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Biological Assessment Addendum

OPERATION & MAINTENANCE OF SOIL CAP, SEDIMENT CAP AND GROUNDWATER REMEDY

MCCORMICK AND BAXTER CREOSOTING COMPANY PORTLAND, OREGON

State of Oregon
Department of Environmental Quality

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U.S. ENVIRONMENTAL PROTECTION AGENCY
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DOCUMENT PURPOSE

This document is the Environmental Protection Agency's (EPA) evaluation of potential effects from a planned Federal action on plant and animal species covered under the Endangered Species Act (ESA). EPA intends this document to demonstrate substantive compliance with ESA pursuant to the requirements of the National Contingency Plan (NCP) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The Federal action addressed in this document is the Operation and Maintenance (O&M) of the soil cap, sediment cap and groundwater remedy at the Federal Superfund site known as the McCormick and Baxter Creosoting Company, Portland, Oregon. This action follows several remedial actions being taken under CERCLA to significantly reduce the potential risk to human health and/or ecological receptors resulting from potential exposure to contaminants present in soils, sediment and groundwater at the project area.

EPA has designated the Oregon Department of Environmental Quality (DEQ) as the lead in implementing the actions contained within the CERCLA Record of Decision (ROD) for the site, although these remain Federal actions.

EPA previously submitted biological assessments for the construction of a subsurface barrier wall, construction of a sediment cap, importing and stockpiling topsoil and construction of an upland soil cap (EPA 2002, 2003, 2004 and 2005).

This evaluation is a continuation of the ongoing consultation between EPA, the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) for remediation of the McCormick & Baxter Creosoting Company site.

EPA considers this a living document in that technical studies are on-going and additional studies will be conducted as part of O&M. Furthermore, this document evaluates several hypothetical scenarios for making repairs to the remedy, in particular the sediment cap. Whether these repairs are actually needed and the exact nature of the potential repairs is unknown at this time. If the nature of the repairs substantially deviates from the hypothetical scenarios presented in this report, EPA will perform additional consultation.

1. SUMMARY OF FINDINGS

Remedial actions described in the Environmental Protection Agency's 1996 ROD, issued in conjunction with the Oregon State Department of Environmental Quality, for the McCormick and Baxter Creosoting Company are being taken pursuant to CERCLA. These actions also are considered agency actions under the ESA and are therefore required to substantively comply with the ESA. The EPA determined that this biological assessment is necessary to evaluate potential effects of the proposed remedial activities on federally listed threatened and endangered species.

This biological assessment (BA) addendum is the fifth BA addendum, which evaluates the potential effects on threatened and endangered species from the following activities that comprise the action:

- Soil Cap Monitoring (i.e., inspection of cap surface, inspection of stormwater conveyance system, inspection of security fencing and inspection of warning signs)
- Soil Cap Vegetation Maintenance (i.e., irrigation, mowing open grass areas, manual removal of invasive plants and targeted application of herbicides)[1]
- Soil Cap Unplanned Maintenance (e.g., repairs of fence, replacement of warning signs, repairs of gravel roads, filling of animal burrows and removal of sediments from manholes)
- Sediment Cap Monitoring (i.e., warning buoys, near shore areas, multibeam bathymetric surveys, side-scan sonar surveys and diver inspections of deep water)
- Sediment Cap Sampling (i.e., surface water, pore water, flux chamber, organoclay cores, crayfish, sculpin/clams and possibly lamprey)
- Sediment Cap Unplanned Maintenance (e.g., replacement of buoys, additional armoring placement and additional organoclay capping)
- Groundwater Remedy - NAPL Recovery

[1] Vegetation maintenance, including the targeted application of herbicides, was addressed in EPA's BA for construction of the sediment cap and in the subsequent Biological Opinion issued by the NMFS (2004). The conclusions of this earlier consultation are carried into the O&M BA in order to provide context and consistency with the other O&M activities.

- Groundwater Monitoring (i.e., downloading continuous water level data loggers, manual water level measurements, NAPL gauging (site-wide), groundwater sampling)

The Federal listed species are:

- Lower Columbia River Chinook Salmon (*Oncorhynchus tshawytscha*)
- Upper Willamette River Chinook Salmon (*Oncorhynchus tshawytscha)*
- Lower Columbia River Steelhead *(Oncorhynchus mykiss)*
- Upper Willamette River Steelhead (*Oncorhynchus mykiss)*
- Columbia River Chum Salmon (*Oncorhynchus keta*)
- Lower Columbia River Coho Salmon (*Oncorhynchus kisutch*)
- Bald Eagle (*Haliaeetus leucocephalus*)
- Golden Paintbrush (*Castilleja levisecta*)
- Water Howellia (*Howellia aquatilis*)
- Bradshaw's Lomatium (*Lomatium bradshawii*)
- Nelson's Checker-Mallow (*Sidalcea nelsoniana*)
- Willamette Daisy (*Erigeron decumbens var. decumbens*)
- Kincaid's Lupine (*Lupinus sulphureus var. kincaidii*)

The Federal proposed species are:

- Oregon Spotted Frog (*Rana pretiosa*).

EPA determined the following effects for each species because of this action.

Listed Species

- Lower Columbia River Chinook Salmon – May affect, likely to adversely affect
- Upper Willamette River Chinook Salmon – May affect, likely to adversely affect
- Lower Columbia River Steelhead – May affect, likely to adversely affect
- Upper Willamette River Steelhead – May affect, likely to adversely affect

- Columbia River Chum Salmon – May affect, likely to adversely affect
- Lower Columbia River Coho Salmon – May affect, likely to adversely affect
- Bald Eagle – No effect
- Golden Paintbrush – No effect
- Water Howellia – No effect
- Bradshaw's Lomatium – No effect
- Nelson's Checker-Mallow – No effect
- Willamette Daisy – No effect
- Kincaid's Lupine – No effect

Federal Proposed Species

- Oregon Spotted Frog – Will not result in jeopardy

2. BACKGROUND INFORMATION ON PROJECT SITE

Site Description

The McCormick & Baxter Creosoting Company site is a former wood treating facility located on the east bank of the Willamette River in Portland, Oregon. The site encompasses approximately 41 acres of land and an additional 23 acres of contaminated river sediments. Figure 1 is a site location map. Figure 2 depicts the current site layout and features on an aerial photograph. Figure 3 depicts the current site layout and features on a topographic map of the sediment and terrestrial surface elevations.

The upland portion is on a terrace of imported sand fill (dredged material placed in the early 1900s) within the historic flood plain of the Willamette River. The upland area is generally flat and lies between a 120 foot high bluff along the northeast border and a 20 foot high bank along the Willamette River to the southwest. Currently the site is vacant except for a paved parking area, small shop building, two field office trailers and associated utilities which are used to support ongoing creosote extraction.

Inactive industrial properties border the site to the south and a residential area is located on the adjacent bluff. A Burlington Northern Santa Fe Railroad track crosses the west portion of the property, and Union Pacific Railroad tracks border the site to the east below the bluff. Beyond the Burlington Northern Santa Fe Railroad tracks, toward the west, is a former industrial property that likely will be developed as a public green space. Additionally, the 92-acre University of Portland college campus is located approximately one half mile east of the McCormick & Baxter Creosoting Company site. The perimeter of the property is fenced and posted with warning signs.

Three hydrostratigraphic units are present at the site: the shallow, intermediate, and deep aquifer zones, which are interconnected to varying degrees depending upon the location within the site. The shallow zone consists of poorly-graded dredge fill sand and wood debris and ranges in thickness from five to greater than 30 feet. In parts of the site, the shallow zone consists mostly of sawdust and wood chips up to 20 to 25 feet thick. The shallow zone acts as an unconfined aquifer that, except within the barrier wall area and close to the bluff away from the river, is in hydraulic connection with the river. Depth to groundwater ranges from approximately 20 to 25 feet below ground surface (bgs). The shallow zone is underlain by a silt aquitard ranging in thickness from zero near the river to greater than 100 feet closer to the bluff.

The intermediate aquifer zone is composed of fine to medium grained alluvial sand and is present below the silt aquitard over most portions of the site. This zone varies in thickness from zero to greater than 50 feet. In the north-central portion of the site, the intermediate zone is approximately 12 feet thick and hydraulically separated from the shallow aquifer. In the south-central portion of the site, the silt aquitard is greater than

100 feet thick and no intermediate aquifer zone is present. Along the beach adjacent to the river, the intermediate zone is up to 50 feet or more thick and is separated from the shallow zone by a discontinuous, thin silt layer.

The deep aquifer zone is present in all portions of the site. The deep zone consists of alluvial sands and is directly connected with the intermediate and shallow zones along the river margin. Near the center of the site, the deep zone is separated from the shallow zone by more than 100 feet of low-permeability silt. Near the bluff, the deep zone is composed of gravel and sands of the Troutdale Formation and Catastrophic Flood Deposits.

Shallow groundwater gradients generally exist from the bluff toward the river. Intermediate and deep zone groundwater surface elevations and gradients have been inferred to flow toward the river in these zones.

The Willamette River is the only surface water body at the site. Near the site, the river is approximately 1,550 feet wide with a typical maximum depth of about 40 to 50 feet below the Columbia River datum. Average flow rates in the river near the site range from 8,300 cubic feet per second (cfs) in summer to 73,000 cfs in winter.

Site History

Much of the McCormick & Baxter Creosoting Company 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 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 used for various pressure treating processes which included the use of creosote, pentachlorophenol (PCP), chromium, ammoniacal copper arsenate, ammoniacal copper zinc arsenate 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 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 were reportedly discharged to a low area near the tank farm prior to 1971.

The site included a wastewater discharge outfall that was used to discharge cooling water to the river when the plant was operating. Contact wastewater also was discharged from this outfall in the early years of operation. Three stormwater outfalls were also present along the river. Two of the outfalls were permitted under the National Pollutant Discharge Elimination System (NPDES). 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 in 1999.

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

Sludge from site processes was disposed at an unknown off-site location until 1968. From 1968 to at least 1973 residues from the retorts, oil/water separator, and evaporators were disposed 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 (ammoniacal copper zinc arsenate) 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 tank farm to the retort building. In 1985 two feet of soil and sludge were excavated from the tank farm and shipped to a hazardous waste landfill. Visibly contaminated soil remained at the tank farm.

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 (comprising 85% of the creosote), PCP, arsenic, chromium, copper, zinc and dioxins/furans. Three main contaminant sources existed at the site: the FWDA which is 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 over a period of several years; the CPA which is located in the center portion of the cite and is where retorts, PCP mixing shed and ACZA storage areas were formerly located; and the TFA which is located in the south-central portion of the site and is 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, in particular 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 that were migrating to the river and impacting surface water and sediments.

Regulatory History

The McCormick & Baxter Creosoting Company began environmental investigations of their property in 1983. Based on those investigations, DEQ entered into a Stipulated

Order with McCormick & Baxter Creosoting Company 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 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 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 EPA in June 1993. The McCormick & Baxter Creosoting Company 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. The SSC was most recently amended in February 2005.

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

- *Record of Decision*, McCormick and Baxter Creosoting Company Portland Plant, Portland, Oregon, EPA and DEQ, March 1996.
- *First Five-Year Review Report,* McCormick and Baxter Creosoting Company Superfund Site, Portland, Multnomah County, Oregon, EPA and DEQ, September 2001.
- *Explanation of Significant Difference* (OU3 – Final Groundwater), McCormick and Baxter Creosoting Company Superfund Site, Portland, Multnomah County, Oregon, EPA and DEQ, August 2002.
- *Preliminary Construction Summary Report*, McCormick and Baxter Creosoting Company Superfund Site, Portland, Multnomah County, Oregon, EPA, September 2005.

Removal Actions

Removal Actions were completed by DEQ under State cleanup rules prior to site listing on the National Priority List (NPL) and under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authority between site listing and issuance of the Record of Decision (ROD). These actions included:

- Installation of a fence around the McCormick & Baxter Creosoting Company site to control access.
- Placement of warning buoys along the river and posting of 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.
- Storm water containment through diversion and collection of storm water 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 storm water 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 tank farm area to recover light nonaqueous-phase liquid (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 5 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.

Remedy Selection

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 principal threats at the site:

1. Excavation and biological land treatment of the most highly contaminated PAH and PCP contaminated soil, stabilization of the most highly contaminated arsenic-contaminated soil and consolidation and capping of treated soil.
2. Enhancement of the existing groundwater and NAPL extraction and treatment system to remove NAPL and hydraulically control contaminated groundwater in a limited area in the immediate vicinity of the extraction wells.
3. As a contingency remedy, installation of a vertical subsurface barrier wall in the event that mobile NAPL cannot be reliably controlled using hydraulic methods.
4. Sediment capping.
5. Monitoring.
6. Institutional controls.

In March 1998 an amended ROD was issued by EPA and DEQ to change a component of the selected remedial action for contaminated soil. The soil remedy in the original 1996 ROD called for excavation and on-site biological treatment. After the ROD was signed, DEQ initiated additional soil sampling for remedial design. This sampling found that dioxin contamination was more widespread than the previous analyses indicated. Accordingly, DEQ and EPA reevaluated the remedy and subsequently selected an alternative, which called for removal and off-site disposal of shallow soil with concentrations above designated action levels and capping the remaining contaminated soil.

In August 2002 EPA and DEQ issued an "Explanation of Significant Differences" (ESD) explaining the decision to implement the contingency remedy for groundwater as specified in the 1996 ROD. The groundwater remedy selected in the ROD included a contingency for installing an impermeable subsurface barrier wall 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 that NAPL had not been contained using groundwater/NAPL extraction and recovery measures, and concluded that hydraulic control of NAPL or groundwater had not been established in either the TFA or the FWDA. To implement the contingency plan, DEQ and EPA selected a fully encompassing, impermeable subsurface barrier wall alignment surrounding the TFA and the FWDA, and a riverfront alignment located along the ordinary high-water mark of the Willamette River.

Remedial Actions

Following is a summary of Remedial Actions implemented by DEQ under CERCLA authority following issuance of the ROD, ROD Amendment, and ESD.

Soil Removal

The purpose of the soil remedy selected in the amended ROD 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 (*i.e.*, "principal threat" or "hot spot soil"). Action levels for contaminated soils were defined for excavation and off-site disposal for

arsenic, pentachlorophenol and total carcinogenic polynuclear aromatic hydrocarbons (cPAHs). These action levels indirectly addressed the removal of dioxins/furans by assuming their presence predominantly in the same areas where elevated concentrations of PCP and PAHs are 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 several major source areas excavation proceeded to depths of 8 to 10 feet. Approximately 32,604 tons of contaminated soil and debris were excavated and disposed offsite at permitted landfills. A total of 33,128 tons of clean sand was imported from an off-site quarry to back fill the excavation pits.

Documentation, record drawings, and a detailed summary of the soil removal construction activities are provided in *Phase 1 Soil Remedial Action Summary Report* (E & E, 1999).

Upland Soil Cap

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 *Upland Soil 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 an impermeable cap within a 14.7-acre portion of the subsurface barrier wall (the barrier wall is described under Remedial Actions for the Groundwater Operable Unit); 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. Fire hydrants were removed and any associated piping was grouted to prevent preferential flow paths, and water lines were capped. Demolition items were salvaged, scrapped, or disposed of as non-hazardous waste or hazardous waste. Concrete, creosote-contaminated steel and asbestos-containing water pipe was also 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 0.8-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 Resource Conservation and Recovery Act (RCRA) type impermeable cap was constructed over the entire 14.7-acre area inside of the barrier wall, excluding the riparian zone bordering the river. Capping of the riparian zone had been 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 from bottom to top):

- 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;
- 72,000 square yards of a geocomposite plastic 'fabric' that allows water to flow laterally;
- 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; and
- 20 species of native grasses to provide a diverse and sustainable herbaceous cover in order to minimize surface erosion.

The impermeable cap has a minimum thickness of 29 inches; however, 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 sand leveling layer, a 62-inch sand drainage layer, a 6-inch rock biotic barrier, and 12 inches of topsoil.

The impermeable cap also consists of a subsurface drainage system above the HDPE liner to collect storm water percolating through the upper soil, rock, and sand layers of the cap. Storm water is collected in the geocomposite fabric and perforated piping and conveyed by gravity flow through conveyance piping to an outfall structure which daylights at the Ordinary High Water (OHW) level of the Willamette River (*i.e.*, 19 feet above the National American Vertical Datum [NAVD]).

An earthen soil cap, consisting of a 2-foot layer of imported top soil, was installed over 18.9 acres of the site outside of the barrier wall area excluding the gravel entrance road and parking area. The purpose of this 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 storm water management system was also constructed to minimize storm water runoff from the site to neighboring properties and the Willamette River. This system consists of a swale that conveys storm water directly to an on-site retention/infiltration pond. The surface of the soil cap is constructed with sloped surfaces (approximately 1% slope) to direct surface water runoff towards the drainage swale.

A 6-foot high chain-link fence was also reinstalled along the site perimeter. Along the riverfront the fence is located at the top of the bank, inland of the riparian zone. Gravel access roads were constructed around the perimeter of the site (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.

Creosote Recovery

Creosote (i.e., 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.

NAPL recovery continued following issuance of the ROD in March 1996. Through March 2004 monthly extraction volumes of NAPL from extraction wells in the TFA and FWDA ranged from 0.4 to 73 gallons, with some periods of no extraction. As of February 2006 slightly more than 6,000 gallons of NAPL have been removed from groundwater.

Since the McCormick & Baxter Creosoting Company facility was shut down in 1991, various extraction methods have been attempted to optimize NAPL recovery. The goal of the extraction was to remove and deplete NAPL pools to residual levels to minimize or prevent migration into the Willamette River. Key NAPL extraction activities are summarized below.

- 1998: The treatment system in the TFA was again modified. Previously, total fluids extracted from three wells were conveyed to the former pilot treatment system and treated by a DAF 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 consisting of an oil/water separator, an in-line anthracite/clay filter, two granulated activated carbon units and a metals treatment unit.

- 1999 & 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 – Current: Select wells inside and outside the barrier wall are monitored weekly for the presence and thickness of NAPL. NAPL is extracted weekly from

interior and exterior wells if the thickness is greater than 0.4 feet. NAPL recovery is continuing until the effectiveness of the barrier wall and sediment cap has been verified.

Subsurface Barrier Wall

As required by the ESD, a fully encompassing, impermeable subsurface barrier wall was designed and installed to meet the remedial action objective of minimizing NAPL discharges to the Willamette River and sediment to protect human health and the environment. The alignment of the wall surrounding the TFA, CPA, the FWDA, and along the riverfront at the OHW of the Willamette River was designed to cut off the upgradient sources of dense non-aqueous phase liquid (DNAPL) and LNAPL in the TFA and FWDA and prevent NAPL migration from these areas to the river.

The majority of 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. Documentation, record drawings, and a detailed summary of the barrier wall construction activities are provided in *Remedial Action Construction Summary Report, Combined Sheet Pile and Soil-Bentonite Barrier Wall* (E & E, 2004).

The barrier wall was constructed to fully encompass approximately 17.8 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 45 feet below ground surface (bgs) to 80 feet bgs to account for differences in the topography and soil profile at the site.

Approximately 1,440 feet of the barrier wall along the bank of the Willamette River were 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).

Approximately 2,355 linear feet of soil-bentonite barrier wall were 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 and 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 side 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, this segment of the wall was extended to such a depth that DNAPL migration toward the river will be substantially retarded.

Review of NAPL Recovery Innovative Technologies

The 1996 ROD required pilot testing to evaluate innovative technologies, such as surfactant flushing, to increase the effectiveness of NAPL removal. This requirement was modified in the 2002 ESD because NAPL accumulations on site (at that time) appeared to be decreasing and there were concerns that, in the absence of containment, the pilot tests could mobilize NAPL and increase discharges to the river.

DEQ, through its contractors, GeoEngineers Inc. and Aquifer Solutions Inc., prepared a technical memorandum that develops and evaluates several innovative technologies and presents a cost-benefit analysis of the most promising innovative technology for enhanced NAPL extraction, the current method of NAPL recovery, and additional capping of potential seeps with Organoclay (capping with Organoclay is discussed under the Sediment Operable Unit). The evaluation of innovative technologies utilizes two general criteria: effectiveness and implementability at the site. The following technologies were developed and evaluated in the report: six-phase soil heating; dual-phase extraction or bioslurping; dynamic underground stripping and hydrous pyrolysis oxidation; in situ flushing; waterflood oil recovery; hydrogen peroxide in situ bioremediation; and membrane filtration system. The cost-benefit analysis considers the cost to construct, operate, and decommission the most promising innovative technology, and these costs associated with the existing system for NAPL recovery; and a scenario where no further NAPL recovery is performed and potential seepage of NAPL is contained by the targeted use of additional Organoclay.

At this time, no additional construction is foreseen. However, as part of the Five Year Review, the results of this or future evaluations will be considered for opportunities to improve the long-term protectiveness or cost efficiencies of the selected remedy.

Sediment Cap

The selected sediment remedy required capping areas that contain contaminant concentrations above human health and ecological risk-based protective levels or that exhibit significant toxicity to biological organisms in the near surface. Documentation, record drawings, and a detailed summary of the sediment cap construction activities are provided in *Remedial Action Construction Summary Report Sediment Cap (June 2004 through November 2004)* (E & E, 2006a) and the *Remedial Action Construction Summary Report Sediment Cap Completion (August 2005 through October 2005)* (E & E, 2006b).

Construction activities during the sediment cap implementation consisted of the following major components: removal of approximately 1,630 pilings, bulkhead and 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, organoclay, and armoring; monitoring well abandonment and modification; bank regrading; and disposal and demobilization.

The sediment cap footprint encompasses approximately 23 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 furthest offshore location extends into the Willamette River to an approximate elevation of -40 feet NAVD, outside of the limits of the USACE-designated navigational channel, and to 16 feet deep in Willamette Cove. The cap consists of a 2-foot thick layer of sand layer 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 was 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 organoclay to prevent breakthrough of the NAPL through the cap. Organoclay is bentonite or hectorite clay that has been modified to be hydrophobic and to have an affinity for non-soluble organics.

The sediment cap incorporated different types of armoring to prevent erosion of the sand and organoclay layers. The specific armoring material and where it was installed was dependent on the expected hydraulic and physical environments (*e.g.*, currents, wave energy, erosive energies, etc.). Articulating concrete block (ACB) mats were installed along the shore and in shallow water where erosive forces would be the greatest due to wave action. ACB is 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 4-inch thick layer of 3-inch-minus filter rock. This fabric and rock was installed to hinder the migration of the sand through the larger and more porous armoring layer or layers.

ACB installation began on July 7, 2004, and proceeded from the downstream end of the site in the 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. The 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 is also comprised of angular basalt and/or andesite. Approximately 23,300 tons of 10-inch-minus rock was 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. Approximately 558 tons of riprap was placed along the shoreline and on an offshore shoal between the embayment and the river at the McCormick & Baxter Creosoting Company site. Each boulder cluster consisted of six to seven boulders.

As a result of the sediment cap construction 18 monitoring wells were abandoned and 36 monitoring wells were modified in accordance with Oregon Water Resources Department (OWRD) requirements (*e.g.*, boreholes were over-drilled and grouted with bentonite).

A 6-acre riparian zone was created by regrading the riverbank, placement of a demarcation layer, placement and grading of two feet 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 pressurized sewer lines were found exposed within the sediment capping area. The City of Portland 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 the sediment cap was resumed in August 2005 and completed in October 2005 and consisted of the following major components: placement of 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 to -2 NAVD. Construction activities also included the installation of 24,150 square feet of organoclay mats. These mats were placed in three areas along the shoreline: under the Burlington Northern Railway 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 mats were covered with sand and rock armoring.

3. DESCRIPTION OF THE PROPOSED ACTION

The proposed action addressed in this BA is the O&M of the soil cap, sediment cap, and groundwater remedy through September 2011. The anticipated O&M activities are discussed in the paragraphs below.

The results of these O&M activities through this five year period will be evaluated as part of the Five-Year Review Report to be issued by the DEQ and EPA in October 2011. The O&M Plan will be updated following this Five-Year Review and subsequent Five-Year Reviews in order to assure the remedies are operated and maintained in a manner that is protective of human health and the environment.

Description, Frequency and Duration of Soil Cap O&M

O&M of the soil cap consists of monitoring, vegetation maintenance, and potential unplanned maintenance. Monitoring activities for the soil cap 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. Vegetation maintenance will include irrigation of the trees and shrubs (i.e., stormwater swales shrub areas, pond sideslopes shrub areas, natural tree/shrub areas, upper riparian area and lower riparian area) through summer 2008, mowing of open space/grasslands, manual removal of invasive plant throughout the site, and targeted application of herbicides to problem areas throughout the site. Figure 4 provides the locations and sizes of the vegetated areas. Vegetation maintenance, including the targeted application of herbicides, was addressed in EPA's BA for construction of the sediment cap (EPA 2003) and in the subsequent Biological Opinion issued by the NMFS (2004). The conclusions of this earlier consultation are carried into the O&M BA in order to provide context and consistency with the other O&M activities. For a detailed description of vegetation maintenance see Appendix A of the 2003 BA. Unplanned maintenance work may include repairs of the fence, replacement of warning signs, gravel roads, filling of potential animal burrows dug into the earthen cap, removal of sediments from manholes, and replanting of unsuccessful trees and shrubs.

The frequency of these O&M activities over the first five years of O&M is provided in the following table.

Description and Frequency of Soil Cap O&M Activities through September 30, 2011.	
O&M Activity	**Frequency**
Monitoring: • Inspection of cap surface • Inspection of stormwater	 • Monthly • Monthly

conveyance system • Inspection of security fencing • Inspection of warning signs	• Monthly • Monthly
Vegetation Maintenance: • Irrigation • Mowing open grass areas • Manual removal of invasive plants • Targeted application of herbicides	• Summer 2007 and 2008 • Annually • Annually • Biannually (April and September)
Unplanned Maintenance – such as: • Repairs of fence • Replacement of warning signs • Repairs of gravel roads • Filling of potential animal burrow into the earthen cap • Removal of sediments from manholes	• As needed • As needed • As needed • As needed • As needed

Equipment requirements for monitoring of the soil cap include a site vehicle for inspecting the 41 acre soil cap, perimeter fencing, warning signs and vegetation. Survey equipment, such as GPS, will be needed. Inspections likely will be performed by contractors under oversight of DEQ staff.

Although routine maintenance is not anticipated for the soil cap, unplanned repairs may be needed. The nature of any repairs will determine the equipment and material requirements. These repairs likely could be performed by a contractor with general construction capabilities. Any substantial repairs, such as those requiring the impermeable cap to be breached or repaired, will be detailed in work plan prepared prior to performing this activity. The work plan will provide technical specifications and drawings sufficient to assure that this work is performed appropriately and by qualified personnel.

Materials needed for potential maintenance include those materials used to construct the soil cap: geomembrane, geocomposite, perforated piping, sand, biotic rock (3-inch-minus rock), 10-inch-minus rock, filter fabric, topsoil, fencing, road gravel, etc. Sand, 3-inch-minus rock and 10-inch-minus rock, 24-inch-minus rock and road gravel have been stockpiled on site. If these materials are inappropriate or insufficient for the repair, additional materials will be imported to address minor and routine cap integrity or soil erosion problems. Any imported soil will be certified by DEQ as meeting the requirements for "clean fill" under Oregon regulations.

Description and Duration of Sediment Cap O&M

O&M of the sediment cap consists of monitoring and potential unplanned maintenance.[2] Monitoring activities for the sediment cap include visual inspections of warning buoys and near shore areas, multibeam bathymetric surveys and side scan sonar surveys of deeper areas, and diver inspections of anomalies in areas of concern identified from the bathymetry and sonar surveys. Monitoring activities also include collection of samples from surface water, subarmoring pore water, flux chambers, crayfish, sculpins, clams if available and organoclay cores. Although the sediment cap is designed to be generally maintenance free, unplanned maintenance work may include the replacement of warning buoys, placement of additional armoring due to erosion and placement of additional organoclay if new releases of creosote are discovered or if the existing organoclay become saturated with creosote. Any new organoclay would require armoring.

The frequency of these O&M activities over the first five years of O&M is provided in the following table.

Description and Frequency of Sediment Cap O&M Activities through September 30, 2011	
O&M Activity	**Frequency**
Monitoring • Inspections of warning buoys • Inspections of near shore areas • Multibeam bathymetric surveys • Side-scan sonar surveys • Diver inspections of deep water	• Monthly • Weekly (August - October) otherwise monthly • Annually through May 2010 • Annually through May 2010 • Annually through Spring/Summer 2010
Sampling • Surface water, pore water, flux chamber • Crayfish, sculpin, clams, possibly lamprey • Organoclay cores	• Biannually (May and September) through 2010 • Annually through September 2010 • Performed in September 2010
Unplanned Maintenance – such as: • Replacement of buoys	• As needed

[2] Monitoring and maintenance of the riparian zone is addressed as part of the soil cap.

• Additional armoring placement • Additional organoclay capping	• As needed • As needed

Equipment requirements for monitoring of the sediment cap include sampling tubes and containers, pumps and probes, flux chambers, use of boats and survey equipment such as GPS. Inspections and sampling will likely be performed by contractors under oversight of DEQ staff. Divers will be needed to perform inspections and assist with sampling in deep water locations. Special analytical procedures will be needed to achieve the desired detection limits. Inspections and sampling likely will be performed by contractors under oversight of DEQ staff.

Although routine maintenance is not anticipated for the sediment cap, unplanned repairs may be needed. The nature of any repairs will determine the equipment and material requirements. These repairs likely would need to be performed by a contractor with expertise in marine construction. Any substantial repairs will be detailed in work plan prepared prior to performing this activity. The work plan will provide technical specifications and drawings sufficient to assure that this work is performed appropriately and by qualified personnel.

Materials needed for potential maintenance include those materials used to construct the sediment cap: sand, organoclay, filter gravel (3-inch-minus rock), ACB, 6-inch-minus rock, 10-inch-minus rock, riprap, etc. Sand, 3-inch-minus rock, ACB, 10-inch-minus rock, riprap and road gravel have been stockpiled on site. If these materials are inappropriate or insufficient for the repair, additional materials will be imported. Further discussion of several hypothetical repair scenarios for the sediment cap is provided later in this section.

Description and Duration of GW O&M

O&M of the groundwater remedies consists of NAPL recovery, groundwater elevation monitoring, and groundwater sampling. Figure 5 provides the locations of the groundwater monitoring and extraction wells. Equipment maintenance and maintaining utilities service (electric, water, and telephone) is also covered under the groundwater O&M.

The frequency of these O&M activities over the first five years of O&M is provided in the following table.

Description and Frequency of Groundwater O&M Activities through September 30, 2011	
O&M Activity	**Frequency**

NAPL Recovery[3] • Extraction of Exterior Wells • Extraction of Interior Wells	• Weekly • Weekly
Groundwater Monitoring • Downloading continuous water level data loggers • Manual water level measurements • NAPL gauging (site-wide)	• Quarterly • Quarterly • Quarterly
Groundwater Sampling • Site-wide • Infiltration pond	• Performed in May 2010 • Quarterly through September 2007 – annually through 2010 thereafter
Equipment Maintenance • Interface probes, pumps, vehicle, data loggers/transducers, etc.	• As needed
Utilities Service • Water, electric, phone, alarm, solid waste, toilet	• Continuous

Equipment requirements for NAPL gauging and extraction include an interface probe for determining the thickness of NAPL within a well, pumps and bailers for extracting NAPL, a generator and compressor for operating the pumps, a utility vehicle for transporting the equipment and waste products, a shop building for storing the equipment, and a contained storage area for storing the extracted creosote prior to off-site disposal. Equipment requirements for groundwater include water level indicators, pumps, bailers and containers. NAPL extraction and groundwater monitoring will likely be performed by contractors under oversight of DEQ staff.

Hypothetical Repairs to the Sediment Cap

As discussed previously, the soil and sediment caps are designed to be relatively maintenance free and should not require substantial repairs. However, two components of the remedy are more susceptible to damage and are the focus of ongoing monitoring. The armoring layer of the sediment cap is susceptible to damage by wave action, scouring of the armoring by river currents, and gauging of the armoring by submerged

[3] NAPL extraction termination criteria are met when recovery efficiency reaches a point of diminishing returns in comparison to historical recovery yields and in consideration of recovery cost versus volume.

logs and commercial vessels (anchoring). The chemical isolation layer of the sediment cap is susceptible to damage by unanticipated releases of mobile NAPL from the underlying contaminated sediments or continued seepage of mobile NAPL from upland sources. These releases of NAPL are possible as a result of saturation of the existing organoclay caps or through portions of the sediment cap where organoclay was not utilized.

Repairs to the sediment will need to be performed in a timely manner in the event that the armoring layer becomes damaged or the chemical isolation layer fails to contain NAPL. The following discussion outlines three hypothetical scenarios for performing these repairs:

Additional Armoring Placement

Corrective measures to address damage to the armoring layer would consist of placing additional armoring over the damaged area. If it is determined that the damage resulted from wave action or river currents, the size of the armoring material would be increased. For example, the 10-inch-minus rock within the embayment area would be up-sized to a 24-inch-minus rock (i.e., riprap). The repair would be performed to as small of an area as determined to be susceptible to damage. For evaluation in this BA, it is assumed that the repair area may extend 30 feet along the shoreline and 10 feet away from the shoreline to encompass an area of 300 square feet (see Section 4 for duration discussion). It also is assumed that the existing elevation of the repair area is +8 to -10 feet NAVD. The repair material would consist of:

- 12-inch layer of 6-inch-minus rock or 12-inch-minus rock in elevations deeper than -5 feet NAVD;
- 12-inch layer of 12-inch-minus rock in areas shallower than -5 feet NAVD; or
- 24-inch layer of riprap in exposed or steep sloping areas shallower than -5 NAVD.

Under this scenario, the beachfront or river bottom elevation would rise by approximately 1 to 2 feet, and a total volume of 11 to 22 cubic yards of rock would be added to the beachfront or river bottom. If sizing of the armoring is increased, the sediment structure would change to that of a larger rock size (i.e., riprap instead of 10-inch-minus rock).

Additional Organoclay Capping Along Beachfront

Intermittent releases of NAPL may be discovered along the beachfront in the vicinity of the former NAPL seep areas within Willamette Cover and Willamette River. These releases may coincide with gas ebullition which is more prevalent during the summer and fall when river levels are at annual lows and during the low tide cycles.

Corrective measures to address these releases would consist of the additional placement of organoclay and armoring over existing river bottom elevations of +8 to +2 feet NAVD. The repair area may extend as much as 300 feet along the shoreline and 100 feet away

from the shoreline to encompass an area of 300,000 square feet. The repair cap would consist of the following components from bottom to top:

- 6-inch layer of sand placed directly on the river bottom;
- 6-inch layer of organoclay or ½-inch layer of organoclay mats;
- 12-inch layer of sand;
- 4-inch layer of 3-inch-minus filter rock; and
- 12-inch layer of 10-inch-minus rock (protected embayment area) or 9-inch layer of ACB mats (areas exposed to wave action).

Under this scenario, the beachfront elevation would rise by approximately 3 feet, and a total volume of 33,300 cubic yards of rock and sand would be added to the beachfront. No change in sediment structure would occur since the media is currently capped with 10-inch-minus rock or ACB.

Likely construction equipment would consist of an excavator, All-Tracks, dozer, loader, and crane or forklift. Prior to installation of the capping materials, a protective layer of sand would be placed over existing ACB armoring and other sensitive surfaces. Sand would be delivered to the top of bank by truck and then loaded into the All-Tracks using the loader. The All-Tracks would transport the sand to the water and unloaded the sand in the general area where it was to be spread. A dozer would spread the sand to a thickness of approximately 6-inches over the repair area. An excavator would reposition any drift logs or boulder cluster located within the footprint of the repair area.

After the sand is placed, the organoclay would be installed with an excavator. As organoclay is placed, it would be covered with a protective layer of sand. The All-Tracks would transport the sand from the top of the bank to the river, and the dozer would spread the sand to a thickness of approximately 12-inches. After the sand layer is installed, a 4-inch layer of 4-inch-minus rock would be installed atop the sand also utilizing the All-Tracks for transportation and dozer for spreading. If 10-inch-minus rock is used as the final layer, it would be placed in a similar manner to the previous layer. If ACB is used as the final layer, it would be transported by All-Tracks from the top of the bank to the river. A forklift or crane then would be used to place the ACB. Once installation of the organoclay and armoring is complete, access road created from equipment going down the bank would be removed and the vegetation would be replanted with native grasses, shrubs and trees as specified in the vegetation management plan provided in the Biological Assessment for the Sediment Cap (EPA 2003).

Additional Organoclay Capping in Deep Water

Intermittent releases of NAPL also may be discovered in deep water, potentially beneath the Burlington Northern Santa Fe Railway Bridge. Corrective measures to address these releases would consist of the additional placement of organoclay and armoring over existing river bottom elevations of -5 to -35 feet NAVD. The repair area may extend as much as 200 feet along the shoreline and 100 feet away from the shoreline to encompass

an area of 200,000 square feet. The repair cap would consist of the following components from bottom to top:

- 6-inch layer of sand placed directly on the river bottom;
- ½-inch layer of organoclay mats;
- 12-inch layer of sand; and
- 12-inch layer of 6-inch-minus rock.

Under this scenario, the river bottom elevation would rise by 2 and ½ feet, and a total volume of 18,500 cubic yards of rock and sand would be added to the river bottom. No change in sediment structure would occur since the media is currently 6-inch-minus rock.

Likely construction equipment would consist of a crane barge, material barge, tug, loader and dive support boat. A crane mounted barge equipped with a clamshell bucket would be used to place the initial layer of sand. The organoclay mats would be placed using a spreader bar attached to the crane. Divers would guide the organoclay mats into the desired location and use sand bags to temporarily secure the mats. The following layers of sand and 6-inch-minus rock would be placed with the clamshell bucket. Upon completion of 6-inch-minus rock placement, the divers would walk the area to ensure appropriate 6-inch-minus rock coverage.

4. DURATION AND TIMING OF THE ACTION

The O&M activities addressed in this document extend through September 30, 2011. These activities would be performed throughout the year over this period as discussed in Section 3. Sampling activities would be performed in the spring, summer and/or fall of each year. Monitoring of the sediment cap surface using multi-beam bathymetry and side-scan sonar would occur in the spring of each year. Diver inspections of the sediment cap would occur in the spring or summer of each year. Any repairs to the sediment cap would be performed between July 1 and October 31 of any given year. These repair would take anywhere between one week and four weeks to complete.

5. DESCRIPTION OF ACTION AREA

An action area is defined by NMFS regulations (50 CFR Part 402) as 'all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved by the action.' The action area for the proposed action includes the entire portion of the Willamette River from RM 8 to the confluence of the Columbia River, including the exposed beach and shoreline areas.

The Willamette River is one of the major rivers in Oregon with a watershed of 12,000 square miles. It is a major tributary to the Columbia River, which it joins approximately 7 miles to the north of the site. The river is tidally influenced at the project site.

The Willamette River is about 1500 feet wide along the reach of the project site and flows to the northwest. Channel sounding maps produced by the U.S. Army Corps of Engineers from January 1991 show a channel width of approximately 600 feet and a maximum depth of approximately 55 to 65 feet below NAVD. There is a 50-foot wide embayment along the south portion of the property, with river depths ranging from 0 to +10 feet NAVD. COE maps indicate that there are steep slopes to the dredged navigational channel approximately 150 feet offshore (or 300 feet from the embayment shoreline).

As described in the US Army Corps' Portland-Vancouver Harbor Information Package (USACE, 2004), maximum monthly stages in the Willamette River at Portland usually occur during the winter (December through February and the spring (March through June). Notable maximum monthly stages of 32.2 feet NAVD in February 1996 and 23.5 feet NAVD in June 1997 indicate the effects that large runoff years on the Columbia River have on stage at Portland. Minimum monthly stages usually occur between July and October. A minimum monthly stage of 6.1 feet NAVD occurred in July of 2001. Normally, August or September is the month when minimum monthly stages are most likely to occur in the Portland Harbor. Tidal effects strongly influence monthly river stages in the Portland Harbor during the summer and fall in which tidal-induced daily stage variations are typically several feet (USACE, 2004). Figure 6 shows a graph of daily average river levels at the Morrison Bridge between 1996 and 2006.

The City of Portland surrounds the action area. Most of the shorelines of the Willamette and the Columbia Rivers are developed as industrial shorelines, although there are areas of greenbelt, residential, and commercial use.

Historic Conditions

European settlement of the Willamette Basin in the early 1800s began a history of substantial changes to the river ecosystem. Although some impacts were the result of naturally occurring events, the principal impacts in the Willamette Basin are from human activities. The most extensive changes in characteristics of the Willamette River occurred as a result of channelization and containment of the main stem (Sedell and

Frogatt 1984). These changes were greatest in the southern half of the river, which historically was a braided system of numerous oxbows, sloughs, ponds, and small side-channels and a broad floodplain with extensive marshlands and riparian gallery forests. Additional habitat loss occurred due to clearing of the extensive riparian forests and draining and filling of wetland habitats (Holland 1994).

Declining anadromous fish stocks in the Willamette Basin and elsewhere in the Pacific Northwest have been attributed to numerous factors, including loss and degradation of freshwater and riparian habitat, introduction of non-native fish species; construction and operation of dams and their effects on habitat, water flows, temperature predation, mortality, and passage; and management of land uses, such as timber harvesting, grazing, and agriculture. Wevers (1994) estimates that approximately 16 million wild salmon and steelhead were produced annually in the Columbia Basin (including the Willamette Basin) 120 years ago. This compares to the approximately 2 million produced today, about 80 percent of which are hatchery fish.

Like the rest of the Willamette River, the action area once supported extensive braided channels, back channels, and marshes. The braided channels and high sediment load were indicative of large seasonal flood events and occasional catastrophic flood events. The low-elevation confluence areas likely supported riparian gallery forests, dominated by black cottonwood (Populus balsimifera), red alder (Alnus rubra) and red maple (Acer macrophylum). These forests would also be indicative of a dynamic, fluctuating river system.

The variability and unregulated river flow resulted in a myriad of conditions and habitat types in the action area. The river likely carried large loads of woody debris and the braided channels provided extensive shallow water habitat with sloping shorelines. The differing bathymetry of the river channel provided pools and backwaters and a variety of water temperature conditions. Adjacent riparian forests and wetlands provided extensive organic detritus and also provided habitat for terrestrial insects, birds and wildlife. During flooding events, the adjacent riparian areas and wetlands also provided feeding and resting areas for migrating fish.

The action area is unique along the Willamette River because it experiences daily tidal fluctuations (lower Willamette River up to Willamette Falls). This allowed for even greater diversity of habitats, including freshwater tidal marshes and forested tidelands in the upper reaches of the flood plain.

There are no estimates of habitat loss for this section of the Willamette. However, the extensive filling for urban and industrial development suggests that most of the area supported wetlands and riparian forests as well as braided channels, back channels, oxbows and other features associated with a dynamic river system.

Current Conditions

The lower Willamette River has been altered to accommodate urban development and a growing shipping industry. Development in the harbor has replaced the natural shoreline with riprap, bulkheads, and other artificial structures, and sand-beach lagoons. Because of navigational dredging by the U.S. Army Corps of Engineers, the river has a steeply sloped, silt and sand bottom.

Several species of anadromous fishes, including Chinook salmon, steelhead, coho salmon, sockeye salmon, American shad, and white sturgeon occur in the area. Both juveniles and adults use the study area as a migratory corridor and as rearing habitat for juveniles. Cutthroat trout are also present, but their abundance is low, particularly in the lower Willamette River (Bennett and Foster 1991, NMFS 1999).

6. EVALUATING PROPOSED ACTIONS

EPA has focused the following discussion on the listed salmonid species because the majority of the work is in migration waters for these species. An expanded discussion for other species of concern is in Section 20 of this document and Section 19 of the June 2002 BA.

Section 5 of the June 2002 BA contains a full discussion on the biological requirements of federally listed or proposed threatened or endangered species. This addendum incorporates by reference the relevant information in the 2002 Biological Assessment. However, since the release of the 2002 BA (EPA 2002), changes have occurred to two of the species that were candidate or proposed for listing at the time of the 2002 submittal; the Southwestern Washington/Columbia River Sea-run Cutthroat Trout and the Lower Columbia River (LCR) / Southwest Washington coho salmon. In June of 2002, the USFWS made a determination that the Southwestern Washington/Columbia River sea-run cutthroat trout did not warrant listing under the ESA. The LCR coho salmon was listed and is discussed in further detail below, as a supplement to the existing information previously provided in the 2002 BA.

On June 28, 2005, the LCR coho salmon was listed as threatened under the ESA (70 CFR §37160). This ESU includes areas within the McCormick and Baxter project area. Critical habitat is not yet proposed for designation in this ESU.

A discussion of the life history for the LCR/Southwest Washington coho salmon ESU in the project area was provided in Section 5.1 of the 2002 subsurface barrier wall BA (EPA 2002). In the 2005 listing, the LCR ESU was identified as a separate ESU and listed as threatened. The listing status of the Southwest Washington coho salmon ESU remains undetermined. The LCR coho salmon ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries, from the mouth of the Columbia River up to the Hood (OR) and Big White Salmon (WA) Rivers, and includes the Willamette River to Willamette Falls, OR, as well as twenty-five artificial propagation programs, including the Eagle Creek National Fish Hatchery on the Clackamas River, a tributary to the Willamette River. The Southwest Washington ESU contains all naturally spawning populations of coho salmon from coastal drainages in southwest Washington between the Columbia River and Point Grenville.

Coho salmon in the LCR ESU that migrate through the project area originate in the Clackamas River. Previous analyses indicated that the Clackamas River coho was a single population (Good et al., 2005) although earlier work did indicate that a remnant native run may exist in the drainage (Cramer and Cramer 1994). More recent analyses by ODFW indicate that there may be two distinct populations; an early run (hatchery origin from LCR outside of the Clackamas River basin) and a late run (native origin) (Good et al., 2005). However, there is continued uncertainty over the population structure for the Columbia River coho salmon. Coho salmon in the Clackamas River is one of only two extant populations in the ESU (70 CFR §37172).

Coho migrate up the Willamette into the Clackamas River from late August through early November with two peaks beginning in mid- to late September and in January/February (Weitkamp et al., 1995). Spawning occurs from September through March, dependent upon the run timing. Clackamas River juveniles have been documented to outmigrate between February and July and peaked in May and June (Cramer and Cramer 1994).

7. BASELINE CONDITIONS IN THE WILLAMETTE RIVER

This section describes habitat pathways and indicators important for salmonids in the riverine ecosystem. Riverine habitat is emphasized because of the potential effects of the proposed action on this type of habitat. For the non-salmonid threatened and endangered species in the action area, the discussion in this document follows a more narrative approach. The complexities of salmonid life histories and estuarine use warranted a more structured approach for the assessment of effects.

EPA based the following description of potential project effects on a set of ecological pathways that may affect listed salmonids by changes in their environment and within the action area (NMFS 1999). EPA considered the ecological pathways of water quality, habitat access, habitat elements, channel condition and dynamics, flow/hydrology, and watershed conditions to describe the existing baseline condition through a set of indicators of these ecological pathways. These indicators reflect essential features of designated critical habitat for salmonids. Although critical habitat has not been designated for coho salmon, many of these features may also be important for the conservation of these species. EPA assessed potential project related changes to the existing baseline conditions using the indicators for each pathway. This allowed EPA to draw conclusions about potential impacts on listed salmonids and their critical habitat. The following is a list of indicators for each of the identified ecological pathways after NMFS (1999). EPA selected these indicators for assessment as they reflected that the action area is primarily a migration area for salmonids. No spawning occurs although there may be some rearing activity in more protected habitats.

Indicators of water quality:

- Temperature
- Sediment/Turbidity
- Water contamination
- Sediment contamination

Indicators of habitat access:

- Physical barriers

Indicators of habitat elements:

- Large woody debris
- Shallow water habitat

Indicators of channel conditions/dynamics and flow/hydrology:

- Streambank condition
- Floodplain connectivity
- Change in peak/baseflows

- Increase in drainage network

Indicators of watershed conditions:

- Disturbance history
- Riparian reserves

Section 6 of the June 2002 Biological Assessment contains a full discussion of the baseline conditions of the Willamette River with respect to these pathways and indicators. This addendum incorporates by reference the information in the 2002 BA.

8. EFFECTS OF THE ACTION

The following sections provide EPA's analysis of the direct and indirect effects of the proposed action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent to the action. These effects are considered along with the environmental baseline and the predicted cumulative effects to determine the overall effects to the species [50 CFR §402.02]. The separate activities making up the proposed action consist of the following:

- Soil Cap Monitoring (i.e., inspection of cap surface, inspection of stormwater conveyance system, inspection of security fencing and inspection of warning signs)
- Soil Cap Vegetation Maintenance (i.e., irrigation, mowing open grass areas, manual removal of invasive plants and targeted application of herbicides)[4]
- Soil Cap Unplanned Maintenance (e.g., repairs of fence, replacement of warning signs, repairs of gravel roads, filling of animal burrows and removal of sediments from manholes)
- Sediment Cap Monitoring (i.e., warning buoys, near shore areas, multibeam bathymetric surveys, side-scan sonar surveys and diver inspections of deep water)
- Sediment Cap Sampling (i.e., surface water, pore water, flux chamber, organoclay cores, crayfish, sculpin/clams and possibly lamprey)
- Sediment Cap Unplanned Maintenance (e.g., replacement of buoys, additional armoring placement and additional organoclay capping)
- Groundwater Remedy - NAPL Recovery
- Groundwater Monitoring (i.e., downloading continuous water level data loggers, manual water level measurements, NAPL gauging (site-wide), groundwater sampling)

EPA determined the effects on the listed, proposed and candidate species by predicting changes in baseline condition for each of the indicators. The EPA's analysis is discussed in the following sections and summarized in Table 1.

[4] Vegetation maintenance, including the targeted application of herbicides, was addressed in EPA's BA for construction of the sediment cap and in the subsequent Biological Opinion issued by the NMFS (2004). The conclusion of this earlier consultation are carried into the O&M BA in order to provide context and consistency with the other O&M activities.

9. WATER QUALITY HABITAT INDICATORS

9.1 Temperature

Soil Cap Monitoring. There would be no change to water temperature as a result of this activity.

Soil Cap Vegetation Maintenance. There would be no change to water temperature as a result of this activity.

Soil Cap Unplanned Maintenance. There would be no change to water temperature as a result of this activity.

Sediment Cap Monitoring. There would be no change to water temperature as a result of this activity.

Sediment Cap Sampling. There would be no change to water temperature as a result of this activity.

Sediment Cap Unplanned Maintenance. Repairs to the sediment cap may consist of additional armoring placement, additional organoclay capping along the beachfront and additional organoclay capping in deep water. These capping materials would be placed in water or along portions of the shoreline exposed at the time of placement because of low river stage.

As discussed in EPA's Biological Assessment Addendum for the Sediment Cap, very little research has been done on the changes in water temperature from placing fill materials in water (EPA 2003). It is likely that there is some minimal change in ambient water temperature from increased activities (e.g. placement of additional rock) in the water column, but not likely of such a magnitude or duration that would result in any measurable change.

After construction, the site would be shallower in depth than existing conditions. During the summer months, this may result in a localized increase in water temperature for the cap area. This increase in temperature would not likely be measurable throughout the action area, but might result in migrating fish avoiding the project site during the warmest parts of the summer months when high temperatures are of concern throughout the lower Willamette River. As such EPA concludes there may be a localized increase in water temperature from placement of the cap.

Groundwater Remedy - NAPL Recovery. There would be no change to water temperature as a result of this activity.

Groundwater Monitoring. There would be no change to water temperature as a result of this activity.

Effect on Baseline. EPA determined that the action may result in degradation of the baseline conditions for localized water temperature in the action area because the constructed cap would create more shallow nearshore conditions, which may result in localized increases in water temperature during the summer months. These conditions may result in migrating salmonids avoiding the cap area and moving to deeper water, or avoiding the site completely to seek out other shallow water areas in the Lower Willamette River.

9.2 Sedimentation/Turbidity

Soil Cap Monitoring. This activity would have no effect on water sedimentation and/or turbidity.

Soil Cap Vegetation Maintenance. This activity would have no effect on water sedimentation and/or turbidity.

Soil Cap Unplanned Maintenance. This activity would have no effect on water sedimentation and/or turbidity.

Sediment Cap Monitoring. This activity would have no effect on water sedimentation and/or turbidity.

Sediment Cap Sampling. This activity would have no effect on water sedimentation and/or turbidity.

Sediment Cap Unplanned Maintenance. Repairs to the sediment cap may consist of additional armoring placement, additional organoclay capping along the beachfront and additional organoclay capping in deep water. These capping materials would be placed in water or along portions of the shoreline exposed at the time of placement because of low river stage.

These repairs would be performed during the low water and lower velocity periods of the year. The cap materials would consist of sand, organoclay, 6-inch-minus rock, possibly 10-inch-minus rock, ACB and/or riprap. The repair materials would be placed directly on the existing cap surface which primarily consists of rock or ACB armoring.

EPA expects the sand layer to settle out quickly with only localized increases in background turbidity levels. This is typical of coarse-grained capping materials. For example, monitoring of total suspended solids (TSS) during the construction of a

McCormick and Baxter sediment cap in 2004 and 2005 found that turbidity levels dropped to less than 10% above background concentrations at the compliance points located 100 feet downstream of the construction work. This is consistent with EPA's (1994) evaluation of TSS during the construction of a sediment cap in Eagle Harbor (Bainbridge Island, Puget Sound, Washington) which found that conditions returned to background within 30 minutes after a discharge period. EPA also found that turbidity had an expected increase in the areas of on-going sediment placement and that it was greatest at the bottom of the water column and limited in extent to the discharge area. The 2000/2001 cap placement at Eagle Harbor, Washington, which placed a greater amount of sand over a longer period of time than the 1994 cap, experienced some turbidity plumes during placement that were directly tied to movement of strong tidal currents. Monitoring indicated that the periodic plumes lasted between 4 to 6 hours before completely settling out with the majority of the material settling out within a few hours. EPA anticipates a similar experience at McCormick and Baxter where turbidity can be controlled through the methods of placement and that any increases in turbidity are expected to be limited in extent and duration, as was documented during the construction of the sediment cap (EPA 2005a). Furthermore, EPA would ensure that any in-water construction work would limit the generation of TSS pursuant to a Water Quality 401 Certification.

EPA also expects turbidity increases with both the placement of the articulated concrete block, 10-inch-minus rock, and the 6-inch-minus rock. In these cases, there would be some minor increases in turbidity from disturbing the bottom sediments (clean sand and clay) during placement. Some fines in the 10-inch and 6-inch-minus rock may also contribute to turbidity. This is expected to be very minor, in both extent and duration.

EPA concludes that there would be an increase in turbidity during construction. EPA expects this to be limited in extent and duration, and would be timed to occur during low water, low-flow periods of the year, and after times of peak out-migration.

Groundwater Remedy - NAPL Recovery. This activity would have no effect on water sedimentation and/or turbidity.

Groundwater Monitoring. This activity would have no effect on water sedimentation and/or turbidity.

Effect on Baseline. EPA determined that the action would temporarily degrade the baseline conditions for water turbidity in the action area because the cap repairs would increase water turbidity through placement of clean cap materials. However, turbidity impacts are expected to be short in duration and limited in extent.

Impacts from increased turbidity on juvenile and adult salmonids are well documented (Bash et al., 2001). Juvenile salmonids are known to avoid streams that are chronically turbid (Lloyd et al., 1987). Salmonids have also been observed to avoid turbid plumes by traversing non-turbid waters adjacent to the plume (Servizi and Martens 1991). A mean avoidance of 25 % was observed for juvenile coho salmon exposed to a 7,000 mg/L level

of suspended sediment and an estimated threshold of avoidance was 37 NTU (Servizi and Martens 1992). (Berg 1982, as cited in Bash et al., 2001) noted that young-of-year coho salmon moved to the substrate after a 60 NTU pulse in a laboratory study.

No adverse impacts to salmon associated with turbidity or other work activities were observed during placement of the sediment cap during the 2004 and 2005 work seasons at the McCormick and Baxter site (EPA 2005).

9.3 Water Contamination

Soil Cap Monitoring. There would be no changes to water contamination as a result of this activity.

Soil Cap Vegetation Maintenance. Vegetation maintenance will require the selective use of herbicides to control invasive species until the riparian community becomes established. This will occur as often as twice a year. The City of Portland's Watershed Revegetation Program recommends using highly targeted applications of chemical controls (herbicide) as a tool against recolonization by invasive species until a healthy native herbaceous plant community can establish. This recommendation is based on the City's experience with evaluating techniques to control invasive vegetation in areas where the city has tried to re-establish native vegetation communities. Their findings show that non-chemical techniques resulted in little success. The proposed herbicides are glyphosate (Roundup®, Roundup Pro®, Rodeo®) with the following surfactants: phosphatidylcholine (LI-700), methylacetic acid and alkyl poloxyethylene ether. Water and WEB oil would be used as carriers.

Herbicides would be applied at the project site where invasive species are hindering or would hinder the establishment of the native plant community. The Vegetation Management Strategy submitted in EPA's Biological Assessment on the Sediment Cap contains the details of application (EPA 2003).

There is little data documenting the effects of the proposed herbicides on aquatic ecosystems and the specific invertebrate prey of listed salmonids. The scientific studies that have been conducted on fish are largely limited to measures of acute mortality – i.e., the concentrations at which short-term exposures to a pesticide will kill fish outright, the standard lethal concentration (LC50). In many cases, actual mortality data may not be appropriate for estimating whether a pesticide will have adverse, non-lethal effects on the essential behavior patterns of salmonids (e.g., feeding, spawning, or migration) (WSDA 2001).

Herbicides can enter water through atmospheric deposition, spray drift, surface water runoff, groundwater contamination and intrusion, and direct application. Although outright mortality from herbicide exposure is not expected at the project site, adverse effects could include reductions in reproductive success, weight loss, physiological effects (endocrine system, blood chemistry, liver function, etc.), and reduction in growth,

prey capture ability, and swimming ability, all of which are associated with reduced survival (WSDA 2001).

EPA proposes to apply the herbicide only under highly controlled conditions. However, both herbicides are highly water soluble, which increases their likelihood of being transported off the application site through rain or surface water. Both Roundup® and Rodeo® herbicides degrade relatively quickly, and Rodeo® is approved for in-water applications in Washington State (WSDA 2001). The risk remains, even with strict controls, that herbicides may reach the Willamette River and may result in sublethal direct effects to aquatic organisms, including salmonids. This impact would be temporary and minimal in extent.

Soil Cap Unplanned Maintenance. There would be no changes to water contamination as a result of this activity.

Sediment Cap Monitoring. There would be no changes to water contamination as a result of this activity.

Sediment Cap Sampling. There would be no changes to water contamination as a result of this activity.

Sediment Cap Unplanned Maintenance. Marine-based repairs to the sediment cap may result in minor releases of NAPL to the river. These releases could occur if the "spuds" used to anchor barges are driven through the existing sediment cap and into highly contaminated sediments. Although EPA would require the barge operators to minimize spud locations, complete elimination of spudding cannot be avoided. Repairs to the sediment using land-based equipment would not require use of barges and, therefore, are not expected to result in releases of NAPL to the river.

In order to minimize the impact of any NAPL releases, EPA would require the construction contractor to maintain adsorptive booms for rapid deployment if necessary.

Groundwater Remedy - NAPL Recovery. There would be no changes to water contamination as a result of this activity.

Groundwater Monitoring. There would be no changes to water contamination as a result of this activity.

Effect on Baseline. EPA has determined that the action has a small potential to directly harm fish through NAPL releases and herbicide exposure. Booms can be deployed to adsorb and contain the fraction of light weight NAPL (LNAPL) that floats, the denser fraction (DNAPL) cannot be contained. The potential DNAPL would likely remain on the river bottom within the sediment cap repair area and would be subsequently capped with new capping material (i.e. organoclay). Therefore, a release of DNAPL to the river is unlikely.

Although herbicide applications can be strictly controlled and the potential for harm minimized by timing and application, some risk of direct effect would remain. As such, EPA concludes that this activity could potentially affect listed salmon and steelhead through sublethal effects of direct contaminant exposure during or immediately following application. EPA also concludes that this action would restore the baseline conditions by repairing deficiencies with the existing sediment cap, to minimize additional releases of contaminants from the project area.

9.4 Sediment Contamination

Soil Cap Monitoring. This activity would have no effect on baseline conditions.

Soil Cap Vegetation Maintenance. This activity would have no effect on baseline conditions.

Soil Cap Unplanned Maintenance. This activity would have no effect on baseline conditions.

Sediment Cap Monitoring. This activity would have no effect on baseline conditions.

Sediment Cap Sampling. This activity would have no effect on baseline conditions.

Sediment Cap Unplanned Maintenance. Additional capping with organoclay may be performed to prevent releases of NAPL not adequately contained by the existing cap. This activity would improve baseline conditions for sediment contamination. The resulting substrate will no longer be a source of potential contamination to sediment and would serve to isolate contaminated sediment from human exposure and biological uptake.

Groundwater Remedy - NAPL Recovery. This activity would have no effect on baseline conditions.

Groundwater Monitoring. This activity would have no effect on baseline conditions.

Effect on Baseline. EPA concludes that the action would maintain baseline conditions during construction. EPA also concludes that this action would restore the baseline conditions by repairing deficiencies with the existing sediment cap.

10. HABITAT ACCESS INDICATORS

10.1 Physical Barriers

Soil Cap Monitoring. This activity would have no effect on baseline conditions.

Soil Cap Vegetation Maintenance. This activity would have no effect on baseline conditions.

Soil Cap Unplanned Maintenance. This activity would have no effect on baseline conditions.

Sediment Cap Monitoring. This activity would have no effect on baseline conditions.

Sediment Cap Sampling. This activity would have no effect on baseline conditions.

Sediment Cap Unplanned Maintenance. Repairs to the sediment cap could increase the bottom elevation by a maximum of approximately 3 feet over potential repair areas of a maximum of 300,000 square feet along the shoreline or a maximum of 200,000 square feet in deeper water. The cap would not be a physical barrier that would preclude migration along the shoreline although more shoreline would be exposed during low water times of the year. This would have minimal effect on baseline conditions.

Groundwater Remedy - NAPL Recovery. This activity would have no effect on baseline conditions.

Groundwater Monitoring. This activity would have no effect on baseline conditions.

Effect on Baseline. EPA determined that the action would degrade baseline conditions for physical barriers because more of the sediment cap would emerge as open beach earlier in the season and more often in low water conditions compared to existing conditions. These conditions would result in migrating salmonids avoiding the shoreline repair area and moving to deeper water.

11. HABITAT ELEMENTS INDICATORS

11.1 Large Woody Debris

Soil Cap Monitoring. This activity would have no effect on baseline conditions.

Soil Cap Vegetation Maintenance. This activity would have no effect on baseline conditions.

Soil Cap Unplanned Maintenance. This activity would have no effect on baseline conditions.

Sediment Cap Monitoring. This activity would have no effect on baseline conditions.

Sediment Cap Sampling. This activity would have no effect on baseline conditions.

Sediment Cap Unplanned Maintenance. Repairs to the sediment cap may require the removal of existing large woody debris along the shoreline. The woody debris would be returned to the shoreline after completion of construction. The removal of this material during the construction period would remove the availability of large woody debris as habitat. This activity would temporarily degrade the baseline condition for large woody debris at the project site.

Groundwater Remedy - NAPL Recovery. This activity would have no effect on baseline conditions.

Groundwater Monitoring. This activity would have no effect on baseline conditions.

Effect on Baseline. EPA determined that the action would temporarily degrade baseline conditions because large woody debris would be removed during construction. Any large woody debris removed during potential sediment cap activities would be returned to the original location, thus resulting in a temporary effect.

11.2 Shallow Water Habitat

Soil Cap Monitoring. This activity would have no effect on baseline conditions.

Soil Cap Vegetation Maintenance. This activity would have no effect on baseline conditions.

Soil Cap Unplanned Maintenance. This activity would have no effect on baseline conditions.

Sediment Cap Monitoring. This activity would have no effect on baseline conditions.

Sediment Cap Sampling. This activity would have no effect on baseline conditions.

Sediment Cap Unplanned Maintenance. Any repairs to the sediment cap would require the placement of rock armoring or ACB. In most cases the armoring would be identical to the existing armoring. However, the size of the armoring may be increased if erosion of existing armoring is discovered. For examples, the 6-inch-minus rock currently used in water elevations deeper than -2 feet NAVD may be increased to 10-inch-minus rock. Furthermore, repairs to shoreline areas currently armored by ACB may be covered with riprap if these areas are inaccessible by construction vehicles (e.g. crane or forklift). The use of riprap will be avoided as much as possible.

Repairs to the sediment cap could increase the bottom elevation by a maximum of approximately 3 feet over potential repair areas of a maximum of 300,000 square feet along the shoreline or a maximum of 200,000 square feet in deeper water. More of the sediment cap would emerge as open beach earlier in the season and more often in low water conditions than existing conditions.

After project construction, the resulting area may be of a different substrate (possibly riprap) and be at a higher elevation than the existing habitat. As such, this activity would degrade baseline conditions.

Groundwater Remedy - NAPL Recovery. This activity would have no effect on baseline conditions.

Groundwater Monitoring. This activity would have no effect on baseline conditions.

Effect on Baseline. EPA determined that the action would degrade baseline conditions for shallow water habitat because the substrate could change to a larger size of the rock armoring and more of the sediment cap would emerge as open beach earlier in the season and more often in low water conditions than existing conditions.

12. CHANNEL CONDITIONS/DYNAMICS AND FLOW/HYDROLOGY INDICATORS

12.1 Streambank Conditions

Soil Cap Monitoring. This activity would have no effect on baseline conditions.

Soil Cap Vegetation Maintenance. This activity would have no effect on baseline conditions.

Soil Cap Unplanned Maintenance. This activity would have no effect on baseline conditions.

Sediment Cap Monitoring. This activity would have no effect on baseline conditions.

Sediment Cap Sampling. This activity would have no effect on baseline conditions.

Sediment Cap Unplanned Maintenance. This activity would have no effect on baseline conditions because it would be constructed below the existing bank.

Groundwater Remedy - NAPL Recovery. This activity would have no effect on baseline conditions.

Groundwater Monitoring. This activity would have no effect on baseline conditions.

Effect on Baseline. EPA determined that the action would have no effect on the baseline for streambank conditions.

12.2 Floodplain Connectivity

Soil Cap Monitoring. This activity would have no effect on baseline conditions.

Soil Cap Vegetation Maintenance. This activity would have no effect on baseline conditions.

Soil Cap Unplanned Maintenance. This activity would have no effect on baseline conditions.

Sediment Cap Monitoring. This activity would have no effect on baseline conditions.

Sediment Cap Sampling. This activity would have no effect on baseline conditions.

Sediment Cap Unplanned Maintenance. This activity would have no effect on baseline conditions because it would be constructed below the existing bank.

Groundwater Remedy - NAPL Recovery. This activity would have no effect on baseline conditions.

Groundwater Monitoring. This activity would have no effect on baseline conditions.

Effect on Baseline. EPA determined that the action would have no effect on the baseline for streambank conditions.

12.3 Change in Peak/Base Flows

Soil Cap Monitoring. This activity would have no effect on baseline conditions.

Soil Cap Vegetation Maintenance. This activity would have no effect on baseline conditions.

Soil Cap Unplanned Maintenance. This activity would have no effect on baseline conditions.

Sediment Cap Monitoring. This activity would have no effect on baseline conditions.

Sediment Cap Sampling. This activity would have no effect on baseline conditions.

Sediment Cap Unplanned Maintenance. This activity would have no effect on baseline conditions because it would be constructed below the existing bank.

Groundwater Remedy - NAPL Recovery. This activity would have no effect on baseline conditions.

Groundwater Monitoring. This activity would have no effect on baseline conditions.

Effect on Baseline. EPA determined that the action would have no effect on the baseline for streambank conditions.

12.4 Increase in Drainage Network

Soil Cap Monitoring. This activity would have no effect on baseline conditions.

Soil Cap Vegetation Maintenance. This activity would have no effect on baseline conditions.

Soil Cap Unplanned Maintenance. This activity would have no effect on baseline conditions.

Sediment Cap Monitoring. This activity would have no effect on baseline conditions.

Sediment Cap Sampling. This activity would have no effect on baseline conditions.

Sediment Cap Unplanned Maintenance. This activity would have no effect on baseline conditions because it would be constructed below the existing bank.

Groundwater Remedy - NAPL Recovery. This activity would have no effect on baseline conditions.

Groundwater Monitoring. This activity would have no effect on baseline conditions.

Effect on Baseline. EPA determined that the action would have no effect on the baseline for streambank conditions.

13. WATERSHED CONDITIONS

13.1 Disturbance History

Soil Cap Monitoring. This activity would have no effect on baseline conditions.

Soil Cap Vegetation Maintenance. This activity would have no effect on baseline conditions.

Soil Cap Unplanned Maintenance. This activity would have no effect on baseline conditions.

Sediment Cap Monitoring. This activity would have no effect on baseline conditions.

Sediment Cap Sampling. This activity would have no effect on baseline conditions.

Sediment Cap Unplanned Maintenance. Any repairs to the sediment cap would require the use of armoring. However, these materials would be of a similar nature as the existing hardened substrate. As such, this activity would have no effect on baseline conditions.

Groundwater Remedy - NAPL Recovery. This activity would have no effect on baseline conditions.

Groundwater Monitoring. This activity would have no effect on baseline conditions.

Effect on Baseline. EPA determined that the action would have no effect on the baseline for disturbance history.

13.2 Riparian Reserves

Soil Cap Monitoring. This activity would have no effect on baseline conditions.

Soil Cap Vegetation Maintenance. This activity would have no effect on baseline conditions.

Soil Cap Unplanned Maintenance. This activity would have no effect on baseline conditions.

Sediment Cap Monitoring. This activity would have no effect on baseline conditions.

Sediment Cap Sampling. This activity would have no effect on baseline conditions.

Sediment Cap Unplanned Maintenance. This activity would have no effect on baseline conditions.

Groundwater Remedy - NAPL Recovery. This activity would have no effect on baseline conditions.

Groundwater Monitoring. This activity would have no effect on baseline conditions.

Effect on Baseline. EPA determined that the action would have no effect on the baseline for riparian reserves.

14. BENEFICIAL EFFECTS

EPA, through its responsibilities under CERCLA, has concluded that soil, sediment and groundwater at McCormick and Baxter are contaminated with hazardous substances. DEQ on behalf of EPA has constructed the soil and sediment caps and implemented the groundwater remedy, as specified in the ROD, in order to minimize further releases of hazardous substances and prevent unacceptable risks to human health and the environment.

In order to assure the protectiveness of the remedies, DEQ is required to provide long-term O&M of the remedies. There will be significant beneficial effects as a result of this action. Specifically, O&M is necessary to prevent the remedies from failing and resulting in further releases of hazardous substances and unacceptable risks to human health and the environment. The action will reverse the trend of continued degradation of the riverine environment.

There will also be a significant portion of the existing shoreline that will be improved or restored to more natural functions within the nearshore and riparian environment of the project site and Willamette Cove.

15. INTERRELATED AND INTERDEPENDENT EFFECTS

Interdependent actions are those that have no independent utility apart from the action being considered. Interrelated actions are activities that are part of the larger action and depend on the larger action for their justification.

The O&M assures that the soil cap (see 2005 BA), sediment cap (see 2003 BA) and groundwater remedy (see 2002 BA) remain effective and reliable at preventing further releases of hazardous substances and unacceptable risks to human health and the environment.

16. CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR part 402.02 as "those effects of future State or private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation." The action area for this project encompasses a significant portion of the Willamette River. This area is currently a disturbed riverine ecosystem altered by previous dredging, backfilling, sewage and industrial discharges, and other anthropogenic activities over the past 100 years. Future Federal actions, including additional clean-up activities, navigational dredging, and activities permitted under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act, would be reviewed under separate Section 7 consultation processes and are not considered cumulative effects.

The clean-up activities have the potential to increase public interest in the site for educational purposes, recreational activities, or other shoreline amenities. Activities requiring Federal permits or Federal funding will be subject to Section 7 review.

17. CONCLUSION

The action area has degraded baseline conditions. The proposed action would provide operation and maintenance of the cleanup remedies in order to assure their effectiveness and reliability in preventing further releases of hazardous substances and unacceptable risks to human health and the environment. The action would result in short-term and long-term degradation of several baseline indicators for water quality. The action also would result in long-term degradation of baseline indicators for habitat access and habitat elements. However, the degree of degradation would be minor. The action also would result in improvements to several indicators for water quality.

The action is in support of the overall efforts by EPA to contain a source of soil, sediment, and groundwater contamination thereby resulting in improved baseline conditions for certain aspects of habitat supporting threatened or endangered species.

The conservation measures proposed in Section 19 are intended to lessen the potential impacts of the proposed action.

17.1 Chinook Salmon (Lower Columbia River ESU, Upper Willamette River ESU)

Containment of the source of soil, sediment, and river contamination (NAPL) is the primary purpose of the soil cap, sediment cap, and groundwater remedy. Operation and maintenance of the cleanup remedies will assure their effectiveness and reliability in preventing further releases of hazardous substances and unacceptable risks to human health and the environment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

However, EPA acknowledges that the project would result in short-term degradation of baseline conditions for sediment/turbidity and water contamination, if the sediment cap needs repairs, and long-term degradation of baseline conditions for water temperature, physical barriers, and shallow water habitat. There is also potential risk of direct harm through exposure to herbicides or placement of fill. If additional repairs to the cap are necessary, a permanent loss of a small amount of shoreline beach habitat could occur. Given the more recent observations of chinook salmon utilizing beach habitats and the growth increases observed for chinook migrating through the lower river (Friesen 2005), loss of shoreline habitat could have an adverse impact on salmon. It is EPA's determination that the project **may adversely affect Chinook salmon.**

17.2 Steelhead (Lower Columbia River ESU, Upper Willamette River ESU)

Containment of the source of soil, sediment, and river contamination (NAPL) is the primary purpose of the soil cap, sediment cap, and groundwater remedy. Operation and maintenance of the cleanup remedies will assure their effectiveness and reliability in preventing further releases of hazardous substances and unacceptable risks to human

health and the environment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

However, EPA acknowledges that the project would result in short-term degradation of baseline conditions for sediment/turbidity and water contamination, if the sediment cap needs repairs, and long-term degradation of baseline conditions for water temperature, physical barriers, and shallow water habitat. In addition, there is potential risk of direct harm through exposure to herbicides or placement of fill. It is EPA's determination that the project **may adversely affect steelhead.**

17.3 Columbia River Chum Salmon

Containment of the source of soil, sediment, and river contamination (NAPL) is the primary purpose of the soil cap, sediment cap, and groundwater remedy. Operation and maintenance of the cleanup remedies will assure their effectiveness and reliability in preventing further releases of hazardous substances and unacceptable risks to human health and the environment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

However, EPA acknowledges that the project would result in short-term degradation of baseline conditions for sediment/turbidity and water contamination, if the sediment cap needs repairs, and long-term degradation of baseline conditions for water temperature, physical barriers, and shallow water habitat. In addition, there is potential risk of direct harm through exposure to herbicides or placement of fill. It is EPA's determination that the project **may adversely affect chum salmon.**

17.4 Lower Columbia River Coho Salmon

Containment of the source of soil, sediment, and river contamination (NAPL) is the primary purpose of the soil cap, sediment cap, and groundwater remedy. Operation and maintenance of the cleanup remedies will assure their effectiveness and reliability in preventing further releases of hazardous substances and unacceptable risks to human health and the environment. The project's long-term effects will help improve and restore salmon habitat in the Willamette River.

However, EPA acknowledges that the project would result in short-term degradation of baseline conditions for sediment/turbidity and water contamination, if the sediment cap needs repairs, and long-term degradation of baseline conditions for water temperature, physical barriers, and shallow water habitat. In addition, there is potential risk of direct harm through exposure to herbicides or placement of fill. Given the more recent observations of coho salmon utilizing near shore areas and spending relatively long periods of time in the Lower Willamette River (Friesen 2005), permanent loss of shoreline habitat could have an adverse impact on coho salmon. It is EPA's determination that the project **may adversely affect coho salmon.**

18. PROPOSED CRITICAL HABITAT

NOAA Fisheries filed proposed rules in the Federal Register on 20 November 2004 to designate critical habitat areas for a number of populations of salmon and steelhead. The salmon and steelhead populations are listed in the following: (1) Puget Sound Chinook salmon; (2) LCR Chinook salmon; (3) Upper Willamette River Chinook salmon; (4) Upper Columbia River spring-run chinook salmon; (5) Oregon Coast coho salmon; (6) Hood Canal summer-run chum salmon; (7) Columbia River chum salmon; (8) Ozette Lake sockeye salmon; (9) Upper Columbia River steelhead; (10) Snake River Basin steelhead; (11) Middle Columbia River steelhead; (12) LCR steelhead; and (13) Upper Willamette River steelhead. At this time, there is no critical habitat designated for the LCR Coho Salmon.

The proposed designations look at certain factors called "primary constituent elements" (PCEs) that are essential to support one or more of the life stages of salmon. The PCEs consist of the following habitats:

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
2. Freshwater rearing sites with:
    - water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;
    - water quality and forage supporting juvenile development;
    - natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival;
4. Estuarine areas free of obstruction and excessive predation with:
    - water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater;
    - natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels;
    - juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.
5. Nearshore marine areas free of obstruction and excessive predation with:
    - water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation;
    - natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.
6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

The areas of critical habitat proposed in 50 CFR Part 226 for the project area includes the following:

1. Lower Columbia River Chinook Salmon ESU
   - Critical Habitat Lower Willamette Subbasin (Unit 10)
   - Rearing/Migration Corridor (Unit 11)
2. Upper Willamette River Chinook Salmon ESU
   - Rearing/Migration Corridor (Unit 11)
3. Lower Columbia River Steelhead ESU
   - Critical Habitat Lower Willamette Subbasin (Unit 9)
4. Upper Willamette River Steelhead ESU
   - Rearing/Migration Corridor (Unit 8)

The analysis and findings of impacts to proposed critical habitat are contained in Appendix B of this document.

19. CONSERVATION MEASURES

The following conservation measures will reduce or eliminate potential impacts to the listed anadromous fish species.

In-Water Work Window. Repairs to the sediment cap will be completed within the in-water work period July 1 through October 31, and December 1 through January 31. If it becomes necessary to perform repairs during other times, EPA will request approval in writing by biologists from NMFS.

Minimization of Work Area. Construction impacts will be confined to the minimum area necessary to complete the project.

Biological Monitoring. A biological monitoring and reporting program will be developed and employed prior to repairs being made to the sediment cap to ensure measures provided in this Biological Assessment and the ensuing Biological Opinion are effective in minimizing the likelihood of take from permitted activities. In implementing the monitoring and reporting program, an environmental professional will monitor and document on a daily basis the conditions of the shoreline and nearshore area during construction. Furthermore, a qualified biologist will oversee work performed by the environmental professional.

Water Quality Monitoring and Turbidity Standards. The sediment cap repair contractor will be required to adhere to water quality protections and other conditions found in EPA's Water 401 Quality Certification for Sediment Cap Remedial Action at the McCormick & Baxter Creosoting Company Site (EPA 2004a). These measures are described in the **Water Quality Plan, Pollution and Erosion Control Plan** (see below).

Removal and Isolation of NAPL Sheens. The sediment cap repair contractor will be required provide sorbant booms, pads and other sorbant materials and vacuum pumps to remove and isolate any NAPL sheen resulting from construction activities. Oil absorbent materials will be employed if visible sheens are observed. The booms will remain in place until all oily material and floating debris has been collected and the sheens have dissipated.

Stoppage of Work. If an uncontrolled release of NAPL sheen is observed during sediment cap repairs, the existing protective measures would be reevaluated for efficacy.

If deemed necessary by the environmental professional, work may be stopped until the cause of the event is determined and work can be resumed without additional impacts.

Avoidance and Minimization of Water and Sediment Quality Impacts. All prudent and necessary steps be taken during sediment cap repairs to avoid and minimize potential water and sediment quality impacts. These will include strict contractor performance controls for all shoreline and in-water construction activities.

Composition of Sediment Cap Repair Materials. Sediment cap repair material will not contain detectable levels of organic contaminants and will have background level concentrations of metals. Use of riprap armoring will be avoided to the extent practicable.

Placement of Sediment Cap Repair Materials. Sediment cap repair materials will be placed in a controlled and accurate manner. Armor stone will be placed in a manner that does not disrupt or penetrate the other cap components.

Large Woody Debris. Large Woody Debris within the sediment cap repair area will be moved carefully and returned to its original location after construction.

Heavy Equipment. Land-based heavy equipment use will be restricted as follows.

I. When heavy equipment is required, it will be equipment having the least impact to the existing sediment cap and riverine environment (e.g., minimally-sized, rubber-tired).
II. Heavy equipment will be fueled, maintained and stored as follows.
    a. Place vehicle staging, maintenance, refueling, and fuel storage areas a minimum of 150 feet horizontal distance from the Willamette River. Exceptions may be made for cranes and other very slow-moving equipment; these vehicles may be refueled in place but will have containment measures in place that meet or exceed 100% containment.
    b. All vehicles operated within 150 feet of the Willamette River will be inspected daily for fluid leaks before leaving the vehicle staging area. Any leaks detected will be repaired before the vehicle resumes operation.
    c. When not in use, vehicles will be stored in the vehicle staging area with the exception of cranes and other very slow-moving vehicles.

Pesticide Use. Pesticide use will be limited in type and extent, as described in the proposed action.

Water Quality Plan, Pollution and Erosion Control Plan. Prior to performing repairs to the sediment cap, the construction contractor and/or construction oversight consultant

will be required to prepare and carry out a pollution and erosion control plan to prevent increased turbidity. The plan will be made available for inspection on request by NMFS. The pollution and erosion control plan will contain the pertinent elements listed below.

I. The names and address of the party(s) responsible for accomplishment of the water quality and pollution and erosion control plan.
II. Describe methods or best management practices (BMPs) that will be used to minimize turbidity increases as a result of placement of cap materials, or resuspension of river sediment that may have deposited over previously capped areas. Silt curtains and floating booms will be deployed, as necessary, during placement of the cap (including sand, clay, rock and ACB) to maintain the water quality standards described below. All materials will be placed by equipment such as a clamshell bucket to control placement and minimize disturbance to the existing sediment or new cap materials.
III. As specified in EPA's Water Quality 401 Certification, cap materials will be placed in a manner that does not result in exceedance of the following turbidity criteria at a distance of 100 feet downstream from the turbidity-causing activity:
    a. Turbidity shall be no greater than 5 NTU over background turbidity when background is 50 NTU or less; or
    b. No more than 10% increase in turbidity when background turbidity is more than 50 NTU.
    c. Background turbidity shall be established by collecting seven independent turbidity measures, at a minimum, during a two-day period before construction. Mean turbidity values will be used to represent background.
IV. Turbidity will be monitored during active in-water work with a turbidity meter that is calibrated daily (calibration measures must be documented and available for review upon request). Monitoring points will be an undisturbed site 100 feet upstream of the activity and 100 feet downstream from the fill point. In addition, monitoring points at the point of discharge will be collected at the bottom, midlevel, and top of the water column.
V. Turbidity will be measured and recorded at least once every four hours during in-water work. The first sample of the day will be taken four hours after the initiation of the in-water activity, and once at each four-hour interval thereafter. If the turbidity criteria are exceeded, work will not proceed until the turbidity level has dropped to an acceptable level.
VI. Visual monitoring also will occur at least once every four hours during in-water work. If, at any time, the visual turbidity levels are estimated to be approaching the turbidity exceedance level, field-testing will be performed. If field testing confirms turbidity criteria exceedances, then the contractor will cease operations responsible for causing the elevated turbidity.
VII. Daily turbidity measurements will be emailed or faxed to NMFS, including information identifying all sampling locations.
VIII. The BMPs will be evaluated and modified (when applicable) throughout the construction period to assure that the water quality standards are met. BMP modifications may include deployment of addition sediment control devices, if it is determined that there may be difficulty meeting turbidity requirements. If

isolation of in-water work area (see below) is necessary, ESA consultation will be reinitiated to ensure appropriate fish exclusion practices (see below – Capture and Release) are followed.

IX. A description of the hazardous products or materials that will be used, including inventory, storage, handling, and monitoring.

X. A spill containment and control plan with notification procedures, specific clean up and disposal instructions for different products, quick response containment and clean up measures will be available on site, proposed methods for disposal of spilled materials, and employee training for spill containment.

Isolation of In-Water Work Area. If the in-water work area requires isolation in order to maintain the turbidity criteria described above, the work area will be isolated using inflatable bags, sandbags, 10-inch-minus rock, sediment curtains or similar materials. All listed salmonids trapped within the isolation area will be removed and placed in the actively-flowing river using methods described below.

Capture and Release. If the in-water work area requires isolation in order to maintain the turbidity criteria described above, attempts will be made to capture and release fish from the isolated area using trapping, seining, electrofishing or other methods as are prudent to minimize risk of injury.

I. The entire capture and release operation will be conducted or supervised by a fishery biologist experienced with work area isolation and competent to ensure the safe handling of all ESA-listed fish.

II. Methods of fish capture will primarily involve beach seining and/or electrofishing.

III. Electrofishing will not be performed if water temperatures exceed 18 °C.

IV. If electrofishing equipment is used to capture fish, the contractor will comply with NOAA Fisheries' electrofishing guidelines (NMFS 2000).

V. ESA-listed fish will be handled with extreme care, keeping fish in water to the maximum extent possible during seining and transfer procedures to prevent the added stress of out-of-water handling.

VI. Fish will be transported in aerated buckets or tanks.

VII. Fish will be released into a safe release site as quickly as possible, and as near as possible to capture sites.

VIII. ESA-listed fish will not be transferred to anyone except NMFS personnel, unless otherwise approved in writing by the NMFS.

IX. All other Federal, state, and local permits necessary to conduct the capture and release activity will be attained.

X. NMFS or its designated representative will be allowed to accompany the capture team during the capture and release activity, and to inspect the team's capture and release records and facilities.

Construction Monitoring Report. A construction monitoring report describing EPA's success in meeting the conservation measures will be provided to NMFS within 30 days following the completion of capping repairs. This report will consist of the following information.

I. Project identification.
II. Photographic documentation of environmental conditions at the project site before, during, and after project completion. Each photograph will be labeled with the date, time, photo point, project name, the name of the photographer, and a comment describing the photograph's subject.
III. Isolation of in-water work area, capture and release.
    a. Supervisory fish biologist - name and address.
    b. Methods of work area isolation and take minimization.
    c. Stream conditions before, during, and within one week after completion of work area isolation.
    d. Means of fish capture.
    e. Number of fish captured by species.
    f. Location and condition of all fish released.
    g. Any incidence of observed injury or mortality of listed species.
IV. Narrative that briefly discusses project implementation and consistency with the conservation measures, with special attention to turbidity.

Annual O&M Report. O&M reports will be prepared annually by DEQ and its contractors. A copy of this report will be submitted to NMFS.

Five-Year Vegetation Monitoring Report. As required in NMFS's Biological Opinion for construction of the sediment cap, a five-year monitoring report that addresses planting success of the trees and shrubs planted along the Willamette River will be sent to NOAA Fisheries, Oregon State Habitat Office (NMFS 2004). This report will be issued by December 31, 2011.

Five-Year Review Report. The results of these O&M activities through this five year period will be evaluated as part of the Five-Year Review Report to be issued by the DEQ and EPA in October 2011. The O&M Plan will be updated following this Five-Year Review and subsequent Five-Year Reviews in order to assure the remedies are operated and maintained in a manner that is protective of human health and the environment. Additional protective measures may be implemented as a result of site monitoring and/or the development of new standards. This Five-Year Review Report will be made available to NMFS upon request.

Reporting of Dead, Injured or Sick ESA Species. If a dead, injured, or sick endangered or threatened species specimen is found, initial notification will be made to the National Marine Fishery Service Law Enforcement Office, Vancouver Field Office, 600 Maritime, Suite 130, Vancouver, Washington 98661; telephone: 360-418-4246. Care will be taken in handling sick or injured specimens to ensure effective treatment and care or the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death.

20. EFFECTS OF THE PROPOSED ACTION ON OTHER LISTED SPECIES

*20.1 Bald Eagle (*Haliaeetus leucocephalus*)*

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. Although bald eagles are within the action area, no bald eagle nests are within 1 mile of the project site. Survival and reproductive success of eagles would be unaffected.

Cumulative, Interrelated or Interdependent Effects. There would be no significant cumulative, interrelated or interdependent effects on this species from the proposed project in conjunction with other projects or actions.

Conservation Methods. None.

Effect Determination. The proposed action will have **no effect** on the bald eagle.

*20.2 Golden Paintbrush (*Castilleja levisecta*)*

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly affect areas known to support or potentially support individuals or populations of *C. levisecta.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects because of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *C. levisecta*

*20.3 Water Howellia (*Howellia aquatilis*)*

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly affect areas known to support or potentially support individuals or populations of *H. aquatilis.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects because of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Howellia aquatilis.*

20.4 Bradshaw's lomatium (Lomatium bradshawii)

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly affect areas known to support or potentially support individuals or populations of *L. bradshawii.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects because of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Lomatium bradshawii.*

20.5 Nelson's Checker Mallow (Sidalcea nelsoniana)

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly affect areas known to support or potentially support individuals or populations of *S. nelsoniana.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects because of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Sidalcia nelsoniana.*

20.6 Willamette Daisy (Erigeron decumbens var. decumbens)

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly affect areas known to support or potentially support individuals or populations of *E. decumbens.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects because of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Erigeron decumbens var. decumbens.*

*20.7 Kincaid's Lupine (*Lupinus sulphureus var. kincaidii*)*

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly affect areas known to support or potentially support individuals or populations of *L. sulphureus.*

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects because of this action.

Conservation Methods. None

Effect Determination. The action would have **no effect** on *Lupinus sulphureus var. kincaidii.*

*20.8 Oregon Spotted Frog (*Rana pretiosa*)*

Species and site use information can be found in the June 2002 Biological Assessment.

Analysis of Effects. The actions proposed for the project site would not directly or indirectly affect areas known to support or potentially support individuals or populations of Oregon spotted frog.

Cumulative, Interrelated or Interdependent Effects. There would be no cumulative, interrelated or interdependent effects because of this action.

Conservation Methods. None

Effect Determination. The action would **not result in jeopardy** for Oregon spotted frog.

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TABLE 1. EXPECTED CHANGES TO BASELINE CONDITIONS

INDICATOR	EFFECTS			
	Improve or Restore	Maintain	Degrade Short Term	Degrade Long Term
WATER QUALITY				
Temperature				X
Sediment/Turbidity		X	X	
Water Contamination	X		X	
Sediment Contamination	X			
HABITAT ACCESS				
Physical Barriers				X
HABITAT ELEMENTS				
LWD		X		
Shallow Water				X
CHANNEL CONDITIONS AND DYNAMICS				
Streambank Condition		X		
Floodplain Connectivity		X		
FLOW/HYDROLOGY				
Change in Peak/Base Flows		X		
Increase in Drainage Network		X		
WATERSHED CONDITIONS				
Disturbance History		X		
Riparian Reserves		X		

FIGURES

APPENDIX A ESSENTIAL FISH HABITAT

The project area has been designated as Essential Fish Habitat (EFH) for various life stages of Chinook and coho salmon, and starry flounder (*Platyichthys stellatus*). The Pacific Fisheries Management Council (PFMC) has designated EFH for federally managed fisheries within the waters of Washington, Oregon, and California. The designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line, and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon, and California, seaward to the boundary of the U.S. exclusive economic zone (PFMC 1998a, and 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years) (PFMC 1999).

Detailed descriptions and identifications of EFH for the groundfish species are found in the Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to the Pacific Groundfish Management Plan (PFMC 1998a) and the NOAA Fisheries Essential Fish Habitat for West Coast Groundfish Appendix (Casillas et al 1998). Detailed descriptions and identifications of EFH for salmon are found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the potential adverse effects to these species' EFH from the proposed action is based on this information.

EFH Considerations

The *Adverse Nonfishing Impacts and Recommended Conservation Measures* portions of the groundfish and coastal pelagic EFH appendices identify several impacts of filling projects on EFH. Those impacts include: (1) adverse effects on infaunal and bottom dwelling organisms; (2) changes to benthic habitats resulting from erosion, slumping, or lateral displacement of surrounding bottom deposits; (3) elevated turbidity which may impact aquatic vegetation or directly affect fish species; (4) changes to the chemistry and physical characteristics of the receiving water; and (5) loss of habitat function due to burial.

Essential Fish Habitat (EFH) for the Pacific coast salmon fishery is those waters and substrate necessary for salmon production needed to support a long-term sustainable fishery and salmon contributions to a healthy ecosystem. Important features of freshwater EFH for salmon are: (1) substrate composition; (2) water quality; (3) water quantity, depth, and velocity; (4) channel gradient and stability; (5) food; (6) cover and habitat complexity; (7) space; (8) access and passage; and (9) flood plain and habitat connectivity (PFMC 1999).

Effects of Proposed Action

EPA determined that the project would not result in degrading EFH. As such, EPA has determined that the proposed action will not adversely affect the EFH for starry flounder and Pacific salmon species (Chinook and coho salmon).

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APPENDIX B ADDENDUM FOR ESA CONSULTATION ON PROPOSED CRITICAL HABITAT

ADDENDUM FOR ESA CONSULTATION

ASSESSMENT OF IMPACTS TO CRITICAL HABITAT FOR

Lower Columbia River Chinook Salmon

Salmon Critical Habitat - Primary Constituent Elements

From 50 CFR Part 226

The primary constituent elements determined essential to the conservation of Lower Columbia River Chinook Salmon (*Oncorhynchus tshawytscha*) are as follows:

(1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

Existing Conditions: No spawning occurs, or is likely to occur, at the project site.

(2) Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

Existing Conditions: The project site is adjacent to shallow, near shore areas that may provide some limited rearing functions. The City of Portland noted that juvenile fish were holding in a protected embayment directly downstream of the project site, in the adjacent Willamette Cove. Conditions are similar enough in the near shore adjacent to the project site to assume some holding may occur here.

(3) Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Existing Conditions: The project site is adjacent to shallow, near shore areas that may provide resting areas for out-migrating juveniles. See (2) above.

(4) Estuarine areas free of obstruction with water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh-and

saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels, and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Existing Conditions: The project is not located in or near estuarine areas.

(5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulder and side channels.

Existing Conditions: The project is not located in or near nearshore marine areas.

(6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Existing Conditions: The project is not located in or near offshore marine areas.

Effects Analysis: The project will result in only slight modifications to the fresh water environment.

Determination of Effect: The project will not result in the destruction or adverse modification of critical habitat for this ESU.

Conservation Measures: Conservation measures are listed in Section 18 and are pertinent to any modification of critical habitat for this ESU.

ADDENDUM FOR ESA CONSULTATION

ASSESSMENT OF IMPACTS TO CRITICAL HABITAT FOR

Upper Willamette River Chinook Salmon

Salmon Critical Habitat - Primary Constituent Elements

From 50 CFR Part 226

The primary constituent elements determined essential to the conservation of Upper Willamette River Chinook Salmon are as follows:

(1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

Existing Conditions: No spawning occurs, or is likely to occur, at the project site.

(2) Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

Existing Conditions: The project site is adjacent to shallow, near shore areas that may provide some limited rearing functions. The City of Portland noted that juvenile fish were holding in a protected embayment directly downstream of the project site, in the adjacent Willamette Cove. Conditions are similar enough in the near shore adjacent to the project site to assume some holding may occur here.

(3) Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Existing Conditions: The project site is adjacent to shallow, near shore areas that may provide resting areas for out-migrating juveniles. See (2) above.

(4) Estuarine areas free of obstruction with water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh-and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels, and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Existing Conditions: The project is not located in or near estuarine areas.

(5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation;

and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulder and side channels.

Existing Conditions: The project is not located in or near nearshore marine areas.

(6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Existing Conditions: The project is not located in or near offshore marine areas.

Effects Analysis: The project will result in only slight modifications to the fresh water environment.

Determination of Effect: The project will not result in the destruction or adverse modification of critical habitat for this ESU.

Conservation Measures: Conservation measures are listed in Section 18 and are pertinent to any modification of critical habitat for this ESU.

ADDENDUM FOR ESA CONSULTATION

ASSESSMENT OF IMPACTS TO CRITICAL HABITAT FOR

Lower Columbia River Steelhead

Salmon Critical Habitat - Primary Constituent Elements

From 50 CFR Part 226

The primary constituent elements determined essential to the conservation of Lower Columbia River Steelhead are as follows:

(1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

Existing Conditions: No spawning occurs, or is likely to occur, at the project site.

(2) Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

Existing Conditions: The project site is adjacent to shallow, near shore areas that may provide some limited rearing functions. The City of Portland noted that juvenile fish were holding in a protected embayment directly downstream of the project site, in the adjacent Willamette Cove. Conditions are similar enough in the near shore adjacent to the project site to assume some holding may occur here.

(3) Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Existing Conditions: The project site is adjacent to shallow, near shore areas that may provide resting areas for out-migrating juveniles. See (2) above.

(4) Estuarine areas free of obstruction with water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh-and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels, and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Existing Conditions: The project is not located in or near estuarine areas.

(5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation;

and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulder and side channels.
Existing Conditions: The project is not located in or near nearshore marine areas.

(6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Existing Conditions: The project is not located in or near offshore marine areas.

Effects Analysis: The project will result in only slight modifications to the fresh water environment.

Determination of Effect: The project will not result in the destruction or adverse modification of critical habitat for this ESU.

Conservation Measures: Conservation measures are listed in Section 18 and are pertinent to any modification of critical habitat for this ESU.

ADDENDUM FOR ESA CONSULTATION

ASSESSMENT OF IMPACTS TO CRITICAL HABITAT FOR

Upper Willamette River Steelhead

Salmon Critical Habitat - Primary Constituent Elements

From 50 CFR Part 226

The primary constituent elements determined essential to the conservation of Upper Willamette River Steelhead are as follows:

(1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

Existing Conditions: No spawning occurs, or is likely to occur, at the project site.

(2) Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

Existing Conditions: The project site is adjacent to shallow, near shore areas that may provide some limited rearing functions. The City of Portland noted that juvenile fish were holding in a protected embayment directly downstream of the project site, in the adjacent Willamette Cove. Conditions are similar enough in the near shore adjacent to the project site to assume some holding may occur here.

(3) Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Existing Conditions: The project site is adjacent to shallow, near shore areas that may provide resting areas for out-migrating juveniles. See (2) above.

(4) Estuarine areas free of obstruction with water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh-and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels, and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Existing Conditions: The project is not located in or near estuarine areas.

(5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulder and side channels.

Existing Conditions: The project is not located in or near nearshore marine areas.

(6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

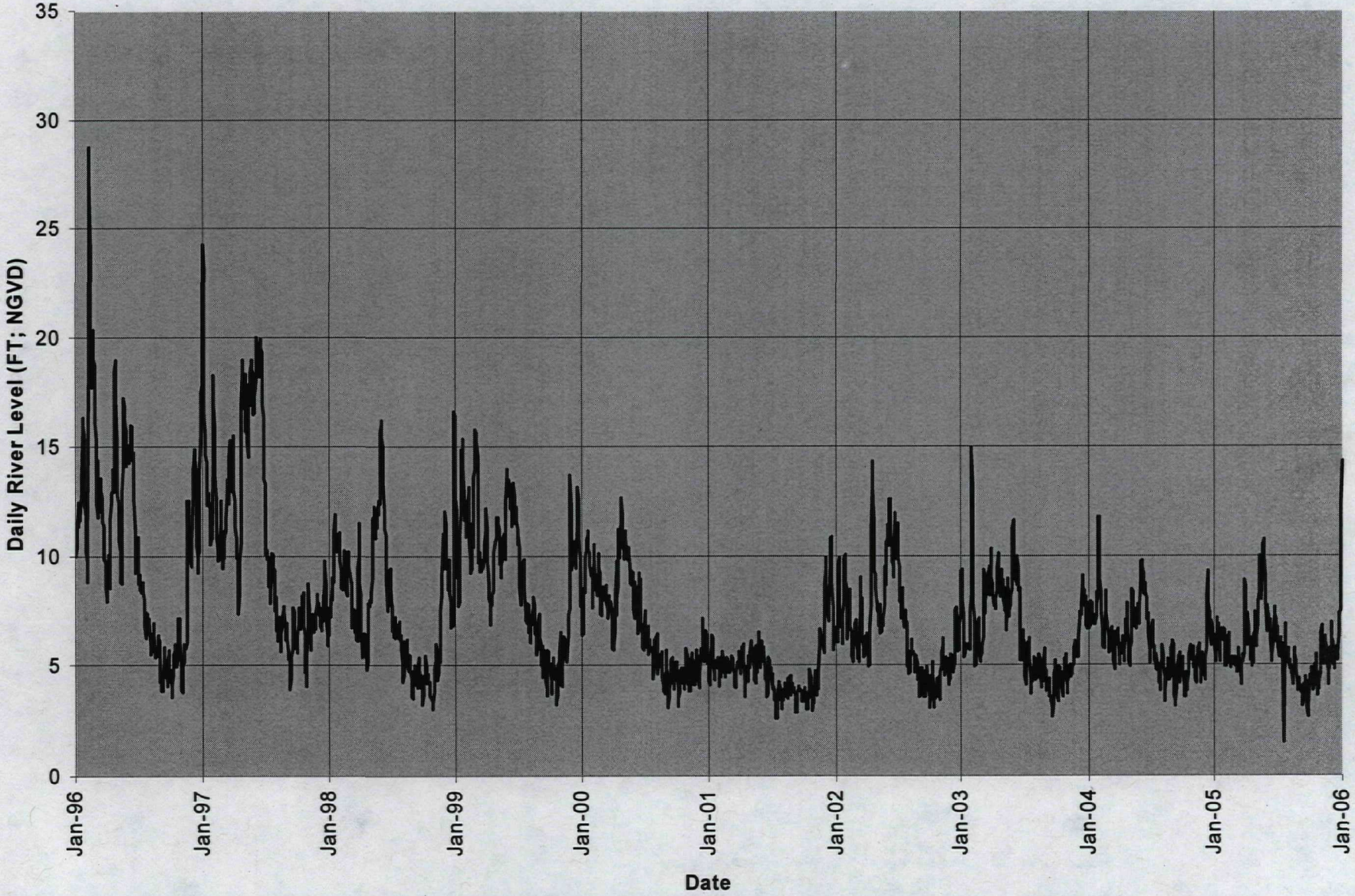
Existing Conditions: The project is not located in or near offshore marine areas.

Effects Analysis: The project will result in only slight modifications to the fresh water environment.

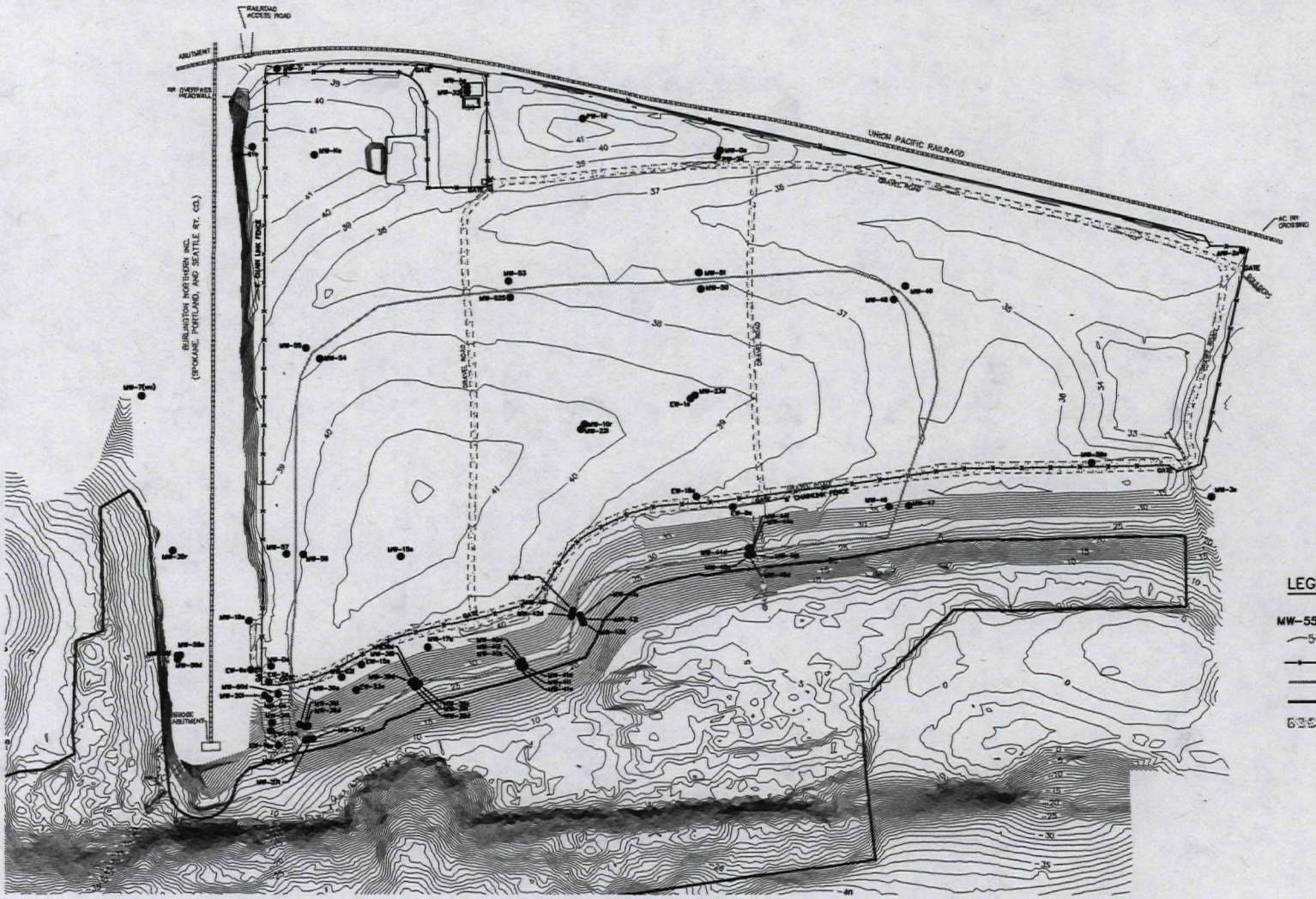
Determination of Effect: The project will not result in the destruction or adverse modification of critical habitat for this ESU.

Conservation Measures: Conservation measures are listed in Section 19 and are pertinent to any modification of critical habitat for this ESU.

Figure 6
River Levels (1996-2005)



Source of Data: Linda Baker (RETEC) email communication with Heidi Blischke (DEQ), January 7, 2006.
Daily average river levels at Morrison Bridge station maintained by USGS. To convert National Geodetic Vertical Datum (NGVD) to NAVD, add 3.5 feet.

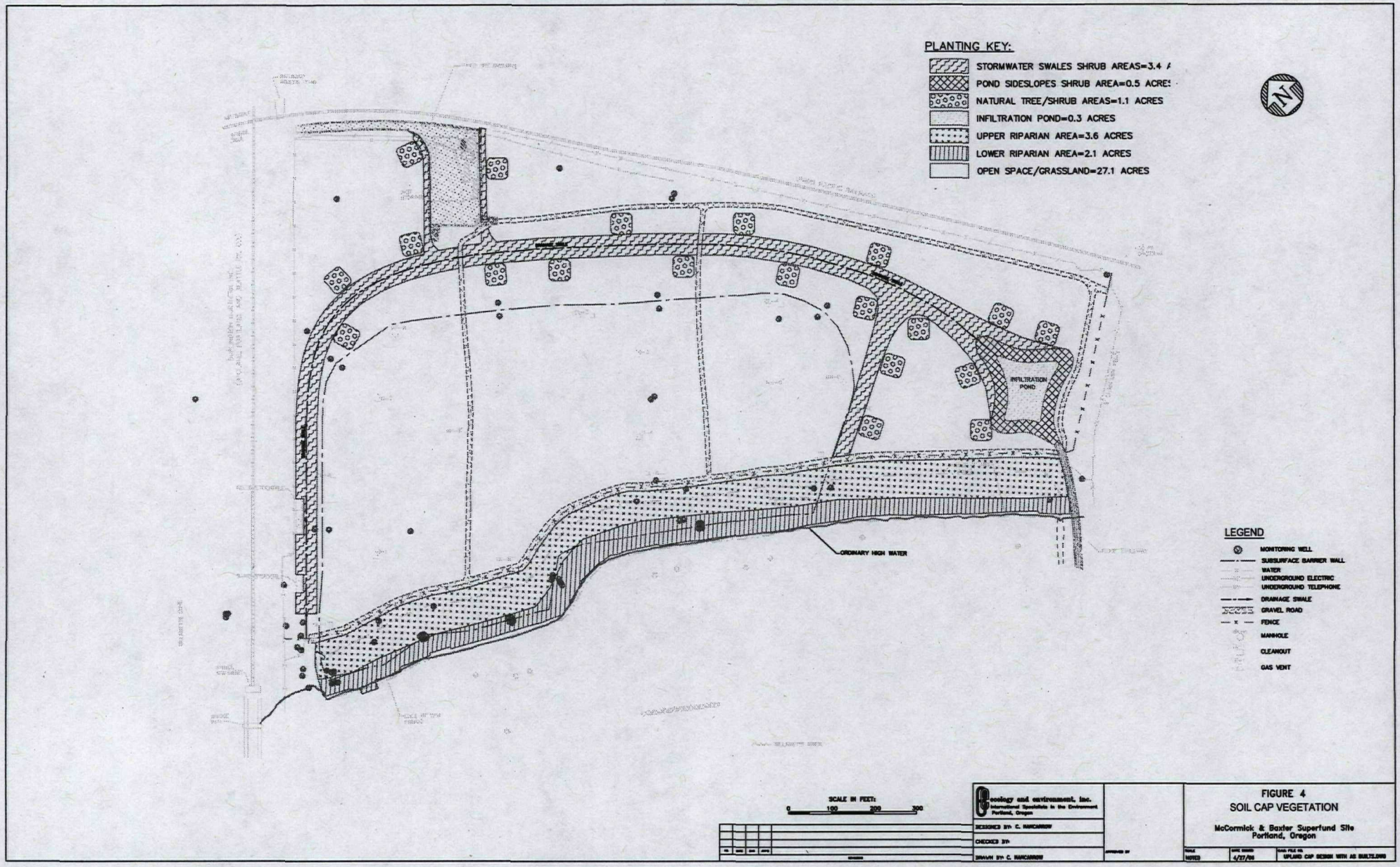


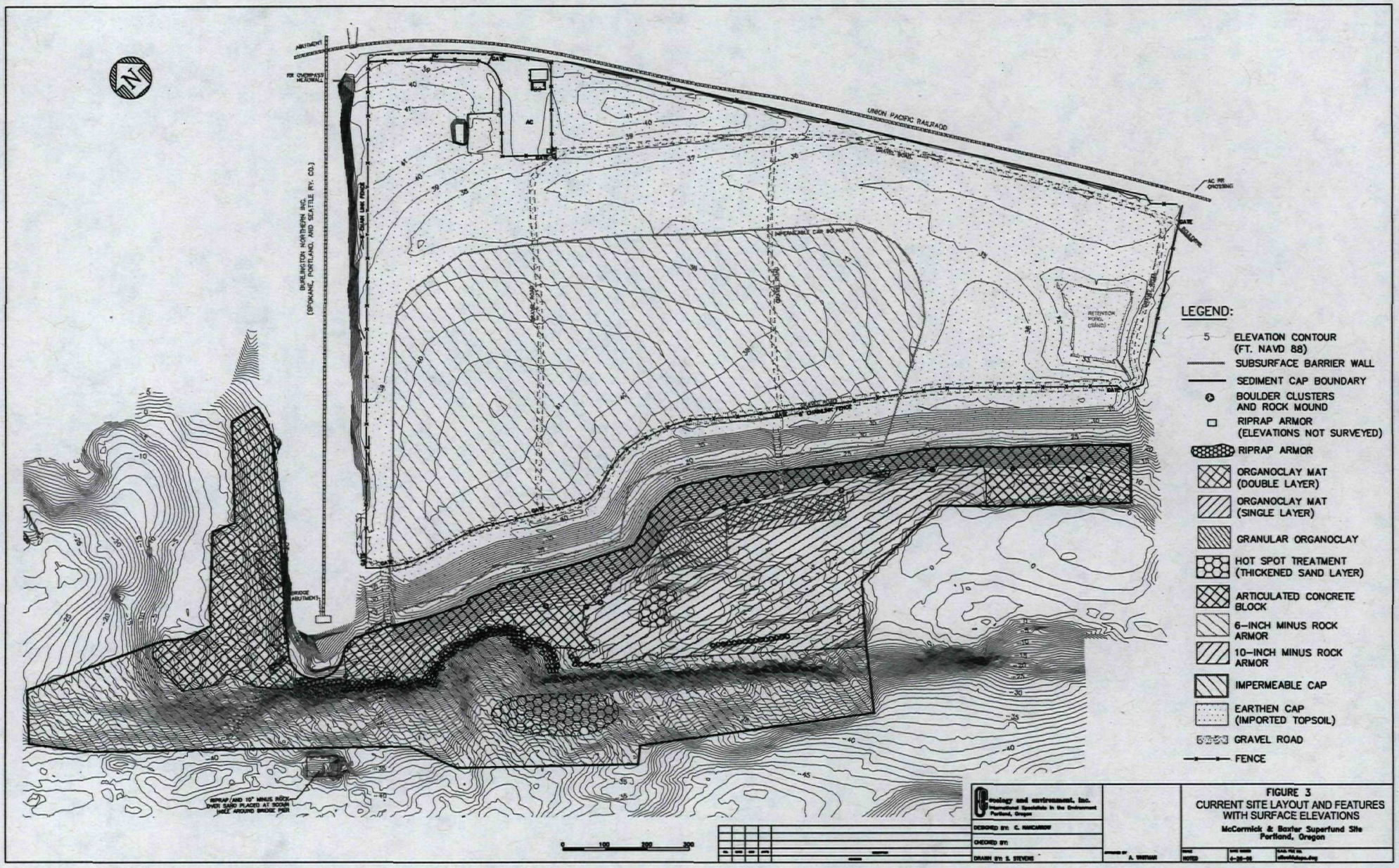
LEGEND:

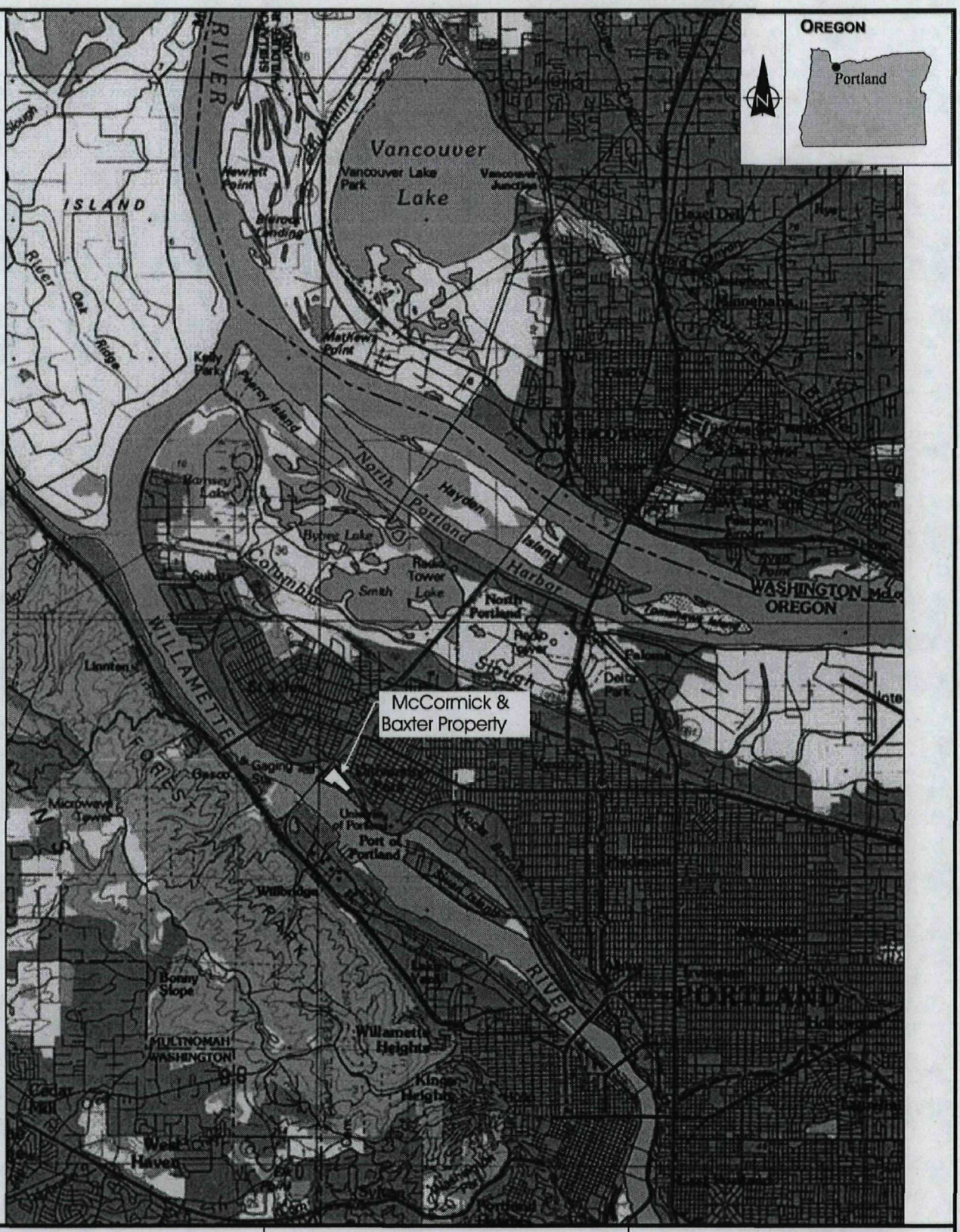
- MW-55 MONITORING WELLS
- 5 ELEVATION CONTOUR (FT. NAVD 88)
- FENCE
- SUBSURFACE BARRIER WALL
- SEDIMENT CAP BOUNDARY
- GRAVEL ROAD

0 100 200 300

Geology and environment, inc. International Specialists in the Environment Portland, Oregon		FIGURE 5 GW MONITORING AND EXTRACTION WELLS McCormick & Baxter Superfund Site Portland, Oregon	
DESIGNED BY: C. HANCARROW			
CHECKED BY:			
DRAWN BY: S. STEVENS	APPROVED BY: A. WHITMAN	SCALE: NOTED	DATE ISSUED: 6-26-96


PLANTING KEY:
STORMWATER SWALES SHRUB AREAS=3.4
POND SIDESLOPES SHRUB AREA=0.5 ACRES
NATURAL TREE/SHRUB AREAS=1.1 ACRES
INFILTRATION POND=0.3 ACRES
UPPER RIPARIAN AREA=3.6 ACRES
LOWER RIPARIAN AREA=2.1 ACRES
OPEN SPACE/GRASSLAND=27.1 ACRES
N
INFILTRATION POND
ORDINARY HIGH WATER
LEGEND
MONITORING WELL
SUBSURFACE BARRIER WALL
WATER
UNDERGROUND ELECTRIC
UNDERGROUND TELEPHONE
DRAINAGE SWALE
GRAVEL ROAD
FENCE
MANHOLE
CLEANOUT
GAS VENT
SCALE IN FEET:
0 100 200 300
geology and environment, inc.
International Specialists in the Environment
Portland, Oregon
DESIGNED BY: C. HANCARROW
CHECKED BY:
DRAWN BY: C. HANCARROW
APPROVED BY
FIGURE 4
SOIL CAP VEGETATION
McCormick & Baxter Superfund Site
Portland, Oregon
SCALE: NOTED
DATE ISSUED: 4/27/00
DWG FILE NO.: UPLAND CAP DESIGN WITH AS BUILTS.DWG


UNION PACIFIC RAILROAD
BURLINGTON NORTHERN INC.
(SPOKANE, PORTLAND, AND SEATTLE RY. CO.)
IMPERMEABLE CAP BOUNDARY
BRIDGE ABUTMENTS
RIPRAP AND 10" MINUS ROCK OVER SAND PLACED AT BOONA PIPE AROUND BRIDGE PIER
LEGEND:
ELEVATION CONTOUR (FT. NAVD 88)
SUBSURFACE BARRIER WALL
SEDIMENT CAP BOUNDARY
BOULDER CLUSTERS AND ROCK MOUND
RIPRAP ARMOR (ELEVATIONS NOT SURVEYED)
RIPRAP ARMOR
ORGANOCLAY MAT (DOUBLE LAYER)
ORGANOCLAY MAT (SINGLE LAYER)
GRANULAR ORGANOCLAY
HOT SPOT TREATMENT (THICKENED SAND LAYER)
ARTICULATED CONCRETE BLOCK
6-INCH MINUS ROCK ARMOR
10-INCH MINUS ROCK ARMOR
IMPERMEABLE CAP
EARTHEN CAP (IMPORTED TOPSOIL)
GRAVEL ROAD
FENCE
0 100 200 300
ecology and environment, inc.
International Specialists in the Environment
Portland, Oregon
DESIGNED BY: C. HANCARROW
CHECKED BY:
DRAWN BY: S. STEVENS
APPROVED BY: A. WATHAN
FIGURE 3
CURRENT SITE LAYOUT AND FEATURES WITH SURFACE ELEVATIONS
McCormick & Baxter Superfund Site
Portland, Oregon



ecology and environment, inc.
International Specialists in the Environment
Portland, Oregon

McCORMICK & BAXTER
CREOSOTING CO.
Portland, Oregon

Figure 1

SITE LOCATION MAP

Date:
2-21-03

10:001688OY021402\fig 1