MCBSF 3.2

U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington

Oregon Department of Environmental Quality
811 Southwest Sixth Avenue
Portland, Oregon

Record of Decision

McCormick and Baxter Creosoting Company
Portland Plant
Portland, Oregon

March 1996

#68893

RECORD OF DECISION
McCORMICK AND BAXTER CREOSOTING COMPANY
PORTLAND PLANT

THE DECLARATION

Site Name and Location
McCormick and Baxter Creosoting Company, Portland Plant
Portland, Oregon

Statement of Basis and Purpose

This decision document presents the selected final remedial actions for the McCormick and Baxter Creosoting Company, Portland Plant site (McCormick & Baxter or site) located in Portland, Oregon. This remedy was developed in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC §9601 *et seq.* (CERCLA), as amended by Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. This decision is based on the Administrative Record for this site.

The State of Oregon concurs with the selected remedy.

Assessment of the Site

The McCormick & Baxter site is located on the Willamette River in Portland, Oregon, and covers approximately 58 acres of terrestrial and aquatic land. The McCormick & Baxter Creosoting Company operated a wood-treating facility on a portion of the site from 1944 until 1991. Site contamination is primarily attributed to releases from these wood-treating activities and on-site disposal of wastes.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

This ROD addresses contaminated soil, groundwater, and sediment. The selected remedy is a series of remedial actions that address the principal threats at the site by treating the most highly contaminated soil, extracting nonaqueous phase liquid (NAPL) and treating contaminated groundwater, and capping the most highly contaminated sediment. These are considered to be the final actions needed to control the release of contaminants and reduce the risks to human health, welfare, and the environment from the site. The following are the major components of the selected remedy for each medium of concern:

Soil

- Excavation, consolidation, and on-site treatment of approximately 31,000 cubic yards of contaminated soil;
- Off-site treatment and disposal of approximately 1,000 cubic yards of the most highly contaminated soil which cannot effectively be treated on the site;
- Consolidation and capping of treated soil;
- Capping of the remaining portions of the site where soil contaminant concentrations exceed background concentrations and health-based protective levels; and
- Long-term monitoring, operation and maintenance, and institutional controls.

Groundwater

- Passive extraction of NAPL;
- Enhanced extraction of NAPL through pumping of contaminated groundwater;
- On-site treatment of contaminated groundwater;
- Discharge of treated groundwater to the Willamette River or the site as part of an enhanced NAPL recovery system;
- Off-site disposal or recycling of recovered NAPL and other groundwater treatment system residuals;
- A contingent remedy to install a subsurface vertical barrier to control NAPL migration, if necessary, or to increase the effectiveness of the NAPL/groundwater extraction system; and
- Long-term monitoring and institutional controls.

Sediment

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

Declaration

The selected remedy is protective of human health and the environment, attains federal and state requirements that are legally applicable or relevant and appropriate for this remedial action, and is cost effective. This remedy satisfies the statutory preference for remedies that employ treatment, that reduce toxicity, mobility, or volume as a principal element and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

Because this remedy will result in hazardous substances above health-based levels remaining on-site, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Langdon Marsh
Director
Oregon Department of Environmental Quality

Date 4/4/96

Chuck Clarke
Regional Administrator
United States Environmental Protection Agency
Region 10

Date 3/29/96

RECORD OF DECISION

FOR

FINAL REMEDIAL ACTION
McCORMICK AND BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

DECISION SUMMARY

MARCH 1996

RECORD OF DECISION
McCORMICK AND BAXTER CREOSOTING COMPANY
PORTLAND PLANT
DECISION SUMMARY

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ABBREVIATIONS AND ACRONYMS

ACL	alternate concentration limit
ACZA	ammoniacal copper zinc arsenate
AOC	area of contamination
ARAR	applicable or relevant and appropriate requirement
AWQC	ambient water quality criteria
bgs	below ground surface
CAMU	corrective action management unit
CCA	chromated copper arsenate
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cfs	cubic feet per second
CWA	Clean Water Act
DEQ	Oregon Department of Environmental Quality
DNAPL	dense nonaqueous-phase liquid
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
HI	Hazard Index
IRA	interim remedial action
LDR	land disposal restriction
LNAPL	light nonaqueous-phase liquid
LOAEL	lowest-observed-adverse-effect level
McCormick & Baxter	McCormick and Baxter Creosoting Company, Portland Plant
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MTR	minimum technology requirement
NAPL	nonaqueous-phase liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NGVD	National Geodetic Vertical Datum
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RPE	relative potency estimates
SARA	Superfund Amendments and Reauthorization Act
SVOC	semivolatile organic compound
TAG	technical assistance grant
TBC	*to be considered*
TCLP	toxicity characteristic leaching procedure
TEC	toxic equivalent concentration

TLC	thin-layer chromatography
TSD	treatment, storage, and disposal
UCL	Upper confidence limit
USACE	U.S. Army Corps of Engineers
UV	ultraviolet
WAKE-UP	Willamette Associates for Kindness to the Environment in University Park
WRD	Oregon Water Resources Department
XRF	x-ray fluorescence

RECORD OF DECISION
McCORMICK AND BAXTER CREOSOTING COMPANY
PORTLAND PLANT

DECISION SUMMARY

1.0 SITE NAME, LOCATION, AND DESCRIPTION

1.1 Site Name and Location

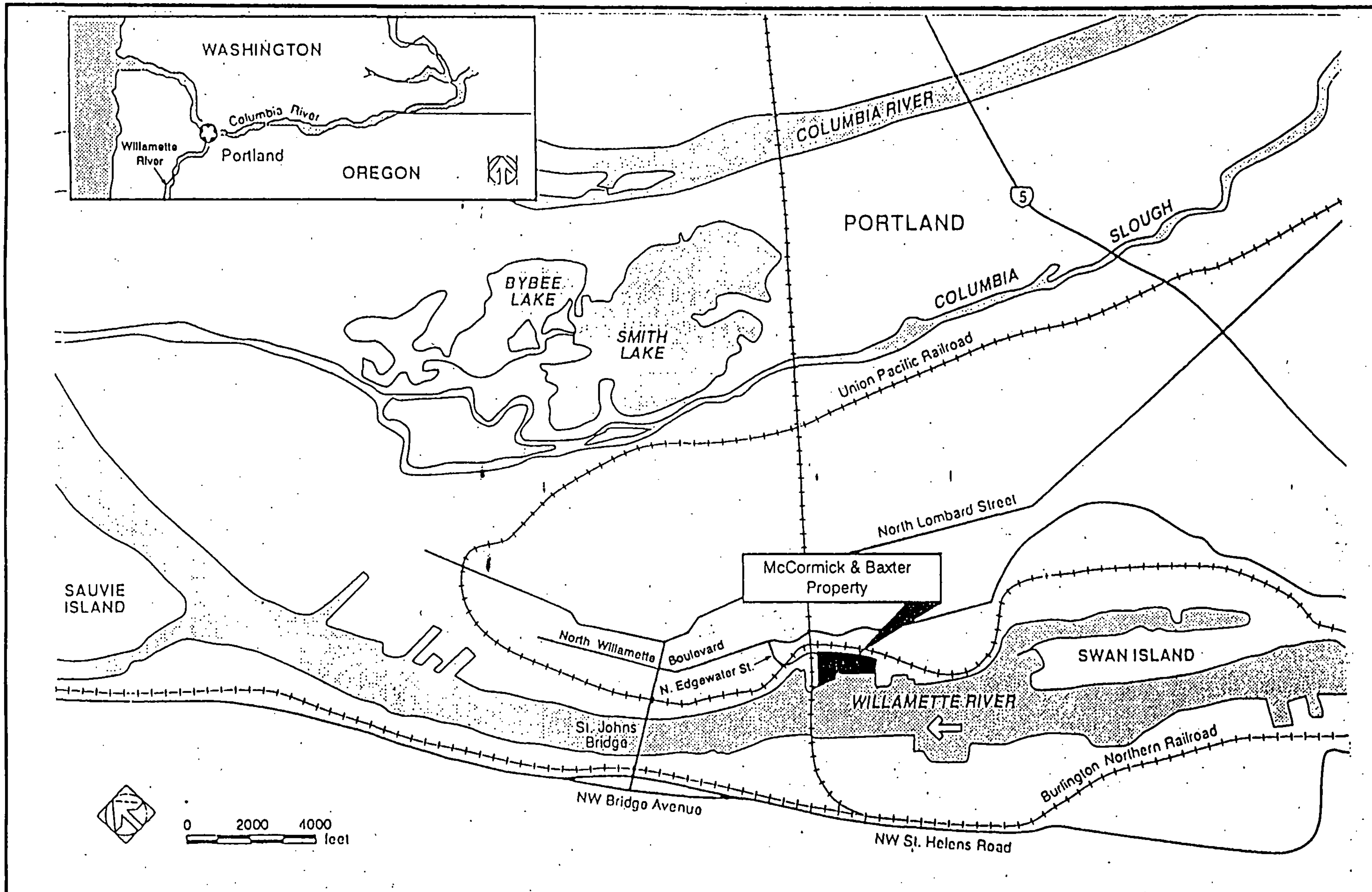
The McCormick and Baxter Creosoting Company, Portland Plant site (McCormick & Baxter or site) covers approximately 58 acres of terrestrial and aquatic land and is located on the east bank of the Willamette River in Portland, Oregon (Figure 1-1). The site is downstream of Swan Island and upstream of the St. John's Bridge and is located in an area that was constructed using dredged material in the early 1900s. The site, which can be accessed from North Edgewater Street, consists of approximately 43 acres on land and 15 acres in the river. It is generally flat, and lies between a 120-foot-high bluff along the northeastern border and a 20-foot-high bank along the Willamette River to the southwest (Figure 1-2). A sandy beach is exposed at the base of the bank except during periods of high river stage (generally late winter or early spring). The site is bordered by industrial properties to the south, the Willamette River to the west, Burlington Northern Sante Fe Railroad tracks to the north, and Union Pacific Railroad tracks and a residential area on top of the bluff to the east.

1.2 Site Description

The current configuration of the McCormick & Baxter property is shown in Figure 1-3. The McCormick & Baxter property is accessed via the partially-paved North Edgewater Street which leads from Willamette Boulevard to the main gate in the northwest corner of the site. The driveway leading into the property and the parking lot are paved; the remainder of the property is unpaved, covered with gravel, or vegetated. There are an office building, a laboratory, a former shop building (currently used to house the water treatment plant), and several sheds remaining on the property. In addition, several process-related structures remain, including the foundation of demolished buildings, concrete retort sumps, concrete containment walls around the former location of the tank farm and creosote tank, and a creosote dock. A Burlington Northern Railroad spur (approximately 7,500 linear feet) crosses the western portion of the property. The entire perimeter of the McCormick & Baxter property is fenced, and warning signs are posted on the fence.

Three main contaminant source areas exist at the site: the former waste disposal area, the central process area, and the tank farm area (Figure 1-3). These areas are described below.

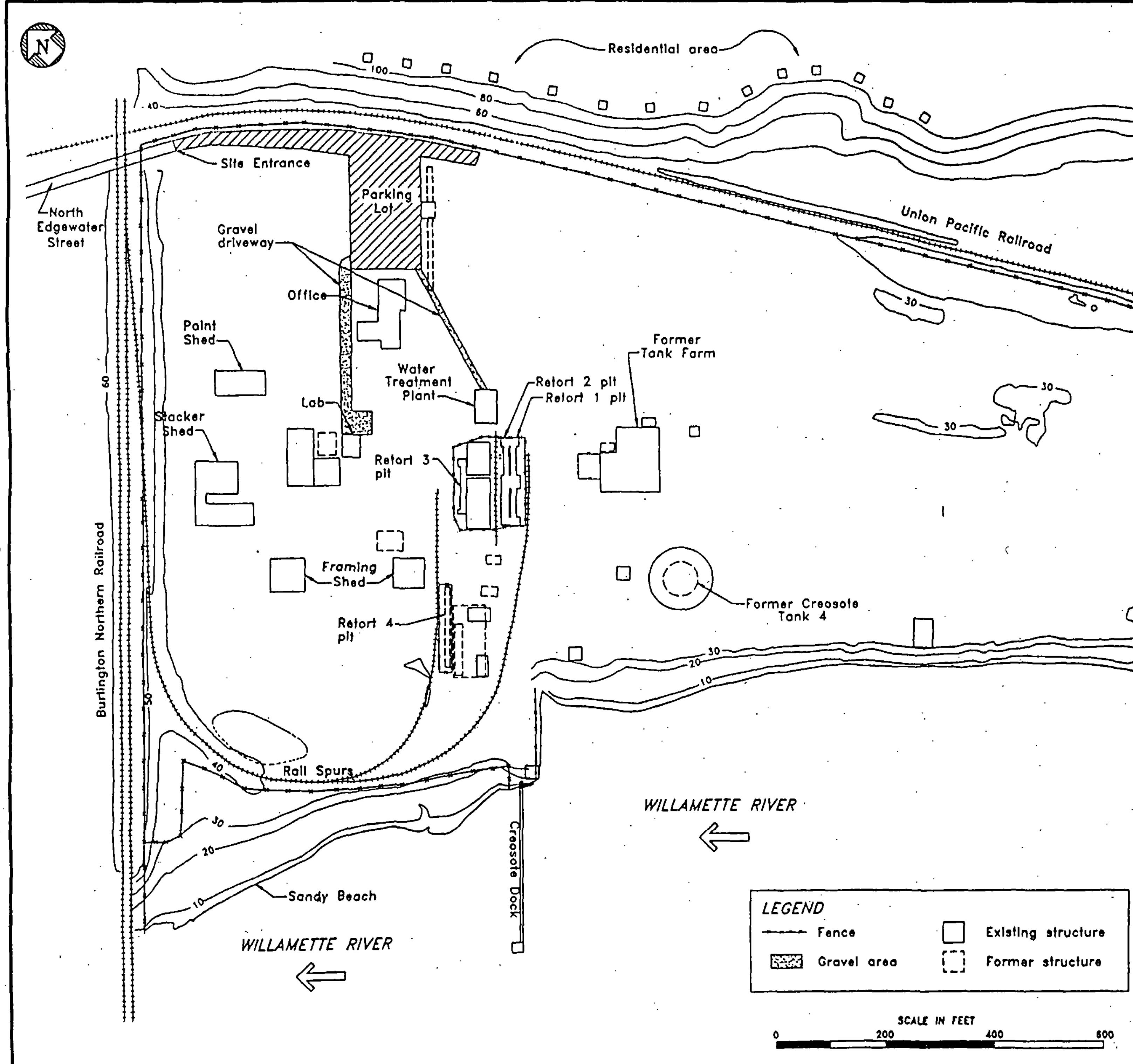
- The former waste disposal area is located at the western corner of the site adjacent to the Willamette River. This area is characterized by a large depression where waste oils, retort sludges, and wastewater were disposed over a period of several years. Based on historical aerial photographs, this former waste disposal area could have been as large as 0.4 acres.



McCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND PLANT, PORTLAND, OREGON

Figure 1-1
SITE LOCATION MAP

OU9023/WBDOR1-2.DWG/03-13-96/SEATTLE,WA./AUTOCAD OPR ED MARTIN



McCormick & Baxter Creosoting Company
Portland Plant
Portland, Oregon

FIGURE 1–2

PROPERTY FEATURES

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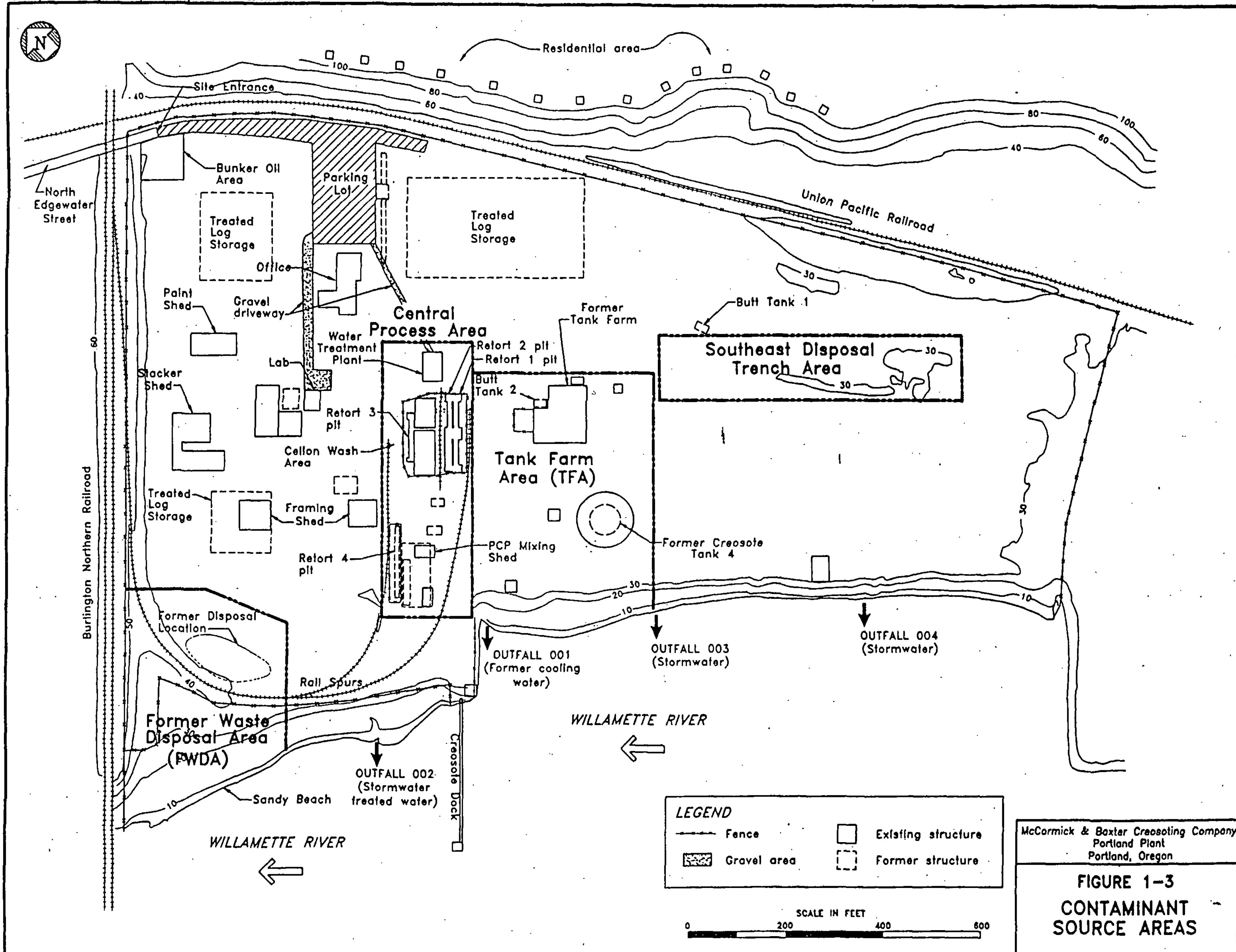

FIGURE 1-3
CONTAMINANT SOURCE AREAS

- The central process area is the present or former location of the retorts, pentachlorophenol (PCP) mixing shed, and ammoniacal copper zinc arsenate (ACZA) storage areas.

- The tank farm area is located in the central area of the site and is the former location of the main tank farm, the large creosote tank, and several other wood treatment process-related tanks or process areas.

Other source areas include the southeast disposal trench area, located southeast of the tank farm area, which received overflow of oily wastes from the system pits and tank farm; miscellaneous small waste disposal areas; and monitoring well MW-1 located near the entrance to the property. This well contains high concentrations of total aliphatic (generally bunker-range) hydrocarbons. However, it has been determined that the contaminants in this well are not the result of wood-treating activities; their source is unknown.

No registered historical landmarks or structures with historical significance have been identified at the site.

1.2.1 Topography

The McCormick & Baxter property (Figure 1-4) is located on a terrace, which is generally flat with surface elevations ranging from about 29 to 36 feet mean sea level (MSL [referenced to City of Portland datum]). The site is part of a larger industrial area that encompasses a former cooperage and shipyard on the northwest and Riedel International on the southeast. The Burlington Northern Railroad tracks that border the site on the northwest are located on an embankment that is elevated approximately 40 feet above the site. The northeast side of the site is bordered by Union Pacific Railroad tracks and a naturally formed, 120 foot-high bluff, that houses a residential area. A narrow, vegetated, 20-foot bank separates the site from the Willamette River on the southwest. A sandy beach is exposed at the base of the bank, except during periods in the late winter or early spring when higher river stages prevail (greater than 15 feet). Surveyed beach elevations generally range from 10 to 15 feet (MSL).

Elevations on the site are generally highest at the base of the 120-foot bluff, ranging from 30 to 36 feet, and gradually decrease toward the river. Elevations northwest of the central process area range from 33 to 36 feet, with the exception of the Burlington Northern Railroad spur line, which slopes down to the site from approximately a 40-foot elevation. Southeast of the central process area, elevations generally range from 29 to 33 feet. The lowest elevations on-site are along the southeastern fence line adjacent to the Riedel International property and in the southeast waste disposal trench.

The McCormick & Baxter site is located at River Mile 7 on the Willamette River. Along this reach, the river flows to the northwest and is about 1,500 feet wide. Channel sounding maps for January 1991 from the U.S. Army Corps of Engineers (USACE)indicate that adjacent to the site the channel is maintained at a width of approximately 600 feet, and to a maximum depth of approximately 40 to 50 feet below the Columbia River datum. The

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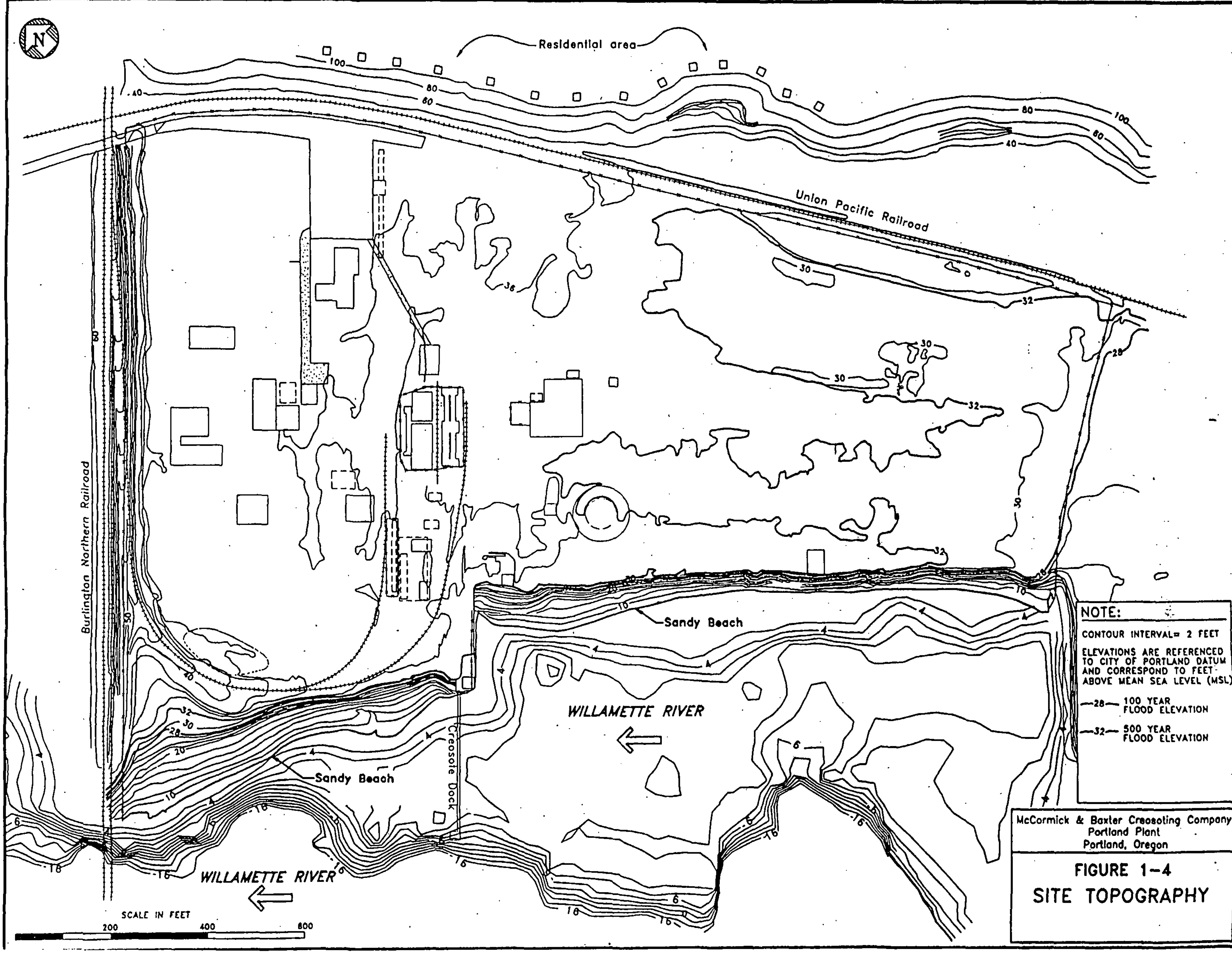

McCormick & Baxter Creosoting Company
Portland Plant
Portland, Oregon

FIGURE 1-4
SITE TOPOGRAPHY

Columbia River datum is 1.78 feet below the City of Portland datum that was used as a control for the site topographic survey. An additional 500 foot-wide embayment exists along the southern portion of the McCormick & Baxter property. River depths in the embayment range from +10 to -25 feet (City of Portland datum) northwest and southeast of the creosote dock. USACE maps indicate that steep slopes to the dredged navigational channel occur along a line approximately 100 to 200 feet southwest from the end of the creosote dock.

The elevation of the 100-year flood plain along this reach of the Willamette River is 28 feet NGVD (National Geodetic Vertical Datum 1929), and the elevation of the 500-year flood is 32 feet NGVD. The NGVD and the City of Portland datum are approximately equal at the site. A 100-year flood would rise up the bank to within a few feet of the terrace. A storm event of this magnitude occurred in February 1996. A 500-year flood would encroach onto the southeastern portion of the site, flooding most of the former untreated wood storage areas southeast of the tank farm and creosote tank.

1.2.2 Geology and Hydrogeology

The McCormick & Baxter site is located in an area of sand fill adjacent to the Willamette River. Three hydrostratigraphic units are present at the site: the shallow, intermediate, and deep aquifer zones, which are interconnected to varying degrees depending on the location within the site. Geologic cross-sections for the tank farm area and the former waste disposal area are illustrated in Figures 1-5 and 1-6, respectively.

The shallow unconfined sand fill aquifer is present across the entire site, and ranges in thickness from about 5 to greater than 30 feet. Depth of groundwater ranges from approximately 20 to 25 feet below ground surface (bgs). The base of the shallow aquifer is defined by a silt aquitard that ranges in thickness from 0 to greater than 100 feet. The silt aquitard is thickest near the central portion of the site (i.e., in the tank farm area) and thins toward the Willamette River. At the Willamette River, the silt aquitard is truncated and a thick sequence of poorly-graded sands extends from ground surface to at least 80 feet bgs. In this area, the aquifer zones are hydraulically connected and form a single continuous unconfined aquifer near the river boundary. Depth intervals along the river are referred to as shallow, intermediate, and deep zones of a single aquifer that are separated landward into distinct aquifers.

The intermediate aquifer is composed of fine- to medium-grained alluvial sand and is present below the silt aquitard. The intermediate aquifer varies in thickness from 0 to greater than 50 feet. In the central process area, the intermediate aquifer is approximately 12 feet thick and is hydraulically separated from the shallow aquifer. In the tank farm area, the silt aquitard is greater than 100 feet thick and no intermediate aquifer is present. In other portions of the site, the intermediate zone is separated from the shallow zone by a thin silt aquitard and the intermediate zone is up to 50 feet or more in thickness. In these areas, the intermediate and deep zones are not separated by a continuous confining layer and apparently are in hydraulic connection.

The deep aquifer zone is present in all portions of the site. As previously discussed, the deep zone is in alluvial sands and is directly connected with the intermediate and shallow

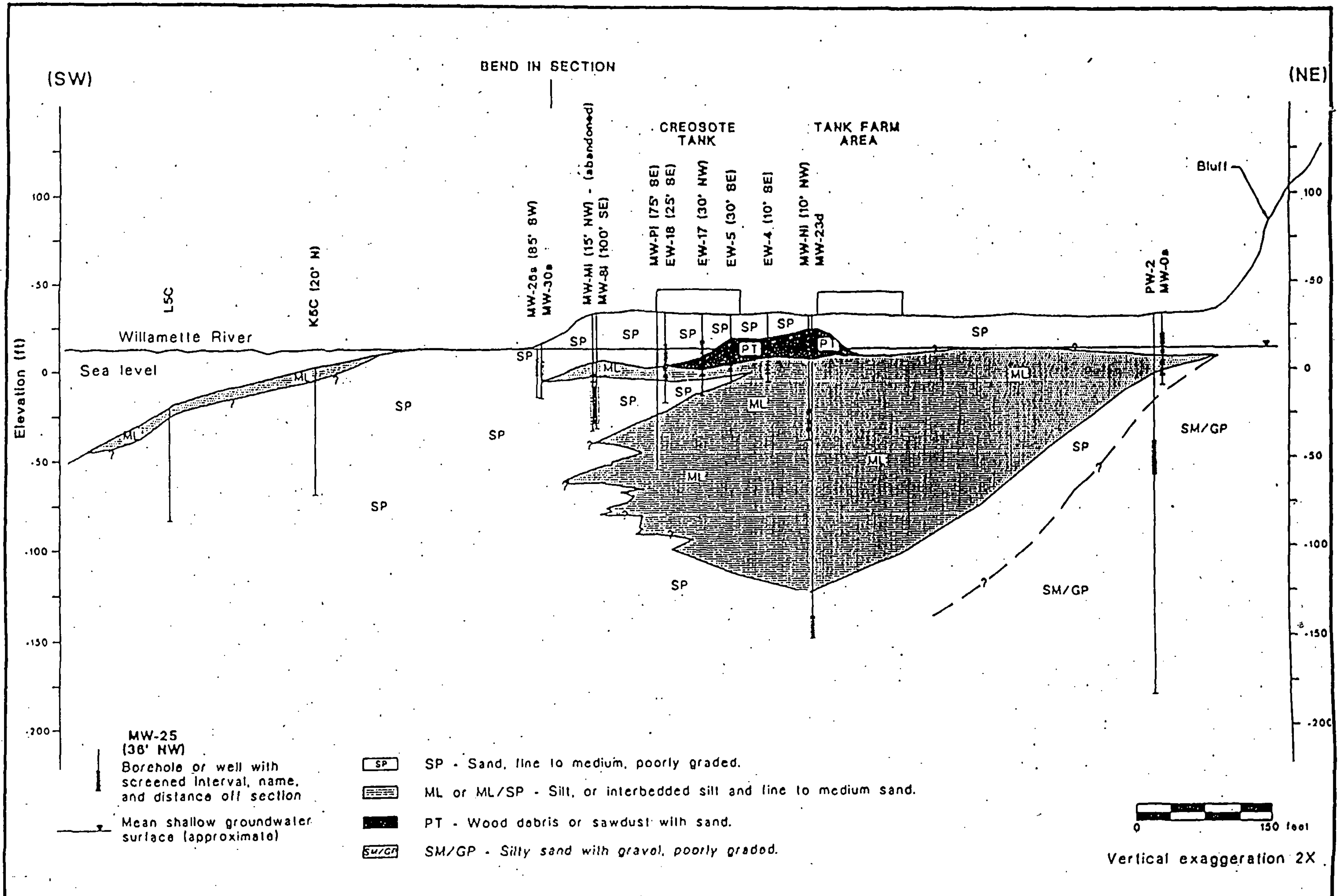

Figure 1-5 Generalized geologic cross-section at Tank Farm Area

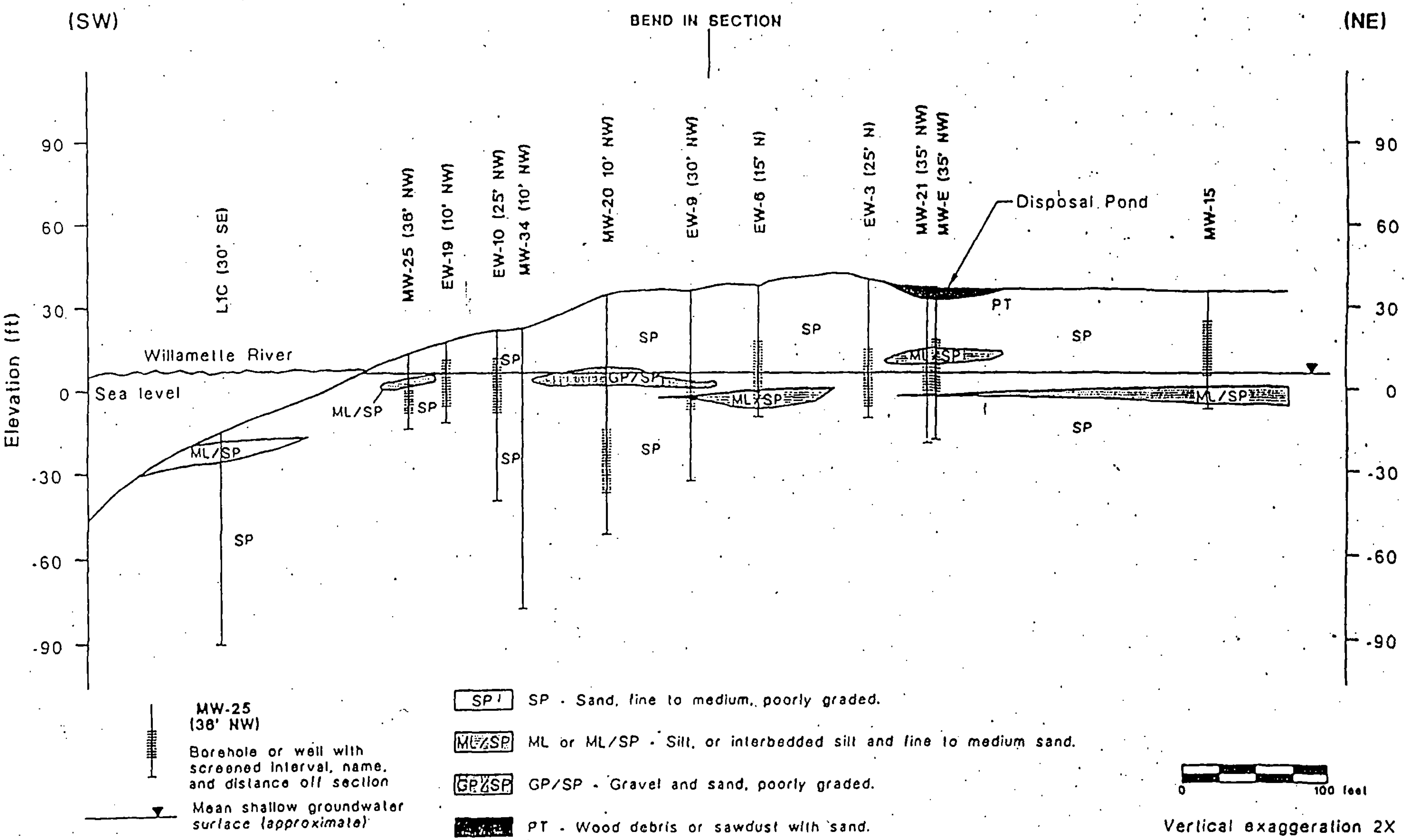

Figure 1-6 Generalized geologic cross-section at Tank Farm Area

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 aquifer 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 City of Portland supplies drinking water to residential areas in north Portland, including the site. The source of this drinking water is the Bull Run Reservoir located approximately 40 miles east of Portland. This water supply is supplemented by a well field in East Multnomah County (approximatley 10 miles east of the site) that uses deep aquifers completed in the Troutdale Formation. The only current use of groundwater in the vicinity of the site is by the University of Portland which operates a supply well for irrigation. This supply well is completed in the deep aquifer.

1.2.3 Surface Water

The Willamette River is the only surface water body at the site. Near the site, the river flows at a rate ranging from 8,300 cubic feet per second (cfs) in summer to 73,000 cfs in winter and is about 1,500 feet wide. The Willamette River is a major river that flows through Portland and joins the Columbia River approximately 7 miles north of the site. The Willamette River is not used as a drinking water source downstream of the site.

There are four outfalls (001 through 004 [see Figure 1-3]) on the McCormick & Baxter property. Historically, Outfall 001 was used to discharge noncontact cooling water to the river. Contact waste waters were also discharged from this outfall in the early years of wood-treating operations. Three storm water outfalls (002, 003, and 004) are also present on the property. Outfalls 001 and 002 were permitted under the National Pollutant Discharge Elimination System (NPDES). Following shutdown of the McCormick & Baxter facility, earthen berms were placed around storm water collection sumps to minimize off-site discharge through these outfalls. Currently, storm water at the site infiltrates into the subsurface. Groundwater treated in the on-site pilot treatment system is currently discharged to the river through Outfall 002.

1.2.4 Climate and Meteorology

The temperature in Portland area is generally mild with little precipitation during summer and spring. Winter is generally characterized by mild temperatures, cloudy skies, and frequent rain. Monthly average temperatures range from approximately 41°F in winter to approximately 70°F in summer. Daily minimum temperatures in January average 32°F; daily maximum temperatures in July average 79°F. Average annual precipitation for Portland is 37.6 in., with more than 76 percent of this falling between October and March. Monthly average relative humidity ranges from 65 to 84 percent.

Winds measured at the site average 4.7 mph. Monthly average wind speeds measured at the site were relatively constant, varying from 3 to 6 mph, but wind speeds were generally higher in the summer months than in the fall and winter.

Wind directions measured at the site were generally aligned with the Willamette River Valley. The predominate wind direction through much of the year was from the north-northwest. During the late fall and winter, however, winds shifted so that the wind direction was generally from the southeast. This same pattern is present in the Portland Airport data, although the directions are shifted slightly to reflect the differing orientations of the Columbia and Willamette river valleys.

1.2.5 Land Use

Land use at the site has been industrial since the 1940s and it has been projected to continue as industrial, or perhaps recreational, in the future. There are established railroad right-of-ways on two sides of the site, and it is anticipated that the area on top of the bluff will remain residential.

1.2.6 Rare and Endangered Species

The McCormick & Baxter property is a highly developed industrial area with little terrestrial wildlife habitat; however, numerous benthic (sediment dwelling), aquatic, and amphibian species have been observed at the site. The only federally endangered species observed at the site is the peregrine falcon *(Falco peregrinus)*.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 History of Plant Operations

The McCormick & Baxter property was created using dredged materials in the early 1900s. At that time, a sawmill operated on the southeast portion of the property. McCormick & Baxter Creosoting Company was founded in 1944 during World War II to produce treated wood products, including lumber, piling, timbers, and railroad ties. In 1945, one retort (a cylindrical chamber in which logs are pressure-treated) for coal tar-based creosote treatment was constructed. Treated logs were stored at three main locations (see Figure 1-3).

In 1953, a second retort for oil-based PCP treatment was constructed, and, in 1954, a third retort for water-based chrome treatment was added. After 1970, ammoniacal copper arsenate was used instead of chrome; ammoniacal copper arsenate was replaced by ammoniacal copper zinc arsenate (ACZA) in 1986. In 1968, a fourth retort for Cellon (pentachlorophenol, liquid butane, and isopropyl ether) treatment was added. Cellon treatment was discontinued in 1988.

Between 1945 and 1969, wastewater and cooling water were discharged into the Willamette River. Based on early site engineering drawings, the sump from Retort 1 was once connected to the river via a drainage line. It is not known when the drainage line was abandoned. In addition, prior to 1971, boiler water, storm water, and oily wastes were directed or discharged to a waste disposal trench in the southeast portion of the site. Contaminated soil was removed from this area in the mid-1980s.

Two major spills have reportedly occurred at the site: a 50,000-gallon release in the tank farm in approximately 1950 and a large (quantity unrecorded) spill of creosote from a tank car near the tank farm in 1956. Between 1950 and 1965, waste oil containing creosote and PCP was applied to soil to improve the structural stability to allow construction of tanks and other structures.

In 1971, an evaporator was installed to treat process wastewater. Noncontact cooling water continued to be discharged into the Willamette River through Outfall 001, and storm water was discharged to the river through Outfalls 002, 003, and 004. Storm water discharges from Outfalls 001 and 002 were authorized under an NPDES permit. The other storm water discharges were unpermitted and have been largely discontinued as a result of interim site stabilization activities conducted by Oregon Department of Environmental Quality (DEQ) in January 1992. Treated wood products were also placed in the river at various times prior to shipment. An area containing oily sediment near the creosote dock was reportedly dredged approximately "every 3 years" during the Vietnam War to allow access for loading ships. The disposal location of the dredged sediment is currently unknown.

Sludges from site processes were disposed off-site (at an unknown location) until 1968. From 1968 to 1971, residues from the retorts, oil/water separator, and evaporators were disposed on-site in the former waste disposal area (see Figure 1-3). Beginning in 1972, wood preservative sludges were stored in metal containers that were accumulated on-site in the former waste disposal area and near the retorts. After 1978, wood preservative sludges were shipped to a permitted hazardous waste disposal facility, Chem Security System, Inc., near Arlington, Oregon. In 1981, the hazardous waste storage area on-site 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 storage and process facilities in 1980 to prevent spills from entering the soil. The retorts and retort openings are lined with concrete, but the integrity of the concrete has not been verified. The creosote lines and other pipelines pass through a concrete underground walkway that extends from the tank farm to the retort building. In 1985, 2 feet of soil and sludge was excavated from the tank farm and shipped to a hazardous waste landfill; however, visibly contaminated soil remains at the tank farm.

Creosote was delivered to the facility by rail car, truck, and ship. Vessels unloaded creosote at the creosote dock into a pipeline that runs to a 750,000-gallon creosote tank. Unloading at the creosote dock was gradually phased out throughout the 1980s in favor of rail car unloading. Use of the large creosote tank was discontinued in 1988. Contaminated soil from inside the retaining wall of the creosote tank was apparently removed, although the date of removal and disposal location of the contaminated soil are unknown.

Since 1985, six underground storage tanks have been removed. These tanks contained diisopropyl ether, diesel fuel, and gasoline. Some contamination of soil and groundwater from one of the diesel tanks was evident. Most of the contaminated soil was excavated and disposed.

On October 10, 1991, McCormick & Baxter's lending institution took control of their assets. In response to this action, McCormick & Baxter discontinued operations on that date. In December 1991, DEQ began interim remedial activities at the site to prevent releases of chemicals remaining at the site, maintain site security, and reduce storm water discharges from the McCormick & Baxter property to the Willamette River.

2.2 Enforcement Activities

McCormick & Baxter identified environmental problems at the site during a preliminary site investigation and reported these findings to DEQ in August 1983. Subsequently, McCormick & Baxter retained a contractor to conduct environmental investigations on the property. McCormick & Baxter submitted investigation reports to DEQ in January 1985 and February 1987. Primary sources of contamination were identified as the tank farm area, the former waste disposal area, the Cellon (PCP in butane and ether) wash area, and areas where treated wood was stored.

DEQ entered into a Stipulated Order with McCormick & Baxter in November 1987, requiring the following corrective actions:

- Installation of extraction wells in the tank farm and former waste disposal areas;

- Design and installation of a groundwater pump-and-treat system, and groundwater monitoring program;
- Construction of covered storage areas for treated wood;
- Construction of drip pads in front of retorts;
- Collection and treatment of stormwater; and
- Performance of surface soil bioremediation treatment studies.

In December 1988, McCormick & Baxter filed for Chapter 11 bankruptcy, and in 1990, DEQ assumed responsibility for completing investigation and cleanup activities at the site.

McCormick & Baxter's bankruptcy reorganization was approved in November 1990. As part of the this operating plan, DEQ was to receive $250,000 per year and 20 percent of profits toward payment of environmental investigation and cleanup costs, as well as 50 percent recovery from insurance policies (claims are currently in litigation), until the costs of investigation and cleanup have been repaid. McCormick & Baxter was unable to comply with the Chapter 11 reorganization plan and ceased all operations in October 1991. Although the corporation exists and owns the property, it has no other tangible assets of operations. DEQ holds a first mortgage security interest, up to $20 million, in the property as security for repayment of investigation and cleanup costs.

The McCormick & Baxter site was proposed for addition to the National Priorities List (NPL) on June 18, 1993. The site was added to the NPL on June 1, 1994.

2.3 DEQ Investigation and Interim Remedial Measures

DEQ began the remedial investigation and feasibility study (RI/FS) in September 1990. DEQ issued a public notice of a proposed cleanup plan in January 1993 and held several public meetings (see Section 3). DEQ elected not to finalize the proposed remedial action at the McCormick & Baxter site in 1993 due to the pending addition of the site to NPL by the U.S. Environmental Protection Agency (EPA). The primary objectives of the interim remedial activities conducted by DEQ included:

- Stabilizing or limiting the migration of contaminants at the site to control immediate threats to public health and safety and the environment;
- Reducing the mass of contaminants through "source control" measures (e.g., NAPL extraction);
- Recycling or reusing site equipment and materials to the extent possible; and
- Preparing the site for demolition and remediation.

Interim remedial actions conducted by DEQ include:

- Installation of a fence around the entire McCormick & Baxter property 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; and

- Design, construction, and operation of a pilot treatment system to treat NAPL-contaminated groundwater.

Since 1993, approximately 2,000 gallons of NAPL have been recovered. The average rate of NAPL extraction, prior to implementing enhanced NAPL recovery, is approximately 30 gallons per month. Enhanced NAPL extraction efforts conducted to date, (e.g., analysis of loading rates, and evaluation of dual-phase and pulse pumping) indicate that recovery rates can be increased significantly.

In March 1995, DEQ and EPA entered into a cooperative agreement for EPA funding of ongoing interim remedial actions. Ongoing interim remedial action activities include creosote extraction, pilot treatment plant operation, and site security.

In September 1994, DEQ and EPA initiated discussions on DEQ's 1993 Proposed Plan and the 1992 FS. Based on the comments received from EPA, DEQ chose to revise the 1992 FS to incorporate the findings from the interim remedial actions and site characterization conducted since the 1992 RI/FS to revise remedial alternatives for the site. The Revised FS Report, completed in September 1995, describes updated remedial action alternatives for the McCormick & Baxter site and describes interim remedial actions conducted since the 1992 FS.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

This section summarizes the community relations activities performed by DEQ both prior to and after listing of the site on the NPL.

3.1 DEQ Community Relation Activities

3.1.1 Open House and Informational Meetings

DEQ held an open house meeting on August 8, 1990, prior to initiating field investigations at the site. During the open house, DEQ provided information on project activities, schedules, and objectives to the public. DEQ conducted two public informational meetings in January 1993 to explain details of the first proposed plan.

3.1.2 Community Work Group

DEQ organized a work group, comprised of representatives from local neighborhood and environmental groups, in the summer of 1991 to provide a forum for discussion of project activities and community concerns. The work group met five times in 1991, twice in 1992, and on a quarterly schedule since May 1993. Work group meetings, which are open to the public, will continue periodically through the project cleanup phase.

3.1.3 Fact Sheets

Since 1990, DEQ mailed out fact sheets that summarize project activities, findings, and plans. The mailing list for these fact sheets includes approximately 370 interested individuals. Fact sheets will continue to be mailed periodically during cleanup activities.

3.1.4 Presentations

DEQ made five presentations to neighborhood groups or associations during the investigation; three during 1991 and two during 1992. DEQ made these presentations at the request of the individual groups. DEQ conducted several additional presentations between 1993 and 1995.

3.1.5 Public Notice

DEQ issued a public notice of its 1992 Proposed Cleanup Plan in the Secretary of States's Bulletin on January 1, 1993, in The Oregonian on January 4, 1993, and in Between the Rivers on March 1, 1993. Summaries of the proposed plan were mailed to those on the project mailing list. The proposed plan identified as the preferred remedy for the site in situ stabilization and capping for soil, capping for sediment, and enhanced NAPL extraction for groundwater. Copies of the 1992 RI/FS were available for review at the St. John's Library and the North Portland Neighborhood Office. The public comment period began on January 1, 1993 and ended on March 8, 1993, after being extended one month at the request of a citizen. DEQ held a public comment meeting on February 2, 1993; however, no verbal testimony was received. DEQ provided written responses to all written comments received on the 1992 proposed plan.

DEQ chose not to implement the selected remedy identified in the 1992 proposed plan due to pending addition of the site to the NPL. DEQ conducted several interim remedial actions at the site in 1994, during preparation of a revised FS for final cleanup of the site.

3.2 DEQ and EPA CERCLA Community Relation Activities

3.2.1 Technical Assistance Grant

EPA awarded a technical assistance grant (TAG) to a community group named Willamette Associates for Kindness to the Environment in University Park (WAKE-UP) founded by the University Park and Friends of Cathedral Park Neighborhood Associations. WAKE-UP represents approximately 11,000 people residing in the community located near the site. WAKE-UP submitted written comments on the Proposed Plan. DEQ and EPA responses to those comments are provided in the Responsiveness Summary, which is included in Appendix A of this ROD.

3.2.2 Public Notice

The revised RI/FS and Proposed Plan for the McCormick & Baxter site were released to the public in October 1995. These two documents were made available to the public in both the administrative record and an information repository maintained at the St. John's Library, and DEQ Headquarters. A third information repository, which contained most of the documents in the administrative record, was provided at the North Portland Neighborhood office. The Proposed Plan describing the alternatives for cleaning up contamination in soil, groundwater, and sediment at the site was released and sent to interested parties in late October 1995. The plan also identified the preferred alternatives proposed by DEQ and EPA. The public comment period started on November 6, 1995, and a public meeting was held on November 28, 1995. At the request of WAKE-UP, the agencies extended the comment period until January 16, 1996. Responses to comments received during this period are provided in the Responsiveness Summary, which is included as Appendix A of this ROD. This decision document presents the selected remedial action for the McCormick & Baxter site, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the NCP. The decision for this site is based on the administrative record.

4.0 SCOPE AND ROLE OF RESPONSE ACTION

The selected remedial actions presented in this ROD address the contamination in soil, groundwater, and sediment at the McCormick & Baxter site. The site poses a principal threat to human health and the environment because of the risks from direct human contact with soil, NAPL seeps, and sediment. The purpose of the response action is to prevent current or future exposure to the contaminated media, to minimize NAPL discharges to the Willamette River, and migration to the deep aquifer. This ROD describes the selection of the final response action for this site.

5.0 SUMMARY OF SITE CHARACTERISTICS

The nature and extent of soil, groundwater, surface water, and sediment contamination is summarized below and discussed in detail in the Remedial Investigation Report and the Supplemental Site Characterization Report which are part of the Administrative Record which is included as Appendix B of this ROD. The results of an evaluation of contaminant fate and transport mechanisms and pathways are also presented in this section.

5.1 Nature and Extent of Contamination

Contaminants on the site are chemicals used in the wood preserving industry, including polycyclic aromatic hydrocarbons (PAHs, comprising about 85 percent of creosote constituents), PCP, arsenic, chromium, copper, and zinc. Polychlorinated dibenzo-*p*-dioxins and dibenzofurans (dioxins/furans), which are trace constituents of PCP, were also found in soil, groundwater, and sediment at the site.

All contaminants were found in concentrations that exceed natural background levels by substantial margins; maximum values of PAHs, PCP, dioxins/furans and arsenic exceeded background levels by factors of more than 1,000. Many contaminants are considered human carcinogens, and many are also toxicants. Copper and zinc, while relatively nontoxic to humans, are toxic to aquatic organisms.

5.1.1 Soil

DEQ conducted surface soil investigations at the site during the RI (September 1990 to March 1992) and during the supplemental site characterization and removal action (April and August 1994). During the RI, DEQ's contractor collected composite surface soil samples from 39 on-site stations and submitted the samples for laboratory analysis of site-related contaminants (e.g., metals, PAHs, and PCP). Additionally, a subset of samples also was analyzed for dioxins/furans, volatile organic compounds, semivolatile organic compounds, pesticide/polychlorinated biphenyls (PCBs), and additional metals. During the 1994 supplemental investigation and removal action, DEQ's contractor collected composite soil samples from 651 on-site locations along a pre-established grid on 50-foot centers. These samples were field analyzed for total PAHs and PCP using thin-layer chromatography (TLC) and selected metals (arsenic, chromium, copper, and zinc) using x-ray fluorescence analysis. The contractor also submitted a subset of the field screening samples to a commercial laboratory for semivolatile organic compound analysis by EPA Method 8270 for PAHs and PCP (24 samples) and for metals analysis by EPA Method 6000/7000 for arsenic, chromium, copper, and zinc (10 samples).

During the RI, DEQ's contractor collected subsurface soil from boreholes in conjunction with monitoring well installation. Samples also were collected in the former proposed retort drip pad areas and in other potential source areas to further characterize the nature and extent of subsurface soil contamination. Ninety-two samples from 29 monitoring wells and soil boreholes and 22 samples from 15 shallow soil boreholes installed along the former proposed drip pads for Retorts 1, 2, and 4 were analyzed. Samples collected from the monitoring well and borehole installations ranged in depth from 0 to 77 ft bgs, and samples collected from the retort pads ranged in depth from 1 to 5 ft bgs. An additional 18 samples from depths of 0 to 30 ft bgs from 17 boreholes were analyzed for the source characterization investigation. In addition to samples collected during the RI, an extensive set of subsurface samples were collected during previous investigations. Subsurface soil in the tank farm and former waste disposal areas are highly contaminated with PAHs and PCP. Other areas with subsurface soil contamination include Butt Tank 1 (PAHs); MW-1 (PAHs); the southeast waste disposal trench (PAHs and PCP, and metals in a limited area); the PCP mixing shed, Cellon wash area, and Retort 4 (PCP); and the 0- to 2-ft depth interval near the ACZA tanks and retort area (metals). These areas are illustrated on Figure 1-3.

In June 1994, prior to conducting a removal action, DEQ conducted additional sampling and field screening analyses to further delineate the areas with the highest soil contaminant concentrations. In August 1994, DEQ conducted a removal action in three areas with the highest contaminant concentrations, including the arsenic-chromium-copper area (203 tons of soil disposed) in the southeastern part of the McCormick & Baxter property, the PCP soil area in the western corner of the property (3.3 tons of soil disposed), and the PCP crystals area near the PCP mixing shed (124.4 tons of soil disposed) in the central process area. Post-removal sampling indicated a significant reduction in soil contaminant concentrations in these areas.

Figure 5-1 illustrates the areas of the McCormick & Baxter property (post-removal action) with the highest concentrations of key site contaminants (primarily arsenic, PAHs, and PCP). The highest soil contaminant concentrations occur primarily in source areas such as the tank farm area, the central process area, the southeast disposal trench area, the former waste disposal area, and in portions of the treated log storage areas. PCP and PAH contamination in the former waste disposal and tank farm areas has been identified in the vadose and saturated zones to depths up to 80 feet bgs, and has migrated horizontally into sediment in the Willamette River. Also in these source areas, miscellaneous wastes such as creosote tar balls, hardened materials resembling asphalt, and naphthalene blocks located west of the central process area, still remain on-site from former McCormick & Baxter operations. In addition, surface soil (up to a depth of approximately 6 inches bgs) across most of the McCormick & Baxter property exhibits contaminant concentrations exceeding risk-based screening levels. Tables 5-1 and 5-2 show the range of contaminant concentrations found in on-site surface and subsurface soil, respectively, during the RI and subsequent investigations. PAHs were detected in nearly every sample. Dioxins/furans were also detected in all samples for which they were analyzed.

Although other contaminants (primarily chromium, copper, zinc and dioxins/furans) are present in soil above background or risk-based concentrations, these contaminants coincide with other contaminants of concern. In source areas such as the central process and the tank farm areas, surface soil is noticeably discolored. In most other areas of contamination, the ground surface is vegetated, semi-vegetated, or covered with gravel, and contamination is not visually evident.

During the RI, DEQ's contractor collected 15 off-site surface soil samples and submitted them to an off-site laboratory for PAH, PCP, and metals analysis. Off-site soil sampling

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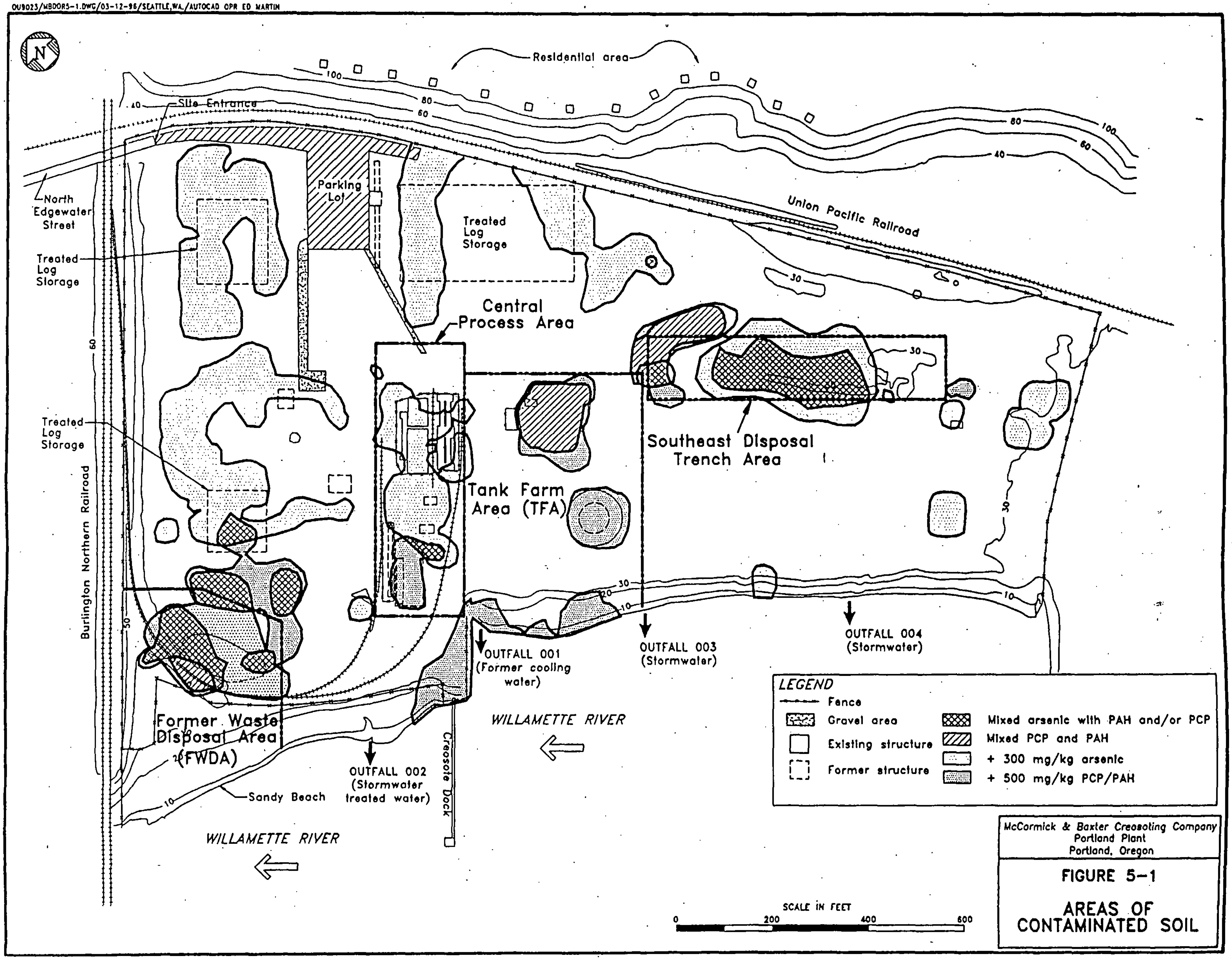

FIGURE 5-1

AREAS OF CONTAMINATED SOIL

Table 5-1

CONTAMINANT CONCENTRATIONS IN ON-SITE SURFACE SOIL (1990-1994)

Compound	Range (mg/kg dry weight)		Location of Maximum Concentration
	Minimum	Maximum	
Naphthalene	0.06	42	TFA
Acenaphthylene	0.062	50	TFA
Acenaphthene	0.026	940	CPA
Fluorene	0.021 U	1,300	CPA
Phenanthrene	0.48	4,900	CPA
Anthracene	0.33	2,600 E	CPA
Fluoranthene	0.73	2,900	CPA
Pyrene	0.58	1,600	CPA
Benz[a]anthracene	0.22 U	420 E	TFA
Chrysene	0.60	1,900 E	TFA
Total benzofluoranthenes [b+k]	1.6	1,000 E	Former treated log storage area (near FWDA)
Benzo[a]pyrene	0.22 U	210	TFA
Benzo[e]pyrene	0.22 U	620 E	TFA
Indeno[1,2,3-cd]pyrene	0.16 E	56	TFA
Dibenz[a,h]anthracene	0.078	22	Former treated log storage area (near FWDA)
Benzo[ghi]perylene	0.23 E	66	TFA
Carbazole	0.079	1,200 E	TFA
2,3,4,5-Tetrachlorophenol	0.052 U	65 E	CPA
2,3,4,6-Tetrachlorophenol	0.052 U	64 E	CPA
Pentachlorophenol	0.88	4,800 E	CPA
Dioxins/Furans (TEC)	4.6×10^{-3} E	3.8×10^{-1} E	TFA
Arsenic	1.1	5,100	CPA
Chromium	9.6	720 M	Former treated log storage area (near FWDA)
$Chromium^{6+}$	0.050 UG	11 G	Southwest end of site
Copper	11	3,600	CPA
Zinc	35	4,200 E	CPA

Abbreviations:
- CPA - Central Process Area
- FWDA - Former Waste Disposal Area
- TFA - Tank Farm Area
- TEC - Toxicity Equivalant Concentration

Qualifiers:
- E - estimated
- G - actual value is probably greater than reported value
- L - actual value is probably less than reported value
- M - mean
- U - undetected at detection limit shown

Table 5-2

CONTAMINANT CONCENTRATIONS IN SUBSURFACE SOILS (1991)

Compound	Range (mg/kg)		Location of Maximum Concentration
	Minimum	Maximum	
Naphthalene	0.010 U	23,000	MW-29s
Acenaphthylene	0.011 U	13	TFA
Acenaphthene	0.013	2,800 E	TFA
Fluorene	0,011 U	3,100 E	TFA
Phenanthrene	0.011 U	3,600 E	TFA
Anthracene	0.011 U	530 E	TFA
Fluoranthene	0.011 U	2,500 E	TFA
Pyrene	0.011 U	1,900 E	TFA
Benz[a]anthracene	0.011 U	870 E	TFA
Chrysene	0.011 U	770 E	TFA
Total Benzafluoranthenes [b+k]	0.011 U	460	TFA
Benzo[a]pyrene	0.011 U	170	TFA
Benzo[e]pyrene	0.011 U	150	TFA
Idenol[1,2,3-cd]pyrene	0.054 UE	64	TFA
Dibenz[a,h]anthracene	0.054 UE	22	TFA
Benzo[ghi]perylene	0.054 U	30	TFA
Carbazole	0.013 U	460 E	TFA
Pentachlorophenol	0.11	5,200 E	TFA
Dioxins/Furans (TEC)	9.0×10^{-7}	3.7×10^{-2} E	TFA
Arsenic	0.92	61,000	South of SE Disposal Trench
Chromium	5.7	46,000	South of SE Disposal Trench
$Chromium^{6+}$	0.030 UG	0.9G M	MW-3s
Copper	11	19,000	TFA
Zinc	25 E	570	TFA

Abbreviations:
- MW - Monitoring Well
- TFA - Tank Farm Area
- TEC - Toxicity Equivalent Concentration

Qualifiers:
- E - estimated value
- G - actual value is probably greater than reported value
- M - mean of laboratory splits
- U - undetected at detection limit shown

locations included a reference location at the University of Portland, residential areas along the bluff, locations midway between the site and the top of the residential bluff, areas along North Edgewater Street (the access road to the McCormick & Baxter property), and locations on adjacent properties along the river. Generally, the concentrations of site-related contaminants in off-site surface soil in residential areas near the site are consistent with typical residential soil concentrations in the Portland area. Table 5-3 shows the range of contaminant concentrations found in off-site soil. Unpaved portions of North Edgewater Street leading to the site exhibited somewhat elevated concentrations of PAHs and metals. These elevated concentrations are attributed to deposition by vehicles leaving the site. Air modeling of dust emissions from the site conducted by DEQ did not predict contaminant concentrations of concern on airborne particulates in the residential areas surrounding the site, even under worst-case scenarios. The modeling results were subsequently verified by off-site soil sampling.

5.1.2 Groundwater

As with soil, the main contaminants in groundwater are PAHs, PCP, and metals associated with wood treating solutions. Table 5-4 summarizes the range of contaminant concentrations in groundwater. The primary source areas of the groundwater contamination include the tank farm area and creosote tank, the former waste disposal area, the central process area, and, to a limited extent, a localized area in the southeast disposal trench and an unknown source area near MW-1. Wood-treating contaminants are not generally soluble in water, and the contaminants either float on the water table or continue to sink depending on the density of the waste compared to that of water. These relatively insoluble materials are commonly described as NAPL. NAPL that is lighter than water (i.e., floats) is referred to as LNAPL, and NAPL that is heavier (i.e., has a higher density) than water and sinks is referred to as dense non-aqueous phase liquid (DNAPL). Groundwater quality at the site has also been impacted by dissolved-phase contaminants.

Releases of NAPL contaminants from the main source areas at the site, in particular the tank farm area and the former waste disposal area, have primarily affected the shallow aquifer. Table 5-5 summarizes NAPL constituent concentrations at the site. As the pure-phase NAPL has migrated toward the river, it has also spread downward vertically, affecting a layer of sand adjacent to the river. Two distinct NAPL plumes are present at the site, one in the tank farm area and the other in the former waste disposal area. Smaller NAPL plumes are present near MW-1 and the former location of Butt Tank 1 in the northeast corner of the site. The tank farm area and the former waste disposal area plumes show that free-phase LNAPL and DNAPL are present.

The former waste disposal area NAPL plume affects approximately 4 acres of soil and 5 acres of sediment (Figures 5-2 and 5-4). This area contains either LNAPL or DNAPL that primarily consists of creosote compounds. The origin of this plume is the former waste disposal area, where waste oils, storm water from system pits, and other liquid wastes were disposed. This mixture migrated vertically to the water table (approximately 30 feet bgs) and then laterally toward the river, as both LNAPL and DNAPL. Monitoring and extraction wells have contained up to 8 feet of LNAPL and 21 feet of DNAPL, with visible DNAPL present in soil samples collected at depths up to 88 feet bgs.

Table 5-3

CONTAMINANT CONCENTRATIONS IN OFFSITE SURFACE SOIL (1991)

Compound/Metal	Range (mg/kg dry weight) Minimum	Range (mg/kg dry weight) Maximum	Location of Maximum Concentration
Naphthalene	0.011 U	0.11	Vacant lot N of BNRR
Acenaphthene	0.021 U	0.024	Vacant lot N of BNRR
Fluorene	0.011 U	0.031	Vacant lot N of BNRR
Phenanthrene	0.029 E	0.27	N. Edgewater Street
Anthracene	0.011 U	0.049	Vacant lot N of BNRR
Fluoranthene	0.041 UE	0.88	N. Edgewater Street
Pyrene	0.041 UE	0.7	N. Edgewater Street
Benz[a]anthracene	0.011 U	0.33	N. Edgewater Street
Chrysene	0.031 E	1.1	N. Edgewater Street
Total benzofluoranthenes[b+k]	0.022 UE	1.3	Vacant lot N of BNRR
Benzo[a]pyrene	0.022 UE	0.3 E	Vacant lot N of BNRR
Benzo[e]pyrene	0.022 UE	0.7	N. Edgewater Street
Indenol[1,2,3-cd]pyrene	0.055 U	0.42	N. Edgewater Street
Dibenz[a,h]anthracene	0.053 U	0.09 8	Vacant lot N of BNRR
Benzo[ghi]perylene	0.064	0.026	Vacant lot N of BNRR
Anthanthrene	0.052 U	0.52 E	Vacant lot N of BNRR
Carbazole	0.021 U	0.052	Vacant lot N of BNRR
Pentachlorophenol	0.11 U	0.95	South fenceline
Dioxins/Furans (TEC)	8.1×10^{-6} L	1.1×10^{-3} E	N. Edgewater Street
Arsenic	2.2 E	17	South fenceline
Chromium	11	24	Southeast of site (bluff)
Copper	21	72 M	N. Edgewater Street
Zinc	78 E	260 EM	N. Edgewater Street

Abbreviations:
TEC - Toxicity Equivalent Concentration
BNRR - Burlington Northern Railroad
N - North

Qualifiers:
E - estimated
L - actual value is probably less than reported value
M - mean
U - undetected at detection limit shown

Table 5-4

CONTAMINANT CONCENTRATIONS IN GROUNDWATER (1991)

Compound	Range (μg/L) Minimum	Range (μg/L) Maximum	Location of Maximum Concentration	Well Location
Naphthalene	1.0 U	2,400,000	MW-G	West of Former Waste Disposal Area
Acenaphthylene	1.0 U	150,000	MW-I	Tank Farm Area
Acenaphthene	1.0 U	2,000,000	MW-I	Tank Farm Area
Fluorene	1.0 U	1,800,000	MW-I	Tank Farm Area
Phenanthrene	1.0 U	3,900,000	MW-I	Tank Farm Area
Anthracene	1.0 U	620,000	MW-I	Tank Farm Area
Fluoranthene	1.0 U	2,000,000	MW-I	Tank Farm Area
Pyrene	1.0 U	1,100,000	MW-I	Tank Farm Area
Benz[a]anthracene	1.0 U	240,000	MW-I	Tank Farm Area
Chrysene	1.0 U	190,000	MW-I	Tank Farm Area
Total benzofluoranthenes [b+k]	1.0 U	160,000	MW-I	Tank Farm Area
Benzo[a]pyrene	1.0 U	100,000	MW-I	Tank Farm Area
Benzo[e]pyrene	1.0 U	5,300	MW-7	Downgradient of Tank Farm Area
Idenol[1,2,3-cd]pyrene	1.0 U	52,000	MW-E	Former Waste Disposal Area
Dibenz[a,h]anthracene	1.0 U	17,000	MW-I	Downgradient of Tank Farm Area
Benzo[ghi]perylene	1.0 U	20,000	MW-H	Central Process Area
2,3,4,5-Tetrachlorophenol	1.0 U	190 E	MW-18	Downgradient of Former Waste Disposal Area
2,3,4,6-Tetrachlorophenol	1.0 U	170 E	MW-7	Downgradient of Tank Farm Area
Pentachlorophenol	5.0 U	1,200,000	MW-I	Tank Farm Area
Dioxins/Furans (TEC)	4.6×10^{-3} L	2.0×10^{-1} L	MW-20	Downgradient of Former Waste Disposal Area
Arsenic	1.0 U	9,000	MW-R	Tank Farm Area
Chromium	2.0 U	12,000	MW-G	West of Former Waste Disposal Area
$Chromium^{6+}$	2.0 U	120	MW-H	Central Process Area
Copper	3.6	5,400	MW-H	Central Process Area
Zinc	8.4	260,000	MW-O	East of Central Process Area (Upgradient)

Abbreviations:
MW - Monitoring Well
TEC - Toxicity equivalent concentration

Qualifiers:
E - estimated value
L - actual value is probably less than reported value
U - undetected at detection limit shown

Table 5-5

CONSTITUENT CONCENTRATIONS IN NAPL SAMPLES (mg/L)

Compound	DNAPL	LNAPL
Naphthalene	87,000 E	16,000 E
Acenaphthlene	410 E	100 UE
Acenaphthene	30,000 E	16,000 E
Fluorene	36,000 E	13,000 E
Phenanthrene	88,000 E	21,000 E
Anthracene	8,200 E	3,500 E
Carcinogenic PAH Compounds (sum)	13,000 L	5,300 L
Carbazole	12,000 E	1,200 E
Pentachlorophenol	500 UE	500 UE

Abbreviations:
PAH - Polycyclic Aromatic Hydrocarbon

Qualifiers:
E - estimated values
L - actual value is probably less than reported value
U - undetected at detection limit shown

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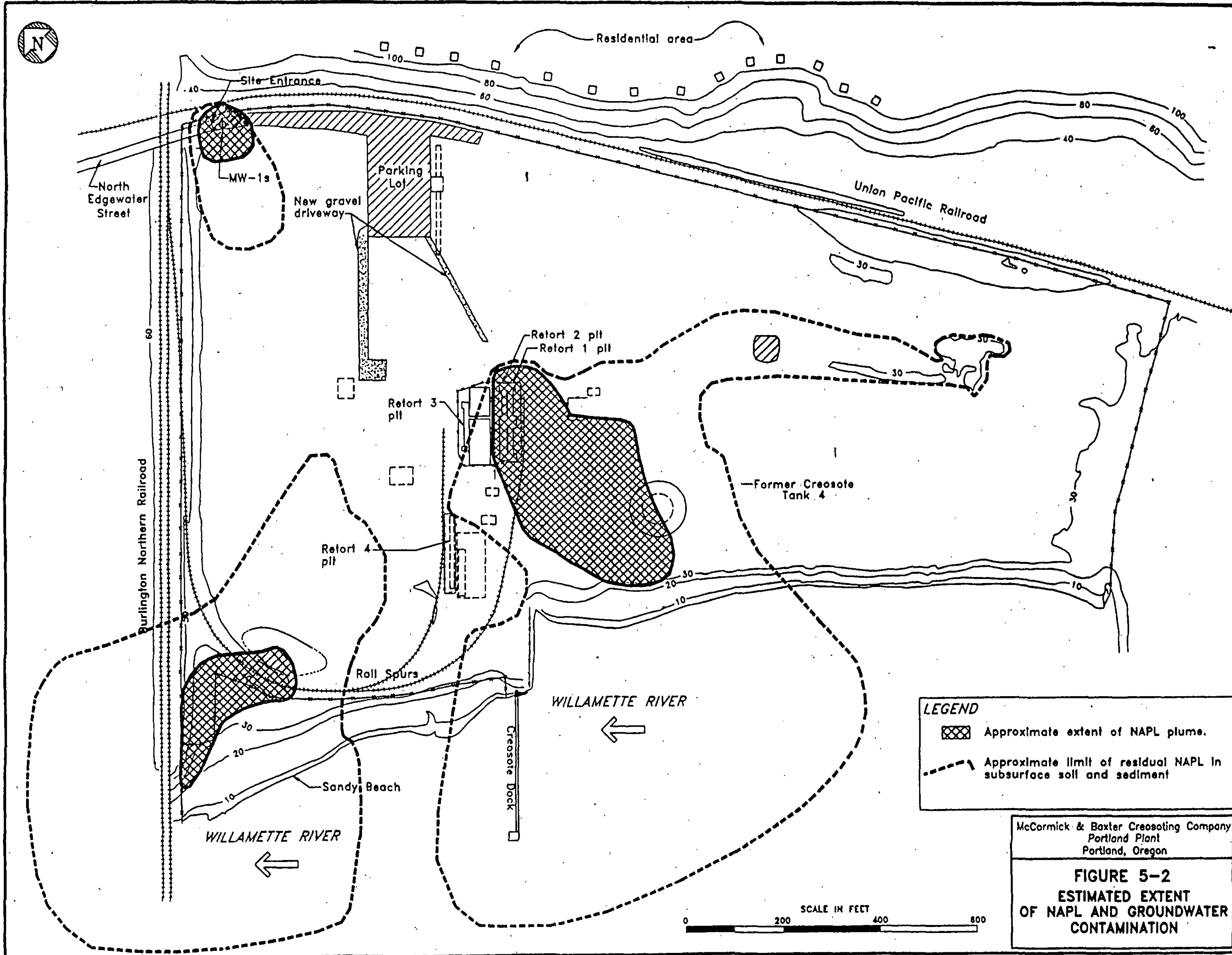

FIGURE 5-2
ESTIMATED EXTENT OF NAPL AND GROUNDWATER CONTAMINATION

The tank farm area NAPL plume affects approximately 8 acres of soil and 6 acres of sediment (Figures 5-2 and 5-4). This area also contains either LNAPL or DNAPL that primarily consists of creosote compounds. The origin of this plume is the former tank farm, large creosote tank, creosote retorts, butt tanks, and waste disposal trench, which either had periodic spills or were used for disposal of waste oils (creosote and PCP) and other liquid wastes. This mixture migrated vertically to the water table (approximately 30 feet bgs) and then laterally toward the river, spreading as both LNAPL and DNAPL. Near the beach, LNAPL has been observed as seeps at low tides and low river stage, generally during late summer. Wells in this NAPL plume have contained up to 3 feet of LNAPL and 10 feet of DNAPL, with visible DNAPL present in soil samples collected at depths up to 62 feet bgs.

DEQ installed and sampled monitoring wells during the RI to delineate areas where dissolved-phase organic and inorganic contaminants were present in groundwater (Figure 5-3). Two rounds of samples were collected from most of the wells installed during the RI to evaluate the extent of groundwater contamination in the shallow, intermediate, and deep groundwater zones at the site. A subsequent phase of groundwater monitoring was conducted in 1994 to evaluate the stability of and possible changes in the configuration of the dissolved groundwater contaminant plumes since the RI was completed. Below is a summary of organic and inorganic contaminants in groundwater:

Organic Contaminants

- Dissolved organic (primarily PAHs) and inorganic (primarily arsenic, chromium, copper, and zinc) contaminants are present in groundwater samples from site wells.

- The highest concentrations of dissolved groundwater contaminants in the shallow aquifer are in the two major source areas (tank farm area and former waste disposal area); however, many of the wells in these areas either contained NAPL at the time of sampling or had previously contained NAPL. Results of water quality data in wells with NAPL do not accurately represent dissolved-phase concentrations in the aquifer. Groundwater samples collected during the RI likely contained droplets of NAPL; therefore, reported contaminant concentrations represent dissolved-phase and some pure-phase NAPL in immiscible form.

- Shallow monitoring wells within NAPL plume areas contain total PAH concentrations in the range of 2,000 to 920,000 micrograms per liter (μg/L), but are generally in the range of 10,000 to 100,000 μg/L. The results were sensitive to the presence of NAPL droplets (as evidenced from sample appearance and erratic duplicate sample results).

- Shallow wells downgradient of the primary NAPL plumes in the tank farm area and former waste disposal area have the next highest levels of organic site contaminants. Total PAH concentrations in these wells generally range from 1,000 to 10,000 μg/L; however, total PAHs range from undetected to

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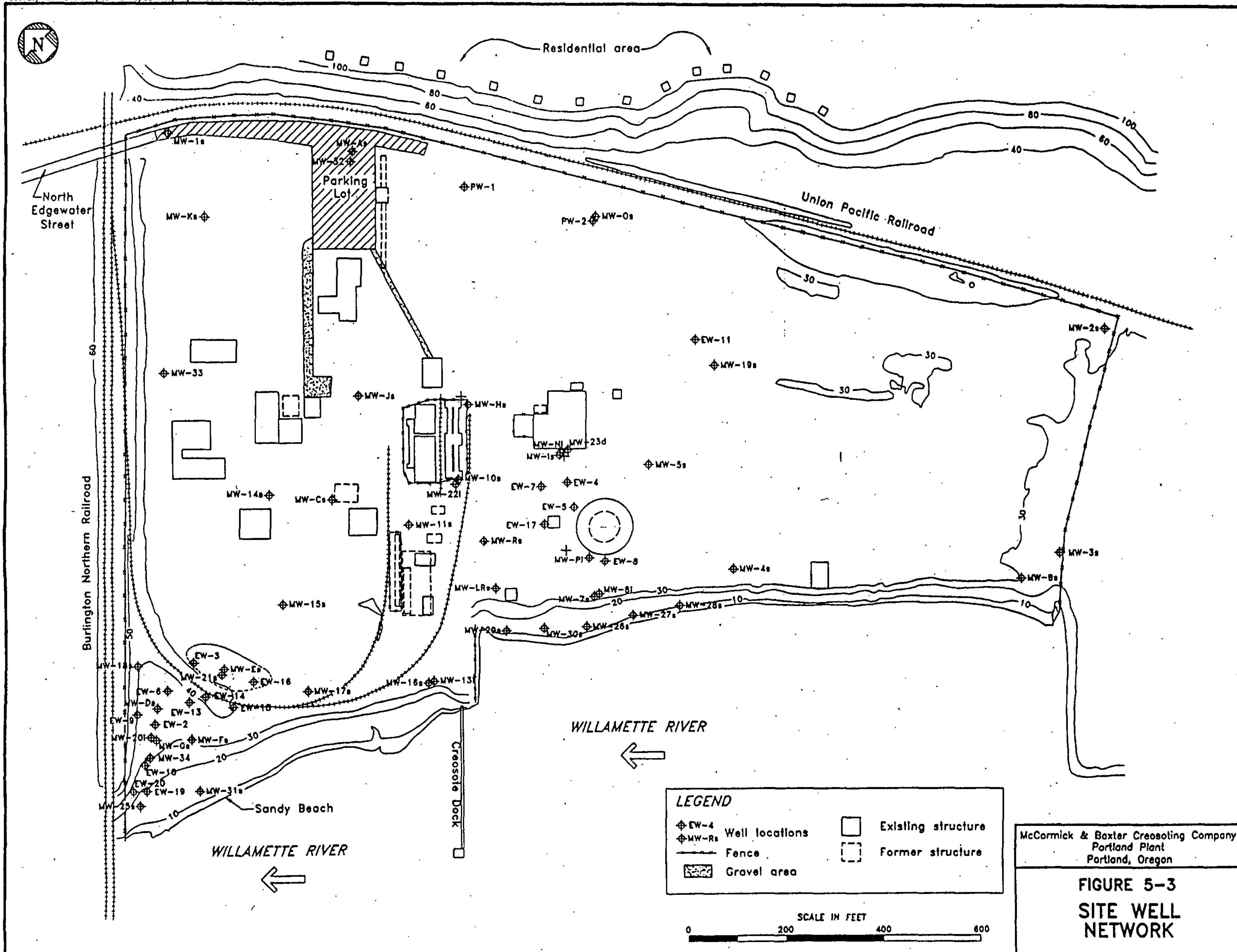

FIGURE 5-3
SITE WELL NETWORK

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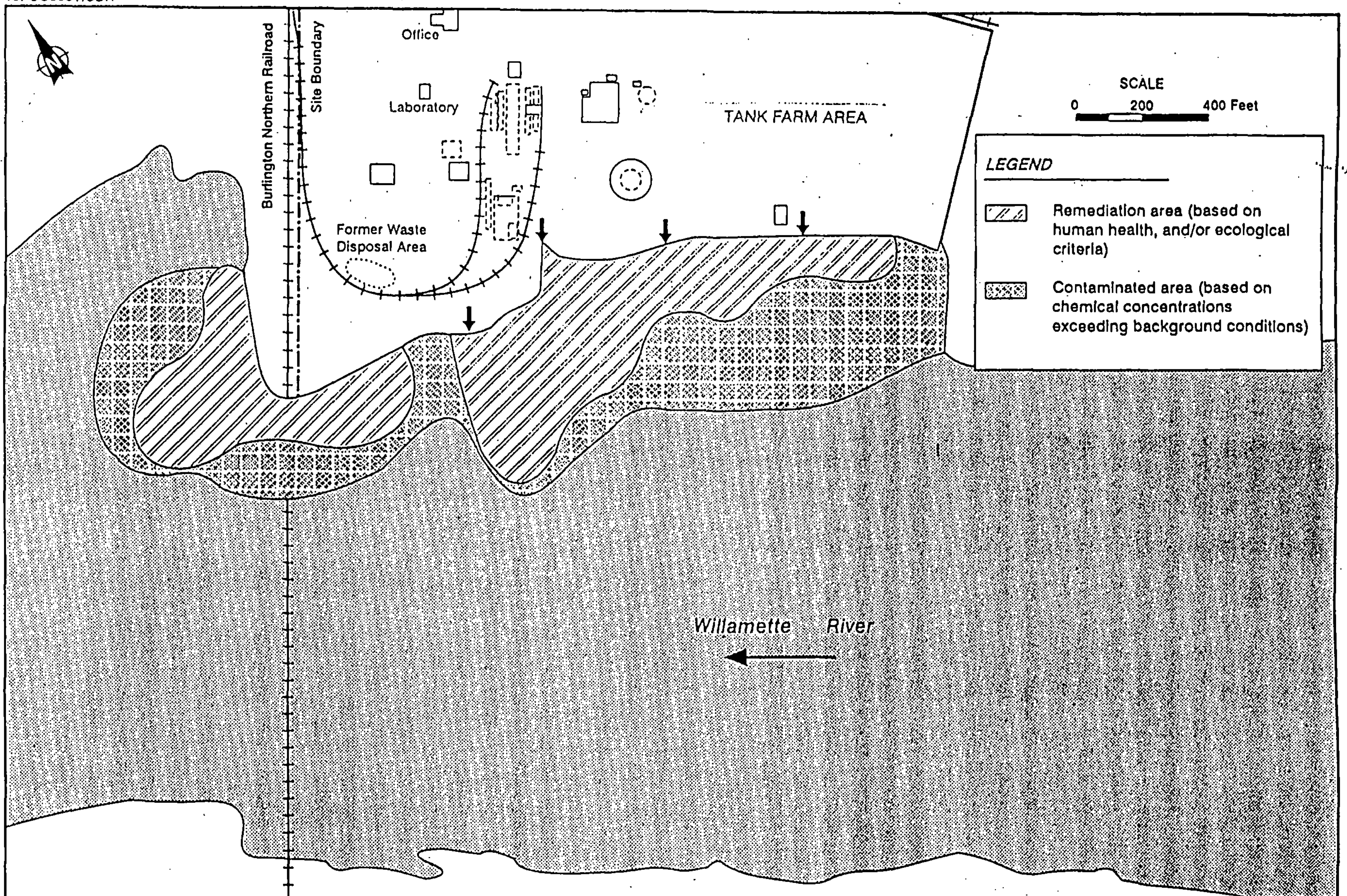


McCORMICK & BAXTER CREOSOTING COMPANY PORTLAND PLANT, PORTLAND OREGON	Figure 5-4 ESTIMATED EXTENT OF SEDIMENT CONTAMINATION

Table 5-6

CONTAMINANT CONCENTRATIONS IN SEDIMENTS (1990)

Compound	Range (mg/kg DW)		Range (mg/kg OC)		Location of Maximum Concentration[a]
	Minimum	Maximum	Minimum	Maximum	
Naphthalene	0.010 U	3,500 E	0.68 U	88,000 E	Creosote Dock
Acenaphthalene	0.012 U	17	0.68 U	2,000 E	Bank north of BNRR trestle
Acenaphthene	0.019 U	1,300	1.3 U	73,000 E	Bank north of BNRR trestle
Fluorene	0.010 U	1,100 E	0.68 U	80,000 E	Bank north of BNRR trestle
Phenanthrene	0.013 U	1,900 E	0.84	150,000 E	Bank north of BNRR trestle
Anthracene	0.012 U	290	0.68 U	22,000 E	Bank north of BNRR trestle
Fluoranthene	0.010 U	960	2.1	60,000 E	Bank north of BNRR trestle
Pyrene	0.010 U	610	2.4	40,000 E	Bank north of BNRR trestle
Benz[a]anthracene	0.012 U	170	0.88 U	12,000 E	Bank north of BNRR trestle
Chrysene	0.012 U	170	0.88 U	7,700 E	Bank north of BNRR trestle
Benzo[b,k]fluoranthene	0.012 U	170	0.88 U	14,000 L	Bank north of BNRR trestle
Benzo[a]pyrene	0.012 U	58	0.75 U	2,900 E	Bank north of BNRR trestle
Benzo[e]pyrene	0.012 U	50	0.68 U	1,900 UE	Bank north of BNRR trestle
Indeno[1,2,3-cd]pyrene	0.062 U	87	3.3 UE	2,200	Creosote Dock
Dibenz[a,h]anthracene	0.062 U	87	1.7	2,200	Creosote Dock
Pentachlorophenol	0.0024 U	7.2 E	NA	NA	SW Corner of M & B property
Dioxins/Furans (TEC)	2.1×10^{-6} L	2.7×10^{-3} E	9.0×10^{-4} L	4.8×10^{-2} E	Creosote dock
Arsenic	1.8	18 E	NA	NA	Creosote dock
Chromium	1.1	64 E	NA	NA	Between Outfalls 003 & 004
Chromium^{6+}	0.07 UG	0.99 G	NA	NA	Outfall 003
Copper	12	330	NA	NA	Upstream
Zinc	35 EM	490 EM	NA		Bank north of BNRR trestle

[a] Based on organic carbon-normalized data for PAHs and PCDDs/PCDFs.

Abbreviations:
- BNRR - Burlington Northern Railroad
- DW - dry weight
- EAR - elevated above reference
- NA - data for these contaminants are not organic carbon-normalized
- OC - organic carbon-normalized
- TEC - Toxicity equivalent concentration

Qualifiers:
- E - estimated
- G - actual value is probably greater than reported value
- L - actual value is probably less than reported value
- M - mean
- U - undetected at detection limit shown

5.1.3 Sediment

During the RI, 55 surface sediment samples and 38 subsurface (ranging from 1.5 to 72 feet) sediment samples were collected and analyzed for standard site-related contaminants. In addition, selected samples were analyzed for a broad range of additional organic and inorganic contaminants, including pesticides/PCBs, volatile organic compounds, and dioxins/furans. Table 5-6 shows the range of contaminant concentrations found in the sediment during the RI. PAHs are the primary contaminants present; however, slightly elevated concentrations of chlorinated phenols, dioxins/furans, and arsenic are also present. Subsurface sample data indicated that contamination may extend as deep as 35 feet in heavily contaminated areas.

The primary contaminated sediment areas are located downgradient of the NAPL plumes in the tank farm and former waste disposal areas (Figure 5-4). The beach seeps and sheens observed on the river are related to bleb releases from sediment, are seasonal in nature, and typically occur in late summer when the river stage is below 3 feet MSL. There are two main areas of observable beach seeps at the site:

- NAPL has migrated from the former waste disposal area and seeps along the beach have been observed during periods of low river stage.

- NAPL has migrated from the tank farm area to beneath the beach and has been observed as seeps during periods of low river stage. An interceptor trench was constructed in 1993 downgradient of the tank farm to intercept NAPL, but has not been effective in NAPL removal to date.

In addition, areas near the creosote dock and the bulkhead were observed to have ongoing discharges as evidenced by sheens on the surface of the river. Additional investigations of this area were conducted to evaluate the presence and locations of existing NAPL pool areas in the near-shore sediment, the practicability of NAPL extraction from NAPL pools located in near-shore sediment, and the effectiveness of upland NAPL extraction efforts in preventing continued migration of NAPL into near-shore sediment. Wells were installed in the sediment for this investigation, but have been destroyed by river debris. Conclusions of the additional sediment investigations are presented below:

- Recoverable NAPL is found in sediment in an area around the creosote dock. Measurable LNAPL thicknesses (between 0.5 and 1.0 feet thick) were measured in three sediment wells; however, no DNAPL has been measured in any of the sediment wells. The LNAPL may represent a fractionation of a mixture of NAPLs present in the sediment.

- The composition of the NAPL removed from sediment well SED-3 included both aliphatic hydrocarbons (approximately 7 percent) and low-density PAHs (approximately 14 percent).

100,000 μg/L. PCP concentrations ranged from undetected up to 2,100 μg/L (MW-18s).

- Along the upgradient site boundary, shallow wells do not have detectable concentrations of PAHs or PCP. Well MW-1, located in the northern corner of the site, contains LNAPL, which has accumulated in the well since the RI. The source of this LNAPL cannot be directly attributed to site-related releases and is still unknown.

- Shallow monitoring wells in the interior of the site but outside of the NAPL plume areas (e.g., MW-4s, MW-5s, MW-11s, MW-14s, MW-15s, MW-17s, MW-Js, MW-Ks) have undetectable or very low concentrations of site contaminants.

- Intermediate zone wells within the two source areas exhibit a range of contaminant concentrations of total PAHs and PCP similar to shallow wells. Intermediate zone wells downgradient of plume areas generally show little or no impact by organic contaminants.

- Deep zone wells sampled (MW-23D, PW-1, and PW-2) do not regularly contain detectable concentrations of PAHs or PCP. MW-23d has exhibited elevated concentrations of phenanthrene (from 0.88 to 1.1 μg/L) and fluoranthene (0.4 μg/L in both rounds). Anthracene and pyrene have also been detected. It is not known whether the PAH in MW-23d is related to site contamination.

<u>Inorganic Contaminants</u>

- Inorganic site contaminants (primarily arsenic, chromium, copper, and zinc) were measured in site wells during the RI and during subsequent assessment sampling. Initial results suggested that the shallower groundwater across the site was affected by these inorganic contaminants. For example, in well MW-O along the upgradient property boundary, arsenic, chromium, copper, and zinc were measured at 74, 530, 1,300, and 260,000 μg/L, respectively. During subsequent sampling in the RI and during later assessment sampling, inorganic contaminant levels decreased to 9, 10*U*, 10*U*, and 40 μg/L, respectively, in this well. Similar patterns of decreased metals concentrations were observed in the second round of groundwater sampling.

- The reduction in inorganic contaminant concentrations with subsequent sampling rounds is probably due to the changes in the sampling technique. During the RI, groundwater samples were collected with bailers, which may have resuspended fines within the well casing and surrounding sandpack. During subsequent sampling events, a submersible electric pump was used to purge and collect the samples at a low flow rate. Use of the pump minimized the potential for resuspension of fines within the well casing and sandpack.

- Where present, NAPL appears to be found in the upper 5 to 7 feet of the sediment; the interval from 7 to 15 feet does not yield NAPL, perhaps due to this depth interval having a higher percentage of silt or finer-grained sediment.

- Based on an apparent difficulty in intersecting extractable NAPL pools with sediment wells, it appears that the NAPL layers may be thin and discontinuous, or migration of NAPL may be occurring along preferential pathways (i.e., differences in sediment composition from depositional differences or historic dredging, or a topographic low in the top of a silt zone in the sediment).

- Based on the limited NAPL extraction data from the near-shore sediment wells, the extent of readily extractable NAPL from sediment wells that had NAPL accumulations may be limited.

- Discharge of NAPL (as indicated by an oily sheen on the river surface) to the sediment appears to be greatest during low river stages when hydraulic gradients are steepest. Increases in air, soil, and water temperatures during the summer months may decrease the NAPL viscosity. This increase in temperature in the summer also coincides with the lowest river stages and sediment agitation caused by tidal fluctuations and river traffic, apparently resulting in increased NAPL discharge.

- The rate of NAPL discharge from near-shore sediment appears to have decreased since monitoring of the oily sheen was conducted by McCormick & Baxter between July 1985 and December 1986; however, a quantitative evaluation of the NAPL discharge rate has not been conducted.

Sediment samples also were tested for evidence of toxicity to organisms commonly found in sediment. Sediment toxicity tests conducted included amphipod mortality bioassays using *Hyalella azteca* and Microtox™. These tests indicated significant toxicity to benthic organisms in highly contaminated areas.

5.1.4 Surface Water

Filtered and unfiltered storm water samples were collected from Outfalls 002 and 003 (Outfall 004 was dry) and from the non-contact cooling water Outfall 001 during fall and winter storm events in 1991. Table 5-7 shows the analytical results from Outfalls 002 and 003 before and after interim remedial actions were conducted.

Analytical data indicated that storm water runoff from the McCormick & Baxter property to the Willamette River was contaminated with metals, PCP, PAHs, and dioxins/furans through suspension of contaminated soil particles. Following shutdown of the McCormick & Baxter facility in 1991, earthen berms were placed around storm water collection sumps to minimize off-site discharge through these outfalls to the Willamette River. Currently, storm water at the site infiltrates into the subsurface. Surface water samples were not collected from the Willamette River during the RI.

Table 5-7

CONTAMINANT CONCENTRATIONS IN STORM WATER

Compound	Outfall 2 (μg/L)		Outfall 3 (μg/L)	
	Pre-IRA	Post-IRA	Pre-IRA	Post-IRA
Pentachlorophenol	1,700	51	450 E	12
Dioxons/Furans (TEC)	2.4×10^{-1} E	NA	NA	NA
Arsenic	7,600 M	62	3,300	26
Chromium	780 M	3.9	500	8.6
$Chromium^{6+}$	5.2 M	NA	19	NA
Copper	15,000 M	60	8,000	51
Zinc	8,200 M	870	4,400	46

[a] *Collected after site shutdown*

Abbreviations:
- IRA - Interim remedial action
- NA - Not analyzed
- TEC - Toxicity equivalent concentration

Qualifiers:
- E - estimated
- L - actual value is probably less than reported value
- M - mean
- U - undetected at detection limit shown

5.1.5 Fish and Crayfish

Fish and crayfish were collected in, upstream, and downstream of contaminated sediment areas and examined for physical evidence of exposure (e.g., tumors or inflammation). Muscle tissue samples were analyzed for site-related contaminants (PAHs, PCP, and dioxins/furans). Fish and crayfish tissue samples collected near the site show slight elevations of dioxins/furans and low molecular-weight PAHs compared with fish and crayfish samples collected in other parts of the Willamette River. Visual examination of fish tissue showed no adverse effects from exposure to site-related contaminants other than mild inflammation, which was also observed in fish collected in other areas of the Willamette River.

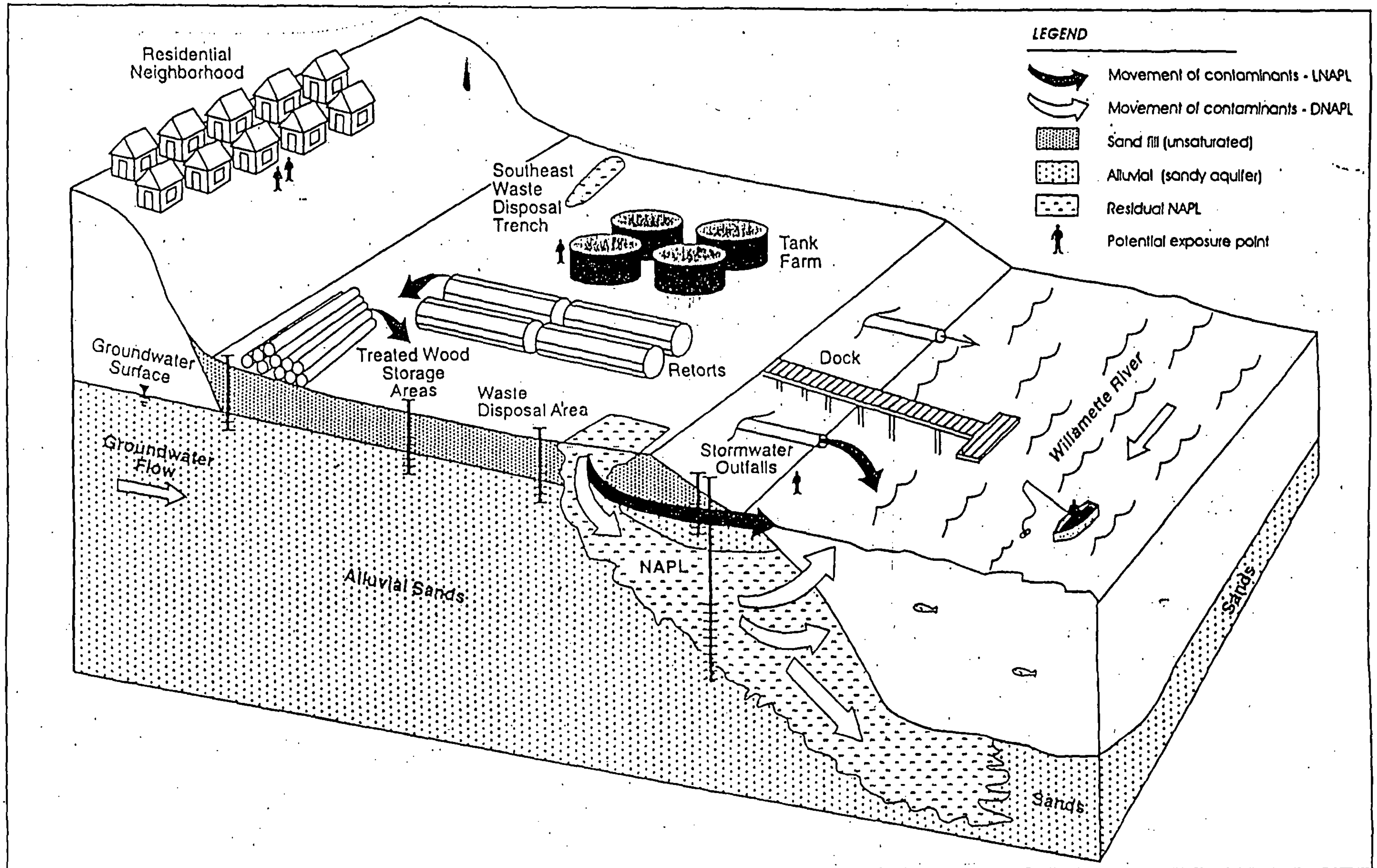
5.2 Fate and Transport

There are several mechanisms by which contaminants may be transported at the McCormick & Baxter site. The most significant is the transport of NAPL from creosote and oils that were spilled or discharged during historical wood treating operations and, as a result, have contaminated soil, groundwater, and sediment at the site. Other contaminant transport pathways that were considered in the RI but are less significant include migration of dissolved-phase contaminants in groundwater, infiltration, surface water flow, air transport, and mechanical transport.

The largest discharges of wood-treating chemicals to the ground surface and then to groundwater via migration, occurred in the tank farm and former waste disposal areas. Figure 5-5 illustrates a conceptual model of contaminant migration through soil, groundwater, and sediment. The conceptual model considers both the hydrogeologic setting and the chemical characteristics, which affect the NAPL migration behavior in these areas.

Both pure-phase product and waste liquids were released in the major source areas on the site. Pure creosote and creosote wastes are generally DNAPLs that are denser than water. Therefore, creosote migration is significantly affected by hydraulic gradients and other physical factors that vary across the site (e.g., the presence or absence of the silt aquitard) or that fluctuate seasonally (e.g., groundwater levels, tidal influences, and water temperature). PCP was mixed with oil that is generally LNAPL; therefore, PCP movement is associated with LNAPL plumes. The LNAPL contamination fluctuates with the water table. These fluctuations in the shallow aquifer groundwater surface create a vertical band of residual LNAPL referred to as the "smear zone."

Mobile NAPL refers to NAPL in pore spaces that is able to move under natural groundwater flow conditions. The creosote trapped in pore spaces by capillary forces is essentially immobile and is left as residual NAPL unless sufficient creosote is accumulated within the open pore space to overcome the viscous force of the creosote and capillary pressures. Residual DNAPL in the vadose zone serves as a long-term source of groundwater contamination as the NAPL continues to migrate and dissolve into the groundwater that passes through the contaminated soil.



McCORMICK & BAXTER CREOSOTING COMPANY PORTLAND PLANT, PORTLAND OREGON	Figure 5-5 CONCEPTUAL MODEL OF CONTAMINANT MIGRATION

6.0 RISK ASSESSMENT

This section summarizes the results of the human health and ecological risk assessments which were conducted to analyze the potential adverse health effects that could result from current and future exposures to hazardous substances released at the site, in the absence of any action to control or mitigate these releases. The results of the risk assessment summarized below do not account for interim remedial actions conducted by DEQ since the completion of the RI in 1992.

6.1 Human Health Risk Assessment

Elements of the human health risk assessment include identification of contaminants of concern, exposure assessment, toxicity assessment, risk characterization, and uncertainty assessment.

6.1.1 Contaminants of Concern

Contaminants of concern were identified for the human health risk assessment based on knowledge of historical site activities (i.e., only those contaminants known to be related to site activities were included); relative toxicity; and concentrations detected. Because several of the contaminants of concern are ubiquitous in urban environments (e.g., PAHs and dioxins/furans), concentrations of these contaminants were compared to background concentrations and local reference concentrations. Contaminants of concern include carcinogenic and noncarcinogenic PAHs; chlorinated phenols including PCP, tetrachlorophenol and trichlorophenol; dioxins/furans; hexachlorobenzene; arsenic; and chromium.

6.1.2 Exposure Assessment

The exposure assessment considered current and potential future land uses for the site and adjacent properties and exposure pathways for potential exposure to contaminated media.

Human populations that could potentially be exposed to site contamination include future site occupants, trespassers to the site and beachfront, recreational anglers and their families, and residents in the community above the bluff. The site is currently zoned for heavy industrial use under the Portland Comprehensive Plan. Because future land use at the site could change over time, future commercial/industrial, recreational, and residential uses also were evaluated.

Groundwater was not considered in the human health risk assessment completed during the RI. The Revised FS evaluated groundwater consumption exposure scenario at the request of the EPA.

The primary pathways for exposure to site contaminants include:

- Direct contact with contaminated surface soil through incidental ingestion, inhalation, and dermal contact for future site residents, workers, visitors or trespassers;

- Incidental ingestion of and dermal contact with contaminated sediment related to recreational uses of the beachfront;

- Consumption of fish and crayfish caught by recreational anglers in the area of contaminated sediment;

- Inhalation of fugitive dust (i.e., contaminated particulates) by future on-site residents or workers and current and future on-site visitors, beach visitors, or recreational anglers; and

- Exposure to groundwater under a hypothetical use of groundwater as a drinking water supply.

The human health risk assessment did not identify inhalation of fugitive dust by nearby residential communities as a exposure pathway of concern based on air modeling results for fugitive dust emissions from the site.

Quantitation of exposure for each of the exposure scenarios was performed in accordance with Region 10 and federal EPA risk assessment guidance. Chemical intake estimates were based on reasonable maximum exposure parameters and exposure point concentrations (e.g., 95 percent upper confidence limit (UCL) on the arithmetic mean). The exposure pathway for dermal contact for the recreational exposure scenario assumes use of the beach for 3 days per week for 3 months of the year.

6.1.3 Toxicity Assessment

Toxicity factors used for the toxicity assessment were obtained from EPA Integrated Risk Information System (IRIS) and/or EPA Health Effects Summary Tables (HEAST).

Most of the contaminants of concern identified in Section 6.1.1 are either known or probable human carcinogens. Cancers related to PAH exposures include stomach and respiratory tract. Cancers associated with chlorinated phenols, dioxins/furans, and hexachlorobenzene include leukemia, liver, and other organs. Arsenic and chromium are known to cause cancer to the lung through inhalation. Arsenic has also been shown to cause skin cancer from ingestion.

Noncancer effects associated with exposure to PAHs and chlorinated phenols are primarily related to toxicity of the kidney and liver. Effects associated with exposures to arsenic and chromium include keratosis and atrophy of the nasal mucosa.

6.1.4 Risk Characterization

The results of the risk characterization were compared to acceptable risk levels cited in the NCP (40 CFR Part 300.430(e)(2)(i)(A)). The NCP states that cancer risk levels in the range of 1×10^{-6} to 1×10^{-4} (1 in 1,000,000 to 1 in 10,000) and lower are within the range of acceptable risks for Superfund sites. Similarly, noncancer hazard quotients less than 1 are not expected to result in adverse health effects.

Table 6-1 summarizes the excess lifetime cancer risk estimates for each of the exposure scenarios and contaminants of concern in the absence of remedial action. As shown in Table 6-1, carcinogenic PAHs and dioxins/furans represent the greatest percentage of the excess lifetime cancer risk posed by the site. The risk assessment concluded that living near the site and eating fish or shellfish collected near the site did not present risks greater than those normally present in an urban environment. However, all potential future uses of the site (recreational, commercial/industrial and residential) were associated with significant human health risks (greater than 1×10^{-4} excess cancer risk) assuming no removal/remediation of surface soil. The risks summarized in Table 6-1 represent conditions at the site before DEQ conducted interim remedial actions. Interim remedial actions mitigated some of the risks, but current risks still warrant a cleanup at the site.

Excess lifetime cancer risk estimates for groundwater (Table 6-1) exceeded the 1×10^{-4} risk level for all groups of wells. The contaminants responsible for these risk estimates were carcinogenic PAHs, PCP, dioxins/furans, hexachlorobenzene, and arsenic.

A hazard quotient exceeding 1 indicates a potential for noncarcinogenic health effects from site contaminants. A hazard quotient of 8 related to dermal contact with or incidental ingestion of contaminated soil was derived for a future residential exposure scenario assuming no cleanup of the site. This risk is primarily associated with incidental ingestion of arsenic-contaminated soil and dermal contact with PAH compounds. The hazard quotient for the recreational scenarios involving beach visitors and recreational fishing had hazard quotients of 2 related to dermal exposure to contaminated sediment.

Hazard indices for groundwater exceeded 1 for the source area (HI = 300) and downgradient wells (HI = 40). The contaminants responsible for these risk estimates included noncarcinogenic PAHs, pentachlorophenol, hexachlorobenzene, and arsenic.

Risks were calculated for three potential future uses of the site; recreational, industrial, and residential. Risks are highest for future residents, followed by future site workers and then recreational users.

6.2 Ecological Risk Assessment

This section summarizes the results of the baseline ecological risk assessment for the site. The objectives of the assessment were to assess qualitatively and quantitatively the potential adverse ecological effects associated with contaminants detected at the site in the absence of remedial action. The focus of the assessment was to assess risk to fish and aquatic invertebrates associated with river sediment contaminated primarily by creosote and other

Table 6-1

SUMMARY OF EXCESS CANCER RISK ESTIMATES CALCULATED FOR KEY CONTAMINANTS OF CONCERN

Exposure Scenario	Total Excess Cancer Risk by Chemical of Concern[a]				
	CPAH	PCP	Dioxins/ Furans	Arsenic	Scenario Total
ONSITE MEDIA					
Exposure to Soil[b]					
Visitor	3x10^{-4}	7x10^{-6}	3x10^{-3}	7x10^{-5}	3x10^{-3}
Future Worker	6x10^{-4}	2x10^{-5}	9x10^{-3}	2x10^{-4}	1x10^{-2}
Future Resident	5x10^{-3}	1x10^{-4}	5x10^{-2}	1x10^{-3}	6x10^{-2}
Exposure to Groundwater[c]					
Future Worker	5x10^{-2}	2x10^{-3}	2x10^{-3}	1x10^{-3}	6x10^{-2}
Future Resident	2x10^{-1}	8x10^{-3}	8x10^{-3}	3x10^{-3}	2x10^{-1}
ONSITE TOTAL:					
Visitor	3X10^{-4}	7X10^{-16}	3X10^{-3}	7X10^{-5}	3X10^{-3}
Future Worker	5x10^{-2}	2x10^{-3}	1x10^{-2}	1x10^{-3}	7x10^{-2}
Future Resident	2x10^{-1}	8x10^{-3}	6x10^{-2}	4x10^{-3}	3x10^{-1}
OFFSITE MEDIA					
Recreational Exposure to Sediments[d]	5x10^{-5}	3x10^{-8}	1x10^{-4}	7x10^{-7}	2x10^{-4}
Consumption of fish/crayfish	--	--	1x10^{-4}	1x10^{-5}	1x10^{-4}
OFFSITE TOTAL:	5x10^{-5}	3x10^{-8}	2x10^{-4}	1x10^{-5}	3x10^{-4}

Note:
- CPAH - carcinogenic polycyclic aromatic hydrocarbons
- Dioxins/Furans - polychlorinated dibenzo-p-dioxins and furans
- PCP - pentachlorophenol
- HCB - hexachlorobenzene
- TEC - Toxicity Equivalent Concentration
- -- - not evaluated because contaminant was either not analyzed for or not detected.

[a] Includes consideration of ingestion of and dermal contact with contaminated on-site soils prior to interim remedial actions including hot spot source area removal.

[b] Includes consideration of ingestion and inhalation of contaminants in water from the shallow aquifer. Only source wells are included here.

[c] Includes consideration of ingestion of and dermal contact with sediments in shallow water and dermal contact with sediments in deeper water.

[d] The highest estimates for consumption of fish or crayfish are shown here. (See also RI Table 7-6 for separate risk estimates for fish and crayfish.)

chemicals that were used in wood treating activities by McCormick & Baxter. Analyses of sediment chemistry, sediment bioassays, bioaccumulation (tissue residues) in fish and crayfish, fish histopathology, and wildlife observations were evaluated to identify areas of the site that potentially pose an ecological hazard.

6.2.1 Receptor Characterization

The river habitat near the site includes crayfish, clams, and numerous fish species, although the shoreline upstream and on the opposite bank of the Willamette River are highly industrialized. Shorebirds observed in the vicinity of the site include great blue herons, cormorants, Canada geese, ducks, and gulls. Mammals known to be present in the vicinity of the site that may come into contact with contaminated sediment include racoons, beavers, and otters, as well as numerous other species.

6.2.2 Exposure Assessment

The primary exposure pathways for the aquatic environment include contact with contaminated sediment, interstitial pore water, and the water column. Major exposure routes for aquatic receptors include dermal exposure, exposure through respiratory structures and ingestion, as well as exposures through ingestion of contaminated prey by higher trophic level species such as predatory fish, fish-eating birds, and small mammals such as the racoon.

Exposure point concentrations were evaluated through analyses of sediment and soil samples collected at the site. Sediment is primarily contaminated with PAH compounds associated with creosote; PCP contamination of sediment was infrequently detected at low concentrations. Limited arsenic and dioxins/furans contamination also was detected at concentrations exceeding background by a factor of 10 and 2, respectively. Chromium, copper, and zinc were within the range of background concentrations upstream of the site.

6.2.3 Toxicity Assessment

The toxicity assessment included a quantitative and qualitative analysis of available toxicity data to identify what potential toxicological effects might be expected based on-site conditions. Data evaluated included acute and chronic water quality criteria, 50 percent lethal concentration values, sediment quality benchmarks, and mammalian and avian toxicity profiles.

Hyalella azteca and Microtox™ bioassays were performed on 48 and 17 sediment sample locations, respectively, to assess contaminated sediment toxicity to benthic invertebrates. Histopathological studies were conducted on the large scale sucker. The frequency of liver lesions in this fish species is an indicator of carcinogens in the environment and potential adverse effects in aquatic biota. Chemical analysis of fish and crayfish tissue was also performed to evaluate foodchain exposures by predator species.

6.2.4 *Risk Characterization*

The bioassay results indicated that a substantial area of river sediment is likely to be toxic to benthic organisms. The area of significant toxicity is confined to the shoreline near the site and the creosote dock, and in the immediate vicinity of the Burlington Northern Railroad bridge. The toxicity of sediment and surface soil at the site to other types of wildlife has not been quantified or directly studied, though wading shore birds, raccoons, beavers, ground squirrels, and burrowing mice are considered to be at the greatest potential risk.

Based on bioaccumulation and histopathological studies of the site, risks to fish and shellfish near the site are generally low, although seeps of oily material may present acute risks to individual organisms.

6.3 Uncertainty Analysis

Uncertainties associated with the human health risk assessment include such things as exposure assumptions (e.g., pathways, frequency, and duration), the applicability of experimental animal study data on humans, potential differences in toxicity and absorption efficiency between humans and laboratory animals, derivation of dermal toxicity values from oral toxicity values, and the validity of adding risks or hazard quotients for multiple chemicals or pathways. Because several factors used in the risk assessment are uncertain, a conservative (risk aversive) approach was used to select variables for use in risk calculations.

For example, exposure point concentrations were derived using the 95% UCL of the mean concentration from the samples collected for each media of concern (i.e., surface soil, sediment, or groundwater). In the case of dioxins/furans, where there was limited data to conduct valid statistical analysis (i.e., less than 10 samples) and where the UCL exceeded the maximum detected concentration, the maximum concentration was used to estimate the excess cancer risk. The risks associated with dioxins/furans presented in Table 6-1 may be significantly overestimated and may more closely reflect "worst-case" estimates.

Other potentially significant uncertainties include the use of the only available carcinogenic slope factor for benzo(a)pyrene for all carcinogenic compounds. At the time the risk assessment was completed, relative potency estimates had not been accepted by EPA for use in risk calculations; therefore, cancer risks presented in Table 6-1 are likely overestimated. Additional uncertainties are associated with the use of one third of the EPA consumption rate estimate for fish and crayfish based on the limited number of fish in the area. This may either under or over estimate the actual risk. Other uncertainties include averaging the detected concentrations with the detection limit for other samples in which the contaminant was detected at least one time. This approach did not result in an overestimation of risks because few contaminants were undetected in analyses of samples from on-site soil, which contributed heavily to the total risk estimate.

Risk estimates for groundwater ingestion were derived from source areas wells which contain significant NAPL. It is highly unlikely that water in the shallow aquifer will be used as a drinking water source, especially from wells that are located in the source areas. Therefore, risks presented in Table 6-1 for ingestion of groundwater are likely overestimated.

Uncertainties in the ecological risk assessment are related to the lack of standardized methodologies, the limited amount of available data ecological receptors (especially fish and benthic invertebrates) at the site and lack of toxicity data and sediment quality criteria for some of the contaminants of concern. Other uncertainties are related to limitations of the analytical methods or assumptions inherent in the analytical approach.

Information on benthic invertebrates, fish, and wildlife present at the site provides a limited basis for the exposure assessment. A complete characterization of ecological receptors was not possible because a full year of monitoring data on use of the site by fish and wildlife was unavailable. Also, site-specific data are not available to characterize the frequency and duration of exposure and the particular activities (e.g., foraging or nesting) of wildlife species. As a result, doses of contaminants to specific receptors cannot be precisely quantified.

Measurement of contaminant concentrations in muscle tissue of fish and crayfish provided evidence of potential exposure to site contaminants. Limitations of the bioaccumulation data include: contaminants (e.g., dioxins/furans) from regional sources also contribute to measured concentrations in fish collected near the site; because bioaccumulation data were primarily intended for use in the human health risk assessment, data were not collected on contaminant concentrations in specific organs (e.g., liver) of aquatic species where tissue residues may be high relative to other body parts; and data are not available on metabolites of PAH compounds.

Another source of uncertainty is the lack of data on concentrations of contaminants in river water. This data gap is most important for contaminants that are relatively soluble in water, such as the chlorinated phenols and metals. However, because of the high potential for dilution of contaminant releases to the river water, the volume of water that would have detectable concentrations of contaminants from the site is likely to be very small.

6.4 Conclusions

Actual or threatened releases of hazardous substances for this site, if not addressed by implementing the response action selected in the ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

7.0 REMEDIAL ACTION OBJECTIVES AND CLEANUP GOALS

The overall goal of the remedial actions for the McCormick & Baxter site is to protect human health and the environment from contaminated soil, sediment, and groundwater while allowing future use of the site for industrial or recreational purposes. This section presents the remedial action objectives (RAOs) and cleanup goals for soil, groundwater, and sediment at the site that will achieve the overall goal and eliminate the potential risks to human health and the environment which were summarized in Section 6. Additionally, a description of the major applicable or relevant and appropriate requirements (ARARs) and other standards for components of the remedial alternatives is provided. Section 8 provides a detailed description of the remedial alternatives and Section 9 provides an evaluation of the ability of each of the remedial alternatives to satisfy the RAOs and ARARs.

DEQ and EPA have determined that cleanup to protective levels for industrial uses is appropriate for this site considering the current use (industrial) and potential future use (industrial or recreational). The RAOs listed below are protective of both industrial and recreational uses.

7.1 Remedial Action Objectives

7.1.1 Remedial Action Objectives for Soil

Former wood-treating operations at the McCormick & Baxter facility have resulted in widespread contamination of soil across much of the property. Key soil contaminants of concern at the McCormick & Baxter site identified in the human health and ecological risk assessments include PAHs, PCP, arsenic, and dioxins/furans. The RAOs identified for soil are:

- Preventing human exposure through direct contact (ingestion, inhalation, or dermal contact) to contaminated surface and near-surface soil that would result in an excess lifetime cancer risk above 1×10^{-6} for individual compounds, above 1×10^{-5} for additive carcinogenic compounds, or above a Hazard Index (HI) of 1 for noncarcinogenic compounds in an industrial land use scenario.

- Preventing storm water runoff containing contaminated soil from reaching the Willamette River.

7.1.2 Remedial Action Objectives for Groundwater

Dissolved-phase groundwater contamination in the shallow aquifer at the site is associated with the NAPL plumes migrating from the tank farm and former waste disposal areas. Dissolved-phase groundwater contaminants include PAHs, PCP, and metals. Groundwater at the site is not currently used for drinking water. The RAOs for groundwater and NAPL contamination at the site include:

- Preventing human exposure to or ingestion of groundwater with contaminant concentrations in excess of federal and state drinking water standards or protective levels.

- Minimizing further vertical migration of NAPL to the deep aquifer.

- Preventing groundwater discharges to the Willamette River that contain dissolved contaminants that would result in contaminant concentrations within the river in excess of background concentrations or in excess of water quality criteria for aquatic organisms.

- Minimizing NAPL discharges to the Willamette River beach and adjacent sediment to protect human health and the environment.

- Removing mobile NAPL to the extent practicable to reduce the continuing source of groundwater contamination and potential for discharge to Willamette River sediment.

7.1.3 Remedial Action Objectives for Sediment

Sediment contamination in the Willamette River is associated with NAPL migrating from the tank farm and former waste disposal areas. RAOs for sediment were developed to protect indigenous sediment-dwelling organisms and to prevent human exposure through direct contact. The RAOs for sediment include:

- Preventing humans and aquatic organisms from direct contact with contaminated sediment.

- Minimizing releases of contaminants from sediment that might result in contamination of the Willamette River in excess of federal and state ambient water quality criteria.

7.2 Cleanup Goals

The cleanup goals and objectives listed above were identified by EPA and DEQ and are based upon the results of the RI/FS, risk assessments, and a number of other risk management considerations, including the impact on workers and the community, community acceptance of the remedy, technical practicability, and cost of implementing the remedy.

7.2.1 Soil Cleanup Goals

Based upon future industrial land use at the site, cleanup goals for soil have been established for arsenic, PCP, carcinogenic PAHs, and dioxins/furans. The RAOs for soil are to prevent direct contact or incidental ingestion, or runoff to the Willamette River of soil with contaminant concentrations in excess of the background and risk-based concentrations presented Table 7-1.

Table 7-1 SOIL CLEANUP GOALS	
Compound	Soil Concentration (mg/kg)
Arsenic	8[a]
Pentachlorophenol	50[b]
Carcinogenic PAHs	1[c]
Dioxins/Furans	0.00004[d]

a Based on background concentrations equivalent to an excess lifetime cancer risk of 2×10^{-6} in an industrial scenario.
b Equivalent to an excess lifetime cancer risk of 1×10^{-6} in an industrial scenario.
c Equivalent to an excess lifetime cancer risk of 1×10^{-6} in an industrial scenario using benzo(a)pyrene.
d Equivalent to an excess lifetime cancer risk of 1×10^{-6} in an industrial scenario using TCDD equivalency.

Table 7-1 does not include all contaminants of potential concern, but only compounds that pose the greatest potential risk to human health and the environment at the site. Because other contaminants of potential concern are co-located with these compounds, attainment of these cleanup levels would result in the cleanup of all contaminants of concern to protective levels.

7.2.2 Groundwater Cleanup Goals

The RAOs for groundwater are to contain the NAPL plumes, prevent ongoing discharges of NAPL to the Willamette River, and minimize further contamination of the intermediate and deep aquifers. This will eliminate discharge of site-related contaminants to the beach and to the Willamette River sediment.

Because of the extensive NAPL contamination, it is not technically practicable to restore the groundwater aquifers under the site to drinking water quality; therefore, site-specific contaminant concentration limits that are protective of the environment were developed. These protective limits, called Alternate Concentration Limits (ACLs), were developed in accordance with CERCLA Section 121(d)(2)(B)(ii) for dissolved contaminants in groundwater discharging to the Willamette River. Section 121 provides that ACLs may be used at a Superfund site when:

- Groundwater has a known or projected point of entry to surface water;

- There is no significant increase in contaminant concentrations in the surface water at the discharge point or any point at which contaminants are expected to accumulate; and

- There are measures such as institutional controls that prevent human exposure to groundwater contaminants that are above health-based levels.

DEQ and EPA determined that these provisions of CERCLA have been met for the dissolved constituents in groundwater at this site. Further, DEQ and EPA determined that active restoration of the aquifers to non-zero Maximum Contaminant Level Goals (MCLGs) or Maximum Contaminant Levels (MCLs) is technically impracticable due to the extensive NAPL contamination of the saturated zone beneath the site and the river sediment. DEQ and EPA also determined that the risk from potential degradation products in the groundwater can be managed through institutional controls, and that no significant increase of contaminants or their degradation compounds have been found in surface water and no significant increase of contaminants will occur in sediment from groundwater at or downgradient of the point where groundwater discharges to surface water based on calculations that show contaminants would be below detectable levels. The remedial action will result in minimizing the further spread of the plume to the lower aquifer. The ACLs (see Table 7-2) were established to protect aquatic organisms based on EPA/State water quality criteria and will not result in statistically significant increases of contaminant concentrations above background in the Willamette River (i.e., predicted concentrations are significantly below analytical method detection limits). The groundwater quality monitoring program also will include monitoring selected deep aquifer wells. The specific details of the monitoring program will be decided during remedial design.

Table 7-2

ALTERNATE CONCENTRATION LIMITS FOR GROUNDWATER (SHALLOW AQUIFER)

Analyte	Groundwater Concentration (mg/L)[a]
Total PAHs[b]	43
Pentachlorophenol	5
Dioxins/Furans[c]	2×10^{-7}
Arsenic(III)	1
Chromium(III)	1
Copper	1
Zinc	1

a Based on aqueous solubility and consideration of groundwater/surface water dilution.
b Sum of low and high molecular weight PAHs.
c Based on solubility and toxic equivalency to 2,3,7,8-TCDD.

7.2.3 Sediment Cleanup Goals

The RAOs for sediment are designed to prevent direct human contact with sediment contaminated above the health-based cleanup goals presented in Table 7-3, and to prevent exposure of benthic organisms to sediment contaminated above known toxicity levels. Currently, no state or federal sediment quality criteria exist; however, bioassay results indicated that a substantial area of near shore contaminated sediment is toxic to sedentary benthic invertebrates. These areas coincide with areas that exceed human health risk-based goals. Benthic threshold effects concentrations derived in the ecological risk assessment are 12 mg/kg for total PAHs and 0.32 mg/kg for benzo(a)pyrene. In general, the human health-based sediment cleanup goals are protective of benthic organisms, except for one individual compound, benzo(a)pyrene. Verification of cleanup goals for protection of benthic organisms will be based on sediment bioassay tests (such as *Hyalella azteca*, Microtox, or other aquatic toxicity tests that are determined to be more predictive of potential risks) resulting in a mortality rate less than or equal to upstream reference conditions.

Table 7-3

CLEANUP GOALS FOR SEDIMENT

Compound	Sediment Concentration (mg/kg, dry weight)
Arsenic	12[a]
Pentachlorophenol	100[b]
Carcinogenic PAHs	2[b]
Dioxins/furans	0.008[b,c]

a Based on concentrations in upstream reference station.

b Based on an acceptable risk of 1×10^{-6} for recreational exposure scenario. Exposure to sediment is not considered relevant to occupational scenarios. Exposure under the residential scenario would be similar to that assumed for the recreational scenario.

c Expressed as 2,3,7,8-TCDD toxic equivalent concentrations.

7.3 Applicable or Relevant and Appropriate Requirements

In meeting the cleanup objectives, DEQ and EPA must comply with the ARARs of state and federal laws and regulations. These include, among others, the Resource Conservation and Recovery Act (RCRA) and the Clean Water Act (CWA). These regulations are described below. Other ARARs are presented in Section 11.

7.3.1 Resource Conservation and Recovery Act

One of the most significant ARARs affecting the development and selection of cleanup alternatives for the McCormick & Baxter site are the regulations implementing RCRA and the Oregon Hazardous Waste Management Act.

The regulations in 40 CFR Part 261 and parallel Oregon regulations (ORS 466.005 *et seq*; OAR340-100-001 *et seq*) contain definitions and criteria for identifying RCRA hazardous waste. Listed waste codes associated with the residuals from the wood- preserving processes used at the McCormick & Baxter site are F032, F034, and F035. However, McCormick & Baxter ceased operations prior to the effective dates of the F032, F034, and F035 listings in Oregon (October 16, 1992, for F034 and F035, and June 6, 1991, with a conditional stay until February 6, 1992, for F032). Therefore, the listed waste codes are not applicable to the contaminated media as long as they are managed within the area of contamination (AOC.) Because the entire McCormick & Baxter site is contaminated to varying degrees, DEQ and EPA have designated the entire site an AOC.

Regardless of the effective date of the listings, media contaminated with waste that meets the definition of a listed hazardous waste takes on that waste designation when it is actively managed (i.e., treated, stored, or disposed under RCRA) outside the AOC. Transfer of soil to a newly constructed, engineered unit is considered to be outside of the AOC. Therefore, wastes that are actively managed outside of the AOC after the effective dates would be considered to carry the F032, F034, and F035 waste designations.

In addition, the contaminated medium may require management as a characteristic waste based on the toxicity characteristic for arsenic or chromium. Concentrated waste (e.g., pure-phase NAPL) may also be a characteristic waste based on ignitability (40 CFR 261.21).

For those RCRA hazardous wastes that are managed on-site outside the AOC and are RCRA listed or characteristic wastes, substantive RCRA 40 CFR 264 and 268 standards are applicable. This will primarily affect alternatives involving treatment of the principal threat wastes. The regulations in 40 FR 268 set standards that must be met before a hazardous waste can be land disposed. An alternative approach for meeting some of these substantive RCRA requirements is to establish a Corrective Action Management Unit (CAMU). A CAMU allows protective, site-specific design, operation, and closure standards to be set.

Where the substantive RCRA hazardous waste requirements are not applicable, they may still be relevant and appropriate. At the McCormick & Baxter site, RCRA closure requirements have been determined to be relevant and appropriate to contaminated soil within the AOC that pose an unacceptable threat to human health and the environment.

EPA rules allow contaminated soil and other wastes to be excavated and consolidated within an AOC and processed within an AOC (but not in a separate unit such as a tank) without the activity constituting a new placement of the soil that would cause the soil to become regulated as a hazardous waste (46 FR 8758). Therefore, the RCRA closure regulations of 40 CFR Part 264 are not applicable to the excavation, consolidation, stockpiling, and sorting of the soil and debris at the site. The requirements of 40 CFR Part 264 may be applicable to any alternative that involves ex situ treatment and replacement of hazardous waste soil unless a CAMU is established.

Regulations addressing CAMUs were promulgated February 16, 1993 (58 FR 8658). The main regulations that address CAMUs are found in Subpart S, 40 CFR 264.552. A CAMU is defined as an area within a facility designated by the Regional Administrator for the purpose of implementing corrective action requirements under RCRA. A CAMU can only be used for the management of remediation wastes pursuant to these corrective action requirements. The CAMU approach provides for management of remediation wastes that does not constitute placement. Because placement does not occur, Land Disposal Regulations (LDRs) and Minimum Technology Requirements (MTRs) are not triggered (e.g., requirements for double liners, leachate collection systems). This approach also *provides for moving or consolidating wastes within* a CAMU or placing wastes from one CAMU into another CAMU at a facility without triggering LDRS or MTRs. Wastes that are generated in a CAMU can be treated in a separate unit outside the CAMU (but within the facility boundary) and redeposited into the CAMU. Placement of the treated wastes into the CAMU does not necessarily trigger LDRs and MTRs. Site-specific standards, which can include LDRs and MTRs, are set for the treated wastes. The designation of a CAMU at the McCormick & Baxter site is appropriate because it:

- Provides incentive for some degree of treatment which would otherwise be precluded by the LDRs; and

- Uses technologies that are appropriate for the site, and that are protective of human health and the environment.

7.3.2 Clean Water Act

Primary sections of the CWA that apply to remediation of contaminated sites are found in Titles III and IV, which address effluent standards and permit requirements for discharges to U.S. waters. The primary state ARAR for surface water at the site is found in ORS, Chapter 468; groundwater protection is also addressed in the state law.

Remedial actions that may result in a discharge of a pollutant to U.S. waters must comply with the substantive requirements of a Section 401 certification. Discharges of dredged or fill material into U.S. waters must comply with the substantive requirements of a Section 404 permit.

Section 304 of the CWA establishes federal water quality criteria (FWQC). The FWQC are nonenforceable guidelines to be used by states to set water quality standards for surface water. CERCLA requires FWQC to be attained if they are relevant and appropriate for a site. FWQC are set for the protection of human health and welfare, and freshwater and marine aquatic life. The State of Oregon has used FWQC and other factors to set water quality standards for the Willamette River (OAR 340-41-445(p)). Alternatives that involve the discharge of treated groundwater to the Willamette River will need to satisfy these state requirements. These requirements are also relevant and appropriate for non-point source discharges from the site.

8.0 DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

The McCormick & Baxter 1995 FS report identified and evaluated a number of alternatives that could be used to address threats and/or potential threats posed by the site. The remedial action alternatives were presented separately for soil, groundwater (including NAPL), and sediment. Interactions between the media were taken into consideration during the development and evaluation of alternatives. For each medium, the FS identified a range of remedial action alternatives. The range of remedial action alternatives included a "no action" alternative, alternatives that involve containment of waste with little or no treatment, and alternatives that include treatment of waste as a primary component to address the principal threats at the site.

Use of institutional controls at the site was considered during development of the remedial alternatives. Institutional controls include measures such as deed restrictions, public awareness efforts, and fencing, which limit human exposure by restricting site use and access. As a stand-alone alternative, institutional controls will not meet the RAOs for the site. However, components included under institutional controls could be used with the remedial alternatives to further reduce human exposure. Therefore, institutional controls are not developed as a stand-alone alternative, but rather their components are included with all the assembled alternatives, except the no action alternative.

Some institutional controls, such as perimeter fencing, warning signs, and buoys along the river, are already in place and would be maintained until completion of the cleanup. Long-term institutional controls also will be implemented including prohibition of drinking water wells at the site, hazard notices that warn future owners of the contamination on the property, and land use restrictions that apply to the property (e.g., protecting the cap and restricting future use of the site to industrial/commercial or recreational use).

During the development of soil remedial alternatives, DEQ considered the use of remedies listed in EPA's *Technology Selection Guide for Wood Treater Sites* (EPA 1993b). The presumptive remedies for treating soil at wood treater sites include biotreatment, incineration, other thermal treatment (e.g., thermal desorption), and immobilization. All of these technologies have been included in the soil remedial alternatives. These alternatives are consistent with EPA's guidance, *Presumptive Remedies for Soils, Sediment, and Sludges at Wood Treater Sites* (EPA Directive 9200.5/5-162, December 1995).

The cleanup alternatives for soil, groundwater, and sediment are summarized below. The summary includes a cost estimate and estimated timeframe for completion of the cleanup. Cost estimates for each alternative are given in 1995 dollars and include design, construction, and long-term operation and maintenance costs for up to 30 years. Estimated timeframes are based on the construction periods of the cleanup. Some operation and maintenance requirements and institutional controls will remain indefinitely.

8.1 Common Elements to All Cleanup Alternatives

All of the alternatives considered for the site include a monitoring program, except the no action alternative for soil. All alternatives, except the no action alternatives, would include institutional controls, as well as demolition and removal of site structures and equipment prior to remediation.

8.1.1 Monitoring

Monitoring is included as a component of all remedial action alternatives, including no action alternatives for groundwater and sediment. Monitoring is not included in the no action option for soil due to limited potential for changes in the distribution of site contaminants. Separate monitoring programs would be needed for the short-term (during remedial action) and for the long-term (following completion of remediation and for long-term groundwater treatment). Specific details of a monitoring program, however, would vary with the selected remedial action. Detailed monitoring plans will be developed for any selected remedial actions during remedial design. Monitoring plans will be included in detailed presentations of the remedial action plans and in operations and maintenance plans (e.g., for a groundwater treatment system). In addition, the initial long-term monitoring plan will probably require some modifications based on the information gained during short-term monitoring.

Short-term monitoring is conducted during remediation activities for the following purposes:

- To detect any negative effects of remediation activities (e.g., dust generation during excavation) to allow prompt and appropriate mitigation of problems;

- To evaluate the performance of the remedy for comparison to design expectations (e.g., ensure that wastewater treatment meets discharge requirements; ensure that all surface soil exceeding RAOs is removed for disposal or consolidated under a cap; define the areas to be capped); and

- To identify operation and maintenance concerns to allow optimization of remediation to better meet RAOs (e.g., modify well configurations or add new wells to better contain and extract NAPL and contaminated groundwater).

Long-term monitoring is conducted primarily to allow timely maintenance of containment (e.g., soil and sediment caps) and ensure that the selected remedial action performs as expected in the long term (e.g., stabilized contaminated soil is not contributing to groundwater contamination, or natural recovery is actually occurring). For long-term extraction and treatment of groundwater, monitoring would include operational parameters to ensure that contaminated groundwater is not escaping containment (this would include monitoring of the deeper aquifer) and that the treatment system is operating properly and is meeting regulatory discharge limitations. For costing purposes, long-term monitoring and operation and maintenance is defined as 30 years, although actual monitoring and operation and maintenance may occur for longer periods of time.

8.1.2 Institutional Controls

Institutional controls are used to restrict access and thereby reduce human exposure to contaminated materials at the site. As discussed earlier, several institutional controls are already in place. For the McCormick & Baxter site, the institutional controls described would be included in all alternatives except the no action alternatives (Alternatives S-1, GW-1, and SD-1). Existing institutional controls (fencing and signs) would remain under the no action alternatives, but would not be maintained.

The McCormick & Baxter property is surrounded by a chain-link fence (Figure 1-2) on which warning signs are posted. Buoys which provide notice of site contamination and warnings against fishing and swimming are located in the Willamette River, extending from upstream of the creosote dock to downstream near the railroad bridge. A security guard also patrols the site during evening hours and on weekends.

Some contaminated sediment are located north of the Burlington Northern rail spur. Measures to restrict or prohibit dredging of contaminated sediment, without prior notice to and approval from DEQ or EPA, will be pursued with the United States Army Corps of Engineers (the organization responsible for issuing dredging permits) and property owner(s).

Contaminated groundwater will remain at the site for an extended period of time under all alternatives. Institutional controls for groundwater will consist of prohibiting the use of the shallow and intermediate aquifers for any purpose and prohibiting the use of the deep aquifer as a drinking water source.

Institutional controls, such as deed restrictions, will be imposed to ensure that the effectiveness of the remedy is not compromised. If DEQ is the site owner, additional use restrictions could be imposed through lease restrictions (e.g., if the land is leased for commercial/industrial use) or active control of the site (e.g., if the area is used as a public park).

8.1.3 Demolition

The remedial action options considered for the site assume demolition and removal of remaining site structures and equipment prior to remediation. Buildings and foundations would be demolished (a limited number of buildings may be left in place if needed for remediation purposes, such as to house a groundwater treatment system). The determination of whether below-grade foundations, such as the retort sumps, can be filled and capped in place will be made during remedial design. Demolition debris (e.g., concrete, wood, and reinforcing bar) would either be consolidated on-site under the soil cap or transported off the site for disposal.

8.2 Soil Alternatives

Contaminant concentrations and soil volumes were evaluated in the revised FS to identify where significant risk reduction could be cost-effectively achieved through treatment. For the McCormick & Baxter site, soil contaminated with arsenic, PCP, and carcinogenic PAHs above the action levels presented in Table 8-1 would be consolidated (except in Alternatives S-1 and S-2a) and, in some of the alternatives, treated to reduce the toxicity, mobility, or volume of contaminants.

Table 8-1

ACTION LEVELS FOR SOIL TREATMENT

Compound	Treatment Action Level (mg/kg)
Arsenic	300[a]
Pentachlorophenol	500[b]
Carcinogenic PAHs	100[a]

[a] Based on an excess cancer risk of 1×10^{-4} for industrial land use and 2×10^{-5} for recreational land use.
[b] Based on an excess cancer risk of 1×10^{-5} for industrial land use.

The estimated volume of soil above actions levels for arsenic, PCP, and/or carcinogenic PAHs that would be consolidated, or treated and consolidated, is approximately 31,000 cubic yards. A summary of the estimated volume of contaminated soil is presented in Table 8-2. In addition, approximately 1,000 cubic yards of the most highly contaminated soil and other wastes which are not expected to be effectively treated using the methods described in the alternatives will be transported off-site for treatment and disposal (except in Alternative S-1 and S-2a) in accordance with applicable hazardous waste regulations. This would include soil with significant dioxin concentrations (i.e., several orders of magnitude above protective levels).

Table 8-2

ESTIMATED VOLUME OF CONTAMINATED SOIL

Contaminant	Estimated Volume (cubic yards)
Arsenic only	12,500
Arsenic and PAHs or PCP	6,500
PAHs and/or PCP	12,000
Total	**31,000**

8.2.1 Alternative S-1: No Action

Under the no action alternative, the site would be left in its current condition. DEQ and EPA are required to consider the no action alternative as a basis for comparison of existing site conditions and risks resulting from implementation of remedial alternatives.

Although some risk reduction measures have been implemented under the interim cleanup actions, no action would be taken to treat or stabilize contaminated site soil. No additional institutional controls beyond those already in place would be applied to restrict access to the site. Limited natural degradation of organic contaminants may occur slowly through photolysis or biodegradation. The no action alternative would not address continued contact of storm water with surface soil, potentially resulting in contaminated runoff, nor would it prevent potential direct contact with surface soil by site trespassers. No costs or implementation timeframes are associated with this alternative.

8.2.2 Alternative S-2a: Capping In Place

This alternative includes debris removal, site clearing, grading, and placement of a 2-foot-thick cap of clean soil across the entire McCormick & Baxter property (approximately 43 acres) to prevent direct contact with contaminated soil which will result in an excess cancer risk above 1×10^{-6} from long-term exposure in an industrial scenario. The cap design would include a soil layer, a gravel layer, and a topsoil/vegetation cover. The cap would be designed to reduce, but not to eliminate infiltration. Prior to placement of the cap, the underlying soil would be graded to provide a slope of at least 2 percent to direct stormwater runoff to integrated catch basins.

The cap would be inspected at least annually and repaired if needed. Institutional controls would be implemented as described earlier. Dust control and standard safety measures would be implemented during construction to minimize dust and protect site workers.

Estimated Capital Costs:	\$3.430 million
Estimated Annual O&M Costs:	\$0.036 million
Estimated Present Worth of Annual O&M Costs:	\$0.557 million
Estimated Total Costs:	\$3.987 million
Estimated Timeframe:	3-6 months construction, 30 years O&M

8.2.3 Alternative S-2b: Capping With Consolidation

This alternative is similar to Alternative S-2a (Capping in Place), except that areas of soil exceeding the action levels in Table 8-1 would be excavated and consolidated on-site in a designated area (e.g., in the northwestern portion of the site near the Burlington Northern railbed). This area was selected because it is highly contaminated; groundwater contamination is present both upgradient and downgradient of the area; and it does not interfere with implementation of the groundwater remedy. This small quantity of extremely contaminated soil would be transported off-site for treatment and disposal.

Soil contaminated above action levels (Table 8-1) would be excavated to a depth of approximately 1 foot bgs and placed in the consolidation area. The most highly contaminated soil in the source areas would be excavated to depths of approximately 4 feet bgs and placed in the on-site consolidation area; approximately 1,000 cubic yards would be transported off-site for treatment and disposal. The consolidation area would be lined with a geotextile fabric to mark the limits of the zone of contaminated soil, and capped with a geotextile fabric and a 2-foot-thick soil cap, similar to Alternative 2a, to prevent direct contact. The remainder of the site containing residual contamination exceeding a 1×10^{-6} risk level would be capped with 2 feet of clean soil. Capped consolidation areas would be inspected regularly and repaired if needed. Institutional controls would be implemented as described earlier.

Estimated Capital Costs:	$7.244 million
Estimated Annual O&M Costs:	$0.036 million
Estimated Present Worth of Annual O&M Costs:	$0.557 million
Estimated Total Costs:	$7.801 million
Estimated Timeframe:	6 months construction, 30 years monitoring

8.2.4 Alternative S-3: Stabilization, Consolidation, and Cap

This alternative includes all the components in Alternative S-2b (Capping With Consolidation). In addition, excavated soil would be stabilized by mixing it with cement or other stabilizing agents prior to placement in the consolidation areas to reduce contaminant mobility. Treatability tests would be performed during design to determine the optimum mixture of stabilizing agents and soil.

Estimated Capital Costs:	$9.524 million
Estimated Annual O&M Costs:	$0.036 million
Estimated Present Worth of Annual O&M Costs:	$0.557 million
Estimated Total Costs:	$10.081 million
Estimated Timeframe:	1 year construction, 30 years O&M

8.2.5 Alternative S-4a: Soil Wash, Slurry Biotreatment, Stabilization, and Cap

This alternative includes excavation, stockpiling, and screening (to remove large debris), of surface and near-surface soil contaminated above the action levels (Table 8-1). Soil contaminated with PAHs and PCP above the action levels would be washed with water to concentrate the fine soil particles for further treatment. Microorganisms and/or nutrients would be added to the soil/water solution to biologically degrade the organic contaminants *(primarily PAHs and PCP). The fine soil fraction* would be dewatered and mixed with the unwashed soil containing primarily arsenic contamination and stabilized to reduce contaminant mobility as described for Alternative S-3. The washed course fraction would be placed back on the site prior to capping under a 2-foot-thick soil cap. All stabilized soil would be placed in a consolidation area under a 2-foot-thick soil cap. Treatability tests would be conducted during design to optimize the treatment process.

Estimated Capital Costs:	$13.600 million
Estimated Annual O&M Costs:	$0.036 million
Estimated Present Worth of Annual O&M Costs:	$ 0.557 million
Estimated Total Costs:	$14.157 million
Estimated Timeframe:	2 years construction, 30 years O&M

8.2.6 Alternative S-4b: Soil Wash, Off-Site Incineration, Stabilization, and Cap

This Alternative is similar to alternative S-4a, except that the concentrated fine soil fraction would be transported off-site for incineration at a permitted hazardous waste treatment facility. Washed coarse material with arsenic concentrations in excess of action levels would be combined with excavated arsenic soil, stabilized and consolidated and capped as described in Alternative 4a. Washed soil with concentrations below action levels would remain on-site under a 2-foot-thick soil cap.

Estimated Capital Costs:	$26.776 million
Estimated Annual O&M Costs:	$0.036 million
Estimated Present Worth of Annual O&M Costs:	$ 0.557 million
Estimated Total Costs:	$27.333 million
Estimated Timeframe:	2-3 years construction, 30 years O&M

8.2.7 Alternative S-5a: Biological Land Treatment, Consolidation, and Cap

This alternative includes biological treatment identified as land treatment in the FS of highly contaminated PAH- and PCP-contaminated soil. Under this alternative, surface and near-surface soil in the source areas contaminated with PAH and PCP in excess of the action levels in Table 8-1 would be excavated, stockpiled, screened to remove large debris, and treated biologically in an on-site engineered land treatment cell. Water, nutrients, and possibly microbes or enzymes would be added to the soil and rototilled or disc-harrowed in thin layers to enhance oxygen transfer and microbial growth. Soil would be added to the engineered treatment cell in 2-foot lifts when biological treatment for concentrations the previous for lift is complete. Soil contaminated with arsenic above action levels (Table 8-1) would be excavated and consolidated on-site without treatment. After biological treatment is complete, the treatment cell and arsenic consolidation cell would be capped with a 2-foot soil cover to prevent direct contact. The remaining portions of the site would also be capped with 2-foot-thick soil cover as described in Alternative 2a.

Estimated Capital Costs:	$9.273 million
Estimated Annual O&M Costs:	$0.036 million
Estimated Present Worth of Annual O&M Costs:	$0.557 million
Estimated Total Costs:	$9.830 million
Estimated Timeframe:	2 years construction, 30 years O&M

8.2.8 Alternative S-5b: Biological Land Treatment, Stabilization, Consolidation, and Cap

This alternative includes land treatment of PAH- and PCP-contaminated soil, and stabilization of arsenic-contaminated soil. The alternative is similar to Alternative S-5a, except that excavated soil containing arsenic above action levels would be stabilized prior to consolidation and capping.

Estimated Capital Costs:	$10.065 million
Estimated Annual O&M Costs:	$0.036 million
Estimated Present Worth of Annual O&M Costs:	$ 0.557 million
Estimated Total Costs:	$10.622 million
Estimated Timeframe:	2 years construction, 30 years O&M

8.2.9 Alternative S-6a: On-Site Thermal Desorption and Cap

Under this alternative, soil contaminated with PAH and PCP above action levels (Table 8-1) would be excavated, stockpiled, screened to remove large debris, and subjected to thermal desorption. Thermal desorption treatment involves heating soil to remove organic chemicals (e.g., PCP, PAHs) from the soil. Organic vapors are removed and emissions are purified prior to release to the environment. Treated soil would be placed back on the site and covered with a 2-foot-thick soil cap. Contaminants recovered from the air emissions treatment would be transported off-site for treatment and/or disposal at a hazardous waste facility.

Soil primarily contaminated with arsenic above action levels would be consolidated without treatment prior to capping. The consolidation area and the site would be capped as described in Alternative 2a. The remaining portions of the site with soil above cleanup goals also would be capped to prevent direct contact.

Estimated Capital Costs:	$18.256 million
Estimated Annual O&M Costs:	$0.036 million
Estimated Present Worth of Annual O&M Costs:	$ 0.557 million
Estimated Total Costs:	$18.813 million
Estimated Timeframe:	2-3 years construction, 30 years O&M

8.2.10 Alternative S-6b: On-Site Thermal Desorption, Stabilization, Consolidation, and Cap

This alternative is similar to Alternative S-6a, except that the arsenic-contaminated soil would be stabilized on-site prior to placement in the consolidation area. For soil containing PAHs/PCP and arsenic, stabilizing agents would be added to the thermally treated soil during the quench stage (a common practice for soil that also contains inorganic contaminants of concern). Non-thermally treated soil would be stockpiled and stabilized separately.

Estimated Capital Costs:	$19.048 million
Estimated Annual O&M Costs:	$0.036 million
Estimated Present Worth of Annual O&M Costs:	$ 0.557 million
Estimated Total Costs:	$19.605 million
Estimated Timeframe:	2-3 years construction, 30 years O&M

8.3 Groundwater/NAPL Alternatives

Each of the groundwater cleanup alternatives includes routine groundwater monitoring for at least 30 years. Institutional controls to prevent use of contaminated groundwater at the site would be imposed under all alternatives except the no action alternative.

8.3.1 Alternative GW-1: No Action

The no action alternative is required as a baseline for comparison with other alternatives. Current NAPL recovery operations would be suspended which could result in discharge of NAPL to site beaches and Willamette River sediment. Natural degradation processes, such as biodegradation, chemical transformation, and dilution would be relied upon to achieve restoration of the environment. It is estimated that groundwater restoration by natural processes would take several hundred to thousands of years. The only cost for this alternative is for groundwater monitoring. Costs for this alternative are based on semiannual monitoring for the first 5 years and annual monitoring for the following 25 years.

Estimated Capital Costs:	None
Estimated Annual O&M Costs:	$0.038 million (Year 1 through 5)
Estimated Annual O&M Costs:	$0.019 million (Year 6 through 30)
Estimated Present Worth of Annual O&M Costs:	$0.369 million
Estimated Total Costs:	$0.369 million
Estimated Timeframe:	30 years monitoring

8.3.2 Alternative GW-2: NAPL Extraction

This alternative would consist of removing LNAPL and DNAPL as they accumulate in existing extraction wells completed in the shallow aquifer located in and downgradient of the primary source areas. The objective of this alternative is to remove NAPL that could continue to affect groundwater and sediment. Additional extraction wells may be located in the tank farm area and former waste disposal area where significant NAPL is known or suspected to be present. NAPL would be removed using automated pumps and/or bailing wells. Dissolved-phase contaminated groundwater would not be extracted and would continue to discharge to the Willamette River.

The NAPL extracted from the shallow aquifer would be collected in tanks on-site and periodically shipped off-site for treatment and disposal at a hazardous waste treatment and disposal facility. Reuse of the NAPL may be an option if another wood treating facility is identified that would reuse the product. Historical NAPL extraction rates have been in the range of 50 gallons per month (600 gallons/year).

Continued operation of the pilot scale groundwater treatment plant would not be included in this alternative because groundwater would not be extracted during NAPL recovery.

Estimated Capital Costs:	$0.203 million
Estimated Annual O&M Costs:	$0.142 million (Year 1 through 5)

Estimated Annual O&M Costs:	$0.123 million (Year 6 through 30)
Estimated Present Worth of Annual O&M Costs:	$1.974 million
Estimated cost:	$2.177 million
Estimated Timeframe:	30 years

8.3.3 Alternative GW-3: Enhanced NAPL Extraction

This alternative is similar to Alternative GW-2 (NAPL Extraction) except that, in addition to pure-phase NAPL extraction, NAPL-contaminated groundwater (i.e., groundwater with small amounts of NAPL) also would be extracted to enhance NAPL recovery rates. Additional extraction wells would be placed in the areas of the site where significant recoverable NAPL is present as described for Alternative GW-2. This alternative would not only remove pure-phase NAPL, but also would hydraulically control contaminated groundwater in a limited area in the vicinity of each extraction well. Some groundwater contamination would continue to discharge to the Willamette River under this alternative. Groundwater would be monitored and additional measures would be taken if contaminant concentrations exceed levels which would adversely impact the river. This alternative would contain the NAPL and minimize ongoing NAPL discharges to the river.

A groundwater treatment plant, similar to the one presently operating at the site, would be required for this alternative. The existing system includes separation of NAPL and groundwater, filtration of groundwater to remove organic contaminants, and additional treatment using granular activated carbon. The NAPL would continue to be collected in on-site tanks and periodically shipped off-site for treatment and disposal, or reuse. Treated groundwater would either be discharged to the Willamette River or to drain fields installed in major source areas (e.g., tank farm area) to facilitate flushing of any mobile NAPL that may remain in these areas after soil excavation.

Alternative GW-3 includes a contingency to install a subsurface vertical barrier (e.g., interlocking steel sheets) along the beach downgradient of the tank farm and former creosote tank. The vertical barrier contingency would be evaluated during remedial design and installed if it is determined it will improve the overall effectiveness of the remedy by enhancing NAPL removal or providing additional control of contaminant migration. This contingency is included in the estimated costs provided below.

Estimated Capital Costs:	$0.816 million
Estimated Annual O&M Costs:	$0.574 million (Year 1 through 5)
Estimated Annual O&M Costs:	$0.555 million (Year 6 through 15)
Estimated Annual O&M Costs:	$0.019 million (Year 16 thr. 30)
Estimated Present Worth of Annual O&M Costs:	$5.939 million
Estimated Total Costs:	$6.755 million
Estimated Timeframe:	15 years for NAPL/GW extraction, 30 years for monitoring

8.3.4 Alternative GW-4a: Groundwater and Enhanced NAPL Extraction

Alternative 4a would consist of recovering both groundwater and NAPL using extraction wells. The objective of this alternative would be not only to extract pure-phase NAPL, but also to extract groundwater to hydraulically control the dissolved-phase contaminant plume that would otherwise discharge to the Willamette River.

The groundwater extraction wells would be installed within the groundwater remediation areas near the NAPL sources to contain the groundwater contaminant plume. Some extraction wells would also be installed in the near-shore sediment to extract contaminated groundwater.

Estimated Capital Costs:	$1.335 million
Estimated Annual O&M Costs:	$0.880 million (Year 1 through 5)
Estimated Annual O&M Costs:	$0.895 million (Year 6 through 20)
Estimated Annual O&M Costs:	$0.395 million (Year 16 thr. 30)
Estimated Present Worth of Annual O&M Costs:	$11.342 million
Estimated Total Costs:	$12.677 million
Estimated Timeframe:	15 years for groundwater extraction, 30 years for monitoring

8.3.5 Alternative GW-4b: Groundwater and Enhanced NAPL Extraction with Downgradient Barrier

This alternative would consist of a combination of enhanced NAPL extraction (as in Alternative GW-3), groundwater extraction (as in Alternative GW-4a), and a subsurface vertical barrier (e.g., interlocking steel sheets) installed along the beach downgradient of the major source areas. The vertical barrier would be used to control the movement of groundwater and NAPL into the shallow beach sediment. The physical barrier would provide additional mechanism to control migration and discharge of NAPL in the event that NAPL removal (Alternative 2) or NAPL and groundwater extraction (Alternatives 3 and 4) are not effective.

Estimated Capital Costs:	$3.957 million
Estimated Annual O&M Costs:	$0.914 million (Year 1 through 5)
Estimated Annual O&M Costs:	$0.895 million (Year 6 through 20)
Estimated Annual O&M Costs:	$0.395 million (Year 16 thr. 30)
Estimated Present Worth of Annual Total Costs:	$15.299 million
Estimated Timeframe:	15 years for groundwater extraction, 30 years for monitoring

8.4 Sediment

Each of the sediment alternatives, including the no action alternative, includes routine monitoring of sediment (or cap thickness), sediment core sampling (to analyze movement of contaminants), and biological testing to assess the impact of the remedial alternatives on aquatic organisms. Cost estimates assume these studies would be conducted over a 30-year period.

Institutional controls such as restricting or prohibiting dredging of contaminated sediment areas, without prior approval from DEQ or EPA, will be implemented for all alternatives, except the no action alternative. The final design elements for the sediment remedy will incorporate habitat restoration to the extent possible. The sediment remedy would not be implemented until NAPL migration is sufficiently controlled to prevent contamination of the cap.

8.4.1 Alternative SD-1: No Action

Under this alternative, no permanent actions would be implemented to remove or isolate areas of sediment contamination. Monitoring, as described above, would be implemented to track the gradual natural recovery that would occur through elimination of NAPL discharges, natural sedimentation within the river, biological degradation of organic contaminants, or dispersion of sediment into the main channel of the river during storms or high river stage. However, existing human health threats and environmental risks would continue near levels currently estimated for exposure to sediment at the site.

Estimated Capital Costs:	None
Estimated Annual O&M Costs:	$0.063 million
Estimated Present Worth of Annual O&M Costs:	$0.961 million
Estimated Total Costs:	$0.961 million
Estimated Timeframe:	30 years monitoring

8.4.2 Alternative SD-2a: Cap Remediation Areas

Alternative SD-2a involves capping the areas with the mostly highly contaminated sediment based on either toxicity to aquatic organisms or human health risks. The size of the areas which exceeds one or both of these criteria is estimated at 15 acres. These areas are identified as sediment remediation areas and are located downgradient of the NAPL plumes. Adjacent areas with lower concentrations of sediment contaminants would be allowed to naturally recover over time. The cap would consist of a 3-foot layer of sand to prevent humans and aquatic organisms from direct contact with the contaminated sediment. This alternative also includes long-term cap maintenance and sediment monitoring to ensure continued cap effectiveness (i.e., to monitor erosion, detect any recontamination).

Estimated Capital Costs:	$2.262 million
Estimated Annual O&M Costs:	$0.081 million
Estimated Present Worth of Annual O&M Costs:	$1.248 million
Estimated Total Costs:	$3.510 million
Estimated Timeframe:	3-6 months construction, 30 years monitoring

8.4.3 Alternative SD-2b: Cap All Areas Above Background Levels of Contamination

Under this alternative, a cap would be placed over all areas (approximately 32 acres) exhibiting elevated (above background) concentrations of site-related contaminants. The cap would extend from the shoreline to the navigation channel. Different capping designs may be required to accommodate an area this large because a variety of slopes and river currents are anticipated. For the majority of the offshore area, a sand cap would be effective in isolating sediment from direct contact. Rip-rap would be used near the rail bridge crossing to protect the underlying cap from erosion. Long-term maintenance and monitoring would be implemented as described for Alternative SD-2a.

Estimated Capital Costs:	$4.061 million
Estimated Annual O&M Costs:	$0.103 million
Estimated Present Worth of Annual O&M Costs:	$1.583 million
Estimated Total Costs:	$5.644 million
Estimated Timeframe:	6-9 months construction; 30 years monitoring

8.4.4 Alternative SD-3: Selective Dredging With On-Site Treatment; Cap Remediation Areas

This alternative involves the removal of hot spots (highly contaminated surface sediment estimated at 20,000 cubic yards) for treatment onshore. The sediment dredging and on-site treatment would be coordinated with the soil remedy to allow use of the biological land treatment system installed for soil. The remaining contaminated sediment in the remediation area only would be capped after the highly contaminated sediment were dredged for treatment. The intent of the dredging under this alternative is to remove and treat sediment that presents the greatest potential risk to human health and the environment and to prevent direct contact with the residual contaminated sediment in the remediation areas. Treatment of dewatered dredge material and water would be the same as that recommended for treatment of contaminated soil and groundwater. As in Alternative SD-2a, this alternative involves capping the sediment remediation areas without extending the cap to adjacent sediment containing low levels of contamination.

Estimated Capital Costs:	$6.572 million
Estimated Annual O&M Costs:	$0.081 million
Estimated Present Worth of Annual O&M Costs:	$1.245 million
Estimated Total Costs:	$7.817 million
Estimated timeframe:	1 year construction, 30 years monitoring

8.4.5 Alternative SD-4: Selective Dredging With Off-Site Disposal; Cap Remediation Areas

This alternative is identical to Alternative SD-3, except that the dredged sediment would be treated, if necessary, and disposed in an off-site landfill. The sediment would be dewatered on-site and transported overland to a final disposal site.

Estimated Capital Costs:	$13.652 million
Estimated Annual O&M Costs:	$0.081 million
Estimated Present Worth of Annual O&M Costs:	$ 1.245 million
Estimated Total Costs:	$14.897 million
Estimated timeframe:	1 year construction, 30 years monitoring

9.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section discusses the comparison of alternatives with respect to the nine NCP requirements. The NCP requires that each remedial alternative analyzed in detail in the FS be evaluated according to specific criteria. The purpose of this evaluation is to promote consistent identification of the relative advantages and disadvantages of each alternative in order to guide selection of remedies offering the most effective and efficient means of achieving site cleanup goals. There are nine criteria by which feasible remedial alternatives are evaluated. All nine criteria are important; but they are weighed differently in the decision-making process depending on whether they describe a required level of performance (threshold criteria), provide for consideration of technical or socioeconomic merits (primary balancing criteria), or involve the evaluation of non-EPA reviewers that may influence an EPA decision (modifying criteria).

The remedial alternatives were first evaluated by comparison with the threshold criteria: overall protection of human health and the environment and compliance with ARARs. The threshold criteria must be fully satisfied by candidate alternatives before the alternatives can be given further consideration in remedy selection. For those alternatives satisfying the threshold criteria, five primary balancing criteria are used to evaluate other aspects of the potential remedies. The five primary balancing criteria are: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. No single alternative will necessarily receive the highest evaluation for every balancing criterion. This primary criteria balancing phase of the comparative analysis is useful in refining the relative merits of candidate alternatives for cleanup. The two modifying criteria, state and community acceptance, are used in the final analysis of remedial alternatives and are generally considered in altering an otherwise viable alternative rather than deciding between very different alternatives.

For the most part, these criteria are similar to the criteria set forth by the State of Oregon under OAR 340-122-080 and 340-122-090. Considerations of protectiveness, permanence, effectiveness, implementability, and compliance with ARARs are included in both criteria. The federal criteria include separate consideration for cost and effectiveness and combined consideration for long-term effectiveness and permanence. Oregon criteria consider cost-effectiveness and permanence separately. Other than these minor differences, the evaluation methods are essentially identical.

9.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

9.1.1 Soil

All alternatives except S-1 (no action) meet the threshold criterion of protection of human health and the environment. Risk of direct contact or ingestion of soil is significantly reduced by the application of a site-wide soil cap for all action alternatives. Treatment alternatives (S-3 through S-6) provide additional protection by treating the most contaminated near-surface soil.

9.1.2 Groundwater

Alternative GW-1 (no action) provides no reduction of existing risks. GW-2 (NAPL extraction) rates lowest of all action alternatives because only NAPL is removed. Alternatives GW-3 (enhanced NAPL extraction) and GW-4 (groundwater and enhanced NAPL extraction) provide for protection of the Willamette River by preventing contaminant discharges at concentrations exceeding background levels and water quality criteria for the protection of aquatic life. GW-4 provides a slightly higher level of protection by pumping and treating more contaminated groundwater than GW-3.

9.1.3 Sediment

Alternative SD-1 (no action) would do nothing to mitigate current threats to human health or the environment. All other alternatives provide effective protection of both human health and the environment by isolating the contamination through capping. Alternative SD-2b (which caps all sediment exceeding background levels of contamination) provides only a small increment of additional protectiveness over Alternatives SD-2a, SD-3, and SD-4. Alternatives SD-3 and SD-4 (dredging of hot spots and capping) provide a small additional increment of protectiveness over SD-2 (capping) by removing the most contaminated sediment.

9.2 Compliance with ARARs

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of federal and state environmental statutes or provides a basis for invoking a waiver from complying with these requirements.

CERCLA requires that remedial actions satisfy all identified ARARs. An "applicable" requirement directly and fully addresses the situation at the site. It would legally apply to the response action if that action were undertaken independently from any CERCLA authority. A "relevant and appropriate" requirement is one that is designed to apply to problems which are sufficiently similar to the problem being addressed at the site, that its use is well suited to the particular site.

9.2.1 Soil

Except for the no action alternative (S-1), all of the cleanup alternatives under consideration would be designed to meet applicable, or relevant and appropriate, criteria or standards. The alternatives involving treatment (S-3, S-4a, S-4b, S-5a, S-5b, S-6a, and S-6b) would include designation of a RCRA CAMU to allow for on-site treatment of hazardous wastes. The CAMU would allow for site-specific standards to be set for the cleanup, rather than those dictated by the RCRA land disposal restrictions.

9.2.2 Groundwater

Site-specific cleanup goals (ACLs) for the groundwater aquifers were developed to protect the Willamette River. DEQ and EPA consider the site-specific ACLs more appropriate for these aquifers than drinking water standards. As allowed under CERCLA Section 121, the site-specific ACLs were developed for the site as action levels for dissolved-phase contaminants in groundwater that is discharging to the Willamette River. This approach is appropriate for the site since, due to the extensive NAPL contamination, it is technically impracticable to restore the aquifers to drinking water standards. Alternatives GW-2, GW-3, GW-4a and GW-4b are expected to meet the cleanup levels for the aquifers. Alternative GW-1 (no action) would not meet cleanup levels for the shallow aquifer or provide adequate protection for the deep aquifer.

9.2.3 Sediment

All sediment remediation alternatives (SD-2a, SD-2b, SD-3, and SD-4) would be designed to meet applicable or relevant and appropriate laws, regulations and standards, including Sections 401 and 404 of CWA, which regulate the discharge of dredged or fill material. Alternative SD-1 (no action) would not comply with Oregon's Environmental Cleanup Law.

9.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

9.3.1 Soil

Alternatives that maximize contaminant destruction or removal (Alternatives S-4a, S-4b, S-5a, S-5b, S-6a, and S-6b) will provide the highest level of long-term permanence because the risks posed to future site occupants in the event of a failure in the site cap would be lower. Alternatives that depend solely on capping or stabilization (S-2a, S-2b, and S-3) are considered lower in long-term effectiveness because there is no reduction of contaminant concentrations through treatment prior to capping. Alternative S-1 (no action) is not effective in the long term because it is not protective.

9.3.2 Groundwater

Alternatives GW-3, GW-4a, and GW-4b rate highest, and are essentially equal regarding long-term effectiveness and permanence. Alternative GW-2 provides lower long-term effectiveness due to the higher residual NAPL left after NAPL extraction is completed. Alternative GW-1 rates lowest because NAPL will not be removed and may continue to migrate.

9.3.3 Sediment

With proper maintenance and monitoring of the cap, all alternatives providing capping (SD-2a, SD-2b, SD-3, and SD-4) provide long-term effectiveness by preventing direct contact with and migration of contaminated sediment. Because contaminated sediment would still remain after dredging, alternatives involving dredging (SD-3 and SD-4) are not expected to provide much additional enhancement of the protectiveness or effectiveness of the remedy in the long term.

9.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies in reducing the toxicity, mobility, or volume of the contaminated media.

9.4.1 Soil

Alternatives involving treatment to reduce contaminant toxicity, mobility and volume (S-4a, S-4b, s-5a, S-5b, S-6a, and S-6b) rate highest for this criterion. Thermal desorption (S-6a and S-6b) would remove the greatest amount of organic contaminants (an estimated 90 percent reduction). Soil washing (S-4a and S-4b) provides for significant reduction of the volume of contaminated soil needing further treatment, but probably would result in a higher degree of contamination in the coarse grained soil left behind than thermal desorption. Biological treatment (S-4a, S-5a, and S-5b) is estimated to remove a similar amount of organic contaminants as soil washing (an estimated 80 to 85 percent reduction). Alternatives using stabilization (S-3, S-4b, S-5b, and S-6b) reduce the mobility of metals in the soil and thereby provide additional groundwater protection. All alternatives, except no action (S-1), also provide for capping which will reduce the likelihood of erosion by wind or stormwater runoff.

9.4.2 Groundwater

Alternatives GW-3, GW-4a, and GW-4b provide the greatest reduction of toxicity, mobility, and volume of contaminants by extraction and treatment of NAPL and groundwater, with Alternative GW-3 providing slightly less reduction because less water and NAPL will be extracted. Alternative GW-2 rates lower because smaller amounts of NAPL will be removed. Alternative GW-1 (no action) rates lowest because it does not reduce toxicity, mobility, or volume of contaminants in NAPL or groundwater.

9.4.3 Sediment

Alternatives SD-2a, SD-2b, SD-3, and SD-4 provide for reduction of contaminant mobility through capping but not through treatment. Alternative SD-3 is the only alternative which provides for treatment to reduce the toxicity, mobility, or volume of contaminants in sediment. Alternative SD-1 does nothing to reduce the toxicity, mobility, and volume of contaminants in sediment.

9.5 Short-Term Effectiveness

Short-term effectiveness refers to the period of time needed to complete the remedy and any adverse impacts on human health and the environment that may be posed during the construction and implementation of the remedy until cleanup levels are achieved.

9.5.1 Soil

Alternatives S-2a and S-2b (capping without treatment) provide the greatest short-term effectiveness because they can be implemented the most quickly with minimal soil handling and processing. Alternatives S-4a and S-4b (soil washing) and S-6a and S-6b (thermal desorption) will likely have the longest implementation time and pose the greatest risk of short-term impacts and exposure to workers and the surrounding community. Alternatives S-5a and S-5b, involving land treatment, involve less mechanical processing and are estimated to have slightly better short-term effectiveness. All alternatives include air monitoring and protective measures to protect site workers and the surrounding community during implementation of the cleanup.

9.5.2 Groundwater

All groundwater cleanup alternatives, except Alternatives GW-1 and GW-2, can be implemented quickly and with minimal short-term impacts to the community and site workers by augmenting the existing NAPL extraction and groundwater treatment systems. Alternatives GW-4b (and possibly GW-3) include the construction of a physical barrier to restrict NAPL migration. Construction of this barrier may include excavation of contaminated soil, which would increase the possibility of short-term exposure to contaminants. Air monitoring and other protective measures would be implemented to protect site workers and the community during excavation activities.

9.5.3 Sediment

Alternatives SD-2a and SD-2b provide the highest short-term effectiveness because they can be completed in the shortest amount of time and include the least disturbance of contaminated sediment. Alternatives SD-3 and SD-4 would take longer to implement and could potentially cause significant short-term impacts to aquatic life during dredging of contaminated sediment. All alternatives would be designed to minimize short-term impacts to the river and would include water quality monitoring.

9.6 Implementability

Implementability addresses the technical and administrative feasibility of the alternative and the availability of services and materials required to implement the alternative.

9.6.1 Soil

Alternatives S-2a and S-2b (capping) and S-3 (stabilization) involve the most readily implementable and reliable technologies. Alternatives S-5a and S-5b (biological land treatment) utilize a technology for which equipment is readily available; however, site-specific treatability tests will be required to determine its effectiveness. Soil washing (S-4a and S-4b) and thermal desorption (S-6a and S-6b) are readily implementable; however, because they are relatively new technologies, they have a slightly less reliable performance record. Alternatives utilizing soil washing and thermal desorption treatment technologies also would require treatability studies before they could be implemented. All the alternatives, except the no action alternative include institutional controls. Institutional controls would be used to restrict access or future development at the site in areas where residual contaminated soil is present (e.g., under the cap). Institutional controls, which will be implemented through deed restrictions, will be approximately equal to implement for all of the alternatives (except the no action alternative).

9.6.2 Groundwater

All of the groundwater extraction and treatment alternatives may be easily implemented by modifying the existing extraction and treatment system. Alternatives which include construction of a physical barrier (GW-4b and possibly GW-3) increase the difficulty of implementation; however, technologies for constructing physical barriers (e.g., sheet pile barriers) are generally well established and reliable. Similar institutional controls will be implemented for all the groundwater alternatives (except no action), institutional controls will include prohibiting installation of all wells except irrigation or industrial supply wells in the deep aquifer.

9.6.3 Sediment

All sediment cleanup alternatives involve capping which is a well established and reliable technology. Dredging (SD-3 and SD-4) will increase the complexity of the cleanup due to the difficulties in preventing releases of sediment contaminants to the river. Similar institutional controls will be implemented for all sediment alternatives (except no action). Dredging of contaminated sediment will be restricted or prohibited without prior approval from DEQ.

9.7 Cost

The total costs of the alternatives developed during the FS are summarized in Table 9-1. These costs are estimated for purposes of comparison and are considered to be accurate to within -30 to +50 percent. The net present value of each alternative is calculated using a discount rate of 5 percent for a period of 30 years. Cost estimates include direct and indirect capital costs, as well as annual operations and maintenance costs.

Table 9-1
SUMMARY OF ESTIMATED REMEDIAL ALTERNATIVE COSTS

Alternative	(Millions of Dollars)			Implementation (years)
	Capital Cost	Annual O&M Cost	30-Year Present Worth Cost[a]	
Soil Alternatives				
S-1: No Action	0	0	0	0
S-2a: Capping in Place	$3.430	$0.036	$3.987	.25-.5
S-2b: Capping with Consolidation	$7.244	$0.036	$7.801	.5
S-3: Stabilization, Consolidation, and Cap	$9.524	$$0.036	$10.081	1
S-4a: Soil Wash, Slurry Biotreatment, Stabilization, and Cap	$13.600	$$0.036	$14.157	2
S-4b: Soil Wash, Off-Site Incineration, Stabilization, and Cap	$26.776	$0.036	$27.333	2-3
S-5a: Land Treatment, Consolidation, and Cap	$9.273	$0.036	$9.830	2
S-5b: Land Treatment, Stabilization, Consolidation, and Cap	$10.065	$0.036	$10.622	2
S-6a: On-Site Thermal Desorption and Cap	$18.256	$0.036	$18.813	2-3
S-6b: On-Site Thermal Desorption, Stabilization, Consolidation, and Cap	$19.048	$0.036	$19.605	2-3
Groundwater Alternatives				
GW-1: No Action	0	$0.038[b] $0.019[c]	$0.369	30[h]
GW-2: NAPL Extraction	$0.203	$0.142[b] $0.123[c]	$2.177	30[h]
GW-3: Enhanced NAPL Extraction	$0.816	$0.574[b] $0.555[d] $0.019[e]	$6.755	15-30[h]
GW-4a: Groundwater and Enhanced NAPL Extraction	$1.335	$0.880[b] $0.895[d] $0.395[e]	$12.677	30[h]

Table 9-1
SUMMARY OF ESTIMATED REMEDIAL ALTERNATIVE COSTS

Alternative	(Millions of Dollars) Capital Cost	Annual O&M Cost	30-Year Present Worth Cost[a]	Implementation (years)
GW-4b: Groundwater and Enhanced NAPL Extraction with Downgradient Barrier	$3.957	$0.914[b] $0.895[d] $0.395[e]	$15.299	30[h]
Sediment Alternatives				
SD-1: No Action	0	$0.063	$0.961	30[g]
SD-2a: Cap Remediation Areas	$2.262	$0.081	$3.510	.25-.5[f]/30[g]
SD-2b: Cap All Areas Above Background	$4.061	$0.103	$5.644	.5-.75[f]/30[g]
SD-3: Selective Dredging With On-Site Treatment; Cap Remediation Areas	$6.572	$0.081	$7.817	1[f]/30[g]
SD-4: Selective Dredging with Off-Site Disposal, Cap Remediation Areas	$13.652	$0.081	$14.897	1[f]/30[g]

[a] Includes capital and O&M costs in today's dollars.
[h] Year 1 through 5.
[c] Year 6 through 30.
[d] Year 6 through 15.
[e] Year 16 through 30.
[f] For construction.
[g] For monitoring.

9.7.1 Soil

No costs are associated with Alternative S-1. Alternatives S-2a, S-2b, S-3a, and S-3b, which include combinations offcapping, consolidation, and stabilization (but no active treatment of the organic contamination), range in cost from $4.0 million to $10.1 million. For alternatives that include treatment of contaminated soil, the biological land treatment alternative (S-5a) is the least expensive at $9.8 million. Other alternatives involving treatment of the organics in the highly contaminated surface soil (S-4a, S-5b, S-6a, and S-6b) range in cost from $10.6 to $19.6 million. The alternative that requires off-site disposal (S-4b) has the highest cost, estimated at $27.3 million.

9.7.2 Groundwater

For groundwater, the lowest cost alternative is GW-1 (no action) at approximately $0.37 million. The NAPL extraction alternatives have the lowest estimated costs among the active remediation alternatives at $2.2 million and $6.8 million for Alternatives GW-2 and GW-3 net present value, respectively. The two alternatives that involve groundwater extraction and treatment have the highest estimated costs, at $12.7 million and $15.3 million, for Alternatives GW-4a and GW-4b, respectively.

9.7.3 Sediment

For sediment, Alternative SD-1 (no action) has the lowest overall costs at $1.0 million. The capping alternatives have the lowest estimated costs among the active cleanup alternatives at $3.5 million and $5.6 million for Alternatives SD-2a and SD-2b, respectively. The two alternatives that involve dredging, SD-3 and SD-4, have the highest estimated costs at $7.8 million and $14.9 million.

9.8 State Acceptance

DEQ has been the lead agency for the development and review of the RI/FS, and for the preparation of the Proposed Plan and ROD for the cleanup of this site. The State of Oregon approves of the selected remedy in this ROD and believes it provides measures that will fulfill the requirements of Oregon laws and regulations for the site.

9.9 Community Acceptance

EPA and DEQ have carefully considered all comments submitted during the public comments period and have taken them into account during the selection of the remedy for the McCormick & Baxter site. Members of the public were concerned about such things as site security, migration of contaminated airborne particulate impacting nearby residential areas, and consideration of future use of the site as a park or wildlife refuge. EPA's and DEQ's responses to comments received during the public comment period are included in the attached Responsiveness Summary (Appendix A).

10.0 THE SELECTED REMEDY

DEQ and EPA have selected Alternative S-5b for soil, Alternative GW-3 for groundwater, and Alternative SD-2a for sediment as the final remedy for the site. The selected remedial actions focus on recovering contaminants, reducing toxicity, mobility, or volume through treatment, and providing cost-effective and readily implementable means of protecting human health and the environment. The selected remedial alternatives for soil, groundwater, and sediment consist of those options that meet the threshold criteria, and best satisfy the remedy selection balancing and modifying criteria as defined by the NCP. The selected remedy uses a combination of treatment, containment, and institutional controls to achieve the optimum compliance with the five balancing criteria: long-term effectiveness, short-term effectiveness, implementability, reduction in toxicity, mobility, or volume through treatment, and cost. Treatment of highly contaminated soil meets the statutory preference for treatment as a principal element of the remedy. Treatment with containment is a more permanent solution than containment alone.

The selected remedial actions for each medium are described in separate sections below. The description includes the identification of the cleanup goals, the elements of the alternatives, and the criteria to be used to ensure protection of human health, safety, welfare, and the environment.

10.1 Soil - Alternative S-5b: Biological Land Treatment, Stabilization, Consolidation, and Cap

The selected soil cleanup alternative includes excavation and biological 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. Note that some of the biologically treated soil also will require stabilization to reduce the mobility of inorganics. In addition, soil contaminated above the cleanup goals, but below the treatment action levels, will be capped to prevent potential risks from direct contact. Approximately 1,000 cubic yards of highly contaminated soil and other wastes which are not expected to be effectively treated using bioremediation or stabilization will be transported off-site for treatment and disposal in accordance with applicable hazardous waste regulations. This would include soil with significant dioxin concentrations (i.e., several orders of magnitude above protective levels).

The main components of the soil remedy are described in detail below.

10.1.1 Demolition

Remaining site structures and miscellaneous debris will be removed for reuse, recycling, or disposal in accordance with applicable regulations. This includes cranes, railroad track and ties, treated and untreated logs, buildings, and the creosote dock. These structures and miscellaneous debris must be removed to be able to excavate contaminated soil, construct soil and groundwater treatment facilities, and construct the cap.

The main office, shop, and laboratory buildings will be maintained through completion of the soil and sediment remedies. The shop building will likely house the groundwater treatment plant and will be maintained through completion of the groundwater remedy. Existing concrete foundations of the buildings, retort sumps, and retaining walls around the tank farm area will be abandoned in place or demolished for disposal off-site or on-site beneath the cap. Product pipelines from the creosote dock to tank farms and the central processing area will be investigated during demolition activities to determine whether these utility lines contain significant contamination or are preferential pathways for contaminant transport. If these pipelines are significant sources or pathways, the pipelines will be removed and either decontaminated and recycled, or disposed off-site in accordance with applicable regulations. If the pipelines are not significant sources or pathways, the pipe ends will be plugged and the pipelines will be abandoned in place.

10.1.2 Soil Excavation and Handling

All soil exceeding the site-specific treatment action levels summarized in Table 10-1, will be excavated, consolidated, and treated on-site prior to being capped. The most highly contaminated soil (i.e., soil requiring treatment) that is located in the major source areas (e.g., tank farm, central process, former waste disposal, and southeast disposal trench areas [Figure 5-1]) will be excavated to a minimum depth of 4 feet and a maximum depth of 10 feet bgs. The minimum depth of excavation in these areas was established to accommodate future development at the site based on typical utility depths as described in the City of Portland building code. The maximum depth was established based on the retort sump and tunnel depths and volume considerations. In other areas where soil contaminant concentrations exceed treatment action levels, the depth of contamination (i.e., excavation) is estimated to be 1 foot bgs or less. This soil also will be consolidated and treated on-site prior to being capped. The estimated volume of soil targeted for treatment is 31,000 cubic yards.

Table 10-1

ACTION LEVELS FOR SOIL TREATMENT

Compounds	Remedial Action Level (mg/kg)
Arsenic	300[a]
Pentachlorophenol	500[b]
Carcinogenic PAHs	100[a]

[a] Based on an excess cancer risk of 1×10^{-4} for industrial land use and 2×10^{-5} for recreational land use.
[b] Based on an excess cancer risk of 1×10^{-5} for industrial land use.

Areas that exhibit soil contaminant concentrations above background and risk-based concentrations for arsenic (8 mg/kg), PCP (50 mg/kg), carcinogenic PAHs (1 mg/kg), or dioxins/furans (0.00004 mg/kg), but below action levels for treatment will be capped. The extent of this lower level contamination is significant, and the majority of the site will require capping.

Soil excavated for treatment will be stockpiled on a lined and bermed area adjacent to the engineered biological treatment cell and consolidation areas which are currently designated for the northwest portion of the McCormick & Baxter property (Figure 10-1). The final location of the treatment and consolidation cells will be determined following surveying of existing utility corridors (i.e., City of Portland sewer main and water supply lines) to ensure that the treatment or consolidation cells do not infringe on existing easements. The exact location of the stockpile areas will be determined during remedial design. Soil to be treated biologically will be stockpiled separately from soil to be stabilized only. Prior to treatment, the excavated soil will be screened to remove large debris and gravel. The large debris will be consolidated with the concrete foundation materials and landfilled on-site or disposed off-site. Recovered gravel may be used in the drainfields to be constructed in the major source areas for pilot testing of enhanced NAPL recovery methods. Engineering controls, such as spraying water with surfactant amendments, will be used to minimize dust generation during soil excavation and processing.

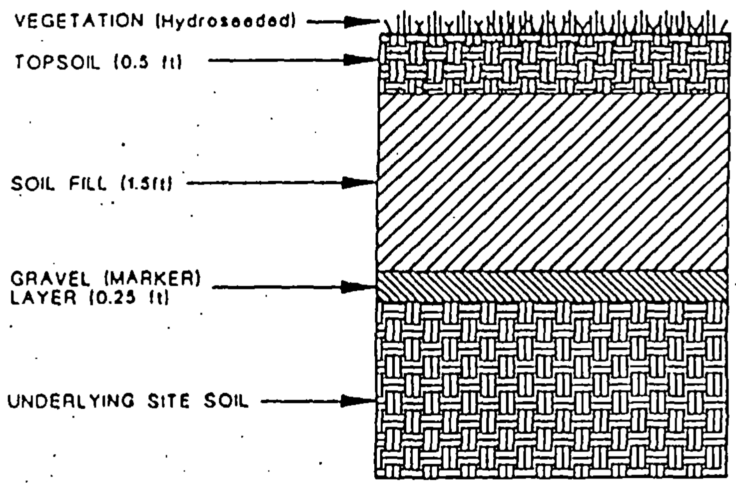
Following completion of the excavation activities described above, the deep excavations will be backfilled with soil, regraded, capped, and hydroseeded to minimize air transport of residually contaminated surface soil until placement of the final site cap (see Section 10.1.5). The shallow excavations will not likely require backfilling, but will be regraded prior to capping and hydroseeded to prevent erosion and excessive dust.

10.1.3 Soil Treatment

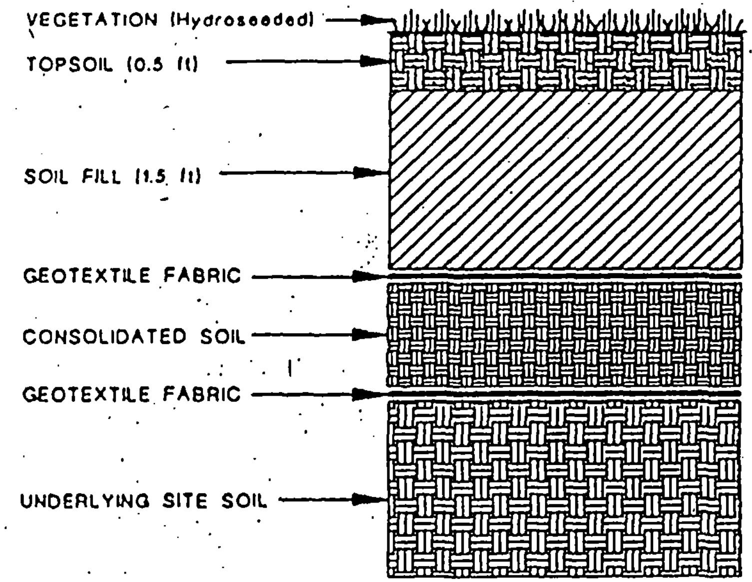
All soil exceeding the site-specific action levels in Table 10-1 will be treated on site. The most highly PAH- and PCP-contaminated soil (approximately 18,000 cubic yards) and arsenic-contaminated soil (approximately 12,000 cubic yards), which is primarily located in the major source areas, will be excavated and stockpiled in a lined, bermed area prior to either biological treatment in an on-site engineered land treatment cell or stabilization. Soil contaminated with arsenic (and potentially other metals such as chromium and zinc) will be stabilized with Portland cement or other chemical additives and consolidated in a geotextile-lined cell located next to the land treatment unit. Due to the commingling of organic and inorganic contaminants, some biologically treated soil may also require stabilization.

Soil amendments for biological treatment will be added to the soil, possibly using a pug mill system, which will be connected in series with the screen vibrator used to remove debris and large gravel. Water and additional nutrients, enzymes or exogenous bacteria will be added to the soil in the engineered treatment cell and rototilled or disc-harrowed in thin layers to enhance oxygen transfer and microbial growth. Additional lifts of contaminated soil will be placed in the cell for treatment when verification soil samples demonstrate that treatment performance goals have been met for the previous lift. Leachate collected from the treatment cell will be treated in the groundwater treatment plant described in Section 10.2.

Treatability studies will be completed during remedial design for selection of the most effective amendments for biological treatment and stabilization. Treatment performance



CONCEPTUAL CAP CROSS SECTION



CONCEPTUAL CONSOLIDATION AREA CAP CROSS SECTION

McCORMICK & BAXTER CREOSOTING COMPANY PORTLAND PLANT, PORTLAND OREGON	Figure 10-1 CONCEPTUAL CAP AND CONSOLIDATION AREA CROSS SECTIONS

criteria for both biological treatment and stabilization are summarized in Table 10-2.

Table 10-2

SOIL TREATMENT PERFORMANCE CRITERIA

Compound	Treatment Goal
Arsenic	5.0 mg/L TCLP[a]
Chromium	5.0 mg/L TCLP[a]
Pentachlorophenol	500 mg/kg[b]
Carcinogenic PAHs	100 mg/kg[b]

a Based on the toxicity characteristic leaching procedure (TCLP) leachate concentration.
b Based on an average reduction in contaminant concentration of 80 percent.

When the excavated soil is placed in the on-site land treatment cell, the soil is required to be managed as a RCRA hazardous waste. RCRA hazardous waste requirements will be met by designating the area as a CAMU. This designation allows site-specific, but highly protective, design, operation, and closure standards to be set. Section 10.1.4 describes the justification and requirements of this CAMU.

10.1.4. Corrective Action Management Unit

The regulations in 40 CFR 264.552 establish the standards and requirements of CAMUs. This regulation is an applicable ARAR for this site. A CAMU at the McCormick & Baxter site will facilitate the implementation of a reliable, effective, protective, and cost-effective remedy. The CAMU will enable the use of treatment technologies, particularly biological treatment and solidification/stabilization of the principal threat soil, which will enhance the long-term effectiveness of remedial actions by reducing the toxicity of the near-surface waste that will remain in place after closure of the CAMU and completion of the remedial action. The CAMU will not include any uncontaminated areas of the facility.

Without a CAMU, a remedy that involves treatment of such large volumes of contaminated soil would be precluded because of RCRA regulatory impediment. Treatment in a tank, container, or containment building would be prohibitively expensive and inefficient due to the volume of soil and unit cost. Treatment in any land-based unit would not be possible because of the requirement that the soil meet the LDRs prior to placement in such a unit. Because LDR treatment standards are so much lower than the cleanup goals at this site, the additional treatment would be unwarranted and unjustified. The only other regulatory approach would be to use an ARAR waiver. However, it is not necessary to meet LDRs in this CAMU because the risk analysis shows that the remedy will be protective. Similarly, engineering and risk analysis during remedial design will demonstrate that the remedy is protective.

While many of the details of this CAMU will not be determined until remedial design, the following design and operational requirements will apply:

- Waste management activities associated with the CAMU will be designed to ensure that these activities will not create unacceptable risks to humans or to the environment resulting from exposure to hazardous wastes or hazardous constituents. Monitoring will be conducted to ensure that treatment in the unit will not result in increases in contamination.

- Biological treatment will take place in an engineered unit designed to minimize the potential exposure routes, and will not increase contaminant concentration, mobility, or toxicity through its construction or operation. Minimum technology requirements will be viewed as a point of departure for evaluating engineering and monitoring requirements. These requirements may be relaxed if the treatability studies and remedial design shows that the risks to human health and the environment associated with the alternative approach are no greater than that from the non-CAMU area of the site. Treatment will continue until the standards summarized in Table 10-2 are met.

After treatment of the soil is completed, the CAMU will be closed. Equipment, devices, and aboveground structures used in the remedial treatment will be removed, decontaminated as necessary, and properly recycled or disposed on or off-site. A cap will then be placed over the CAMU, as described in Section 10.1.5. Because the treatment in the CAMU will reduce the potential risks to at least the same level as the surface soil remaining in place in the rest of the site, the cap for the CAMU will be similar to the cap for the rest of the site (see Figure 10-1). Geotextile fabric will be used as part of the cap to mark the location of the unit and the treated soil. This cap will be designed, consistent with RCRA hybrid closure requirements, to minimize the need for further maintenance, and will control, to the extent necessary to protect human health and the environment, post-closure escape of hazardous substances to the ground, surface water, or the atmosphere.

Post-closure care of the CAMU will be integrated with the long-term operation and maintenance of the rest of the remedial action as described in Section 10.1.7 of this ROD. Post-closure care will include monitoring the groundwater, monitoring and maintaining the cap to ensure its continued integrity, and land use controls to ensure that future site uses do not impair the integrity of the cap.

The design and operating, closure and post-closure requirements for land treatment units (40 CFR 264.270) will be considered during the remedial design of the CAMU.

While the conceptual design outlined in the FS located the CAMU in a rectangle along the northwest property line, the final location and size of the CAMU within the property will be determined during remedial design. The final location will be determined by a number of factors, including, but not limited to: the size of the area needed to treat soil effectively and efficiently; height above the floodplain; avoidance of existing utility lines and right-of-ways as necessary; and integration into future site land use plans so as to ensure long-term protectiveness. While the remedial design may result in a CAMU with a minimum land area to reduce construction and operational costs, such minimization is not a required performance standard of this CAMU because the entire facility (not just the CAMU) will continue to have subsurface wastes in place. Minimizing the size of the CAMU will not minimize the areas of the site requiring continuing monitoring, maintenance, and institutional controls.

Monitoring of the CAMU will be integrated into the overall site-wide monitoring program. If groundwater monitoring data indicate that treatment is not increasing the mobility or availability of the waste constituents, monitoring of the CAMU will be modified to focus on overall site protection instead of focusing on potential unit specific releases. This monitoring approach will be protective because of site-specific factors, including extensive NAPL and subsurface soil contamination beneath the CAMU and remedial requirements for containment of this NAPL contamination.

10.1.5 Site Cap

Impermeable multilayer caps are typically required for closure of RCRA treatment, storage, or disposal (TSD) facilities to prevent leaching of contaminants through unsaturated soil into uncontaminated groundwater via surface water infiltration. However, the shallow groundwater beneath this site is highly contaminated and cleanup of the groundwater to meet drinking water standards is impractical. An impermeable cap would provide minimal, if any, additional protection to groundwater while adding significant cost. Because RCRA is only relevant and appropriate to the majority of the site, and a CAMU will occupy the rest of the site, RCRA closure requirements will be met through a hybrid-landfill closure at the site. A soil cap will protect against direct contact with residual contamination. The cap will be installed following completion of soil treatment and may be delayed up to 2 years to coordinate future site development infrastructure into the final cap design and evaluate long-term requirements for the groundwater cleanup (i.e., physical barrier construction).

A soil cap will be placed over all soil at the site that exceeds risk-based or background concentrations, as identified in Table 7-1, following completion of excavation and treatment or disposal of the most highly contaminated soil. Capping is included as a component of the final remedy to achieve protectiveness. Capping the McCormick & Baxter property will be required because of the widespread distribution of low level contamination. Surface soil samples will be collected along the property boundary to determine whether contaminants extend off the property. If site-related contamination is detected on other property, either the cap will be extended to cover these areas or the off-site contaminated soil will be consolidated on-site beneath the cap.

The cap will consist of layers of soil covered with a layer of topsoil to promote revegetation (Figure 10-1). Special provisions may be necessary for placement of the cap around monitoring or extraction wells. A geotextile liner will be placed between the cap and the treatment and consolidation cells. A 3-inch gravel demarcation layer will be placed under the cap on the remainder of the site to provide a visible separation between the cap and underlying soil containing residual contamination. A nominal cap thickness of 2 feet will be used to provide isolation of contaminants. The cap will also be vegetated and will include a storm water collection system to reduce the potential for erosion from or pooling of surface water. Actual cap design and extent will be determined during remedial design activities.

DEQ and EPA will consider alternatives for transport of soil for the cap (including the sediment cap) that do not involve hauling materials through the St. John's neighborhood.

Additional soil to increase the thickness of the cap may be added or required of future landowners when zoning and future property use become more firmly established. The appropriate cap thickness would take into consideration building foundations; root depth for grasses, bushes, and trees; and surface contours. The actual thickness of the cap and the soil/material type used may vary depending on developments in land ownership, land use zoning and use designation, and engineering specifications. Development on the site will only be allowed when land users can demonstrate to DEQ and EPA that protectiveness can be maintained and that the contemplated use is consistent with the level of protection achieved by the cleanup. DEQ and EPA will resample the unpaved portions of North Edgewater Street to determine if contaminant concentrations exceed action levels in Tale 7-1. The unpaved areas that exceed action levels will be covered with a 3-inch layer of asphalt.

10.1.6 Monitoring

Monitoring activities to be performed as part of the soil remedy include the following:

- Sampling and analysis of soil to define the extent of soil to be treated and to verify that soil exceeding the remedial action levels have been excavated for treatment;

- Air monitoring during soil excavation, processing, and treatment to ensure that airborne contaminants do not pose a threat to site workers and off-site residential populations. Specific air monitoring stations will be located within work areas and along the perimeter fence to assess particulate emissions. Control of particulate emissions within the property boundary will ensure that neighboring residents are protected from particulate emissions during remedial action.. The monitoring program will be available for public review prior to implementation.

- Verification sampling to demonstrate that the treatment of soil has achieved the treatment performance criteria presented in Table 10-2 and to ensure that more mobile toxic breakdown products have not been produced;

- Surface soil sampling along the perimeter of the site to determine the limits of the cap; and

- Groundwater monitoring to demonstrate the protectiveness of the CAMU will be integrated with the site-wide groundwater monitoring program (see Section 10.2).

Details on the soil monitoring protocols will be developed in the remedial design and remedial action work plans.

10.1.7 Long-Term Maintenance of the Cap

Regular, visual inspections of the cap, especially along the perimeter where erosional forces may be highest, will ensure the cap remains intact and effective. Other visual indicators such as stressed vegetation, or pooling of surface water indicating subsidence, also will be used to monitor the effectiveness of the cap. The cap will be inspected regularly. Repairs will be conducted as necessary to ensure the integrity of the cap. Other measures to protect the cap (e.g., fencing, access restrictions) are discussed below as part of Institutional Controls.

10.1.8 Institutional Controls

Institutional controls would include physical restrictions (e.g., fencing), warning signs, and safety measures until completion of the remedial action. Long-term institutional controls may include, but are not limited to, deed notices containing information on the levels and location of contamination at the property, and deed restrictions such as environmental easements or restrictive covenants limiting future uses of the site to industrial/commercial activities. The deed restrictions will prohibit future uses not consistent with the level of protectiveness achieved by the cleanup. Deed restrictions may also include routine maintenance or repair activities of the cap, the proper disposal of contaminated soil excavated during installation or maintenance of underground utilities by future owners or lessees, and maintenance of the integrity of the selected remedy, as applicable. Deed restrictions shall be set forth in a DEQ-approved form running with the land and enforceable by DEQ against present and future owners of the property.

10.2 Groundwater - Alternative GW-3: Enhanced NAPL Extraction

The purpose of this portion of the remedy is to contain the NAPL and minimize ongoing discharges of NAPL to the Willamette River. The selected groundwater remedy includes enhancement of the existing groundwater and NAPL extraction and treatment system currently being operated at the site. The remedy will remove NAPL and will hydraulically control contaminated groundwater in a limited area in the immediate vicinity of the extraction wells.

The selected groundwater cleanup alternative includes the following components:

- Enhanced NAPL recovery using pure-phase extraction and/or groundwater/NAPL extraction;
- Evaluation by pilot testing of innovative technologies, such as surfactant flushing, to increase the effectiveness and the rate of NAPL removal;
- Treatment of groundwater using methods such as dissolved air floatation, filtration, carbon absorption, extended aeration/packed bed bioreactor, or other biological treatment;
- Discharge of treated groundwater to the Willamette River in accordance with substantive NPDES requirements, or alternatively discharge to drainfields installed in major source areas for enhanced NAPL recovery if pilot testing is successful;

- Off-site treatment and/or disposal of NAPL and other treatment residuals in accordance with applicable hazardous waste regulations;

- Monitoring to ensure that site-specific ACLs are met at compliance monitoring locations;

- A contingency to install a vertical physical barrier in the event that:

  - The mobile NAPL cannot be reliably controlled using hydraulic methods; or
  - It improves the overall cost-effectiveness of the groundwater remedy; and

- Institutional controls restricting groundwater use at the site.

Each of these components is described in the following sections.

10.2.1 Pure-Phase NAPL and NAPL-Contaminated Groundwater Extraction

Two distinct NAPL plumes are present at the site, one in the tank farm area and the other in the former waste disposal area (Figure 5-2). Pure-phase NAPL and NAPL-contaminated groundwater will be recovered using extraction wells and/or trenches, as appropriate. A total of 38 monitoring wells and 20 extraction wells are currently installed at the site (Figure 5-3). Table 10-3 identifies the initial wells targeted for pure-phase NAPL and/or NAPL and groundwater extraction.

Table 10-3

TARGET WELLS FOR NAPL EXTRACTION

Location	Well Designation
Former Waste Disposal Area	W-D, MW-G, MW-21, EW-2, EW-6, EW-9, EW-10 and EW-15
Tank Farm Area	EW-1, MW-1, EW-4, EW-5, EW-7, EW-8, EW-17, EW-18, and MW-17

Pure-phase extraction of floating and sinking NAPL, dual-phase pumping (water and NAPL pumped separately but simultaneously from the same well to promote "upwelling" of creosote), and total fluids removal (extraction of water and NAPL together with a single pump) will be employed in both plumes to establish hydraulic control of the mobile NAPL pools. The most productive method will be selected and implemented for each extraction well.

Specific details on the use of accumulation tanks for NAPL and/or groundwater storage will be determined during remedial design. Tanks used for storage of NAPL and/or contaminated groundwater which are not components of the groundwater treatment facility will comply with applicable RCRA requirements for tanks.

NAPL recovery will be conducted as rapidly as is practicable and cost-effective. NAPL recovery will be expanded to increase the recovery efficiency in areas where NAPL is currently being extracted or to increase the coverage of the remediation area. Production rates will be evaluated, and additional wells considered when:

- Significant NAPL accumulation is occurring in a well(s) outside the remediation area;
- NAPL seeps are observed on the beach or in the river, and adjacent extraction wells or recovery trenches are not effective;
- ACLs are exceeded at compliance monitoring locations; or
- Other monitoring data indicate that installation of an additional well would increase NAPL recovery.

An assessment of NAPL recovery performance and the residual risk posed by terminating NAPL recovery efforts will be completed at least every 5 years following implementation of the remedy. NAPL recovery may cease when, in the opinion of DEQ and EPA, NAPL recovery rates become minimal, alternate pumping strategies have been examined and/or field tested with poor results, and remaining NAPL does not pose a threat to the Willamette River and sediment.

Several innovative technologies will be evaluated for pilot testing to increase the effectiveness and the rate of NAPL removal. Specifically, surfactant flushing and hot water flushing will be evaluated for pilot-scale testing in the tank farm area. If the pilot test in this area indicates significant increase in NAPL recovery, application of the successful technology will be expanded to include the former waste disposal area.

10.2.2 Groundwater Treatment

Gravity separation of LNAPL or DNAPL will be completed prior to groundwater treatment. Pure phase NAPL will be periodically removed from the gravity separation tank(s) and stored in a NAPL holding tank within a lined containment area. NAPL will be periodically shipped off-site for treatment and/or disposal in accordance with applicable hazardous waste regulations, or alternatively reused by another wood-treating facility if such a facility is identified that will beneficially use the product.

A pilot scale groundwater treatment plant with a treatment capacity of 10 gallons per minute is currently operating at the site. The pilot system includes dissolved air floatation using chemical polymer additives and filtration and carbon absorption treatment components. This system, however, is not automated and requires a person to monitor and adjust the system on a continual basis (the system currently operates approximately 8 hours/day, 5 days a week). The pilot system will either be enhanced to increase capacity and automated for continuous operation or replaced by a new system with a capacity of at least 30 gallons per minute designed for continuous automated operation. Biological treatment may be incorporated as a system component in a new system to reduce the volume of generated wastes such as sludges and spent activated carbon for off-site disposal.

10.2.3 Monitoring

10.2.3.1 Groundwater Monitoring

Monitoring including groundwater quality sampling of the shallow, intermediate, and deep aquifers, water level measurements, and NAPL thickness measurements will be performed on a periodic basis. The specific details of the monitoring program will be decided during remedial design.

The groundwater quality monitoring program will include monitoring of the ACL compliance point wells which will be located downgradient of the primary source areas. ACLs for groundwater are presented in Table 7-2. ACLs were developed for groundwater discharging to the Willamette River to protect the environment in accordance with CERCLA Section 121 (refer to Section 7.2.2 for a discussion of the selection of ACLs).

The ACLs listed in Table 7-2 are based on the solubility limits for organic contaminants (i.e., PAHs and dioxins/furans) and on a groundwater/surface water dilution factor for PCP and metals. Contingency measures described in Section 10.2.6 will be implemented in the event of confirmed exceedances of the ACL limits at the compliance points.

Groundwater monitoring results will be evaluated at least every 5 years to confirm the following: 1) dissolved contaminant concentrations are not significantly increasing over time; 2) NAPL thicknesses are decreasing over time; and 3) the estimated groundwater contaminant flux to the river is decreasing.

The groundwater monitoring program will be reassessed at least every 5 years to decide if the monitoring well network should be supplemented or modified. Additional remedial actions may be required in the event that the evaluation of monitoring data show contaminant levels have significantly increased and pose imminent threats to human health or the environment (see Section 10.2.6).

10.2.3.2 Surface Water Monitoring

Surface water will also be sampled before and after sediment remediation has been completed (see Section 10.3). This sampling will be conducted in areas of the Willamette River where dissolved phase groundwater contaminants discharge to verify estimates that contaminants are below detectable levels or background. Bioassay sampling may also be combined with sediment monitoring to determine any net impact on the river from contaminated groundwater discharge or from contaminated sediment. Specific details of the monitoring program will be determined during remedial design.

Surface water sampling results will be used to assess the protectiveness of the sediment cap and the effectiveness of the NAPL extraction program. In the event that it is determined the contaminant flux to the river poses potential risks to human health or the environment, additional remedial measures may be required, such as increased groundwater extraction, a reassessment of ACLs and compliance points, or installation of the physical barrier.

10.2.4 Groundwater/NAPL Disposal

10.2.4.1 Groundwater

Treated groundwater will either be discharged to the Willamette River in accordance with substantive NPDES requirements, and the discharge limits identified in Table 10-4, and/or will be used in pilot testing of enhanced NAPL recovery methods. Discharge limitations, which are established by DEQ's Water Quality Source Control Section, will include a 10-foot mixing zone from the point source discharge to the river, and will meet the ambient water quality criteria (AWQC) at the edge of the mixing zone, in accordance with OAR 340-45-445.

Table 10-4

NPDES DISCHARGE LIMITS[a]

Parameter	Monthly Average	Daily Maximum
Flow		43,200 gallons/day[b]
Arsenic (total)	80	120
Chromium (IV)[c]	19	28
Chromium (III)	350	500
Copper	20	30
Zinc	190	280
Pentachlorophenol[d]	22	33
Total PAHs[e]	1700	2500
pH	6.5 - 8.5 SU	6.5 - 8.5 SU

[a] All units in micrograms per liter (μg/L) unless otherwise noted.
[b] Equivalent to 30 gallons per minute over a continuous 24-hour period.
[c] Hexavalent chromium need not be analyzed if chromium III is below limits for hexavalent chromium.
[d] DEQ has established a total maximum daily load tetrachlorodibenzo-p-dioxins (TMDL) and waste load allocation (WLA) for discharges to the Willamette River of 2,3,7,8-tetrachlorodibenzodioxins (TCDD). A 5 μg/day WLA has been established for NPDES discharges from the site, which will be met through compliance with pentachlorophenol discharge limits.
[e] Sum of all detected polycyclic aromatic hydrocarbons.

10.2.4.2 NAPL and Treatment Residuals

Collected NAPL and treatment sludges will be transported off-site for treatment and disposal in accordance with applicable hazardous waste regulations and in accordance with EPA's

Off-Site Rule. The reuse of NAPL may be considered if another wood-treating facility is identified which will beneficially reuse the NAPL. Spent carbon will either be sent off-site for regeneration or for disposal in accordance with hazardous waste regulations.

10.2.5 Institutional Controls

Since the selected remedial action includes ACLs, use of groundwater at the property will be precluded through deed restrictions such as environmental easements or restrictive covenants as discussed in Section 10.1.8. The restrictions will prohibit groundwater use from the shallow and intermediate aquifers for any purpose, and the deep aquifer as a drinking water supply. The use of the deep aquifer for other purposes (e.g., industrial or irrigation) will require approval by DEQ and Oregon Water Resources Division. Deed restrictions shall be set forth in a DEQ-approved form running with the land and enforceable by DEQ against present and future owners of the property.

10.2.6 Physical Barrier Contingency

The selected remedy for groundwater includes a contingency to install a vertical physical barrier between the mobile NAPL pools and the Willamette River. The physical barrier may be installed if the following or similar conditions are met:

- The NAPL pool areas cannot be reliably contained using hydraulic methods. Evidence of this may include exceedance of ACLs, accumulation of NAPL in compliance monitoring points, or continued occurrence of seeps along the beach; or

- The incremental cost for installation of the barrier results in a proportional decrease in the long-term costs of hydraulic control of the pool areas through decreases in the volume of groundwater to be extracted and treated.

The physical barrier may be constructed of sheet metal or a slurry wall. The objective of constructing a physical barrier would be to contain mobile NAPL so it can be extracted from wells installed along the interior perimeter of the barrier. In the tank farm area, the containment wall would be tied into the shallow silt aquitard and would be effective at containing LNAPL and DNAPL. In the former waste disposal area, no aquitard is present; therefore; a barrier in this area would control migrating LNAPL only. The actual design of the physical barrier, if determined to be necessary, will be determined as part of the design phase.

10.3 Sediment - Alternative SD-2a: Cap Remediation Areas

The selected remedy for sediment includes capping of areas that contain site contaminants in the near surface (0 to 4 feet) above human health and ecological risk-based protective levels or exhibit significant biological toxicity. Major components of the sediment remedy include:

- Sampling of surface and near-surface sediment to determine contaminant concentrations and the level of attenuation of contaminant concentrations and toxicity since completion of the RI sediment monitoring and plant closure in 1991;

- Collection of hydrodynamic data for the Willamette River necessary for effective cap design for control of cap erosion;

- Coordination in the timing of the placement of the cap with the effectiveness evaluation of the groundwater remedy;

- Long-term monitoring of the cap and surrounding areas following installation; and

- Institutional controls to ensure the cap integrity is maintained.

The following sections discuss the components of the sediment remedy.

10.3.1 Baseline Sediment Quality Testing

During the RI field sampling conducted in 1990 and 1991, widespread sediment contamination was detected along much of the McCormick & Baxter shoreline, around the railroad bridge abutment, and partially into the downstream embayment. Areas of heaviest contamination are located around the creosote dock and railroad bridge which are downgradient of the tank farm area NAPL plume and the former waste disposal area NAPL plume, respectively. Additional sediment samples will be collected in and near the proposed remediation areas to identify the natural attenuation of sediment contamination levels and toxicity since 1990/1991, if any, and to determine more precisely the areas requiring remedial action.

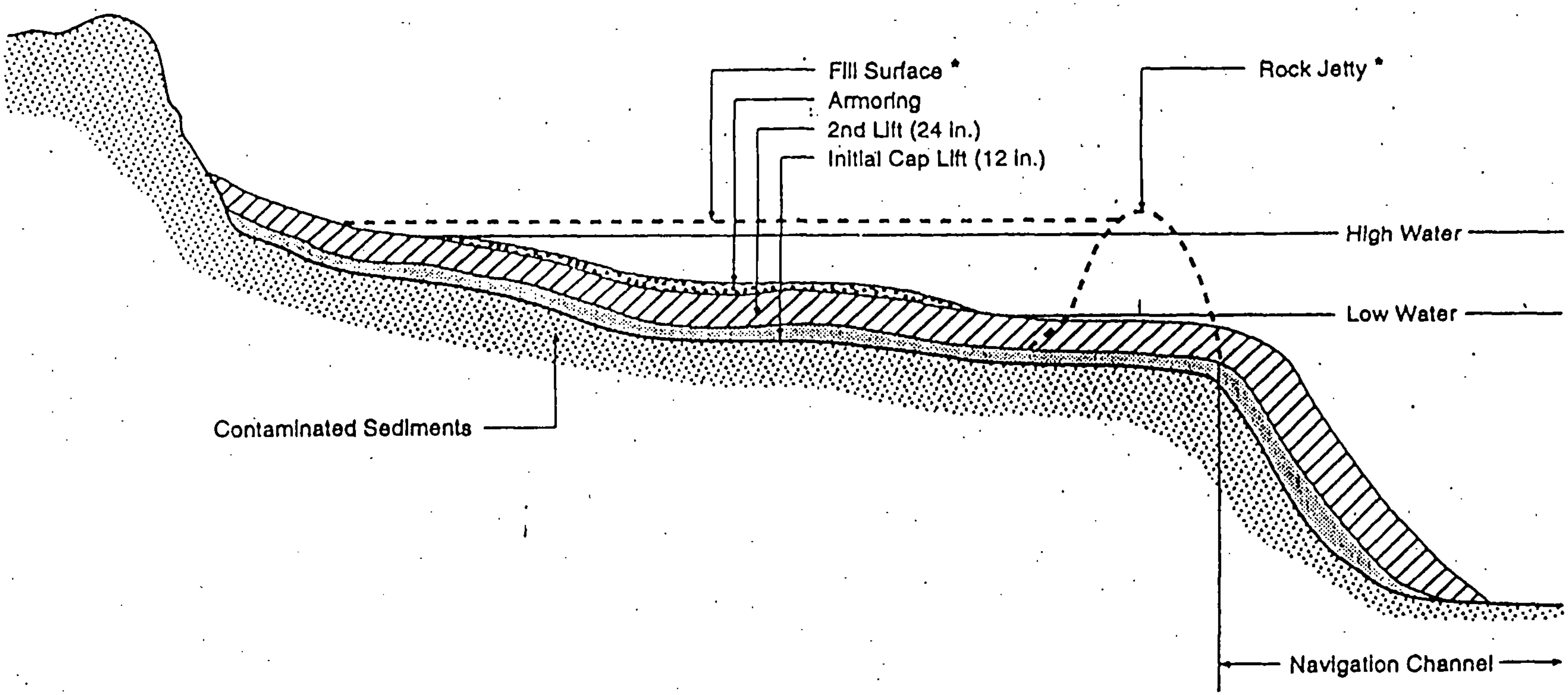
10.3.2 River Hydrodynamics

Measurements of nearshore river circulation patterns, bottom water velocities, and nearshore wave heights will be collected during remedial design and high river stage or flood events to determine design criteria for the sediment cap.

10.3.3 Sediment Capping

The cap will be placed over contaminated sediment that exceeds human health and ecological risk-based criteria (see Section 7.2.3). Based on the results from the RI, the cap will cover approximately 15 acres, and will extend along virtually the entire site shoreline, under the railroad bridge and into the embayment to the north. The final extent of the cap will be based on more extensive sediment sampling and river hydrodynamic measurements conducted during remedial design.

The cap itself will consist of sand, or other readily available clean fill suitable for placement in water. The cap will be a minimum of 3 feet in thickness, and may be armored in areas susceptible to erosion by river currents or wave action. A cross sectional view of a typical sediment cap is shown on Figure 10-2. The cap will extend over the sediment remediation areas illustrated in Figure 5-4. Actual design will be determined during remedial design. The cap will be placed using methods to minimize disturbance of sediment and will be conducted in accordance with federal and state requirements established by appropriate resource agencies. Measures will be taken to minimize the release of contaminants or



* Dredged material fill applied only if land reclamation or wetlands creation is desired.

McCORMICK & BAXTER CREOSOTING COMPANY PORTLAND PLANT, PORTLAND OREGON	Figure 10-2 CONCEPTUAL CROSS SECTION OF SEDIMENT CAP

contaminated sediment during cap placement. Final cap design will consider wetland creation to the extent practicable within the restraints of the existing cost of the sediment cap.

Placement of the cap will not occur until after implementation of the groundwater remedy and after DEQ and EPA have determined that adequate control of NAPL has occurred to ensure that recontamination of the sediment will not occur. DEQ and EPA currently estimate that such a determination will be completed within 2 years of implementation of the groundwater remedy.

10.3.4 Monitoring

The cap will be periodically monitored to determine effectiveness and to detect possible contaminant migration through the cap. The cap will be inspected regularly during the first 5 years after installation and after any major or 100-year flood event to verify that physical integrity of the cap remains intact and necessary repairs will be conducted. Inspection frequency may then be reassessed based on previous inspection reports and observations from the previous 5 years.

10.3.5 Institutional Controls

Deed restrictions such as environmental easements or restrictive covenants will be used to prevent disturbance of the sediment cap. Notice will be given to the U.S. Corps of Engineers and Oregon Division of State Lands of the properties and areas where dredging restrictions have been instituted. Deed restrictions, as discussed in Section 10.1.8 will be applied to the property to the north of the Burlington Northern rail spur owned by METRO. DEQ and EPA will work with METRO to ensure that the cap design is compatible with future use of the property. Deed restrictions shall be set forth in a DEQ-approved form running with the land and enforceable by DEQ against present and future owners of the property.

10.3.6 Contingency Plan

If contaminant migration through the cap is detected and exceeds sediment action levels, contingency measures will be taken. This may include adding an additional layer to further buffer the contaminants from the river. Alternate materials will be evaluated, such as soil with high silt or clay content that might retard migration by adsorption. If necessary, the cap thickness may be extended to above the ordinary low water level, bringing the cap above the water level. The perimeter of the cap may also be expanded if sediment monitoring shows significant contamination outside the cap perimeter. A review of remedy effectiveness and site conditions will be conducted at a minimum of every 5 years.

10.4 Cost of Selected Remedy

The overall present worth cost for the selected remedy is $20,887,000. This total cost consists of total present worth costs of $10,622,000, $6,755,00, and $3,510,000 for the soil, groundwater, and sediment remedies, respectively. These costs include capital costs of $10,065,000 and annual O&M costs of $36,000 (years 1 through 30) for the soil remedy;

capital costs of $819,000 and annual O&M costs of $574,000 (years 1 through 5), $555,000 (years 6 through 16), and $19,000 (years 16 through 30) for the groundwater remedy; and capital costs of $2,262,000 and annual O&M costs of $81,000 (years 1 through 30) for the sediment remedy.

11.0 STATUTORY DETERMINATIONS

The selected remedy satisfies the requirements under Section 121 of CERCLA and the NCP. The following sections discuss how the selected remedy meets these requirements for each medium of concern.

11.1 Protection of Human Health and the Environment

The selected remedy is protective of human health and the environment. The future land use at the site will be restricted to industrial or recreational uses, and the selected remedy is protective for these uses at all points of exposure to each contaminated medium.

Soil contamination at the site includes a mixture of both organic and inorganic contaminants. Through on-site and off-site treatment and containment, the selected remedy will eliminate the risks posed by direct contact and incidental ingestion and reduce concentrations in soil to levels acceptable under state and federal guidelines.

The shallow and intermediate aquifers at the site are contaminated with large quantities of NAPL and some related residual dissolved-phase contaminants. No technology exists for complete removal of all NAPL from the shallow and intermediate aquifers; however, the selected remedy will remove as much NAPL from the aquifers as is practical and prohibit the use of the aquifers as sources of drinking water. Remaining NAPL will continue to act as a source of contamination to groundwater, making it technically impracticable to restore groundwater to drinking water standards.

Extensive site-related sediment contamination is present along the bank and in the nearshore sediment in the Willamette River. Capping the contaminated sediment will eliminate the potential risks from direct contact and will be protective of aquatic organisms.

NAPL recovery is the highest priority remedial action considered for this site, as it provides significant, permanent reduction of highly concentrated contaminants (primarily creosote). If left in place, NAPLs could continue to migrate vertically or horizontally, contaminating additional portions of the aquifer or discharging directly to the Willamette River. Significant amounts of residual NAPL will remain trapped in soil pores after extraction efforts are complete and remain a continuing source of dissolved-phase groundwater contamination for decades. The creosote compounds which are the principal components of NAPL, however, have very low aqueous solubilities. Compliance with ACLs for dissolved-phase constituents will be protective; and continued discharge of groundwater with dissolved-phase contamination below ACLs will not result in measurable impact to the Willamette River and associated ecosystem.

11.2 Compliance With Applicable or Relevant and Appropriate Requirements

The selected remedy will meet all chemical-, location-, and action-specific ARARs. The ARARs that have been identified for the McCormick & Baxter site are discussed below:

11.2.1 Chemical-Specific ARARs

Chemical-specific requirements are usually health-based or risk-based numerical values or methodologies that establish the acceptable amount or concentration of a chemical in the ambient environment.

- **Clean Water Act (40 CFR, Parts 122, 125, 230, 231, 401, and 403); Water Pollution Control Laws (ORS Chapter 468).** The primary applicable requirements address effluent standards, substantive permit requirements for discharges to U.S. waters, and minimum federal water quality criteria which are enforced by the State. The selected remedy will meet these requirements.

11.2.2 Location Specific ARARs

Location-specific requirements are restrictions based on the concentration of hazardous substances on the conduct of the activities in specific locations. These may restrict or preclude certain remedial actions or may apply only to certain portions of the site.

- **Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands, May 24, 1977 incorporated in 40 CFR Part 6, Appendix A; Federal Clean Water Act, Section 404, 42 USC §1344.** These requirements regulate actions that occur in wetlands and flood plains and may be applicable to actions that may adversely affect wetlands and flood plains.

11.2.3 Action-Specific ARARs

Action-specific requirements are restrictions of certain activities based on the location of the site.

- ***Solid Waste Disposal Act, also known as the Resource Conservation and* Recovery Act, Subchapter III, (42 USC § § 6921-6939; 40 CFR Parts 261, 264, and 268); Oregon Hazardous Waste Management Act (ORS 466.005 *et seq.*).** State management of hazardous waste is authorized in the Oregon Hazardous Waste Management Act (ORS 466.005 *et seq.*). The law is implemented by regulations that are codified at OAR 340-100-001 *et seq.* Oregon hazardous waste management regulations adopt by reference most of the substantive provisions of Subtitle C of RCRA. Subtitle C is the primary federal law for the management of hazardous waste. The principal federal regulations that implement Subtitle C are codified in 40 CFR Parts 260-271. If federal and Oregon hazardous waste laws conflict, the more stringent law will be followed. The specifics of how RCRA applies to or is relevant and appropriate for cleanup activities at this site are discussed in greater detail in Section 7.3.1 of this ROD.

- **40 CFR Part 261: Identification and Listing of Hazardous Waste.** Part 261 contains RCRA definitions and criteria for identifying hazardous waste. All listed or characteristic wastes transported off-site for treatment and/or disposal will comply with these regulations.

- **40 CFR Part 264: Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.** The applicable or relevant and appropriate requirements of Part 264 will be satisfied for all activities conducted in the consolidation and treatment cell areas which will be designated as a CAMU. Excavation, consolidation, stockpiling, and sorting of soil and debris will be conducted within the AOC at the site. Landfill closure requirements are relevant and appropriate for the remaining areas of the property and will be met through a hybrid closure.

- **Clean Water Act (40 CFR Part 404).** Establishes requirements for discharges of dredged or fill material into U.S. waters. The selected remedy will comply with all substantive requirements of a Section 404 permit.

- **Procedures for Planning and Implementing Off-Site Response Actions (40 CFR 300.440).** This regulation is applicable to, and will be complied with, for all wastes that are transported off-site for treatment and/or disposal.

- **Endangered Species Act (16 USC 1531 *et seq.*).** Peregrine Falcon have been observed near the site; however, no nests or use of the site by this protected bird has been observed. If Peregrine Falcon are observed at the site during implementation of the remedy, precautionary steps will be taken to protect their habitat, in accordance with this regulation.

- **Oregon Hazardous Substance Remedial Action Act and Rules (ORS 465.200 *et seq.*)** The selected remedy meets the substantive requirements of these applicable regulations.

11.3 Policy, Guidance, and Regulations To-Be-Considered

Additional policies, guidance, and other laws and regulations to be considered for source control and remedial actions include, but are not necessarily limited to, the following.

- **Transportation of Hazardous Materials (49 CFR 171-177; OAR 860-66-001 *et seq.*)** Transporters must comply with U.S. Department of Transportation labeling, containment, and spill reporting regulations found in 49 CFR, Subchapter C. Transportation of hazardous waste by rail or highway must comply with regulations of the Public Utility Commissioner (OAR 860-66-001 *et seq.*), which adopt by reference U.S. Department of Transportation regulations in Title 49 CFR. These regulations are applicable for hazardous or dangerous waste disposed off-site. The selected remedy will comply with these federal and state regulations.

- **EPA Area of Contamination Policy (Federal Register Volume 55, No. 46, March 8, 1990, pages 8759-8760).** Excavation, consolidation, stockpiling, and sorting of soil and debris will be conducted within the AOC at the site.

- **Willamette Greenway Plan.** DEQ has received Land Use Compatibility Statements demonstrating the selected remedy is consistent with these requirements.

- **The Lower Willamette River Management Plan (LWRMP).** Requirements of the LWRMP are waived for environmental cleanup plans selected by DEQ and developed in consultation with the Department of State Lands.

11.4 Cost Effectiveness

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its costs and duration for remediation of the contaminated soil, groundwater, and sediment.

11.5 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practical

DEQ and EPA determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used cost-effectively at the McCormick & Baxter site. Of those alternatives that are protective of human health and the environment and comply with ARARs, DEQ and EPA have determined that the selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness; implementability; cost; the statutory preference for treatment as a principle element; and considering state and community acceptance.

11.6 Preference for Treatment as a Principal Element

The selected remedy satisfies the statutory preference for treatment by utilizing treatment as a main method to permanently reduce the toxicity, mobility, and volume of the most highly contaminated soil. Biological treatment will be used to reduce PAH and PCP toxicity and volume, and stabilization will be used to reduce the mobility of arsenic and other metals. NAPL at the site will be extracted from groundwater and taken for disposal in accordance with applicable hazardous waste regulations (e.g., incineration), or alternatively, the NAPL may be reused by another wood-treating facility if such a facility is identified that will beneficially use the product.

Groundwater extracted with the NAPL will be treated. Biological treatment may be incorporated as a system component in a new system to reduce the volume of generated wastes requiring off-site disposal.

12.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The selected remedy includes two significant changes from the preferred alternative originally presented in the Proposed Plan. The changes include revision of the remedial action level for PAHs and lowering of the ACLs for groundwater. These changes are a logical outgrowth of information available to the public in the Proposed Plan and the Administrative Record.

12.1 Remedial Action Level for PAHs

The remedial action level for PAHs was changed from 500 mg/kg total PAHs to 100 mg/kg for carcinogenic PAHs in response to public comments from WAKE-UP (see the Responsiveness Summary in Appendix A) and further evaluation of the field screening data used to estimate volumes for the FS. Re-evaluation of the field screening data indicates that the results obtained from thin layer chromatography (TLC) overestimate PAH concentrations when compared to results obtained from laboratory analysis using EPA analytical methods. The use of total carcinogenic PAHs as the remedial action level will allow a better estimation of risk reduction which is less evident using total PAHs, and is not expected to result in an increase of soil volume for treatment.

12.2 Alternate Concentration Limits

ACLs for shallow and intermediate groundwater derived in the revised FS were based on the estimated dilution of groundwater discharging to the Willamette River during summer low flow conditions. The calculated ACLs based on the dilution exceeded solubility limits for PAHs, PCP, and dioxins/furans. The calculated ACLs conflicted with one of the RAOs which specifies minimizing discharge of NAPL to the river. The calculated ACLs for metals (arsenic, chromium, copper, and zinc) were orders of magnitude above maximum concentrations detected in groundwater. Therefore, DEQ adjusted the ACLs for metals downward to provide added protectiveness to the environment.

APPENDIX A

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

DEQ and EPA received comments on the Proposed Cleanup Plan during the November 28, 1995, public meeting at the St. Johns Community Center, and in writing during the public comment period from November 6, 1995, through January 16, 1996. Comments received, and DEQ and EPA responses, are summarized below.

WAKE-UP AND TURTLE COVE COMMENTS DATED JANUARY 16, 1996

SIMILAR COMMENTS FROM THE PUBLIC MEETING AND OTHER LETTERS ARE INCLUDED

Written comments were received from Willamette Associates for Kindness to the Environment in University Park (WAKE-UP) who received a technical assistance grant from EPA for technical consulting support related to McCormick & Baxter remedial action development, selection and implementation. Written comments from Turtle Cove, a group of people interested in commercial/residential development of the adjacent Riedel facility were received endorsing WAKE-UP's comments.

1. **COMMENT:** WAKE-UP commented that DEQ must improve site security and better maintain the perimeter fence and warning signs. WAKE-UP recommended posting of multilingual warning signs to reflect the ethnic diversity of the neighborhood. Two people who commented at the public meeting were also concerned about security at the site and said the fence had a hole in it.

RESPONSE: DEQ and EPA agree that security should be upgraded to limit unauthorized access to the site. Since the public meeting on November 28th, DEQ has contracted with a security company to monitor the site during evenings and weekends when DEQ or its contractors are not conducting interim cleanup activities.

DEQ has also installed security fencing around the retorts as a safety measure in the event of an unauthorized access to the site. DEQ is currently in the process of installing additional lighting at the site, evaluating options for installation of electronic surveillance equipment, and maintenance of warning buoys in the Willamette River. DEQ contractors will continue to make repairs to the perimeter fence and post additional warning signs in Spanish and Vietnamese.

2. **COMMENT:** WAKE-UP recommended removal or better security for remaining treated logs at the site. WAKE-UP's concern is that treated logs are being removed from the site for firewood.

RESPONSE: DEQ plans to remove additional outbuildings from the site in 1996, depending on receipt of funding from EPA. The removal would include other debris, such as scrap logs. DEQ investigated whether there are signs of cutting and removal of treated logs in response to WAKE-UP's comment, but did not find evidence of this activity. Until removal occurs, improved site security measures, as discussed above, should reduce the risk of illegal use of the treated wood as firewood.

3. **COMMENT:** WAKE-UP recommended that DEQ, EPA and ATSDR support community efforts to implement a proposed Cancer Cluster Analysis Protocol to evaluate whether contamination from the McCormick & Baxter site has caused an increased incidence of cancer in surrounding neighborhoods.

WAKE-UP provided additional comment supporting ATSDR's conclusions regarding the extent of current site hazards documented in the conclusions of their Public Health Assessment.

RESPONSE: DEQ and EPA's role is to develop and implement a cleanup of the McCormick & Baxter site which protects human health and the environment, not assess health effects related to historical releases from the site. DEQ and EPA support ATSDR's role in addressing potential health effects which may be related to historical air emissions from McCormick & Baxter woodtreating operations. WAKEUP should consult with ATSDR concerning the proposed Cancer Cluster Analysis Protocol.

DEQ and EPA agree with ATSDR's conclusion in the Public Health Assessment that there is "an indeterminate health hazard for nearby residents" as it relates to historical inhalation exposures. However, DEQ and EPA do not agree with ATSDR's conclusion that there is an indeterminate health hazard for present or future inhalation. This is because the risk assessment conducted during the RI evaluated the air inhalation pathway and concluded that potential excess cancer risks for on-site occupational workers from inhalation were not significant (less than one in a million excess cancer risk considered protective under CERCLA). The potential risk to off-site residential populations are even lower than on-site industrial inhalation exposure estimates.

4. **COMMENT:** WAKE-UP recommended that air samples for particulate contaminants be collected at sites within the community at locations likely to encounter wind blown particulates.

RESPONSE: As discussed under DEQ and EPA's response to comment 3 above, excess cancer risk estimates to future on-site workers do not exceed protective levels, and the potential risk to off-site residents are even lower. In addition, information gathered during the RI (Section 6.5 of the RI Report) shows that wind direction is away from the residential properties on the bluff and toward the river during dry summer months when transport of particulates would be the greatest. Based on this information, DEQ and EPA do not plan to collect particulate samples from neighboring residential areas. However, DEQ and EPA will conduct perimeter air monitoring as part of the remedial action.

5. **COMMENT:** WAKE-UP also recommended off-site ambient air quality monitoring in residential locations nearest to the site during remedial action activities, and that a

comprehensive description of the monitoring program and evaluation parameters be provided to the community before remedial action begins. ATSDR also recommended that air monitoring be conducted during remedial activities.

RESPONSE: The air monitoring program that will be conducted during remedial action activities will be designed to assess significant transport of airborne particulates off-site. Specific monitoring locations to assess particulate emissions would be within working zones and along the site perimeter fence. Maintaining control of particulate emissions within the property boundaries using dusts suppression techniques will ensure that neighboring residents are protected from particulate emissions during the cleanup. The monitoring program and other remedial design and remedial action plans and documents will be available to the public at the information repositories identified in the proposed plan.

6. **COMMENT:** WAKE-UP recommended that surface soil contamination exceeding risk based concentrations in the unpaved portion of Edgewater street be removed.

RESPONSE: DEQ and EPA will resample the unpaved portion of Edgewater street during remedial design to determine whether contaminant concentrations exceed protective levels identified for capping the site. The final remedy includes provisions to pave the unpaved portion of Edgewater Street as an element of the remedy in the event that contaminant concentrations exceed protective levels.

7. **COMMENT:** WAKE-UP recommended that blackberries along the roadside be sampled to determine levels of arsenic, dioxins, and other contaminants of concern.

RESPONSE: EPA has data on blackberries collected from another Superfund site which showed that contaminant deposition from particulates were not a significant risk to human health. This information, coupled with the results of the off-site surface soil samples collected near the site, does not support the conclusion that significant exposures would occur to people who eat blackberries growing near the site. Therefore, DEQ and EPA do not plan to collect blackberry samples for chemical analysis.

8. **COMMENT:** WAKE-UP recommended that off-site surface soil samples be collected near the perimeter fence in areas adjacent to the on-site contamination to verify that all off-site contamination resulting from McCormick & Baxter site operations is below health based levels.

RESPONSE: DEQ and EPA concur with WAKE-UP's comment. Off-site surface soil sampling is included as a component of the soil remedy to determine the lateral extent of the soil cap or to identify off-site soil for consolidation on-site prior to capping the site.

9. **COMMENT:** WAKE-UP requested assurances that off-site remedial activities can proceed in a timely manner, concurrent with on-site remedial activities. WAKEUP ques-

tioned whether DEQ or EPA had authority to conduct off-site remedial activities, including institutional controls to maintain cap integrity, with the present process.

RESPONSE: DEQ and EPA have the authority under State or Federal law to perform remedial action on adjacent properties which are included as a portion of the McCormick & Baxter Superfund site. The approach generally used by the agencies is to work closely with neighboring property owners to agree upon and sign enforceable agreements that provide access in a timely manner, and ensure that institutional controls are maintained.

10 & 11. COMMENT: WAKE-UP commented that DEQ had indicated, during a site tour, that final site closure would be linked to sale of the property in order to integrate the cap design with the new owner's plan for the site. WAKE-UP suggested that DEQ should clarify that site closure will be accomplished to the extent necessary to prevent the spread of contamination, regardless of the timing of sale of the property. WAKE-UP's recommendation #11 stated that final capping of the site should proceed within 2 years of site remediation; sediment in Willamette Cove should be remediated promptly regardless of how long it takes to sell the property.

RESPONSE: DEQ and EPA concur that the final remedy should stipulate a time limit on delaying final capping of the site to accommodate future development of the site which is currently unknown. A two year time limit has been incorporated into the final remedy for capping site soil.

Capping of the contaminated sediment area in Willamette Cove will be conducted when sufficient control of the mobile NAPL has been achieved to ensure that the sediment cap does not become contaminated from NAPL seeps. DEQ and EPA believe that two years may be necessary to determine whether NAPL pools can be effectively controlled through extraction and to implement the physical barrier contingency if they are not. The final remedy reflects these time lines.

12. COMMENT: WAKE-UP commented that DEQ should demonstrate that the proposed cleanup is consistent with all reasonable, potential future land uses for the site and surrounding areas. WAKE-UP suggested that the assumed industrial or recreational land use introduces bias into the evaluation of a preferred alternative, and that the FS assumes that direct exposure to river sediment would be minimal, and that it is not clear that exposure assumptions and the proposed cleanup are compatible with the full range of anticipated land uses. Several people at the public meeting commented that they would like to see a park, greenway, open space area, and habitat for wildlife when the site is cleaned up.

RESPONSE: The human health risk assessment for the site evaluated all reasonable future uses, including residential (see Section 2 of the RI Report). The risk assessment exposure assumptions assumed that exposure to contamination at the site would be greatest for residents who live at the site, less for industrial workers (eight hour work day and five days per week), and least for recreational users. The exposure scenario for dermal contact assumes recreational use along the beachfront at the site including sunbathing (i.e. lying prone or supine on the beach) three days per week, three months per year, for thirty years.

The evaluation of alternatives in the FS used industrial land use as the point of departure for determining soil treatment levels since this is the current land use for the site. The agencies believe that cleanup to industrial levels is appropriate for this site since these levels are reasonable and protective given the current land use, and likely future land use (industrial, or recreational if the zoning changes). Cleanup to these levels is also protective of potential future recreational use of the site. Inclusion of a habitat for wildlife will be considered in design of the final remedy (see response to U. S. Fish and wildlife Comment # 5, below).

13. **COMMENT:** WAKE-UP asked that the proposed cleanup be adequate for activities that could take place on a portion of the site that is in the Willamette Greenway, as set by the Oregon State Land Use Goal 15.

RESPONSE: The selected remedy is protective for activities that could take place on portions of the site, including Willamette Cove property owned by the Portland Development Commission (PDC), as set by Oregon State Land Use Goal 15. The remedy in this ROD will allow either industrial/commercial or recreational uses of the site and is protective of the uses. As noted in the response to comments from the Trust for Public Lands, METRO and PDC, DEQ and EPA will work with these parties to facilitate sediment cap design and a recreational boat launch on their property and maintenance of institutional controls on those areas where sediment contamination exists underneath the cap. The combination of the sediment and site cap will eliminate the direct contact threat and allow activities contemplated for the Willamette Greenway.

14. **COMMENT:** WAKE-UP commented that if a remedial alternative precludes a post-remedial use, that such restrictions (e.g., excavations greater than four feet) should be noted in the FS and the ROD. WAKE-UP also asked if the added reduced risk from Alternative S-5b (capping with consolidation and biological treatment) is worth the cost and added restrictions to the site over the cost and restriction of S-2a (capping and consolidation without treatment). WAKE-UP, in summary, recommended that DEQ should evaluate risks, benefits, site restrictions, and costs from each of the proposed alternatives.

RESPONSE: Consistent with DEQ and EPA guidance and policy, the FS structured all of the alternatives to be protective of reasonably anticipated future uses. As discussed in our response to Comment # 12, the FS used industrial land use as the point of departure for determining cleanup levels at the site. All remedial alternatives are also protective of recreational uses as well. The FS and the Proposed Plan did identify various possible institutional controls that would be imposed at the site as part of the remedy to ensure that the cleanup is protective of these anticipated uses. The ROD provides additional details on those site restrictions that will be imposed.

The FS did present and evaluate the risks, benefits, and costs from each of the proposed alternatives. The agencies believe that the selected remedy is protective of human health and the environment, meets ARARs, is cost effective, and provides the best balance of trade-offs among alternatives in terms of the five primary balancing criteria. One of these balancing criteria is cost. The selected remedy also satisfies CERCLA's preference for those remedies involving treatment. The selected alternative for soil best satisfies the remedy selection criteria in the NCP, as well as Oregon's revised Environmental Cleanup Law (ORS 465 *et seq.*), by requiring treatment of "hot spots", and utilizing engineering and institutional controls to prevent exposure to soil contaminated at levels exceeding 10^{-6} protective levels.

15. **COMMENT:** WAKE-UP said that DEQ should consider limited road access to the McCormick and Baxter site when developing remedial designs and when considering sale of the property. A speaker at the public meeting from WAKE-UP also expressed concern about truck traffic during cleanup, and mentioned rail and ship transport available.

RESPONSE: The selected remedy does not involve the transport of large volumes of contaminated media from the site for treatment and disposal. The anticipated volumes (e.g., up to 1000 cubic yards of soil, 5000 gallon tanker shipments of NAPL etc.) are less than or equivalent to volumes previously transported from the site during plant shutdown and demolition activities conducted in 1993-1994. The likely transportation route would not be on Willamette Boulevard and by University of Portland but on Highway 30. DEQ and EPA will consider alternatives for transport of fill material for the soil and sediment cap that do not involve trucking of these materials through the St. Johns neighborhood. The issue of truck traffic related to future uses of the site following remedial action would be the responsibility of local agencies.

16. **COMMENT:** WAKE-UP commented that local residents have expressed concerns about the proposed location for the soil consolidation and land treatment areas. WAKE-UP commented that the proposed consolidation area design does not provide adequate protection against intrusion under future recreational land use. Lower overall site risks could be achieved by alternative cleanup levels and off site disposal of the most highly contaminated soil, and a thicker cap. WAKE-UP noted that the fragmented presentation of cleanup alternatives does not facilitate this optimization. WAKE-UP recommended that soil that cannot be effectively treated to health based levels should be disposed of offsite.

RESPONSE: The location of the consolidation and treatment areas was based on the magnitude of contamination in this area as compared to other areas of the site, the location of groundwater contamination and the need to have uninterrupted access to these areas for groundwater remediation for NAPL, and the presence of the Burlington Northern railroad spur which provides a physical barrier between the treatment area and Willamette Cove. DEQ and EPA did not consider the southern portion of the site for the consolidation and treatment areas because the bulk of soil exceeding the remedial action levels is in the northern portion of the site where wood treating operations occurred and treated logs were stored. Placement of the treatment cells to the south would involve more movement of contaminated soil across the site and would result in additional site restrictions in this area.

Off-site disposal of all contaminated soil exceeding health based levels (for industrial uses) is not as cost-effective as on-site treatment alternatives. In addition, transport of soil exceeding 10^{-4} risk based concentrations would result in significant truck transport of soil offsite. Transport of all soil identified for treatment under Alternative S-5B would involve 1000 truck loads of soil which would result in considerably more short term risk to the community than on-site treatment. Transport and disposal cost for 30,000 cubic yards of soil (over 40,000 tons) would be in the range of 8 to 10 million dollars if the soil was not incinerated. If incineration was required to meet applicable land disposal restrictions, the cost could increase to well over $40,000,000.

The selected remedy includes transporting some of the most highly contaminated soil off-site for treatment and disposal. This will include soil that is not expected to be effectively treated using bioremediation or stabilization (including soil containing the highest levels of dioxin). Soil with arsenic, PAH and PCP contamination exceeding a 1 in 10,000 (1×10^{-4}) excess cancer risk for industrial uses will be treated onsite and then capped. Capping of the site and institutional controls will eliminate the pathways of exposure to contaminants remaining at the site.

DEQ respectfully disagrees that the presentation of the cleanup alternatives is fragmented and does not facilitate optimization. The selected remedy appropriately utilizes treatment technologies for the types of contaminants found at the site consistent with EPA identified presumptive remedies for wood treating sites.

17. **COMMENT:** WAKE-UP asks that DEQ consider cap designs with a greater barrier.

RESPONSE: DEQ and EPA believe that a two foot soil cap provides a protective barrier to residual contamination exceeding capping levels. Additional protection could be implemented by a future owner or lessee of the property depending on the site use. For example, under a future recreational use scenario, parking lots or buildings such as a pavilion could be placed over the land treatment cells to further reduce potential exposure to residual contamination in these areas. DEQ and EPA would work with the future owner to address specific issues related to future development of the site.

18. **COMMENT:** WAKE-UP noted that concerns have been expressed about whether the microbes used for bioremediation will be native or non-native and whether potential negative effects have been evaluated. WAKE-UP suggested that DEQ should consider potential negative effects of microbes selected for land treatment of excavated soil.

RESPONSE: There are no known negative effects related to native or nonnative microbes which would be used for bioremediation. Microbes die when either nutrients, oxygen or the food source (i.e. contaminants) have been depleted.

19. **COMMENT:** A commenter suggested that DEQ should revise its uncertainty analysis for dioxins/furans in view of recent studies on effects thresholds. The commenter noted that the risk assessment used the Hazard Indices calculated from a 1991 report from the Washington Department of Health. The commenter stated that this report suggests that actual "cancer risks" from dioxins/furans may be lower than estimated due to a "threshold for adverse effects". The commenter goes on to state that the Washington Department of Health, in a phone conversation dated November 6, 1995, stated that the "Hazard Indices" in the report should not be used.

RESPONSE: The threshold effects and Hazard Indices of concern to the commenter are measures of non-carcinogenic effects. Hazard Indices are not a measure of carcinogenic risks. Thus, even if it is recommended that the data of concern should not be used in the risk assessment, it would affect the Hazard Indices, not the cancer risks (which are based on slope factors) from dioxins/furans as presented in the risk assessment.

DEQ and EPA do not believe that it is necessary to revise the uncertainty analysis in the RI, since this Hazard Indices information of concern to the commenter was not used to set remediation goals for soil (Table 3-1 of the RI). The cleanup standards for dioxins/furans presented in the ROD (Table 7-1), were based on cancer risks, and not on non-carcinogenic risks (Hazard Indices).

20, 21 & 22. **COMMENT:** WAKE-UP recommended that DEQ should set a cleanup level for dioxins/furans, recommended that the proposed cleanup plan should be revised to include effective treatment for these contaminants, and that DEQ should set a success criteria for treatment of dioxins/furans.

RESPONSE: The revised FS discussed the fact that there is insufficient data to set a remedial action level for treatment for dioxins/furans using the soil volume vs. concentration curve analyses for PCP, PAHs and arsenic. While DEQ and EPA believe that the highest concentrations of dioxins/furans were removed during the 1994 soil and sludge removal actions, the agencies will conduct additional dioxin sampling during remedial design. This information will be used to assist the agencies in determining the soil with high dioxin concentrations that should be removed from the site, soil that will be consolidated, treated and capped, and soil requiring capping alone. This information will be available to the public prior to a final decision by DEQ and EPA on the soil identified for off-site disposal. Capping of the entire site will eliminate exposure to residual site contaminants.

23. **COMMENT:** WAKE-UP believes that DEQ should sample soil at the pole peeler site for dioxins and the soil should be removed and treated if levels are higher than risk based cleanup goals.

RESPONSE: The pole peeler may have been periodically used to mill treated logs. However, the PAH and PCP concentrations detected in this area are orders of magnitude less than found in other areas of the site. Therefore, DEQ and EPA do not believe that dioxin levels are significantly higher in this area than in other areas of the site. Sawdust and other debris from this area will be managed with other debris from the site which DEQ and EPA intend to consolidate and landfill on-site prior to placement of the final site cap.

24. **COMMENT:** WAKE-UP asked for clarification of how the FS assigned a risk level to the total PAH cleanup level. WAKE-UP commented that the FS establishes a soil cleanup (treatment) level for PAHs at 500 mg/kg total PAHs (carcinogenic and non-carcinogenic) and assigns this concentration an occupational risk level of 2×10^{-4}. WAKE-UP stated that it is unclear how these total PAH values were converted to risk levels. WAKE--UP also commented that if DEQ assumed that total PAHs levels represent total carcinogenic PAH levels, this would be a very conservative assumption and would tend to overestimate risk (in addition to the conservatism from using the slope factor for benzo[a]pyrene to represent the cancer potency of all carcinogenic PAHs). WAKE-UP further states that excavations exceed the risk-based levels for carcinogenic PAHs (rather than to PAH) might result in significantly less soil requiring excavation and treatment.

RESPONSE: The revised FS used total PAH concentrations measured by field screening methods to identify a remedial action level for treatment of soil hot spots. DEQ concurs that the use of total PAHs does not clearly reflect carcinogenic risk reduction achieved through treatment. DEQ and EPA also agree with WAKE-UP's comment that setting a treatment level for carcinogenic PAHs vs. total PAHs would clarify the risk reduction achieved for treatment of soil exceeding a risk based concentration. Towards this end, DEQ examined the field screening and laboratory PAH data. Based on this review, it appears that carcinogenic PAHs account (conservatively) for approximately 50 percent of the total PAHs. The evaluation also indicates that there appears to be a positive bias in the field screening results as compared to laboratory results. This positive bias means that it is likely that the actual concentrations of PAHs may not be as high as the field screening data indicate. Based upon the reevaluation of the data, DEQ and EPA have revised the treatment level for PAHs to 100 mg/kg carcinogenic PAHs (equal to a 1×10^{-4} industrial risk). This level is consistent with the treatment levels selected for PCP and arsenic. However, based on the likelihood that actual PAH concentrations are lower than the field screening methods indicate, the actual volume of soil treated should be within the same order of magnitude and most likely will not significantly change the cost of the cleanup.

25. **COMMENT:** DEQ should estimate the cumulative risk from all contaminants remaining at the site after removal and treatment (without benefit of the cap). A commenter at the public meeting also would like a study done about cumulative impacts of this site to the river and other polluters nearby, including other Superfund sites.

RESPONSE: DEQ and EPA will estimate the risk related to residual surface soil contamination at the site at the completion of the treatment of the soil hot spots. The maximum residual risk for carcinogenic PAHs and arsenic should be at 1×10^{-4} (1 in 10,000) without the cap. Also, the highest levels of dioxin will be removed from the site for treatment and disposal. The residual risk at the site for all contaminants of concern should be less than 1×10^{-4} because the hot spot concentrations will be removed resulting in an overall reduction in the average concentration across the site. A cap will then be designed and placed on the site to protect against industrial exposures greater than 1 in 1,000,000 (1 x 10^{-6}.

DEQ does not believe it is feasible to quantify cumulative impacts to the Willamette River from this site and other contaminated sites which may be discharging contamination to the river because this information is either not available or is currently being evaluated at other facilities. DEQ has established a waste load allocation (WLA) of five micrograms per day for dioxin permitted discharges to the river from this site which is based on waste loads for known point sources under permit from DEQ.

26. **COMMENT:** DEQ should determine the quantity of soil excavation and types of treatment necessary to achieve the minimum cleanup goals for all contaminants (without benefit of the cap).

RESPONSE: The revised FS included estimates of soil volumes exceeding protective levels (see Table 3-5). The only treatment technology demonstrated to be effective for dioxins is incineration. Cleanup of 74,000 cubic yards of surface soil contamination to protective levels would be at least two to three times the costs discussed in the response to comment 16. Also, clean backfill would need to be imported to raise the site above the 100 year flood plain. Backfill costs would be comparable to the cost of the cap.

The 1992 FS Report included two alternatives (S-13 and S-14) which attempted to restore the site to protective levels. The costs for these alternatives were $532 million for incineration, and $52 million for off-site disposal in a hazardous waste landfill. As discussed in the 1992 FS, neither of these alternatives satisfied the remedy selection criteria, and these were not considered in the 1995 Revised FS.

27. **COMMENT:** Soil excavation volumes should be based on total residual risk from all contaminants (including dioxins/furans) versus volume. DEQ should be concerned with reducing total risk, not just the mass of individual contaminants.

RESPONSE: There is insufficient data to estimate soil volume vs. contaminant concentration curves for dioxin. Since risk is proportionate to concentration, risk reduction is achieved through treatment of the hot spots. Further contaminant mass and risk reduction will be achieved through selective removal and off-site treatment and disposal of soil which may not be amenable to biological or stabilization treatment technologies. This includes soil containing the highest concentrations of dioxins that may be remaining on site.

28. **COMMENT:** WAKE-UP wants DEQ to explain why the proposed land disposal restrictions treatment standards for wood treatment wastes were not considered in developing remedial alternatives. Also, why is DEQ is proposing to designate the site a CAMU?

RESPONSE: The proposed treatment standards for F032, F034 and F035 listed hazardous wastes from wood treating operations were proposed by EPA on August 22, 1995 during finalization of the revised FS Report. DEQ and EPA did consider universal treatment standards specified in 40 CFR Part 268 which would be triggered for soil exceeding TCLP concentration thresholds. The universal treatment standards concentrations are consistent with the proposed land disposal restriction (LDR) concentrations for the listed waste codes noted above.

DEQ and EPA designated a CAMU for the land treatment cells because that is the only way (other than an ARAR waiver) to do land treatment. Additional details on ARARs and CAMUs can be found in the memorandum to the McCormick & Baxter file (in the Administrative Record) from Bruce Gilles and Allison Hiltner, dated October 18, 1995, which was included as part of the administrative record made available to the public for comment with the proposed plan.

29. **COMMENT:** WAKE-UP recommends that DEQ and EPA should present at least one alternative cleanup method for contaminated soil that achieves the remedial action goals through removal or destruction of contaminants rather than capping. WAKE-UP noted that their review of RODs from other sites have involved excavation of more that 200,000 cubic yards of contaminated soil with cleanup levels much lower than those proposed for McCormick and Baxter.

RESPONSE: The 1992 FS Report prepared by DEQ considered a wide range of remedial alternatives for soil. Alternative S-14, off-site land disposal, of 160,000 cubic yards of soil cost $52 million. As shown in Table 3-5 of the revised FS, the actual volume of contaminated soil above the water table is approximately 220,000 cubic yards. Factoring in the cost for clean backfill material, the cost of off-site removal would easily exceed $60 million. DEQ and EPA have determined that off-site removal would not be cost-effective as compared to any of the alternatives involving treatment in the revised FS.

DEQ and EPA reviewed the information on treatment at other wood treatment superfund sites provided by WAKE-UP. WAKE-UP acknowledged that some of the cleanup levels used at other sites were necessary for protection of groundwater. However, it is not clear from Attachment 4 whether the numbers reported are for protection of groundwater, risk-based concentrations for direct contact, the land use at the site, and/or performance standards for treatment. For the McCormick & Baxter site-specific conditions, including the magnitude of the contamination, use of groundwater, anticipated land use, and technical practicability, were factors in determining the cleanup goals and objectives at this site. DEQ and EPA believe the remedy selected is consistent with remedies selected at other sites and is protective.

30. **COMMENT:** WAKE-UP recommends that other cap designs be evaluated that provide better isolation of contaminants, and that a cap maintenance program that will ensure cap integrity over time be required. A comment received at the public-meeting also asked for greater assurance about the long-term quality of the cap.

RESPONSE: DEQ and EPA believe that removal of the grossly contaminated soil/sludge in 1994 and treatment of hot spot areas to 1 in 10,000 (1×10^{-4}) excess cancer risk levels will ensure that no significant risk to human health and environment would occur even in the event of a breach in the cap. The cap will be designed to protect against industrial exposures greater than 1 in 1,000,000 (1×10^{-6}). The agencies believe that the cap for this site will be protective of anticipated future uses of the site. The ROD includes requirements for long term monitoring and maintenance for the soil and sediment cap to ensure that any breaches in the cap materials would be short term vs. long term which is assumed for deriving risk based concentrations and residual risk.

31. **COMMENT:** DEQ should reevaluate the ranking of sediment areas of concern and should consider the "sediment remediation areas" separately from the remainder of the sediment. Treatment and removal of highly contaminated sediment was not recommended due to averaging hot spot bioassay results with those of cleaner sediment.

RESPONSE: The FS evaluated two alternatives (SD-3 and SD-4) for sediment "hot spots" areas that included removal and treatment of contaminated sediment. However, the reason for not selecting SD-3 or SD-4 was not based on the averaging of hotspot bioassay results. These alternatives were not selected due to the impacts to fish and crayfish and the short term risks involved with dredging these materials as compared to the overall long term effectiveness of capping.

32. **COMMENT:** The area along the river is a prime concern of the community. The proposed plan should designate areas of high concern as principle threats and should reconsider treatment or removal options for these sediment.

RESPONSE: The revised FS, Section 3.3.1 provides the rationale for not identifying sediments as principal threats under the criteria identified in the NCP. The FS states that surface sediment poses a direct contact risk and exhibits toxicity to test organisms in localized areas, but has less potential for exposure to humans than surface soil. The sediment does not appear to be significantly adversely affecting the broader Willamette River ecosystem, or pose a high risk for mobilization out of the nearshore area at the site. Under these conditions, use of engineering controls, such as capping, is consistent with EPA's national strategy for contaminated sediment. The long term monitoring and institutional controls which are elements of the selected remedy will ensure protection of human health and the environment. The monitoring program will include provisions for timely assessment and repairs of damage from events such as the February 1996 flood.

33. **COMMENT:** The sediment cap design should recognize that the beach and river will be used for recreational purposes and by wildlife.

RESPONSE: The sediment and the beach area will be capped and the cap will protect both human health and the environment by eliminating exposure to the contaminated sediment. To the extent possible, the cap will be designed to maximize its habitat value to wildlife.

34. **COMMENT:** A cap that permanently isolates the contaminants in the sediment should be evaluated. Options for isolating contaminated sediment might be a wetlands or a filled in area behind a wall.

RESPONSE: The final sediment cap design will consider creation of a wetland environment as discussed in the revised FS Report to the extent possible within the cost of the remedy.

35. **COMMENT:** Prior to final selection of an enhanced groundwater extraction system, longer pilot scale tests should be conducted to verify the cost effectiveness of the method. A verbal commenter thought that the pumping that's already going on is enough and less costly than what's proposed.

RESPONSE: DEQ has been conducting pilot tests for enhanced NAPL extraction since the treatment plant went on-line in March 1995. The results of these tests provided the basis for the NAPL recovery rates presented in the revised FS for Alternative GW-3. A comparison of the volume of NAPL recovered between Alternative GW-2 and GW-3 clearly indicates that the increased volume of NAPL recovered by GW-3 as compared with GW-2 is proportionate with the increased cost between these two alternatives. Therefore, GW-3 is cost-effective in comparison with GW-2 even with the additional cost for installation of a physical barrier.

36. **COMMENT:** DEQ should conduct frequent monitoring of the deep aquifer to verify that it is not being affected by on-site contamination. If contaminants are found, further remediation will be needed.

RESPONSE: Monitoring of the deep aquifer will be included in the groundwater monitoring program for the site.

COMMENTS FROM THE U.S. FISH AND WILDLIFE SERVICE

1. **COMMENT:** Monitoring for dioxins/furans and trace elements in stormwater runoff should continue after completion of soil cleanup to determine if contaminants are present at concentrations potentially harmful to fish and wildlife and if additional remediation is warranted.

RESPONSE: The soil cap will include a storm water collection system to reduce the potential for erosion of the soil cap during high rainfall events. This system would replace the existing stormwater collection system. Since the runoff from the cap would not be in direct contact with contaminated soil, there would be no need to conduct monitoring of storm water for dioxins/furans and trace metals.

2. **COMMENT:** Groundwater should be tested prior to discharge into the river. Discharges should be stopped, and additional treatment should be conducted, if contaminants are found to exceed ambient water quality criteria.

RESPONSE: Alternate concentration limits have been established for dissolved phase groundwater contamination which would be allowed to discharge to the Willamette River. It is anticipated that the concentrations of contaminants in groundwater that discharges to the river will be below detection limits and well below ambient water quality criteria. As a result, extraction/treatment of groundwater is not planned as part of the selected remedy.

3. **COMMENT:** Institutional controls should remain in place permanently, ecological risk assessment should be conducted prior to removal of any sediment, access by boating should be restricted within the capping zone, and the boundary of the cap, including a suitable buffer zone, should be permanently marked with buoys.

RESPONSE: Land use restrictions to protect the capped area will be implemented and will continue indefinitely. The ROD does not contemplate sediment removal, only capping. Controlled boat access to the capped areas will be evaluated following completion of remedial design, sediment monitoring, and finalization of areas to be capped.

4. **COMMENT:** Additional sampling should be implemented to determine dioxins/furans concentrations in fish, crayfish and possibly other species in the river near the site to determine if bioaccumulation in higher trophic species is occurring over time.

RESPONSE: Since the sediment cap will eliminate direct contact with contaminated sediment by fish and crayfish, the monitoring program will focus on recontamination of the sediment cap. If contamination of the cap occurs, it may be appropriate to expand the assessment to fish and crayfish.

5. **COMMENT:** Wetland mitigation (habitat restoration) should occur on-site in areas where contamination is not present in soil and where storm water containing contaminants will not reach the wetland. If habitat restoration on site is not feasible due to the possibility of attracting wildlife to contaminated areas, off-site mitigation should be considered.

RESPONSE: DEQ and EPA believe that habitat restoration should be considered in the development of the sediment cap designs. Our primary concern is creating a wetland environment in areas of highly contaminated sediment that attracts wildlife which could be impacted if for some reason the cap fails. DEQ and EPA will consult with USF&W in designing the sediment cap.

COMMENTS FROM PORTLAND DEVELOPMENT COMMISSION, THE TRUST FOR PUBLIC LAND, AND METRO.

These agencies provided written comment in support of the proposed cleanup plan prepared by DEQ and EPA. The agencies' interest relates to future recreational use of the Willamette Cove property located immediately north of the Burlington Northern railroad spur. Portions of the 27 acre property are included as part of the site where sediment remediation will occur.

1. **COMMENT:** Coordination with DEQ and EPA was requested on the sediment cap design adjacent to the Willamette Cove uplands. Additional comments emphasizing the need for long term monitoring and establishment of contingency plans for sediment and groundwater were provided.

RESPONSE: DEQ and EPA will work with these agencies to address specific issues, including the cap, related to the cleanup and future uses of the Willamette Cove area for recreational purposes; as well as issues related to the Willamette Greenspace and the cleanup on the McCormick & Baxter property.

Enhanced NAPL extraction, groundwater monitoring and a contingency for installation of a physical barrier were retained as components of the final groundwater remedy.

VERBAL COMMENTS DURING PUBLIC MEETING NOT INCLUDED ABOVE

1. **COMMENT:** Pat Connelly provided comment on a treatment technology for sediment called RENEW. Mr. Connelly is interested in a floating home moorage for approximately 130 homes along the McCormick & Baxter shoreline. The moorage would require dredging of sediment to a depth of at least 20 feet. Bill Barnes from Terra Delta provided a video regarding the RENEW process. Mr. Barnes provided a written "proposal" to cleanup the site using an alternative approach than presented in the revised FS.

RESPONSE: DEQ has significant concerns with dredging of sediment along the shoreline to depths necessary to facilitate a moorage. DEQ's primary concern is that the dredging would alter the equilibrium with groundwater resulting in increased migration of creosote product in groundwater to surface water. This could result in a sheen on the river surface for extensive periods during summer months resulting in greater risk to human health and wildlife than capping sediment.

DEQ has evaluated the RENEW process information provided by Terra Delta and has concluded that there is insufficient information to conclude that this technology would be effective or cost-effective in comparison to the technologies evaluated in the FS.

2. **COMMENT:** Several comments were made requesting pilot testing of innovative technologies for removal of non-aqueous-phase liquids (NAPL). Specific comments were received indicating the potential availability of grant funding for research of such technologies by federal agencies.

RESPONSE: DEQ and EPA support pilot testing of innovative technologies at the McCormick & Baxter site. DEQ has facilitated use of the site for two EPA Superfund Innovative Treatment Technology Evaluation (SITE) demonstrations involving bioremediation of wood treating chemicals in soil. DEQ and EPA are willing to consider other federal or private funded pilot studies provided that the studies are consistent with the final remedy for the site (i.e. enhanced NAPL extraction is consistent with the goals of the selected groundwater remedy).

3. **COMMENT:** A person commented that members of the community have not been notified by WAKE-UP about their meetings noted that EPA has given them a grant to provide information to the community about the site. She wants to be notified about the WAKE-UP meetings.

RESPONSE: DEQ and EPA will encourage WAKE-UP to notify all citizens within the neighborhoods represented by WAKE-UP of meetings they schedule concerning the site.

4. **COMMENT:** A person commented that the remedy should look at the long term and not just assume a 30 year lifetime for the cap.

RESPONSE: The EPA RI/FS uses a 30 year time frame to estimate costs which implied to members of the public that monitoring and institutional controls would be terminated at that time. Long term monitoring and institutional controls will continue indefinitely as long as contamination exists above protective levels.

WRITTEN COMMENTS FROM AN ATTORNEY WITH CABLE HUSTON BENEDICT AND HAAGENSEN

1. **COMMENT:** An attorney for Rhone Poulenc stated that, since he had not heard back from EPA regarding a request for information, the company was reserving its right to comment on the Proposed Plan after the comment period ended on January 16, 1996.

RESPONSE: Rhone Poulenc's request, pursuant to the Freedom of Information Act, asked for any information EPA had on its potential liability at the site. EPA called the commenter on January 31, 1996 to discuss this comment with Rhone Poulenc. During this conversation, the commenter noted that his letter was not to be considered a comment for the record on the Proposed Plan, nor was it a request to extend the period for commenting on the Proposed Plan.

EPA informed the commenter that the information was enforcement confidential, and not subject to release under the Freedom of Information Act. In addition, EPA informed the commenter that the withheld information does not include any information the agencies used in developing or deciding upon the cleanup remedy for the site. The information used to reach the cleanup decision is included in the Administrative Record for the site and was available to the public for review during the comment period. Further, EPA and DEQ already extended the comment period from December 8, 1995 to January 16, 1996 to allow the public additional time to comment on the Proposed Plan.

EPA also informed the commenter that the National Contingency Plan (NCP) identifies those circumstances when EPA must consider comments from interested persons *after the comment period has closed.* As discussed in §300.825(c) of the NCP, DEQ and EPA are required to consider comments after the close of the comment period only to the extent that comments contain significant information not contained elsewhere in the record which could not have been submitted during the comment period, and *"which substantially support the need to significantly alter the response action"* (emphasis added).

APPENDIX B

ADMINISTRATIVE RECORD INDEX

March 1996

McCORMICK & BAXTER CREOSOTING COMPANY - PORTLAND PLANT.

ADMINISTRATIVE RECORD INDEX

1.0 SITE IDENTIFICATION

1.1 Site inspection, McCormick & Baxter Creosoting Company. Prepared for the U.S. Environmental Protection Agency, Region 10. Ecology and Environment, Seattle, WA. December 9, 1983

1.2 Preliminary Site Investigation of McCormick & Baxter Creosoting Company Plant, dated April 3, 1984, prepared by CH2M Hill. Submitted to Oregon Department of Environmental Quality by McCormick & Baxter.

1.3 McCormick & Baxter Creosoting Company site water and soil investigation. Interim Report. Submitted to Oregon Department of Environmental Quality, Portland, OR. CH2M Hill, Portland, OR. January 1985.

1.4 CH2M Hill. February 1987. McCormick & Baxter Creosoting Co. Portland Plant: environmental contamination site assessment and remedial action report. Volume 1. Submitted to Oregon Department of Environmental Quality, Portland, OR. Prepared by McCormick & Baxter Creosoting Company and CH2M Hill, Portland, OR.

1.5 CH2M Hill. December 1989. McCormick & Baxter Creosoting Company 1988 and 1989 environmental monitoring summary report. Prepared for McCormick & Baxter Creosoting Company, Portland, OR. CH2M Hill, Portland, OR.

1.6 *McCormick & Baxter Creosoting Company 1990 environmental monitoring summary* report. Prepared for McCormick & Baxter Creosoting Company, Portland, OR. CH2M Hill, Portland, OR. December 1990.

2.0 REMOVAL RESPONSE

2.1 PTI. March 1991. McCormick & Baxter Creosoting Company interim remedial action work plan. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Bellevue, WA.

2.2 PTI. August 1991. McCormick & Baxter Creosoting Company interim remedial action summary. Draft. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Bellevue, WA.

2.3 PTI. September 1991. McCormick & Baxter Creosoting Company interim remedial action creosote recovery work plan. Draft. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Bellevue, WA.

2.4 McCormick & Baxter Creosoting Company DNAPL Extraction Design Report. October 1992. Prepared for Oregon Department of Environmental Quality, Portland. PTI Environmental Services.

2.5 Creosote extraction system performance evaluation. McCormick & Baxter Creosoting Company. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Lake Oswego, OR. June 1993.

2.6 McCormick & Baxter Creosoting Company Extracted Groundwater Pilot Treatment System Preliminary Engineering Analysis. March 1994. Prepared for Oregon Department of Environmental Quality and PTI Environmental Services by Onsite Enterprises.

2.7 Site Activity Status Report, McCormick & Baxter Creosoting Company. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Lake Oswego, OR. June 1994.

2.8 NAPL Extraction System Operations and Maintenance Manual, McCormick & Baxter Creosoting Company. Prepared for Oregon Department of Environmental Quality by PTI Environmental Services, dated December 1994.

2.9 Tank Dismantling Summary Report, McCormick & Baxter Creosoting Company. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Lake Oswego, OR. January 1995.

2.10 Quarterly Creosote Extraction Summary, Fourth Quarter 1994. McCormick & Baxter Creosoting Company. Prepared for Oregon Department of Environmental Quality by PTI Environmental Services, dated February 1995.

2.11 EPA Action Memorandum dated March 2, 1995 authorizing Removal Action for the McCormick & Baxter Creosoting Site.

2.12 Quarterly Creosote Extraction Summary, First Quarter 1995. McCormick & Baxter Creosoting Company. Prepared for Oregon Department of Environmental Quality by PTI Environmental Services, dated April 1995.

2.13 Quarterly Creosote Extraction Summary, Second Quarter 1995. McCormick & Baxter Creosoting Company. Prepared for Oregon Department of Environmental Quality by PTI Environmental Services, dated July 1995.

2.14 Monthly Creosote Extraction Summary Reports dated June 1993 through August 1994, Prepared for Oregon Department of Environmental Quality by PTI Environmental Services.

2.15 Pre-Remedial Design Work Plan, McCormick & Baxter Creosoting Company Portland Plant. Prepared for Oregon Department of Environmental Quality by Ecology & Environment, Inc., dated February 1996.

2.16 Memorandum from Mike Wiltsey, DEQ Northwest Region, to Jim Sheetz, DEQ Northwest Region, dated February 21, 1995. Memorandum provides mixing zone modeling results for interim NPDES discharge limits for treated groundwater discharge to Willamette River.

3.0 REMEDIAL INVESTIGATION (RI)

3.1 McCormick & Baxter Creosoting Company Remedial Investigation and Feasibility Study Sampling and Analysis Plan and Quality Assurance Project Plan. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Bellevue, WA. September 1990.

3.2 McCormick & Baxter Creosoting Company Remedial Investigation and Feasibility Study Work Plan. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Bellevue, WA. September 1990.

3.3 McCormick & Baxter Creosoting Company Phase II Remedial Investigation Work Plan. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Bellevue, WA. September 1991.

3.4 McCormick & Baxter Creosoting Company Phase II Remedial Investigation Sampling and Analysis Plan. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Bellevue, WA. October 1991.

3.5 McCormick & Baxter Creosoting Company Remedial Investigation/Feasibility Study Pilot Extraction Testing Results. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Bellevue, WA.

3.6 McCormick & Baxter Creosoting Company Remedial Investigation Report. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Bellevue, WA. September 1992.

3.7 Supplemental Characterization and Initial Removal of Contaminated Soils, McCormick & Baxter Creosoting Company Draft. Prepared for Oregon Department of Environmental Quality. PTI Environmental Services, Lake Oswego, OR. October 1994.

4.0 FEASIBILITY STUDY (FS)

4.1 PTI. September 1992. McCormick & Baxter Feasibility Study Report. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Lake Oswego, OR.

4.2 McCormick & Baxter Creosoting Company Revised Feasibility Study. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Lake Oswego, OR. September 1995.

4.3 McCormick & Baxter Creosoting - Review of Treatability Study Data for Wood-Treating Sites. Prepared for Oregon Department of Environmental Quality, Portland, OR. PTI Environmental Services, Bellevue, WA. August 1992

4.4 Solid-Phase Bioremediation of Creosote- and PCP-contaminated soils: pilot test results. Prepared for McCormick & Baxter Creosoting Company, Portland, OR. CH2M Hill, Portland, OR. 1990.

4.5 Supplemental Technical Note: Laboratory Study PCP Degradation in an Oregon Soil. Prepared by Grace Dearborn for U.S. Environmental Protection Agency dated May 1995.

4.6 Memorandum to the McCormick & Baxter Project file from Bruce Gilles, Project Manager dated May 22, 1995. Provides written comments on the draft Revised FS Report dated April 1995.

4.7 Memorandum to McCormick & Baxter Project File dated October 18, 1995 concerning interpretations of applicable or relevant and appropriate RCRA regulations for the McCormick & Baxter Site.

4.8 Memorandum to McCormick & Baxter Project File, dated March 14, 1996, by Bruce Gilles, Project Manager, Oregon DEQ. Errata and Addenda for Revised Feasibility Study, Appendix C - Alternate Concentration Limits Development.

4.9 Memorandum to McCormick & Baxter Project File, dated March 11, 1996, by Bruce Gilles, Project Manager, Oregon DEQ - Rationale for Revision of Remedial Action Level for Treatment for PAHs.

4.10 Memorandum from Bruce Gilles, DEQ Project Manager, to Jim Sheetz, DEQ Northwest Region Water Quality dated March 8, 1996. Final NPDES Discharge Limits for Treated Groundwater Discharge to Willamette River.

4.11 Memorandum from Yu-Ting Liu, EPA Remedial Project Manager, to McCormick & Baxter Project File concerning EPA's assessment of DEQ's March 11, 1996 memorandum on PAH action level revisions.

5.0 RECORD OF DECISION (ROD)

5.1 McCormick & Baxter Cleanup Plan dated December 1992 prepared by Oregon Department of Environmental Quality.

5.2 The Proposed Cleanup Plan for the McCormick and Baxter Creosoting Site prepared by the Oregon Department of Environmental Quality and U.S. Environmental Protection Agency. October 30, 1995.

5.3 Record of Decision, McCormick & Baxter Creosoting Company Portland Plant dated March 1996

6.0 STATE COORDINATION

6.1 Letter from Mary Wahl, Oregon DEQ to Carol Rushin, EPA Region X dated March 4, 1994 requesting State Lead for the McCormick & Baxter Site.

6.2 Letter from Carol Rushin, EPA Region X, to Mary Wahl, Oregon DEQ, dated May 11, 1994 prepared in response to DEQ request for State Lead for remedial design and remedial action for the McCormick & Baxter Site.

6.3 Letter from Mary Wahl, Oregon DEQ, to Carol Rushin, EPA Region X, in response to EPA's May 11, 1994 letter.

6.4 Memorandum from Allison Hilter, EPA Remedial Project Manager, to Bruce Gilles, DEQ Project Manager dated November 2, 1994 transmitting comments on the 1992 RI/FS and necessary documentation to support a final remedy decision by EPA.

6.5 Superfund State Contract between U.S. Environmental Protection Agency and Oregon Deparment of Environmental Quality dated March 30 1995. Contract provides funding from EPA for removal action for continued creosote extraction activities being performed by DEQ.

6.6 Cooperative Agreement between Oregon Department of Environmental Quality and U.S. Environmental Protection Agency for funding of interim remedial actions (IRA), March 1995.

6.7 Memorandum from Scott Huling, U.S. EPA Robert S. Kerr Environmental Research Laboratory, to Allison Hiltner, EPA Remedial Project Manager, dated April 11, 1995. Memorandum of comment on Technical Memorandum on Groundwater Remediation, for the McCormick & Baxter Creosoting Site.

6.8 Memorandum from Allison Hilter, EPA Remedial Project Manager, to Bruce Gilles, DEQ Project Manager, dated May 8, 1995. Provides EPA comments on the draft Revised FS, dated April 1995.

6.9 IRA Credit Application from Oregon DEQ to U.S. EPA for remedial action costs incurred by DEQ prior to placement of the McCormick & Baxter Creosoting Company site on the NPL, dated September 29, 1995.

6.10 Cooperative Agreement Amendment for IRA activities between Oregon DEQ and U.S. EPA, dated February 29, 1996.

7.0 ENFORCEMENT

7.1 Stipulation and Final Order No. HW/WQ-NWR-97-64 between McCormick & Baxter Creosoting Company and the Oregon Department of Environmental Quality, dated November 24, 1987.

7.2 CERCLA Section 104(e) letter from Michael Gearheard, U.S. EPA Region 10 to Rhone Poulenc Inc., dated January 11, 1996

7.3 CERCLA Section 104(e) letter from Michael Gearheard, U.S. EPA Region 10 to Burlington Northern Railway Company, dated January 11, 1996

8.0 HEALTH ASSESSMENTS

8.1 Public Health Assessment, McCormick & Baxter Creosoting Company, Portland, Multnomah County, Oregon. CERCLIS No. ORD009020603. U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. June 13, 1995.

8.2 Toxicological Profile for Pentachlorophenol. Agency for Toxic Substances and Disease Registry. Document No. ATSDR/TP-93/13.

8.3 Toxicological Profile for Creosote, Draft Report. Agency for Toxic Substances and Disease Registry. February 1995.

8.4 Toxicological Profile for 2,3,7,8-tetrachlorodibenzodioxin (TCDD), Agency for Toxic Substances and Disease Registry. Document No. ATSDR/TP-88/23.

8.2 Toxicological Profile for Arsenic. Agency for Toxic Substances and Disease Registry. Document No. ATSDR/TP-92/02.

9.0 NATURAL RESOURCE TRUSTEES

9.1 Letter from Bruce Gilles, Oregon DEQ to Russell Peterson, U.S. Fish and Wildlife Service requesting endangered species consultation for the McCormick & Baxter Creosoting Site, Portland. November 18, 1994.

9.2 Letter from Russell Peterson, U.S. Fish and Wildlife Service to Bruce Gilles, Oregon DEQ, dated January 30, 1995 providing list of endangered or threatened species that may occur within the area of the McCormick & Baxter Creosoting Site.

9.3 Notification of Natural Resource Trustees Letter from Deborah Yamamoto, EPA Remedial Project Manager, to Mr. Chris Beaverson, NOAA Coastal Resource Coordinator, dated October 30, 1995 requesting comment on DEQ and EPA Proposed Cleanup Plan for the McCormick & Baxter Creosoting Co. Superfund Site.

9.4 Notification of Potential Natural Resource Damages Letter from Deborah Yamamoto, EPA Remedial Project Manager, to Mr. Donald Samson, Chairman, Board of Trustees, Confederated Tribes of the Umatilla Indian Reservation, dated October 30, 1995 requesting comment on DEQ and EPA Proposed Cleanup Plan for the McCormick & Baxter Creosoting Co. Superfund Site.

9.5 Notification of Potential Natural Resource Damages Letter from Deborah Yamamoto, EPA Remedial Project Manager, to Mr. Donald Samson, Chairman, Board of Trustees, Confederated Tribes of the Umatilla Indian Reservation, dated October 30, 1995 requesting comment on DEQ and EPA Proposed Cleanup Plan for the McCormick & Baxter Creosoting Co. Superfund Site.

9.6 Notification of Potential Natural Resource Damages Letter from Deborah Yamamoto, EPA Remedial Project Manager, to Mr. Samuel N. Penney, Chairman, Nez Perce Tribe of Idaho, dated October 30, 1995 requesting comment on DEQ and EPA Proposed Cleanup Plan for the McCormick & Baxter Creosoting Co. Superfund Site.

9.7 Notification of Potential Natural Resource Damages Letter from Deborah Yamamoto, EPA Remedial Project Manager, to Bruce Brunoe, Chairman, Confederated Tribes of Warm Springs, dated October 30, 1995 requesting comment on DEQ and EPA Proposed Cleanup Plan for the McCormick & Baxter Creosoting Co. Superfund Site.

9.8 Notification of Potential Natural Resource Damages Letter from Deborah Yamamoto, EPA Remedial Project Manager, to Jerry Meninick, Chairman, Yakima Tribal Council, dated October 30, 1995 requesting comment on DEQ and EPA Proposed Cleanup Plan for the McCormick & Baxter Creosoting Co. Superfund Site.

9.9 Notification of Natural Resource Trustees Letter from Deborah Yamamoto, EPA Remedial Project Manager, to Mr. Charles Polityka, U.S. Department of Interior, dated October 30, 1995 requesting comment on DEQ and EPA Proposed Cleanup Plan for the McCormick & Baxter Creosoting Co. Superfund Site.

9.10 Preliminary Natural Resources Survey for the McCormick & Baxter Creosoting Company Superfund Site dated September 1995. Prepared by National Oceanic and Atmospheric Administration for U.S. Environmental Protection Agency.

10.0 PUBLIC PARTICIPATION

10.1 DEQ Proposed plan for the McCormick and Baxter Creosoting Company Site. Oregon Department of Environmental Quality, Portland, OR. December 1992.

10.2 News Release dated December 30, 1992 and February 4, 1993 issued by Oregon DEQ; Public notices dated December 30, 1992 to Secretary of State's Bulletin and Oregonian. Followup advertisements/articles published in local newspapers:

- *St. Johns Review*. Thursday, December 31, 1992.
- *Daily Journal of Commerce*. January 5, 1993.
- *Oregon Insider*. January 15, 1993.

10.3 DEQ Project Public Relations files containing Fact Sheets mailed to project mailing list between November 1990 to July 1995, newspaper articles and information meetings concerning the McCormick & Baxter Creosoting Site investigations and interim cleanup activities conducted by DEQ.

10.4 Letter of Comment on Proposed Cleanup Plan from Julie Winslow to Paul Burnet, Oregon DEQ, dated February 2, 1993.

10.5 Letter of Comment on Proposed Cleanup Plan from John E. Lilly, Oregon Division of State Lands, to Paul Burnet, Oregon DEQ dated February 3, 1993.

10.6 Letter of Comment on Proposed Cleanup Plan from Dave King, Cathedral Park Neighborhood Association to Paul Burnet, Oregon DEQ, received February 16, 1993.

10.7 Memoranda to McCormick & Baxter project file from Paul Burnet, Oregon DEQ summarizing the January 26, 1993 and February 2, 1993 public comment meeting on proposed plan.

10.8 Letter of Comment on Proposed Cleanup Plan from Lee Poe, Chair of Portsmouth Neighborhood Association and Odor Abatement Committee to Paul Burnet, Oregon DEQ, dated March 5, 1993.

10.9 Memorandum of Comment on Proposed Cleanup Plan from Pam Arden, Kenton Neighborhood Association, to Paul Burnet, Oregon DEQ, dated March 8, 1993.

10.10 Response to Comment on the Proposed Cleanup Plan letters from Paul Burnet to Pam Arden, Julie Winslow, Dave King, and Lee Poe dated March 13, 1993.

10.11 Community Relations Plan for the McCormick & Baxter Creosoting Site prepared by the Oregon Department of Environmental Quality, dated January 23, 1995.

10.12 Advertizements Anouncing Avialability of Proposed Cleanup Plan for Public Comment in the Oregonian and St Johns Review Newspapers, November 6, 1995.

10.13 Letter from Dave Soloos, President of WAKE-UP, dated November 14, 1995, to Bruce Gilles, DEQ Project Manager requesting a 60 day extension of the public comment period for the proposed cleanup plan.

10.14 Letter from Bruce Gilles, Oregon DEQ, to Dave Soloos, President of WAKE-UP, dated November 22, 1995 notifying WAKE-UP of DEQ and EPA's decision to grant a 35 day extension of the public comment period to Friday, January 15, 1996.

10.15 Transcript and written comments from the public hearing held on November 28, 1995 at St Johns Community Center.

10.16 Letter of comment on the 1995 Proposed Cleanup Plan from Richard Robinson, Agency for Toxic Substances and Disease Registry, dated December 5, 1995.

10.16 Letter of comment on the 1995 Proposed Cleanup Plan from Mike Burton, Executive Officer for METRO, dated December 8, 1995.

10.16 Letter of comment on the 1995 Proposed Cleanup Plan from Bowen Blair, Vice President of The Trust for Public Land, dated December 29, 1995.

10.17 Letter of comment on the 1995 Proposed Cleanup Plan from Connie Lively, Project Coordinator for Portland Development Commission, dated January 3, 1996.

10.18 Review Report on McCormick & Baxter Creosoting Site - Proposed Cleanup Plan and Feasibility Study, Prepared for Willamette Associates for Kindness to the Environment in University Part (WAKE-UP) by SJO Consulting Engineers, dated January 16, 1996.

10.19 Letter of comment on the 1995 Proposed Cleanup Plan from Stephen Miller, Architect for Turtle Cove Community Trust, dated January 16, 1996.

10.20 Letter from James E. Benedict; Cable Huston Benedict & Haagensen, to Bruce Gilles, DEQ, dated January 16, 1996.

10.21 Letter from Bill Barnes to Bruce Gilles, dated December 8, 1995.

10.22 Letter of comment on the 1995 Proposed Cleanup Plan from Russell D. Peterson, State Supervisor, U.S. Department of Interior Fish & Wildlife Service dated January 19, 1996.

11.0 LAWS AND REGULATIONS

11.1 The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986.

11.2 The National Contingency Plan, 40 CFR Part 300.

11.3 Oregon Hazardous Substance Remedial Action Rules OAR Chapter 340, Division 122.

11.4 Oregon Hazardous Waste Management Act/RCRA. (ORS 466.005 et seq. and implementing regulations codified in OAR 340-100-001 et seq. .

11.5 Corrective Action Management Units and Temporary Units; Final Rule. Federal Register, Volume 58, No. 29, Tuesday, February 16, 1993.

11.6 Federal Register, Volume 59, No. 103, Tuesday, May 31, 1994 Listing McCormick & Baxter Creosoting Site on the National Priorities List.

11.7 Federal Register, Volume 58, No. 182, Wednesday, September 22, 1993. Amendments to NCP; Procedures for Planning and Implementing Off-Site Response Actions.

12.0 TECHNICAL SOURCES AND GUIDANCE DOCUMENTS

12.1 Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, OERR, EPA/540/G-89/004, OSWER Directive 9355.3-01, October 1988.

12.2 Risk Assessment Guidance for Superfund, Volume I, Human Health and Evaluation Manual (Part A), EPA/540/1-89/002, December 1989.

12.3 Human Health Evaluation Manual, Part B: Development of Risk Based Preliminary Remediation Goals, OSWER Directive No. 9285.7-01B, December 1991.

12.4 Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual, EPA/540/1-89/001, March 1989.

12.5 Final Guidance on Administrative Records for Selecting CERCLA Response Actions, OSWER Directive No. 9833.3A-1.

12.6 CERCLA Compliance With Other Laws Manual, Part 1, EPA/540/G-89/006, August 1988.

12.7 CERCLA Compliance With Other Laws Manual, Part 2, Clean Air Act and Other Environmental Statutes and State Requirements, EPA/540/G-89/009, August 1989.

12.8 Guidance on Remedial Actions for Contaminated Ground Water, OSWER Directive 9283.1-2FS, April 1989.

12.9 On-Site Treatment of Creosote and Pentachlorophenol Sludges and Contaminated Soil, EPA/600/2-91/019, May 1991.

12.10 Contaminants and Remedial Options at Wood Preserving Sites, EPA/600/R-92/182. Prepared by Foster Wheeler Enviresponse, Inc., Edison, NJ. Prepared for U.S. Environmental Protection Agency, Office of Research and Development, Risk Reduction Engineering Laboratory, Washington, DC., October 1992.

12.11 Presumptive Remedies for Soils, Sediments, and Sludges at Wood Treating Sites. U.S. Environmental Protection Agency. Draft Publication, November 1994.

12.12 Technology Selection Guide for Wood Treater Sites. Memorandum from Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, DC., EPA/540/-F-93-020, May 1993.

12.13 Guidance for Evaluating the Technical Impracticability of Ground Water Restoration. U.S. Environmental Protection Agency. Directive 9234.2-25, September 1993,

12.14 DNAPL Site Evaluation. Prepared by Robert M. Cohen and James W. Mercer of Geotrans, Inc. for the U.S. Environmental Protection Agency. EPA/600/R-93/022. February 1993.

12.15 Land Use in the CERCLA Remedy Selection Process. U.S. Environmental Protection Agency. OSWER Directive No. 9355.7-04. May 1995.

12.16 Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual, Part C, Risk Evaluation of Remedial Alternatives. OSWER Directive 9285.7-01C.

12.17 DNAPL Site Characterization, EPA/540/f-94/049. OSWER Publication 9355.4-16FS. September 1994.

Notes:

Documents in the Administrative Record are available for public review at the designated locations:

St Johns Community Library, 7510 N. Charleston, Portland
Oregon Department of Environmental Quality, 811 S.W. 6th Avenue, Portland (10th floor)

Most documents contained in the administrative record are also available for review at:
North Portland Neighborhood Office, 2410 N. Lombard, Portland.