area was flagged by Sarah Miller as deep enough to warrant placement of additional material (See Photo 1 and 2).

No stormwater discharge was observed from the outfall during the site inspection. The outfall is in good condition. Vegetation is growing between the rock armoring near the outfall and may need to be pruned in the future. No change to the outfall armoring since the last inspection were observed. No repairs are planned and the armoring will be monitored during the rainy season for signs of additional scouring or erosion.

The site inspection occurred at a river stage where personnel were able to walk out onto the tidal mud flats. A large tire (approximately 4 feet in diameter (Photo 3) was observed along with small bits of trash deposited by the river.

No ebullition was observed from the organoclay layers in Willamette Cove or the Willamette River.

A brush fire in August 2018 burned approximately one acre in the riparian area. Groundcover in the area has recovered with grasses and some noxious weeds present. Larger trees and shrubs show signs of recovery with new leaf development. Charred limbs are still observable on brush and small trees.

Vegetation in the riparian area did not show signs of drought stress however a watering event was in the process of being coordinated when a series of precipitation events occurred in September eliminating the need for a watering event.

Upland Inspection

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin.
- Subsurface drainage (manholes) – Manhole SDMH-B
- Soil cap (burrows, erosion, etc.).
- EW-1s and MW-23d area of subsidence.
- Inspected gas vents

The site perimeter fence was intact. No cut locks were found and no animal burrows greater than 6 inches deep requiring filling were observed. A few plastic drums and a stack of plastic buckets are still present in the storage area.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

Gas vents G-1, G3, and G-4 were inspected as they were not inspected during the last site inspection as planned. None of the inspection personnel had a map with the exact location of the gas vents and they had to be located in the field. Personnel found gas vents gas vents G-3, G-4, and G-1 at which point heavy rain began to fall so the inspection was concluded. Photos of the gas vents are included as Photo 4 to 7 taken on August 21, 2019, are included to document that vault boxes had additional soil placed to stabilize the vault box (G-2 and G-3) or that the vault box was replaced entirely (G-1 and G-4). Site maps currently list two probes as G-3. Based on the apparent clockwise order the gas vents are labeled as G-1 in the NW corner, G-3 in both the NE and SE corner, and G-4 in the SW corner, it is concluded that the label for G-3 in the NE corner should be G-2 and will be revised accordingly.

Modifications to the PVC well casing on MW-59s were made on August 21, 2019 and were planned to be included during this site inspection. The well was not inspected due to concluding the inspection at the onset of heavy rain. Photos 8 through 11 documents before and after conditions of the well modification.

Action Items and Schedule:	Person Responsible	Deadline
■ Site Maintenance – Replace locks if any found to be cut, fill-in burrows along the fence line, perform shop maintenance (e.g. mouse traps, check equipment).	Kevin Woodhouse	Quarterly
■ Place material under TRM at northern end of riparian area.	Kevin Woodhouse	November 2019
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kevin Woodhouse	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kevin Woodhouse Dan Knapp Tess Lydick	Quarterly
■ Quarterly Site Inspections	Kevin Woodhouse	Quarterly
■ Plan activities for the Five-Year Review groundwater monitoring	Andrew Davidson Kevin Woodhouse	October 2019 through March 2020

Site Activities / Miscellaneous Field Activities Performed Since Last Inspection

- Site features and topographic survey performed between August 13 and 21, 2019, as part of subsidence monitoring program.
- Low-tide monitoring and transducer data download was performed on September 12, 2019.
- Backflow testing on water service performed on September 12, 2019.
- Completed video inspection of the storm sewer on October 4, 2019, as part of the subsidence monitoring program.
- The riparian area watering event scheduled for September 2019 was not performed as significant rainfall occurred during the month eliminating the need for the watering event.
- Maintain storage building and supplies.
- Inspect herbicide application effectiveness on noxious weeds and monitor for growth of noxious weeds.

Deliverables

- Hart Crowser prepared and submitted BAPs on September 19, 2019, to cover O&M and O&F activities from October 1, 2019, through March 31, 2019. Activities to be performed under the O&F task order will be initiated once funding from EPA is received.
- The hard copy DVD of the storm sewer inspection was mailed to the DEQ

Budget Status: Currently at or below anticipated budget**.**

Photos:

Photo 1: TRM at northern end of riparian area displaying signs of sagging.

Photo 2: View of depression under TRM where sand appears to have washed out from under the corner of the mat.

Photo 3: View of tidal mud flats at low tide during and the large, discarded tire that is present.

Photo 4: View of gas vent G-1.

Photo 5: View of gas vent G-2.

Photo 6: View of gas vent G-3.

Photo 7: View of gas vent G-4.

Photo 8: Well cap and casing for MW-59s protruding above the rim of the well box in the perimeter road.

Photo 9: MW-59s well casing after removal of 3 inches using a power drill attached internal PVC pipe cutter.

Photo 10: Well casing sitting below the rim of the well box after trimming.

Photo 11: Well lid sitting correctly in well box after trimming of MW-59s casing.

McCormick & Baxter Operational & Functional Determination Period Status Meeting Agenda

Wednesday 2/26/2020
9:00 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kevin Woodhouse
Attendees:	Sarah Miller Kevin Woodhouse Ben Johnson	Project Officer Site Manager Hydrogeologist	DEQ Hart Crowser GSI

Meeting Summary

Site Walk and Inspection

Site Inspection participants met at Cathedral Coffee at 09:00 to discuss site inspection items and site related items including:

- Achieving M&B dioxin cleanup goals for fall sediment sampling
- Discuss 5YR SAP and updates from DEQ/EPA meeting
- Sampler design: anchor points for buoy/line attachment
- Staffing for sediment sampling
- Discussion: Long term data evaluation and database needs, update O&M Plan/Manual
- Replacement barometric transducer to arrive Wednesday and will be replaced at the site
- Potential cleaning of the storage building onsite

The discussion ended at 10:00 and participants departed Cathedral Coffee to enter site. The site inspection ended at 12:00 and Sarah Miller departed site. Kevin performed lock maintenance until 12:40 with Ben staying onsite for H&S support (buddy system).

Shoreline Inspection

The following items were inspected along the shoreline:
Shoreline:

- Willamette River and Willamette Cove shoreline conditions
- Gravel overlay on ACB
- Buoy locations
- Stormwater discharge
- Derelict boats
- Ebullition from sediment cap
- Shoreline vegetation
- Fire damage along Willamette River shoreline in the riparian area
- Debris and dumpsites
- Shoreline conditions at proposed sediment sampling locations
- Measure ACB void width/length.

The Willamette River tides at the time of inspection (between 10:00 and 12:00) were at 2.88 COP (7.98 NAVD88) and 2.46 feet COP (7.56 NAVD88). Daily low and high tides were at 03:30 and 07:15 with a tide of approximately 1.41 feet COP (6.51 NAVD88) and 3.72 COP (8.82 NAVD88), respectively. The five buoys were visible and appeared to be in good condition and functional.

Multiple derelict boats were observed to be anchored in Willamette Cove (photograph 1). None appeared to be anchored on the ACB shoreline of Willamette cove. Several items of trash were observed along the shoreline but no homeless encampments were observed in this area.

In preparation for the fall sediment sampling, the dimensions of the void space in the ACB was measured to provide measurements for which the sediment samplers will fit into. Dimensions of the openings were 2.5 by 8 inches. Depth dimensions of the Willamette Cove ACB are ~5 inches and ~10 inches for ACB in the Riparian Area.

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will continue to be monitored throughout the year. Patches of river rock were present along the lower edge of the shoreline along the riparian area. Some small erosional depressions were observed at seams along the TRM during the last site inspection. Along the northern edge of the TRM along the dirt path from the cap area to the shoreline, an erosional depression was observed beneath the edge of the TRM during the October 2019 inspection. No change in the depression was observed during this inspection and it was agreed between DEQ and Hart Crowser that the repairs would be performed in the springtime during a period of dry weather.

Stormwater discharge was observed from the outfall during the site inspection at a consistent flow estimated to be between 5-10 gpm. The outfall is in good condition. No change to the outfall armoring was observed since the last inspection. No repairs are planned and the armoring will continue to be monitored during the rainy season for signs of additional scouring or erosion.

No ebullition was observed from the organoclay layers in Willamette Cove or the Willamette River.

A homeless encampment (photograph 3) was observed along the shoreline in the riparian area with three tents present. No activities are currently planned within the next month for the site, but personnel will look for the presence of the encampment during the next visit to the site. If the encampment is active, Hart Crowser will initiate removal activities with law enforcement assistance. If the encampment is abandoned, Hart Crowser will initiate trash removal activities.

Other debris items (e.g. an empty 55-gallon drum [photograph 4]) were observed along the shoreline in the vicinity of the homeless encampment. The remainder of the shoreline had minor amounts of trash and varying amounts of driftwood (photograph 5).

A brush fire in August 2018 burned approximately one acre in the riparian area. Groundcover in the area has recovered with grasses and some noxious weeds present (background of photograph 5). Charred limbs are still observable on brush and small trees.

Upland Inspection

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin
- Subsurface drainage – Manholes and drainage
- Soil cap integrity (burrows, erosion, etc.)
- EW-1s and MW-23d area of subsidence
- Shrubs and trees to be removed
- Presence of crawfish traps in storage building

The site perimeter fence was intact, however no lock was observed on the gate in the northern corner of the site. A chain and replacement lock were put on the gate to secure it. Hart Crowser personnel attempted to change the combination on locks during a previous O&M visit however only the combination locks to the paved parking/storage area were able to be changed due to needing lock reset keys to change the lock combinations. The remaining gate locks were changed to the new site combination

The drainage basin was functioning properly during the site inspection and no standing water was observed in the basin (photograph 6).

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

A gaggle of geese was observed on the earthen cap portion of the upland area and a murder of crows was observed on the impermeable cap portion of the upland area. Foraging activities from the crows gave the surface/ vegetative cover of the cap a tilled-like appearance (photograph 7).

The closed and properly fitting well box lid for MW-59s was observed. DEQ did not observe the well box after well casing trimming in August 2019 because the October 2019 inspection ended due to heavy rain before the well was observed.

No crawfish traps were observed in the storage building.

Several volunteer madrones were observed growing along the perimeter fence between the upland and riparian areas and in the immediate vicinity of wells.

Action Items and Schedule:	**Person Responsible**	**Deadline**
■ Check storage building for supplies that can be used during the Five-Year Review sampling	Kevin Woodhouse Sarah Miller Ben Johnson	February 2020
■ Site Maintenance – Replace locks if any found to be cut, fill-in burrows along the fence line, perform shop maintenance (e.g. mouse traps, check equipment).	Kevin Woodhouse	Quarterly
■ Prepare BAP/TO for both Soil/Sediment OUs and GW OU ■ Place material under TRM at northern end of riparian area.	Kevin Woodhouse	May 2020
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kevin Woodhouse	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kevin Woodhouse	Quarterly
■ Quarterly Site Inspections	Kevin Woodhouse	Quarterly
■ Plan activities for the Five-Year Review sampling activities.	Andrew Davidson Ben Johnson Kevin Woodhouse	Through March 2020

Site Activities / Miscellaneous Field Activities Performed Since Last Inspection

■ Cleaning of the storage container was performed on January 22, 2020 to free up space for silt curtain storage to be brought in from offsite. Most items were cleaned from the storage container with the exception of a few chemicals in the flammable storage cabinet that will need to be disposed of as hazardous waste.

Deliverables

■ The revised "Technical Memorandum – Subsidence Monitoring and Evaluation" was submitted on January 21, 2020.

Budget Status: Currently within the anticipated budget**.**

Photos:

Photograph 1: Derelict boats anchored in Willamette Cove.

Photograph 2: Trash and debris items observed along the shoreline in Willamette Cove.

Photograph 3: Homeless encampment along the riparian area shoreline at the upper edge of the ACB.

Photograph 4: Debris (empty 55-gallon drum) present along the riparian area shoreline.

Photograph 5: Driftwood present on the shoreline of the Riparian Area.

Photograph 6: View of the infiltration pond and drainage swale. No standing water present.

Photograph 7: Impermeable cap surface vegetation following crow foraging activities.

Photograph 8: Volunteer madrone tree growing along fence-line that needs to be removed.

McCormick & Baxter Operational & Functional Determination Period Status Meeting Summary

Monday 7/6/2020, 08:30
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kevin Woodhouse
Attendees:	Sarah Miller Kevin Woodhouse Andrew Davidson Trang Lam	Project Officer Site Manager Hydrogeologist Adjacent Property Representative	DEQ Hart Crowser GSI University of Portland

Meeting Summary

Site Walk and Inspection

The second quarter 2020 meeting was delayed until the first week of July due to limitations from State orders related to COVID-19.

Site Inspection participants met at the storage building onsite at 08:30 to perform the site inspection items and site related items including:

- Site access issues and plan for access during Five-Year Sampling
- Contracting status for Texas Tech University
- Discuss Five-Year Review SAP updates and any outstanding planning items for sampling event
- Discuss sediment porewater and crayfish sampling logistics
- Site maintenance needs

Shoreline Inspection

The following items were inspected along the shoreline:
Shoreline:

- Willamette River and Willamette Cove shoreline conditions
- Gravel overlay on ACB
- Buoy locations
- Stormwater discharge
- Derelict boats
- Ebullition from sediment cap
- Shoreline vegetation
- Debris and dumpsites
- Shoreline conditions at proposed sediment sampling locations

The Willamette River tides at the time of inspection (between 08:30 and 10:30) were at 4.07 COP (9.17 NAVD88) and 3.52 feet COP (8.62 NAVD88). Daily low tide was at 16:55 with heights of 6.92 feet NAVD88 and 1.82 feet COP. Daily high tide was at 06:45 with heights of 9.69 feet NAVD88 and 4.59 feet COP. The five buoys were visible and appeared to be in good condition and functional.

Multiple boats (some presumed derelict) were observed to be anchored in Willamette Cove. None appeared to be anchored on the ACB shoreline of Willamette cove. Several items of trash were observed along the shoreline and a portion of a floating dock was present (Photograph 1).

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will continue to be monitored throughout the year. Patches of river rock were present along the lower edge of the shoreline along the riparian area.

Stormwater discharge was not observed from the outfall during the site inspection. The outfall is in good condition. No change to the outfall armoring was observed since the last inspection. No repairs are planned and the armoring will continue to be monitored during the rainy season for signs of additional scouring or erosion.

No ebullition was observed from the organoclay layers in Willamette Cove or the Willamette River.

A homeless encampment observed during the previous inspection was still present along the shoreline in the riparian area with two tents present. The encampment now appears derelict and abandoned. DEQ and Hart Crowser will check with Metro to initiate removal activities. Other new trash piles (Photograph 2) were observed along the shoreline.

A pedestrian was observed to be actively camping on the shoreline at the southern end of the site and had a smoldering fire going. We doused the fire and requested the pedestrian to abstain from further campfires due to the fire hazard at the site (Photograph 3).

Upland Inspection

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin
- Subsurface drainage – Manholes and drainage
- Soil cap integrity (burrows, erosion, etc.)
- EW-1s and MW-23d area of subsidence

The site perimeter fence was intact and all locks and chains were present and working condition.

The drainage basin was functioning properly during the site inspection and no standing water was observed in the basin.

The soil cap was in good condition and no burrows or disturbances were observed (Photograph 4).

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

A coyote was observed in the distance along the fence line, it was unclear if the coyote was inside or outside of the site due to the range.

Two small trash piles were observed along the exterior of the perimeter fence (one shown in Photograph 5).

Action Items and Schedule:	**Person Responsible**	**Deadline**
■ Site Maintenance – Replace locks if any found to be cut, fill-in burrows along the fence line, perform shop maintenance (e.g. mouse traps, check equipment).	Kevin Woodhouse	Quarterly
■ Prepare BAP/TO for both Soil/Sediment OUs and GW OU	Kevin Woodhouse	Fall/Winter 2020

■ Place material under TRM at northern end of riparian area.	Kevin Woodhouse	Fall 2020
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kevin Woodhouse	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kevin Woodhouse	Quarterly
■ Quarterly Site Inspections	Kevin Woodhouse	Quarterly
■ Coordinate and implement Five-Year Review sampling activities.	Kevin Woodhouse Ben Johnson	August through September 2020
■ Low tide monitoring	Kevin Woodhouse	October 2020

Site Activities / Miscellaneous Field Activities Performed Since Last Inspection

- No site visits or maintenance activities were performed since the last meeting due to COVID-19 restrictions.

Deliverables

- The draft 2019 Annual O&M Report was submitted on June 9, 2020.

Budget Status: Currently within the anticipated budget**.**

Photos:

Photograph 1: Section of floating dock washed up along Willamette Cove shoreline.

Photograph 2: Trash on Willamette River riverbank at base of access road down do shoreline.

Photograph 3: Pedestrian camping on shoreline on southern end of the site.

Photograph 4: Soil cap conditions and current vegetation state.

Photograph 5: Trash dumped along exterior of perimeter fence.

McCormick & Baxter Operational & Functional Determination Period Status Meeting Summary

Wednesday 9/30/2020
08:30 A.M.
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kevin Woodhouse
Attendees:	Sarah Miller Kevin Woodhouse Ben Johnson	Project Officer Site Manager Hydrogeologist	DEQ Hart Crowser GSI

Meeting Summary

Site Walk and Inspection

Site Inspection participants met onsite at 08:30 at the paved parking area to discuss site inspection items and site related items including:

- Ongoing sediment porewater sampler (PSD) retrieval and crayfish sampling for the Five-Year Review
- Upcoming task order amendment for O&F work
- Task order amendment needed for O&M work
- Boom from Willamette Cove drifting into and pulling warning buoy #4. NRC (GSI subcontractor) scheduled to adjust boom anchoring later today.
- Cleanup services for abandoned transient encampment along shoreline.

The site inspection concluded at 10:30.

Shoreline Inspection

The following items were inspected along the shoreline:
Shoreline:

- Willamette River and Willamette Cove shoreline conditions
- Gravel overlay on ACB
- Buoy locations
- Stormwater discharge
- Ebullition from sediment cap
- Shoreline vegetation
- Fire damage along Willamette River shoreline in the riparian area
- Debris and dumpsites

The Willamette River tides at the time of inspection (between 08:30 and 10:30) were at 3.09 COP (8.19 NAVD88) and 2.43 feet COP (7.53 NAVD88). Daily low and high tides were at 13:55 and 05:10 with a tide of approximately 1.32 feet COP (6.42 NAVD88) and 4.86 COP (9.96 NAVD88), respectively. The five buoys were visible and four of the buoys were in good condition and functional. The boom around Willamette Cove drifted into buoy #4. To prevent the boom from potentially dragging the buoy and dislodging its anchor, GSI scheduled NRC to fix the boom's anchor. The anchor line for the boom also became entangled with the buoy line for the PSD sampler at Station G and caused it to break in half. The PSD ended up being useable but the damage and cause will be noted. It was also noted that the markings on some of the buoys are starting to appear faded. Hart Crowser will look into repainting options for the buoys and this maintenance may be performed at a later date.

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will continue to be monitored throughout the year. Patches of river rock were present along the lower edge of the shoreline along the riparian area. An erosional depression along the northern edge of the TRM and the dirt path from the cap area to the shoreline during the October 2019 inspection. No change in the

depression was observed during this inspection. The depression was slated for filling in during the summer and will be performed on 10/6 during maintenance activities.

The eastern most edge of the ACB armoring was observed to be buckling/sagging. The suspected cause of the buckling is lack of support from the sand beneath the edge. Repair activities will be scheduled to place more consolidated base rock beneath the ACB edge and to grout the edge pieces in place.

No stormwater discharge was observed from the outfall during the site. The outfall is in good condition. No change to the outfall armoring was observed since the last inspection. No repairs are planned and the armoring will continue to be monitored during the rainy season for signs of scouring or erosion.

No ebullition was observed from the organoclay layers in Willamette Cove or the Willamette River. Danny Rieble (Texas Tech University) and his team noted ebullition from the Willamette cove shoreline during PSD retrieval on 9/28/2020.

An abandoned transient encampment that has been present since the first quarter inspection remains at the top of the ACB along the Willamette River shoreline (Photos 2 and 3). Metro is unable to provide cleanup assistance so Hart Crowser will look into costs and include in the upcoming BAP for the O&M project.

Small items of trash or debris were observed along the shoreline.

A brush fire in August 2018 burned approximately one acre in the riparian area. Some charred limbs are still observable on brush and small trees however the area has otherwise fully recovered from the fire.

Upland Inspection

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin
- Subsurface drainage – Manholes and drainage
- Soil cap integrity (burrows, erosion, etc.)
- EW-1s and MW-23d area of subsidence
- Shrubs and trees to be removed
- Presence of crawfish traps in storage building

The site perimeter fence was intact, however the lock to the main entrance gate was found cut (photo 4). When attempting to open the gate, Hart Crowser found that the lock cutting efforts had bent the metal lock tab that allows the lock to secure the gate. Hart Crowser used a hammer to try and bend the tab back into place but was unsuccessful. Additional effort and a replacement lock will be brought on 10/6 during maintenance activities.

The drainage basin was functioning properly during the site inspection and no standing water was observed in the basin.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

Burrows under the fence gates were observed in two locations (photo 5). The burrows will be filled in during maintenance activities scheduled for 10/6.

A count of the number of volunteer trees growing along or through the perimeter fence was performed. A total of 46 trees predominantly in a range of 5-10 feet tall were counted and will be included as an activity in the vegetation maintenance request for bids to be prepared by Hart Crowser.

A site warning sign was found broken a short distance north of the Van Houton gate entrance (photo 5). Additional tools (power auger) are needed to reset sign-post and repair sign and will be scheduled for an upcoming day.

Action Items and Schedule:	Person Responsible	Deadline
■ Site Maintenance – Replace locks if any found to be cut, fill-in burrows along the fence line, perform shop maintenance (e.g. mouse traps, check equipment).	Kevin Woodhouse	Quarterly
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kevin Woodhouse	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kevin Woodhouse	Quarterly
■ Quarterly Site Inspections	Kevin Woodhouse	Quarterly
■ Low-tide monitoring, transducer data download, and MW-59s sampling	Kevin Woodhouse Dan Knapp Rodrigo Prugue	October 6, 2020
■ Maintenance Activities: Place material under TRM at northern end of riparian area and fill in burrows, fix gate and replace lock.	Kevin Woodhouse Dan Knapp Rodrigo Prugue	October 6, 2020
■ Maintenance to fix broken sign	Kevin Woodhouse Dan Knapp	Fall 2020
■ Five-Year Review data review and reporting.	Kevin Woodhouse Ben Johnson	Summer 2021

Site Activities / Miscellaneous Field Activities Performed Since Last Inspection

- Vegetation assessment performed on August 5, 2020.
- Deployment of sediment porewater samplers (PSDs) performed between August 24 through 27, 2020. Crayfish sampling was performed between August 26 through 28, 2020. Crayfish successfully collected from Station 2 (collocated with PSD station C) only.
- Retrieval of PSDS and crayfish sampling began on September 28, 2020 and is ongoing.
- Water service backflow preventer service testing performed on September 28, 2020. Backflow preventer passed.

Deliverables

- The Final 2019 O&M Annual Report was submitted to DEQ on July 22, 2020.

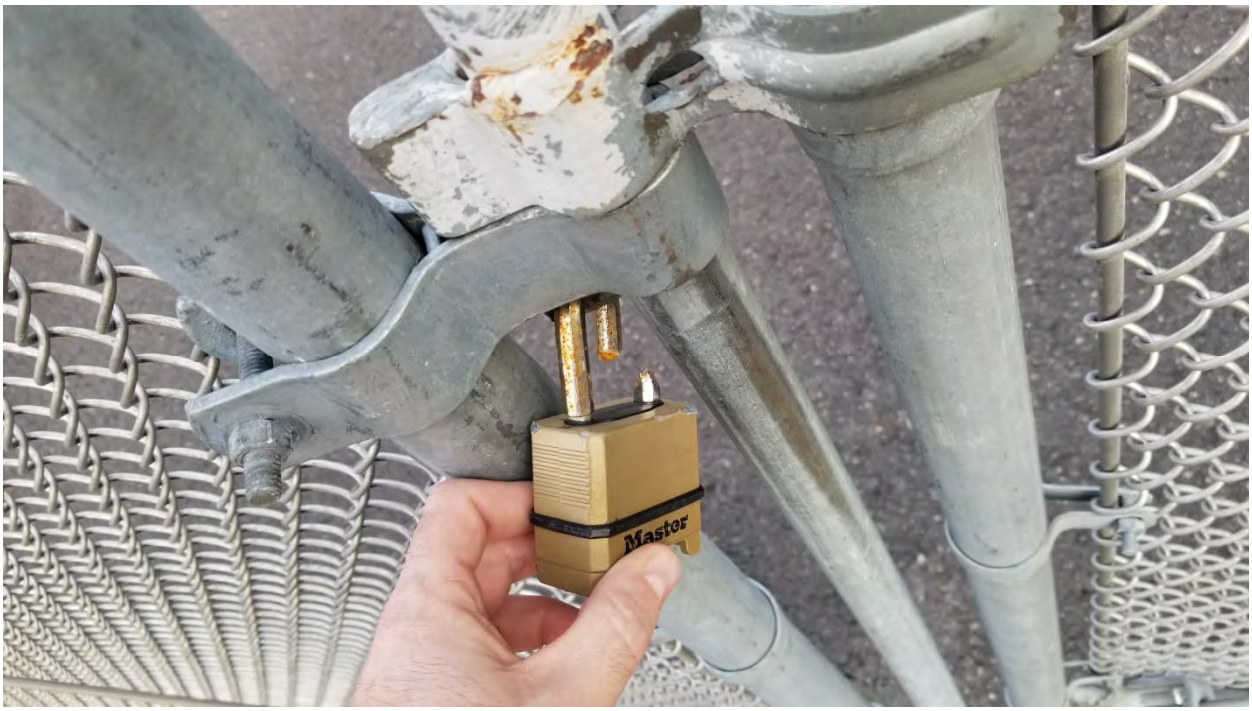
Budget Status: Currently within the anticipated budget**.**

Photos:

Photograph 1: Buckling and sagging of the ACB border on the eastern edge of the Willamette Cove ACB.

Photograph 2: Abandoned transient camp along shoreline of Willamette River.

Photograph 3: Abandoned transient camp along shoreline of Willamette River.

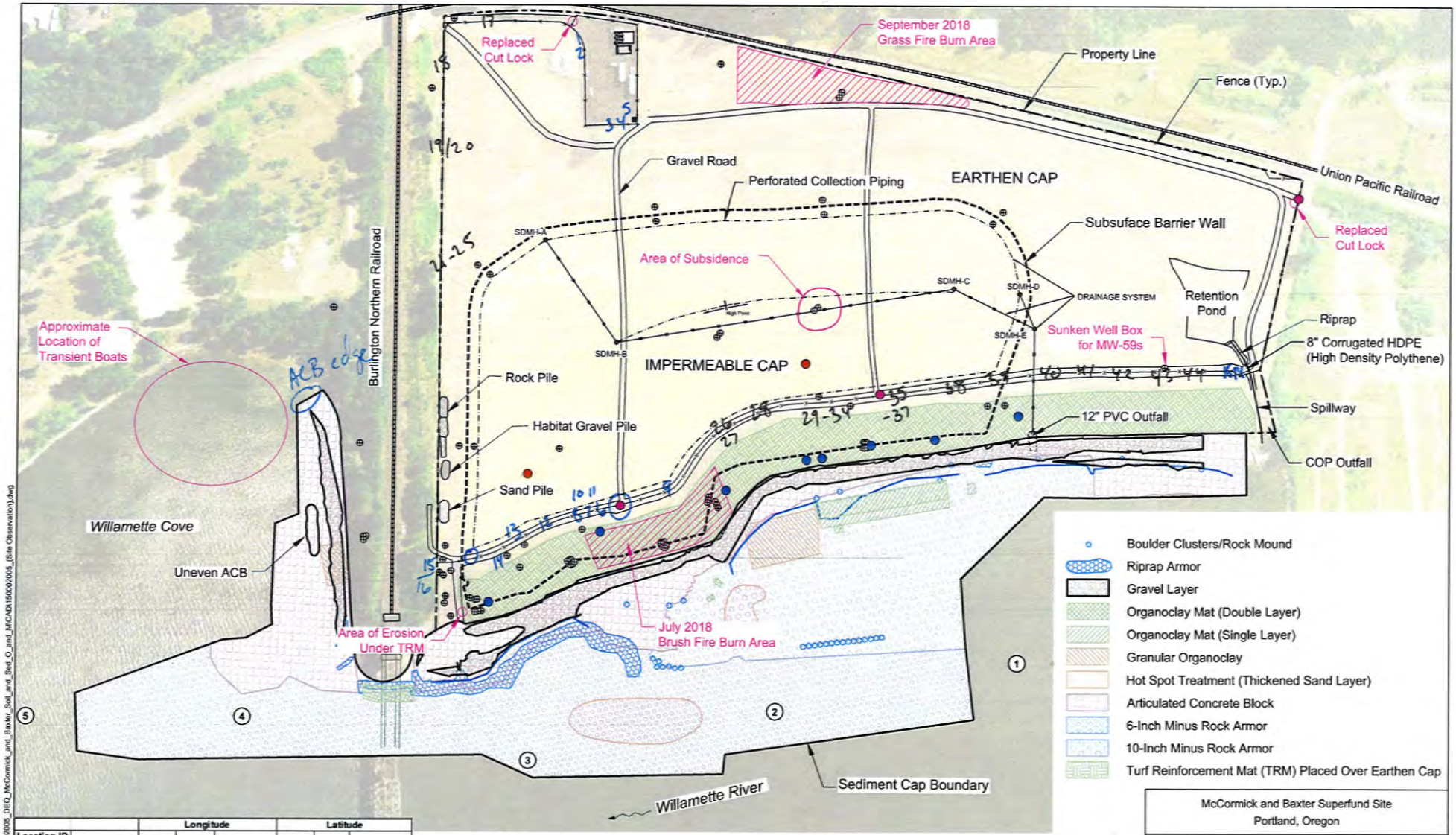


Photograph 4: Lock on main gate entrance found cut and metal tab bent so that gate can't open.

Photograph 5: Burrow underneath fence gate along southwest perimeter of site.

Photograph 6: Downed warning sign between gravel road and perimeter fence along railroad tracks.

39 = 12-18" base



Location ID Figure 2.5	Buoy Label	Longitude Degree	Longitude Minute	Longitude Second	Latitude Degree	Latitude Minute	Latitude Second
1	Danger Rocks	-122	44	27.9115188	45	34	33.7505887
2	Danger Rocks	-122	44	34.6730244	45	34	36.3603940
3	Danger Rocks	-122	44	41.5979124	45	34	39.0343156
4	Danger Rocks	-122	44	47.5345212	45	34	43.8265931
5	Danger Rocks	-122	44	53.2295880	45	34	47.1865397

Coordinate projection: GCS_North_American_1983

\\pdxservdata\Notebooks\150002005_DEQ_McCormick_and_Baxter_Soil_and_Sed_O_and_M\CADA\150002005_(Site Observation).dwg

McCormick & Baxter Operational & Functional Determination Period Status Meeting Summary

Thursday 12/17/2020, 09:00
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kevin Woodhouse
Attendees:	Sarah Miller Kevin Woodhouse Ben Johnson	Project Officer Site Manager Hydrogeologist	DEQ Hart Crowser GSI

Meeting Summary

Site Walk and Inspection

Site Inspection participants met onsite at 09:00 at the paved parking and storage building area to discuss site inspection items including:

- Fence repair and debris removal activities
- Transducer replacement
- Five-Year review data reporting and timeline
- Maintenance items performed on 12/9/20
- Site maintenance needs

The site inspection concluded at approximately 11:30.

Shoreline Inspection

The following items were inspected along the shoreline:
Shoreline:

- Willamette River and Willamette Cove shoreline conditions
- ACB condition
- Gravel overlay on ACB
- Buoy locations
- Stormwater discharge
- Ebullition from sediment cap
- Shoreline vegetation
- Debris and dumpsites

The Willamette River tides at the time of inspection (between 09:00 and 11:30) were at 8.28 feet NAVD88 (3.18 feet COP) and 7.49 feet NAVD88 (2.39 feet COP), respectively. The daily high tide was at 07:55 with elevations of 8.63 feet NAVD88 and 3.53 feet COP. The daily low tide was at 15:10 with elevations of 6.67 feet NAVD88 and 1.57 feet COP. Shoreline conditions are shown in Photograph 1.

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will continue to be monitored throughout the year. Patches of river rock were present along the lower edge of the shoreline along the riparian area.

The repair to the erosional depression under the TRM is functioning and will be monitored for the next few inspections for signs of additional erosion.

The eastern most edge of the ACB armoring was observed to be buckling/sagging during the last inspection. Repairs were made to place more material under individual blocks and then they were concreted in place. The repair is functioning and will be monitored over the next few inspections to verify that the repair is holding.

Stormwater discharge (Photograph 2) was occurring from the outfall at an estimated 5-10 gallons per minute. The outfall is in good condition. No change to the outfall armoring was observed since the last inspection. No repairs are planned and the armoring will continue to be monitored during the rainy season for signs of scouring or erosion.

No ebullition was observed from the organoclay layers in Willamette Cove or the Willamette River.

The abandoned transient encampment that has been present since the first quarter inspection remains at the top of the ACB along the Willamette River shoreline. Metro is unable to provide cleanup assistance so Hart Crowser is including trash and debris removal costs for inclusion in the BAP being prepared and will begin preparing an RFB for those services. Small items of trash or debris were also observed along the shoreline.

A small burrow was observed at the top of the ACB and TRM. The burrow will be filled during the next maintenance activity event.

An abandoned boat (Photograph 4) was beached along the shoreline and tied up to a driftwood trunk in the vicinity of the stormwater outfall. Sarah Miller will inquire within DEQ on what procedures are needed for removal of the abandoned boat.

Upland Inspection

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin
- Subsurface drainage – Manholes and drainage
- Soil cap integrity (burrows, erosion, etc.)
- EW-1s and MW-23d area of subsidence

The site perimeter fence was cut in four places, three spots in the northern fence and one spot in the western fence. Budget for fence repair activities will be included in the BAP being prepared and solicitation/subcontracting will be performed after the task order amendment has been issued. All locks and chains on site gates were intact after replacement of cut locks was performed on 12/9/20.

The drainage basin was functioning properly during the site inspection and no standing water was observed in the basin.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

A burrow under the fence on the eastern side of the site was observed. The burrow was previously filled but coyotes are re-digging the same spot to gain access to the site. During the next maintenance event, the spot will be filled with aggregate base and tamped to pack it down and prevent further digging.

The down sign-posts identified during the previous site inspection were replaced during maintenance activities performed on 12/9/20. The signs on the posts were very weathered, no longer legible, and unable to be reused. Hart Crowser is in the process of having replacement signs made and will attach them once completed.

Action Items and Schedule:	**Person Responsible**	**Deadline**
■ Site Maintenance – Replace locks if any found to be cut, fill-in burrows along the fence line, perform shop maintenance (e.g. mouse traps, check equipment).	Kevin Woodhouse	Quarterly

■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kevin Woodhouse	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kevin Woodhouse	Quarterly
■ Quarterly Site Inspections	Kevin Woodhouse	Quarterly
■ Maintenance Activities: Replacement of weathered signs on replaced sign-posts	Kevin Woodhouse Ryan Lewis	January 2021
■ Trash and debris removal, tree removal, and fence repair	Kevin Woodhouse	January or February 2021
■ Low-tide monitoring and transducer data download,	Kevin Woodhouse Tess Lydick Rodrigo Prugue	June 2021
■ Five-Year Review data review and reporting.	Kevin Woodhouse Ben Johnson	Summer 2021

Site Activities / Miscellaneous Field Activities Performed Since Last Inspection

- Maintenance activities were performed on 12/9/20 and included concreting the gap along the ACB edge in Willamette cove where buckling was observed, filling in the erosional depression under the northern edge of the TRM mat alongside the access road down to the shoreline, replacing two fallen over sign posts, filling in ruts greater than 6 inches along the perimeter fence, and replacing cut chains and locks.

Deliverables

- None submitted

Budget Status: Currently within the anticipated budget**.** A BAP is in the process of being prepared and will be submitted in the next week.

Photos:

Photograph 1: Shoreline conditions with abandoned transient camp still present (visible in background).

Photograph 2: Stormwater outfall discharge at an estimated 5-10 gallons per minute.

Photograph 3: Abandoned transient camp along shoreline of Willamette River.

Photograph 4: Abandoned boat on the shoreline of the Willamette River.

McCormick & Baxter Operational & Functional Determination Period Status Meeting Summary

Monday, 3/8/2021, 13:30
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kevin Woodhouse
Attendees:	Sarah Miller Kevin Woodhouse Ben Johnson	Project Officer Site Manager Hydrogeologist	DEQ Hart Crowser GSI

Meeting Summary

Site Walk and Inspection

Site inspection participants met onsite at 13:55 at the paved parking and storage building area at the site. Participants attempted to enter at the N. Van Houton gate but it was blocked by a train across the tracks. Participants were able to enter from the N. Edgwater gate as the train did not extend that far along the tracks. Once onsite the following items were discussed.

- Fence repair and tree removal activities
- Transducer replacement in MW-37s and MW-44d
- Five-Year review data reporting and timeline
- Maintenance items performed on 1/22/21 and trash removal performed on 1/28/21
- Site maintenance needs, including upcoming tree removal for the third week of March 2021
- Upcoming BAP, DEQ would like technical assistance from Hart Crowser during the PPA process

The site inspection concluded at 15:25. Kevin Woodhouse stayed onsite until 16:00 replacing transducers for wells MW-37s and MW-44d. Kevin left the site at 16:00 to purchase a replacement lock and returned at 16:25 to secure the gate before finishing at the site.

Shoreline Inspection

The following items were inspected along the shoreline:
Shoreline:

- Willamette River and Willamette Cove shoreline conditions
- ACB condition
- Gravel overlay on ACB
- Buoy locations
- Stormwater discharge
- Ebullition from sediment cap
- Shoreline vegetation
- Debris and dumpsites

The Willamette River tides at the time of inspection (between 13:55 and 15:25) were at 9.05 feet NAVD88 (3.95 feet COP) and 8.43 feet NAVD88 (3.33 feet COP), respectively. The daily high tide was at 13:10 with elevations of 9.24 feet NAVD88 and 4.14 feet COP. The daily low tide was at 22:50 with elevations of 6.32 feet NAVD88 and 1.22 feet COP.

A lot of wood debris (trunks, branches, and small sticks) was deposited on the Willamette River shoreline after the recent rains in January and February 2021. Shoreline conditions are shown in Photographs 1 and 2. Trash and debris was removed from the Willamette River shoreline and the riparian area in January 2020, however small trash items have been washed up and deposited on the shoreline.

The September 2017 shoreline ACB repairs continue to appear to be in good condition and will continue to be monitored throughout the year. Patches of river rock were present along the lower edge of the shoreline along the riparian area.

The repair to the erosional depression under the TRM is functioning and will be monitored for the next few inspections for signs of additional erosion. No changes were observed to the repair since the fourth quarter 2020 site inspection.

The eastern most edge of the ACB armoring was observed to be buckling/sagging during the third quarter 2020 inspection. Repairs were made in December 2020. The repair is functioning and will be monitored over the next few inspections to verify that the repair is holding.

Stormwater discharge (Photograph 3) was occurring from the outfall at an estimated 5-8 gallons per minute. The outfall is in good condition. No change to the outfall armoring was observed since the last inspection. No repairs are planned and the armoring will continue to be monitored during the rainy season for signs of scouring or erosion.

Sporadic, light ebullition was observed from the organoclay layers in Willamette Cove. No ebullition was observed from organoclay layers in the Willamette River.

The abandoned vessel that was identified during the previous inspection was still present along the shoreline during the inspection (Photograph 4).

Buoys 1, 3 and 4 were not visible during the time of inspection. It is unlikely that they were incidentally moved and based on the partially submerged view of Buoy 5, it is believed that the buoys not visible are submerged since the inspection took place during a high tide. The presence of the buoys will be observed during the next event where personnel are onsite and closer to a low tide to verify if they are submerged or missing.

Upland Inspection

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin
- Subsurface drainage – Manholes and drainage
- Soil cap integrity (burrows, erosion, etc.)
- EW-1s and MW-23d area of subsidence

The lock on the main gate was found cut upon arrival (Photograph 5) and the gates were open. No evidence of theft or entry into the storage building was observed. Following the conclusion of the inspection, Kevin Woodhouse purchased a replacement lock and secured the gate before departing the site.

The impermeable cap and soil cap were in good condition. The ground surface (top 1-2 inches of soil) in the northern portion of the cap showed more signs of bird foraging than the southern portion of the site, though no wildlife was observed on the cap during the inspection.

The drainage basin was functioning properly during the site inspection and no standing water was observed in the basin.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

The down sign-posts identified during the previous site inspection were replaced during maintenance activities performed on 12/9/20 with the signs replaced on 1/22/21. The completed sign posts were observed by DEQ and functioning as designed (Photograph 6).

Action Items and Schedule:	Person Responsible	Deadline
■ Site Maintenance – Replace locks if any found to be cut, fill-in burrows along the fence line, perform shop maintenance (e.g. mouse traps, check equipment).	Kevin Woodhouse	Quarterly
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kevin Woodhouse	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kevin Woodhouse	Quarterly
■ Quarterly Site Inspections	Kevin Woodhouse	Quarterly
■ Maintenance Activities	Kevin Woodhouse	As needed
■ Tree removal and blackberry vine removal	Kevin Woodhouse	March 2021
■ Fence Repair	Kevin Woodhouse	Spring 2021
■ Low-tide monitoring and transducer data download,	Kevin Woodhouse Tess Lydick Rodrigo Prugue	June 2021
■ Five-Year Review data review and reporting.	Kevin Woodhouse Ben Johnson	Summer 2021

Site Activities / Miscellaneous Field Activities Performed Since Last Inspection

- Finished replacement of signs on sign-posts on 1/22/21.
- Performed trash and debris removal with Rapid Response Bio-Clean on 2/22/21.

Deliverables

- None submitted

Budget Status: Currently within the anticipated budget**.** A BAP is in the process of being prepared for additional data management framework development effort (Task 7), removal of the abandoned vessel (Task 2), and technical assistance (Task 4).

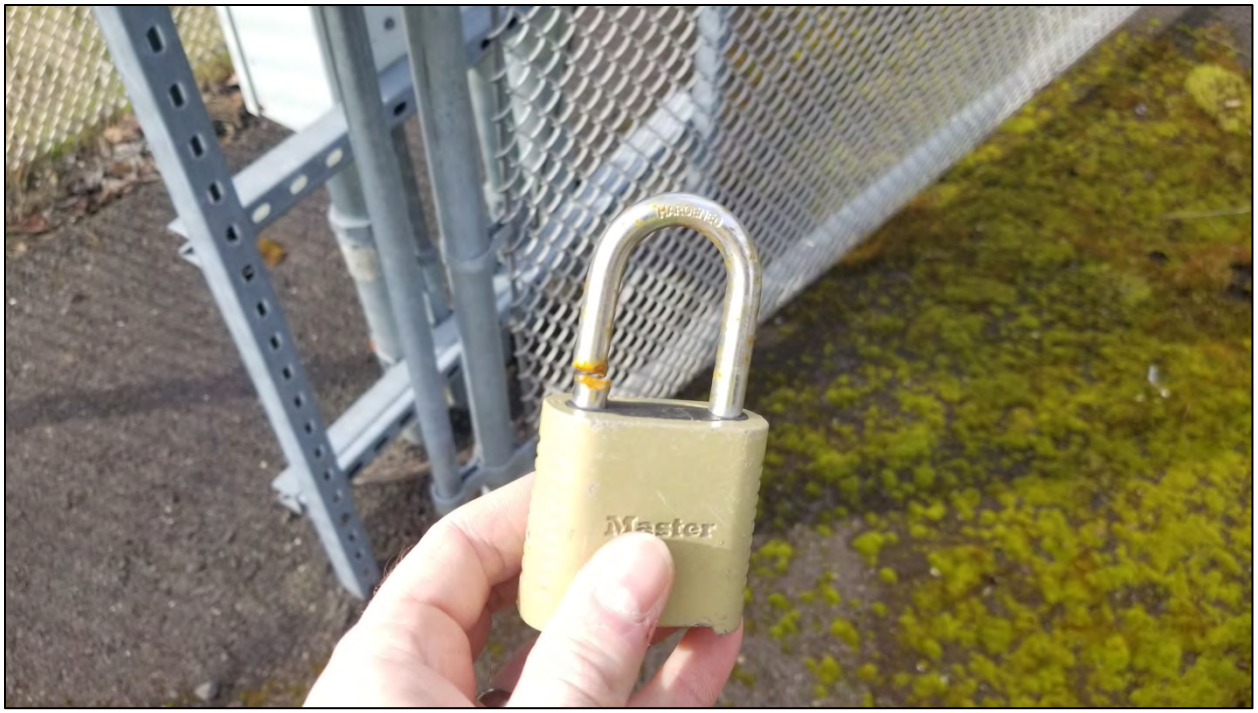
Photos:

Photograph 1: Large tree trunk that washed up on shore at Willamette Cove and Willamette River shoreline junction beneath Burlington Northern Railroad lines. View facing northeast.

Photograph 2: Willamette River shoreline with lots of wood debris deposited on it. View facing southeast.

Photograph 3: Stormwater outfall with approximately 5-8 gpm of flow. View facing southeast.

Photograph 4: Abandoned vessel on the shoreline of the Willamette River is still present. View facing west.



Photograph 5: Lock cut on the main gated entrance from N. Edgewater Avenue.

Photograph 6: Replaced sign and sign post by eastern perimeter fence. View facing west.

McCormick & Baxter Operational & Functional Determination Period Status Meeting Summary

Monday, 5/20/2021, 09:00
6900 N. Edgewater Street
Portland, OR 97203

Meeting called by:	Oregon Department of Environmental Quality (DEQ)	Type of Meeting:	Quarterly Progress Meeting
Facilitator:	Sarah Miller	Note Taker:	Kevin Woodhouse
Attendees:	Sarah Miller	Project Officer	DEQ
	Kevin Woodhouse	Site Manager	Hart Crowser
	Ben Johnson	Hydrogeologist	GSI
	Annie Christopher	Project Team	EPA
Site Visitors:	Hunter Young	Visitor	EPA
	CDM-Smith representative	Visitor	CDM-Smith

Meeting Summary

Site Walk and Inspection

Site inspection participants met onsite at 09:00 at the paved parking and storage building area at the site. Also meeting onsite were Hunter Young (EPA) and a CDM-Smith representative to look at storage building facility and river access to evaluate if EPA can use the site as a processing facility for upcoming sediment coring work. Attendees showed visitors the facilities and visitors departed between approximately 09:45 and 10:00. After visitor departure, attendees began inspection of site

Once onsite the following items were discussed.

- Fence repair and tree removal activities
- Transducer replacement in MW-37s and MW-44d
- Annual report
- Five-Year review data reporting and timeline
- Maintenance items performed on since last inspection
- Technical assistance needs from DEQ under Task 4

The site inspection concluded at 11:30 and Ben Johnson and Kevin Woodhouse departed the site at 11:45. Sarah Miller and Annie Christopher stayed onsite longer to discuss additional details regarding the prospective purchaser agreement for the site.

Shoreline Inspection

The following items were inspected along the shoreline:
Shoreline:

- Willamette River and Willamette Cove shoreline conditions
- ACB condition
- Gravel overlay on ACB
- Buoy locations
- Stormwater discharge
- Ebullition from sediment cap
- Shoreline vegetation
- Trash and debris
- Derelict vessel

The Willamette River tides at the time of inspection (between 09:00 and 11:30) were at 9.38 feet NAVD88 (4.28 feet COP) and 9.93 feet NAVD88 (4.83 feet COP), respectively. The daily high tide was

at 12:50 with elevations of 10.10 feet NAVD88 and 5.00 feet COP. The daily low tide coincided with the river level at the start of the inspection at 09:00.

Abundant amounts of wood debris (trunks, branches, and small sticks) are present on the shoreline following the winter high river levels (photograph 1 and 2). Minor amounts of washed up or pedestrian deposited trash are present along the shoreline.

Shoreline repairs to ACB voids completed in 2017 and 2020 continue to be in good condition and functioning as intended. The ACB will continue to be monitored during quarterly inspections. Patches of river rock were present along the waterline along the riparian area while sand was present in other patches.

The repair to the erosional depression under the TRM continues to function. The repair will be monitored for one more quarter, after which it will be determined stabilized and specific monitoring will not be needed unless additional erosion is observed.

Several seams of the TRM were loose in the middle section of the Willamette River shoreline and several tears/rips were present from snags by woody debris (photograph 3). Replacement of TRM sections and securing of the loose seams will be performed during the next O&M visit.

Stormwater discharge was occurring from the outfall at an estimated 1 gallon per minute or less. The outfall is in good condition but had a little bit of moss buildup clogging the bottom of the “duckbill” outlet. Once the moss was cleared, the flow temporarily increased for a minute until the backed-up water flowed out. It was observed during this time that someone had shoved some wiring and metal into the outfall as a hiding place. The metal/wiring is presumed to have been stripped from the derelict vessel and will be removed during the next O&M visit.

No ebullition was observed from the organoclay layers in Willamette Cove or in Willamette River.

The derelict vessel that was first observed in December 2020 on the Willamette River shoreline remains in place near the stormwater outfall. Hart Crowser was authorized under the recent task order amendment to initiate removal activities and will begin coordinating with Oregon State Marine Board to do so.

Buoys 1, 3 and 4 were observed missing during the first quarter inspection in March 2021 and remained missing during this inspection. The buoys are presumed to have been struck by wood trunk/debris over the winter which broke the chain and will be replaced. Hart Crowser will initiate procurement activities for buoy replacement.

Upland Inspection

The following items were inspected during the upland site walk and inspection:

- Site perimeter and fence, and drainage basin
- Subsurface drainage – Manholes and drainage
- Soil cap integrity (burrows, erosion, etc.)
- EW-1s and MW-23d area of subsidence
- Gas vents.

The locks on all gates were intact and functioning during the inspection.

The impermeable cap and soil cap were in good condition. Similar to conditions observed during the first quarter inspection in March, the ground surface (top 1-2 inches of soil) in the northern portion of the cap showed more signs of bird foraging than the southern portion of the site, though no wildlife was observed on the cap during the inspection. Grasses and plant species on the impermeable cap were approximately 1 to 2 feet high (approximately kneed high) at the time of inspection.

An animal burrow was identified in the vicinity of MW-48s (photograph 4). The animal burrow appears to be greater than 1 foot deep but the full depth is unknown. The burrow will be filled during the next O&M site visit.

Gas vents were inspected as part of the Five-Year Review checklist of items. Evidence of rodent or animal activity (e.g., nesting materials or freshly dug up soil was observed in two of the gas vent vaults. Repairs will be made to reset or install larger vault boxes with gravel bottoms to fortify the vaults and prevent animal intrusion.

While searching for gas vent vault boxes, a black PVC riser and cap was found protruding slightly from the cap surface in the vicinity of MW-48s. This may be a cleanout for the storm sewer. Sarah believes this may be a storm sewer cleanout riser. DEQ and Hart Crowser will review record drawings after this meeting to verify if the riser is a cleanout. If it is a cleanout, a vault box and marker post will be installed.

The drainage basin was functioning properly during the site inspection and no standing water was observed in the basin.

The distance between the inner and outer casing of MW-23d was 2.75 inches, which is the same as recent measurements.

Action Items and Schedule:	**Person Responsible**	**Deadline**
■ Site Maintenance – Replace locks if any found to be cut, fill-in burrows along the fence line, perform shop maintenance (e.g. mouse traps, check equipment).	Kevin Woodhouse	Quarterly
■ Continue to Monitor MW-23d inner/outer casing relationship for movement.	Kevin Woodhouse	Quarterly
■ Monitor burned holes (approximately 3-inch diameter) in the TRM in brush fire area.	Kevin Woodhouse	Quarterly
■ Quarterly Site Inspections	Kevin Woodhouse	Quarterly
■ Maintenance Activities	Kevin Woodhouse	As needed
■ Fence Repair	Kevin Woodhouse	Spring 2021
■ Vessel Removal	Kevin Woodhouse	June 2021
■ TRM and vault box repairs	Kevin Woodhouse	June 2021
■ Low-tide monitoring and transducer data download	Ryan Lewis Tess Lydick Rodrigo Prugue	June 2021

■ Five-Year Review data review and reporting.	Kevin Woodhouse Ben Johnson	June 2021

Site Activities / Miscellaneous Field Activities Performed Since Last Inspection

■ Tree and blackberry vine removal was performed on 3/18.

Deliverables

■ None submitted

Budget Status: Currently within the anticipated budget.

Photos:

Photograph 1: Willamette River shoreline conditions south of the Burlington Northern Santa Fe Railroad lines. View facing northeast.

Photograph 2: Willamette River shoreline with lots of wood debris deposited on it. View facing southeast.

Photograph 3: Loose or torn section of TRM that requires repairs. View facing north.

Photograph 4: Animal burrow in the vicinity of MW-48s.

Photograph 5: PVC riser and cap protruding through the soil cap and presumed to be a storm sewer cleanout.

Photograph 6: Rodent nesting inside the gas vent vault box at GV-3.

Table I-1: Chronology of Major Site Events
2021 Five Year Review
McCormick & Baxter Superfund Site

Event	Date
EPA performs a Site inspection which raises concerns about possible releases of hazardous substances.	1983
McCormick & Baxter Creosoting Company performs a preliminary Site investigation and notifies DEQ of possible off-site releases near the former waste disposal area.	1983
McCormick & Baxter Creosoting Company completes Site investigation concluding that soil and groundwater contamination exists at the Site.	1985
DEQ and McCormick & Baxter Creosoting Company sign a Stipulation and Final Order requiring the firm to perform specified remedial activities.	November-1987
McCormick & Baxter Creosoting Company files for bankruptcy protection.	December-1988
McCormick & Baxter Creosoting Company ceases operations.	October-1991
DEQ conducts a Remedial Investigation and Feasibility Study under State cleanup regulations.	1990 to 1992
DEQ conducts Removal Actions, including NAPL extraction, under State of Oregon cleanup regulations.	1992 to 1996
The McCormick & Baxter Creosoting Company Site is added to the NPL.	June-1994
DEQ revises Feasibility Study to comply with CERCLA.	September-1995
EPA issues ROD.	March-1996
NAPL extraction resumed as a Remedial Action.	March-1996
DEQ and EPA entered into a Superfund State Contract.	May-1996
EPA issues Amended ROD specifying off-site disposal of highly contaminated soils.	March-1998
Excavation and off-site disposal of highly contaminated soils completed.	Feb to May 1999
DEQ and EPA complete first Five-Year Review.	September-2001
EPA issues an ESD for groundwater contingency remedy.	August-2002
The subsurface barrier wall is constructed.	Apr to Sept. 2003
The sediment cap is constructed.	July 2004 to Sept 2005
The soil cap is constructed.	May to Sept 2005
Pre-final inspection of remedial actions is conducted by DEQ and EPA -Construction Completion is Achieved.	September-2005
Preliminary Close Out Report is signed by EPA.	September-2005
Operational and Functional (O&F) period begins.	October-2005
DEQ and EPA complete second Five-Year Review.	September-2006
Draft O&M Plan is approved by EPA (as a Draft Document).	March-2007
Soil Operable Unit operational and functional determination.	April-2007
DEQ and EPA complete third Five-Year Review.	September-2011
Sediment Operable Unit operational and functional determination.	September-2013
O&M Plan is approved by EPA	October-2013
DEQ and EPA complete fourth Five-Year Review.	September-2016
Annual O&M Reports.	Annually 2006 - 2020

Table II-3: Site Activities Completed Since Fourth FYR 2021 Five Year Review McCormick & Baxter Superfund Site

Activities and Investigations	Dates and Descriptions
2016 (October - December)	
Soil and sediment cap inspections	Quarterly.
Routine and non-routine maintenance and vegetation management	As needed.
Groundwater elevation and non-aqueous phase liquid monitoring	Semi-annually for site-wide wells; select wells gauged continuously.
Transducer replacement	Replaced transducers for MW-37s and MW-44d in December 2016.
2017	
Soil and sediment cap inspections	Quarterly.
Routine and non-routine maintenance and vegetation management	As needed; invasive plant removal in May 2017; herbicide application in April and May 2019.
Groundwater elevation and non-aqueous phase liquid monitoring	Semi-annually for site-wide wells; select wells gauged continuously.
Removal of job trailer	February 2017.
2016 Annual O&M report preparation	March 2017.
Riparian area watering	August 2017.
Transducer replacement	Replaced transducers forMW-52s in August 2017.
Shoreline Repairs	Filled voids in articulated concrete block mat with concrete in September 2017.
2018	
Soil and sediment cap inspections	Quarterly.
Routine and non-routine maintenance and vegetation management	As needed.
Groundwater elevation and non-aqueous phase liquid monitoring	Semi-annually for site-wide wells; select wells gauged continuously.
2017 Annual O&M report preparation	March 2018.
Fire damage inspections	July and September 2018.
Riparian area watering	August 2018.
2019	
Soil and sediment cap inspections	Quarterly.
Routine and non-routine maintenance and vegetation management	As needed; herbicide application in June 2019.
Groundwater elevation and non-aqueous phase liquid monitoring	Semi-annually for site-wide wells; select wells gauged continuously.
Gas vent cover repairs	March 2019.
2018 Annual O&M report preparation	March 2019.
Soil cap subsidence monitoring including land survey and storm sewer video inspection.	August and October 2019.
2020	
Soil and sediment cap inspections	Quarterly.
Routine and non-routine maintenance and vegetation management	As needed; invasive plant removal in March 2020; herbicide application in June 2020.
Groundwater elevation and non-aqueous phase liquid monitoring	Semi-annually for site-wide wells; select wells gauged continuously.
Groundwater quality assessment	May 2020.
2019 Annual O&M report preparation	July 2020.
Sediment cap performance monitoring	Surface water, inter-armor porewater, sub-armor porewater, and crayfish tissue sampling in August to September 2020.
MW-59s Sampling	October 2020.
Shoreline repairs including depression filling under turf-reinforcement mat and concreting articulated concrete block voids.	Filled erosional depression under turf reinforcement mat and filled articulated concrete block void with concrete in December 2020.
Sign post and warning sign replacement.	December 2020.

Table II-3: Site Activities Completed Since Fourth FYR 2021 Five Year Review McCormick & Baxter Superfund Site

Activities and Investigations	Dates and Descriptions
2021 (January through June 2021)	
Soil and sediment cap inspections	Quarterly.
Routine and non-routine maintenance and vegetation management	As needed.
Groundwater elevation and non-aqueous phase liquid monitoring	Semi-annually for site-wide wells; select wells gauged continuously.
Buoy Replacement	Buoys # 1, 3, and 5 observed missing in January through March 2021. Replacement activities initiated in May 2021.
Trash and debris removal	Abandoned homeless encampment and dump sites removed and disposed of in January 2021.
Tree and blackberry vine removal along fence line	March 2021.
Derelict vessel removal	Initiated activities to remove derelict vessel on Willamette River shoreline in May 2021.

Table II-4: Surface Water and Sediment Porewater Comparison Criteria
2021 Five Year Review
McCormick & Baxter Superfund Site

Chemical		1996 AWQCs[1]		DEQ 2011 EPA--Approved AWQCs updated 2017[2]		2015 NRWQCs[3]		2011 MCLs updated 2015[4]	ROD ACLs
		Aquatic Life (chronic)	Human Health (fish consumption only)	Aquatic Life[5] (chronic)	Human Health (consumption of organism only)	Aquatic Life (chronic)	Human Health (consumption of organism only)	Maximum Contaminant Levels (MCLs)	Alternate Concentration Limits (ACLs)
Metals (mg/L)									
Total Arsenic		0.19	--	0.15	2.1	0.15	0.00014	0.01	1
Total Chromium		0.21	--	0.024	--	0.074	--	0.1	1
Total Copper		0.012	--	Note[6]	--	0.0049	--	1.3 [7]	1
Total Zinc		0.11	--	0.036	2,600	0.12	26	5 [8]	1
Pentachlorophenol (µg/L)									
Pentachlorophenol		13	--	Note[9]	0.3	15	0.04	1	5,000
Polycyclic Aromatic Hydrocarbons (µg/L)									
Acenaphthene	L	520	--	--	99	--	90	--	--
Acenaphthylene	L	--	--	--	--	--	--	--	--
Anthracene	L	--	--	--	4,000	--	400	--	--
Benz[a]anthracene	H, C	--	--	--	0.0018	--	0.0013	--	--
Benzo[a]pyrene	H, C	--	--	--	0.0018	--	0.00013	0.2	
Benzo[b]fluoranthene	H, C	--	--	--	0.0018	--	0.0013	--	--
Benzo[g,h,i]perylene	H, C	--	--	--	--	--	--	--	--
Benzo[k]fluoranthene	H	--	--	--	0.0018	--	0.013	--	--
Chrysene	H, C	--	--	--	0.0018	--	0.13	--	--
Dibenzo[a,h]anthracene	H, C	--	--	--	0.0018	--	0.00013	--	--
Fluoranthene	H	--	54	--	14	--	20	--	--
Fluorene	L	--	--	--	530	--	70	--	--
Ideno[1,2,3--cd]pyrene	H, C	--	--	--	0.0018	--	0.0013	--	--
Naphthalene	L	620	--	--	--	--	--	--	--
Phenanthrene	L	--	--	--	--	--	--	--	--
Pyrene	H	--	--	--	400	--	30	--	--
Total LPAHs		--	--	--	--	--	--	--	--
Total HPAHs		--	--	--	--	--	--	--	--
Total PAHs		--	--	--	--	--	--	--	43,000
Total cPAHs		--	0.031	--	--	--	--	--	--

Table II-4: Surface Water and Sediment Porewater Comparison Criteria
2021 Five Year Review
McCormick & Baxter Superfund Site

Notes:
[1] The 1996 Record of Decision (ROD) specifies the remedial action objects of the sediment cap as: 1) preventing human and aquatic organisms from direct contact with contaminated sediment; and 2) minimizing releases of contaminants from sediment that might result in contamination of the Willamette River in excess of Ambient Water Quality Criteria (AWQCs).
[2] Oregon's revised AWQCs for human health approved by EPA on October 17, 2011. Updated for copper in 2017.
[3] National Recommended Water Quality Criteria (NRWQCs) published as of August 15, 2007, are included for comparison (see http://www.epa.gov/waterscience/criteria/wqcriteria.html).
[4] National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs) promulgated as of August 15, 2007, are included for comparison (see http://www.epa.gov/safewater/contaminants/index.html).
[5] Aquatic Life Water Quality Criteria (AWQCs) published as of 2011, and updated for copper effective 2017, are included for comparison (see ORS 340-041-8033). Oregon default hardness of 25 mg/l used.
[6] Copper criteria is the Biotic Ligand Model and dependent concentration of ions, alkalinity, organic carbon, pH and temperature in water column. Please see Oregon Table 30 Aquatic Life Water Quality Criteria for Toxic Pollutants for procedures.
[7] Treatment technique action level
[8] National Secondary Drinking Water Regulation
[9] Pentachlorphenol criteria is pH dependent. Please see Oregon Table 30 Aquatic Life Water Quality Criteria for Toxic Pollutants for procedures. 6.7ug/l corresponds to a pH of 7.0. https://www.oregon.gov/deq/FilterDocs/EcoRiskTablesAppendices.pdf

Abbreviations:
ACLs = Alternate Concentration Limits
AWQCs = Aquatic Life Water Quality Criteria
C = Carcinogenic PAH (cPAH)
NRWQCs = National Recommended Water Quality Criteria
PAH = Polycyclic Aromatic Hydrocarbon
MCLs = Maximum Contaminant Levels
L = Low Molecular Weight PAH (LPAH)
H = High Molecular Weight PAH (HPAH)
mg/L = milligrams per liter
µg/L = micrograms per liter

Table IV-1: Groundwater Quality Assessment Sampling Results
2021 Five Year Review
McCormick & Baxter Superfund Site

Analyte		ROD Alternate Concentration Limits (ACLs)	EW-19s		EW-19s-DUP		MW-35r		MW-37d		MW-37i		MW-37s		MW-39s		MW-41s		MW-47s		MW-53s	
			Site-Wide		Site-Wide		Site-Wide		Site-Wide		Site-Wide		Site-Wide		Site-Wide		Site-Wide		Site-Wide		Site-Wide	
			5/26/20		5/26/20		5/27/20		5/26/20		5/26/20		5/26/20		5/27/20		5/27/20		5/26/20		5/26/20	
			Shallow		Shallow		Shallow		Deep		Intermediate		Shallow		Shallow		Shallow		Shallow		Shallow	
Total Metals (µg/L)																						
Arsenic		1,000	**20.3**		**21.5**		**4.73**		**3.43**		**42.6**		**2.89**		**6.21**		0.735	U	**17.1**		**17.9**	
Chromium		1,000	1.49	U	1.49	U	1.49	U	1.49	U	1.49	U	1.49	U	1.49	U	1.49	U	1.49	U	1.49	U
Copper		1,000	2.50	U	2.50	U	2.50	U	2.50	U	2.50	U	2.50	U	2.50	U	2.50	U	2.50	U	2.50	U
Zinc		1,000	9.96	U	9.96	U	9.96	U	9.96	U	9.96	U	9.96	U	9.96	U	9.96	U	9.96	U	9.96	U
Pentachlorophenol (µg/L)																						
Pentachlorophenol		5,000	0.322	U	0.313	U	0.313	U	0.332	U	0.351	U	0.313	U	0.319	U	0.313	U	0.313	U	**110**	
Polyaromatic Hydrocarbons (µg/L)																						
Acenaphthene	L	--	**1.24**		**1.25**		0.019	U	**0.0507**		**24.8**		**19.5**		**0.0442**	**J**	**0.021**	**J**	**2.62**		0.019	U
Acenaphthylene	L	--	**2.15**		**2.09**		0.0171	U	0.0171	U	**0.116**		**0.272**		0.0171	U	0.0171	U	0.0171	U	0.0171	U
Anthracene	L	--	**33.8**		**33.1**		**0.0722**		**0.0544**		**0.056**		**0.574**		**0.0647**		**0.0497**	**J**	**0.034**	**J**	**0.145**	
Benzo(a)anthracene	H, C	--	**0.0442**	**J**	**0.0454**	**J**	0.0203	U	0.0203	U	0.0203	U	0.0203	U	0.0203	U	0.0203	U	0.0203	U	0.0203	U
Benzo(a)pyrene	H, C	--	0.0184	U	0.0184	U	0.0184	U	0.0184	U	0.0184	U	0.0184	U	0.0184	U	0.0184	U	0.0184	U	0.0184	U
Benzo(b)fluoranthene	H, C	--	0.0168	U	0.0168	U	0.0168	U	0.0168	U	0.0168	U	0.0168	U	0.0168	U	0.0168	U	0.0168	U	0.0168	U
Benzo(k)fluoranthene	H, C	--	0.0202	U	0.0202	U	0.0202	U	0.0202	U	0.0202	U	0.0202	U	0.0202	U	0.0202	U	0.0202	U	0.0202	U
Benzo(g,h,i)perylene	H	--	0.0184	U	0.0184	U	0.0184	U	0.0184	U	0.0184	U	0.0184	U	0.0184	U	0.0184	U	0.0184	U	0.0184	U
Chrysene	H, C	--	**0.0291**	**J**	**0.0286**	**J**	0.0179	U	0.0179	U	0.0179	U	0.0179	U	0.0179	U	0.0179	U	0.0179	U	0.0179	U
Dibenzo(a,h)anthracene	H, C	--	0.016	U	0.016	U	0.0160	U	0.0160	U	0.0160	U	0.0160	U	0.0160	U	0.0160	U	0.0160	U	0.0160	U
Fluoranthene	H	--	**1.38**		**1.34**		0.0270	U	0.0270	U	0.0270	U	**0.135**		0.0270	U	0.0270	U	0.0270	U	0.0270	U
Fluorene	L	--	**13.8**		**13.2**		0.0169	U	0.0169	U	**0.447**		**8.76**		0.0169	U	0.0169	U	0.0169	U	0.0169	U
Indeno(1,2,3-cd)pyrene	H, C	--	0.0158	U	0.0158	U	0.0158	U	0.0158	U	0.0158	U	0.0158	U	0.0158	U	0.0158	U	0.0158	U	0.0158	U
Naphthalene	L	--	**93.2**		**97.9**		0.0917	U	0.0917	U	**0.277**		**38.1**	**J**	0.0917	U	0.0917	U	0.0917	U	0.0917	U
Phenanthrene	L	--	**211**		**186**		0.018	U	0.018	U	**0.0366**	**J**	**0.537**		0.018	U	0.018	U	0.143		0.018	U
Pyrene	H	--	**0.645**		**0.625**		0.0169	U	0.0169	U	0.0169	U	**0.0731**		0.0169	U	0.0169	U	0.0169	U	0.0169	U
LPAHs (ND = 1/2 MDL)		--	**355**	**T**	**334**	**T**	**0.154**	**T**	**0.177**	**T**	**25.7**	**JT**	**67.7**	**JT**	**0.181**	**JT**	**0.143**	**JT**	**2.86**	**JT**	**0.226**	**T**
HPAHs (ND = 1/2 MDL)		--	**2.15**	**JT**	**2.09**	**JT**	0.0270	UT	0.0270	UT	0.0270	UT	**0.280**	**T**	0.0270	UT	0.0270	UT	0.0270	UT	0.0270	UT
Total PAHs (ND = 1/2 MDL)		43,000	**357**	**JT**	**336**	**JT**	**0.247**	**T**	**0.27**	**T**	**25.83**	**JT**	**68.02**	**JT**	**0.28**	**JT**	**0.24**	**JT**	**2.95**	**JT**	**0.32**	**T**
Total cPAHs (No TEFs, ND = 1/2 MDL)		--	**0.1169**	**JT**	**0.118**	**JT**	0.0627	UT	0.0627	UT	0.0627	UT	0.0627	UT	0.0627	UT	0.0627	UT	0.0627	UT	0.0627	UT
Total cPAH (BaP Eq, ND = 1/2 MDL)		--	**0.023**	**JT**	**0.023**	**JT**	0.020	UT	0.020	UT	0.020	UT	0.020	UT	0.020	UT	0.020	UT	0.020	UT	0.020	UT
Field Parameters																						
Groundwater Elevation (feet NAVD 88)		--	11.85		11.85		18.35		12.06		11.98		10.83		15.62		--		21.18		24.43	
Temperature (°C)		--	16		16		13.6		15.2		14.9		14.1		14.2		14.3		15		15.1	
Oxidation-Reduction Potential (mV)		--	-117.3		-117.3		-120.3		-116.0		-131.7		-71.6		-72.8		3.0		-67.8		-111.9	
pH		--	6.61		6.61		6.93		7.08		7.01		6.42		6.52		6.54		6.15		6.57	
Specific Conductance (µS/cm)		--	678		678		672		683		767		504		618		618		728		673	
Turbidity (NTU)		--	0.0		0.0		31.6		3.6		3.0		2.0		19.9		14.0		0.0		0.0	
Dissolved Oxygen (mg/L)		--	0.0		0.0		0.0		0.31		0.35		0.25		0.45		0.83		0.00		0.07	

Table IV-1: Groundwater Quality Assessment Sampling Results
2021 Five Year Review
McCormick & Baxter Superfund Site

Analyte		ROD Alternate Concentration Limits (ACLs)	MW-55s		MW-58s		MW-59s	
			Site-Wide		Site-Wide		Infiltration Pond	
			5/26/20		5/27/20		10/6/20	
			Shallow		Shallow		Shallow	
Total Metals (µg/L)								
Arsenic		1,000	**4.42**		**50.9**		**50.9**	
Chromium		1,000	**1.56**	**J**	1.49	U	1.49	U
Copper		1,000	**2.74**	**J**	**3.21**	**J**	2.5	U
Zinc		1,000	9.96	U	**86.0**		9.96	U
Pentachlorophenol (µg/L)								
Pentachlorophenol		5,000	0.313	U	0.329	U	0.313	U
Polyaromatic Hydrocarbons (µg/L)								
Acenaphthene	L	--	0.0190	U	**0.0267**	**J**	0.019	U
Acenaphthylene	L	--	0.0171	U	0.0171	U	0.0171	U
Anthracene	L	--	**0.0362**	**J**	**0.0289**	**J**	**0.0344**	**J**
Benzo(a)anthracene	H, C	--	0.0203	U	0.0203	U	0.0203	U
Benzo(a)pyrene	H, C	--	0.0184	U	0.0184	U	0.0184	U
Benzo(b)fluoranthene	H, C	--	0.0168	U	0.0168	U	0.0168	U
Benzo(k)fluoranthene	H, C	--	0.0202	U	0.0202	U	0.0202	U
Benzo(g,h,i)perylene	H	--	0.0184	U	0.0184	U	0.0184	U
Chrysene	H, C	--	0.0179	U	0.0179	U	0.0179	U
Dibenzo(a,h)anthracene	H, C	--	0.0160	U	0.0160	U	0.0160	U
Fluoranthene	H	--	0.0270	U	0.0270	U	0.0270	U
Fluorene	L	--	0.0169	U	0.0169	U	0.0169	U
Indeno(1,2,3-cd)pyrene	H, C	--	0.0158	U	0.0158	U	0.0158	U
Naphthalene	L	--	0.0917	U	0.0917	U	0.0917	U
Phenanthrene	L	--	0.018	U	0.018	U	0.018	U
Pyrene	H	--	0.0169	U	0.0169	U	0.0169	U
LPAHs (ND = 1/2 MDL)		--	**0.118**	**JT**	**0.127**	**JT**	**0.116**	**J**
HPAHs (ND = 1/2 MDL)		--	0.0270	UT	0.0270	UT	0.0270	UT
Total PAHs (ND = 1/2 MDL)		43,000	**0.21**	**JT**	**0.22**	**JT**	**0.21**	**JT**
Total cPAHs (No TEFs, ND = 1/2 MDL)		--	0.0627	UT	0.0627	UT	0.0627	UT
Total cPAH (BaP Eq, ND = 1/2 MDL)		--	0.02	UT	0.02	UT	0.02	UT
Field Parameters								
Groundwater Elevation (feet NAVD 88)		--	26.61		27.65		23.16	
Temperature (°C)		--	13.7		13.9		16.8	
Oxidation-Reduction Potential (mV)		--	52.0		-158.4		-33.8	
pH		--	5.78		6.99		5.37	
Specific Conductance (µS/cm)		--	207		678		591	
Turbidity (NTU)		--	0.0		13.1		33.7	
Dissolved Oxygen (mg/L)		--	0.10		0.01		0.12	

Table IV-1: Groundwater Quality Assessment Sampling Results
2021 Five Year Review
McCormick & Baxter Superfund Site

Notes:
Bold = a chemical detected above the MDL
Bold and shaded = Indicates the analyte was detected in excess of ACL
Historical summation rules: Total LPAHs, HPAHs, and CPAHs are calculated using the sum of detections, or the sum of one half the detection limits if all constituents are non-detects. Total PAHs are the sum of detections of LPAH and HPAH, or sum of the detection limits if both LPAH and HPAH are non-detects. Pentachlorophenol was included in the LPHAs.
Updated summation rules (ND = 1/2 MDL): Total LPAHs, HPAHs, and CPAHs are calculated using the sum of detections plus the sum of one half the detection limits for non-detects. If all constituents are non-detects, the highest detection limit is used. Pentachlorophenol is not included in the LPAHs.

Abbreviations:
°C = degrees Celsius
µg/L = micrograms per liter
µS/cm = microSiemens/centimeter
ACL = Alternate Concentration Limits
BaP Eq = Benzo(a)pyrene equivalents
C = carcinogenic PAH (cPAH)
H = High Molecular Weight PAH (HPAH)
J = Reported value is estimated
L = Low Molecular Weight PAH (LPAH)
MDL = method detection limit
mg/L = milligrams per liter
mV = millivolts
NAVD 88 = North American Vertical Datum of 1988
ND = non-detect
NTU = nephelometric turbidity unit
PAH = polycyclic aromatic hydrocarbon
ROD = Record of Decision
T = Value is a mathematically derived total.

Table IV-2: Infiltration Pond MW-59s Sampling Results
2021 Five Year Review
McCormick & Baxter Superfund Site

Analyte		ROD Alternate Concentration Limits (ACLs)	MW-59s (2nd Quarter 2006)		MW-59s (4th Quarter 2006)		MW-59s (1st Quarter 2007)		MW-59s (3rd Quarter 2007)		MW-59s (3rd Quarter 2008)		MW-59s (3rd Quarter 2009)		MW-59s (4th Quarter 2010)		MW-59s (2015)		MW-59s (2015)		MW-59s (2020)	
			4/26/06		11/3/06		2/28/07		10/3/07		8/21/08		8/31/09		10/7/10		10/2/15		10/21/15		10/6/20	
			18:01		14:47		12:00		9:58		9:50		17:19		14:52		8:55		16:00		16:26	
			shallow		shallow		shallow		shallow		shallow		shallow		shallow		shallow		shallow		shallow	
Total Metals (mg/L)																						
Arsenic		1	**0.0080**		**0.0197**		**0.0122**		**0.0225**		**0.0301**		**0.0301**		**0.0302**		NA		**0.0453**		**0.0509**	
Chromium		1	**0.0011**		**0.0015**		**0.00319**		**0.00474**		**0.0466**		**0.00073**		**0.00048**	**J**	NA		**0.000543**	**J**	0.0015	U
Copper		1	**0.0005**	**J**	**0.0011**	**J**	**0.000520**	**J**	**0.00107**	**J**	**0.0584**		**0.0011**		**0.00066**		NA		**0.000646**	**J**	0.0025	U
Iron		--	NA		NA		NA		NA		NA		**52.6**		NA		NA		**50.5**		NA	
Zinc		1	**0.00556**		**0.0075**		**0.00707**		**0.00845**		**0.140**		**0.0102**		**0.0081**		NA		**0.00567**	**J**	0.00996	U
Pentachlorophenol (µg/L)																						
Pentachlorophenol		5,000	NA		1.0000	U	0.9900	U	0.238	U	0.238	U	NA		NA		NA		NA		0.313	U
Polyaromatic Hydrocarbons (mg/L)																						
Acenaphthene	L	--	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0476	U	0.019	U	0.0032	U	**0.0139**	**J**	NA		0.019	U
Acenaphthylene	L	--	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0476	U	0.019	U	0.0030	U	0.012	U	NA		0.0171	U
Anthracene	L	--	0.0472	U	0.0500	U	0.0495	U	**0.0121**	**J**	**0.0397**		**0.064**		**0.039**	**J**	**0.0485**	**J**	NA		**0.0344**	**J**
Benz(a)anthracene	H, C	--	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U	**0.033**		0.0023	U	**0.00902**	**J**	NA		0.0203	U
Benzo(a)pyrene	H, C	--	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U	0.078	U	0.0030	U	0.0116	U	NA		0.0184	U
Benzo(b)fluoranthene	H, C	--	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U	0.11	U	0.020	U	0.00212	U	NA		0.0168	U
Benzo(k)fluoranthene	H, C	--	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U	**0.021**		0.0039	U	0.0136	U	NA		0.0202	U
Benzo(g,h,i)perylene	H	--	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U	**0.035**		0.0055	U	0.00227	U	NA		0.0184	U
Chrysene	H, C	--	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U	**0.033**		0.0032	U	0.0108	U	NA		0.0179	U
Dibenzo(a,h)anthracene	H, C	--	0.0943	U	0.1000	U	0.0990	U	0.0238	U	0.0238	U	0.019	U	0.0076	U	0.00396	U	NA		0.016	U
Fluoranthene	H	--	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U	**0.041**		**0.031**	**J**	**0.0306**	**J**	NA		0.027	U
Fluorene	L	--	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0476	U	**0.026**		0.0034	U	**0.0211**	**J**	NA		0.0169	U
Indeno(1,2,3-cd)pyrene	H, C	--	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U	0.064	U	0.0062	U	0.0148	U	NA		0.0158	U
Naphthalene	L	--	0.0472	U	0.0500	U	0.0495	U	**0.257**		0.0119	U	**0.042**	**J**	0.0057	U	**0.0865**	**J**	NA		0.0917	U
Phenanthrene	L	--	0.0472	U	0.0500	U	0.0495	U	**0.0259**		**0.0357**		**0.085**		**0.048**		**0.0522**		NA		0.018	U
Pyrene	H	--	0.0472	U	0.0500	U	0.0495	U	0.0119	U	0.0119	U	**0.032**		**0.020**	**J**	**0.0219**	**J**	NA		0.0169	U
Total LPAHs (ND = 1/2 MDL)		--	0.0472	UT	0.0500	UT	0.0495	UT	**0.3129**	**JT**	**0.1527**	T	**0.2360**	**JT**	**0.095**	**JT**	**0.228**	**JT**	NA		**0.116**	**JT**
Total HPAHs (ND = 1/2 MDL)		--	0.0943	UT	0.1000	UT	0.0990	UT	0.0238	UT	0.0238	UT	**0.331**	**T**	**0.077**	**JT**	**0.091**	**JT**	NA		0.027	UT
Total PAHs (ND = 1/2 MDL)		43,000	0.0943	UT	0.1000	UT	0.0990	UT	**0.378**	**JT**	**0.2182**	T	**0.567**	**JT**	**0.172**	**JT**	**0.319**	**JT**	NA		**0.210**	**JT**
Total cPAHs (No TEF, ND = 1/2 MDL)		--	0.1888	UT	0.2000	UT	0.1980	UT	0.0476	UT	0.0476	UT	**0.223**	**T**	0.023	UT	**0.037**	**JT**	NA		0.063	UT
Total cPAHs (BaP Eq, ND = 1/2 MDL)		--	0.0781	UT	0.0828	UT	0.0819	UT	0.0197	UT	0.0197	U	**0.061**	**T**	0.007	UT	**0.010**	**JT**	NA		0.020	UT
Field Parameters																						
Groundwater Elevation (ft NAVD88)		--	17.10		12.01		16.52		23.73		14.63		13.06		22.90		12.30		12.21		12.51	
Temperature (°C)		--	14.60		14.02		10.51		14.43		15.21		17.4		14.71		14.20		14.64		16.80	
Oxidation-Reduction Potential (mV)		--	-20.00		13.60		44.7		-19.50		-15.69		-33		11.6		-27.9		-26.6		-33.8	
pH		--	5.94		5.77		5.89		5.90		6.09		6.23		6.00		6.08		5.94		5.37	
Specific Conductance (mS/cm)		--	0.54		0.36		0.264		0.52		0.559		0.480		0.441		0.597		0.601		0.591	
Turbidity (NTU)		--	40.80		11.60		3.42		9.15		78.70		NA		NA		NA		NA		33.7	
Total Suspended Solids (mg/L)		--	NA		NA		NA		NA		NA		NA		257		NA		84		NA	
Dissolved Oxygen (mg/L)		--	NA		0.40		0.7		0.32		0.78		NA		0.39		0.53		0.54		0.12	

Table IV-2: Infiltration Pond MW-59s Sampling Results
2021 Five Year Review
McCormick & Baxter Superfund Site

Notes:
bold = Indicates the analyte was detected above MDL
bold and shaded = Indicates the analyte was detected in excess of ACL
Historical summation rules: Total LPAHs, HPAHs, and CPAHs are calculated using the sum of detections, or the sum of one half the detection limits if all constituents are non-detects. Total PAHs are the sum of detections of LPAH and HPAH, or sum of the detection limits if both LPAH and HPAH are non-detects. Pentachlorophenol was included in the LPHAs.
Updated summation rules (ND = 1/2 MDL): Total LPAHs, HPAHs, and CPAHs are calculated using the sum of detections plus the sum of one half the detection limits for non-detects. If all constituents are non-detects, the highest detection limit is used. Pentachlorophenol is not included in the LPAHs.

Abbreviations:
°C = degrees Celsius
µg/L = micrograms per liter
ACL = Alternate Concentration Limits
C = Carcinogenic PAH (cPAH)
H = High Molecular Weight PAH (HPAH)
J = Estimated Value
L = Low Molecular Weight PAH (LPAH)
MDL = method detection limit
mg/L = milligrams per liter
mS/cm = milliSiemens/centimeter
mV = millivolts
NA = Not available
NAVD 88 = North American Vertical Datum of 1988
ND = non-detect
NTU = nephelometric turbidity unit
PAH = polynuclear aromatic hydrocarbon
ROD = Record of Decision
U = Value Below MDL (value represents MDL)

Table IV-3: Surface, Inter-Armor, and Sub-Armor Water Sampling Locations
2021 Five Year Review
McCormick & Baxter Superfund Site

Sampling Location ID	Target Sample Coordinates (NAD83) [1]				Actual Sample Coordinates (NAD83) [1]				Sample Elevation [2] (ft NAVD88)	Location with ACB	Colocated Crayfish Sampling Location	Number of Days Deployed
	Northing	Easting	Latitude	Longitude	Northing	Easting	Latitude	Longitude				
Compliance Sampling Locations												
A	704151.8	7628801.0	45.57630	-122.73924	7628794.7	704139.5	45.57627	-122.73920	6.1	Yes	01	34
B	704369.2	7628482.9	45.57687	-122.74050	7628480.8	704372.3	45.57689	-122.74045	4.6	--	--	32
C	704556.6	7628058.5	45.57735	-122.74218	704556.6	7628058.5	45.57735	-122.74218	1.8	--	02	32
D	704693.1	7627598.7	45.57769	-122.74399	7627598.8	704693.6	45.57770	-122.74393	-17.2	--	03	35
E	704787.3	7627213.2	45.57792	-122.74550	7627213.1	704787.8	45.57793	-122.74545	-27.8	--	04	36
F	705220.9	7627179.7	45.57911	-122.74568	7627182.6	705220.1	45.57911	-122.74561	0.5	Yes	05	34
G[4]	705263.6	7627011.2	45.57921	-122.74634	7627006.0	705262.1	45.57921	-122.74631	1.1	Yes	--	34
H	705118.3	7626983.2	45.57881	-122.74644	7626986.2	705122.8	45.57883	-122.74637	-8.9	--	--	35
I	704565.8	7627624.4	45.57734	-122.74387	7627626.1	704559.8	45.57733	-122.74381	-18.6	--	--	35
J	704511.5	7627800.2	45.57721	-122.74318	7627777.0	704505.0	45.57720	-122.74321	7.2	--	--	32
K	704219.7	7628010.5	45.57643	-122.74233	7628009.3	704220.0	45.57643	-122.74228	-20.9	--	--	36
L	704335.6	7628390.4	45.57677	-122.74086	7628387.3	704336.0	45.57678	-122.74081	4.5	--	--	34
Early Warning Sampling Locations												
5	704576.3	7628007.4	45.57740	-122.74238	704576.3	7628007.4	45.57740	-122.74238	1.8	--	--	35
12	705197.2	7627236.8	45.57905	-122.74546	705197.2	7627236.8	45.57905	-122.74546	4.9	Yes	--	33
13	705303.9	7627321.8	45.57935	-122.74514	705303.9	7627321.8	45.57935	-122.74514	5.4	Yes	--	33
16	704293.9	7627812.9	45.57661	-122.74311	704308.0	7627821.1	45.57666	-122.74302	-28.6	--	--	36
Background Sampling Locations												
1 (Upstream)[5]	703730.7	7628583.6	45.57513	-122.74004	703730.6	7628585.6	45.57513	-122.73997	-31.5	--	--	NA
27 (Downstream)	705647.6	7626360.3	45.58021	-122.74893	705647.4	7626359.1	45.58022	-122.74887	-19.3	--	--	34

Notes:
[1] Northing and easting coordinates exist in the following coordinate system: North American Datum of 1983 (NAD83), Oregon State Plane North Zone, International Feet.
[2] Elevations exist in the following coordinate system: North American Vertical Datum of 1988 (NAVD88) in units of feet and are based on survey data.
[3] Metals analyzed include arsenic, chromium, and copper.
[4] Sampler was found broken at the 5th cell.
[5] Sampler was missing at the time of retrieval.

Abbreviations:
ACB = Articulated concrete block
NA = Not applicable

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
2021 Five Year Review
McCormick & Baxter Superfund Site

Sample Location		Comparison Criteria				5			12			13		
Sample ID		1996 AWQCs[1]		Current AWQCs[2]		ORG_P13_SW	ORG_P13_6	ORG_P13_18	ORG_P14_SW	ORG_P14_6	ORG_P14_18	ORG_P25_SWa	ORG_P25_6a	ORG_P25_18a
Sample Interval		Aquatic Life (chronic)	Human Health (fish only)	Aquatic Life (chronic)	Human Health (Consumption only)	SW	6	18	SW	6	18	SW	6	18
Sample Date						09/29/2020	09/29/2020	09/29/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020
Metals (mg/L)														
Total Arsenic		0.19	--	0.15	2.1	**0.0005**	**0.031**	**0.0259**	**0.0005**	**0.0285**	**0.0397**	**0.0001 J**	**0.0009**	**0.0009**
Total Chromium		0.21	--	0.024	--	**0.00007 J**	**0.0002**	**0.0005**	**0.00006 J**	**0.0001**	**0.00007 J**	**0.000006**	**0.00009 J**	**0.00002**
Total Copper		0.012	--	--[3]	--	**0.0006**	**0.00004**	**0.0001 J**	**0.0006**	**0.0002 J**	**0.00003**	**0.0002 J**	**0.0002 J**	**0.0003 J**
Total Zinc		0.11	--	0.036	2,600	**0.002**	**0.0014**	0.001 U	**0.0029**	**0.0016**	0.00075 U	**0.0011**	**0.0013**	**0.0012**
Pentachlorophenol (µg/L)														
Pentachlorophenol		13	--	--	0.3	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U
Polycyclic Aromatic Hydrocarbons (µg/L)														
1,2-Dimethylnaphthalene		--	--	--	--	0.00254 U	0.00254 U	**0.00475**	**0.01042**	**0.74318**	**0.82216**	0.00254 U	0.00254 U	0.00254 U
1,3-Dimethylnaphthalene		--	--	--	--	0.00949 U	0.00949 U	**0.02848**	**0.04158**	**1.32071**	**1.70655**	0.00949 U	0.00949 U	0.00949 U
1,8-Dimethylnaphthalene		--	--	--	--	0.00189 U	0.00189 U	0.00189 U	0.00189 U	**0.07743**	**0.0496**	0.00189 U	0.00189 U	0.00189 U
1-Ethylnaphthalene		--	--	--	--	0.00167 U	0.00167 U	**0.00407**	**0.002**	**0.63518**	**0.41042**	0.00167 U	0.00167 U	**0.0022**
1-Methylfluorene		--	--	--	--	0.00776 U	0.00776 U	**0.01331**	0.00776 U	**0.18749**	**0.08334**	0.00776 U	0.00776 U	0.00776 U
1-Methylnaphthalene		--	--	--	--	**0.01494**	**0.01556**	**0.03592**	0.00966 U	**0.11338**	**0.11797**	0.00966 U	**0.0139**	**0.01139**
1-Methylphenanthrene		--	--	--	--	**0.00215**	0.00178 U	**0.00345**	0.00178 U	**0.03605**	**0.01376**	0.00178 U	0.00178 U	0.00178 U
1-Methylpyrene		--	--	--	--	**0.0005**	0.00031 U	**0.0004**	0.00031 U	**0.00167**	**0.00134**	0.00031 U	0.00031 U	0.00031 U
2-(tert-Butyl)anthracene		--	--	--	--	**0.0001**	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U
2,3,5-Trimethylnaphthalene		--	--	--	--	0.00213 U	**0.00216**	**0.00513**	**0.00847**	**0.3463**	**0.15299**	0.00213 U	0.00213 U	0.00213 U
2,6-Dimethylnaphthalene		--	--	--	--	0.00775 U	0.00775 U	**0.02134**	**0.01609**	**0.02691**	**0.06156**	0.00775 U	0.00775 U	0.00775 U
2-Ethylanthracene		--	--	--	--	**0.001**	0.00084 U	**0.00203**	**0.00124**	**0.00273**	**0.0016**	0.00084 U	0.00084 U	0.00084 U
2-Ethylnaphthalene		--	--	--	--	0.00462 U	**0.01048**	**0.01426**	0.00462 U	**0.02208**	**0.05208**	0.00462 U	0.00462 U	**0.03031**
2-Isopropyl Naphthalene		--	--	--	--	0.00085 U	0.00085 U	0.00085 U	0.00085 U	**0.01033**	**0.0028**	0.00085 U	0.00085 U	0.00085 U
2-Methylanthracene		--	--	--	--	0.0014 U	0.0014 U	0.0014 U	0.0014 U	**0.03154**	**0.01167**	0.0014 U	0.0014 U	0.0014 U
2-Methylnaphthalene		--	--	--	--	**0.02592**	**0.02607**	**0.04909**	**0.01269**	**0.03741**	**0.04023**	**0.01413**	**0.02397**	**0.02056**
2-Methylphenanthrene		--	--	--	--	0.00605 U	0.00605 U	**0.01024**	0.00605 U	0.00605 U	0.00605 U	0.00605 U	0.00605 U	0.00605 U
9,10-Dimethylanthracene		--	--	--	--	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U
9-Methylanthracene		--	--	--	--	0.00124 U	0.00124 U	0.00124 U	0.00124 U	**0.00241**	0.00124 U	0.00124 U	0.00124 U	0.00124 U
Acenaphthene	L	520	--	--	99	**0.05024**	**0.06985**	**0.12916**	**0.22655**	**59.76684**	**75.01775**	**0.0555**	**0.02715**	**0.02937**
Acenaphthylene	L	--	--	--	--	0.00788 U	0.00788 U	0.00788 U	**0.01228**	**0.95056**	**1.04661**	0.00788 U	0.00788 U	0.00788 U
Anthracene	L	--	--	--	4,000	**0.00346**	**0.00371**	**0.00539**	**0.00454**	**0.19955**	**0.09095**	0.0023 U	0.0023 U	0.0023 U
Benz(a)anthracene	H,C	--	--	--	0.0018	**0.0005**	0.00038 U	**0.0006**	0.00038 U	**0.00255**	**0.00434**	0.00038 U	0.00038 U	0.00038 U
Benzo(a)pyrene	H,C	--	--	--	0.0018	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U
Benzo(e)pyrene	H	--	--	--	--	**0.0002**	0.00014 U	**0.0003**	0.00014 U	**0.0003**	**0.0008**	0.00014 U	0.00014 U	**0.0002**
Benzo(b)fluoranthene	H,C	--	--	--	0.0018	**0.0002**	**0.00008**	**0.0002**	**0.0001**	**0.0003**	**0.0007**	0.00007 U	**0.0002**	**0.0002**
Benzo(k)fluoranthene	H,C	--	--	--	0.0018	0.00013 U	0.00013 U	0.00013 U	0.00013 U	**0.0002**	**0.0005**	0.00013 U	**0.0002**	0.00013 U
Benzo(g,h,i)perylene	H	--	--	--	--	0.0003 U	0.0003 U	**0.0006**	0.0003 U	0.0003 U	0.0003 U	0.0003 U	0.0003 U	0.0003 U
Chrysene	H,C	--	--	--	0.0018	**0.0006**	**0.0005**	**0.0016**	0.00043 U	**0.00429**	**0.00675**	**0.0005**	**0.0008**	**0.0009**
Dibenz(a,h)anthracene	H,C	--	--	--	0.0018	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U
Fluoranthene	H	--	54	--	14	**0.00421**	**0.00534**	**0.01013**	0.00313 U	**0.13715**	**0.09163**	**0.00411**	**0.0058**	**0.00437**
Fluorene	L	--	--	--	530	**0.02582**	**0.03295**	**0.05909**	**0.14638**	**18.14856**	**6.97415**	**0.02378**	**0.01368**	**0.01559**

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
2021 Five Year Review
McCormick & Baxter Superfund Site

Sample Location		Comparison Criteria				5			12			13		
Sample ID		1996 AWQCs[1]		Current AWQCs[2]		ORG_P13_SW	ORG_P13_6	ORG_P13_18	ORG_P14_SW	ORG_P14_6	ORG_P14_18	ORG_P25_SWa	ORG_P25_6a	ORG_P25_18a
Sample Interval		Aquatic Life (chronic)	Human Health (fish only)	Aquatic Life (chronic)	Human Health (Consumption only)	SW	6	18	SW	6	18	SW	6	18
Sample Date						09/29/2020	09/29/2020	09/29/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020
Indeno(1,2,3-cd)pyrene	H,C	--	--	--	0.0018	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U
Naphthalene	L	620	--	--	--	**0.07754**	**0.07208**	**0.27569**	0.0662 U	**0.74602**	**0.77268**	0.0662 U	**0.12846**	0.0662 U
Perylene		--	--	--	--	**0.0002**	**0.0007**	**0.0008**	0.00014 U	0.00014 U	**0.0002**	0.00014 U	0.00014 U	0.00014 U
Phenanthrene	L	--	--	--	--	0.01307 U	0.01307 U	**0.02436**	0.01307 U	**0.01973**	**0.0137**	0.01307 U	0.01307 U	0.01307 U
Pyrene	H	--	--	--	400	0.01294 U	0.01294 U	**0.02724**	0.01294 U	**0.22456**	**0.14371**	0.01294 U	0.01294 U	0.01294 U
Total LPAHs (ND = 1/2 EDL)		--	--	--	--	**0.1675 T**	**0.18907 T**	**0.4976 T**	**0.4294 T**	**79.8313 T**	**83.9158 T**	**0.1240 T**	**0.1809 T**	**0.0897 T**
Total HPAHs (ND = 1/2 EDL)		--	--	--	--	**0.0129 T**	**0.01340 T**	**0.0413 T**	**0.0094 T**	**0.3700 T**	**0.2491 T**	**0.0121 T**	**0.0144 T**	**0.0131 T**
Total PAHs (ND = 1/2 EDL)		--	--	--	--	**0.1805 T**	**0.20246 T**	**0.5389 T**	**0.4387 T**	**80.2013 T**	**84.1650 T**	**0.1361 T**	**0.1953 T**	**0.1028 T**
Total cPAHs (No PEFs; ND = 1/2 EDL)		--	0.031	--	--	**0.0019 T**	**0.0014 T**	**0.003 T**	**0.0011 T**	**0.0079 T**	**0.013 T**	**0.0013 T**	**0.0019 T**	**0.0019 T**
Total cPAHs (B[a]P eq. ND = 1/2 EDL)		--	--	--	--	**0.0005 T**	**0.00050 T**	**0.0006 T**	**0.0005 T**	**0.0008 T**	**0.0010 T**	**0.0005 T**	**0.0005 T**	**0.0005 T**

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
2021 Five Year Review
McCormick & Baxter Superfund Site

Sample Location		Comparison Criteria				16			A			B		
Sample ID		1996 AWQCs[1]		Current AWQCs[2]		ORG_P27_SWa	ORG_P27_6a	ORG_P27_18a	ORG_P20_SW	ORG_P20_6	ORG_P20_18	ORG_P16_SW	ORG_P16_6	ORG_P16_18
Sample Interval		Aquatic Life (chronic)	Human Health (fish only)	Aquatic Life (chronic)	Human Health (Consumption only)	SW	6	18	SW	6	18	SW	6	18
Sample Date						09/29/2020	09/29/2020	09/29/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020
Metals (mg/L)														
Total Arsenic		0.19	--	0.15	2.1	**0.0005**	**0.0156**	**0.0156**	**0.0004**	**0.0014**	**0.0097**	**0.0005**	**0.0005**	**0.0189**
Total Chromium		0.21	--	0.024	--	**0.00004**	**0.0003**	**0.0002**	**0.00009 J**	**0.00002**	**0.0001**	**0.0001**	**0.00005**	**0.0001**
Total Copper		0.012	--	--[3]	--	**0.0005 J**	**0.00007 J**	**0.00008 J**	**0.0004 J**	**0.0002 J**	**0.0001 J**	**0.0012**	**0.0013**	**0.00004**
Total Zinc		0.11	--	0.036	2,600	**0.0089**	**0.0021**	**0.0015**	**0.0017**	**0.0023**	**0.0012**	**0.0022**	**0.0019**	**0.0012**
Pentachlorophenol (µg/L)														
Pentachlorophenol		13	--	--	0.3	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U
Polycyclic Aromatic Hydrocarbons (µg/L)														
1,2-Dimethylnaphthalene		--	--	--	--	0.00254 U	0.00254 U	**0.00649**	0.00254 U	**0.00406**	**0.0187**	0.00254 U	**0.00276**	0.00254 U
1,3-Dimethylnaphthalene		--	--	--	--	0.00949 U	**0.00953**	**0.01838**	0.00949 U	0.00949 U	**0.01554**	0.00949 U	**0.01085**	0.00949 U
1,8-Dimethylnaphthalene		--	--	--	--	0.00189 U	0.00189 U	0.00189 U	0.00189 U	0.00189 U	**0.00375**	0.00189 U	0.00189 U	0.00189 U
1-Ethylnaphthalene		--	--	--	--	0.00167 U	0.00167 U	**0.00324**	0.00167 U	**0.00422**	**0.02055**	0.00167 U	0.00167 U	0.00167 U
1-Methylfluorene		--	--	--	--	0.00776 U	0.00776 U	0.00776 U	0.00776 U	**0.01593**	**0.08326**	0.00776 U	0.00776 U	0.00776 U
1-Methylnaphthalene		--	--	--	--	**0.01627**	**0.0175**	**0.01781**	**0.01328**	0.00966 U	**0.01492**	**0.0107**	**0.01133**	**0.01203**
1-Methylphenanthrene		--	--	--	--	0.00178 U	0.00178 U	0.00178 U	**0.00182**	**0.00202**	**0.00356**	0.00178 U	0.00178 U	0.00178 U
1-Methylpyrene		--	--	--	--	0.00031 U	0.00031 U	0.00031 U	0.00031 U	**0.0003**	**0.0005**	0.00031 U	0.00031 U	**0.0004**
2-(tert-Butyl)anthracene		--	--	--	--	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U
2,3,5-Trimethylnaphthalene		--	--	--	--	0.00213 U	0.00213 U	0.00213 U	0.00213 U	**0.0057**	**0.01618**	0.00213 U	0.00213 U	**0.00209**
2,6-Dimethylnaphthalene		--	--	--	--	**0.00726**	**0.00956**	0.00775 U	0.00775 U	0.00775 U	**0.01043**	0.00775 U	0.00775 U	0.00775 U
2-Ethylanthracene		--	--	--	--	0.00084 U	0.00084 U	0.00084 U	0.00084 U	0.00084 U	0.00084 U	0.00084 U	0.00084 U	0.00084 U
2-Ethylnaphthalene		--	--	--	--	0.00462 U	**0.00822**	**0.00857**	0.00462 U	0.00462 U	**0.00656**	0.00462 U	0.00462 U	**0.00926**
2-Isopropyl Naphthalene		--	--	--	--	0.00085 U	0.00085 U	0.00085 U	0.00085 U	0.00085 U	0.00085 U	0.00085 U	0.00085 U	0.00085 U
2-Methylanthracene		--	--	--	--	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	**0.00368**	0.0014 U	0.0014 U	0.0014 U
2-Methylnaphthalene		--	--	--	--	**0.03025**	**0.03358**	**0.0364**	**0.02197**	**0.01595**	**0.03144**	**0.01648**	**0.0186**	**0.02227**
2-Methylphenanthrene		--	--	--	--	0.00605 U	0.00605 U	0.00605 U	0.00605 U	0.00605 U	0.00605 U	0.00605 U	0.00605 U	0.00605 U
9,10-Dimethylanthracene		--	--	--	--	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U
9-Methylanthracene		--	--	--	--	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U
Acenaphthene	L	520	--	--	99	**0.05184**	**0.05852**	**0.44859**	**0.04534**	**0.12306**	**2.0472**	**0.07722**	**0.12985**	**0.09168**
Acenaphthylene	L	--	--	--	--	0.00788 U	0.00788 U	**0.01593**	0.00788 U	0.00788 U	**0.05892**	0.00788 U	0.00788 U	0.00788 U
Anthracene	L	--	--	--	4,000	0.0023 U	0.0023 U	**0.00365**	0.0023 U	**0.00881**	**0.0385**	0.0023 U	**0.00215**	**0.00591**
Benz(a)anthracene	H,C	--	--	--	0.0018	0.00038 U	0.00038 U	0.00038 U	0.00038 U	**0.0004**	**0.0007**	**0.0004**	0.00038 U	**0.00102**
Benzo(a)pyrene	H,C	--	--	--	0.0018	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U
Benzo(e)pyrene	H	--	--	--	--	0.00014 U	0.00014 U	**0.0002**	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U	**0.0003**
Benzo(b)fluoranthene	H,C	--	--	--	0.0018	**0.00009**	**0.0001**	**0.0001**	0.00007 U	**0.00009**	**0.00009**	0.00007 U	**0.00007**	**0.0002**
Benzo(k)fluoranthene	H,C	--	--	--	0.0018	0.00013 U	0.00013 U	0.00013 U	0.00013 U	0.00013 U	0.00013 U	0.00013 U	0.00013 U	**0.0002**
Benzo(g,h,i)perylene	H	--	--	--	--	0.0003 U	0.0003 U	0.0003 U	0.0003 U	0.0003 U	0.0003 U	0.0003 U	0.0003 U	0.0003 U
Chrysene	H,C	--	--	--	0.0018	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0007**	**0.0011**	**0.0005**	**0.0004**	**0.00192**
Dibenz(a,h)anthracene	H,C	--	--	--	0.0018	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U
Fluoranthene	H	--	54	--	14	0.00313 U	**0.00435**	**0.00606**	**0.00348**	**0.00742**	**0.0135**	**0.00402**	0.00313 U	**0.00784**
Fluorene	L	--	--	--	530	**0.02766**	**0.02817**	**0.0457**	**0.02073**	**0.03954**	**0.16117**	**0.03341**	**0.05021**	**0.03578**

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
2021 Five Year Review
McCormick & Baxter Superfund Site

Sample Location		Comparison Criteria				16			A			B		
Sample ID		1996 AWQCs[1]		Current AWQCs[2]		ORG_P27_SWa	ORG_P27_6a	ORG_P27_18a	ORG_P20_SW	ORG_P20_6	ORG_P20_18	ORG_P16_SW	ORG_P16_6	ORG_P16_18
Sample Interval						SW	6	18	SW	6	18	SW	6	18
Sample Date		Aquatic Life (chronic)	Human Health (fish only)	Aquatic Life (chronic)	Human Health (Consumption only)	09/29/2020	09/29/2020	09/29/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020
Indeno(1,2,3-cd)pyrene	H,C	--	--	--	0.0018	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U
Naphthalene	L	620	--	--	--	**0.06448**	**0.08504**	**0.09583**	**0.10125**	0.0662 U	0.0662 U	0.0662 U	0.0662 U	0.0662 U
Perylene		--	--	--	--	**0.0001**	**0.0003**	**0.0004**	**0.0002**	**0.0002**	**0.0002**	**0.0002**	**0.0001**	**0.0006**
Phenanthrene	L	--	--	--	--	0.01307 U	0.01307 U	0.01307 U	0.01307 U	0.01307 U	**0.01634**	0.01307 U	0.01307 U	0.01307 U
Pyrene	H	--	--	--	400	0.01294 U	0.01294 U	0.01294 U	0.01294 U	**0.02498**	**0.07533**	0.01294 U	0.01294 U	**0.01555**
Total LPAHs (ND = 1/2 EDL)		--	--	--	--	**0.1556 T**	**0.1834 T**	**0.6162 T**	**0.1789 T**	**0.2150 T**	**2.3552 T**	**0.1554 T**	**0.2258 T**	**0.1769 T**
Total HPAHs (ND = 1/2 EDL)		--	--	--	--	**0.0096 T**	**0.0124 T**	**0.0143 T**	**0.0115 T**	**0.0344 T**	**0.0915 T**	**0.0122 T**	**0.0095 T**	**0.0277 T**
Total PAHs (ND = 1/2 EDL)		--	--	--	--	**0.1652 T**	**0.1958 T**	**0.6305 T**	**0.1904 T**	**0.2494 T**	**2.4468 T**	**0.1676 T**	**0.2353 T**	**0.2047 T**
Total cPAHs (No PEFs; ND = 1/2 EDL)		--	0.031	--	--	**0.0014 T**	**0.0014 T**	**0.0014 T**	**0.0013 T**	**0.0018 T**	**0.0025 T**	**0.0015 T**	**0.0013 T**	**0.0039 T**
Total cPAHs (B[a]P eq. ND = 1/2 EDL)		--	--	--	--	**0.0005 T**	**0.0005 T**	**0.0005 T**	**0.0005 T**	**0.0005 T**	**0.0006 T**	**0.0005 T**	**0.0005 T**	**0.0006 T**

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
2021 Five Year Review
McCormick & Baxter Superfund Site

Sample Location		Comparison Criteria				C			Duplicate Station C			D		
Sample ID		1996 AWQCs[1]		Current AWQCs[2]		ORG_P21a_SW	ORG_P21a_6	ORG_P21a_18	ORG_P21b_SW	ORG_P21b_6	ORG_P21b_18	ORG_P31_SWa	ORG_P31_6a	ORG_P31_18a
Sample Interval		Aquatic Life (chronic)	Human Health (fish only)	Aquatic Life (chronic)	Human Health (Consumption only)	SW	6	18	SW	6	18	SW	6	18
Sample Date						09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020
Metals (mg/L)														
Total Arsenic		0.19	--	0.15	2.1	**0.0006**	**0.0109**	**0.0196**	-	-	-	**0.0005**	**0.0271**	**0.0286**
Total Chromium		0.21	--	0.024	--	**0.0003**	**0.00007 J**	**0.00007 J**	-	-	-	**0.00004**	**0.0002**	**0.0001**
Total Copper		0.012	--	--[3]	--	**0.0015**	**0.0002 J**	**0.00005 J**	-	-	-	**0.0004 J**	**0.00003 J**	**0.00003**
Total Zinc		0.11	--	0.036	2,600	**0.0027**	**0.0012**	**0.0011**	-	-	-	**0.0021**	**0.0012**	**0.001**
Pentachlorophenol (µg/L)														
Pentachlorophenol		13	--	--	0.3	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U
Polycyclic Aromatic Hydrocarbons (µg/L)														
1,2-Dimethylnaphthalene		--	--	--	--	0.00254 U	**0.00818**	**0.03405**	0.00254 U	**0.0063**	**0.04552**	0.00254 U	**0.00666**	**0.00302**
1,3-Dimethylnaphthalene		--	--	--	--	**0.01606**	**0.00958**	**0.03907**	0.00949 U	0.00949 U	**0.04681**	**0.01172**	**0.07396**	**0.02233**
1,8-Dimethylnaphthalene		--	--	--	--	0.00189 U	**0.00528**	**0.00408**	0.00189 U	**0.00268**	**0.00638**	0.00189 U	0.00189 U	**0.00218**
1-Ethylnaphthalene		--	--	--	--	0.00167 U	**0.00666**	**0.02067**	0.00167 U	**0.0057**	**0.02575**	0.00167 U	**0.00768**	**0.003**
1-Methylfluorene		--	--	--	--	0.00776 U	0.00776 U	0.00776 U	0.00776 U	0.00776 U	0.00776 U	0.00776 U	**0.03888**	**0.00965**
1-Methylnaphthalene		--	--	--	--	**0.02089**	**0.02034**	**0.01756**	**0.01415**	**0.02032**	**0.02229**	**0.01602**	**0.0767**	**0.02454**
1-Methylphenanthrene		--	--	--	--	**0.003**	0.00178 U	0.00178 U	0.00178 U	0.00178 U	**0.00435**	**0.00192**	**0.01201**	**0.00327**
1-Methylpyrene		--	--	--	--	0.00031 U	0.00031 U	0.00031 U	0.00031 U	0.00031 U	**0.0004**	0.00031 U	**0.00161**	**0.0006**
2-(tert-Butyl)anthracene		--	--	--	--	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	**0.0004**	**0.0002**
2,3,5-Trimethylnaphthalene		--	--	--	--	**0.00299**	0.00213 U	**0.00388**	0.00213 U	0.00213 U	**0.0062**	**0.00223**	**0.01106**	**0.00386**
2,6-Dimethylnaphthalene		--	--	--	--	**0.01302**	**0.00867**	**0.012**	0.00775 U	0.00775 U	**0.01367**	**0.01035**	**0.05835**	**0.01898**
2-Ethylanthracene		--	--	--	--	**0.001**	0.00084 U	0.00084 U	0.00084 U	0.00084 U	0.00084 U	**0.00121**	**0.01126**	**0.00319**
2-Ethylnaphthalene		--	--	--	--	**0.00518**	**0.01197**	**0.02835**	0.00462 U	**0.01406**	**0.02308**	**0.00491**	**0.01886**	**0.01023**
2-Isopropyl Naphthalene		--	--	--	--	0.00085 U	0.00085 U	0.00085 U	0.00085 U	0.00085 U	0.00085 U	0.00085 U	**0.00197**	0.00085 U
2-Methylanthracene		--	--	--	--	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	**0.00345**	0.0014 U	**0.00365**	0.0014 U
2-Methylnaphthalene		--	--	--	--	**0.03298**	**0.02953**	**0.0279**	**0.02506**	**0.03188**	**0.035**	**0.0268**	**0.0996**	**0.03739**
2-Methylphenanthrene		--	--	--	--	0.00605 U	0.00605 U	0.00605 U	0.00605 U	0.00605 U	**0.00676**	0.00605 U	**0.04146**	**0.01083**
9,10-Dimethylanthracene		--	--	--	--	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U
9-Methylanthracene		--	--	--	--	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	**0.00158**	0.00124 U
Acenaphthene	L	520	--	--	99	**0.0668**	**6.48272**	**4.535851**	**0.11472**	**5.52763**	**4.94116**	**0.04597**	**0.06507**	**0.18563**
Acenaphthylene	L	--	--	--	--	0.00788 U	**0.16174**	**0.13245**	0.00788 U	**0.13034**	**0.17846**	0.00788 U	**0.00793**	**0.00803**
Anthracene	L	--	--	--	4,000	**0.00339**	**0.00606**	**0.01632**	**0.00252**	**0.00516**	**0.03238**	0.0023 U	**0.0052**	**0.0048**
Benz(a)anthracene	H,C	--	--	--	0.0018	**0.0004**	0.00038 U	**0.0004**	0.00038 U	0.00038 U	**0.00113**	**0.0005**	**0.00258**	**0.001**
Benzo(a)pyrene	H,C	--	--	--	0.0018	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U
Benzo(e)pyrene	H	--	--	--	--	**0.0002**	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U	**0.0002**	**0.0007**	**0.0003**
Benzo(b)fluoranthene	H,C	--	--	--	0.0018	**0.0001**	**0.0001**	**0.0001**	0.00007 U	0.00007 U	**0.0001**	**0.0001**	**0.0005**	**0.0002**
Benzo(k)fluoranthene	H,C	--	--	--	0.0018	0.00013 U	0.00013 U	**0.0001**	0.00013 U	0.00013 U	0.00013 U	0.00013 U	**0.0002**	**0.0002**
Benzo(g,h,i)perylene	H	--	--	--	--	0.0003 U	0.0003 U	0.0003 U	0.0003 U	0.0003 U	0.0003 U	0.0003 U	**0.00122**	**0.0005**
Chrysene	H,C	--	--	--	0.0018	**0.0007**	**0.0004**	**0.0007**	**0.0006**	0.00043 U	**0.00127**	**0.001**	**0.00673**	**0.00284**
Dibenz(a,h)anthracene	H,C	--	--	--	0.0018	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U
Fluoranthene	H	--	54	--	14	**0.00458**	**0.00336**	**0.00892**	**0.00463**	0.00313 U	**0.03244**	**0.00702**	**0.04198**	**0.01749**
Fluorene	L	--	--	--	530	**0.04173**	**0.04191**	**0.11708**	**0.03848**	**0.03692**	**0.1857**	**0.02937**	**0.06871**	**0.03182**

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
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Sample Location		Comparison Criteria				C			Duplicate Station C			D		
Sample ID		1996 AWQCs[1]		Current AWQCs[2]		ORG_P21a_SW	ORG_P21a_6	ORG_P21a_18	ORG_P21b_SW	ORG_P21b_6	ORG_P21b_18	ORG_P31_SWa	ORG_P31_6a	ORG_P31_18a
Sample Interval						SW	6	18	SW	6	18	SW	6	18
Sample Date		Aquatic Life (chronic)	Human Health (fish only)	Aquatic Life (chronic)	Human Health (Consumption only)	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020
Indeno(1,2,3-cd)pyrene	H,C	--	--	--	0.0018	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U
Naphthalene	L	620	--	--	--	**0.12986**	**0.15646**	**0.0737**	0.0662 U	**0.14046**	**0.09034**	**0.09248**	**0.57863**	**0.2091**
Perylene		--	--	--	--	0.00014 U	**0.0002**	**0.0002**	0.00014 U	0.00014 U	**0.0002**	0.00014 U	**0.0004**	**0.0005**
Phenanthrene	L	--	--	--	--	**0.02169**	**0.01296**	**0.03187**	**0.01387**	0.01307 U	**0.10132**	**0.01414**	**0.08326**	**0.02508**
Pyrene	H	--	--	--	400	0.01294 U	0.01294 U	**0.03268**	0.01294 U	0.01294 U	**0.05593**	**0.01596**	**0.15061**	**0.05346**
Total LPAHs (ND = 1/2 EDL)		--	--	--	--	**0.2674 T**	**6.8619 T**	**4.9073 T**	**0.2066 T**	**5.8470**	**5.5294 T**	**0.1871 T**	**0.8088 T**	**0.4645 T**
Total HPAHs (ND = 1/2 EDL)		--	--	--	--	**0.0132 T**	**0.0113 T**	**0.0437 T**	**0.0127 T**	0.0093 UT	**0.0917 T**	**0.0255 T**	**0.2051 T**	**0.0765 T**
Total PAHs (ND = 1/2 EDL)		--	--	--	--	**0.2806 T**	**6.8732 T**	**4.9509 T**	**0.2194 T**	**5.8563**	**5.6210 T**	**0.2126 T**	**1.0139 T**	**0.5410 T**
Total cPAHs (No PEFs; ND = 1/2 EDL)		--	0.031	--	--	**0.0018 T**	**0.0013 T**	**0.0018 T**	**0.0014 T**	0.00062 UT	**0.0031 T**	**0.0022 T**	**0.011 T**	**0.0048 T**
Total cPAHs (B[a]P eq. ND = 1/2 EDL)		--	--	--	--	**0.0005 T**	**0.0005 T**	**0.0005 T**	**0.0005 T**	0.0005 UT	**0.0006 T**	**0.0005 T**	**0.0008 T**	**0.0006 T**

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
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Sample Location		Comparison Criteria				E			F			G		
Sample ID		1996 AWQCs[1]		Current AWQCs[2]		ORG_P30_SWa	ORG_P30_6a	ORG_P30_18a	ORG_P23_SW	ORG_P23_6	ORG_P23_18	ORG_P29_SWa	ORG_P29_6a	ORG_P29_18a
Sample Interval		Aquatic Life (chronic)	Human Health (fish only)	Aquatic Life (chronic)	Human Health (Consumption only)	SW	6	18	SW	6	18	SW	6	18
Sample Date						09/30/2020	09/30/2020	09/30/2020	09/29/2020	09/29/2020	09/29/2020	09/29/2020	09/29/2020	09/29/2020
Metals (mg/L)														
Total Arsenic		0.19	--	0.15	2.1	**0.0005**	**0.0006**	**0.0192**	**0.0281**	**0.0257**	**0.0245**	**0.0028**	**0.0099**	**0.0212**
Total Chromium		0.21	--	0.024	--	**0.00006 J**	**0.00007 J**	**0.0001**	**0.0002**	**0.0002**	**0.0003**	**0.00002**	**0.0002**	**0.0002**
Total Copper		0.012	--	--[3]	--	**0.0004 J**	**0.0004 J**	**0.0001 J**	**0.00007 J**	**0.00007 J**	**0.00006 J**	**0.0004 J**	**0.00009 J**	**0.0011**
Total Zinc		0.11	--	0.036	2,600	**0.0025**	**0.0021**	**0.0013**	**0.0011**	**0.0013**	**0.0015**	**0.002**	**0.0011**	**0.0017**
Pentachlorophenol (µg/L)														
Pentachlorophenol		13	--	--	0.3	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U
Polycyclic Aromatic Hydrocarbons (µg/L)														
1,2-Dimethylnaphthalene		--	--	--	--	0.00254 U	**0.0055**	0.00254 U	0.00254 U	0.00254 U	**0.00516**	**0.00357**	0.00254 U	**0.0027**
1,3-Dimethylnaphthalene		--	--	--	--	**0.01409**	**0.06576**	0.00949 U	0.00949 U	0.00949 U	**0.01421**	**0.03892**	0.00949 U	**0.01791**
1,8-Dimethylnaphthalene		--	--	--	--	0.00189 U	0.00189 U	0.00189 U	0.00189 U	0.00189 U	0.00189 U	0.00189 U	0.00189 U	0.00189 U
1-Ethylnaphthalene		--	--	--	--	0.00167 U	**0.0067**	0.00167 U	0.00167 U	0.00167 U	**0.00241**	**0.00407**	0.00167 U	**0.00208**
1-Methylfluorene		--	--	--	--	0.00776 U	**0.03426**	0.00776 U	0.00776 U	0.00776 U	0.00776 U	**0.01963**	0.00776 U	0.00776 U
1-Methylnaphthalene		--	--	--	--	**0.02365**	**0.07085**	0.00966 U	**0.01195**	0.00966 U	**0.01241**	**0.04521**	**0.01525**	**0.02146**
1-Methylphenanthrene		--	--	--	--	**0.0028**	**0.00976**	0.00178 U	0.00178 U	0.00178 U	**0.00212**	**0.00583**	0.00178 U	**0.00236**
1-Methylpyrene		--	--	--	--	**0.0003**	**0.00105**	0.00031 U	0.00031 U	0.00031 U	**0.0003**	**0.0006**	0.00031 U	**0.0004**
2-(tert-Butyl)anthracene		--	--	--	--	0.0001 U	**0.0003**	0.0001 U	0.0001 U	0.0001 U	0.0001 U	**0.0002**	0.0001 U	0.0001 U
2,3,5-Trimethylnaphthalene		--	--	--	--	**0.00229**	**0.0096**	0.00213 U	0.00213 U	0.00213 U	**0.00627**	**0.00631**	0.00213 U	**0.0035**
2,6-Dimethylnaphthalene		--	--	--	--	**0.01202**	**0.05169**	0.00775 U	0.00775 U	0.00775 U	**0.00908**	**0.03109**	**0.00842**	**0.01546**
2-Ethylanthracene		--	--	--	--	**0.00141**	**0.00744**	0.00084 U	0.00084 U	0.00084 U	**0.0009**	**0.00447**	0.00084 U	**0.00132**
2-Ethylnaphthalene		--	--	--	--	**0.0057**	**0.01496**	0.00462 U	**0.00752**	**0.00697**	**0.01373**	**0.01221**	0.00462 U	**0.01104**
2-Isopropyl Naphthalene		--	--	--	--	0.00085 U	**0.00168**	0.00085 U	0.00085 U	0.00085 U	0.00085 U	**0.0009**	0.00085 U	0.00085 U
2-Methylanthracene		--	--	--	--	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U
2-Methylnaphthalene		--	--	--	--	**0.03648**	**0.09578**	0.01161 U	**0.02201**	**0.01511**	**0.02288**	**0.06108**	**0.02855**	**0.0365**
2-Methylphenanthrene		--	--	--	--	0.00605 U	**0.03462**	0.00605 U	0.00605 U	0.00605 U	0.00605 U	**0.01805**	0.00605 U	0.00605 U
9,10-Dimethylanthracene		--	--	--	--	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U
9-Methylanthracene		--	--	--	--	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U
Acenaphthene	L	520	--	--	99	**0.03555**	**0.04105**	0.02031 U	**0.06019**	**0.05838**	**0.18347**	**0.04368**	**0.0543**	**0.07036**
Acenaphthylene	L	--	--	--	--	0.00788 U	0.00788 U	0.00788 U	0.00788 U	0.00788 U	0.00788 U	0.00788 U	0.00788 U	0.00788 U
Anthracene	L	--	--	--	4,000	**0.00267**	**0.01101**	0.0023 U	**0.00334**	0.0023 U	**0.00546**	**0.00425**	**0.00226**	**0.00542**
Benz(a)anthracene	H,C	--	--	--	0.0018	0.00038 U	**0.0023**	0.00038 U	**0.0004**	**0.0004**	**0.0008**	**0.001**	**0.0006**	**0.0008**
Benzo(a)pyrene	H,C	--	--	--	0.0018	0.00062 U	**0.0009**	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U
Benzo(e)pyrene	H	--	--	--	--	**0.0003**	**0.0008**	0.00014 U	0.00014 U	**0.0002**	0.00014 U	**0.0005**	**0.0002**	**0.0004**
Benzo(b)fluoranthene	H,C	--	--	--	0.0018	**0.0002**	**0.0007**	**0.0001**	**0.0002**	**0.0002**	**0.0002**	**0.0002**	**0.0002**	**0.0003**
Benzo(k)fluoranthene	H,C	--	--	--	0.0018	**0.0001**	**0.0004**	0.00013 U	0.00013 U	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**
Benzo(g,h,i)perylene	H	--	--	--	--	0.0003 U	**0.00129**	0.0003 U	0.0003 U	0.0003 U	0.0003 U	**0.0008**	0.0003 U	0.0003 U
Chrysene	H,C	--	--	--	0.0018	**0.00104**	**0.00606**	0.00043 U	**0.0006**	**0.0007**	**0.00122**	**0.00277**	**0.0009**	**0.00146**
Dibenz(a,h)anthracene	H,C	--	--	--	0.0018	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U
Fluoranthene	H	--	54	--	14	**0.00666**	**0.02683**	**0.00459**	**0.00712**	**0.00733**	**0.01764**	**0.01854**	**0.00717**	**0.01081**
Fluorene	L	--	--	--	530	**0.02576**	**0.05642**	**0.01248**	**0.03424**	**0.02971**	**0.04511**	**0.04683**	**0.03123**	**0.03477**

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
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Sample Location		Comparison Criteria				E			F			G		
Sample ID		1996 AWQCs[1]		Current AWQCs[2]		ORG_P30_SWa	ORG_P30_6a	ORG_P30_18a	ORG_P23_SW	ORG_P23_6	ORG_P23_18	ORG_P29_SWa	ORG_P29_6a	ORG_P29_18a
Sample Interval		Aquatic Life (chronic)	Human Health (fish only)	Aquatic Life (chronic)	Human Health (Consumption only)	SW	6	18	SW	6	18	SW	6	18
Sample Date						09/30/2020	09/30/2020	09/30/2020	09/29/2020	09/29/2020	09/29/2020	09/29/2020	09/29/2020	09/29/2020
Indeno(1,2,3-cd)pyrene	H,C	--	--	--	0.0018	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U
Naphthalene	L	620	--	--	--	**0.22577**	**0.54449**	0.0662 U	0.0662 U	0.0662 U	0.0662 U	**0.30635**	**0.0747**	**0.21075**
Perylene		--	--	--	--	0.00014 U	**0.0002**	**0.0001**	**0.0006**	**0.0006**	**0.0009**	**0.0002**	**0.0006**	**0.0009**
Phenanthrene	L	--	--	--	--	**0.01906**	**0.07136**	0.01307 U	**0.01406**	**0.01305**	**0.03288**	**0.04411**	0.01307 U	**0.02208**
Pyrene	H	--	--	--	400	**0.01753**	**0.09537**	0.01294 U	0.01294 U	0.01294 U	**0.0168**	**0.06362**	0.01294 U	**0.01923**
Total LPAHs (ND = 1/2 EDL)		--	--	--	--	**0.3128 T**	**0.7283 T**	**0.0674 T**	**0.1489 T**	**0.1393 T**	**0.3040 T**	**0.4492 T**	**0.1730 T**	**0.3473 T**
Total HPAHs (ND = 1/2 EDL)		--	--	--	--	**0.0267 T**	**0.1349 T**	**0.0124 T**	**0.0156 T**	**0.0161 T**	**0.0375 T**	**0.0881 T**	**0.0163 T**	**0.0338 T**
Total PAHs (ND = 1/2 EDL)		--	--	--	--	**0.3395 T**	**0.8631 T**	**0.0797 T**	**0.1645 T**	**0.1554 T**	**0.3415 T**	**0.5372 T**	**0.1893 T**	**0.3811 T**
Total cPAHs (No PEFs; ND = 1/2 EDL)		--	0.031	--	--	**0.0021 T**	**0.011 T**	**0.0011 T**	**0.0018 T**	**0.0019 T**	**0.0028 T**	**0.0046 T**	**0.0023 T**	**0.0032 T**
Total cPAHs (B[a]P eq. ND = 1/2 EDL)		--	--	--	--	**0.0005 T**	**0.0014 T**	**0.0005 T**	**0.0005 T**	**0.0005 T**	**0.0006 T**	**0.0006 T**	**0.0006 T**	**0.0006 T**

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
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Sample Location		Comparison Criteria				H			I			J		
Sample ID		1996 AWQCs[1]		Current AWQCs[2]		ORG_P19_SW	ORG_P19_6	ORG_P19_18	ORG_P32_SWa	ORG_P32_6	ORG_P32_18	ORG_P15_SW	ORG_P15_6	ORG_P15_18
Sample Interval		Aquatic Life (chronic)	Human Health (fish only)	Aquatic Life (chronic)	Human Health (Consumption only)	SW	6	18	SW	6	18	SW	6	18
Sample Date						09/30/2020	09/30/2020	09/30/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020
Metals (mg/L)														
Total Arsenic		0.19	--	0.15	2.1	**0.0005**	**0.0128**	**0.0294**	**0.0005**	**0.0244**	**0.0212**	**0.0006**	**0.0409**	**0.0495**
Total Chromium		0.21	--	0.024	--	**0.00004**	**0.0001**	**0.0001**	**0.00006 J**	**0.0002**	**0.0001**	**0.00006 J**	**0.00007 J**	**0.00007 J**
Total Copper		0.012	--	--[3]	--	**0.0003 J**	**0.0002 J**	**0.00005 J**	**0.0006**	**0.0001 J**	**0.00004**	**0.0006**	**0.00009 J**	**0.00007 J**
Total Zinc		0.11	--	0.036	2,600	**0.0017**	**0.0029**	**0.0014**	**0.0019**	**0.0012**	**0.001**	**0.0017**	**0.0019**	**0.0013**
Pentachlorophenol (µg/L)														
Pentachlorophenol		13	--	--	0.3	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U
Polycyclic Aromatic Hydrocarbons (µg/L)														
1,2-Dimethylnaphthalene		--	--	--	--	0.00254 U	0.00254 U	0.00254 U	0.00254 U	**0.00652**	**0.00415**	**0.01356**	**0.0286**	**0.04575**
1,3-Dimethylnaphthalene		--	--	--	--	0.00949 U	0.00949 U	0.00949 U	0.00949 U	**0.04385**	0.00949 U	**0.0286**	**0.01852**	**0.02297**
1,8-Dimethylnaphthalene		--	--	--	--	0.00189 U	0.00189 U	0.00189 U	0.00189 U	0.00189 U	**0.00188**	0.00189 U	**0.00515**	**0.00856**
1-Ethylnaphthalene		--	--	--	--	0.00167 U	0.00167 U	0.00167 U	0.00167 U	**0.00609**	**0.00348**	**0.00558**	**0.01511**	**0.02196**
1-Methylfluorene		--	--	--	--	0.00776 U	0.00776 U	0.00776 U	0.00776 U	**0.02046**	0.00776 U	0.00776 U	0.00776 U	0.00776 U
1-Methylnaphthalene		--	--	--	--	**0.01288**	**0.01126**	**0.01572**	**0.01105**	**0.04464**	**0.01118**	0.00966 U	**0.01268**	**0.01592**
1-Methylphenanthrene		--	--	--	--	0.00178 U	0.00178 U	0.00178 U	0.00178 U	**0.00602**	0.00178 U	0.00178 U	0.00178 U	0.00178 U
1-Methylpyrene		--	--	--	--	0.00031 U	0.00031 U	0.00031 U	0.00031 U	**0.0006**	0.00031 U	0.00031 U	0.00031 U	**0.00128**
2-(tert-Butyl)anthracene		--	--	--	--	0.0001 U	0.0001 U	0.0001 U	0.0001 U	**0.0001**	0.0001 U	0.0001 U	0.0001 U	0.0001 U
2,3,5-Trimethylnaphthalene		--	--	--	--	0.00213 U	0.00213 U	**0.00211**	0.00213 U	**0.00725**	**0.00241**	**0.0032**	**0.0029**	**0.00482**
2,6-Dimethylnaphthalene		--	--	--	--	0.00775 U	0.00775 U	0.00775 U	0.00775 U	**0.03341**	0.00775 U	0.00775 U	0.00775 U	**0.00882**
2-Ethylanthracene		--	--	--	--	0.00084 U	0.00084 U	0.00084 U	0.00084 U	**0.00359**	0.00084 U	0.00084 U	0.00084 U	**0.00164**
2-Ethylnaphthalene		--	--	--	--	0.00462 U	0.00462 U	**0.00601**	0.00462 U	**0.01438**	**0.00513**	0.00462 U	0.00462 U	**0.00577**
2-Isopropyl Naphthalene		--	--	--	--	0.00085 U	0.00085 U	0.00085 U	0.00085 U	**0.00113**	0.00085 U	0.00085 U	0.00085 U	0.00085 U
2-Methylanthracene		--	--	--	--	0.0014 U	0.0014 U	0.0014 U	0.0014 U	**0.00159**	0.0014 U	0.0014 U	0.0014 U	**0.00208**
2-Methylnaphthalene		--	--	--	--	**0.02486**	**0.02271**	**0.03173**	**0.02016**	**0.06158**	**0.02272**	0.01161 U	**0.02032**	**0.02321**
2-Methylphenanthrene		--	--	--	--	0.00605 U	0.00605 U	0.00605 U	0.00605 U	**0.02003**	0.00605 U	0.00605 U	0.00605 U	**0.00669**
9,10-Dimethylanthracene		--	--	--	--	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U
9-Methylanthracene		--	--	--	--	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	**0.00134**
Acenaphthene	L	520	--	--	99	**0.03237**	**0.03086**	**0.08198**	**0.03623**	**0.24215**	**0.65529**	**0.69706**	**5.443911**	**9.62275**
Acenaphthylene	L	--	--	--	--	0.00788 U	0.00788 U	0.00788 U	0.00788 U	**0.00825**	**0.02074**	**0.03421**	**0.14918**	**0.18425**
Anthracene	L	--	--	--	4,000	0.0023 U	0.0023 U	**0.00235**	0.0023 U	**0.00741**	**0.00888**	**0.00376**	**0.00567**	**0.01444**
Benz(a)anthracene	H,C	--	--	--	0.0018	0.00038 U	**0.0005**	**0.0004**	0.00038 U	**0.0009**	**0.0005**	0.00038 U	**0.0005**	**0.00205**
Benzo(a)pyrene	H,C	--	--	--	0.0018	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U
Benzo(e)pyrene	H	--	--	--	--	0.00014 U	0.00014 U	0.00014 U	0.00014 U	**0.0004**	**0.0002**	0.00014 U	**0.0002**	**0.0002**
Benzo(b)fluoranthene	H,C	--	--	--	0.0018	0.00007 U	0.00007 U	**0.0001**	0.00007 U	**0.0003**	**0.0001**	0.00007 U	0.00007 U	**0.00008**
Benzo(k)fluoranthene	H,C	--	--	--	0.0018	0.00013 U	0.00013 U	0.00013 U	0.00013 U	**0.0002**	0.00013 U	0.00013 U	**0.0002**	0.00013 U
Benzo(g,h,i)perylene	H	--	--	--	--	0.0003 U	0.0003 U	0.0003 U	0.0003 U	**0.0008**	0.0003 U	0.0003 U	0.0003 U	0.0003 U
Chrysene	H,C	--	--	--	0.0018	**0.0006**	**0.0007**	**0.0007**	**0.0005**	**0.00243**	**0.0008**	**0.0005**	**0.0006**	**0.00243**
Dibenz(a,h)anthracene	H,C	--	--	--	0.0018	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U
Fluoranthene	H	--	54	--	14	**0.00335**	**0.00761**	**0.0054**	0.00313 U	**0.01459**	**0.00399**	**0.00469**	**0.00702**	**0.01218**
Fluorene	L	--	--	--	530	**0.01862**	**0.01676**	**0.02445**	**0.02191**	**0.0547**	**0.03641**	**0.12504**	**0.04607**	**0.04065**

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
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Sample Location		Comparison Criteria				H			I			J		
Sample ID		1996 AWQCs[1]		Current AWQCs[2]		ORG_P19_SW	ORG_P19_6	ORG_P19_18	ORG_P32_SWa	ORG_P32_6	ORG_P32_18	ORG_P15_SW	ORG_P15_6	ORG_P15_18
Sample Interval		Aquatic Life (chronic)	Human Health (fish only)	Aquatic Life (chronic)	Human Health (Consumption only)	SW	6	18	SW	6	18	SW	6	18
Sample Date						09/30/2020	09/30/2020	09/30/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020
Indeno(1,2,3-cd)pyrene	H,C	--	--	--	0.0018	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U
Naphthalene	L	620	--	--	--	0.0662 U	0.0662 U	**0.08408**	0.0662 U	**0.40042**	0.0662 U	0.0662 U	**0.10092**	0.0662 U
Perylene		--	--	--	--	**0.0002**	**0.0002**	**0.0003**	0.00014 U	**0.0003**	**0.0003**	**0.0002**	**0.0002**	**0.0002**
Phenanthrene	L	--	--	--	--	0.01307 U	0.01307 U	0.01307 U	0.01307 U	**0.04403**	0.01307 U	0.01307 U	0.01307 U	**0.02421**
Pyrene	H	--	--	--	400	0.01294 U	0.01294 U	0.01294 U	0.01294 U	**0.04518**	**0.01247**	0.01294 U	0.01294 U	**0.15444**
Total LPAHs (ND = 1/2 EDL)		--	--	--	--	**0.0957 T**	**0.0923 T**	**0.2033 T**	**0.1029 T**	**0.7570 T**	**0.7610 T**	**0.8997 T**	**5.7523 T**	**9.9194 T**
Total HPAHs (ND = 1/2 EDL)		--	--	--	--	**0.0115 T**	**0.0161 T**	**0.0139 T**	**0.0096 T**	**0.0653 T**	**0.0188 T**	**0.0127 T**	**0.0157 T**	**0.1721 T**
Total PAHs (ND = 1/2 EDL)		--	--	--	--	**0.1072 T**	**0.1085 T**	**0.2172 T**	**0.1124 T**	**0.8223 T**	**0.7798 T**	**0.9124 T**	**5.7680 T**	**10.0915 T**
Total cPAHs (No PEFs; ND = 1/2 EDL)		--	0.031	--	--	**0.0014 T**	**0.0018 T**	**0.0018 T**	**0.0013 T**	**0.0044 T**	**0.002 T**	**0.0013 T**	**0.0019 T**	**0.0052 T**
Total cPAHs (B[a]P eq. ND = 1/2 EDL)		--	--	--	--	**0.0005 T**	**0.0005 T**	**0.0005 T**	**0.0005 T**	**0.0006 T**	**0.0005 T**	**0.0005 T**	**0.0005 T**	**0.0007 T**

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
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Sample Location		Comparison Criteria				K			L			27 (Downstream)		
Sample ID		1996 AWQCs[1]		Current AWQCs[2]		ORG_P18_SW	ORG_P18_6	ORG_P18_18	ORG_P28_SWa	ORG_P28_6a	ORG_P28_18a	ORG_P17_SW	ORG_P17_6	ORG_P17_18
Sample Interval		Aquatic Life (chronic)	Human Health (fish only)	Aquatic Life (chronic)	Human Health (Consumption only)	SW	6	18	SW	6	18	SW	6	18
Sample Date						09/29/2020	09/29/2020	09/29/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020
Metals (mg/L)														
Total Arsenic		0.19	--	0.15	2.1	**0.0005**	**0.018**	**0.0056**	**0.0006**	**0.0005**	**0.0537**	**0.0005**	**0.0165**	**0.008**
Total Chromium		0.21	--	0.024	--	**0.00005**	**0.0002**	**0.0003**	**0.00007 J**	**0.00004**	**0.0002**	**0.00005 J**	**0.0003**	**0.0005**
Total Copper		0.012	--	--[3]	--	**0.0031**	**0.00003**	**0.0003 J**	**0.0006**	**0.0004 J**	**0.00006 J**	**0.0017**	**0.00009 J**	**0.0016**
Total Zinc		0.11	--	0.036	2,600	**0.0018**	**0.0023**	**0.0013**	**0.0015**	**0.0019**	**0.0014**	**0.0025**	**0.0034**	**0.0018**
Pentachlorophenol (µg/L)														
Pentachlorophenol		13	--	--	0.3	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U	0.10952 U
Polycyclic Aromatic Hydrocarbons (µg/L)														
1,2-Dimethylnaphthalene		--	--	--	--	**0.00353**	0.00254 U	0.00254 U	**0.0037**	0.00254 U	**0.00372**	**0.00456**	**0.03693**	**1.00835**
1,3-Dimethylnaphthalene		--	--	--	--	**0.03182**	0.00949 U	0.00949 U	**0.03991**	0.00949 U	**0.02841**	**0.02265**	**0.08271**	**4.59044**
1,8-Dimethylnaphthalene		--	--	--	--	0.00189 U	0.00189 U	0.00189 U	0.00189 U	0.00189 U	0.00189 U	0.00189 U	0.00189 U	**0.03202**
1-Ethylnaphthalene		--	--	--	--	**0.00343**	0.00167 U	0.00167 U	**0.00418**	0.00167 U	**0.00337**	**0.00193**	**0.01775**	**0.51556**
1-Methylfluorene		--	--	--	--	**0.01543**	0.00776 U	0.00776 U	**0.0191**	0.00776 U	**0.01306**	0.00776 U	**0.01932**	**0.17933**
1-Methylnaphthalene		--	--	--	--	**0.03825**	**0.01147**	**0.01165**	**0.04258**	**0.01063**	**0.033**	0.00966 U	**0.0103**	**0.06553**
1-Methylphenanthrene		--	--	--	--	**0.00493**	0.00178 U	0.00178 U	**0.00696**	**0.00218**	**0.00417**	**0.00198**	**0.00845**	**0.02095**
1-Methylpyrene		--	--	--	--	**0.0007**	0.00031 U	0.00031 U	**0.0006**	0.00031 U	**0.0004**	0.00031 U	**0.0008**	**0.00127**
2-(tert-Butyl)anthracene		--	--	--	--	**0.0002**	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	**0.0002**
2,3,5-Trimethylnaphthalene		--	--	--	--	**0.00529**	0.00213 U	0.00213 U	**0.00592**	0.00213 U	**0.00441**	0.00213 U	**0.02478**	**0.2672**
2,6-Dimethylnaphthalene		--	--	--	--	**0.02432**	0.00775 U	0.00775 U	**0.03216**	0.00775 U	**0.0217**	0.00775 U	**0.01036**	**0.02159**
2-Ethylanthracene		--	--	--	--	**0.00571**	**0.0008**	0.00084 U	**0.00501**	**0.00102**	**0.00239**	**0.0008**	**0.00251**	**0.00454**
2-Ethylnaphthalene		--	--	--	--	**0.00832**	0.00462 U	0.00462 U	**0.00933**	0.00462 U	**0.00996**	**0.00752**	**0.01832**	**0.27102**
2-Isopropyl Naphthalene		--	--	--	--	0.00085 U	0.00085 U	0.00085 U	**0.00112**	0.00085 U	0.00085 U	0.00085 U	0.00085 U	**0.01076**
2-Methylanthracene		--	--	--	--	0.0014 U	0.0014 U	0.0014 U	0.0014 U	0.0014 U	**0.00162**	0.0014 U	**0.00271**	**0.01106**
2-Methylnaphthalene		--	--	--	--	**0.05481**	**0.02125**	**0.02342**	**0.05501**	**0.01814**	**0.04646**	**0.01568**	**0.01909**	**0.07567**
2-Methylphenanthrene		--	--	--	--	**0.01277**	0.00605 U	0.00605 U	**0.01994**	0.00605 U	**0.01213**	0.00605 U	**0.0128**	**0.04774**
9,10-Dimethylanthracene		--	--	--	--	**0.00104**	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U	0.00098 U
9-Methylanthracene		--	--	--	--	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	0.00124 U	**0.00179**
Acenaphthene	L	520	--	--	99	**0.03798**	**0.03838**	**0.06031**	**0.0365**	**0.03399**	**0.0838**	**0.13142**	**1.16959**	**40.07554**
Acenaphthylene	L	--	--	--	--	0.00788 U	0.00788 U	0.00788 U	0.00788 U	0.00788 U	0.00788 U	0.00788 U	**0.03867**	**0.76996**
Anthracene	L	--	--	--	4,000	**0.00284**	0.0023 U	0.0023 U	**0.00538**	0.0023 U	**0.00406**	0.0023 U	**0.01882**	**0.47902**
Benz(a)anthracene	H,C	--	--	--	0.0018	**0.0006**	0.00038 U	0.00038 U	**0.0009**	0.00038 U	**0.0009**	**0.0004**	**0.00252**	**0.00484**
Benzo(a)pyrene	H,C	--	--	--	0.0018	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U	0.00062 U
Benzo(e)pyrene	H	--	--	--	--	**0.0004**	0.00014 U	0.00014 U	**0.0004**	**0.0002**	**0.0006**	0.00014 U	**0.0002**	**0.0003**
Benzo(b)fluoranthene	H,C	--	--	--	0.0018	**0.0001**	0.00007 U	0.00007 U	**0.0004**	**0.0001**	**0.0002**	**0.0001**	**0.0002**	**0.0004**
Benzo(k)fluoranthene	H,C	--	--	--	0.0018	0.00013 U	0.00013 U	0.00013 U	**0.0001**	0.00013 U	**0.0003**	0.00013 U	**0.0001**	**0.0002**
Benzo(g,h,i)perylene	H	--	--	--	--	**0.0005**	0.0003 U	0.0003 U	**0.0009**	0.0003 U	**0.0007**	0.0003 U	0.0003 U	0.0003 U
Chrysene	H,C	--	--	--	0.0018	**0.00221**	**0.0006**	**0.0005**	**0.00296**	**0.0007**	**0.00211**	**0.0006**	**0.00335**	**0.00572**
Dibenz(a,h)anthracene	H,C	--	--	--	0.0018	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U	0.00032 U
Fluoranthene	H	--	54	--	14	**0.01966**	**0.00502**	**0.00426**	**0.01777**	**0.00551**	**0.01404**	0.00313 U	**0.1059**	**0.29446**
Fluorene	L	--	--	--	530	**0.03688**	**0.0198**	**0.02337**	**0.03247**	**0.01689**	**0.03929**	**0.03472**	**0.33984**	**19.72239**

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
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Sample Location		Comparison Criteria				K			L			27 (Downstream)		
Sample ID		1996 AWQCs[1]		Current AWQCs[2]		ORG_P18_SW	ORG_P18_6	ORG_P18_18	ORG_P28_SWa	ORG_P28_6a	ORG_P28_18a	ORG_P17_SW	ORG_P17_6	ORG_P17_18
Sample Interval		Aquatic Life (chronic)	Human Health (fish only)	Aquatic Life (chronic)	Human Health (Consumption only)	SW	6	18	SW	6	18	SW	6	18
Sample Date						09/29/2020	09/29/2020	09/29/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020	09/28/2020
Indeno(1,2,3-cd)pyrene	H,C	--	--	--	0.0018	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U
Naphthalene	L	620	--	--	--	**0.28101**	0.0662 U	0.0662 U	**0.35328**	0.0662 U	**0.26667**	0.0662 U	**0.06572**	**0.63862**
Perylene		--	--	--	--	**0.0003**	**0.0004**	**0.0005**	**0.0002**	**0.0003**	**0.0004**	**0.0002**	**0.0003**	**0.0004**
Phenanthrene	L	--	--	--	--	**0.03159**	0.01307 U	0.01307 U	**0.0418**	0.01307 U	**0.02851**	0.01307 U	**0.31454**	**3.79366**
Pyrene	H	--	--	--	400	**0.06922**	0.01294 U	0.01294 U	**0.06573**	0.01294 U	**0.03749**	0.01294 U	**0.085**	**0.11689**
Total LPAHs (ND = 1/2 EDL)		--	--	--	--	**0.3942 T**	**0.1029 T**	**0.1284 T**	**0.4734 T**	**0.0956 T**	**0.4263 T**	**0.2109 T**	**1.9472 T**	**65.4792 T**
Total HPAHs (ND = 1/2 EDL)		--	--	--	--	**0.0933 T**	**0.0131 T**	**0.0123 T**	**0.0897 T**	**0.0139 T**	**0.0569 T**	**0.0100 T**	**0.1980 T**	**0.4235 T**
Total PAHs (ND = 1/2 EDL)		--	--	--	--	**0.4875 T**	**0.1160 T**	**0.1407 T**	**0.5631 T**	**0.1095 T**	**0.4831 T**	**0.2208 T**	**2.1451 T**	**65.9027 T**
Total cPAHs (No PEFs; ND = 1/2 EDL)		--	0.031	--	--	**0.0035 T**	**0.0014 T**	**0.0013 T**	**0.0049 T**	**0.0016 T**	**0.004 T**	**0.0017 T**	**0.0067 T**	**0.012 T**
Total cPAHs (B[a]P eq. ND = 1/2 EDL)		--	--	--	--	**0.0005 T**	**0.0005 T**	**0.0005 T**	**0.0006 T**	**0.0005 T**	**0.0006 T**	**0.0005 T**	**0.0008 T**	**0.0010 T**

Table IV-4: Surface Water, Inter-armor Porewater, and Sub-armor Porewater Sampling Results
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Notes:
Calculations for PAH summations were performed using 1/2 the EDL for non-detect concentrations.

[1] The 1996 Record of Decision (ROD) specifies the remedial action objects of the sediment cap as: 1) preventing human and aquatic organisms from direct contact with contaminated sediment; and 2) Oregon's revised AWQCs for human health approved by EPA on October 17, 2011 and updated in 2017.

[2] Oregon's revised AWQCs for human health approved by EPA on October 17, 2011 and updated in 2017.

[3] Copper criteria is the Biotic Ligand Model and dependent concentration of ions, alkalinity, organic carbon, pH and temperature in water column. Please see

Bold = Analyte detected at or above the laboratory detection limit

Bold and shaded = Indicates the analyte was detected in excess of the current AWQC. If no current AWQC, the 1996 value was used for screening.

Abbreviations:
ACLs = Alternate Concentration Limits
AWQCs = Ambient Water Quality Criteria
B[a]P eq= benzo[a]pyrene equivalent
C = Carcinogenic PAH (cPAH)
EDL = Estimated Detection Limit
H = High Molecular Weight PAH (HPAH)
L = Low Molecular Weight PAH (LPAH)
MCLs = Maximum Contaminant Levels
ND = Non-detect
NRWQC = National Recommended Water Quality Criteria
PAH = Polycyclic Aromatic Hydrocarbon
PEF= potency equivalent factor
T = Value is a calculated total

Qualifiers
J = Estimated result
U = Result not detected above the referenced laboratory detection limit
- = Not analyzed or not applicable

Table IV-5: Surface, Inter-Armoring, and Sub-Armoring Water Sampling Summary Statistics
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CONTAMINANT		Comparison Criteria				Surface Water Statistics							
		1996 AWQCs[1]		Current AWQCs[2]									
		Aquatic Life (chronic)	Human Health (fish consumption only)	Aquatic Life (chronic)	Human Health (Consumption only)	Number of Samples	Detection Frequency (%)	Maximum Concentration	Maximum Concentration Location[3]	Mean Concentration Detection Only	Mean Concentration Including NDs	Data Distribution[4]	95% UCL Value
Dissolved Metals (mg/L)													
Arsenic		0.19	--	0.15	2.1	16	100	0.0281	F	0.0024	0.0024	NP	0.0099
Chromium		0.21	--	0.024	--	16	100	0.0003	C	0.0001	0.0001	Gamma	0.0001
Copper		0.012	--	--[5]	--	16	100	0.0031	K	0.0007	0.0007	Lognormal	0.0013
Zinc		0.11	--	0.036	2,600	16	100	0.0089	16	0.0024	0.0024	Lognormal	0.0029
Pentachlorophenol (µg/L)													
Pentachlorophenol		13	--	--	0.3	17	0	ND	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons (µg/L)													
Acenaphthene	L	520	--	--	99	17	100	0.697	J	0.101	0.101	NP	0.271
Acenaphthylene	L	--	--	--	--	17	12	0.034	J	0.010	0.006	NP	0.014
Anthracene	L	--	--	--	4,000	17	59	0.005	L	0.003	0.003	NP	0.004
Benz(a)anthracene	H,C	--	--	--	0.0018	17	47	0.001	G	0.0005	0.0004	NP	0.001
Benzo (a) pyrene	H,C	--	--	--	0.0018	17	0	ND	NA	NA	NA	NA	NA
Benzo (b) fluoranthene	H,C	--	--	--	0.0018	17	59	0.0004	L	0.0001	0.0001	NP	0.0002
Benzo (g,h,i) perylene	H	--	--	--	--	17	18	0.001	L	0.0004	0.0003	NP	0.001
Benzo (k) fluoranthene	H,C	--	--	--	0.0018	17	18	0.0001	E, G, L	0.0001	0.0001	Normal	0.0001
Chrysene	H,C	--	--	--	0.0018	17	94	0.003	L	0.001	0.001	NP	0.002
Dibenz (a,h) anthracene	H,C	--	--	--	0.0018	17	0	ND	NA	NA	NA	NA	NA
Fluoranthene	H	--	54	--	14	17	82	0.020	K	0.007	0.007	Lognormal	0.011
Fluorene	L	--	--	--	530	17	100	0.146	12	0.043	0.043	NP	0.081
Indeno (1,2,3-c,d) pyrene	H,C	--	--	--	0.0018	17	0	ND	NA	NA	NA	NA	NA
Naphthalene	L	620	--	--	--	17	53	0.353	L	0.127	0.112	NP	0.227
Phenanthrene	L	--	--	--	--	17	47	0.044	G	0.019	0.015	NP	0.029
Pyrene	H	--	--	--	400	17	29	0.069	K	0.023	0.018	NP	0.043
Total LPAHs (ND = 1/2 MDL)		--	--	--	--	17	100	0.906	J	0.279	0.308	Gamma	0.414
Total HPAHS (ND = 1/2 MDL)		--	--	--	--	17	100	0.093	K	0.027	0.027	NP	0.059
Total PAHs (ND = 1/2 MDL)		--	--	--	--	17	100	0.918	J	0.30659	0.30659	Gamma	0.452
Total cPAHs (No PEFs, ND = 1/2 MDL)			0.031	--	--	17	100	0.0049	L	0.0021	0.0021	Lognormal	0.0025
Total cPAHs (B[a]P Eq, ND = 1/2 MDL)		--	--	--	--	17	100	0.001	L	0.001	0.001	Gamma	0.001

Table IV-5: Surface, Inter-Armoring, and Sub-Armoring Water Sampling Summary Statistics
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CONTAMINANT		Comparison Criteria				Inter-Armoring Water Statistics							
		1996 AWQCs[1]		Current AWQCs[2]									
		Aquatic Life (chronic)	Human Health (fish consumption only)	Aquatic Life (chronic)	Human Health (Consumption only)	Number of Samples	Detection Frequency (%)	Maximum Concentration	Maximum Concentration Location[3]	Mean Concentration Detection Only	Mean Concentration Including NDs	Data Distribution[4]	95% UCL Value
Dissolved Metals (mg/L)													
Arsenic		0.19	--	0.15	2.1	16	100	0.0409	J	0.0155	0.0155	Normal	0.0212
Chromium		0.21	--	0.024	--	16	100	0.0003	16 (27)	0.0001	0.0001	Gamma	0.0002
Copper		0.012	--	--[5]	--	16	100	0.0013	B	0.0002	0.0002	Gamma	0.0004
Zinc		0.11	--	0.036	2,600	16	100	0.0029	H (27)	0.0017	0.0017	Normal	0.0020
Pentachlorophenol (µg/L)													
Pentachlorophenol		13	--	--	0.3	17	0	ND	NA	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons (µg/L)													
Acenaphthene	L	520	--	--	99	17	100	59.770	12	4.600	4.600	NP	39.33
Acenaphthylene	L	--	--	--	--	17	35	0.951	12	0.088	0.085	NP	0.640
Anthracene	L	--	--	--	4,000	17	65	0.200	12	0.016	0.016	NP	0.066
Benz(a)anthracene	H,C	--	--	--	0.0018	17	53	0.003	D	0.001	0.001	NP	0.002
Benzo (a) pyrene	H,C	--	--	--	0.0018	17	1	0.001	E	0.001	0.0003	Normal	0.0004
Benzo (b) fluoranthene	H,C	--	--	--	0.0018	17	76	0.001	E	0.0002	0.0002	Gamma	0.0003
Benzo (g,h,i) perylene	H	--	--	--	--	17	18	0.001	E	0.0004	0.0003	NP	0.001
Benzo (k) fluoranthene	H,C	--	--	--	0.0018	17	47	0.0004	E	0.0002	0.0001	NP	0.0002
Chrysene	H,C	--	--	--	0.0018	17	94	0.007	D	0.002	0.002	NP	0.004
Dibenz (a,h) anthracene	H,C	--	--	--	0.0018	17	0	ND	NA	0.0003	NA	NA	NA
Fluoranthene	H	--	54	--	14	17	94	0.137	12	0.017	0.017	NP	0.052
Fluorene	L	--	--	--	530	17	100	18.150	12	1.102	1.102	NP	11.7
Indeno (1,2,3-c,d) pyrene	H,C	--	--	--	0.0018	17	0	ND	NA	0.0001	NA	NA	NA
Naphthalene	L	620	--	--	--	17	71	0.746	12	0.201	0.190	Gamma	0.332
Phenanthrene	L	--	--	--	--	17	35	0.083	D	0.023	0.019	NP	0.044
Pyrene	H	--	--	--	400	17	35	0.225	12	0.041	0.036	NP	0.103
Total LPAHs (ND = 1/2 MDL)		--	--	--	--	17	100	79.870	12	6.011	6.011	NP	52.290
Total HPAHS (ND = 1/2 MDL)		--	--	--	--	17	94	0.370	12	0.057	0.057	NP	0.159
Total PAHs (ND = 1/2 MDL)		--	--	--	--	17	100	80.24	12	6.068	6.068	NP	52.54
Total cPAHs (No PEFs, ND = 1/2 MDL)			0.031	--	--	17	94	0.0110	D and E	0.0032	0.0032	NP	0.0068
Total cPAHs (B[a]P Eq, ND = 1/2 MDL)		--	--	--	--	17	94	0.001	E	0.001	0.001	Normal	0.001

Table IV-5: Surface, Inter-Armoring, and Sub-Armoring Water Sampling Summary Statistics
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CONTAMINANT		Comparison Criteria				Sub-Armoring Water Statistics							
		1996 AWQCs[1]		Current AWQCs[2]									
		Aquatic Life (chronic)	Human Health (fish consumption only)	Aquatic Life (chronic)	Human Health (Consumption only)	Number of Samples	Detection Frequency (%)	Maximum Concentration	Maximum Concentration Location[3]	Mean Concentration Detection Only	Mean Concentration Including NDs	Data Distribution[4]	95% UCL Value
Dissolved Metals (mg/L)													
Arsenic		0.19	--	0.15	2.1	16	100	0.0537	L	0.0240	0.0240	Normal	0.0302
Chromium		0.21	--	0.024	--	16	100	0.0005	5 (27)	0.0002	0.0002	Gamma	0.0002
Copper		0.012	--	--[5]	--	16	100	0.0011	G (27)	0.0002	0.0002	NP	0.0004
Zinc		0.11	--	0.036	2,600	16	100	0.0017	G (27)	0.0012	0.0012	Normal	0.0013
Pentachlorophenol (µg/L)													
Pentachlorophenol		13	--	--	0.3	17	0	ND	NA		NA	NA	NA
Polycyclic Aromatic Hydrocarbons (µg/L)													
Acenaphthene	L	520	--	--	99	17	94	75.02	12	5.777	5.776	NP	49.290
Acenaphthylene	L	--	--	--	--	17	47	1.047	12	0.101	0.099	NP	0.707
Anthracene	L	--	--	--	4,000	17	82	0.091	12	0.014	0.014	NP	0.038
Benz(a)anthracene	H,C	--	--	--	0.0018	17	76	0.004	12	0.001	0.001	Gamma	0.001
Benzo (a) pyrene	H,C	--	--	--	0.0018	17	0	ND	NA	0.001	NA	NA	NA
Benzo (b) fluoranthene	H,C	--	--	--	0.0018	17	94	0.001	12	0.0002	0.0002	Lognormal	0.0003
Benzo (g,h,i) perylene	H	--	--	--	--	17	18	0.001	L	0.0004	0.0002	NP	0.0004
Benzo (k) fluoranthene	H,C	--	--	--	0.0018	17	41	0.001	12	0.0002	0.0001	NP	0.0003
Chrysene	H,C	--	--	--	0.0018	17	94	0.007	12	0.002	0.002	Normal	0.002
Dibenz (a,h) anthracene	H,C	--	--	--	0.0018	17	0	ND	NA	0.0003	NA	NA	NA
Fluoranthene	H	--	54	--	14	17	94	0.092	12 (27)	0.016	0.016	Lognormal	0.024
Fluorene	L	--	--	--	530	17	100	6.974	12	0.464	0.464	NP	2.238
Indeno (1,2,3-c,d) pyrene	H,C	--	--	--	0.0018	17	0	ND	NA	0.0001	NA	NA	NA
Naphthalene	L	620	--	--	--	17	53	0.773	12	0.153	0.138	NP	0.333
Phenanthrene	L	--	--	--	--	17	59	0.101	C	0.024	0.022	NP	0.046
Pyrene	H	--	--	--	400	17	71	0.154	J	0.042	0.040	Gamma	0.068
Total LPAHs (ND = 1/2 MDL)		--	--	--	--	17	100	83.96	12	6.512	6.512	NP	55.120
Total HPAHS (ND = 1/2 MDL)		--	--	--	--	17	100	0.248	12	0.059	0.059	Gamma	0.095
Total PAHs (ND = 1/2 MDL)		--	--	--	--	17	100	84.2	12	6.571	6.571	NP	55.31
Total cPAHs (No PEFs, ND = 1/2 MDL)			0.031	--	--	17	100	0.0130	12	0.0033	0.0033	Gamma	0.0046
Total cPAHs (B[a]P Eq, ND = 1/2 MDL)		--	--	--	--	17	100	0.001	12 (27)	0.001	0.001	Normal	0.001

Table IV-5: Surface, Inter-Armoring, and Sub-Armoring Water Sampling Summary Statistics
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Notes:
The number of significant figures presented in the table do not reflect true accuracy presented by the laboratory results. Data should only retain 2 significant figures. Due to statistical evaluation using Microsoft Excel, additional significant figures may be shown.
[1]The 1996 Record of Decision (ROD) specifies the remedial action objectives of the sediment cap as: 1) preventing human and aquatic organisms from direct contact with contaminated sediment; and 2) minimizing releases of contaminants from sediment that might result in contamination of the Willamette River in excess of Ambient Water Quality Criteria (AWQCs).
[2] Oregon's revised AWQCs for human health approved by EPA on October 17, 2011 and updated in 2017.
[3]Maximum concentration location is specified for the compliance monitoring area. Locations outside the compliance monitoring area with the same or a higher maximum
[4]When multiple distributions fit, assuming a lognormal distribution
[5] Copper criteria is the Biotic Ligand Model and dependent concentration of ions, alkalinity, organic carbon, pH and temperature in water column. Please see Oregon Table 30 Aquatic Life Water Quality Criteria for Toxic Pollutants for procedures.

Abbreviations:
B[a]P eq= benzo[a]pyrene equivalent
C = carcinogenic PAH (cPAH)
Gamma = gamma distribution
H = high molecular weight PAH (HPAH)
J = estimated value
L = low molecular weight PAH (LPAH)
µg/L = micrograms per liter
mg/L = milligrams per liter
MDL = method detection limit
NA= not applicable
Normal = normal distribution
-- = not analyzed
ND = not detected
NP = nonparametric distribution
PAH = Polycyclic aromatic hydrocarbon
PEF= potency equivalent factor
U = value below MDL (value represents MDL)
UCL = upper confidence limit

Table IV-6: Historical Surface, Inter-Armoring, and Sub-Armoring Water Sampling Results
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Analyte	Unit	Year	Quarter	Earliest Collection Date	Method	Interval	Number of Samples	Detection Frequency	Maximum Concentration	Maximum Concentration Location	Mean Concentration	Distribution	95% UCL
Arsenic (total)	mg/L	2006	Spring	5/10/06	Conventional	Inter-Armoring	23	30	0.0049	Location 5	0.0012	NP	0.0023
Arsenic (total)	mg/L	2006	Fall[b]	9/1/06	Conventional	Inter-Armoring	22	100	0.0021	Location 21	0.0007	NP	0.0008
Arsenic (total)	mg/L	2007	Spring[a]	5/1/07	Conventional	Inter-Armoring	23	13	0.0071	Location 5	0.0007	NP	0.0038
Arsenic (total)	mg/L	2007	Fall[b]	9/1/07	Conventional	Inter-Armoring	22	100	0.0020	Location 13	0.0010	Normal	0.0012
Arsenic (total)	mg/L	2008	Spring	3/31/08	Conventional	Inter-Armoring	22	5	0.0008	Location 14	0.0004	NA	NA
Arsenic (total)	mg/L	2008	Fall	9/15/08	Conventional	Inter-Armoring	22	95	0.0026	Location 14	0.0008	Gamma	0.0011
Arsenic (total)	mg/L	2009	Spring	3/16/09	Conventional	Inter-Armoring	22	100	0.0071	Location 7	0.0009	NP	0.0022
Arsenic (total)	mg/L	2009	Fall	10/12/09	Conventional	Inter-Armoring	22	77	0.0040	Location 17	0.0007	NP	0.0014
Arsenic (total)	mg/L	2010	Spring	4/6/10	Conventional	Inter-Armoring	22	100	0.0105	Location 06	0.0013	Nonparametric	0.0033
Arsenic (dissolved)	mg/L	2015	Fall	9/15/15	Passive Sampling	Inter-Armoring	5	20	0.0010	MBIA1015-I	0.0004	NA	NA
Arsenic (total)	mg/L	2020	Fall	9/28/20	Passive Sampling	Inter-Armoring	16	100	0.0409	J	0.0155	Normal	0.0212
Arsenic (total)	mg/L	2005	Fall	10/10/05	Conventional	Sub-Armoring	23	100	0.0332	MBPWPR05-26	0.0053	Gamma	0.0084
Arsenic (total)	mg/L	2006	Spring	5/10/06	Conventional	Sub-Armoring	23	91	0.0370	Location 3	0.0103	Gamma	0.0154
Arsenic (total)	mg/L	2006	Fall[b]	9/1/06	Conventional	Sub-Armoring	22	95	0.0386	Location 18	0.0089	Gamma	0.0142
Arsenic (total)	mg/L	2007	Spring[a]	5/1/07	Conventional	Sub-Armoring	23	100	0.0522	Location 3	0.0080	Gamma	0.0123
Arsenic (total)	mg/L	2007	Fall[b]	9/1/07	Conventional	Sub-Armoring	22	100	0.0322	Location 4	0.0126	Normal	0.0162
Arsenic (total)	mg/L	2008	Spring	3/31/08	Conventional	Sub-Armoring	22	95	0.0296	Location 9	0.0090	Gamma	0.0140
Arsenic (total)	mg/L	2008	Fall	9/15/08	Conventional	Sub-Armoring	22	100	0.0806	Location 5	0.0091	Gamma	0.0156
Arsenic (total)	mg/L	2009	Spring	3/16/09	Conventional	Sub-Armoring	22	100	0.0570	Location 5	0.0080	Gamma	0.0139
Arsenic (total)	mg/L	2009	Fall	10/12/09	Conventional	Sub-Armoring	22	95	0.0451	Location 04	0.0093	Gamma	0.0145
Arsenic (total)	mg/L	2010	Spring	4/6/10	Conventional	Sub-Armoring	22	100	0.0360	Location 02	0.0073	Gamma	0.0115
Arsenic (total)	mg/L	2020	Fall	9/28/20	Passive Sampling	Sub-Armoring	16	100	0.0537	L	0.0240	Normal	0.0302
Arsenic (total)	mg/L	2005	Fall	9/19/05	Conventional	Surface	26	100	0.0014	MBSWGB05-04	0.0008	Gamma	0.0008
Arsenic (total)	mg/L	2006	Spring	5/10/06	Conventional	Surface	23	22	0.0023	Location 25	0.0006	NP	0.0011
Arsenic (total)	mg/L	2006	Fall[b]	9/1/06	Conventional	Surface	22	95	0.0007	Location 25	0.0005	Gamma	0.0005
Arsenic (total)	mg/L	2007	Spring[a]	5/1/07	Conventional	Surface	23	100	0.0004	Location 6	0.0003	Normal	0.0003
Arsenic (total)	mg/L	2007	Fall[b]	9/1/07	Conventional	Surface	22	100	0.0014	Location 17	0.0007	NP	0.0010
Arsenic (total)	mg/L	2008	Spring	3/31/08	Conventional	Surface	22	0	ND	NA	NA	NA	NA
Arsenic (total)	mg/L	2008	Fall	9/15/08	Conventional	Surface	22	91	0.0013	Location 26	0.0005	Gamma	0.0006
Arsenic (total)	mg/L	2009	Spring	3/16/09	Conventional	Surface	22	100	0.0018	Location 19	0.0005	NP	0.0008
Arsenic (total)	mg/L	2009	Fall	10/12/09	Conventional	Surface	22	73	0.0007	Location 19	0.0004	NP	0.0005
Arsenic (total)	mg/L	2010	Spring	4/3/10	Conventional	Surface	22	100	0.0005	Location 16	0.0004	Normal	0.0004
Arsenic (dissolved)	mg/L	2015	Fall	9/15/15	Passive Sampling	Surface	12	8	0.0010	MBSW1015-A	0.0018	NA	NA
Arsenic (total)	mg/L	2020	Fall	9/28/20	Passive Sampling	Surface	16	100	0.0281	F	0.0024	NP	0.0099
Chromium (total)	mg/L	2006	Spring	5/10/06	Conventional	Inter-Armoring	23	43	0.0105	Location 12	0.0008	NP	0.0053
Chromium (total)	mg/L	2006	Fall[b]	9/1/06	Conventional	Inter-Armoring	22	64	0.0022	Location 3	0.0004	NP	0.0015
Chromium (total)	mg/L	2007	Spring[a]	5/1/07	Conventional	Inter-Armoring	23	13	0.0227	Location 5	0.0020	Gamma	0.0040
Chromium (total)	mg/L	2007	Fall[b]	9/1/07	Conventional	Inter-Armoring	22	55	0.0046	Location 16	0.0009	Gamma	0.0014
Chromium (total)	mg/L	2008	Spring	3/31/08	Conventional	Inter-Armoring	22	91	0.0023	Location 14	0.0006	Lognormal	0.0008
Chromium (total)	mg/L	2008	Fall	9/15/08	Conventional	Inter-Armoring	22	55	0.0109	Location 14	0.0014	NP	0.0023
Chromium (total)	mg/L	2009	Spring	3/16/09	Conventional	Inter-Armoring	22	100	0.0043	Location 4	0.0018	Student's T	0.0021
Chromium (total)	mg/L	2009	Fall	10/12/09	Conventional	Inter-Armoring	22	68	0.0027	Location 04	0.0005	Gamma	0.0007
Chromium (total)	mg/L	2010	Spring	4/6/10	Conventional	Inter-Armoring	22	100	0.0470	Location 06	0.0044	Nonparametric	0.0136
Chromium (dissolved)	mg/L	2015	Fall	9/15/15	Passive Sampling	Inter-Armoring	3	67	0.0006	MBIA1015-K	0.0007	NA	NA
Chromium (total)	mg/L	2020	Fall	9/28/20	Passive Sampling	Inter-Armoring	16	100	0.0003	6 and 27	0.0001	Gamma	0.0002
Chromium (total)	mg/L	2005	Fall	10/10/05	Conventional	Sub-Armoring	23	39	0.0144	MBPWPR05-09	0.0014	NP	0.0041
Chromium (total)	mg/L	2006	Spring	5/10/06	Conventional	Sub-Armoring	23	78	0.0169	Location 11	0.0013	Log	0.0027

Table IV-6: Historical Surface, Inter-Armoring, and Sub-Armoring Water Sampling Results
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Analyte	Unit	Year	Quarter	Earliest Collection Date	Method	Interval	Number of Samples	Detection Frequency	Maximum Concentration	Maximum Concentration Location	Mean Concentration	Distribution	95% UCL
Chromium (total)	mg/L	2006	Fall[b]	9/1/06	Conventional	Sub-Armoring	22	23	0.0011	Location 25	0.0002	NP	0.0004
Chromium (total)	mg/L	2007	Spring[a]	5/1/07	Conventional	Sub-Armoring	23	30	0.0026	Location 15	0.0006	NP	0.0022
Chromium (total)	mg/L	2007	Fall[b]	9/1/07	Conventional	Sub-Armoring	22	9	0.0014	Location 3	0.0003	NP	0.0006
Chromium (total)	mg/L	2008	Spring	3/31/08	Conventional	Sub-Armoring	22	55	0.0012	Location 12	0.0003	NP	0.0011
Chromium (total)	mg/L	2008	Fall	9/15/08	Conventional	Sub-Armoring	22	64	0.0058	Location 4	0.0008	Gamma	0.0012
Chromium (total)	mg/L	2009	Spring	3/16/09	Conventional	Sub-Armoring	22	95	0.0100	Location 16	0.0015	Lognormal	0.0031
Chromium (total)	mg/L	2009	Fall	10/12/09	Conventional	Sub-Armoring	22	50	0.0022	Location 18	0.0005	NP	0.0010
Chromium (total)	mg/L	2010	Spring	4/6/10	Conventional	Sub-Armoring	22	59	0.0061	Location 14	0.0009	Nonparametric	0.0021
Chromium (total)	mg/L	2020	Fall	9/28/20	Passive Sampling	Sub-Armoring	16	100	0.0005	5 and 27	0.0002	Gamma	0.0002
Chromium (total)	mg/L	2005	Fall	9/19/05	Conventional	Surface	26	0	ND	NA	NA	NA	NA
Chromium (total)	mg/L	2006	Spring	5/10/06	Conventional	Surface	23	74	0.0046	Location 14	0.0010	NP	0.0036
Chromium (total)	mg/L	2006	Fall[b]	9/1/06	Conventional	Surface	22	64	0.0023	Location 3	0.0003	NP	0.0007
Chromium (total)	mg/L	2007	Spring[a]	5/1/07	Conventional	Surface	23	52	0.0017	Location 26	0.0004	NP	0.0015
Chromium (total)	mg/L	2007	Fall[b]	9/1/07	Conventional	Surface	22	55	0.0008	Location 10	0.0003	Log	0.0004
Chromium (total)	mg/L	2008	Spring	3/31/08	Conventional	Surface	22	77	0.0010	Location 18	0.0004	NP	0.0006
Chromium (total)	mg/L	2008	Fall	9/15/08	Conventional	Surface	22	36	0.0026	Location 13	0.0005	NP	0.0012
Chromium (total)	mg/L	2009	Spring	3/16/09	Conventional	Surface	22	100	0.0095	Location 19	0.0013	NP	0.0031
Chromium (total)	mg/L	2009	Fall	10/12/09	Conventional	Surface	22	45	0.0005	Location 09	0.0002	NP	0.0003
Chromium (total)	mg/L	2010	Spring	4/3/10	Conventional	Surface	22	100	0.0013	Location 06	0.0009	Normal	0.0010
Chromium (dissolved)	mg/L	2015	Fall	9/15/20	Passive Sampling	Surface	11	0	ND	NA	NA	NA	NA
Chromium (total)	mg/L	2020	Fall	9/28/20	Passive Sampling	Surface	16	100	0.0003	C	0.0001	Gamma	0.0001
Copper (total)	mg/L	2006	Spring	5/10/06	Conventional	Inter-Armoring	23	96	0.0168	Location 12	0.0026	NP	0.0056
Copper (total)	mg/L	2006	Fall[b]	9/1/06	Conventional	Inter-Armoring	22	100	0.0044	Location 20	0.0017	Lognormal	0.0022
Copper (total)	mg/L	2007	Spring[a]	5/1/07	Conventional	Inter-Armoring	23	100	0.0370	Location 5	0.0053	NP	0.0124
Copper (total)	mg/L	2007	Fall[b]	9/1/07	Conventional	Inter-Armoring	22	86	0.0086	Location 16	0.0025	Gamma	0.0033
Copper (total)	mg/L	2008	Spring	3/31/08	Conventional	Inter-Armoring	22	82	0.0053	Location 7	0.0019	Gamma	0.0023
Copper (total)	mg/L	2008	Fall	9/15/08	Conventional	Inter-Armoring	22	100	0.0236	Location 14	0.0038	Normal	0.0084
Copper (total)	mg/L	2009	Spring	3/16/09	Conventional	Inter-Armoring	22	100	0.0092	Location 17	0.0038	Gamma	0.0048
Copper (total)	mg/L	2009	Fall	10/12/09	Conventional	Inter-Armoring	22	100	0.0102	Location 04	0.0019	NP	0.0037
Copper (total)	mg/L	2010	Spring	4/6/10	Conventional	Inter-Armoring	22	100	0.0751	Location 06	0.0077	Nonparametric	0.0228
Copper (dissolved)	mg/L	2015	Fall	9/15/15	Passive Sampling	Inter-Armoring	3	67	0.0051	MBIA1015-C	0.0019	NA	NA
Copper (total)	mg/L	2020	Fall	9/28/20	Passive Sampling	Inter-Armoring	16	16	0.0013	B	0.0002	Gamma	0.0004
Copper (total)	mg/L	2005	Fall	10/10/05	Conventional	Sub-Armoring	23	70	0.0282	MBPWPR05-09	0.0027	NP	0.0146
Copper (total)	mg/L	2006	Spring	5/10/06	Conventional	Sub-Armoring	23	70	0.0352	Location 19	0.0055	Gamma	0.0107
Copper (total)	mg/L	2006	Fall[b]	9/1/06	Conventional	Sub-Armoring	22	82	0.0028	Location 15	0.0008	Gamma	0.0012
Copper (total)	mg/L	2007	Spring[a]	5/1/07	Conventional	Sub-Armoring	23	96	0.5440	Location 15	0.0253	NP	0.2600
Copper (total)	mg/L	2007	Fall[b]	9/1/07	Conventional	Sub-Armoring	22	86	0.0048	Location 15	0.0008	NP	0.0018
Copper (total)	mg/L	2008	Spring	3/31/08	Conventional	Sub-Armoring	22	45	0.0042	Location 17	0.0007	NP	0.0029
Copper (total)	mg/L	2008	Fall	9/15/08	Conventional	Sub-Armoring	22	86	0.0135	Location 4	0.0021	Gamma	0.0033
Copper (total)	mg/L	2009	Spring	3/16/09	Conventional	Sub-Armoring	22	73	0.0190	Location 16	0.0026	Gamma	0.0042
Copper (total)	mg/L	2009	Fall	10/12/09	Conventional	Sub-Armoring	22	95	0.0070	Location 02	0.0018	Gamma	0.0026
Copper (total)	mg/L	2010	Spring	4/6/10	Conventional	Sub-Armoring	22	68	0.0095	Location 14	0.0017	Gamma	0.0030
Copper (total)	mg/L	2020	Fall	9/28/20	Passive Sampling	Sub-Armoring	16	100	0.0011	G (27 is higher)	0.0002	NP	0.0004
Copper (total)	mg/L	2005	Fall	9/19/05	Conventional	Surface	26	81	0.0028	MBSWGB05-32 (Dup. of Sample 17)	0.0010	NP	0.0012
Copper (total)	mg/L	2006	Spring	5/10/06	Conventional	Surface	23	74	0.0168	Location 18	0.0040	Max	0.0168

Table IV-6: Historical Surface, Inter-Armoring, and Sub-Armoring Water Sampling Results
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Analyte	Unit	Year	Quarter	Earliest Collection Date	Method	Interval	Number of Samples	Detection Frequency	Maximum Concentration	Maximum Concentration Location	Mean Concentration	Distribution	95% UCL
Copper (total)	mg/L	2006	Fall[b]	9/1/06	Conventional	Surface	22	100	0.0034	Location 3	0.0011	NP	0.0014
Copper (total)	mg/L	2007	Spring[a]	5/1/07	Conventional	Surface	23	100	0.0032	Location 19	0.0014	NP	0.0016
Copper (total)	mg/L	2007	Fall[b]	9/1/07	Conventional	Surface	22	86	0.0022	Location 12	0.0012	Normal	0.0014
Copper (total)	mg/L	2008	Spring	3/31/08	Conventional	Surface	22	77	0.0035	Location 12	0.0011	Normal	0.0012
Copper (total)	mg/L	2008	Fall	9/15/08	Conventional	Surface	22	100	0.0028	Location 18	0.0011	Gamma	0.0013
Copper (total)	mg/L	2009	Spring	3/16/09	Conventional	Surface	22	95	0.0150	Location 19	0.0026	NP	0.0053
Copper (total)	mg/L	2009	Fall	10/12/09	Conventional	Surface	22	100	0.0015	Location 04	0.0010	NP	0.0011
Copper (total)	mg/L	2010	Spring	4/3/10	Conventional	Surface	22	100	0.0025	Location 20	0.0016	Normal	0.0017
Copper (dissolved)	mg/L	2015	Fall	9/15/15	Passive Sampling	Surface	11	100	0.0002	MBSW1015-D	0.0001	Normal	0.0002
Copper (total)	mg/L	2020	Fall	9/28/20	Passive Sampling	Surface	16	100	0.0031	K	0.0007	Lognormal	0.0013
Zinc (total)	mg/L	2006	Spring	5/10/06	Conventional	Inter-Armoring	23	78	0.0392	Location 12	0.0069	NP	0.0154
Zinc (total)	mg/L	2006	Fall[b]	9/1/06	Conventional	Inter-Armoring	22	45	0.0147	Location 17	0.0032	NP	0.0113
Zinc (total)	mg/L	2007	Spring[a]	5/1/07	Conventional	Inter-Armoring	23	4	0.0333	Location 5	0.0051	NA	NA
Zinc (total)	mg/L	2007	Fall[b]	9/1/07	Conventional	Inter-Armoring	22	64	0.0222	Location 16	0.0068	Gamma	0.0093
Zinc (total)	mg/L	2008	Spring	3/31/08	Conventional	Inter-Armoring	22	27	0.1720	Location 9	0.0117	NP	0.0879
Zinc (total)	mg/L	2008	Fall	9/15/08	Conventional	Inter-Armoring	22	77	0.0580	Location 14	0.0109	Normal	0.0220
Zinc (total)	mg/L	2009	Spring	3/16/09	Conventional	Inter-Armoring	22	27	0.0180	Location 4	0.0067	NP	0.0100
Zinc (total)	mg/L	2009	Fall	10/12/09	Conventional	Inter-Armoring	22	100	0.0303	Location 04	0.0064	NP	0.0085
Zinc (total)	mg/L	2010	Spring	4/6/10	Conventional	Inter-Armoring	22	100	0.1620	Location 06	0.0178	Nonparametric	0.0492
Zinc (dissolved)	mg/L	2015	Fall	9/15/15	Passive Sampling	Inter-Armoring	3	67	0.0075	MBIA1015-C	0.0034	NA	NA
Zinc (total)	mg/L	2020	Fall	9/28/20	Passive Sampling	Inter-Armoring	16	100	0.0029	H (27 is higher)	0.0017	Normal	0.0020
Zinc (total)	mg/L	2005	Fall	10/10/05	Conventional	Sub-Armoring	23	100	0.1130	MBPWPR05-09	0.0202	Gamma	0.0280
Zinc (total)	mg/L	2006	Spring	5/10/06	Conventional	Sub-Armoring	23	87	0.3880	Location 11	0.0366	Log	0.0718
Zinc (total)	mg/L	2006	Fall[b]	9/1/06	Conventional	Sub-Armoring	22	50	0.0263	Location 14	0.0059	NP	0.0207
Zinc (total)	mg/L	2007	Spring[a]	5/1/07	Conventional	Sub-Armoring	23	57	0.0526	Location 15	0.0098	NP	0.0350
Zinc (total)	mg/L	2007	Fall[b]	9/1/07	Conventional	Sub-Armoring	22	91	0.0335	Location 16	0.0113	Gamma	0.0154
Zinc (total)	mg/L	2008	Spring	3/31/08	Conventional	Sub-Armoring	22	64	0.0219	Location 2	0.0077	NP	0.0132
Zinc (total)	mg/L	2008	Fall	9/15/08	Conventional	Sub-Armoring	22	64	0.0328	Location 4	0.0082	NP	0.0154
Zinc (total)	mg/L	2009	Spring	3/16/09	Conventional	Sub-Armoring	22	27	0.0810	Location 11	0.0101	NP	0.0264
Zinc (total)	mg/L	2009	Fall	10/12/09	Conventional	Sub-Armoring	22	73	0.0379	Location 18	0.0075	Gamma	0.0111
Zinc (total)	mg/L	2010	Spring	4/6/10	Conventional	Sub-Armoring	22	91	0.0232	Location 14	0.0069	Gamma	0.0096
Zinc (total)	mg/L	2020	Fall	9/28/20	Passive Sampling	Sub-Armoring	16	100	0.0017	G (27 is higher)	0.0012	Normal	0.0013
Zinc (total)	mg/L	2005	Fall	9/19/05	Conventional	Surface	26	88	0.0084	MBSWGB05-32 (Dup. of Sample 17)	0.0031	NP	0.0046
Zinc (total)	mg/L	2006	Spring	5/10/06	Conventional	Surface	23	87	0.0400	Location 25	0.0082	NP	0.0291
Zinc (total)	mg/L	2006	Fall[b]	9/1/06	Conventional	Surface	22	27	0.0048	Location 7	0.0016	NP	0.0028
Zinc (total)	mg/L	2007	Spring[a]	5/1/07	Conventional	Surface	23	35	0.0216	Location 20	0.0028	NP	0.0068
Zinc (total)	mg/L	2007	Fall[b]	9/1/07	Conventional	Surface	22	68	0.0045	Location 12	0.0027	Max	0.0045
Zinc (total)	mg/L	2008	Spring	3/31/08	Conventional	Surface	22	9	0.0125	Location 25	0.0031	NA	NA
Zinc (total)	mg/L	2008	Fall	9/15/08	Conventional	Surface	22	100	0.0111	Location 26	0.0057	Normal	0.0064
Zinc (total)	mg/L	2009	Spring	3/16/09	Conventional	Surface	22	23	0.0320	Location 19	0.0062	NP	0.0116
Zinc (total)	mg/L	2009	Fall	10/12/09	Conventional	Surface	22	73	0.0065	Location 10	0.0029	NP	0.0034
Zinc (total)	mg/L	2010	Spring	4/3/10	Conventional	Surface	22	100	0.0064	Location 21	0.0039	Nonparametric	0.0663
Zinc (dissolved)	mg/L	2015	Fall	9/15/15	Passive Sampling	Surface	11	82	0.0038	MBSW1015-I	0.0029	Gamma	0.0072
Zinc (total)	mg/L	2020	Fall	9/28/20	Passive Sampling	Surface	16	100	0.0089	16	0.0024	Lognormal	0.0029
Acenaphthene	µg/L	2006	Spring	5/10/06	Conventional	Inter-Armoring	22	32	3.6500	Location 5	0.3208	NP	2.3228

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Analyte	Unit	Year	Quarter	Earliest Collection Date	Method	Interval	Number of Samples	Detection Frequency	Maximum Concentration	Maximum Concentration Location	Mean Concentration	Distribution	95% UCL
Acenaphthene	µg/L	2006	Fall[b]	9/1/06	Conventional	Inter-Armoring	22	23	1.8100	Location 20	0.0961	NP	0.9105
Acenaphthene	µg/L	2007	Spring[a]	5/1/07	Conventional	Inter-Armoring	23	13	0.1150	Location 20	0.0143	NP	0.0375
Acenaphthene	µg/L	2007	Fall[b]	9/1/07	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
Acenaphthene	µg/L	2008	Spring	3/31/08	Conventional	Inter-Armoring	22	14	0.0582	Location 2	0.0107	NP	0.0233
Acenaphthene	µg/L	2008	Fall	9/15/08	Conventional	Inter-Armoring	22	18	0.1840	Location 26	0.0213	NP	0.0363
Acenaphthene	µg/L	2009	Spring	3/16/09	Conventional	Inter-Armoring	22	18	6.0000	Location 20	0.2896	NP	1.4760
Acenaphthene	µg/L	2009	Fall	10/12/09	Conventional	Inter-Armoring	22	32	0.1400	Location 13	0.0257	NP	0.0379
Acenaphthene	µg/L	2010	Spring	4/6/10	Conventional	Inter-Armoring	22	9	0.5600	Location 12	0.0306	NA	NA
Acenaphthene	µg/L	2010	Fall	10/12/10	Passive Sampling	Inter-Armoring	21	100	3.1000	Location 5	0.3100	NP	1.1000
Acenaphthene	µg/L	2015	Fall	9/15/15	Passive Sampling	Inter-Armoring	14	93	6.0000	MBIA1015-12	0.9200	NP	24.0000
Acenaphthene	µg/L	2020	Fall	9/28/20	Passive Sampling	Inter-Armoring	17	100	59.7668	12	4.5996	NP	39.3300
Acenaphthene	µg/L	2005	Fall	10/10/05	Conventional	Sub-Armoring	23	57	131.0000	MBPWPR05-20	16.9830	NP	32.6500
Acenaphthene	µg/L	2006	Spring	5/10/06	Conventional	Sub-Armoring	23	74	22.1000	Location 20	4.5200	Gamma	11.2010
Acenaphthene	µg/L	2006	Fall[b]	9/1/06	Conventional	Sub-Armoring	22	73	19.0000	Location 20	3.4010	Gamma	8.5100
Acenaphthene	µg/L	2007	Spring[a]	5/1/07	Conventional	Sub-Armoring	23	78	47.5000	Location 8	8.4310	Gamma	23.0180
Acenaphthene	µg/L	2007	Fall[b]	9/1/07	Conventional	Sub-Armoring	22	59	67.6000	Location 9	10.8140	Gamma	27.0620
Acenaphthene	µg/L	2008	Spring	3/31/08	Conventional	Sub-Armoring	22	73	50.5000	Location 9	7.0340	Gamma	18.9200
Acenaphthene	µg/L	2008	Fall	9/15/08	Conventional	Sub-Armoring	22	59	48.0000	Location 12	7.8140	NP	12.8700
Acenaphthene	µg/L	2009	Spring	3/16/09	Conventional	Sub-Armoring	22	55	19.0000	Location 5	2.2820	NP	7.4180
Acenaphthene	µg/L	2009	Fall	10/12/09	Conventional	Sub-Armoring	22	82	45.1000	Location 16	6.1530	Gamma	16.2000
Acenaphthene	µg/L	2010	Spring	4/6/10	Conventional	Sub-Armoring	22	68	61.5000	Location 12	6.6010	Nonparametric	28.1000
Acenaphthene	µg/L	2010	Fall	10/12/10	Passive Sampling	Sub-Armoring	21	100	22.0000	Location 5	2.2450	NP	2.4000
Acenaphthene	µg/L	2015	Fall	9/15/15	Passive Sampling	Sub-Armoring	4	100	2.7000	MBSA1015-12	0.8900	NA	NA
Acenaphthene	µg/L	2020	Fall	9/28/20	Passive Sampling	Sub-Armoring	17	94	75.0178	12	5.7767	NP	49.2900
Acenaphthene	µg/L	2005	Fall	9/19/05	Conventional	Surface	26	19	0.0972	MBSWGB05-17	0.0168	NP	0.0356
Acenaphthene	µg/L	2006	Spring	5/10/06	Conventional	Surface	23	0	ND	NA	NA	NA	NA
Acenaphthene	µg/L	2006	Fall[b]	9/1/06	Conventional	Surface	22	23	0.1660	Location 25	0.0190	NP	0.0534
Acenaphthene	µg/L	2007	Spring[a]	5/1/07	Conventional	Surface	23	0	ND	NA	NA	NA	NA
Acenaphthene	µg/L	2007	Fall[b]	9/1/07	Conventional	Surface	22	45	0.4110	Location 12	0.0681	NP	0.3359
Acenaphthene	µg/L	2008	Spring	3/31/08	Conventional	Surface	22	14	0.0661	Location 2	0.0125	NP	0.0287
Acenaphthene	µg/L	2008	Fall	9/15/08	Conventional	Surface	22	14	0.7040	Location 26	0.0442	NP	0.3600
Acenaphthene	µg/L	2009	Spring	3/16/09	Conventional	Surface	22	9	0.0200	Location 2	0.0059	NA	NA
Acenaphthene	µg/L	2009	Fall	10/12/09	Conventional	Surface	22	23	0.0980	Location 05	0.0164	NP	0.0534
Acenaphthene	µg/L	2010	Spring	4/3/10	Conventional	Surface	22	14	0.3300	Location 12	0.0200	Nonparametric	0.0847
Acenaphthene	µg/L	2010	Fall	10/12/10	Passive Sampling	Surface	2	100	0.0322	Surface Water 2	0.0287	NA	NA
Acenaphthene	µg/L	2015	Fall	9/15/15	Passive Sampling	Surface	15	100	0.1600	MBSW1015-12	0.0270	Gamma	0.0670
Acenaphthene	µg/L	2020	Fall	9/28/20	Passive Sampling	Surface	17	100	0.6971	J	0.1008	NP	0.2710
Fluoranthene	µg/L	2006	Spring	5/10/06	Conventional	Inter-Armoring	22	5	0.2530	Location 5	0.0172	NA	NA
Fluoranthene	µg/L	2006	Fall[b]	9/1/06	Conventional	Inter-Armoring	22	18	0.1110	Location 5	0.0123	NP	0.0333
Fluoranthene	µg/L	2007	Spring[a]	5/1/07	Conventional	Inter-Armoring	23	0	ND	NA	NA	NA	NA
Fluoranthene	µg/L	2007	Fall[b]	9/1/07	Conventional	Inter-Armoring	22	32	0.0173	Location 10	0.0084	NP	0.0098
Fluoranthene	µg/L	2008	Spring	3/31/08	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
Fluoranthene	µg/L	2008	Fall	9/15/20	Conventional	Inter-Armoring	22	5	0.0170	Location 7	0.0065	NA	NA
Fluoranthene	µg/L	2009	Spring	3/16/09	Conventional	Inter-Armoring	22	14	0.1100	Location 7	0.0125	NP	0.0353
Fluoranthene	µg/L	2009	Fall	10/12/09	Conventional	Inter-Armoring	22	9	0.0280	Location 06	0.0089	NA	NA
Fluoranthene	µg/L	2010	Spring	4/6/10	Conventional	Inter-Armoring	22	9	0.0140	Location 05	0.0032	NA	NA

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Analyte	Unit	Year	Quarter	Earliest Collection Date	Method	Interval	Number of Samples	Detection Frequency	Maximum Concentration	Maximum Concentration Location	Mean Concentration	Distribution	95% UCL
Fluoranthene	µg/L	2010	Fall	10/12/10	Passive Sampling	Inter-Armoring	21	100	0.0190	Location 15	0.0020	NP	0.0057
Fluoranthene	µg/L	2015	Fall	9/15/15	Passive Sampling	Inter-Armoring	14	100	0.0340	MBIA1015-B	0.0035	NP	0.0130
Fluoranthene	µg/L	2020	Fall	9/28/20	Passive Sampling	Inter-Armoring	17	94	0.1372	12	0.0172	NP	0.0515
Fluoranthene	µg/L	2005	Fall	10/10/05	Conventional	Sub-Armoring	23	61	7.4000	MBPWPR05-07	0.8853	NP	5.2590
Fluoranthene	µg/L	2006	Spring	5/10/06	Conventional	Sub-Armoring	23	65	1.6700	Location 7	0.2263	NP	1.1220
Fluoranthene	µg/L	2006	Fall[b]	9/1/06	Conventional	Sub-Armoring	22	59	10.4000	Location 7	0.6263	NP	5.3120
Fluoranthene	µg/L	2007	Spring[a]	5/1/07	Conventional	Sub-Armoring	23	57	2.7500	Location 7	0.1935	NP	1.4340
Fluoranthene	µg/L	2007	Fall[b]	9/1/07	Conventional	Sub-Armoring	22	36	12.2000	Location 7	0.6482	NP	6.1320
Fluoranthene	µg/L	2008	Spring	3/31/08	Conventional	Sub-Armoring	22	64	2.1600	Location 9	0.2574	NP	1.4740
Fluoranthene	µg/L	2008	Fall	9/15/20	Conventional	Sub-Armoring	22	41	2.1900	Location 9	0.2399	NP	0.4280
Fluoranthene	µg/L	2009	Spring	3/16/09	Conventional	Sub-Armoring	22	32	0.7900	Location 7	0.0633	NP	0.2230
Fluoranthene	µg/L	2009	Fall	10/12/09	Conventional	Sub-Armoring	22	41	1.4000	Location 07	0.1200	NP	0.2270
Fluoranthene	µg/L	2010	Spring	4/6/10	Conventional	Sub-Armoring	22	50	0.4600	Location 08	0.0522	Nonparametric	0.1460
Fluoranthene	µg/L	2010	Fall	10/12/10	Passive Sampling	Sub-Armoring	21	33	0.2200	Location 5	0.0228	NP	0.0600
Fluoranthene	µg/L	2015	Fall	9/15/15	Passive Sampling	Sub-Armoring	4	100	0.0015	MBSA1015-12	0.0007	NA	NA
Fluoranthene	µg/L	2020	Fall	9/28/20	Passive Sampling	Sub-Armoring	17	94	0.0916	12 (27 is higher)	0.0156	Lognormal	0.0236
Fluoranthene	µg/L	2005	Fall	9/19/05	Conventional	Surface	26	0	ND	NA	NA	NA	NA
Fluoranthene	µg/L	2006	Spring	5/10/06	Conventional	Surface	23	9	0.0396	Location 25	0.0085	NA	NA
Fluoranthene	µg/L	2006	Fall[b]	9/1/06	Conventional	Surface	22	5	0.0143	Location 14	0.0066	NA	NA
Fluoranthene	µg/L	2007	Spring[a]	5/1/07	Conventional	Surface	23	4	0.0133	Location 19	0.0065	NA	NA
Fluoranthene	µg/L	2007	Fall[b]	9/1/07	Conventional	Surface	22	14	0.0286	Location 12	0.0084	NP	0.0109
Fluoranthene	µg/L	2008	Spring	3/31/08	Conventional	Surface	22	0	ND	NA	NA	NA	NA
Fluoranthene	µg/L	2008	Fall	9/15/20	Conventional	Surface	22	5	0.0239	Location 26	0.0068	NA	NA
Fluoranthene	µg/L	2009	Spring	3/16/09	Conventional	Surface	22	9	0.0120	Location 15	0.0054	NA	NA
Fluoranthene	µg/L	2009	Fall	10/12/09	Conventional	Surface	22	5	0.0160	Location 25	0.0079	NA	NA
Fluoranthene	µg/L	2010	Spring	4/3/10	Conventional	Surface	22	14	0.0210	Location 12	0.0040	NA	NA
Fluoranthene	µg/L	2010	Fall	10/12/10	Passive Sampling	Surface	2	0	ND	NA	NA	NA	NA
Fluoranthene	µg/L	2015	Fall	9/15/15	Passive Sampling	Surface	15	100	0.0034	MBSW1015-B	0.0021	Normal	0.0024
Fluoranthene	µg/L	2020	Fall	9/28/20	Passive Sampling	Surface	17	82	0.0197	K	0.0070	Lognormal	0.0108
Naphthalene	µg/L	2006	Spring	5/10/06	Conventional	Inter-Armoring	22	50	1.1300	Location 5	0.0850	NP	0.6037
Naphthalene	µg/L	2006	Fall[b]	9/1/06	Conventional	Inter-Armoring	22	36	2.0800	Location 20	0.1364	NP	1.0949
Naphthalene	µg/L	2007	Spring[a]	5/1/07	Conventional	Inter-Armoring	23	0	ND	NA	NA	NA	NA
Naphthalene	µg/L	2007	Fall[b]	9/1/07	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
Naphthalene	µg/L	2008	Spring	3/31/08	Conventional	Inter-Armoring	22	27	0.0521	Location 2	0.0112	NP	0.0218
Naphthalene	µg/L	2008	Fall	9/15/08	Conventional	Inter-Armoring	22	14	0.4880	Location 26	0.0312	NP	0.2500
Naphthalene	µg/L	2009	Spring	3/16/09	Conventional	Inter-Armoring	22	23	0.4200	Location 2	0.0407	NP	0.1410
Naphthalene	µg/L	2009	Fall	10/12/09	Conventional	Inter-Armoring	22	32	0.3600	Location 05	0.0310	NP	0.1030
Naphthalene	µg/L	2010	Spring	4/6/10	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
Naphthalene	µg/L	2010	Fall	10/12/10	Passive Sampling	Inter-Armoring	21	76	0.9600	Location 5	0.0800	NP	0.2800
Naphthalene	µg/L	2015	Fall	9/15/15	Passive Sampling	Inter-Armoring	14	29	0.0200	MBIA1015-12	0.0026	NP	0.0090
Naphthalene	µg/L	2020	Fall	9/28/20	Passive Sampling	Inter-Armoring	17	71	0.7460	12	0.2015	Gamman	0.3320
Naphthalene	µg/L	2005	Fall	10/10/05	Conventional	Sub-Armoring	23	61	772.0000	MBPWPR05-09	74.5670	NP	522.0000
Naphthalene	µg/L	2006	Spring	5/10/06	Conventional	Sub-Armoring	23	74	726.0000	Location 16	47.5160	NP	297.0000
Naphthalene	µg/L	2006	Fall[b]	9/1/06	Conventional	Sub-Armoring	22	73	229.0000	Location 5	13.3230	NP	118.0000
Naphthalene	µg/L	2007	Spring[a]	5/1/07	Conventional	Sub-Armoring	23	30	848.0000	Location 5	69.1240	NP	150.0000
Naphthalene	µg/L	2007	Fall[b]	9/1/07	Conventional	Sub-Armoring	22	18	407.0000	Location 16	24.1320	NP	325.0000
Naphthalene	µg/L	2008	Spring	3/31/08	Conventional	Sub-Armoring	22	41	232.0000	Location 5	12.1680	NP	117.0000

Table IV-6: Historical Surface, Inter-Armoring, and Sub-Armoring Water Sampling Results
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Analyte	Unit	Year	Quarter	Earliest Collection Date	Method	Interval	Number of Samples	Detection Frequency	Maximum Concentration	Maximum Concentration Location	Mean Concentration	Distribution	95% UCL
Naphthalene	µg/L	2008	Fall	9/15/08	Conventional	Sub-Armoring	22	55	83.5000	Location 9	4.7930	NP	11.0000
Naphthalene	µg/L	2009	Spring	3/16/09	Conventional	Sub-Armoring	22	41	0.2000	Location 2	0.0300	NP	0.0000
Naphthalene	µg/L	2009	Fall	10/12/09	Conventional	Sub-Armoring	22	45	0.9300	Location 16	0.1560	NP	0.0000
Naphthalene	µg/L	2010	Spring	4/6/10	Conventional	Sub-Armoring	22	32	16.1000	Location 17	1.7440	Nonparametric	6.0000
Naphthalene	µg/L	2010	Fall	10/12/10	Passive Sampling	Sub-Armoring	21	81	69.0000	Location 5	6.0520	NP	18.0000
Naphthalene	µg/L	2015	Fall	9/15/15	Passive Sampling	Sub-Armoring	4	50	0.0260	MBSA1015-12	0.0068	NA	NA
Naphthalene	µg/L	2020	Fall	9/28/20	Passive Sampling	Sub-Armoring	17	53	0.7727	12	0.1534	NP	0.3330
Naphthalene	µg/L	2005	Fall	9/19/05	Conventional	Surface	26	15	0.9110	MBSWGB05-17	0.0663	NP	0.0444
Naphthalene	µg/L	2006	Spring	5/10/06	Conventional	Surface	23	26	0.1900	Location 25	0.0173	NP	0.0523
Naphthalene	µg/L	2006	Fall[b]	9/1/06	Conventional	Surface	22	18	0.9300	Location 25	0.0873	NP	0.6179
Naphthalene	µg/L	2007	Spring[a]	5/1/07	Conventional	Surface	23	0	ND	NA	NA	NA	NA
Naphthalene	µg/L	2007	Fall[b]	9/1/07	Conventional	Surface	22	50	1.3300	Location 7	0.1937	NP	1.0255
Naphthalene	µg/L	2008	Spring	3/31/08	Conventional	Surface	22	18	0.0934	Location 25	0.0135	Normal	0.0324
Naphthalene	µg/L	2008	Fall	9/15/08	Conventional	Surface	22	9	2.9300	Location 26	0.1541	NA	NA
Naphthalene	µg/L	2009	Spring	3/16/09	Conventional	Surface	22	23	0.1100	Location 13	0.0168	NP	0.2240
Naphthalene	µg/L	2009	Fall	10/12/09	Conventional	Surface	22	23	0.5100	Location 05	0.0493	NP	0.0894
Naphthalene	µg/L	2010	Spring	4/3/10	Conventional	Surface	22	0	ND	NA	NA	NA	NA
Naphthalene	µg/L	2010	Fall	10/12/10	Passive Sampling	Surface	2	100	0.0441	Surface Water 2	0.0306	NA	NA
Naphthalene	µg/L	2015	Fall	9/15/15	Passive Sampling	Surface	15	67	0.0740	MBSW1015-C	0.0073	NP	0.0293
Naphthalene	µg/L	2020	Fall	9/28/20	Passive Sampling	Surface	17	53	0.3533	L	0.1272	NP	0.2270
cPAHs	µg/L	2006	Spring	5/10/06	Conventional	Inter-Armoring	22	5	0.0320	Location 5	0.0530	NA	-
cPAHs	µg/L	2006	Fall[b]	9/1/06	Conventional	Inter-Armoring	22	9	0.0559	Location 5	0.0556	NA	-
cPAHs	µg/L	2007	Spring[a]	5/1/07	Conventional	Inter-Armoring	23	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2007	Fall[b]	9/1/07	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2008	Spring	3/31/08	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2008	Fall	9/15/08	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2009	Spring	3/16/09	Conventional	Inter-Armoring	22	5	0.0403	Location 18	0.0368	NA	-
cPAHs	µg/L	2009	Fall	10/12/09	Conventional	Inter-Armoring	22	9	0.0880	Location 06	0.0653	NA	-
cPAHs	µg/L	2010	Spring	4/6/10	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2010	Fall	10/12/10	Passive Sampling	Inter-Armoring	21	14	0.0015	Location 11	0.0003	NA	NA
cPAHs	µg/L	2015	Fall	9/15/15	Passive Sampling	Inter-Armoring	14	57	0.0003	MBIA1015-D	0.0001	NP	0.0003
cPAHs	µg/L	2020	Fall	9/28/20	Passive Sampling	Inter-Armoring	17	94	0.0110	D and E	0.0032	NP	0.0068
cPAHs	µg/L	2005	Fall	10/10/05	Conventional	Sub-Armoring	23	22	3.0170	MBPWPR05-09	0.2390	NP	0.8040
cPAHs	µg/L	2006	Spring	5/10/06	Conventional	Sub-Armoring	23	22	0.3217	Location 5	0.0889	NP	0.1980
cPAHs	µg/L	2006	Fall[b]	9/1/06	Conventional	Sub-Armoring	22	23	0.1053	Location 7	0.0563	NP	0.0710
cPAHs	µg/L	2007	Spring[a]	5/1/07	Conventional	Sub-Armoring	23	13	0.2105	Location 10	0.1789	NP	0.6910
cPAHs	µg/L	2007	Fall[b]	9/1/07	Conventional	Sub-Armoring	22	18	0.1658	Location 7	0.0552	NP	0.0821
cPAHs	µg/L	2008	Spring	3/31/08	Conventional	Sub-Armoring	22	9	0.4621	Location 16	0.0747	NA	NA
cPAHs	µg/L	2008	Fall	9/15/08	Conventional	Sub-Armoring	22	18	0.2180	Location 9	0.0760	NP	0.1260
cPAHs	µg/L	2009	Spring	3/16/09	Conventional	Sub-Armoring	22	14	0.2970	Location 11	0.0528	NP	0.1050
cPAHs	µg/L	2009	Fall	10/12/09	Conventional	Sub-Armoring	22	18	0.0820	Location 13	0.0330	Student's T	0.0617
cPAHs	µg/L	2010	Spring	4/6/10	Conventional	Sub-Armoring	22	14	0.1090	Location 21	0.0229	Nonparametric	0.0461
cPAHs	µg/L	2010	Fall	10/12/10	Passive Sampling	Sub-Armoring	21	29	0.0110	Location 5	0.0011	NP	0.0029
cPAHs	µg/L	2015	Fall	9/15/15	Passive Sampling	Sub-Armoring	4	100	0.0004	MBSA1015-12	0.0002	NA	NA
cPAHs	µg/L	2020	Fall	9/28/20	Passive Sampling	Sub-Armoring	17	100	0.0130	12	0.0033	Gamma	0.0046
cPAHs	µg/L	2005	Fall	9/19/05	Conventional	Surface	26	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2006	Spring	5/10/06	Conventional	Surface	23	9	0.0530	Location 13	0.0524	NA	NA

Table IV-6: Historical Surface, Inter-Armoring, and Sub-Armoring Water Sampling Results
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Analyte	Unit	Year	Quarter	Earliest Collection Date	Method	Interval	Number of Samples	Detection Frequency	Maximum Concentration	Maximum Concentration Location	Mean Concentration	Distribution	95% UCL
cPAHs	µg/L	2006	Fall[b]	9/1/06	Conventional	Surface	22	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2007	Spring[a]	5/1/07	Conventional	Surface	23	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2007	Fall[b]	9/1/07	Conventional	Surface	22	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2008	Spring	3/31/08	Conventional	Surface	22	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2008	Fall	9/15/08	Conventional	Surface	22	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2009	Spring	3/16/09	Conventional	Surface	22	5	0.0600	Location 15	0.0382	NA	NA
cPAHs	µg/L	2009	Fall	10/12/09	Conventional	Surface	22	5	0.0723	Location 25	0.0645	NA	NA
cPAHs	µg/L	2010	Spring	4/3/10	Conventional	Surface	22	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2010	Fall	10/12/10	Passive Sampling	Surface	2	0	ND	NA	NA	NA	NA
cPAHs	µg/L	2015	Fall	9/15/15	Passive Sampling	Surface	15	100	0.0009	MBSW1015-J	0.0005	Normal	0.0006
cPAHs	µg/L	2020	Fall	9/28/20	Passive Sampling	Surface	17	100	0.0049	L	0.0021	Lognormal	0.0025
Pentachlorophenol	µg/L	2006	Spring	5/10/06	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2006	Fall[b]	9/1/06	Conventional	Inter-Armoring	22	14	0.2500	Location 6	0.1351	NP	0.1495
Pentachlorophenol	µg/L	2007	Spring[a]	5/1/07	Conventional	Inter-Armoring	23	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2007	Fall[b]	9/1/07	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2008	Spring	3/31/08	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2008	Fall	9/15/08	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2009	Spring	3/16/09	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2009	Fall	10/12/09	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2010	Spring	4/6/10	Conventional	Inter-Armoring	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2015	Fall	9/15/15	Passive Sampling	Inter-Armoring	14	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2020	Fall	9/28/20	Passive Sampling	Inter-Armoring	17	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2005	Fall	10/10/05	Conventional	Sub-Armoring	23	4	0.4690	MBPWPR05-17 1	0.8562	NA	NA
Pentachlorophenol	µg/L	2006	Spring	5/10/06	Conventional	Sub-Armoring	23	4	18.5000	Location 6	0.9662	NA	NA
Pentachlorophenol	µg/L	2006	Fall[b]	9/1/06	Conventional	Sub-Armoring	22	14	0.2500	Location 6	0.1409	NP	0.1578
Pentachlorophenol	µg/L	2007	Spring[a]	5/1/07	Conventional	Sub-Armoring	23	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2007	Fall[b]	9/1/07	Conventional	Sub-Armoring	22	5	3.2700	Location 16	0.2621	NP	0.8864
Pentachlorophenol	µg/L	2008	Spring	3/31/08	Conventional	Sub-Armoring	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2008	Fall	9/15/08	Conventional	Sub-Armoring	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2009	Spring	3/16/09	Conventional	Sub-Armoring	22	5	0.7400	Location 5	0.1868	NA	NA
Pentachlorophenol	µg/L	2009	Fall	10/12/09	Conventional	Sub-Armoring	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2010	Spring	4/6/10	Conventional	Sub-Armoring	22	5	0.3200	Location 19	0.0850	NA	NA
Pentachlorophenol	µg/L	2015	Fall	9/15/15	Passive Sampling	Sub-Armoring	4	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2020	Fall	9/28/20	Passive Sampling	Sub-Armoring	17	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2005	Fall	9/19/05	Conventional	Surface	26	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2006	Spring	5/10/06	Conventional	Surface	23	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2006	Fall[b]	9/1/06	Conventional	Surface	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2007	Spring[a]	5/1/07	Conventional	Surface	23	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2007	Fall[b]	9/1/07	Conventional	Surface	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2008	Spring	3/31/08	Conventional	Surface	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2008	Fall	9/15/08	Conventional	Surface	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2009	Spring	3/16/09	Conventional	Surface	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2009	Fall	10/12/09	Conventional	Surface	22	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2010	Spring	4/3/10	Conventional	Surface	22	5	0.3200	Location 9	0.0836	NA	NA
Pentachlorophenol	µg/L	2015	Fall	9/15/15	Passive Sampling	Surface	15	0	ND	NA	NA	NA	NA
Pentachlorophenol	µg/L	2020	Fall	9/28/20	Passive Sampling	Surface	17	0	ND	NA	NA	NA	NA

Table IV-6: Historical Surface, Inter-Armoring, and Sub-Armoring Water Sampling Results
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Notes:
Inter-armoring data not collected prior to Spring 2006.
Passive samplers used in the Fall 2020 event consisted of SPME fibers. Passive samplers used in the 2015 Fall event consisted of 1) inert LDPE tubing (carbon sink so that PAHs and pentachlorophenol will sorb to the LDPE and approach equilibrium with freely dissolved concentrations in porewater) and 2) DGT technology to measure freely dissolved metals in porewater. Passive samplers used in the Fall 2020 event consisted of SPME fibers for the analysis of PAHs and pentachlorophenol. Diffusive membranes covering cells containing reference water were used to characterize dissolved metal (arsenic, chromium, and copper) concentrations.
Results are from the 2011 and 2016 Five Year Reviews with the exception of Fall 2010 data, which is from the 2015 annual report.
[a] Spring 2007 collection date generalized for plotting purposes. The date of earliest collection was not identified in previous reports.
[b] Fall 2006 and 2007 collection dates generalized for plotting purposes. The date of earliest collection was not identified in previous reports.

Abbreviations:
- = not available
cPAHs = carcinogenic polyaromatic hydrocarbons
DGT = diffusive gradients in thin film
LDPE = low density polyethylene
mg/L = milligrams per liter
NA = not available
ND = not detected
NP = nonparametric
PAHs = polyaromatic hydrocarbons
SPME = solid phase microextraction
UCL = upper confidence limit

Table IV-7: Crayfish Tissue Sampling Locations
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Sampling Location ID	Sample Coordinates (NAD83) [1]				Sample Elevation [2] (ft NAVD88)	Location with ACB	Colocated Porewater Sampling Location
	Northing	Easting	Latitude	Longitude			
01	704151.8	7628801.0	45.57630	-122.73924	6.1	Yes	**A**
02	704556.6	7628058.5	45.57735	-122.74218	1.8	--	**C**
03	704693.1	7627598.7	45.57769	-122.74399	-17.2	--	**D**
04	704787.3	7627213.2	45.57792	-122.74550	-27.8	--	**E**
05	705220.9	7627179.7	45.57911	-122.74568	0.5	Yes	**F**

Notes:

[1] Northing and easting coordinates exist in the following coordinate system: North American Datum of 1983, Oregon State Plane North Zone, International Feet.

[2] Elevations exist in the following coordinate system: North American Vertical Datum of 1988 in units of feet and are based on survey data.

[3] Metals analyzed include arsenic, chromium, and copper.

[4] Sampler was found broken at the 5th cell.

[5] Sampler was lost during deployment.

Abbreviations:

ACB = Articulated concrete block

NAD83 = North American Datum of 1983

NAVD88 = North American Vertical Datum of 1988

Table IV-8: 2020 Crayfish Tissue Sampling Results
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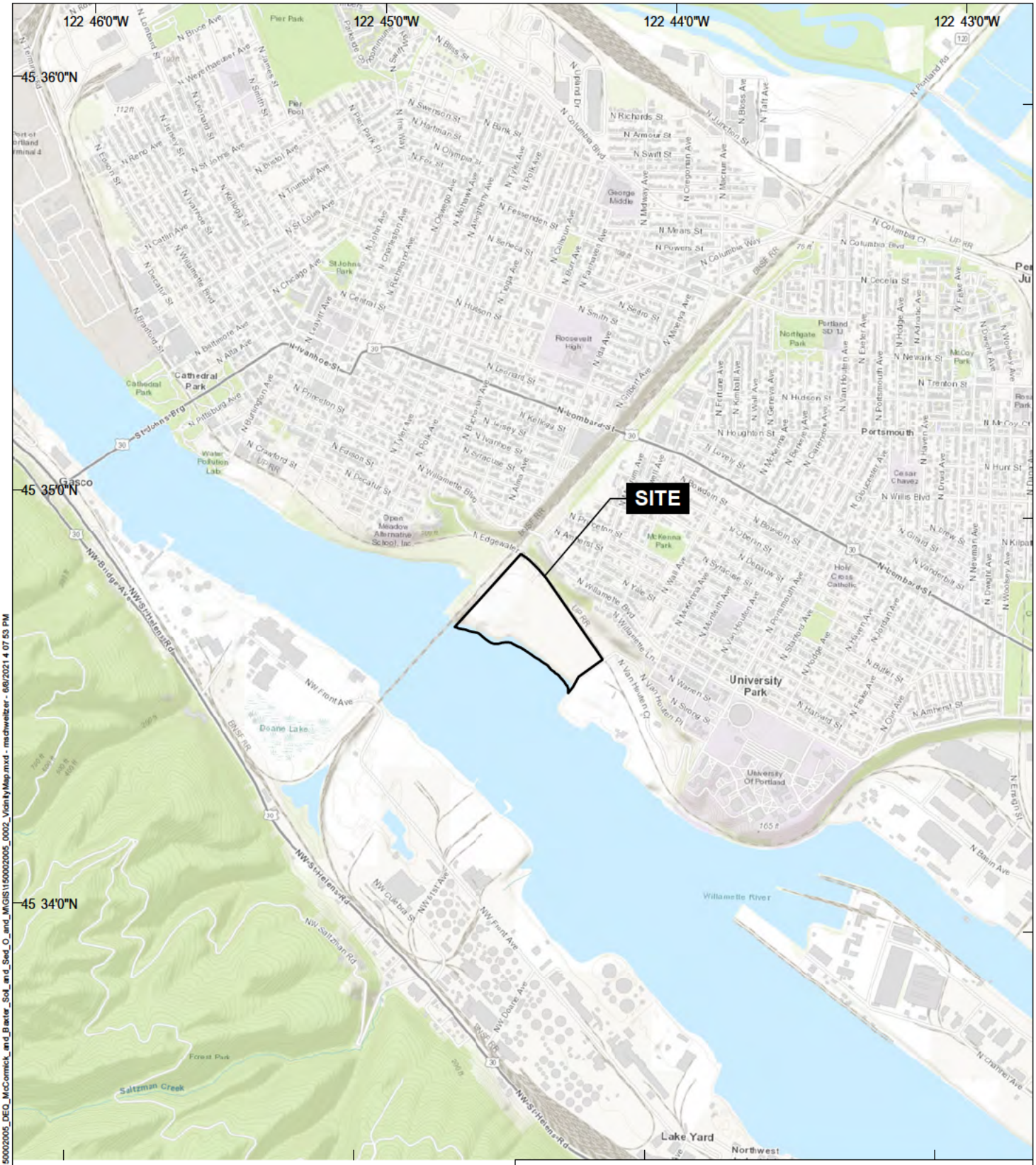
Analyte		MBCFGB1020						MBCFGB
		01	02	03	04		05	Bait
		MBCFGB1020-01	MBCFGB1020-02	MBCFGB1020-03	MBCFGB1020-04	MBCFGB1020-04 DUP	MBCFGB1020-05	MBCFGB-20-BAITCHICKEN
		09/29/2020	08/28/2020	09/29/2020	09/29/2020	09/29/2020	09/29/2020	09/29/2020
Metals (mg/kg)*								
Arsenic		**0.54**	**0.85**	**0.33**	**0.33**	**0.44**	**0.39**	**0.01 J**
Chromium		**0.194**	**0.74**	**0.214**	**0.218**	**0.185**	**0.297**	**0.093**
Copper		**22.8**	**37.3**	**21.8**	**20.6**	**25.3**	**23.7**	**0.796**
Zinc		**25.6**	**57**	**23.7**	**26.1**	**24.4**	**25.3**	**12.7**
Pentachlorophenol (µg/kg)*								
Pentachlorophenol		7.6 U	95 U	7.6 U	7.6 U	7.6 U	7.6 U	7.6 U
Polycyclic Aromatic Hydrocarbons (µg/kg)*								
2-Methylnaphthalene		**0.84 J**	4.9 U	0.39 U	**0.59 J**	**0.5 J**	**0.66 J**	**1.4 J**
Acenaphthene	L	**2.1 J**	4.9 U	0.76 U	**1.4 J**	**2.7 J**	**1.6 J**	0.76 U
Acenaphthylene	L	0.59 U	4.9 U	0.59 U	0.59 U	0.59 U	0.59 U	0.59 U
Anthracene	L	0.58 U	**0.45 J**	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U
Benz(a)anthracene	H, C	0.72 U	**0.64 J**	0.72 U	**0.84 J**	0.72 U	**2.6 J**	**0.92 J**
Benzo(a)pyrene	H, C	0.76 U	0.38 U	0.76 U	0.76 U	0.76 U	**1.9 J**	0.76 U
Benzo(b)fluoranthene	H, C	0.92 U	0.29 U	0.92 U	0.92 U	0.92 U	**2 J**	**0.94 J**
Benzo(k)fluoranthene	H, C	0.87 U	0.24 U	0.87 U	0.87 U	0.87 U	**1.6 J**	0.87 U
Benzo(g,h,i)perylene	H	0.85 U	0.4 U	0.85 U	0.85 U	0.85 U	**1.7 J**	0.85 U
Chrysene	H, C	0.8 U	0.31 U	0.8 U	0.8 U	0.8 U	**2.2 J**	0.8 U
Dibenz(a,h)anthracene	H, C	0.8 U	0.23 U	0.8 U	0.8 U	0.8 U	**1.5 J**	0.8 U
Dibenzofuran		0.63 U	4.9 U	0.63 U	0.63 U	0.63 U	0.63 U	**0.78 J**
Fluoranthene	H	**1.4 J**	4.9 U	**1.1 J**	**1.8 J**	**1.1 J**	**4 J**	0.98 U
Fluorene	L	**1.1 J**	4.9 U	0.61 U	**0.71 J**	**0.73 J**	**1.2 J**	**0.72 J**
Indeno(1,2,3-cd)pyrene	H, C	0.87 U	0.36 U	0.87 U	0.87 U	0.87 U	**1.8 J**	0.87 U
Naphthalene	L	4.7 U	4.9 U	0.6 U	4.8 U	0.6 U	4.9 U	4.9 U
Phenanthrene	L	**1.7 J**	4.9 U	**1.7 J**	**2.2 J**	1.4 U	**2.5 J**	**1.7 J**
Pyrene	H	**0.93 J**	4.9 U	**0.77 J**	**1.2 J**	0.76 U	**3.1 J**	**0.85 J**
Total LPAHs (ND = 1/2 MDL)		**8.7 JT**	**15 JT**	**3.5 JT**	**7.9 JT**	**5.5 JT**	**9 JT**	**7.2 JT**
Total HPAHs (ND = 1/2 MDL)		**5.6 JT**	**6.6 JT**	**5.2 JT**	**6.8 JT**	**4.8 JT**	**22 JT**	**5.7 JT**
Total PAHs (ND = 1/2 MDL)		**14 JT**	**22 JT**	**8.6 JT**	**15 JT**	**10 JT**	**31 JT**	**13 JT**
Total cPAHs (No PEFs, ND = 1/2 MDL)		2.9 UT	**1.5 JT**	2.87 UT	**3.4 JT**	2.87 UT	**13.6 JT**	**3.91 JT**
Total cPAHs (B[a]P Eq, ND = 1/2 MDL)		0.9 UT	**0.4 JT**	0.92 UT	**1.0 JT**	0.92 UT	**4.1 JT**	**1 JT**
Dioxins/Furans (ng/kg)*								
2,3,7,8-TCDD		0.354 U	0.11 U	0.557 U	0.472 U	0.632 U	0.582 U	0.353 U
1,2,3,7,8-PeCDD		0.148 U	**0.19 J**	0.122 U	0.147 U	**0.388 J**	0.186 U	0.104 U
1,2,3,4,7,8-HxCDD		0.0868 U	0.18 U	0.0873 U	0.108 U	**0.943 J**	0.242 U	0.11 U
1,2,3,6,7,8-HxCDD		0.0953 U	**0.42 J**	0.0992 U	0.123 U	**6.21**	0.28 U	0.124 U
1,2,3,7,8,9-HxCDD		0.0889 U	0.18 U	0.0909 U	0.112 U	**3.1**	0.254 U	0.114 U
1,2,3,4,6,7,8-HpCDD		2.42 U	**1.83 J**	2.49 U	2.37 U	**146**	**1.93 J**	2.44 U
OCDD		4.83 U	**12.7**	**5.62**	3.29 UJ	**1360**	**11**	**3.45 J**
2,3,7,8-TCDF (bird egg)		0.256 U	**0.33 J**	0.488 UJ	0.302 U	0.45 U	0.398 U	0.269 U
1,2,3,7,8-PeCDF		0.121 U	**0.228 J**	0.195 UJ	0.0969 U	0.218 U	0.17 U	0.108 U
2,3,4,7,8-PeCDF		0.124 UJ	**0.382 J**	**0.159 J**	0.0927 U	0.192 U	0.152 U	0.105 U
1,2,3,4,7,8-HxCDF		0.119 U	0.15 U	0.118 U	0.0978 U	0.435 UJ	0.201 U	0.0672 U
1,2,3,6,7,8-HxCDF		0.121 U	0.16 U	0.117 U	0.105 U	**22.4 J**	0.199 U	0.0718 U
2,3,4,6,7,8-HxCDF		0.128 U	0.15 U	0.132 U	0.12 U	0.315 U	0.224 U	0.0733 U

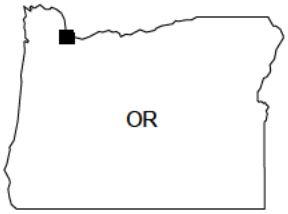
Table IV-8: 2020 Crayfish Tissue Sampling Results
2021 Five Year Review
McCormick & Baxter Superfund Site

Analyte	MBCFGB1020						MBCFGB
	01	02	03	04		05	Bait
	MBCFGB1020-01	MBCFGB1020-02	MBCFGB1020-03	MBCFGB1020-04	MBCFGB1020-04 DUP	MBCFGB1020-05	MBCFGB-20-BAITCHICKEN
	09/29/2020	08/28/2020	09/29/2020	09/29/2020	09/29/2020	09/29/2020	09/29/2020
1,2,3,7,8,9-HxCDF	0.207 U	0.18 U	0.14 U	0.128 U	0.337 U	0.242 U	0.0802 U
1,2,3,4,6,7,8-HpCDF	**0.11 J**	0.21 UJ	**0.233 J**	**0.386 J**	**241 J**	0.842 UJ	**0.355 J**
1,2,3,4,7,8,9-HpCDF	0.108 U	0.11 U	0.101 U	0.0793 U	**3.21**	0.177 U	0.0935 U
OCDF	**1.56 J**	0.21 UJ	**2.23 J**	**2.48 J**	**901**	**5.9**	**3.31 J**
TCDD, 2,3,7,8-, TEQ (ND = 1/2 MDL)	**0.34**	**0.52**	**0.47**	**0.4**	**8.7**	**0.54**	**0.31**
General Chemistry (%)							
Lipids	**0.87**	**0.88**	**0.73**	**1.1**	**0.72**	**1.7**	**11**
Total Solids	**32.6**	**26.1**	**30**	**32.6**	**35.3**	**32.3**	**31.1**

Notes
Tissue results are whole-body results. Insufficient material was obtained to perform whole-body and tail-only analyses.
* wet weight
Bold = Analyte detected at or above the laboratory detection limit

Abbreviations and Acronyms
-- = Not analyzed or not applicable
µg/kg = micrograms per kilogram
B[a]P eq= benzo[a]pyrene equivalent
C = Carcinogenic PAH (cPAH)
H = High Molecular Weight PAH (HPAH)
J = Estimated result
L = Low Molecular Weight PAH (LPAH)
mg/kg = milligrams per kilogram
ng/kg = nanograms per kilogram
PAH = Polycyclic Aromatic Hydrocarbon
PEF= potency equivalent factor
TEQ = toxic equivalency quotient
U = Result not detected above the referenced laboratory detection limit





MAP SOURCE: ESRI
SITE COORDINATES: 45°34'43"N, 122°44'24"W

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GSI Water Solutions, Inc.

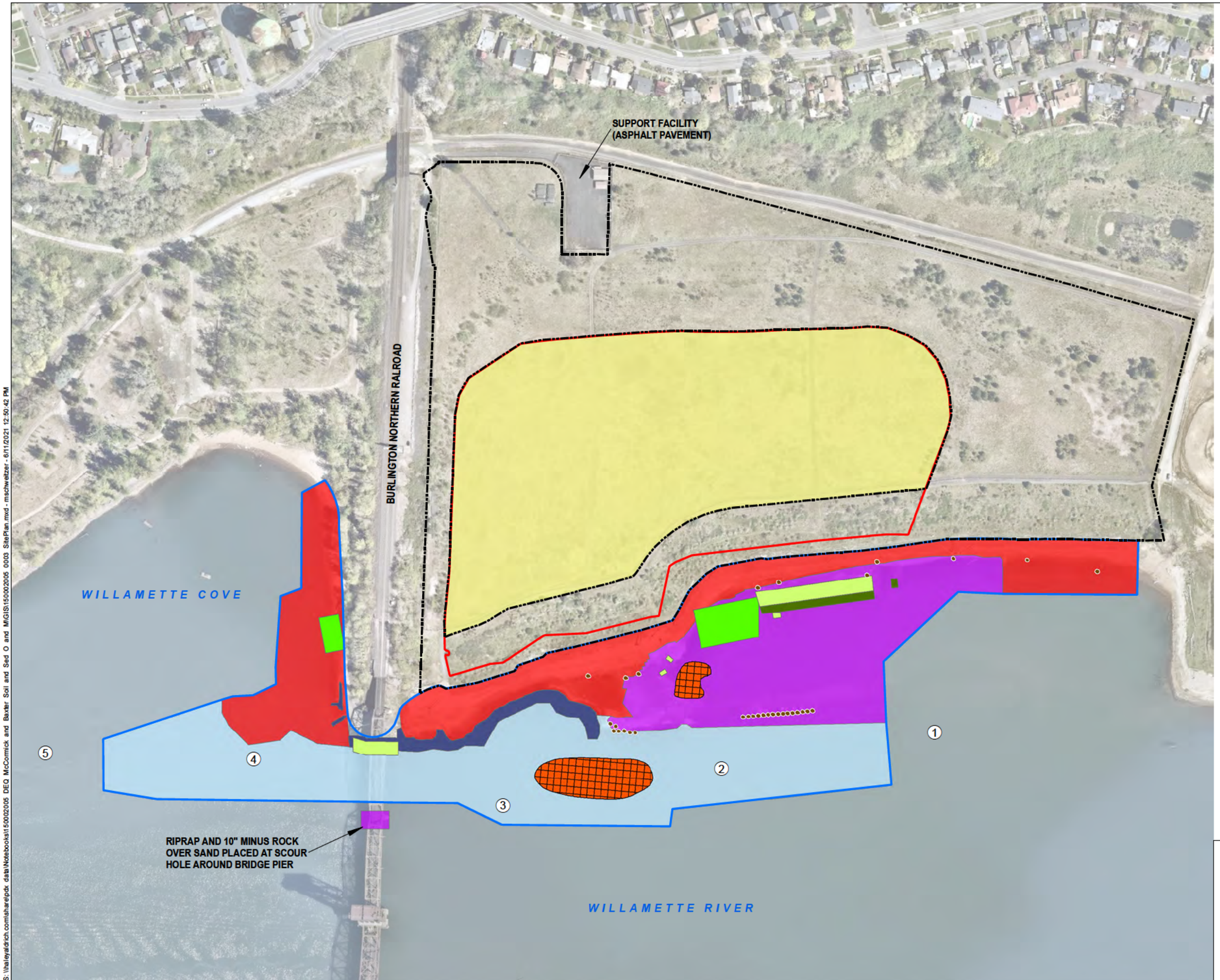
MCCORMICK & BAXTER SUPERFUND SITE
6900 N EDGEWATER STREET
PORTLAND, OREGON

VICINITY MAP

APPROX MATE SCALE: 1 N = 2000 FT
JUNE 2021

FIGURE I-1

GIS: \\haleyaldrich.com\share\gis\gis_data\Notebooks\150002005_DEQ_McCormick_and_Baxter_Sol_and_Sed_O_and_MG\S\150002005_0002_VicinityMap.mxd - mschweitzer - 6/8/2021 4 07 53 PM



LEGEND

- SUBSURFACE BARRIER WALL
- SEDIMENT CAP BOUNDARY
- GRANULAR ORGANOCLAY
- ORGANOCLAY MAT (DOUBLE LAYER)
- ORGANOCLAY MAT (SINGLE LAYER)
- HOT SPOT TREATMENT (THICKENED SAND LAYER)
- BOULDER CLUSTERS/ROCK MOUND
- BUOY LOCATIONS
- RIPRAP ARMOR
- ARTICULATED CONCRETE BLOCK
- 6-INCH MINUS ROCK ARMOR
- 10-INCH MINUS ROCK ARMOR
- IMPERMEABLE CAP
- EARTHEN SOIL CAP BOUNDARY

NOTES

1. ALL FEATURES ARE APPROXIMATE
2. AERIAL MAGERY SOURCE: NEARMAP, 13 APRIL 2021

0 250 500
SCALE N FEET

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MCCORMICK & BAXTER SUPERFUND SITE
6900 N EDGEWATER STREET
PORTLAND, OREGON

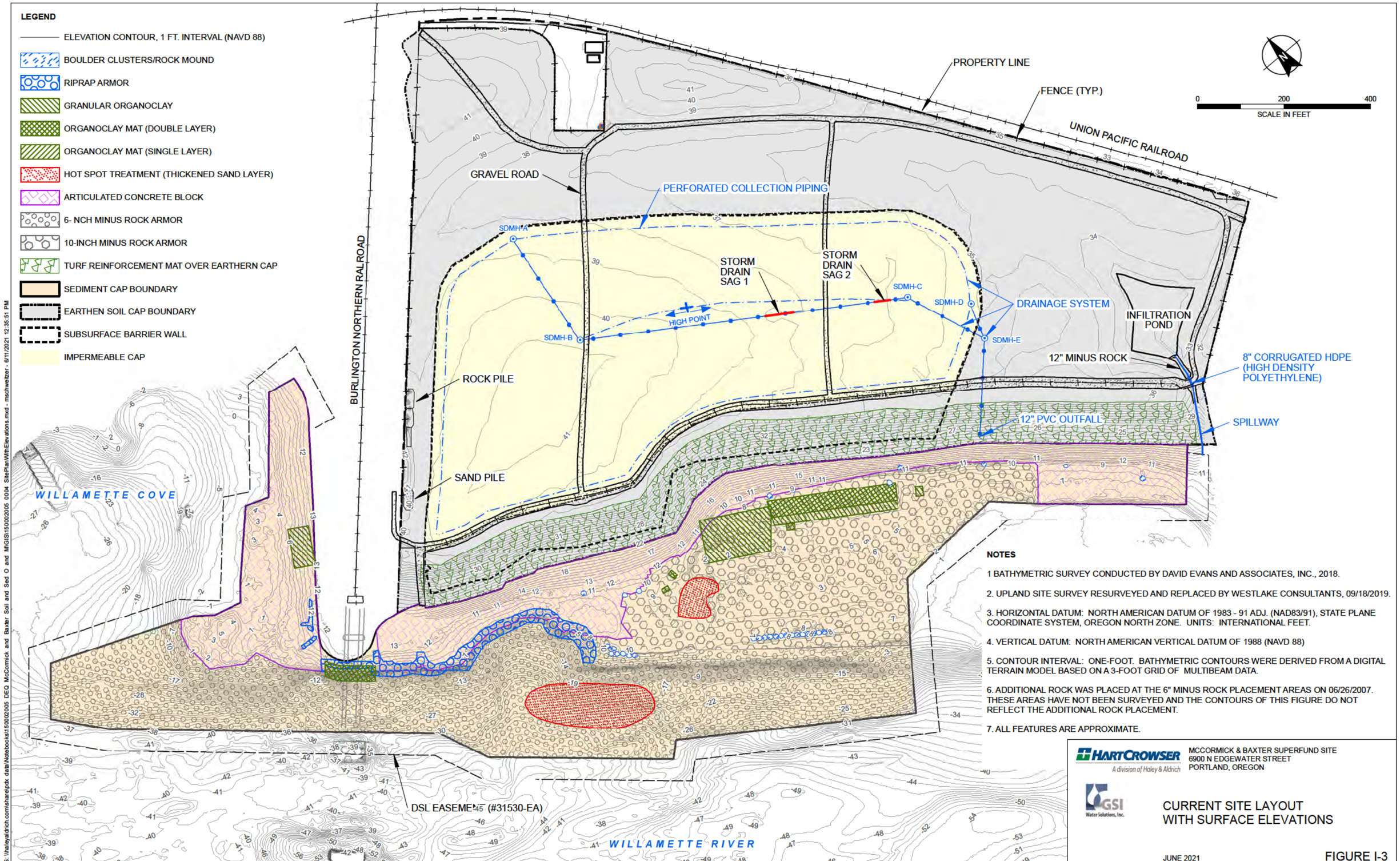
GSI Water Solutions, Inc.

CURRENT SITE LAYOUT
AND FEATURES

JUNE 2021

FIGURE I-2

GIS: \\haleyaldrich.com\shareipdx data\Notebooks\150002005 DEQ McCormick and Baxter Soil and Sed O and M\GIS\150002005 0003 SitePlan.mxd - mschweitzer - 6/11/2021 12:50:42 PM



NOTES

1 BATHYMETRIC SURVEY CONDUCTED BY DAVID EVANS AND ASSOCIATES, INC., 2018.

2. UPLAND SITE SURVEY RESURVEYED AND REPLACED BY WESTLAKE CONSULTANTS, 09/18/2019.

3. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 - 91 ADJ. (NAD83/91), STATE PLANE COORDINATE SYSTEM, OREGON NORTH ZONE. UNITS: INTERNATIONAL FEET.

4. VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

5. CONTOUR INTERVAL: ONE-FOOT. BATHYMETRIC CONTOURS WERE DERIVED FROM A DIGITAL TERRAIN MODEL BASED ON A 3-FOOT GRID OF MULTIBEAM DATA.

6. ADDITIONAL ROCK WAS PLACED AT THE 6" MINUS ROCK PLACEMENT AREAS ON 06/26/2007. THESE AREAS HAVE NOT BEEN SURVEYED AND THE CONTOURS OF THIS FIGURE DO NOT REFLECT THE ADDITIONAL ROCK PLACEMENT.

7. ALL FEATURES ARE APPROXIMATE.

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MCCORMICK & BAXTER SUPERFUND SITE
6900 N EDGEWATER STREET
PORTLAND, OREGON

GSI Water Solutions, Inc.

CURRENT SITE LAYOUT
WITH SURFACE ELEVATIONS

JUNE 2021

FIGURE I-3

GIS: \\haleyaldrich.com\share\pdx data\Notebooks\150002005 DEQ McCormick and Baxter Soil and Sed O and M\GIS\150002005 0004 SitePlanWithElevations.mxd - mschweizer - 6/11/2021 12:35:51 PM

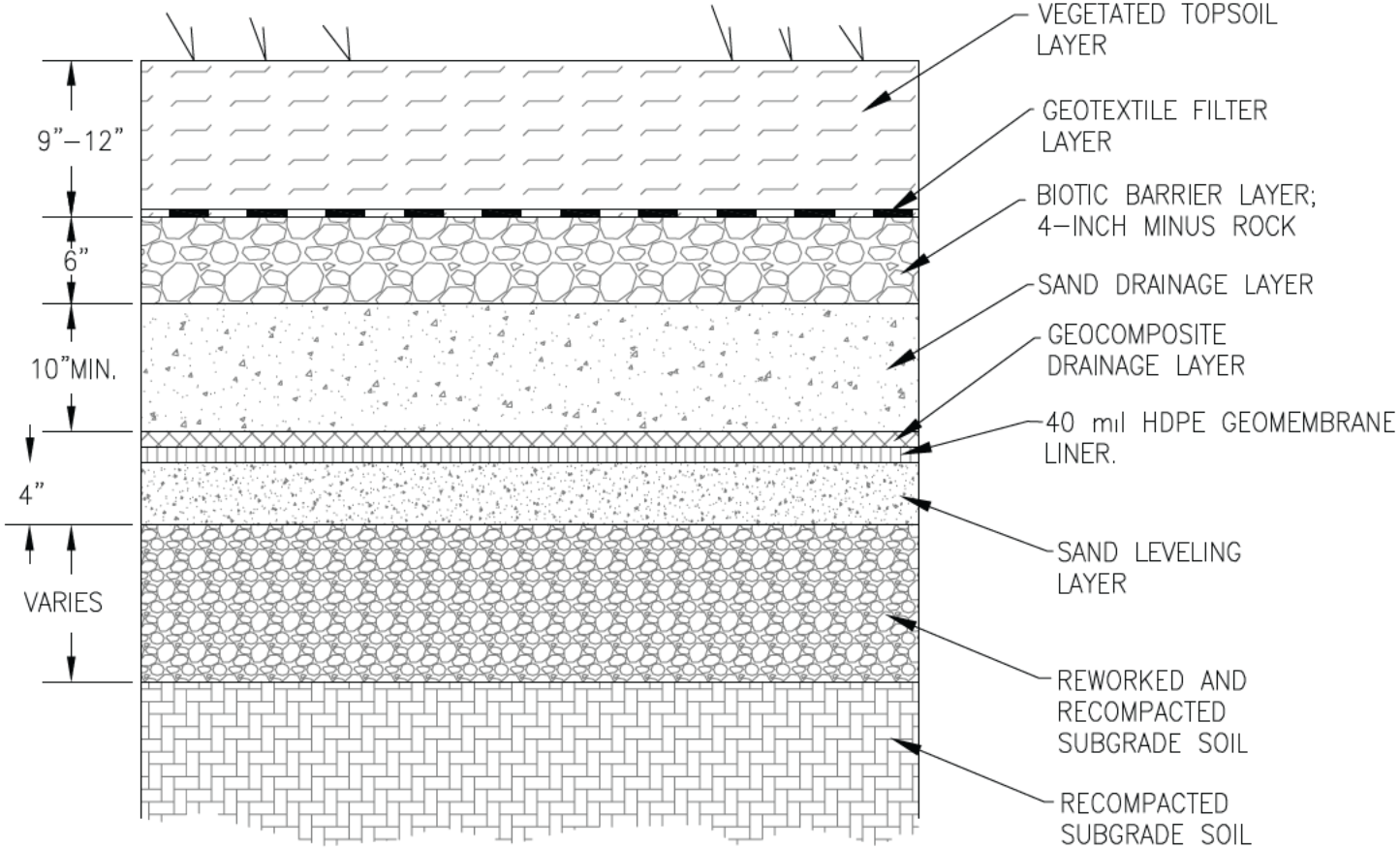

FIGURE II-1

Typical Impermeable Cap Section

McCormick & Baxter Superfund Site
Portland, Oregon

NOTE
Original drawing in Appendix J of the 2006 Annual Report (E&E, 2007).

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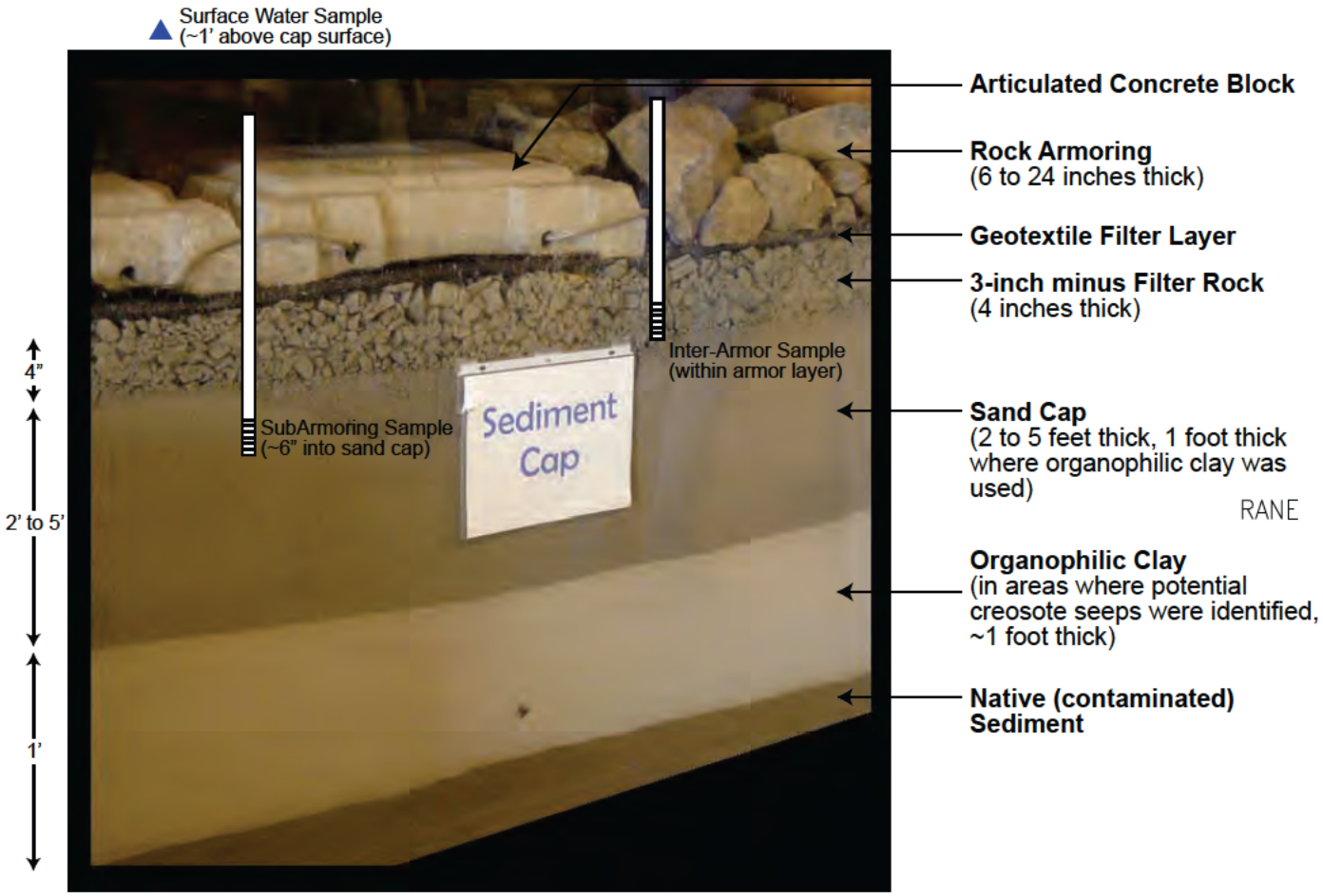

FIGURE II-2

Typical Sediment Cap Section

McCormick & Baxter Superfund Site
Portland, Oregon

NOTE
Detailed sediment cap drawings in Appendix J of the 2006 Annual Report (E&E, 2007).

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FIGURE IV-1

Well Locations and Infiltration Pond

McCormick & Baxter Superfund Site
Portland, Oregon

LEGEND

- Site-Wide Groundwater Quality Sampling Well
- Infiltration Pond Assessment Sampling Well
- Groundwater Monitoring Well
- Swale
- Infiltration Pond
- Subsurface Barrier Wall

NOTE
Water quality samples were taken during the two monitoring events in 2020.

Date: June 8, 2021
Data Sources: Aerial photo City of Portland, 2020

N

0 100 200 300
Feet

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Water Solutions, Inc.

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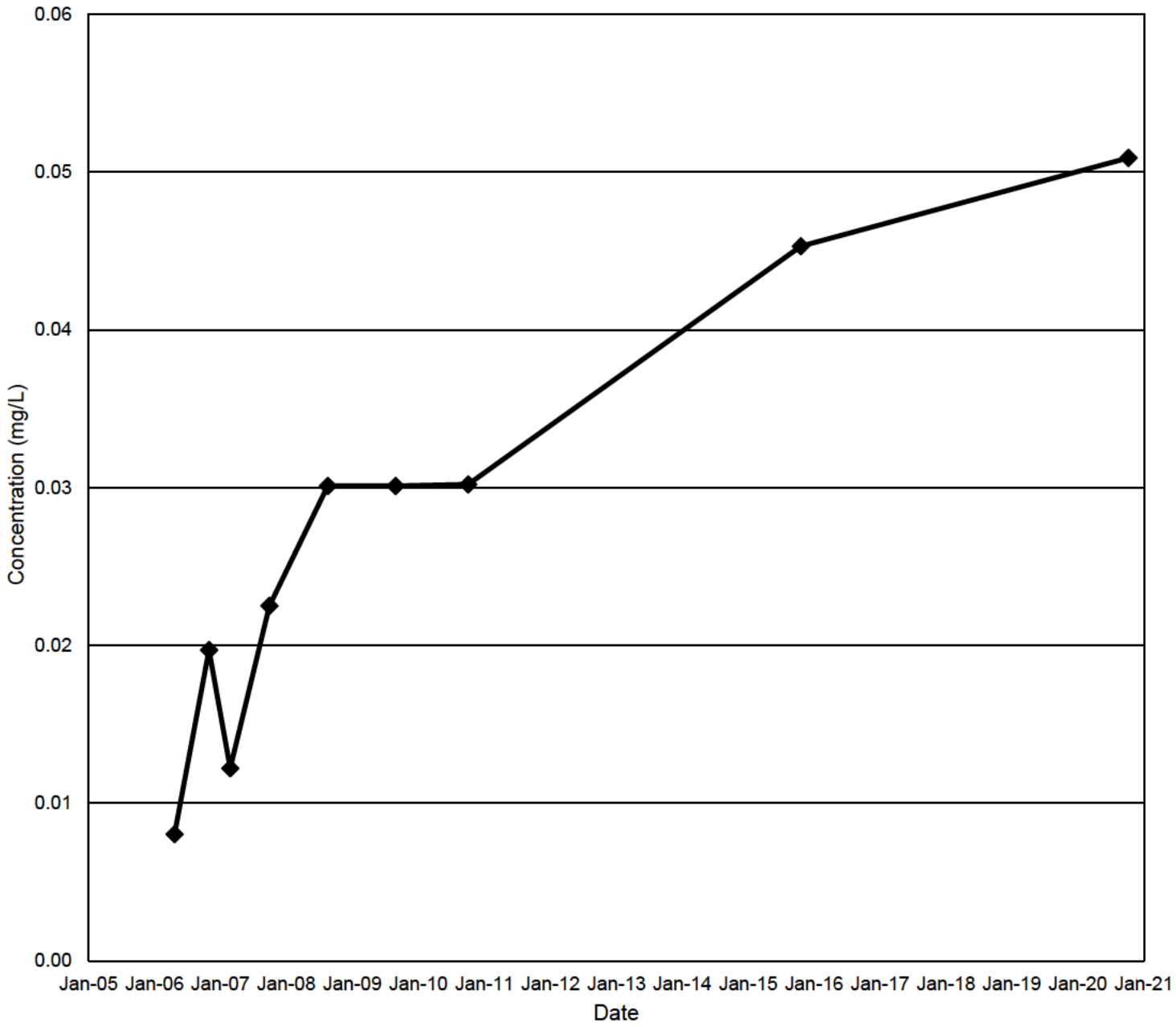

FIGURE IV-2

Arsenic Concentrations in MW-59s Over Time

McCormick & Baxter
Superfund Site
Portland, Oregon

LEGEND

Concentration

NOTES

Alternate Concentration Limit (ACL) = 1.0 mg/L
mg/L: Milligram per Liter

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FIGURE IV-3

Surface, Inter-armor, and Sub-armor Sampling Locations

McCormick & Baxter Superfund Site
Portland, Oregon

LEGEND

O&M Sample Locations

- Compliance Monitoring Sample Location
- Early Warning Sample Location
- Background Sample Location
- Compliance Monitoring Area Boundary

All Other Features

- MW-37s; DGPS Reference Location
- Boulder Cluster
- Actual Willamette River Level (7.0 feet NAVD88)
- Sediment Cap Boundary
- Organoclay Mats (Single)
- Organoclay Mats (Double)
- Organoclay Granular
- Articulated Concrete Block (ACB)
- Hot Spot Treatment (thickened sand layer)
- Subsurface Barrier Wall

NOTE

Aerial photo taken Summer 2020.

Date: August 26, 2021
Data Sources: COP aerial photo

N

0 125 250 375
Feet

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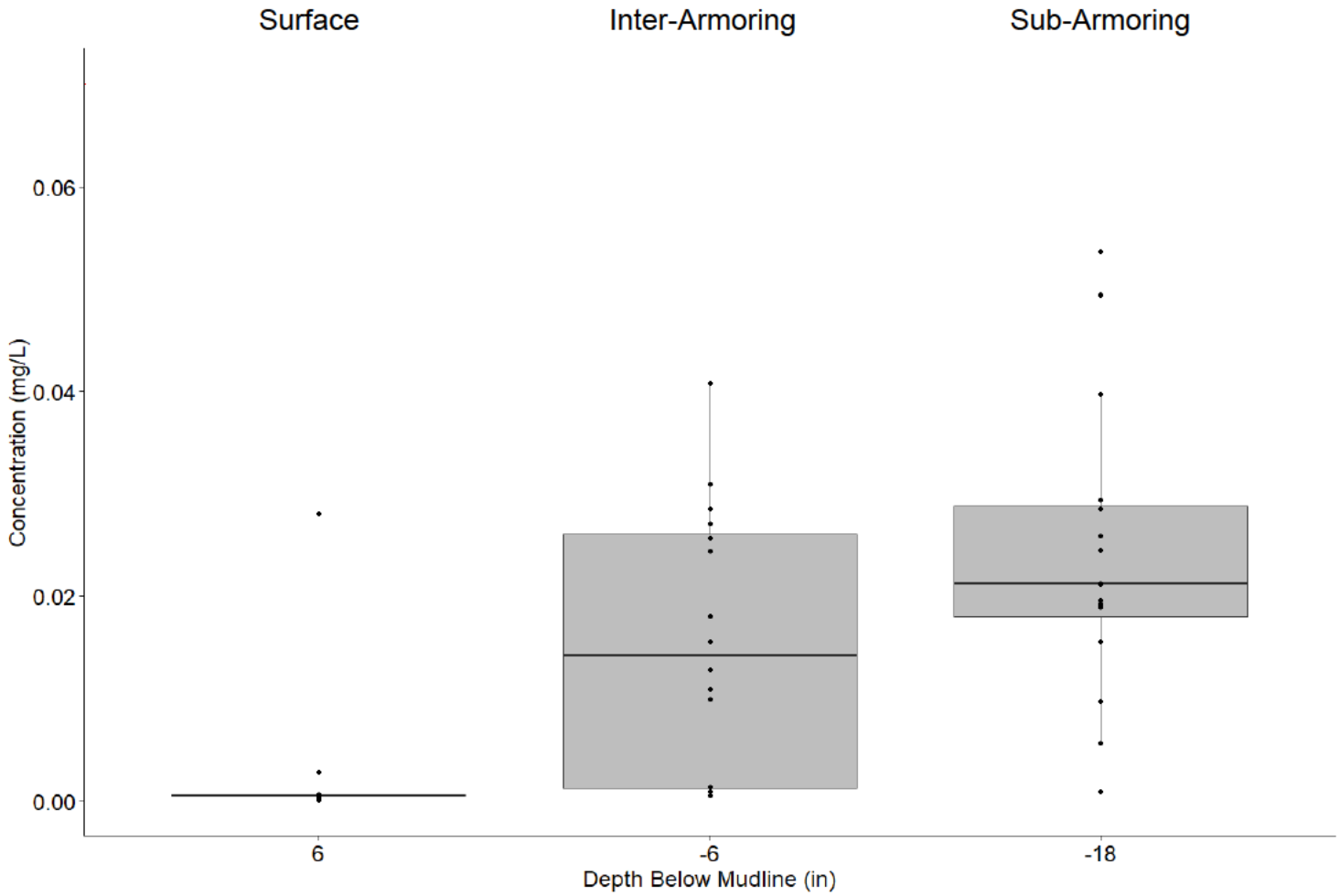
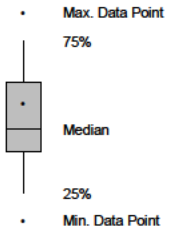


FIGURE IV-4

2020 Arsenic Surface Water and Porewater Results by Depth

McCormick & Baxter
Superfund Site
Portland, Oregon

BOXPLOT LEGEND



NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 2017) = 0.15 mg/L (Aquatic Life) and 2.1 mg/L (Human Health)
mg/L: Milligram per Liter

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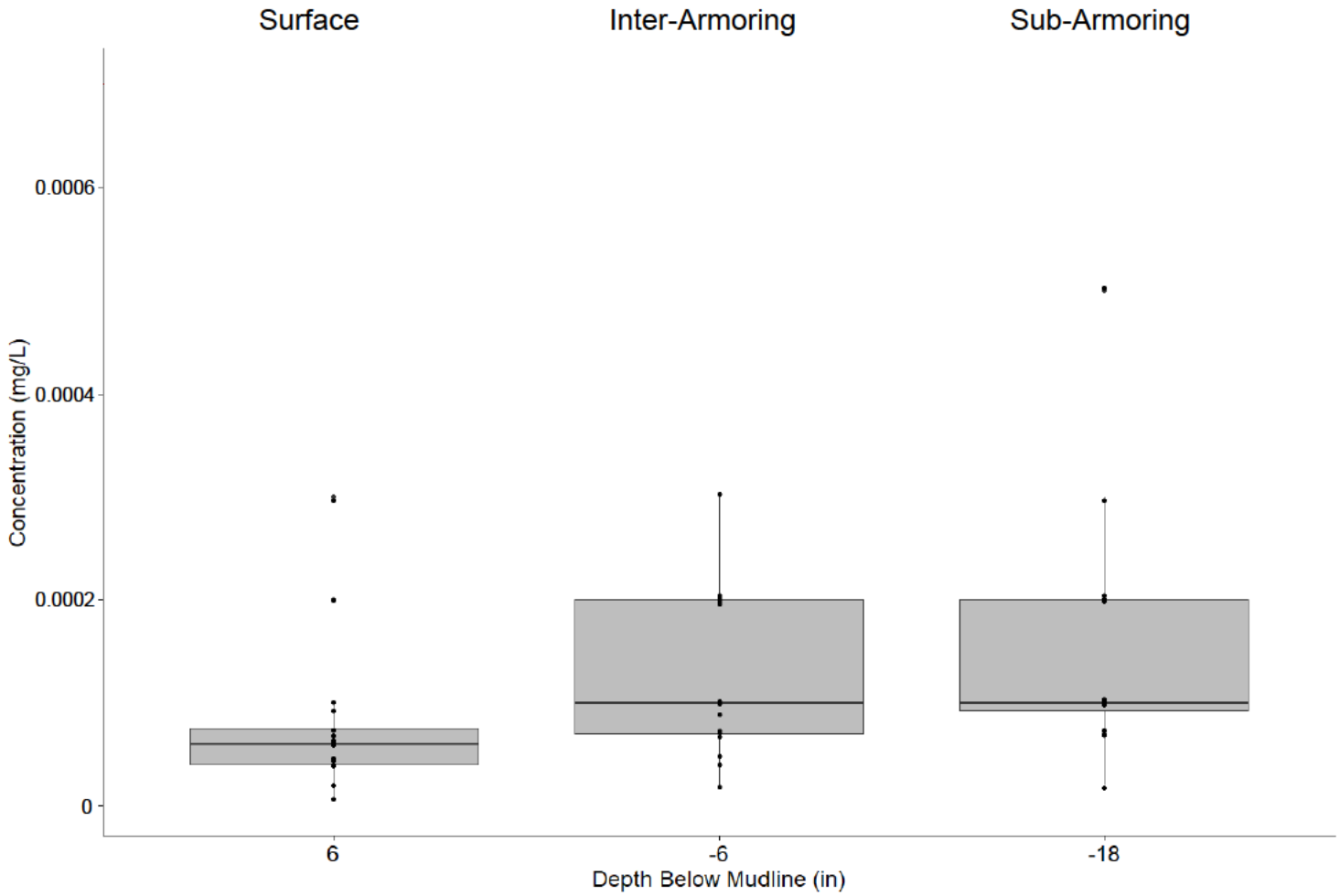
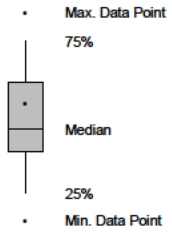


FIGURE IV-5

2020 Chromium Surface Water and Porewater Results by Depth

McCormick & Baxter Superfund Site
Portland, Oregon

BOXPLOT LEGEND



NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 2017) = 0.024 mg/L
mg/L: Milligram per Liter

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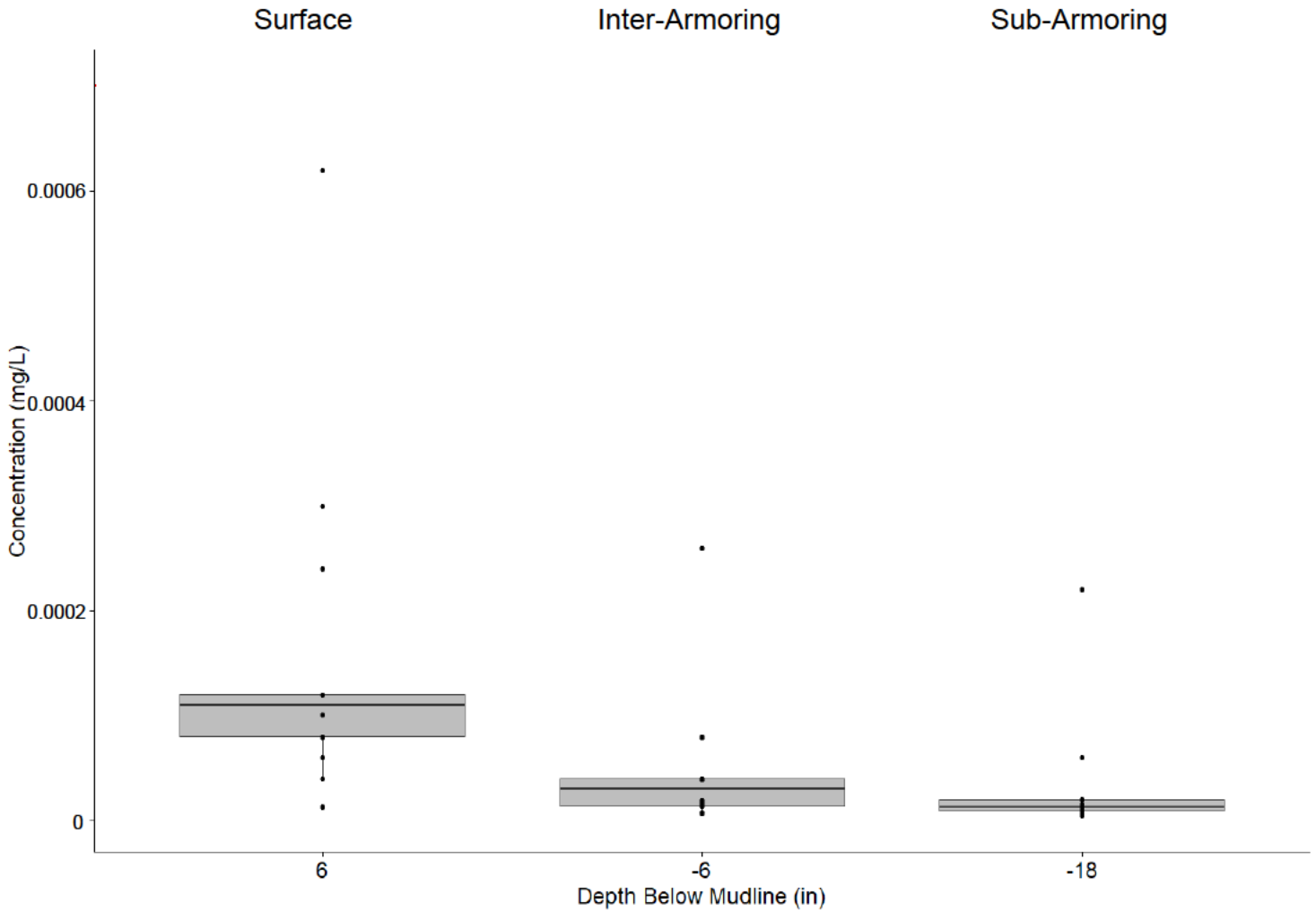
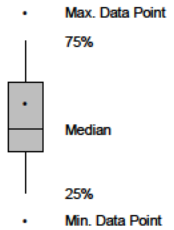


FIGURE IV-6

2020 Copper Surface Water and Porewater Results by Depth

McCormick & Baxter Superfund Site
Portland, Oregon

BOXPLOT LEGEND



NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 1996) = 0.012 mg/L
mg/L: Milligram per Liter

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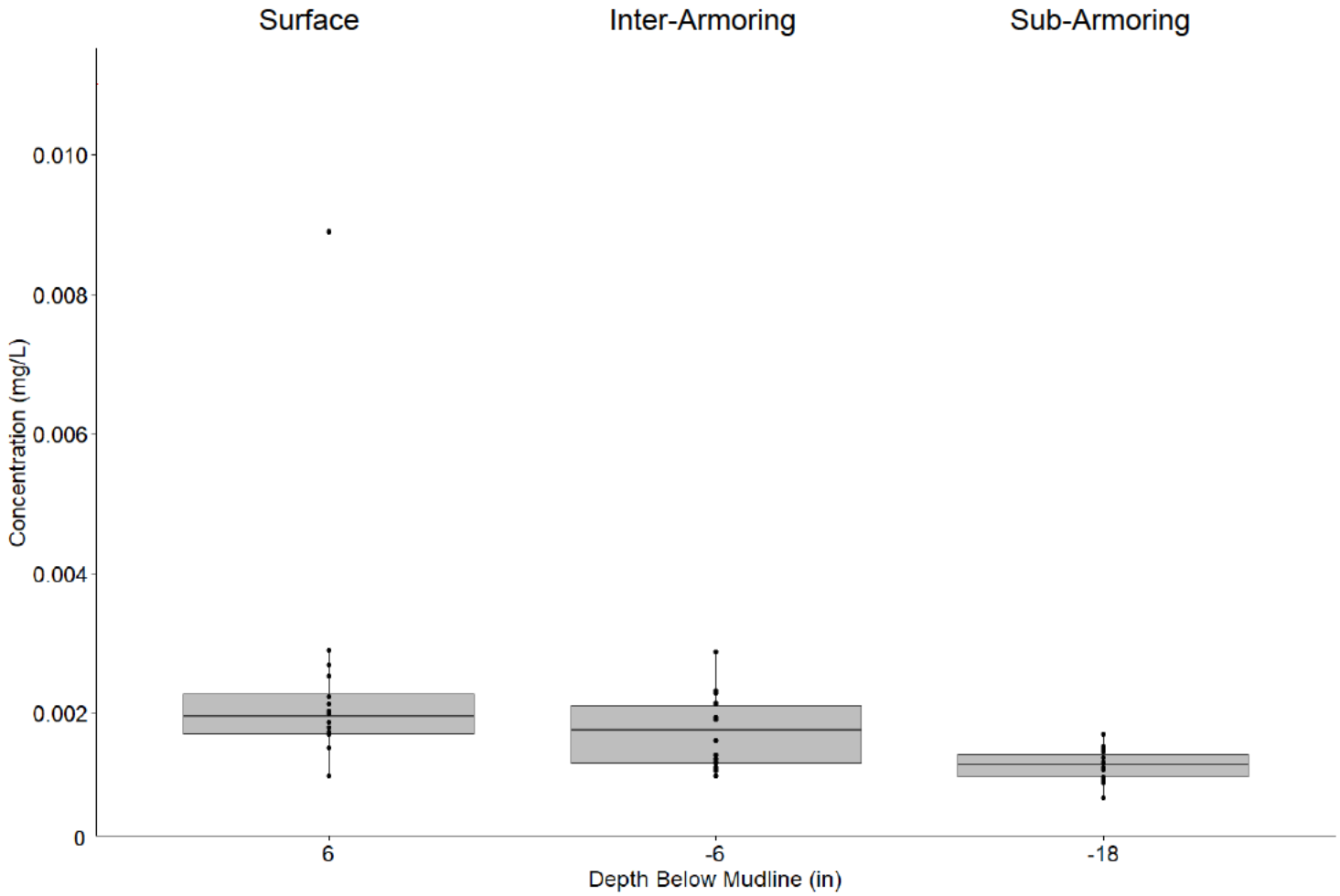
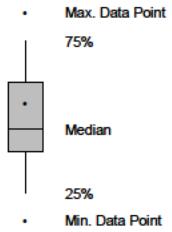


FIGURE IV-7

2020 Zinc Surface Water and Porewater Results by Depth

McCormick & Baxter Superfund Site
Portland, Oregon

BOXPLOT LEGEND



NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 2017) = 0.036 mg/L (Aquatic Life) and 2,600 mg/L (Human Health)
mg/L: Milligram per Liter

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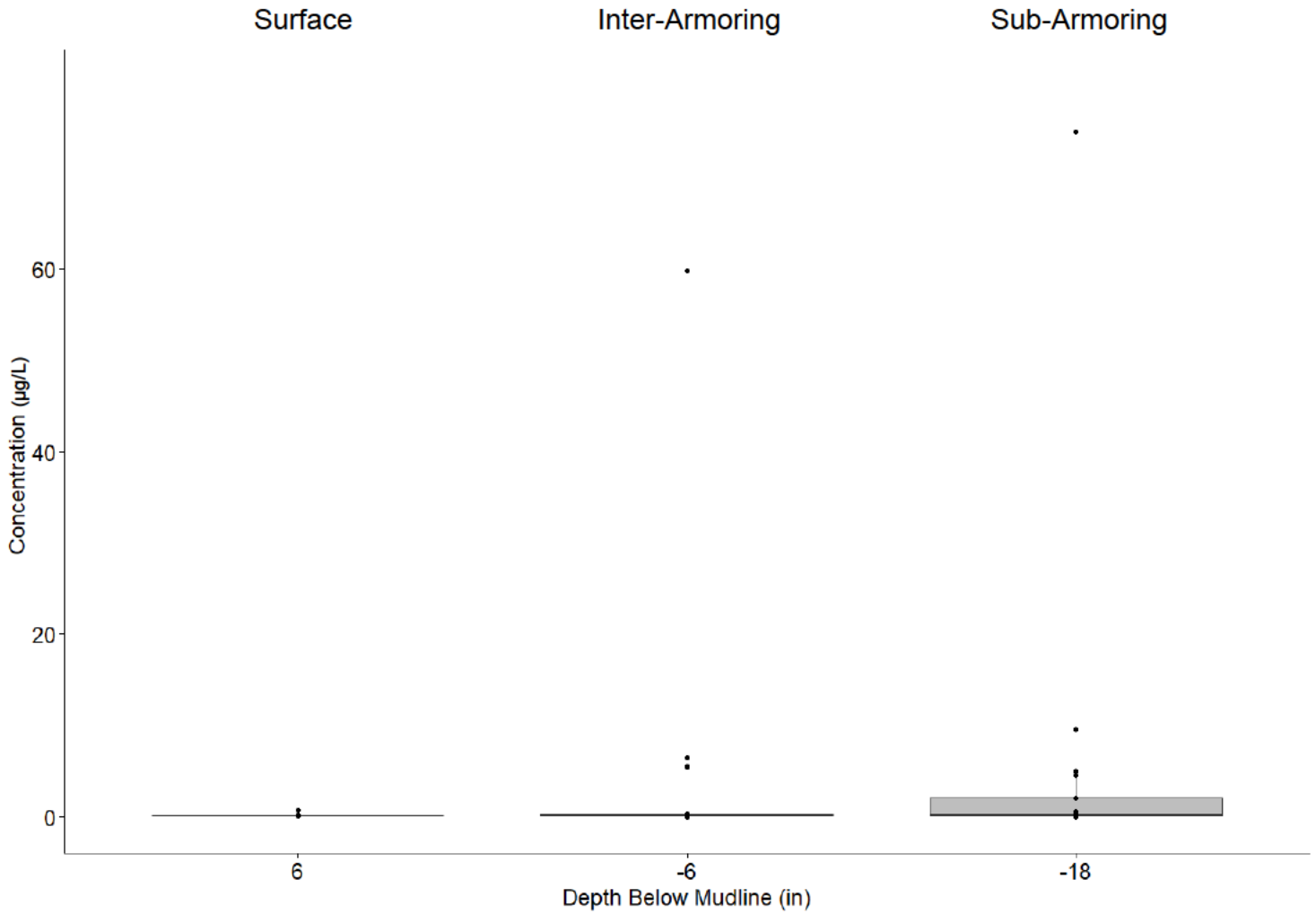
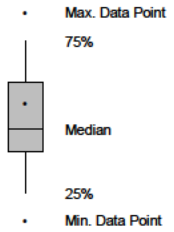


FIGURE IV-8

2020 Acenaphthene Surface Water and Porewater Results by Depth

McCormick & Baxter
Superfund Site
Portland, Oregon

BOXPLOT LEGEND



NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 2017) = 99 µg/L
µg/L: Microgram per Liter

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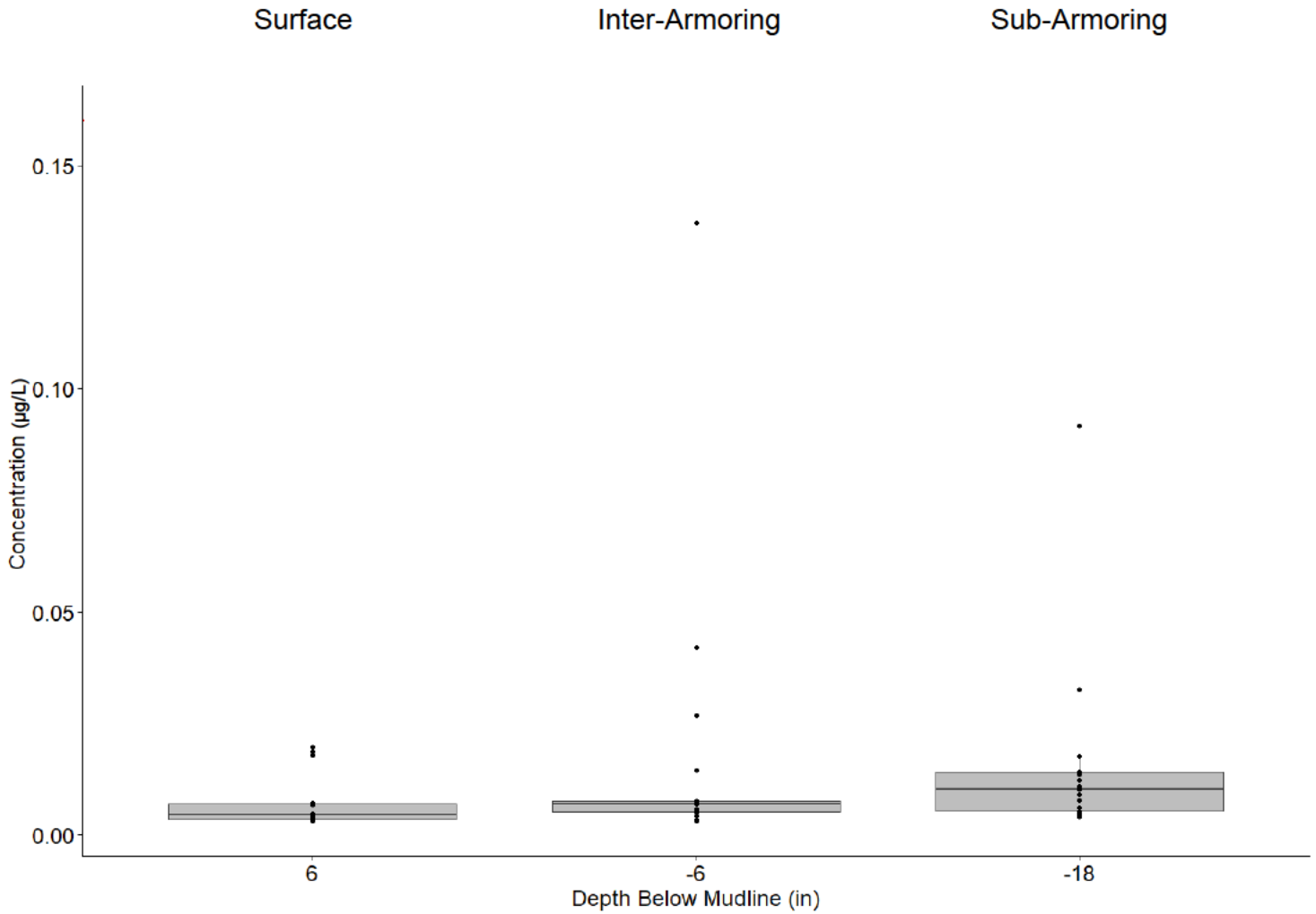
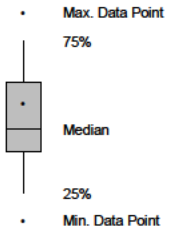


FIGURE IV-9

2020 Fluoranthene Surface Water and Porewater Results by Depth

McCormick & Baxter
Superfund Site
Portland, Oregon

BOXPLOT LEGEND



NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 2017) = 14 µg/L
µg/L: Microgram per Liter

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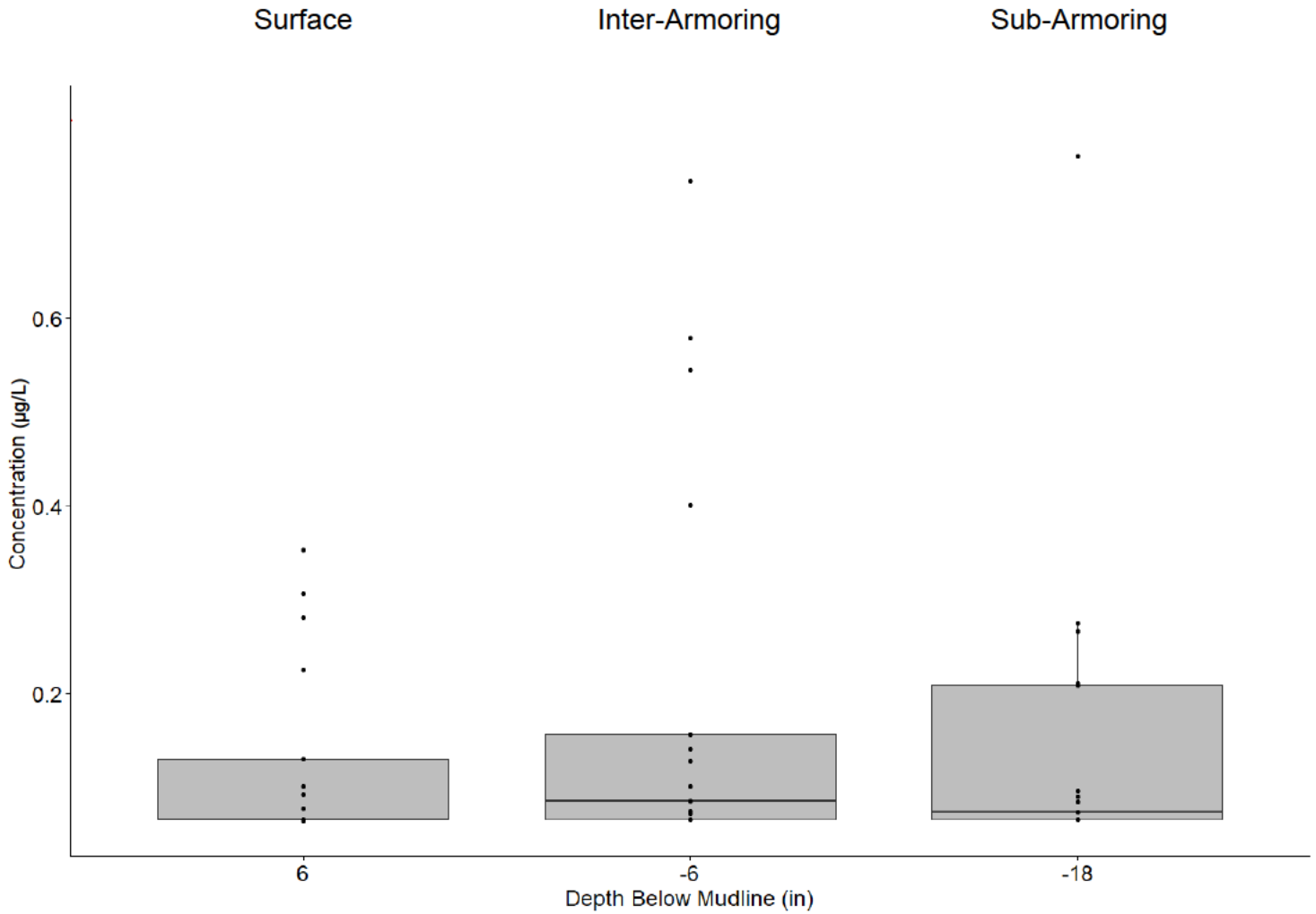
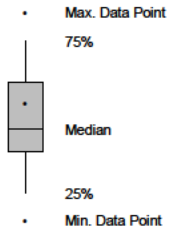


FIGURE IV-10

2020 Naphthalene Surface Water and Porewater Results by Depth

McCormick & Baxter
Superfund Site
Portland, Oregon

BOXPLOT LEGEND



NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 1996) = 620 µg/L
µg/L: Microgram per Liter

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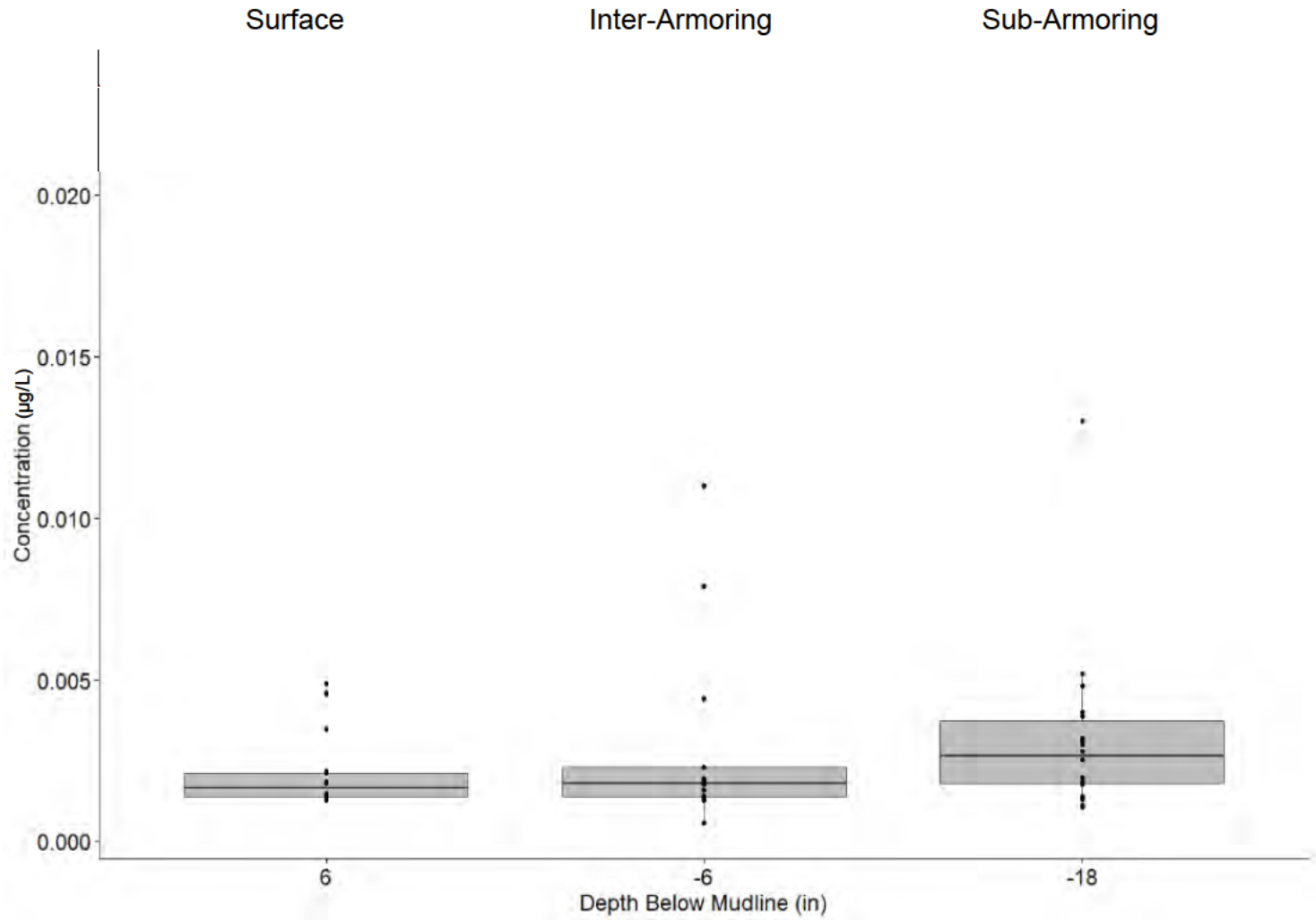

FIGURE IV-11

2020 cPAH Surface Water and Porewater Results by Depth

McCormick & Baxter Superfund Site
Portland, Oregon

BOXPLOT LEGEND

- Max. Data Point
- 75%
- Median
- 25%
- Min. Data Point

NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 1996) = 0.031 µg/L
µg/L: Microgram per Liter

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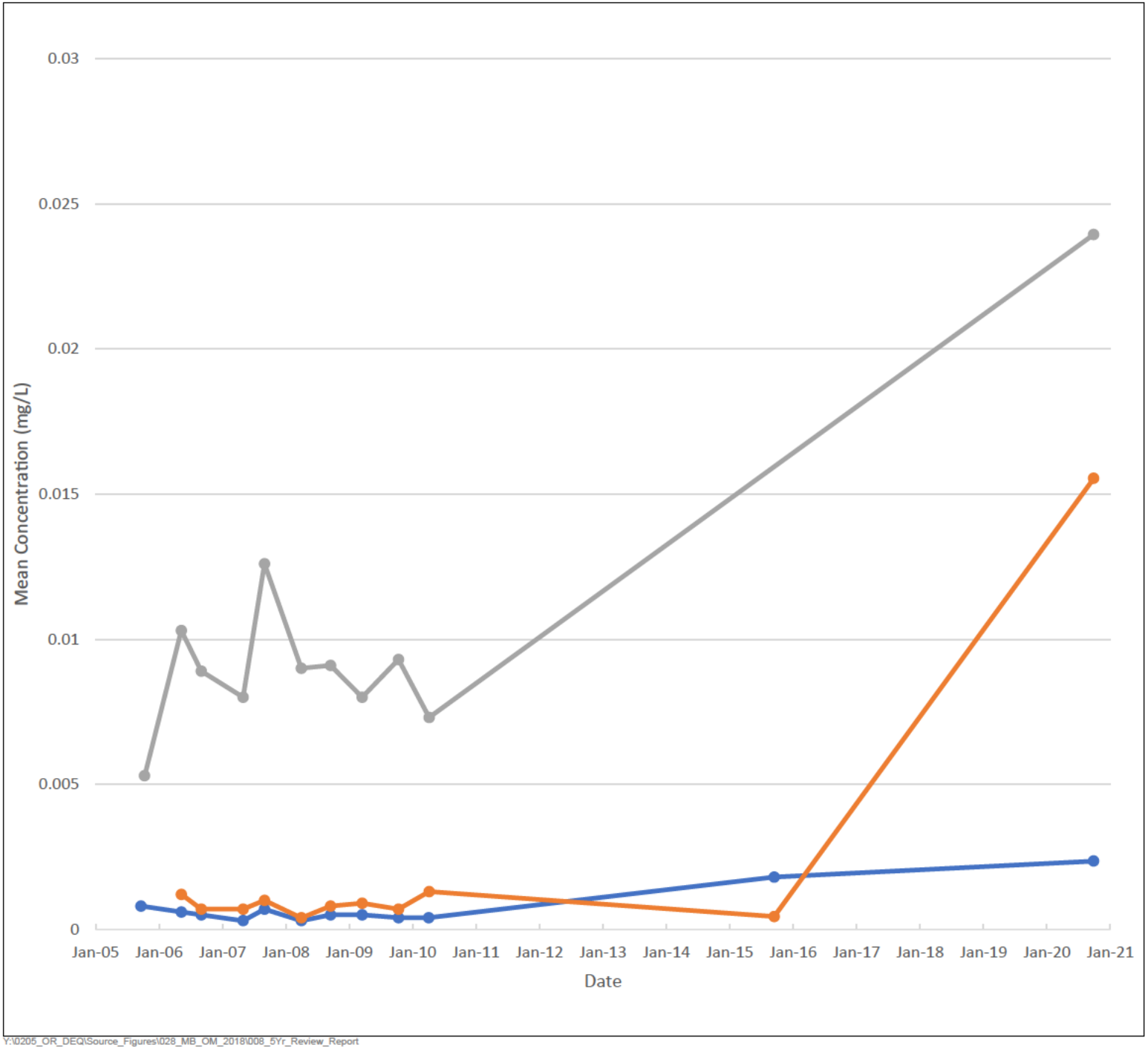

FIGURE IV-12

Mean Arsenic Surface Water and Porewater Concentrations by Depth Over Time

McCormick & Baxter Superfund Site
Portland, Oregon

LEGEND

- Surface
- Inter-Armoring
- Sub-Armoring

NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 2017) = 0.15 mg/L (Aquatic Life) and 2.1 mg/L (Human Health)
mg/L: Milligram per Liter

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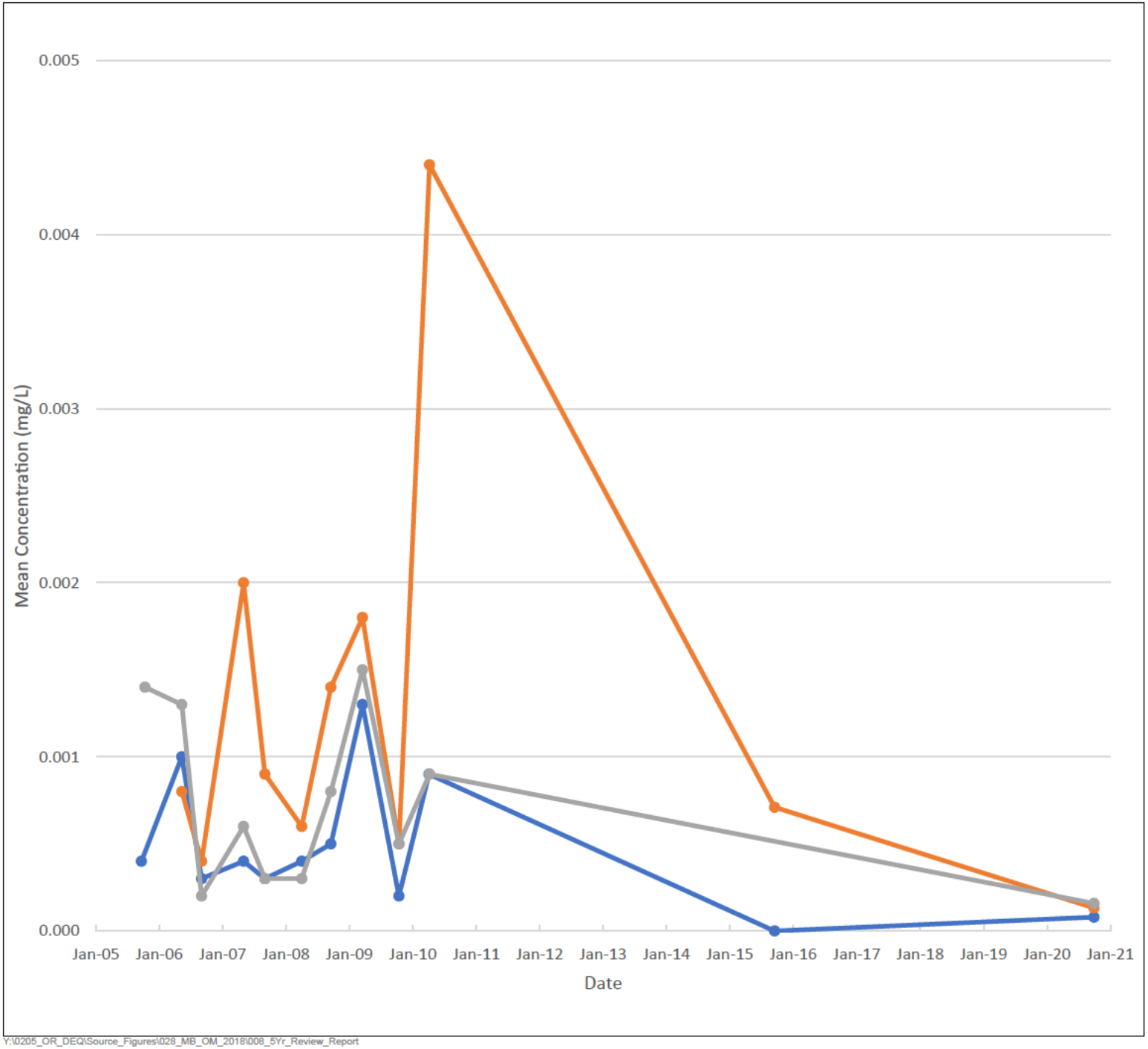

FIGURE IV-13

Mean Chromium Surface Water and Porewater Concentrations by Depth Over Time

McCormick & Baxter Superfund Site
Portland, Oregon

LEGEND

- Surface
- Inter-Armoring
- Sub-Armoring

NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 2017) = 0.024 mg/L
mg/L: Milligram per Liter

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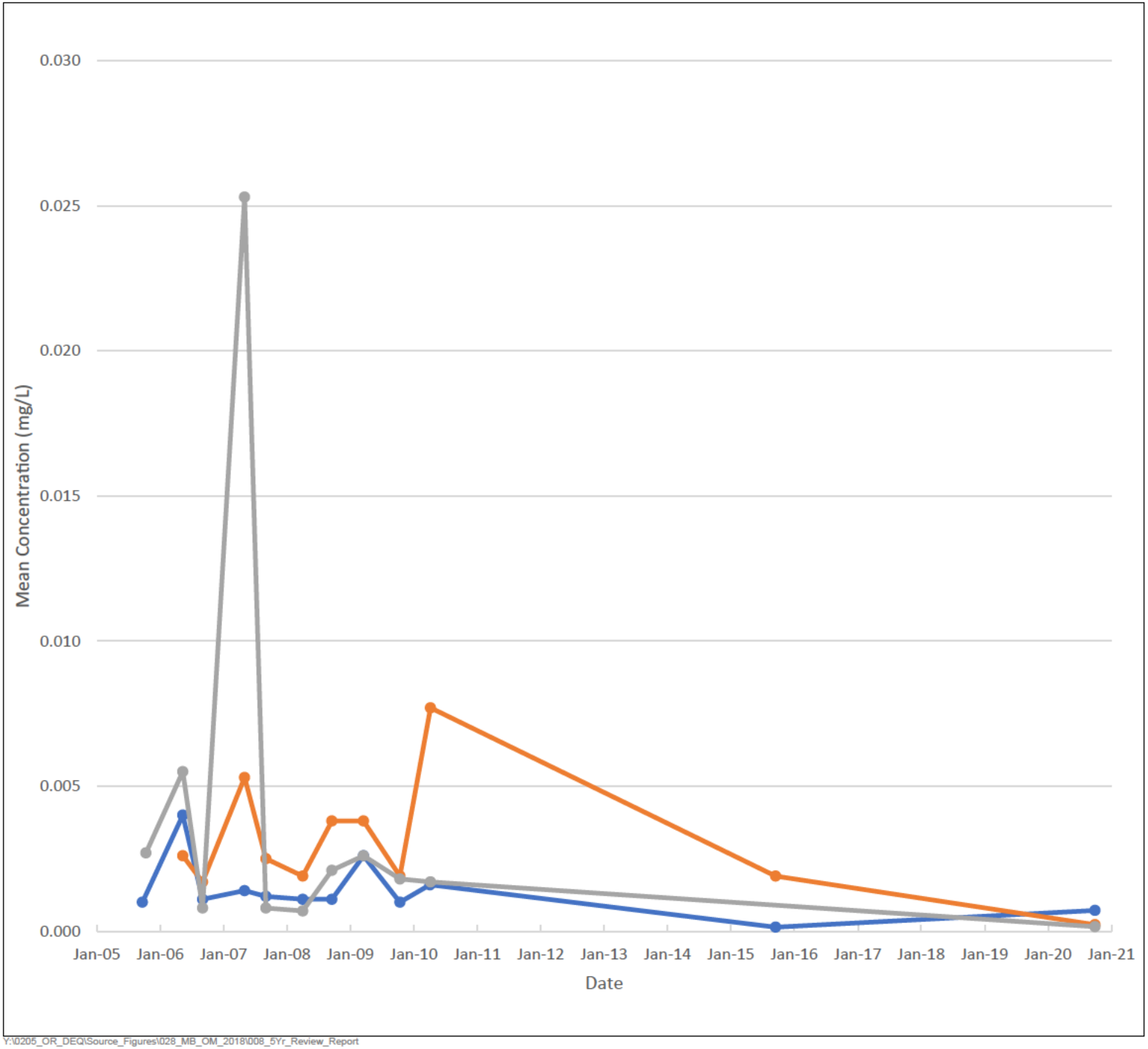

FIGURE IV-14

Mean Copper Surface Water and Porewater Concentrations by Depth Over Time

McCormick & Baxter Superfund Site
Portland, Oregon

LEGEND

- Surface
- Inter-Armoring
- Sub-Armoring

NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 1996) = 0.012 mg/L
mg/L: Milligram per Liter

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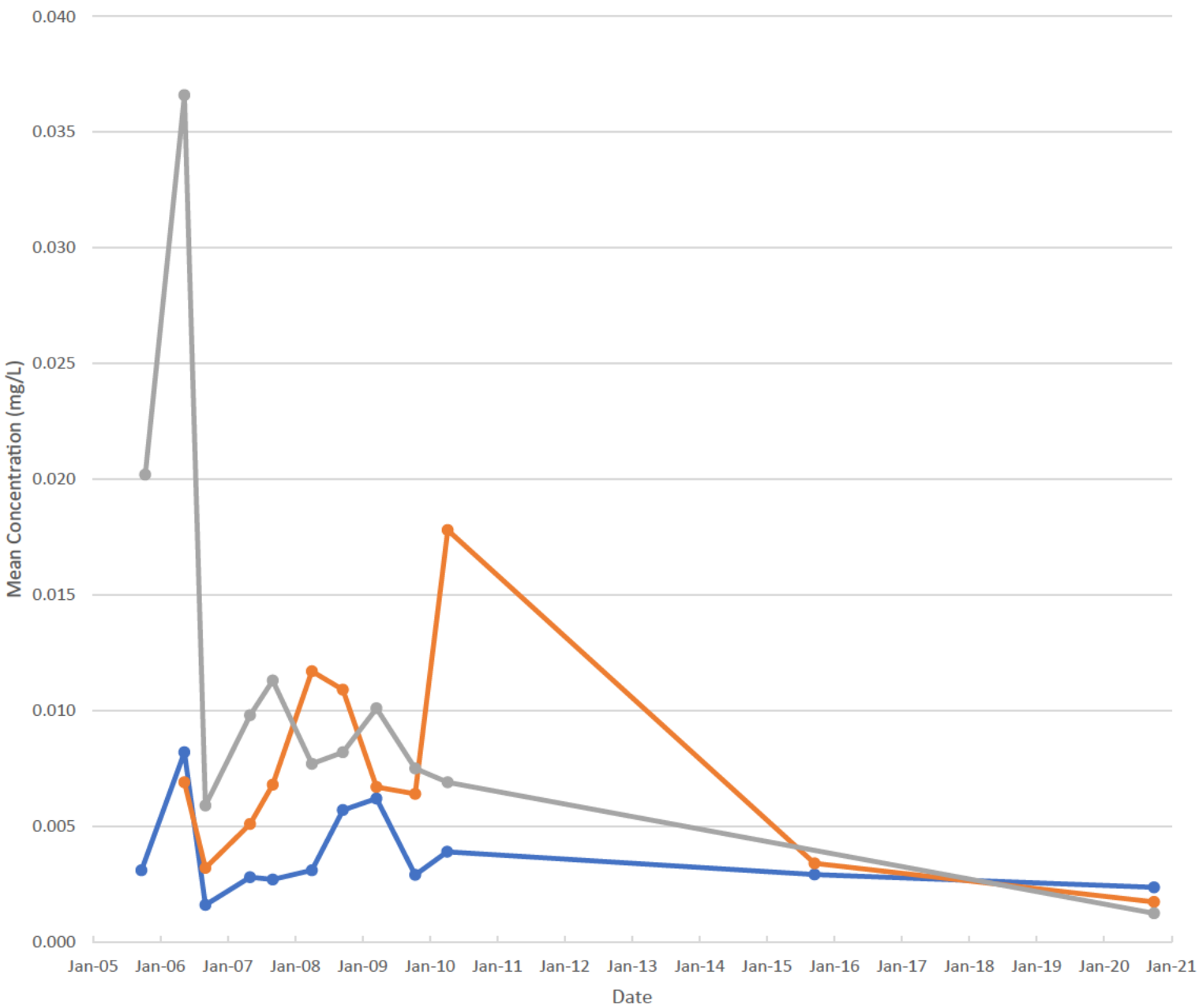

FIGURE IV-15

Mean Zinc Surface Water and Porewater Concentrations by Depth Over Time

McCormick & Baxter Superfund Site
Portland, Oregon

LEGEND

- Surface
- Inter-Armoring
- Sub-Armoring

NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 2017) = 0.036 mg/L (Aquatic Life) and 2,600 mg/L (Human Health)
mg/L: Milligram per Liter

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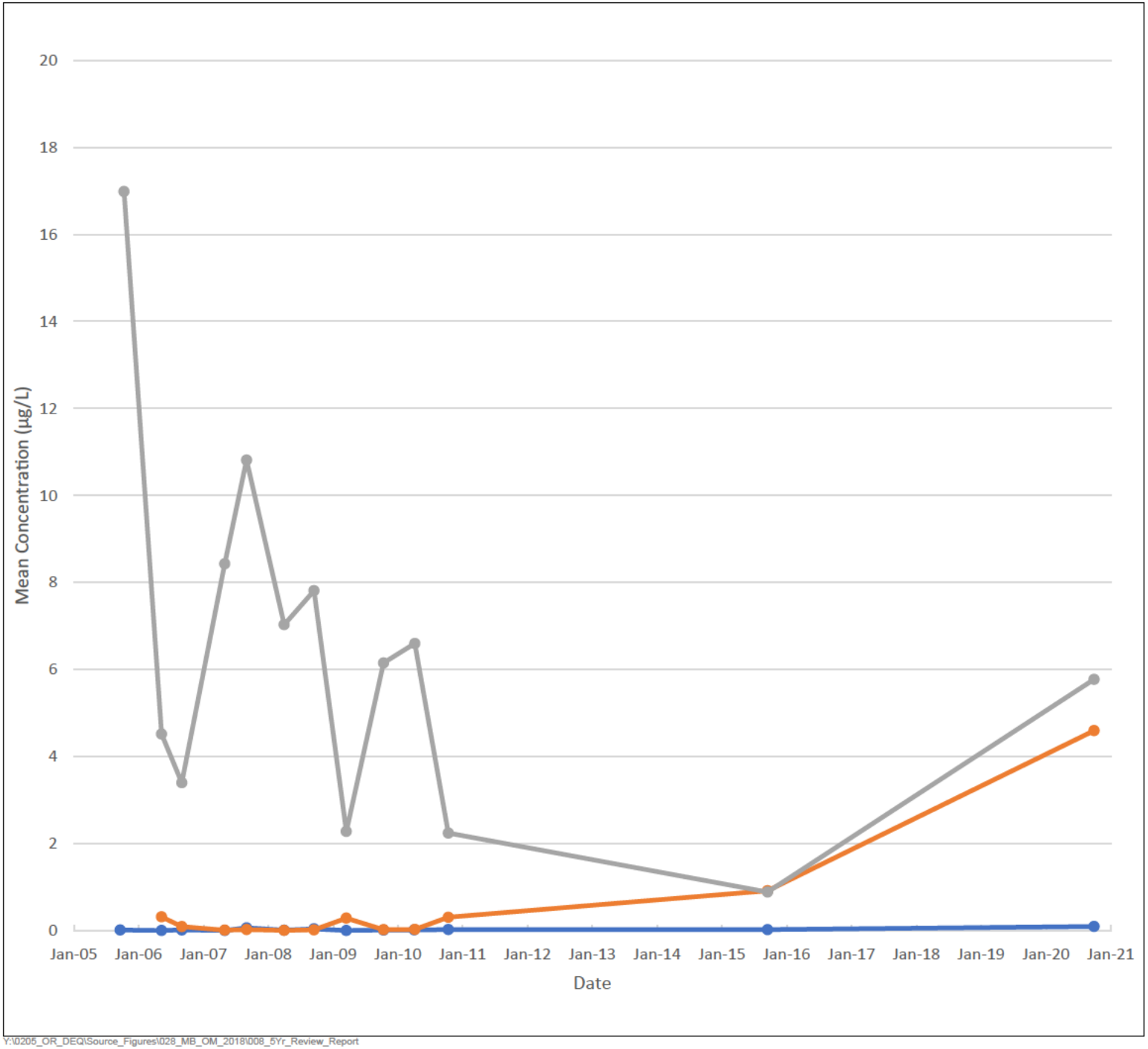

FIGURE IV-16

Mean Acenaphthene Surface Water and Porewater Concentrations by Depth Over Time

McCormick & Baxter Superfund Site
Portland, Oregon

LEGEND

- Surface
- Inter-Armoring
- Sub-Armoring

NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 2017) = 99 µg/L
µg/L: Microgram per Liter

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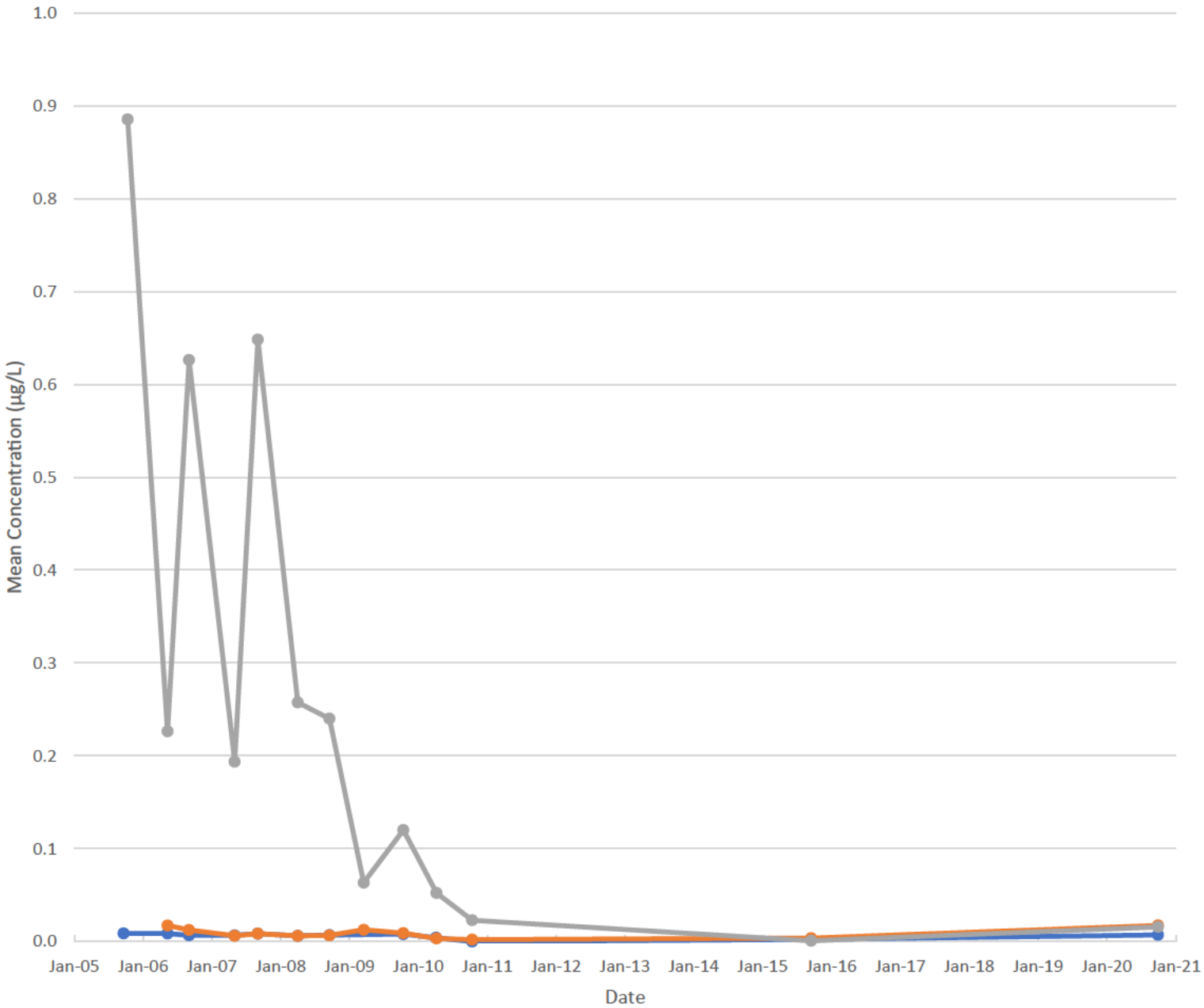

FIGURE IV-17

Mean Fluoranthene Surface Water and Porewater Concentrations by Depth Over Time

McCormick & Baxter Superfund Site
Portland, Oregon

LEGEND

- Surface
- Inter-Armoring
- Sub-Armoring

NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 2017) = 14 µg/L
µg/L : Microgram per Liter

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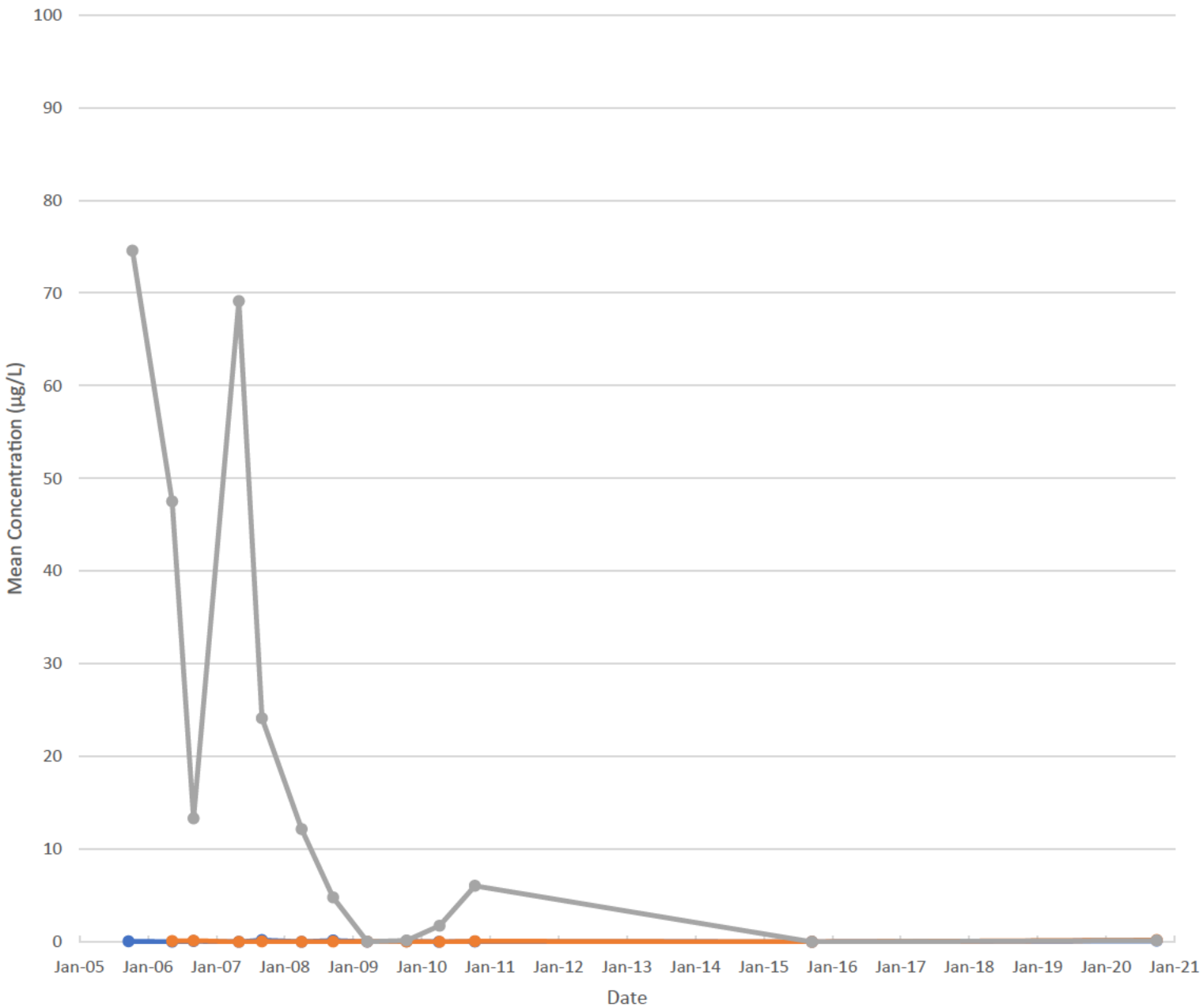

FIGURE IV-18

Mean Naphthalene Surface Water and Porewater Concentrations by Depth Over Time

McCormick & Baxter Superfund Site
Portland, Oregon

LEGEND

- Surface
- Inter-Armoring
- Sub-Armoring

NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 1996) = 620 µg/L
µg/L : Microgram per Liter

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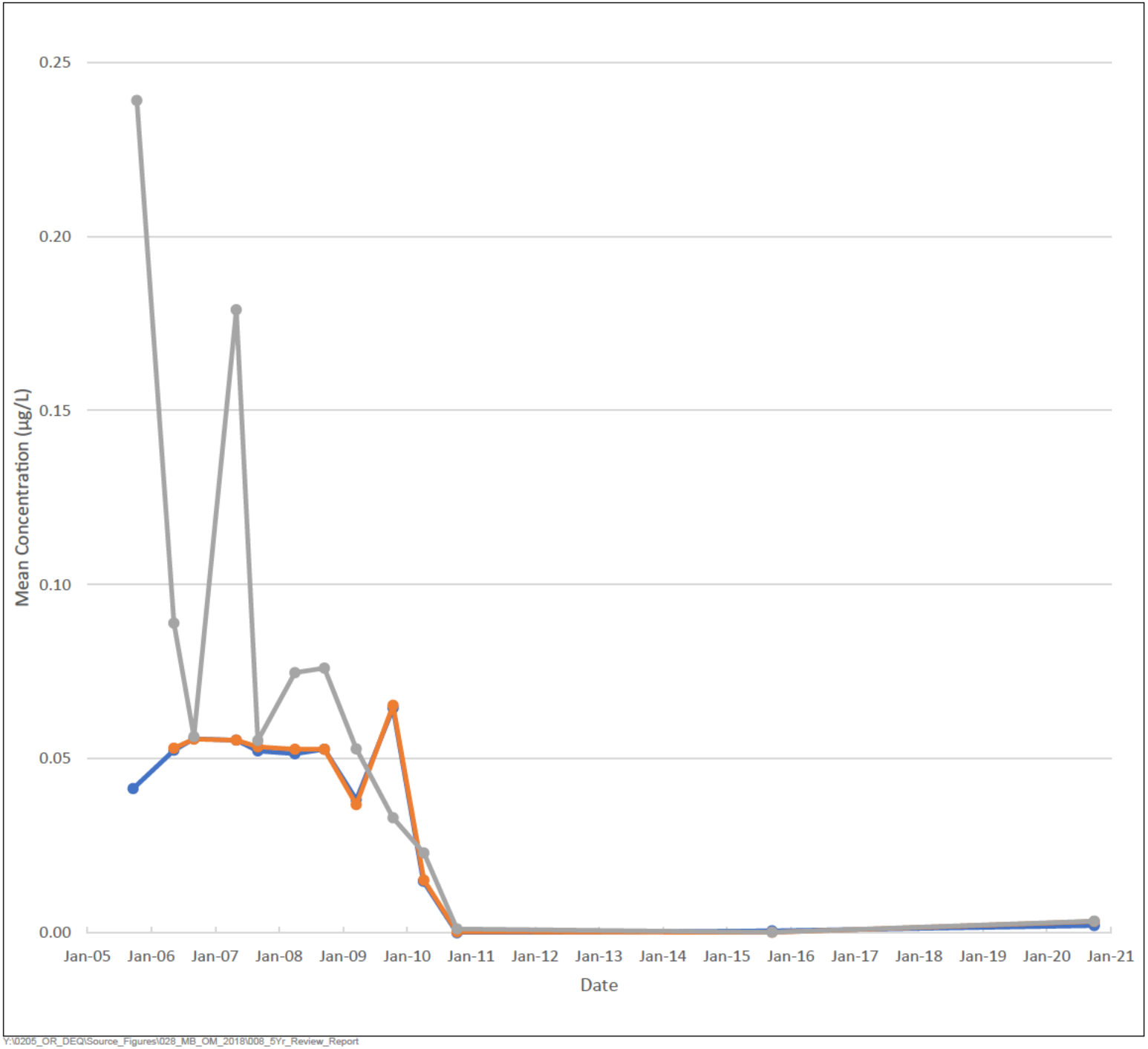

FIGURE IV-19

Mean cPAH Surface Water and Porewater Concentrations by Depth Over Time

McCormick & Baxter Superfund Site
Portland, Oregon

LEGEND

- Surface
- Inter-Armoring
- Sub-Armoring

NOTES

AWQC: Ambient Water Quality Criteria (Oregon Department of Environmental Quality, 1996) = 0.031 µg/L
µg/L : Microgram per Liter

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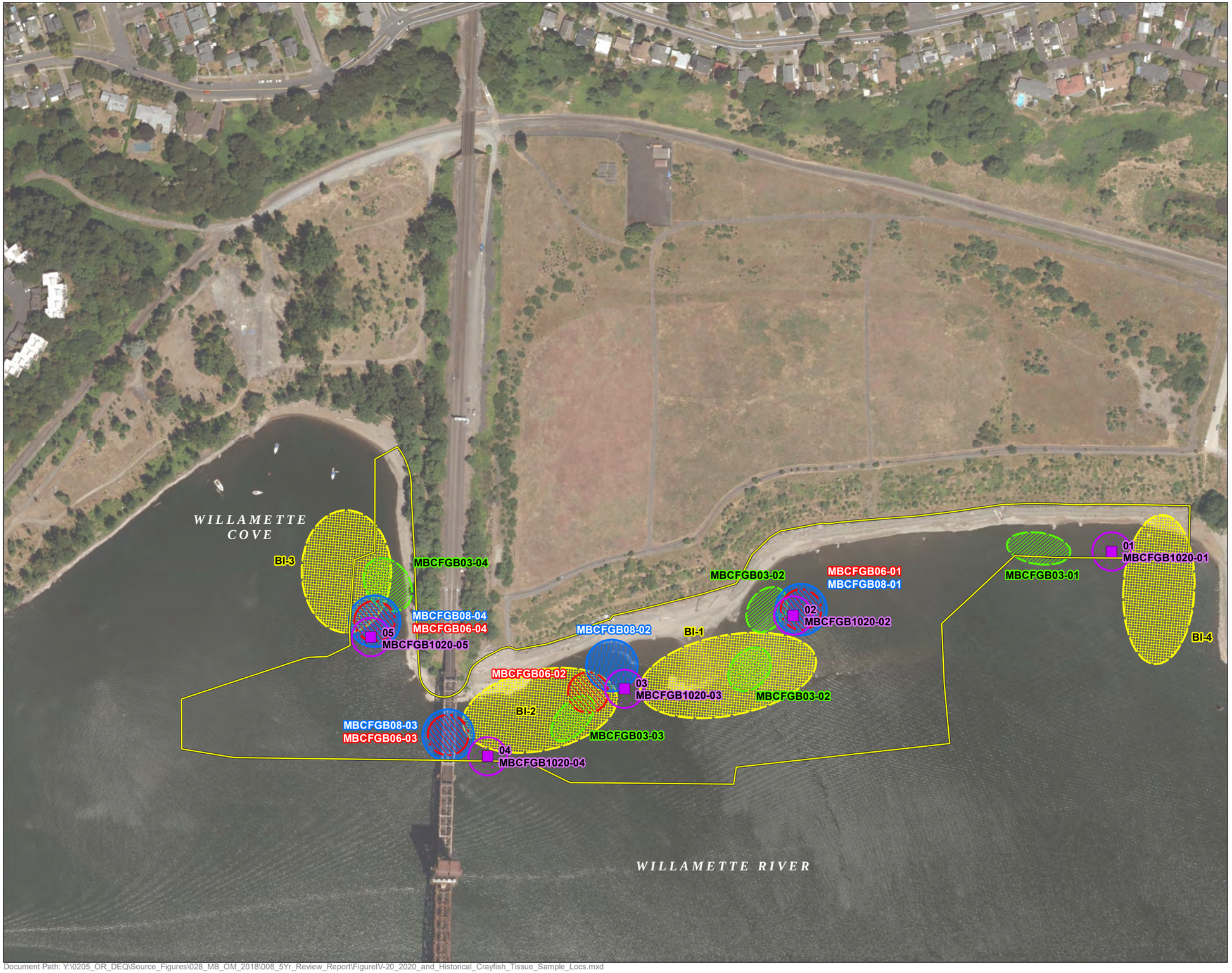

FIGURE IV-20

2020 and Historical Crayfish Tissue Sampling Locations

McCormick & Baxter Superfund Site
Portland, Oregon

LEGEND

- 2020 Crayfish Sample Location
- 2020 Crayfish Sample Buffer (50')
- Compliance Monitoring Area Boundary

Historic Crayfish Trap Locations

- 1991
- 2003
- 2006
- 2008

NOTE

Aerial photo taken Summer 2020.

Date: September 3, 2021
Data Sources: COP aerial photo

N

0 125 250 375
Feet

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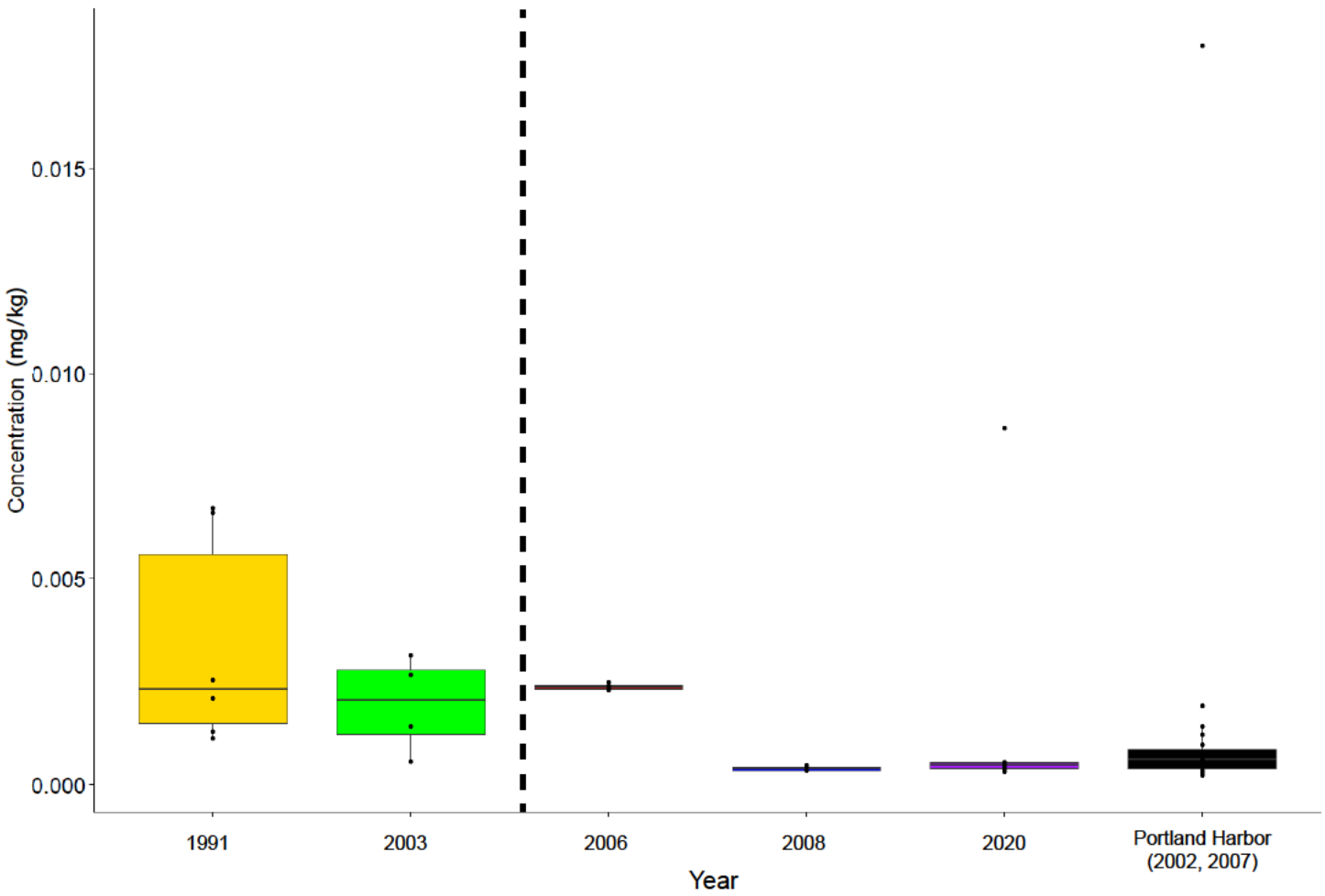

FIGURE IV-21

Boxplots of Historical McCormick & Baxter and Portland Harbor Crayfish Tissue Data Sets for TCDD TEQ

McCormick & Baxter Superfund Site
Portland, Oregon

LEGEND

In-Water Remedy Implemented

Sampling Event

- 1991 (Tail only)
- 2003
- 2006
- 2008
- 2020
- Portland Harbor (2002, 2007)

BOXPLOT LEGEND

- Max. Data Point
- 75%
- Median
- 25%
- Min. Data Point

NOTES

Compressed boxes and points at the same concentration can be indicative of non-detects at a similar method detection limit.

mg/kg: Milligram per kilogram

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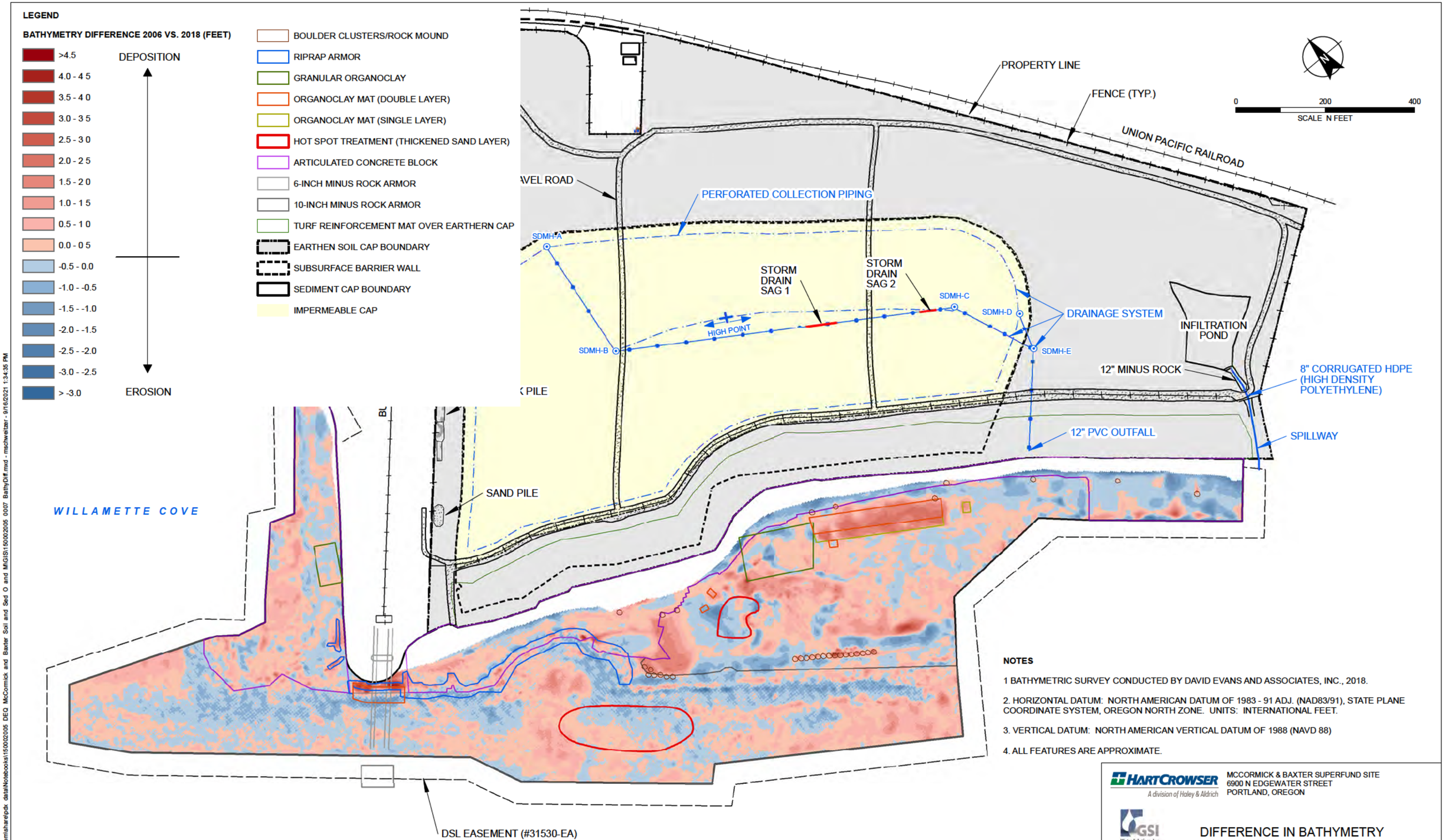

NOTES

1 BATHYMETRIC SURVEY CONDUCTED BY DAVID EVANS AND ASSOCIATES, INC., 2018.

2. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 - 91 ADJ. (NAD83/91), STATE PLANE COORDINATE SYSTEM, OREGON NORTH ZONE. UNITS: INTERNATIONAL FEET.

3. VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

4. ALL FEATURES ARE APPROXIMATE.

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MCCORMICK & BAXTER SUPERFUND SITE
6900 N EDGEWATER STREET
PORTLAND, OREGON

GSI Water Solutions, Inc.

DIFFERENCE IN BATHYMETRY
2006 VS 2018

SEPTEMBER 2021

FIGURE IV-22

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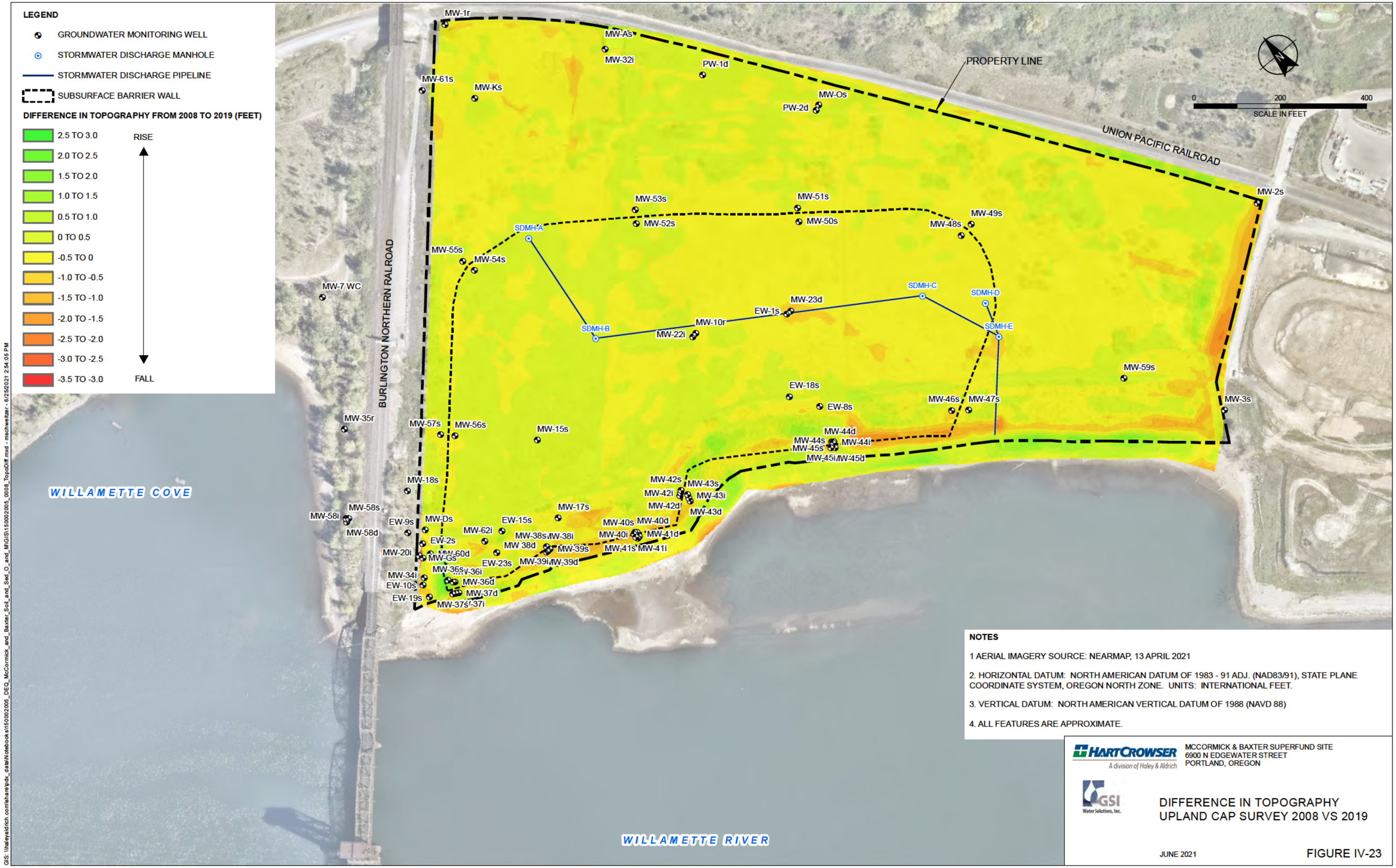

NOTES

1 AERIAL IMAGERY SOURCE: NEARMAP, 13 APRIL 2021

2. HORIZONTAL DATUM: NORTH AMERICAN DATUM OF 1983 - 91 ADJ. (NAD83/91), STATE PLANE COORDINATE SYSTEM, OREGON NORTH ZONE. UNITS: INTERNATIONAL FEET.

3. VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)

4. ALL FEATURES ARE APPROXIMATE.

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MCCORMICK & BAXTER SUPERFUND SITE
6900 N EDGEWATER STREET
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DIFFERENCE IN TOPOGRAPHY
UPLAND CAP SURVEY 2008 VS 2019

JUNE 2021

FIGURE IV-23

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