

Operation and Maintenance Plan

For

McCormick & Baxter Creosoting Company
Superfund Site
Portland, Multnomah County, Oregon

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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.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPA	central processing area
DEQ	Oregon Department of Environmental Quality
DSL	Oregon Department of State Lands
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
FWDA	former waste disposal area
GSI	GSI Water Solutions, Inc.
IC	institutional control
LNAPL	light non-aqueous phase liquid
MCL	maximum contaminant level
µg/L	microgram per liter
mg/kg	milligram per kilogram
ng/L	nanogram per liter
NAPL	non-aqueous phase liquid
NAVD	North American Vertical Datum
NCP	National Oil and Hazardous Substances Contingency Plan
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration

NPL	National Priorities List
NRWQC	National Recommended Water Quality Criteria
O&F	operational and functional
O&M	operation and maintenance
ODSL	Oregon Division of State Lands
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PCP	pentachlorophenol
PPA	Prospective Purchaser Agreement
RAO	remedial action objective
RCM	reactive core mat
RCRA	Resource Conservation and Recovery Act
RNA	Regulated Navigational Area
ROD	Record of Decision
Site	McCormick & Baxter Creosoting Company Superfund Site
SPME	solid phase micro-extraction
SSC	Superfund State Contract
TFA	tank farm area
UPRR	Union Pacific Railroad Co.
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service

OPERATION AND MAINTENANCE PLAN McCORMICK & BAXTER SUPERFUND SITE PORTLAND, OREGON

1.0 INTRODUCTION AND PURPOSE

The Oregon Department of Environmental Quality (DEQ) has prepared this Operations and Maintenance (O&M) Plan for the remedial actions implemented at the McCormick & Baxter Superfund Site (Site), located in Portland, Multnomah County, Oregon. Preparation of this O&M Plan was supported by DEQ's Contractors, Hart Crowser, Inc. (Hart Crowser) and GSI Water Solutions, Inc. (GSI).

Section 104(c)(3) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires the State to assure all future maintenance of CERCLA-funded removal and remedial actions provided for the expected life of such actions as determined by the President. 42 U.S.C. § 9604(c)(3). The DEQ has entered into a State Superfund Contract (SSC) under which the DEQ has assured the O&M of the implemented CERCLA-funded remedial action.

The purpose of this document is to help ensure the proper transition of O&M responsibility of the Fund-lead remedial action at the McCormick & Baxter Superfund Site from the United States Environmental Protection Agency (EPA) to DEQ, and to ensure adequate O&M for the remedial action. This O&M Plan defines the administrative, financial, and technical details and requirements for inspecting, monitoring, operating, and maintaining the remedial actions at the Site. This plan also includes information on maintaining, as appropriate, institutional controls (ICs) established at the Site pursuant to the Record of Decision (ROD), ROD Amendment, Explanation of Significant Difference, and Five Year Reviews jointly issued by EPA and DEQ, and information regarding additional restrictions to ensure that the Site is protective for the long term.

An O&M Manual has been prepared to serve as a companion to the O&M Plan. The O&M Manual contains up-to-date, site-wide record drawings of the remedial features present at the Site. The O&M Manual specifies the sampling and monitoring procedures, quality assurance and quality control, technical information, and data necessary for implementing the O&M activities. The O&M Manual is a living document that will be periodically modified by DEQ to reflect necessary monitoring and maintenance needs at the Site.

The assumption of O&M activities by DEQ and the nature of those actions are described in CERCLA, 42 U.S.C. § 9601 *et seq.*, in EPA regulations titled "The National Oil and Hazardous Substances Pollution Contingency Plan" (NCP), 40 C.F.R. Part 300, and in the following documents:

1. *Operation and Maintenance in the Superfund Program Fact Sheet*, 9200.1-37FS, US. EPA. May 2001;

2. *Superfund State Contract Between EPA and the State of Oregon for Remedial Design and Remedial Action at the McCormick & Baxter Superfund Site* executed on May 22, 1996, as subsequently amended.

This O&M Plan is intended to address the O&M elements described in the EPA Fact Sheet titled *Operation and Maintenance in the Superfund Program*¹, page 7. The general arrangements for the O&M activities for each element of the remedy - soil cap, sediment cap, and subsurface barrier wall - are described in Sections 7, 8, and 9 of this plan. Procedures to conduct the O&M activities for each remedy are contained in the O&M Manual.

This O&M Plan may be modified over time due to changed Site conditions, new guidance, and development of further details concerning O&M at the Site. Modifications to the Plan may be made by mutual agreement between EPA and DEQ.

2.0 DESIGNATION OF THE ORGANIZATIONAL UNIT OF THE GOVERNMENT RESPONSIBLE FOR O&M

DEQ is the State agency responsible to ensure O&M of CERCLA-funded remedial actions will be carried out at the Site. References to “the State” in this plan mean DEQ.

3.0 IDENTIFICATION OF THE AVAILABLE STATE FUNDING MECHANISMS FOR O&M ACTIVITIES

DEQ will conduct O&M activities using funds provided from the DEQ’s Orphan Site Account; to the extent such funds are available. The Orphan Site Account is described in Oregon Revised Statutes 465.381. DEQ will seek funding as necessary and appropriate to conduct O&M activities at the Site.

4.0 SITE BACKGROUND

4.1 Site Description

The McCormick & Baxter Superfund Site includes a former wood-treating facility located on the east bank of the Willamette River in Portland, Oregon (“the McCormick & Baxter Property” which consists of the area owned by the McCormick & Baxter Creosoting Company). The Site encompasses approximately 41 acres of land and an additional 23 acres of contaminated river sediments. The legal address of the McCormick & Baxter Property is 6900 North Edgewater Avenue, Portland, Oregon, and the DEQ’s Environmental Cleanup Site Information (ECSI) number is 74. Figure 1 shows the Site location. Figure 2 shows the current Site layout and features from an aerial photograph. Figure 3 depicts the current Site layout and features on a

¹ EPA, 2001. *Operation and Maintenance in the Superfund Program*. Prepared by the United States Environmental Protection Agency, Office of Solid Waste and Emergency Response. OSWER 9200.1-37FS. EPA 540-F-01-004. May 2001.

topographic map of the sediment and terrestrial surface elevations. Figure 4 shows the groundwater monitoring well locations at the Site. The upland portion of the Site is on a terrace of imported sand fill (dredged material placed in the early 1900s) within the historic flood plain of the Willamette River. This upland area is generally flat and lies between a 120-foot-high bluff along the northeast border and a 25- to 30-foot-high bank along the Willamette River to the southwest. Currently, the McCormick & Baxter Property is vacant except for a paved parking area, a small shop building, and associated utilities used to support ongoing monitoring of the Site.

A residential area is located above the Site on the adjacent bluff. The 115 acre University of Portland college campus is also located on the bluff, approximately 0.5-mile southeast of the Site. The University of Portland recently purchased the former industrial property (Triangle Park) bordering the Site to the southeast with pending plans for reuse (e.g., athletic fields, and supporting buildings). A BNSF Railway Co. (BNSF) track crosses the northwest portion of the Site, and Union Pacific Railroad (UPRR) track borders the Site to the southeast below the bluff. Beyond the BNSF track, toward the northwest, is a former industrial property managed by Metro (regional government) that is planned to be developed as a public green space (Baltimore Woods). The perimeter of the McCormick & Baxter Property² is fenced and posted with warning signs.

4.2 Site History

The McCormick & Baxter Creosoting Company 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 at the Site 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). A 750,000-gallon creosote product storage tank was located in a tank farm area (TFA) that included several additional tanks for storing wood-treatment chemicals at the Site.

Between 1945 and 1969, the plant's wastewater from the retorts' oil/water separators, along with boiler blowdown and condenser cooling water were directly discharged to the Willamette River. Three stormwater outfalls were also present along the river. Following plant shutdown, 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 conducted in 1999.

Site investigations revealed many releases of wood-treating chemical compounds to soils, groundwater, and sediments as a result of historic Site operations. Contaminants detected include

² More specifically, the fence is located along the legal boundary of the McCormick & Baxter Property, except along the riverfront, where the fence is located along the landward edge of the riparian zone.

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 former waste disposal area (FWDA), which was located in the western corner of the Site, adjacent to the Willamette River and 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, where retorts, a PCP mixing shed, and ACZA storage areas were formerly located; and
- The TFA, which was located in the south-central portion of the Site, which 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 riverbed 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 right-of-way toward Willamette Cove. Remedial actions have been implemented to control these sources (as further described in Section 5.0).

Following remedy construction, on-going monitoring has been conducted and numerous investigations have been performed to evaluate remedy effectiveness. Significant activities and investigations were performed during the period between the *Second Five-Year Review* (2006) and the *Third Five-Year Review* (September 2011), and are summarized in Table 1. These investigations and activities include water quality assessments, subsidence monitoring (inside the barrier wall), bathymetric surveys and diver inspections, ebullition and sheen investigations, organophilic clay cap performance assessments, an evaluation of the articulated concrete block (ACB) unconformities in Willamette Cove, and a dense NAPL (DNAPL) Investigation. These studies are discussed in detail in the *Annual O&M Reports* produced after remedy construction and summarized in the *Third Five-Year Review Report* (September 2011). In general, the routine monitoring and subsequent investigations have shown the Site remedies to be functioning as designed. The *Third Five-Year Review* and *Annual O&M Reports* can be found on the McCormick & Baxter EPA Web site:

http://yosemite.epa.gov/r10/cleanup.nsf/sites/mccormick_baxter

4.3 Regulatory History

The McCormick & Baxter Creosoting Company began environmental investigations of the Site in 1983. DEQ entered into a Stipulated Order with the McCormick & Baxter Creosoting Company in 1987, requiring additional investigation and 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, the McCormick & Baxter Creosoting Company filed

for Chapter 11 bankruptcy, and in 1990 DEQ assumed responsibility for completing the investigations and cleanup activities at the Site. In October 1991, the McCormick & Baxter Creosoting Company ceased operations.

DEQ began the Remedial Investigation and Feasibility Study in 1990 and issued a public notice for a proposed cleanup plan in January 1993. DEQ elected not to finalize the proposed plan due to the proposed addition of the Site to the National Priorities List (NPL) by the 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 SSC in May 1996. The SSC and its amendments specify the responsibilities of DEQ as the lead agency and EPA as the support agency and also specify the cost sharing allocation between DEQ and EPA.

Additional regulatory background information regarding the McCormick & Baxter 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 Superfund Site, Portland, Multnomah County, Oregon, EPA and DEQ, September 2001.
- *Explanation of Significant Difference (OU3 – Final Groundwater)*, McCormick & Baxter Superfund Site, Portland, Multnomah County, Oregon, EPA and DEQ, August 2002.
- *Preliminary Close-Out Report*, McCormick & Baxter Superfund Site, Portland, Multnomah County, Oregon, EPA, September 2005.
- *Second Five-Year Review Report*, McCormick & Baxter Superfund Site, Portland, Multnomah County, Oregon, EPA and DEQ, September 2006.
- *Third Five-Year Review Report*, McCormick & Baxter Superfund Site, Portland, Multnomah County, Oregon, EPA and DEQ, September 2011.

4.4 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, September 2005).

4.5 Remedy Selection and Modifications

In March 1996, EPA and DEQ issued one ROD for the Site to address several different media: contaminated soil, groundwater, stormwater, and Willamette River sediment. The selected remedy required the following media-specific actions to mitigate the threats at the Site:

- Excavation, consolidation and biological treatment/stabilization of the most highly contaminated soils;
- Soil capping;
- Enhancement of the existing groundwater and NAPL extraction and treatment system;
- As a contingency remedy, installation of a vertical subsurface barrier wall in the event mobile NAPL could not be reliably controlled;
- Sediment capping;
- Monitoring; and
- Institutional controls (ICs).

After the ROD was signed, DEQ conducted additional soil sampling to support the remedial design of the upland soil remedy. Sampling results documented more extensive dioxin contaminated soils and accordingly, DEQ and EPA reevaluated the remedy and amended the ROD in March 1998. The 1998 ROD required removal and off-site disposal of shallow soil with concentrations above designated action levels, and capping of remaining contaminated soil on the upland portion of the Site.

In August 2002, EPA and DEQ issued an Explanation of Significant Difference (ESD), explaining the rationale to implement the contingency remedy for installing an impermeable barrier wall to control contaminated groundwater, specified in the 1996 ROD. The ROD contingency stated installation of the barrier wall would be necessary in the event that either:

1. NAPL could not be reliably contained using hydraulic methods; or
2. The barrier wall improves the overall cost-effectiveness of the groundwater remedy.

DEQ and EPA determined NAPL had not been contained using groundwater/NAPL extraction and recovery measures, and concluded hydraulic control of NAPL or groundwater had not been established in either the TFA or the FWDA. In 2003, a fully encompassing, impermeable subsurface barrier wall was constructed in accordance with the ESD.

4.6 Redevelopment Potential

A Site Reuse Assessment was conducted between February 2000 and June 2001 by the City of Portland, 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 City concluded that the Site is best suited for recreational use.

5.0 REMEDY DESCRIPTION AND CONSTRUCTION ACTIVITIES

The Site was divided into three operable units (OUs) to facilitate and manage remedy costs, implementation, and construction. The overall remedy at the Site is designed to function as an integrated containment system for contaminants that are present in each OU. The entire McCormick & Baxter Property at the Site is capped. The combined upland capping extends to the riparian area along the shoreline where it meets the sediment cap and the upland cap extends on to property owned by BNSF Railway, Co. The capping works in conjunction with the barrier wall, as a complementary system, to meet the Site Remedial Action Objectives (RAOs) and prevent contaminated sediments and groundwater from adversely impacting the Willamette River.

5.1 Soil Operable Unit Remedy

The soil remedy is composed of three primary components: removal of highly contaminated soil within 4 feet of the ground surface, capping, and institutional controls. 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 1×10^{-6} for individual compounds, above 1×10^{-5} for additive carcinogenic compounds, or above a Hazard Index of 1 for noncarcinogenic compounds in an industrial land-use scenario; and
- Prevent stormwater runoff containing contaminated soil from reaching the Willamette River.

5.1.1 Soil Removal

Phase I of the soil remedy was conducted from February through May 1999, where the most contaminated soil (above removal action levels) was excavated to 4 feet below ground surface and removed from the Site. Clean sand was imported from an off-site quarry to backfill locations of excavated soils.

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 and Environment (E&E), November 1999).

5.1.2 Upland Soil Cap

Phase II of the soil remedy was conducted between March and September 2005 to cap upland areas where residual soil contamination remained 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 Soil Cap Construction Summary Report* (E&E, May 2006).

Construction activities for the upland soil cap included the following major components:

- Demolition and off-site disposal of existing structures and infrastructure;
- Reinstallation of key support facilities;
- Construction of an impermeable cap within a 15-acre portion of the 18-acre area encompassed by the subsurface barrier wall (see Section 5.3.1); and
- Construction of an earthen soil cap outside of the impermeable cap.

Demolition and removal were conducted in 2005 and included the removal of all remaining structures on the Site. A 15-acre Resource Conservation and Recovery Act (RCRA) design, impermeable cap was constructed within the 18-acre area inside of the barrier wall (note: The 3-acre area within the barrier wall that does not have the RCRA-design cap is the riparian zone that borders the river).

The purpose of the impermeable cap is to minimize infiltration of rainwater into the contaminated areas within the wall. The impermeable cap has a minimum thickness of 29 inches, and includes a subsurface stormwater collection and drainage system. Stormwater infiltrates through the cap's soil, rock and sand layers, and is collected and conveyed by gravity flow to an outfall structure at Willamette River.

A 2-foot earthen cap of imported topsoil was installed over 19 acres of the Site outside of the barrier wall area including a small area within the BNSF right-of-way. An asphalt entrance road and parking area (approx. 1 acre) was also placed over an equivalent 2-foot earthen cap and supporting road base material. An additional 6 acres of earthen cap were installed over the riparian zone during construction of the sediment cap. The purpose of the earthen cap is to prevent direct contact with low-level contamination remaining in the Site soil.

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 towards the drainage swale. Rainwater infiltrates into soil and groundwater within the riparian zone, which has a general slope of 25 percent towards the Willamette River.

A 6-foot high, chain-link fence topped with barbed wire was installed with warning signs along the McCormick & Baxter Property perimeter. Along the riverfront, the fence is located 35 feet inland from the top of the bank. Gravel access ways and roads were constructed along the riverfront perimeter and within the interior of the McCormick & Baxter Property to allow monitoring and maintenance of the Site.

Native trees and shrubs were planted throughout the drainage swale and riparian zone in February 2006 to stabilize the soil against stormwater erosion and river flood erosion and to reduce rainwater infiltration by increasing evapotranspiration. A temporary aboveground irrigation system was installed in May 2006 to provide irrigation through 2010. Native grasses were planted on the impermeable cap within the barrier wall. The vegetation is fully established and the irrigation system is no longer needed and will be removed.

5.2 Sediment Operable Unit 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; and
- 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.

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.

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 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 November 2004)* and *Remedial Action Construction Summary Report Sediment Cap Completion (August 2005 through October 2005)*, both issued by E&E 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; and

- Disposal and demobilization.

The sediment cap footprint encompasses approximately 22 acres. 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. The cap also incorporates organophilic clay to prevent NAPL migration through the cap in specific areas in Willamette Cove and adjacent to the TFA. The organophilic clay was applied in bulk and in the form of Organoclay™ reactive core mats (RCMs). A 6-acre riparian zone was created by regrading the riverbank, placing a demarcation layer, placing and grading 2 feet of imported clean fill (topsoil), placing turf reinforcement mat, hydroseeding with native grasses, and planting native vegetation and trees.

Different types of armoring were used to prevent erosion of the sand and organophilic clay layers of the cap. The type, size, and location of armoring material used to protect the cap depended on the expected hydraulic and physical environments (e.g., currents, wave energy, erosive energies, etc.). ACB mats were installed along the shore and in shallow water where erosive forces due to wave action are greatest. Rock armor was placed within the river, away from the shoreline, and included 6- and 10-inch minus material. Riprap was used in some transition areas between the ACB and rock armoring, and near shore where ACB could not be applied. In addition, boulder clusters were added to provide aquatic habitat diversity and a rock mound was added to lower hydraulic energy within the shallow water embayment area.

5.3 Groundwater Operable Unit Remedy

The groundwater remedy is composed of five components: ICs, a subsurface barrier wall, a multi layer RCRA cap, 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;
- Minimize precipitation infiltration by installing a RCRA cap, and have most of the precipitation by-pass the flow path through the contamination inside the barrier wall
- 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 or in excess of water quality criteria for aquatic organisms;
- Minimize NAPL discharges to the Willamette River beach and adjacent sediment; and
- Remove mobile NAPL to the extent practicable to reduce the continuing source of groundwater contamination and the potential for discharge to Willamette River sediment.

5.3.1 Subsurface Barrier Wall

As required by the ESD, an impermeable subsurface barrier wall was designed and installed to contain much of the upgradient sources of dense NAPL (DNAPL) and light NAPL (LNAPL) in the TFA and FWDA, and to reduce NAPL migration from these areas to the Willamette River. The riverfront segment of the barrier wall is located at approximately 30 feet landward from ordinary high water. 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, July 2004).

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

The segment of the 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 considered a “hanging wall” because deeper soil in this area consists of interbedded sand and silt lenses, and therefore, is not a continuous, competent aquitard. This segment of the wall also extends to a depth of 70 to 80 feet bgs. Although not keyed into an aquitard, the depth of this segment serves to increase the distance, and thereby reduce the potential NAPL movement, between the DNAPL source and the Willamette River. 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 extends 45 feet bgs.

5.3.2 Creosote Recovery

Creosote (i.e., NAPL) recovery began in 1989 as a Removal Action, and various extraction methods have been attempted to optimize NAPL recovery since that time. The goal of extraction was to remove and deplete NAPL pools to residual levels to minimize or prevent migration into the Willamette River. NAPL recovery continued through July 2011. Approximately 6,500 gallons of NAPL were recovered from the Site between 1989 and 2011, when NAPL extraction was terminated. NAPL recovered from extraction wells was transported to an off-site RCRA Subtitle C facility for treatment and disposal as a listed hazardous waste.

A DNAPL investigation was performed in 2011 to evaluate the nature, extent, and potential pathway(s) of DNAPL routinely observed in monitoring well MW-20i (outside the barrier wall in the FWDA). The *DNAPL Data Gap Investigation* (Hart Crowser/GSI, 2011) concluded that the source of DNAPL to MW-20i is small and localized and does not appear to pose a threat to the Willamette River. Given that this well has been the primary source of DNAPL recovered for the

past several years and that no pool of mobile NAPL was encountered during the investigation, DEQ and EPA decided to terminate NAPL recovery in late April 2011 and conducted four subsequent gauging efforts to document the thickness of NAPL in the well to ensure that it is stable. Semiannual NAPL gauging of MW-20i will be evaluated every five years starting in 2015 to ensure there is not an increasing trend relative to the gauging data summarized in the *DNAPL Data Gap Investigation*.

6.0 OPERATIONAL AND FUNCTIONAL CRITERIA, RESULTS, AND MILESTONE DATES FOR DEQ ASSUMPTION OF O&M RESPONSIBILITIES

CERCLA requires the States to assure future maintenance of removal and remedial actions constructed at a site to maintain the effectiveness of those measures. The NCP describes this assurance as follows:

40 C.F.R. § 300.435(f) Operation and maintenance. (1) Operation and maintenance (O&M) measures are initiated after the remedy has achieved the RAOs and remediation goals in the ROD, and is determined to be operational and functional, except for ground- or surface-water restoration actions covered under § 300.435(f)(4). A state must provide its assurance to assume responsibility for O&M, including, where appropriate, requirements for maintaining institutional controls, under § 300.510(c).

Furthermore, the date when the State must assume O&M activities is related to the determination that a removal or remedial action is “operational and functional” (O&F). The NCP provides:

40 C.F.R. § 300.435(f)(2) A remedy becomes “operational and functional” [O&F] either one year after construction is complete, or when the remedy is determined concurrently by EPA and the state to be functioning properly and is performing as designed, whichever is earlier. EPA may grant extensions to the one-year period, as appropriate.

EPA and DEQ conducted a joint final inspection of the McCormick & Baxter Superfund Site soil, groundwater, and sediment remedial actions on September 26, 2005 and determined that the Site had achieved the construction completion milestone. This determination means that all remedial action required by the ROD, the ROD Amendment, and the ESD are complete. This determination was documented in the *Preliminary Close-Out Report* (September 2005). DEQ and EPA completed O&F determinations on the soil and sediment remedies in September 2006 and September 2013, respectively. Table 2 specifies the O&F performance measures developed for the 2007 O&M Plan, and the current status in achieving these measures for each of the remedial actions at the Site.

The *Third Five-Year Review Report* (September 2011) presents a summary of activities and investigations conducted since September 2005 to demonstrate the remedies of groundwater and sediment are functioning properly and performing as designed. The report concludes that the soil, sediment, and groundwater OU remedies are meeting the ROD-defined RAOs, and are currently protective of 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 of human health and the environment in the long-term, a ROD Amendment that establishes new cleanup goals and points of compliance needs to be completed for the groundwater remedy and the ICs required by the ROD for the soil and groundwater remedies need to be implemented.

The O&F determination for the groundwater remedy has not been completed due to the invalidation of the Alternate Concentration Limit (ACL) cleanup goals for groundwater by EPA in 2006. In the *Second Five-Year Review*, EPA determined that ACLs were not valid as substitutes for EPA's maximum concentration limits (MCLs) in groundwater. 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 consistent with groundwater cleanup goals for the Portland Harbor Superfund Site ROD, expected in 2016.

7.0 SOIL CAP OPERATION AND MAINTENANCE

7.1 O&M Performance Standards

Contaminated soil removal and construction of an upland soil cap on approximately 41 acres of the Site was completed in September 2005. Institutional controls have not been completed for this portion of the Site.

Soils beneath the soil cap remain contaminated with arsenic, PCP, PAHs, dioxins, and NAPL, thus requiring the need for long-term monitoring and maintenance. The performance standards for the soil cap are:

- Maintain contaminant concentrations in surface soil below the following risk-based cleanup goals, as specified in the ROD (EPA, 1996):
 - Arsenic – 8 milligrams per kilogram (mg/kg)
 - Pentachlorophenol – 50 mg/kg
 - Total Carcinogenic PAHs – 1 mg/kg
 - Dioxins/furans – 0.00004 mg/kg
- Maintain the topsoil layer to within 50 percent of its design specification, by conducting periodic cap inspections to verify that vegetation coverage is preventing erosion
 - Maintain a topsoil thickness of at least 6 inches for the area over impermeable geomembrane cap
 - Maintain a topsoil thickness of at least 12 inches for all areas except over impermeable geomembrane cap

- Minimize infiltration of rainwater within the subsurface barrier wall by maintaining the subsurface stormwater conveyance system.
- Minimize stormwater erosion and ponding outside the barrier wall 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).

7.2 O&M Manual

O&M of the soil cap will be conducted as described in the O&M Manual. 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. A long-term Vegetation Management Plan (revised 2010) has been completed for the soil cap. The plan includes semi-annual qualitative inspections and reporting, and is included in the O&M Manual. General routine maintenance will include 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 sediments from manholes and replanting of unsuccessful trees and shrubs. The frequency of the planned O&M activities for the soil cap remedy through September 2021 is provided in Table 3.

7.3 Equipment and Material Requirements

Equipment requirements for visual monitoring of the soil cap include a field notebook, a digital camera and a manhole cover lifter. Visual inspections will be documented using photographs and field notes, including:

- Condition of the 41-acre soil cap surface (e.g., erosion, subsidence, well casing alignment/stickup)
- Integrity of storm drainage system (e.g., condition of manholes, catch basins, swale)
- Presence/condition of perimeter fencing and warning signs
- Viability of soil cap vegetation (e.g., native grasses, trees, shrubs)

If visual inspections suggest that the soil cap may be settling or subsiding, an elevation survey may be needed to evaluate the significance of changes in the cap. A video survey of stormwater lines may be needed if the inspections suggest that the integrity of the cap storm drainage system is compromised. Inspections will likely be performed by contractors under oversight of DEQ staff. Site vegetation maintenance equipment for herbicide application will be provided by contractors under oversight of DEQ staff. The irrigation system is no longer necessary and has been decommissioned. Additional, unforeseen vegetation maintenance and irrigation activities will depend on weather conditions (e.g., extremely dry and hot) and other unpredictable variables.

Equipment and material requirements for other repairs will be based on the nature of the work (e.g., fencing, landscaping, drilling, or other general construction). Any substantial repairs, such as those requiring the impermeable cap to be breached or repaired, will be described in detailed work plans prepared before these activities are conducted. The work plans will provide technical specifications and drawings sufficient to assure this work is performed appropriately and by qualified personnel.

Materials needed for potential repairs include: geomembrane, geocomposite, perforated piping, sand, biotic rock (3-inch minus rock), 10-inch minus rock, filter fabric, topsoil, road gravel, and chain link fencing. Sand, 3-, 10-, and 24-inch minus rock, and road gravel are stockpiled on site. Additional materials may be imported to address unforeseen integrity or soil erosion problems. All imported soil will be certified by DEQ to meet the requirements for “clean fill” under Oregon regulations.

8.0 SEDIMENT CAP OPERATION AND MAINTENANCE

8.1 O&M Performance Standards

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 and an easement and equitable servitude (EES) was completed in 2006 to restrict sediment cap use and access. Sediments beneath the sediment cap remain contaminated with arsenic, PCP, PAHs, dioxins and NAPL, thus requiring the need for long-term monitoring and maintenance. The performance standards for the sediment cap are:

- Maintain contaminant concentrations in surface sediments below the following risk-based cleanup goals, as specified in the ROD (EPA, 1996):
 - Arsenic – 12 mg/kg, dry weight
 - Pentachlorophenol – 100 mg/kg, dry weight
 - Total Carcinogenic PAHs – 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 (i.e., weight)
- 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 (AWQC):
 - Arsenic (III) – 190 micrograms per liter ($\mu\text{g/l}$)
 - Chromium (III) – 210 $\mu\text{g/l}$
 - Copper – 12 $\mu\text{g/l}$

- Zinc – 110 µg/l
 - Pentachlorophenol – 13 µg/l
 - Acenaphthene – 520 µg/l
 - Fluoranthene – 54 µg/l
 - Naphthalene – 620 µg/l
 - Total Carcinogenic PAHs – 0.031 µg/l
 - Dioxins/furans – 1.4×10^{-5} nanograms per liter (ng/l)
- Maintain armoring layer thicknesses to no less than 50 percent of the design specification throughout the cap. The design specifications are:
 - 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.
 - Assess performance of organophilic clay to ensure it is preventing the release of mobile NAPL to the River (potential assessment parameters include sorption capacity, measure of NAPL currently sorbed, and permeability).

The AWQCs listed above are the surface water criteria in effect at the time of the ROD (EPA, 1996) and are the current applicable AWQCs for the sediment cap; since completion of the ROD, additional recommended EPA water quality criteria were published in 2007, and more stringent AWQCs for human health were adopted by DEQ and approved by EPA in 2011. During meetings in August 2007 between stakeholders (DEQ, EPA, NOAA, Warm Springs Tribe, and Yakama Nation), it was agreed that for water sampling data comparison purposes, the five following 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)*
 - 2007 criteria for chronic effects to aquatic life
 - 2007 criteria for human health (consumption of organisms)
- Current EPA MCLs

Future comparison criteria will include the EPA approved 2011 AWQCs for human health, and other applicable AWQCs at the time of sediment cap water sampling. Attachment A of this plan provides a sampling approach to be conducted in 2015 to evaluate sediment cap protectiveness as part of the fourth Five-Year Review Report, to be completed in 2016.

8.2 O&M Manual

O&M of the sediment cap will be conducted as described in the O&M Manual. Monitoring activities for the sediment cap will include periodic visual inspections of near-shore areas to determine the extent and retention of the sediment cap sand overlay (i.e., biotic layer) and interarmoring habitat gravel, large wood debris accumulating along the shoreline, condition of boulder clusters and rock mound, and deposition of fine-grained substrate from the water column. A multibeam bathymetric survey will be conducted in 2020, and a diver inspection may be conducted if areas of concern are identified from the bathymetry survey. Periodic monitoring activities will include sampling of the water column above the sediment cap, interarmoring water, and may include porewater sampling using passive sampling technology and/or other appropriate sampling methods. Although the sediment cap is designed to be generally maintenance free, unplanned or non-routine maintenance may include: the replacement of warning buoys, placement of additional armoring due to erosion, and placement of additional Organoclay™ RCM if new releases of creosote are discovered. Monitoring and maintenance of the riparian zone is addressed as part of the soil cap. The frequency of the planned O&M activities for the sediment cap remedy through September 2021 is provided in Table 5.

8.3 Equipment and Material Requirements

Equipment requirements for visual inspections of the near-shore sediment cap include a field notebook and a digital camera. Visual inspections will be documented using photographs and field notes.

Equipment requirements for the monitoring of the sediment cap include passive samplers (e.g., solid phase micro-extraction) or other conventional sampling equipment (e.g., Henry samplers), boat services, and survey (e.g., global positioning system) equipment. Divers will be needed to assist with sampling in deep water locations.

The nature of any repairs will determine the equipment and material requirements, and will likely need to be performed by a contractor with expertise in marine construction. Any substantial repairs will be detailed in work plans prepared prior to performing these activities. The work plans will provide technical specifications and drawings sufficient to assure the work is performed appropriately and by qualified personnel.

Materials needed for potential repairs include materials used to construct the sediment cap: sand, organophilic clay, filter gravel (3-inch minus rock), geotextile, ACB, 6-inch minus rock, 10-inch minus rock, 24-inch minus rock, etc. Sand, 3-inch minus rock, 10-inch minus rock, and 24-inch minus rock have been stockpiled on site. Additional materials may be imported as needed for unforeseen repairs. A cement-bentonite grout may also be necessary to fill gaps between the ACB

mats. Substantial repairs to the sediment cap are anticipated and have been budgeted for calendar years 2020 and 2040. These major repairs may be conducted sooner, more frequently, or not conducted at all based on bathymetry and diver inspection data, and unanticipated cap disturbing events (e.g., erosion, earthquakes, etc.).

9.0 GROUNDWATER REMEDY OPERATION AND MAINTENANCE

9.1 O&M Performance Standards

The groundwater remedy consists of groundwater monitoring, NAPL recovery, a subsurface barrier wall surrounding approximately 18 acres within the upland soil cap, and ICs. Institutional controls have not been completed to restrict groundwater use beneath the Site, and NAPL recovery was terminated by EPA and DEQ in 2011.

Groundwater both within and outside of the subsurface barrier wall remain contaminated with metals, PCP, PAHs, dioxins, and NAPL. Contaminated groundwater within the barrier wall is contained and is not migrating to the river. Outside the barrier wall, residual product in soils within the FWDA results in elevated concentrations of PCP, PAHs, and 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) have indicated that the groundwater remedy is performing as designed and that contaminated groundwater is not adversely affecting the river. The performance standards for the subsurface barrier wall and NAPL recovery are:

- Continue to recover NAPL from outside the subsurface barrier wall until recovery rates become minimal, alternate 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 the ACLs set forth in the ROD (EPA, 1996):
 - Arsenic (III) – 1,000 µg/l
 - Chromium (III) – 1,000 µg/l
 - Copper – 1,000 µg/l
 - Zinc – 1,000 µg/l
 - Pentachlorophenol – 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.

As discussed in Section 6, in the *Second Five-Year Review*, EPA determined that ACLs were not valid as substitutes for EPA's MCLs in groundwater. 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 consistent with groundwater cleanup goals for the Portland Harbor Superfund Site ROD, expected in 2016. Once new groundwater cleanup goals are established in a ROD Amendment, the O&M Plan will be revised to reflect the new cleanup goals.

9.2 O&M Manual

O&M of the groundwater remedy will be conducted as described in the O&M Manual. Monitoring activities for the groundwater remedy include groundwater elevation monitoring and groundwater sampling. As described in Section 5, DEQ and EPA terminated NAPL recovery in late April 2011. NAPL gauging will be conducted in conjunction with the semi-annual Site-wide groundwater elevation monitoring events. Groundwater samples will be collected from the monitoring well downgradient of the infiltration pond (monitoring well MW-59s) every 5 years, and select Site-wide wells every ten years starting in calendar year 2020. The frequency of the planned O&M activities for the groundwater remedy through September 2021 is provided in Table 6.

9.3 Equipment and Material Requirements

Equipment requirements for NAPL gauging include an interface probe for determining the thickness of NAPL. Equipment requirements for groundwater include water level indicators, pumps, bailers, and containers. NAPL and groundwater monitoring will likely be performed by contractors under oversight of DEQ staff.

10.0 SUMMARY OF O&M STAFFING NEEDS AND ESTIMATED COSTS

Conservative estimates of staffing needs and costs to conduct specific activities described in this O&M Plan through September 2021 are presented in Table 7.

The total estimated cost (not adjusted for inflation) for implementing the O&M activities described in this O&M Plan through 2021 by DEQ and its contractor is \$1,527,500. This estimate includes \$200,000 for an anticipated repair to the sediment cap in or before 2020. DEQ staff time for project management, contract management, technical oversight and coordination with EPA is anticipated to range between approximately \$25,000 and \$90,000 per year dependant on the

contractor activity. DEQ staff will consist primarily of the project manager, contract officer, and several technical staff (e.g., hydrogeologist, engineer, and public outreach staff).

Contractor staff will consist primarily of the project manager, hydrogeologists, engineers, field staff, and administrative support.

11.0 CONDITIONS FOR O&M TERMINATION

The soil, sediment, and groundwater remedies at the Site will likely require O&M to be performed indefinitely. Some or all O&M activities may be terminated when DEQ and EPA determine they are no longer necessary to ensure that RAOs are being met.

12.0 REPORTING REQUIREMENTS

O&M reports will be prepared annually by DEQ and its contractors. Copies of the annual O&M reports will be provided to EPA and other project team members, including NOAA and Tribal governments. At least once every five years, DEQ will host a meeting with EPA and the project team to discuss O&M activities of importance conducted since the previous meeting.

The annual O&M reports will be summarized in the *Fourth Five-Year Review Report* that will be prepared by DEQ and EPA. DEQ will host a meeting with EPA, NOAA, and Tribal governments before beginning to draft the report. The *Fourth Five-Year Review Report* will be issued in September 2016. Additional Five-Year Reviews will be required as long as contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.³

A copy of the annual O&M reports will be provided to the Oregon Division of State Lands (ODSL) and other members of the project team.

13.0 CONTINGENCY PLAN FOR ABNORMAL OCCURRENCES

As acknowledged by EPA guidance, a remedy may experience problems after construction for a variety of reasons. The responsibility for addressing such problems will depend upon the cause of the problem. DEQ and EPA agree the agencies will cooperate in determining the cause of any such problems and determine the responsibility to address the problem as provided in the SSC.

NAPL recovery may be reinitiated if DEQ and EPA determine that NAPL from the Site poses a threat to the Willamette River and its sediments.

³ 40 C.F.R. § 300.430(f)(4)(ii) states: “If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.”

14.0 SAFETY REQUIREMENTS FOR O&M ACTIVITIES

DEQ will continue to require a Site-wide health and safety plan for its staff and contractors pursuant to 29 C.F.R., §1910.120. The health and safety plan will cover those activities potentially resulting in exposure to hazardous substances and other relevant health and safety concerns. Health and safety plans for unplanned maintenance work will be prepared if and when this work is needed.

15.0 SITE USE AND DISPOSITION OF FACILITIES

Currently, the McCormick & Baxter Property is vacant except for a paved parking area, small shop building, two field office trailers, numerous NAPL extraction and groundwater monitoring wells, drum storage facility, and associated utilities used to support ongoing monitoring and maintenance. The perimeter of the Property is posted with warning signs. A fence surrounds 35 acres of the McCormick & Baxter Property, and does not extend into the 6-acre riparian area.

Long term O&M of the soil, sediment, and groundwater remedies likely will be required in perpetuity. DEQ intends to maintain the shop building on-site to support these activities (trailer offices will be decommissioned). Long-term access and land use will be controlled through engineering and ICs, including environmental easements to ensure the integrity and protectiveness of the cap are maintained. Institutional and Engineering Control requirements for the Site are presented in Section 19 of this plan.

Termination of NAPL recovery and changes in the groundwater monitoring program may result in the abandonment of unneeded Site monitoring wells. Upon determination by DEQ that wells are no longer needed, they will be decommissioned in accordance with Oregon Department of Water Resources regulations. Specific plans for decommissioning wells, equipment, and office trailers will be described in the revised O&M Manual.

16.0 MODIFICATIONS TO THE O&M MANUAL

The O&M Manual is a living document which will be modified by DEQ to reflect monitoring and maintenance needs for the Site. The manual will contain up-to-date Site-wide record drawings, specify sampling and monitoring procedures, and included technical and other information necessary for implementing O&M activities. The O&M Manual will also contain a Health and Safety Plan, and the work plan for implementing repairs to the sediment and soil cap remedies.

17.0 PROPERTY OWNERSHIP CHANGE

As presented in Section 19 of this plan, DEQ obtained a permanent easement for the 23 acre sediment cap from the ODSL (Easement # 31530-EA). This easement was recorded in Multnomah County on May 12, 2004 (record # 2004-083416).

In the event of transfer of any part of the Property owned by McCormick & Baxter to a future owner, DEQ will require proprietary ICs be recorded and anticipates that any person who may acquire the Property in the future enter into a Prospective Purchaser Agreement (PPA) with DEQ. The PPA would specify responsibilities to ensure the integrity of the remedial actions and would include an EES to secure institutional controls in accordance with the ROD. Once recorded, those institutional controls run with the land and subsequent owners of the Property. The PPA also may require that the purchaser perform certain O&M activities under DEQ oversight.

18.0 PROPERTY ACCESS

DEQ controls access to the Site, and has access agreements to conduct required O&M activities on adjacent properties - the BNSF right of way, and the Willamette Cove (Metro) - under this plan. These agreements may be amended or extended to cover future maintenance or monitoring, if necessary.

Access to the sediment cap is provided through a permanent easement with DSL. DEQ will likely secure continued access to the Property through an EES with future owners of the Property.

19.0 ENGINEERING AND INSTITUTIONAL CONTROLS

The ROD specifies the following engineering and institutional controls for the soil, groundwater, and sediment remedies:

- Physical restrictions⁴ (e.g., fencing), warning signs, and safety measures until completion of the remedies;
- Prohibitions on future uses of the Property that are inconsistent 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; and
- Prohibition on the disturbance of sediments.

DEQ currently maintains a perimeter fence and warning signs around the McCormick & Baxter Property to restrict public access. Monitoring wells located outside the fence have locked, steel monuments to prohibit access. These physical Site restrictions will be maintained into the foreseeable future. Public access to the shoreline sediment cap and riparian area riverward of the Property is not restricted. DEQ has obtained a permanent easement for the sediment cap from the DSL. This easement prohibits 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. Permanent buoys were installed in August 2011 along the perimeter of the sediment cap warning boaters of

⁴ EPA has since clarified that physical restrictions are considered engineering controls.

navigational hazards. In addition, the Oregon Marine Board established regulations prohibiting anchoring within the easement boundary [Oregon Administrative Rule 250-020-0280(10) - Boat Operations in Multnomah County]:

No person shall anchor a boat at approximately River Mile 7 of the Willamette River in Multnomah County described in Dept. of State Lands Easement No. 31530-EA, Exhibit A – Legal Description – Permanent Easement

A Regulated Navigational Area (RNA) was established by the U.S. Coast Guard (USCG) in water above and adjacent to the sediment cap pursuant to 33 C.F.R. Part 165. On February 4, 2009, the USCG published the final rulemaking formally establishing the RNA (docket number USCG-2008-0121; Attachment 1 to the *Third Five-Year Review Report*). This rule became effective on March 6, 2009. The RNA prohibits anchoring, spudding, dredging, laying cable, dragging, conducting salvage operations, operating commercial vessels of any size, operating recreational vessels greater than 30 feet in length, operating other vessels in excess of “no wake” speed or the minimum speed needed to maintain steerage, or any other activity which could potentially disturb the riverbed in the designated area.

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 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 to ensure BNSF’s activities are communicated to DEQ, and serve as an institutional control for protection of the soil cap remedy in that location. The License does not contain provisions to restrict groundwater use or to protect groundwater monitoring wells installed in the BNSF right-of-way. DEQ and EPA plan to complete the required IC for groundwater beneath the BNSF property in conjunction with groundwater restrictions for the Site and other adjacent properties.

Site restrictions 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), and limit excavation of Site soils unless authorized by DEQ. Legally recorded ICs have not been implemented for the Site groundwater and soil cap remedies, as required by the ROD. DEQ and EPA plan to complete these ICs in order to achieve long-term remedy protectiveness before the completing the *Fourth Five-Year Review Report* in 2016.

20.0 EPA AND OTHER REGULATORY OVERSIGHT

DEQ will prepare an annual report of O&M activities conducted at the Site for EPA, DSL, NOAA, and Tribal governments. The report will describe Site conditions and O&M activities conducted during the prior calendar year, changed circumstances and any other conditions or O&M related events, and future planned O&M activities. EPA and DEQ will meet within sixty (60) days of receipt of the annual report to discuss findings and follow-up actions. These meetings may be held on a biennial basis as agreed to by DEQ and EPA, and will include

participation by NOAA and Tribal governments. DEQ will host a meeting with EPA, NOAA and Tribal governments before beginning to draft the *Fourth Five-Year Review Report*.

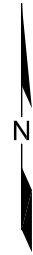
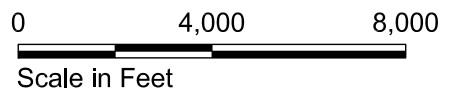
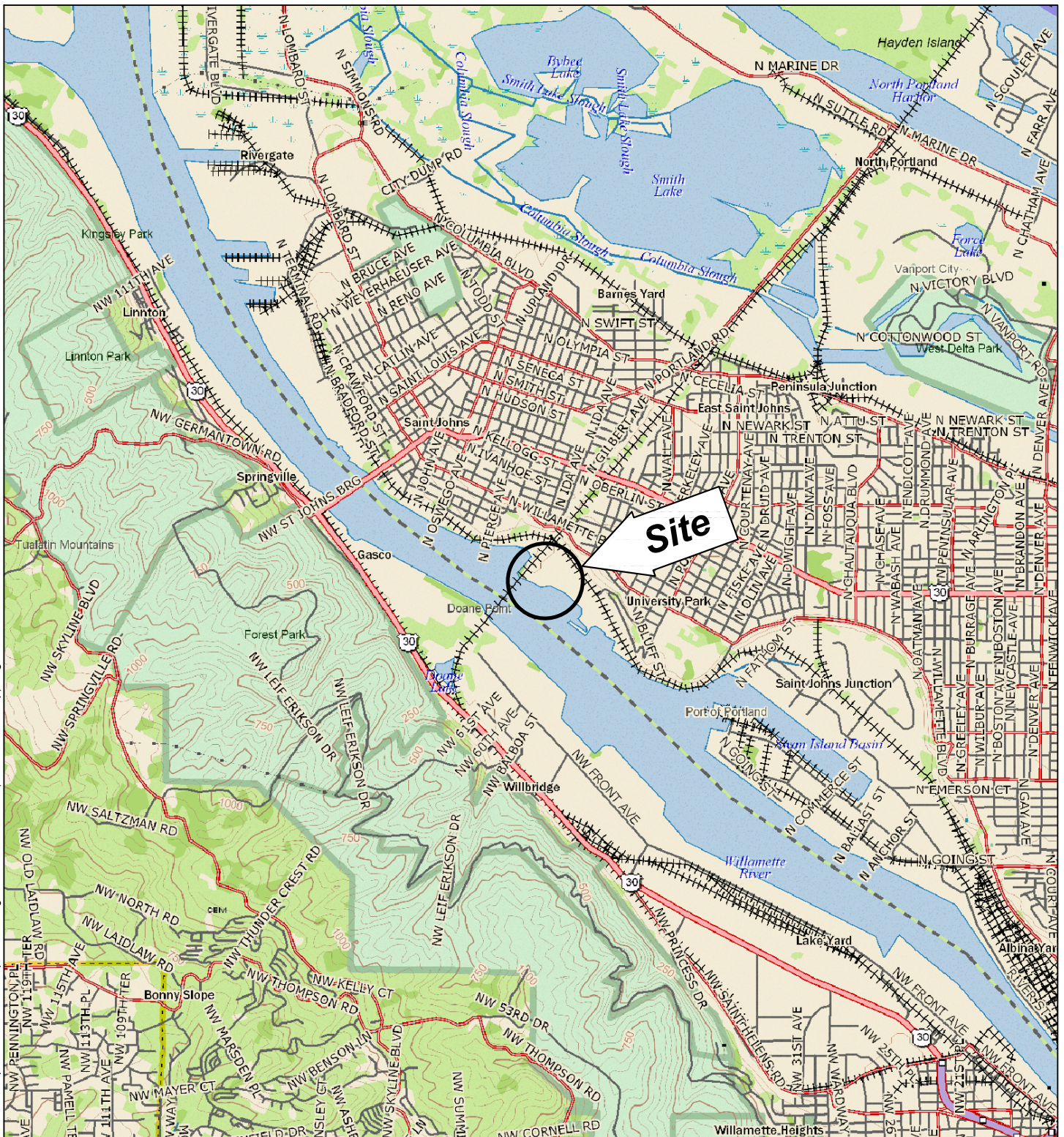
21.0 PERMITS AND OTHER ADMINISTRATIVE REQUIREMENTS

DEQ will be responsible for compliance with all federal, state, and local applicable or relevant and appropriate regulations (ARARs) while conducting O&M activities at the Site. Except for the off-site disposal of hazardous waste, the planned activities presented in the O&M Plan do not require permits or have administrative requirements. However, if repairs to the sediment cap become necessary, a variety of regulations may be ARARs. Several of these potential ARARs are discussed in the *Sediment Cap Basis of Design* report, dated May 2002. Significant ARARs are the Clean Water Act, Sections 401 and 404, and the Endangered Species Act, Section 7.

EPA determined the substantive requirements of the Clean Water Act, Sections 401 and 404, would be met during constructing the sediment cap. Additionally, EPA complied with the Endangered Species Act Section 7 through formal and informal consultation with the U.S. Fish and Wildlife Service (USFWS) and NMFS. As a result of this consultation the NMFS issued a Biological Opinions for construction of the barrier wall and sediment cap.

EPA's substantive requirement determination of the Clean Water Act, Sections 401 and 404, issued in May 2003, will be applied to potential repairs of the sediment cap as long as the scope of these repairs is consistent with the original construction activities.

Compliance with the Endangered Species Act Section 7 will be assured through additional EPA consultations with the FWS and NMFS, which DEQ anticipates will be needed every five years. The Biological Assessment for the first five years of O&M was submitted to the Services in early May 2006, and the NMFS issued its Biological Opinion on October 6, 2006. This consultation addressed planned O&M activities and the most likely potential repair needs of the sediment cap: placement of additional armoring and organophilic clay. If the scope of needed repairs significantly differs from the hypothetical scenarios, additional consultation between the EPA and the Services may be necessary.

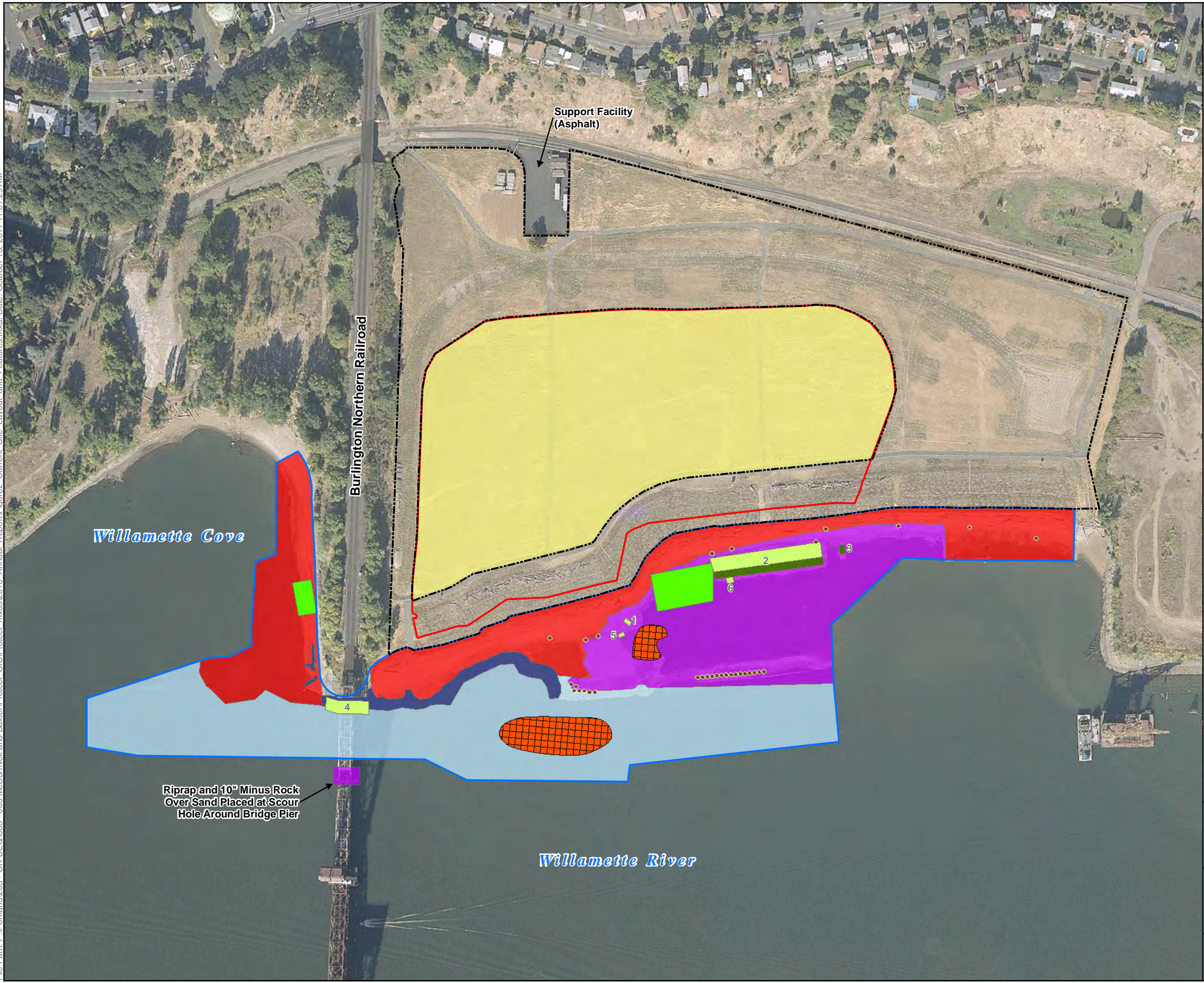


McCormick and Baxter Superfund Site
6900 N Edgewater Street, Portland, Oregon

Site Location Map

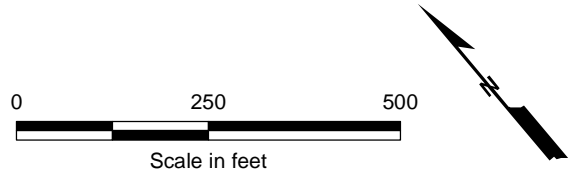


File Path: P:\Portland\205 - OR DEQ\003 - 003 McCormick and Baxter\Project GIS\Project mxd\2010 Annual Report\Figure2 Current Site Layout and Features.mxd Date: October 13, 2011 11:01:29 AM



- LEGEND**
- Subsurface Barrier Wall
 - Sediment Cap Boundary
 - Granular Organophilic Clay
 - Organoclay™ Reactive Core Mats (Double)
 - Organoclay™ Reactive Core Mats (Single)
 - Thickened Sand Layer
 - Boulder Clusters
 - Riprap Armor
 - Articulated Concrete Block
 - 6-inch Minus Rock Armor
 - 10-inch Minus Rock Armor
 - Impermeable Cap
 - Earthen Soil Cap Boundary

NOTE: Aerial photo taken on September 22, 2006



Riprap and 10" Minus Rock Over Sand Placed at Scour Hole Around Bridge Pier

McCormick & Baxter Superfund Site
Portland, Oregon

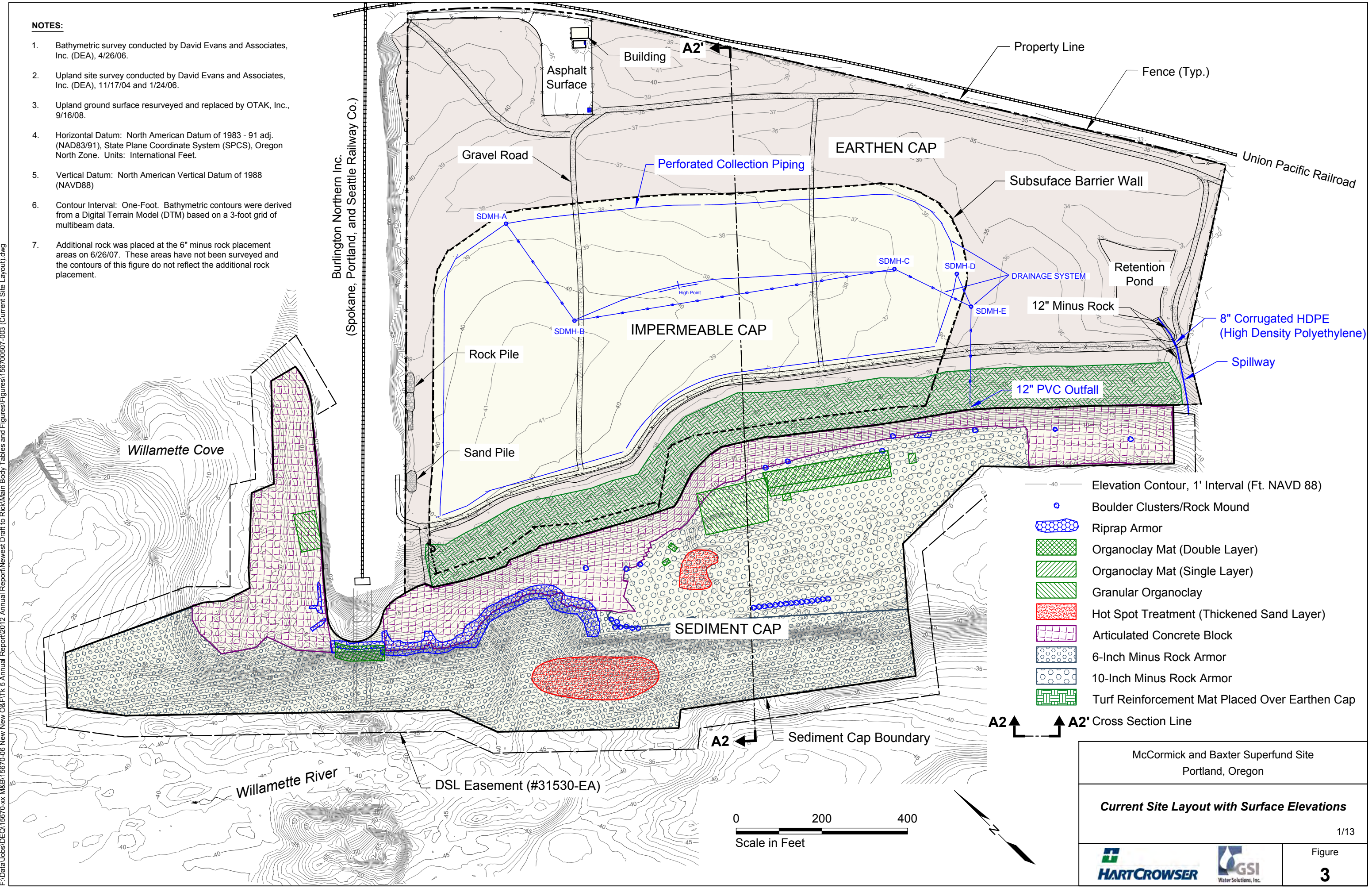
Current Site Layout and Features



NOTES:

1. Bathymetric survey conducted by David Evans and Associates, Inc. (DEA), 4/26/06.
2. Upland site survey conducted by David Evans and Associates, Inc. (DEA), 11/17/04 and 1/24/06.
3. Upland ground surface resurveyed and replaced by OTAK, Inc., 9/16/08.
4. Horizontal Datum: North American Datum of 1983 - 91 adj. (NAD83/91), State Plane Coordinate System (SPCS), Oregon North Zone. Units: International Feet.
5. Vertical Datum: North American Vertical Datum of 1988 (NAVD88)
6. Contour Interval: One-Foot. Bathymetric contours were derived from a Digital Terrain Model (DTM) based on a 3-foot grid of multibeam data.
7. Additional rock was placed at the 6" minus rock placement areas on 6/26/07. These areas have not been surveyed and the contours of this figure do not reflect the additional rock placement.

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McCormick and Baxter Superfund Site
Portland, Oregon

Current Site Layout with Surface Elevations

1/13

Figure
3

File Path: P:\Portland\205 - OR DEQ\003 - 003 McCormick and Baxter\Project GIS\Project mxds\2012 Annual Report\FigureA-1 Monitoring Well Location Map.mxd

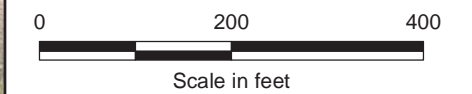


LEGEND

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

NOTES:

- 1) Aerial photo taken on September 22, 2006
- 2) Wells EW-9s, MW-2s, MW-3s, MW-18s, and MW-Ks were decommissioned between June 30 and August 2, 2012



McCormick and Baxter Superfund Site
Portland, Oregon

Groundwater Monitoring Well Location Map

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Figure
4

Table 1 - Summary of O&M Activities Between Second and Third Five-Year Reviews (October 2006-September 2011)

O&M Plan

McCormick and Baxter Superfund Site

Activities and Investigations	Dates and Descriptions
October through December 2006	
Soil and sediment cap inspections	Weekly in October; monthly November and December 2006
Sediment cap multibeam bathymetric and side-scan sonar surveys; diver inspections of deep water	October 2006 diver inspection; December 2006 embayment armor probing
Routine and non-routine maintenance and vegetation management	As needed
Surface water/ inter-armoring/ sub-armoring sampling	October 2006
MW-59s sampling	November 2006
NAPL recovery exterior wells	EW-2s, EW-9s, EW-10s, EW-19s, MW-20i, MW-34i, MW-Ds, MW-Gs gauged weekly, recovery as criterion was met.
NAPL recovery interior wells	Site-wide wells gauged November 2006
Groundwater elevation monitoring	Site-wide wells gauged November 2006; select wells gauged continuously
Crayfish sampling	October 2006
Organoclay cap performance assessment	October 2006 organoclay core sampling
2007	
Soil and sediment cap inspections	Monthly; additional weekly sediment cap inspections July through October 2007.
Sediment cap multibeam bathymetric and side-scan sonar surveys; diver inspections of deep water	Armoring assessment and repair: Differencing images, June and July 2007 diver inspections, additional rock armor placement, additional organoclay mat placement
Routine and non-routine maintenance and vegetation management	As needed
Surface water/ inter-armoring/ sub-armoring sampling	March and September/October 2007
MW-59s sampling	February and October 2007
NAPL recovery exterior wells	EW-2s, EW-9s, EW-10s, EW-19s, MW-20i, MW-34i, MW-Ds, MW-Gs gauged weekly, recovery as criterion was met.
NAPL recovery interior wells	Site-wide wells gauged February, June, September, and December 2007.
Groundwater elevation monitoring	Site-wide wells gauged February, June, September, and December 2007; select wells gauged continuously
Sheen investigation	June 2007 surface water samples; September 2007 surface water and sub-armoring water samples
Organoclay cap performance assessment	Laboratory analysis of organoclay cores collected in 2006
2008	
Soil and sediment cap inspections	Monthly; additional weekly sediment cap inspections July through October 2008.
Habitat enhancement features inspection	October 2008
Routine and non-routine maintenance and vegetation management	As needed
Surface water/ inter-armoring/ sub-armoring sampling	March/April and September 2008
MW-59s sampling	August 2008
NAPL recovery exterior wells	EW-2s, EW-9s, EW-10s, EW-19s, MW-20i, MW-34i, MW-Ds, MW-Gs gauged weekly, recovery as criterion was met.
NAPL recovery interior wells	Site-wide wells gauged March, June, September, and December 2008.
Groundwater elevation monitoring	Site-wide wells gauged March, June, September, and December 2008; select wells gauged continuously
Soil cap subsidence monitoring	June and August 2008 monitoring well surveys and comparison to 2005 survey; storm drain inspections, October 2008 install transducers at two shallow wells
Crayfish sampling	September 2008
Ebullition and sheen investigation	July through October 2008 - sheen surveys, sediment cores, sediment sampling, porewater sampling, ebullition monitoring and mapping, flux chamber gas and water sampling

**Table 1 - Summary of O&M Activities Since Last 5-Year Review
O&M Plan
McCormick and Baxter Superfund Site**

2009	
Soil and sediment cap inspections	Monthly; additional weekly sediment cap inspections July through October 2009.
Habitat enhancement inspection	November 2009
Routine and non-routine maintenance and vegetation management	As needed
Surface/inter-armoring/sub-armoring water sampling	March 2009 by conventional method; October 2009 by conventional method plus colocated SPME sampling at 13 locations
MW-59s sampling	August 2009
NAPL recovery exterior wells	EW-2s, EW-9s, EW-10s, EW-19s, MW-20i, MW-34i, MW-Ds, MW-Gs gauged weekly, recovery as criterion was met.
NAPL recovery interior wells	EW-1s gauged weekly starting July 6, 2009, recovery as criterion was met; site-wide wells gauged March, June, September, and December 2009.
Groundwater elevation monitoring	Site-wide wells gauged March, June, September, and December 2009 (December event included 10 additional wells on Triangle Park property); select wells gauged continuously.
Sheen characterization activities	July and August 2009 sheen surveys, August 2009 sheen sampling, laboratory chemical analysis, biological assessment, and sheen simulation
Soil cap subsidence monitoring	March 2009 storm drain inspection, July 2009 vapor and groundwater sampling at EW-1s, April through September 2009 monthly hub surveys Photos of subsidence?
2010	
Soil and sediment cap inspections	January, February, March, June, August, and December 2010; additional sediment cap inspections July through October 2010.
Sediment cap multi-beam bathymetric and side-scan sonar surveys; diver inspections of deep water	June 2010 sediment cap differencing images; October 2010 diver inspection
Routine and non-routine maintenance and vegetation management	As needed
Surface/inter-armoring/sub-armoring water sampling	April 2010 by conventional method; October 2010 by SPME.
MW-59s sampling	October 2010
NAPL recovery exterior wells	EW-2s, EW-9s, EW-10s, EW-19s, MW-20i, MW-34i, MW-Ds, MW-Gs gauged weekly, recovery as criterion was met.
NAPL recovery interior wells	EW-1s gauged weekly, recovery as criterion was met; site-wide wells gauged June and October 2010.
Groundwater elevation monitoring	Site-wide wells gauged June and October 2010; select wells gauged continuously.
Groundwater quality assessment	11 wells, Spring 2010.
Willamette Cove ACB inspection	Historical data review, April 2010 porewater sampling, and Fall 2010 sediment coring
January through September 2011	
Soil and sediment cap inspections	Monthly
Routine and non-routine maintenance and vegetation management	As needed
NAPL recovery exterior wells	EW-2s, EW-9s, EW-10s, EW-19s, MW-20i, MW-34i, MW-Ds, MW-Gs gauged weekly, recovery as criterion was met; stopped recovery on April 20, 2011; gauged twice in May and monthly thereafter.
NAPL recovery interior wells	EW-1s gauged weekly starting July 6, 2009, recovery as criterion was met; stopped recovery on April 20, 2011; gauged twice in May and monthly thereafter; site-wide wells gauged June 2011.
Groundwater elevation monitoring	Site-wide wells gauged June 2011; select wells gauged continuously.
DNAPL investigation	March 2011 four investigative borings near MW-20i; excavation around high-pressure sewer lines.

**Table 2 - Operational and Functional Performance Measures and Status
O&M Plan
McCormick and Baxter Superfund Site**

Remedy	Operational and Functional Performance Measures	Status
Soil Cap	The support facility and soil cap were constructed in accordance with the design.	Achieved
	The paved entrance road and parking area, the shop building, the electrical, telephone and water services, and the security fencing are functioning properly.	Achieved
	A vegetative cover has been established on all parts of the soil cap, including the riparian area.	Achieved
	The temporary irrigation system functioned as intended and native vegetation is adequately established.	Achieved
	Stormwater is properly collected in the geocomposite fabric and perforated piping, and is being conveyed through conveyance piping to an outfall structure.	Achieved
Soil Removal	Highly contaminated soils were excavated and disposed of off-site.	Achieved
Sediment Cap	The sediment cap was constructed in accordance with the design.	Achieved
	The armoring layer is withstanding erosional forces from the river.	Achieved
	All known creosote seeps have been capped with organoclay.	Achieved
	The organoclay caps are effectively preventing creosote migration to the river.	Achieved
Subsurface Barrier Wall	Groundwater flow is substantially retarded across the barrier wall boundary.	Achieved
	Groundwater elevations of the shallow aquifer within the barrier wall have reached a steady-state elevation (following construction of the impermeable soil cap), so to as not threaten to overtop the riverfront segment of the subsurface barrier wall.	Achieved
NAPL Extraction	NAPL extraction is no longer deemed necessary due to minimal recovery rates and mobility that do not pose a threat to the Willamette River and its sediments.	Achieved

**Table 4 - Comparison of Water Quality Criteria
O&M Plan
McCormick and Baxter Superfund Site**

Chemical	Units	1996 AWQCs ¹		2007 NRWQCs ²		2011 AWQCs ³		1996 ROD ACLs	2011 MCLs ⁴
		Aquatic Life (chronic)	Human Health (fish consumption only)	Aquatic Life (chronic)	Human Health (consumption of organism only)	Aquatic Life (chronic)	Human Health (consumption of organism only)		
Total Arsenic	µg/L	0.19		0.15	0.00014	0.15	2.1	1	0.01
Total Chromium	mg/L	0.21		0.074		0.074		1	0.1
Total Copper	mg/L	0.012		0.009		BLM		1	
Total Zinc	µg/L	0.11		0.12	26	0.12	2600	1	
Pentachlorophenol	µg/L	13		15	3	15	0.3	5	0.001
Acenaphthene	L µg/L	520			990		99		
Acenaphthylene	L µg/L								
Anthracene	L µg/L				40000		4000		
Benz[a]anthracene	H, C µg/L				0.018		0.0018		
Benzo[a]pyrene	H, C µg/L						0.0018		0.0002
Benzo[b]fluoranthene	H, C µg/L				0.018		0.0018		
Benzo[g,h,i]perylene	H, C µg/L				0.018				
Benzo[k]fluoranthene	H µg/L				0.018		0.0018		
Chrysene	H, C µg/L				0.018		0.0018		
Dibenzo[a,h]anthracene	H, C µg/L				0.018		0.0018		
Fluoranthene	H µg/L		54		140		14		
Fluorene	L µg/L				5300		530		
Ideno[1,2,3-cd]pyrene	H, C µg/L				0.018		0.0018		
Naphthalene	L µg/L	620							
Phenanthrene	L µg/L								
Pyrene	H µg/L				4000		400		
Total LPAHs	µg/L								
Total HPAHs	µg/L								
Total cPAHs	µg/L		0.031						
Total PAHs	µg/L							43	

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 federal and state Ambient Water Quality Criteria (AWQCs).

² 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>).

³ Oregon's revised AWQCs for human health approved by EPA on October 17, 2011

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>).

Key:

ACLs = Alternate Concentration Limits
AWQCs = Aquatic Water Quality Criteria
C = Carcinogenic PAH (cPAH)

L = Low Molecular Weight PAH (LPAH)
MCLs = Maximum Contaminant Levels
mg/L = milligrams per liter

NRWQCs = National Recommended Water Quality Criteria
H = High Molecular Weight PAH (HPAH)
µg/L = micrograms per liter

Table 5: Sediment Cap O&M Activities through September 30, 2016

O&M Plan

McCormick and Baxter Superfund Site

O&M Activity	Frequency
Visual Inspections (from shore) Warning buoys Cap surface Habitat quality	Quarterly Quarterly Annually
Routine Monitoring: Water Column and Interarmoring Water Sampling Organoclay Cores (<i>Need to confirm with Heidi</i>)	Every 5 years (starting in 2015) In 2015, then determine frequency
Non-Routine Monitoring – such as: Multibeam bathymetric surveys, side-scan sonar survey Diver Inspection	Every 10 years, starting in 2020; perform as needed (unforeseen natural event) If necessary, will be conducted every 10 years starting in 2020, after bathymetry
Non-Routine Maintenance – such as: Replacement of buoys Additional armoring placement Additional organoclay capping ACB grouting or armoring void space maintenance (habitat gravel)	As needed Schedule for 2020, and 2040, if needed. After unforeseen even, if needed As needed Every 5 years , or as needed based on site inspections

Table 6: Groundwater O&M Activities through 2021
O&M Plan
McCormick and Baxter Superfund Site

O&M Activity	Frequency
NAPL Monitoring Manual gauging of Site wells Manual extraction from exterior wells	Semiannually Not recommended
Groundwater Monitoring Downloading continuous water level data from transducers Manual water level measurements from Site wells	Semiannually Semiannually
Groundwater Sampling Site-wide Infiltration pond (MW-59s)	Every 5 years Every 5 years
Routine Maintenance of Equipment Interface probes, pumps, vehicle, data loggers/transducers, etc.	As needed
Utilities Service Water, electric, phone, alarm, solid waste, toilet	Continuous

