Feasibility Study
Former Koppers Wood-Treating Site
Wauna, Oregon

Prepared for
Beazer East, Inc.
and
Georgia Pacific LLC

October 2008

BRIDGEWATER GROUP, INC.
IN ASSOCIATION WITH AMEC GEOMATRIX, INC.

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The identification and evaluation of potential remedial alternatives in this feasibility study report were prepared and reviewed by the undersigned.

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1.0 INTRODUCTION

1.1 Project Purpose

In 2000, Beazer East, Inc. (Beazer) and Fort James Corporation (now Georgia Pacific LLC [GP]) entered into Voluntary Agreement for Remedial Investigation DEQ No. WMCVC-NWR-00-20 (Agreement) for the former Koppers Wood-Treating site (Site). The Agreement required Beazer and GP to complete a remedial investigation (RI), including human health and ecological risk assessments. RI activities were completed in 2003. The human health risk assessment (HHRA) was completed in December 2007 and the ecological risk assessment (ERA) was completed in August 2007. Both assessments concluded that constituents were present at concentrations that may pose potential unacceptable risks. Based on these findings, the Oregon Department of Environmental Quality (DEQ) requested that Beazer and GP complete a feasibility study (FS) to identify, develop and evaluate potential remedial alternatives.

Beazer and GP retained Bridgewater Group, Inc. and AMEC Geomatrix, Inc. to prepare the FS. Prior to initiating the FS, Bridgewater Group submitted an FS work plan to DEQ.[1] DEQ provided comments on the FS work plan.[2] Bridgewater Group submitted responses to DEQ.[3] The FS was prepared in accordance with the work plan and subsequent comment responses. The draft FS was submitted to DEQ in June 2008. DEQ issued comments on the draft FS on August 20, 2008.[4] The draft FS was revised in response to DEQ's comments.

1.2 Background Information

1.2.1 Site Setting and Description

The Site is located in Wauna, Clatsop County, Oregon approximately 70 miles northwest of Portland, Oregon. It is located in the NW¼ of the SW¼ of Section 22, Township 8N, Range 6W on the United States Geological Survey (USGS) Cathlamet Quadrangle map (Figure 1). The Site is

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[1] Technical memorandum from S. Brown/Bridgewater Group to T. Gainer/DEQ regarding Former Koppers Wood-Treating Site, Wauna, Oregon – Feasibility Study Work Plan, January 3, 2008.

[2] Letter T. Gainer/DEQ to S. Brown/Bridgewater Group regarding Feasibility Study Work Plan, January 24, 2008.

[3] Letter from S. Brown/Bridgewater Group to T. Gainer/DEQ regarding Feasibility Study Work Plan, May 15, 2008.

[4] Letter from T. Gainer/DEQ to S. Brown/Bridgewater Group regarding the June 2008 Draft Feasibility Study (FS) for the Former Koppers Wood Treating Site, August 20, 2008.

approximately 25 acres in size and occupies the western portion of the GP Wauna pulp and paper mill facility. The Columbia River borders the Site to the north. It is bordered to the south by the Portland Western Railway and Crawford Creek Slough, to the west by Crawford Creek Slough, and to the east by the Wauna pulp and paper mill (Figure 2).

The Site generally consists of the area within the lease boundary and an area to the north where groundwater containing constituents associated with former wood treating operations used to discharge from seeps along the Columbia River; the seeps were eliminated through the installation of an interim remedial measure (IRM) consisting of a subsurface barrier wall and aeration treatment trench in 2004 and 2005 (Figure 2).

Wood preserving operations were conducted by Koppers Wood treating who leased the Site between 1936 and 1966. Primary features of the former wood treating operation included retorts, storage tanks, an unloading shed, treated wood storage area, incisor building and loading shed located in the eastern portion of the Site; a wigwam burner located near the western portion of the Site; and a creosote storage tank located south of Crawford Creek Slough. Additional description of site history and historical facility operations is provided in the 2002 RI report (CH2M Hill, 2002).

In 1988, an asphalt cap was installed over the former process area (including where the treated wood storage area and unloading shed were located) under an agreement between DEQ and Crown Zellerbach to reduce the potential for exposure to constituents in soil. The remedial action also included a deed restriction, recorded in county records, to prevent the removal or penetration of the asphalt cap or alteration of surface drainage on the restricted area. Construction of borings or pilings through the cap is not allowed. The deed restriction was put into place in 1989.

Since 1966, the Site has been used for equipment storage for the mill. As is illustrated in Figure 2, the eastern portion of the Site is mostly paved except for a small area northeast of the deed restricted area. The remainder of the Site is unpaved.

1.2.2 Site Geology

The RI determined that the Site is underlain by 3 to 10 feet of well-graded to poorly-graded sand with lenses of gravel and wood-debris. The wood debris is discontinuous and occurs primarily towards the base of the unit. Underlying the sandy unit is a continuous silt layer ranging from greater than 3 feet to 14 feet thick. Underlying the silt layer, there are several thin, alternating layers of clayey silt, silty clay, and sandy silt extending downward to 30 feet below ground surface (bgs), the maximum depth of exploration during the RI.

1.2.3 Site Hydrogeology

Groundwater occurs in two water-bearing zones beneath the Site. The upper zone is referred to as the perched water-bearing zone; the silt layer bounds the bottom of this zone. It is primarily recharged by rainfall infiltration in unpaved areas and low-lying areas where runoff accumulates. During periods of high river stage, the Columbia River can recharge the perched water-bearing zone along the riverbank.

Beneath the silt layer is the shallow water-bearing zone which extends to the maximum depth drilled (30 feet bgs).

Figures 3, 4 and 5 illustrate water levels and potentiometric contours for the perched water-bearing zone based on water level measurements made in April 2001, October 2001, and February 2002. These figures illustrate that prior to the installation of the IRM the direction of groundwater flow was to the north and northwest toward the Columbia River.

The direction of groundwater flow in the shallow water-bearing zone is also towards the Columbia River based on water level measurements made in February 2002 (see Figure 6).

1.2.4 Site Hydrology

The Columbia River borders the north side of the Site. Water levels in the Columbia River fluctuate seasonally in responses to upstream releases from dams and daily in response to diurnal tidal fluctuations. Based on the sediment investigation conducted as part of the RI, the riverbank descends steeply from the uplands at an elevation of +10 feet National Geodetic Vertical Datum (NGVD) to the Columbia River channel at -40 to -50 feet NGVD (Anchor Environmental, 2004). The upper portion of the riverbank is protected by riprap to a depth of -10 to -20 feet NGVD. The riverbank and river bed are affected by strong currents as evidenced by large sand waves and coarse sediment texture (i.e., sand and gravel).

A drainage ditch borders the Site to the south. At the end of the drainage ditch is a small dam that separates the ditch from Crawford Creek Slough which borders the Site to the south and west. The dam consists of compacted soil and gravel, and is approximately 4 feet thick. Crawford Creek flows into the southwest side of the Slough west of the deed restricted area. Water level elevations within the Slough vary in response to seasonal and diurnal tidal fluctuations in Columbia River water levels. When the Columbia River is high, river water flows back into the Slough. The ditch is not affected by tides, as the dam separates the ditch and prevents hydraulic interactions with the Slough under all conditions other than extremely high river stages.

The drainage ditch and dam were constructed sometime before Crown Zellerbach purchased the property in the early 1960s to help drain the property.

After the mill was constructed, the ditch became part of the mill storm water drainage system. Historically, storm water generated around the perimeter of the wastewater treatment plant and heavy equipment traffic areas in the southwest portion of the mill was conveyed to an oil/water separator that discharged to the drainage ditch. GP manually controlled the water elevation behind the dam to ensure that the oil/water separator had sufficient freeboard to operate properly. Water in the ditch flowed over the dam into Crawford Creek Slough. The dam was identified as a compliance point and outfall in the mill's storm water pollution control plan.

The dam was repaired in April 2002. GP placed additional soil and rock on the dam to repair a breach and to replace the "notch" that controlled the water elevation behind the dam.

In 2006, the mill constructed a new paper machine within the storm water basin drained by the ditch. To ensure proper control over storm water from the new paper machine area, the mill decided to route storm water from this basin to its central wastewater treatment system. This was accomplished by installing a pump station to pump storm water to Frasier Lake for temporary storage prior to treatment. The pumping reversed the flow in the ditch. This change eliminated the discharge of mill runoff from the ditch to Crawford Creek Slough. During the fall of 2006, storm events caused the water level in Crawford Creek Slough to rise enough to overtop the dam and flow into the ditch. The additional flow increased the amount of water that was pumped to Frasier Lake and put an unnecessary load on the entire storm water system. To prevent recurrence of such loads, the mill raised the level of the dam less than one foot in November 2006.

The RI determined that the degree of hydraulic connection between the perched water-bearing zone and the Slough is minimal. The lack of connection is likely due to the presence of silt underlying the Slough and/or compaction along the railroad line that runs along the north side of the Slough causing a relatively low-permeability zone adjacent to the Slough.

1.2.5 Remedial Investigation

Since 2002, Beazer and GP have completed a series of studies to define the nature and extent of contamination in the upland and in-water portions of the Site as documented in the following reports:

- Remedial Investigation Report (CH2M Hill, 2002)
- Supplemental Remedial Investigation Report (CH2M Hill, 2003)
- Columbia River Phase I Sediment Investigation (Anchor Environmental, 2004)
- Phase 2 Sediment Investigation Report (Anchor Environmental, 2005)

The RI was performed in three phases: 1) upland soil, groundwater, Crawford Creek Slough sediment, riverbank soil and seep, and Columbia River surface water sampling; 2) supplemental soil, Slough sediment, and groundwater sampling; and 3) Columbia River sediment sampling. In addition, surface water samples were collected from the Slough. Finally, the RI included completion of the HHRA and ERA.

1.2.5.1 Remedial Investigation

The upland RI was initiated in March 2001 to supplement data and information collected as part of the following pre-RI investigations:

- EPA 1984 Preliminary Inspection
- EPA 1986 Soil and Sediment Sampling
- 1988 Crown Zellerbach Sampling and Corrective Action
- DEQ 1993 Evaluation
- 1988 Parametrix Phase II Investigation
- DEQ 1999 Strategy Recommendation

The RI included the following investigation activities:

- Test pit investigation of geophysical anomalies identified by Parametrix in 1998
- Surface soil sampling around the former process area
- Sediment sampling in the Slough adjacent to the former process area
- Monitoring well installation

The RI results were documented in a 2002 RI report that was submitted to DEQ (CH2M Hill, 2002).

1.2.5.1.1 Soil Sampling

A total of 17 surface (i.e., 0 to 0.5 feet bgs) soil samples were collected at locations SS-01 through SS-12 and SB-06 through SB-10. The surface soil samples were analyzed for semivolatile organic compounds (SVOCs) and total metals; selected samples were analyzed for dioxins and volatile organic compounds (VOCs). Figure 7 illustrates the locations where surface soil samples were collected during the RI, as well as where the pre-RI surface soil samples were collected at locations EPA-D1 through EPA–D4 and EPA-DC1. Table 1 presents the concentrations of constituents detected in the surface soil samples collected as part of the RI, as well as samples collected prior to the RI.

Subsurface soil samples were collected at six locations SB-05 through SB-10 at depths of 2 to 4 feet below bgs. The subsurface soil samples were analyzed for SVOCs and total metals; selected samples were analyzed for dioxins and VOCs. Figure 8 illustrates the locations were subsurface soil samples were collected as part of the RI, as well as where pre-RI subsurface soil samples were collected at locations B-02 through B-29. Tables 2, 3 and 4 present the concentrations of constituents detected unsaturated subsurface soil samples collected at a depth of 2.5 feet bgs, unsaturated subsurface soil samples collected at depths of 5 and 7 feet bgs, and saturated subsurface soil samples collected at depths of 7.5 to 12.5 feet bgs, respectively.

The RI report identified two source zones, one where some free and residual creosote or creosote stained soil was observed over most of the former process area extending to the east to PMW-05 (Figure 9); this is the PMW-05 source zone referred to in DEQ's January 24, 2008 comment letter on the FS work plan. Free creosote has historically been observed only in PMW-05. Between PMW-05 and PMW-10, a "finger" of residual creosote or creosote stained soil was observed. A second source zone was identified between PMW-13 and PMW-08 abandoned monitoring well PMW-08. Free creosote was observed in this area. This second source zone is likely the result of creosote migration along a "finger" that extended to the northwest from the former process area. The RI indicates that the residual creosote and creosote stained soils were generally encountered above the confining silt layer. The free and residual creosote observed in these two areas appears to be present as a dense nonaqueous phase liquid (DNAPL).

1.2.5.1.2 Groundwater Sampling

Groundwater samples were collected in May and October of 2001 from the nine perched water-bearing zone wells (PMW-01, PMW-02, and PMW-04 through PMW-010) and one shallow water-bearing zone well (SMW-01). Two perched water-bearing zone (PMW-11 and PMW-12) and two shallow water-bearing zone wells (SMW-02 and SMW-03) were installed in December 2001. All 14 of the wells were sampled in January 2002. Figure 9 shows the locations of each monitoring well.

In addition, geoprobe borings were installed along the Columbia River and in other portions of the Site in November 2001 (Figure 10). Groundwater grab samples were collected from selected borings; all of the borings were logged and visually inspected for the presence of residual DNAPL.

The groundwater samples were analyzed for SVOCs, metals, petroleum hydrocarbons, and VOCs; one sample was analyzed for dioxins. Tables 5 and 6 summarize constituent concentrations detected in the groundwater samples collected from the perched and shallow water-bearing zone monitoring wells, respectively. Table 7 summarizes constituent concentrations detected in water samples collected from the geoprobe borings.

1.2.5.1.3 DNAPL Sampling

A sample of DNAPL was collected from well PMW-05. The DNAPL sample was analyzed for SVOCs, VOCs, petroleum hydrocarbons, and total metals. The DNAPL sample contained polynuclear aromatic hydrocarbons (PAHs), 2-methylnaphthalene, 3,3'-dichlorobenzidine, zinc, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, m,p-xylene, and diesel- and gasoline-range petroleum hydrocarbons.

1.2.5.1.4 Seep and Riverbank Sampling

Seep water samples were collected in April and October 2001 at one location (SW-01) where water from the perched water-bearing zone was seeping from the riverbank (Figure 11). In December 2001 a seep survey was performed along the riverbank between the mill dock and the mouth of Crawford Creek Slough. Twenty-five riverbank seeps were identified;

samples were collected from 13 seeps and a background seep located the mouth of the Slough. Figure 11 shows the locations where seep samples were collected. Seep samples were analyzed for SVOCs, total and dissolved metals, petroleum hydrocarbons, and VOCs. Table 8 summarizes constituent concentrations detected in the seep samples.

During the seep sampling conducted in December 2001, riverbank soil samples were collected adjacent to the 14 seep samples. Riverbank soil samples were analyzed for SVOCs, total metals, petroleum hydrocarbons, and VOCs. Table 9 summarizes constituent concentrations detected in the riverbank samples.

1.2.5.1.5 Columbia River Water Sampling

During the seep sampling conducted in December 2001, Columbia River water samples were collected adjacent to each of the 14 seep samples. The Columbia River water samples were analyzed for SVOCs and total metals; selected samples were analyzed for dioxins and VOCs. Table 10 summarizes constituent concentrations detected in the Columbia River water samples.

1.2.5.1.6 Crawford Creek Slough Sediment Sampling

Finally, the RI included the collection of six sediment samples in Crawford Creek Slough at locations SD-01 through SD-06. The samples were surface samples (i.e., 0 to 0.5 feet bgs). The sediment samples were analyzed for SVOCs, total metals, and dioxins. Figure 12 shows the locations where the six sediment samples were collected as part of the RI, as well as those collected prior to the RI at locations EPA-S1 through EPA–S3 and S-1 through S-3). Table 11 summarizes constituent concentrations detected in the Crawford Creek Slough sediment samples.

1.2.5.2 Supplemental Remedial Investigation

In July 2003, a series of supplemental RI activities were completed to address RI data gaps identified by DEQ. These activities included:

- Installation of temporary piezometers in the silt in Crawford Creek Slough to better define the hydraulic relationship between the Slough and the perched water-bearing zone.
- Additional surface soil sampling near the former wigwam burner to define the extent of arsenic and zinc concentrations. Samples were collected at four locations (SS-13 through SS-16) as illustrated on Figure 7. Table 1 summarizes constituent concentrations detected in these surface soil samples.
- Additional sampling of sediments in the lower Slough at four locations (SD-07 through SD-10) as illustrated in Figure 12. The samples were analyzed for metals, dioxins, hexavalent chromium, and SVOCs. Table 11 summarizes constituent concentrations detected in these sediment samples.
- Collection of an additional round of groundwater and seep samples. The samples were analyzed for SVOCs and VOCs. Tables 5 and 6 summarize constituent concentrations detected in the perched and shallow water-bearing zone groundwater

samples, and Table 8 summarizes the constituents detected in the seep samples.

- Obtaining Columbia River bathymetry data adjacent to the Site.

The supplemental RI results were documented in a 2003 report that was submitted to DEQ (CH2M Hill, 2003).

1.2.5.3 Columbia River Sediment Investigation

The Columbia River sediment investigation was performed in two phases. Phase 1 was conducted in September 2004, and included a geophysical investigation to evaluate site geology, morphology and sedimentary processes in the seep area; and collection of eight surface grab sediment samples to determine sediment physical properties. A conceptual site model for near shore Columbia River sediments was developed based on the Phase 1 investigation results. The Phase 1 investigation results were documented in a November 2, 2004 letter report that was submitted to DEQ (Anchor Environmental, 2004).

Phase 2 of the sediment investigation was completed in April 2005 and consisted of the following activities:

- Collection of six surface (upper 15 centimeters [cm]) sediment samples at locations KWT-SS01 through KWT-SS06 adjacent to the primary seep area (near Seeps 7, 9 and 10, see Figure 11).
- Collection of subsurface sediment samples at three depths (0-2, 2-4 and 4-6 feet below the mudline) at one location (KWT-VC01).

The samples were analyzed for total metals, PAHs, SVOCs, VOCs and petroleum hydrocarbons. Figure 12 shows the sampling locations. Table 12 summarizes the constituent concentrations detected in the Columbia River sediment samples.

The Phase II investigation results were documented in a July 2005 report that was submitted to DEQ (Anchor Environmental, 2005).

1.2.5.4 Crawford Creek Slough Surface Water Sampling

In 2004, DEQ requested that Beazer and GP collect surface water samples just upstream of the Crawford Creek Slough dam. Two samples, DDSW-01 and DDSW-02, were collected on August 26, 2004 (prior to IRM implementation) and on October 18, 2004, respectively (Figure 12). The samples were analyzed for SVOCs, VOCs, petroleum hydrocarbons, metals and dioxins. The analytical results were summarized in a December 27, 2004 letter to DEQ.[5] Table 13 summarizes the constituent concentrations detected in the two water samples.

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[5] Letter from S. Brown/Bridgewater Group to T. Gainer/DEQ regarding surface water sampling results, December 27, 2004.

1.2.5.5 Human Health and Ecological Risk Assessments

Beazer and GP completed an HHRA (AMEC, 2005) and an ERA (Windward Environmental, 2007) for the Site. An addendum to the HHRA that addressed potential human health risks associated with Columbia River sediments and surface water was also completed (AMEC 2007).[6]

These documents and related responses to DEQ comments on these documents, in conjunction with the documents describing remedial investigation and supplemental sampling results, establish baseline conditions, including specific environmental media, areas, and constituents that may pose a potential unacceptable risk:

- **Surface Soils** - The 2005 baseline HHRA concluded that surface soil containing arsenic and one dioxin congener (1,2,3,4,6,7,8-HpCDD) may pose a potential unacceptable risk to current and future outdoor workers due to incidental soil ingestion. As the HHRA report indicates, calculated risks exceeded DEQ's unacceptable risk threshold because maximum concentrations were used as exposure point concentrations for arsenic and 1,2,3,4,6,7,8-HpCDD. Given the baseline risk calculations in the HHRA, potential human health risks could be reduced to acceptable levels by reducing constituent concentrations or eliminating potential exposure to surface soils at three discrete locations:

    - SS-03 northeast of the deed restricted area, next to the paved parking lot where the maximum arsenic concentration of 176 mg/kg was detected.

    - SS-04 also northeast of the deed restricted area, next to the paved parking lot, where the maximum 1,2,3,4,6,7,8-HpCDD concentration of 2.31 x 10^{-2} mg/kg was detected and where the arsenic concentration was 96.1 mg/kg.

    - SB-10 in the former wigwam burner area, where the arsenic concentration was 75 mg/kg.

  Figure 7 illustrates the location of these three surface soil samples.

  The 2007 baseline ERA concluded that dioxins and/or metals (arsenic and chromium) detected in the same three surface soil samples (i.e., SS-03, SS-04 and SB-10) may pose a potential unacceptable risk to ecological receptors.

- **Source Zone Soils and DNAPL** - As described in Section 1.2.5.1.1, the RI report identified two source zones, one that covers most of the former process area extending to the east to PMW-05 and one located to the northwest of the former process area. The first source zone is the PMW-05 source zone referred to in DEQ's January 24, 2008 comment letter on the FS work plan. Free creosote has historically been observed only in PMW-05. This second source zone

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[6] Letter from T. Gainer/DEQ to S. Brown/Bridgewater Group regarding Human Health Risk Assessment Addendum, Former Koppers Wood-Treating Site, Wauna, Oregon, December 11, 2007.

is likely the result of creosote migration along a “finger” that extended to the northwest from the former process area.

The following constituents are present above EPA Region 6 industrial soil screening levels in the former process area source zone:

- At SB-05 soils contain dioxins, arsenic, PAHs, dibenzofuran, and pentachlorophenol at concentrations above industrial soil screening levels at 4 feet bgs.
- At B-2 soils contain arsenic, PAHs and pentachlorophenol at 5 feet bgs.

At B-3, B-20 and B-21 soil may contain arsenic above industrial soil screening levels, although it uncertain due to elevated detection limits in the pre-RI samples.

In the second source zone, arsenic concentrations may exceed the industrial soil screening level for arsenic at 2.5 feet bgs, although it is uncertain due to elevated detection limits in the pre-RI samples.

- **Deed-Restricted Area Soils** - Soil samples collected in the deed restricted area indicate that surface soils contain arsenic, chromium, PAHs and pentachlorophenol above EPA Region 6 industrial soil screening levels at two locations: EPA-D1 and EPA-DC1. Subsurface soils at 2.5 feet bgs contain arsenic, chromium, pentachlorophenol and dioxins above screening levels at two locations: B-5 and B-8; subsurface soils at location B-5 contain arsenic and chromium above their industrial soil screening levels at 5 feet bgs. The potential exists for arsenic to be above its industrial soil screening level at other locations in the deed restricted area, although this is uncertain because of elevated detection limits for some of the pre-RI samples. As was discussed in Section 1.2.1, the potential risks associated with exposure to soil in the deed restricted area were addressed in 1988 through the installation of an asphalt cap and implementation of a deed restriction.

- **Drainage Ditch Sediments** - The baseline ERA concluded that surface sediments containing arsenic, chromium, copper and zinc in the drainage ditch upstream of the Crawford Creek Slough dam may pose a potential unacceptable risk to ecological receptors. Sediment samples containing one or more of these metals at concentrations that may pose a potential unacceptable risk include: SD-01, SD-02, SD-03, SD-04, SD-05, SD-06, S-3 and EPA-S3.

- **Perched Water-Bearing Zone Groundwater** - Sampling of perched water bearing zone groundwater and riverbank seeps conducting during the RI identified the presence of organic and inorganic compounds associated with former wood treating operations. Constituents that could result in significant adverse effects on beneficial uses of water, based on a comparison of sampling results against DEQ Level II surface water SLVs, included ethylbenzene, semivolatile organic compounds, including several PAHs, diesel- and oil-range petroleum hydrocarbons, and metals (arsenic, chromium and copper) (Geomatrix, 2003a). As is discussed in Section 1.2.7, the potential risks associated with seepage of impacted, perched water-bearing zone groundwater to the Columbia River were addressed through an IRM implemented in 2004.

1.2.6 Locality of the Facility

The locality of the facility (LOF) was presented in the supplemental RI report (CH2M Hill, 2003). Subsequent responses to DEQ comments on the supplemental RI report expanded the LOF to include the deed restricted area and the drainage ditch, and indicated that the need to include the Columbia River would be determined after the in-water portion of the RI and the baseline HHRA and ERA were completed.[7] As was stated above, the baseline ERA and HHRA addendum both concluded that surface water and sediments in the Columbia River do not pose a potential unacceptable risk. Thus, they are not part of the LOF.

1.2.7 Groundwater Seeps IRM

In 2004, Beazer and GP implemented an IRM to address seepage of impacted, perched water-bearing zone groundwater water to the Columbia River through the installation of a “funnel and gate” subsurface barrier wall and aeration treatment trench. The subsurface barrier wall and aeration treatment trench were installed in late 2004 and early 2005; final grading and planting of the vegetative cover occurred in late 2005. The IRM was documented in the groundwater seeps IRM revised construction report (Geomatrix, 2006). The most recent monitoring results for the IRM are presented in the 2008 semiannual monitoring report (Geomatrix, 2008). A number of additional monitoring wells were installed as part the IRM, including wells placed on either side of the subsurface barrier wall to monitor its effectiveness and wells placed upgradient, in and downgradient of the aeration treatment trench to monitor the effectiveness of both IRM components. Figure 9 illustrates the locations of the SBW and ATT series wells installed as part of the IRM. Figure 9 also illustrates the RI monitoring wells that were abandoned during IRM construction.

Recent IRM monitoring results indicate that the IRM is performing as designed. Water level monitoring indicates that the subsurface barrier has caused a shift in groundwater flow directions in the perched water-bearing zone. Groundwater now flows to the west toward the aeration treatment trench and then flows to the northwest toward the Columbia River. A small percentage flows around the southeast end of the barrier wall.

Monitoring results have shown that near the former process area source zone constituent concentrations have been relatively constant or decreasing since the IRM was implemented.

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[7] Letter from S. Brown/Bridgewater Group to T. Gainer/DEQ regarding responses to comments on the supplemental RI report, July 2, 2004.

Groundwater quality trends within the subsurface barrier upgradient of the aeration trench indicate that the change in flow directions toward the aeration treatment trench has caused constituents to migrate in that direction. Fluctuations in constituent concentrations in groundwater upgradient of the aeration treatment trench may be the result of seasonal variations in groundwater elevations.

Constituent concentrations in groundwater in the area downgradient from the IRM, between the aeration treatment trench and the Columbia River, have been below SLVs except in October 2007 at monitoring well ATT-02 where ethylbenzene was detected at 13 ug/L, approximately twice its DEQ Level II surface water Screening Level Value (SLV). Given the travel time for groundwater in the vicinity of well ATT-02 to the Columbia River is estimated to be 18 months, it is expected that the ethylbenzene concentration will attenuate below its SLV before groundwater discharges to the river. Subsequent groundwater monitoring conducted in April 2008 found that ethylbenzene in monitoring well ATT-02 was well below the Level II SLV.

Monitoring of groundwater quality downgradient of the southeast end of the subsurface barrier has detected low concentrations of several constituents, all below SLVs except for fluorene which was detected just above its SLV at monitoring well SBW-05 in April 2008.

Finally, monitoring results have shown a substantial decrease in all constituent concentrations from December 2005 levels, where ethylbenzene, dibenzofuran, fluorene and phenanthrene concentrations exceeded their SLVs at monitoring well SBW-09 (near the former primary seep area).

1.3 Report Organization

The remainder of this report is organized as follows:

- Identification and Screening of Technologies
- Development and Screening of Alternatives
- Detailed Analysis of Alternatives
- Recommended Alternative

The following are the included as appendices to this report:

Appendix A – Groundwater Seeps Interim Remedial Measure Alternatives Evaluation

Appendix B – Hydrogeologic Modeling Report

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.1 Areas Posing Potential Unacceptable Risk

DEQ requested that areas posing potential unacceptable risk be identified in the FS work plan. This section discusses areas where surface soils and Slough sediments may pose potential unacceptable risks to human health and/or the environment.

DEQ also requested that the former process area source zone be considered in the FS from the perspective of the potential effectiveness of source zone treatment or removal in relation to the operation period of the groundwater IRM; DEQ refers to this as the PMW-05 source zone.

In addition, DEQ requested that contaminated soil beneath the deed restricted area be evaluated as part of the FS, specifically for purposes of justifying the selection of capping and institutional controls as the final remedy for this area.

Finally, DEQ has expressed concerns about the potential for groundwater to migrate from the former process area source zone around the southeast end of the subsurface barrier wall to the Columbia River. As was discussed in the prior section, groundwater monitoring conducted under the IRM Monitoring and Maintenance Plan (MMP) has shown that constituent concentrations in this area are below Level II SLVs, except for the recent detection of fluorene just above its SLV at SBW-05. Regardless, DEQ has requested that this area be evaluated as part of the FS.

2.1.1 Surface Soils

The estimated lateral extent of surface soils that pose a potential unacceptable risk is illustrated in Figure 13. The lateral extent of surface soils that may pose a potential unacceptable risk around sample locations SS-03 and SS-04 was estimated to be the unpaved area between the capped, deed restricted area and the paved parking lot. The southwest boundary of the area was established based on the limits of the area where soils were graded and revegetated as part of the IRM (see drawing G-3 in the IRM construction report [Geomatrix, 2006]). Given the number and location of surface soil samples collected in this area, there is some uncertainty regarding the actual lateral extent of surface soils that pose a potential unacceptable risk. Further delineation would be conducted to define the extent of this area during the remedial planning phase.

The extent of surface soil that may pose a potential unacceptable risk around sample location SB-10 was estimated by assuming that the boundaries of the area extend halfway to the nearest surface soil sample (e.g., SB-07 to the northeast, SB-09 to the northwest, SS-15 to the southwest, and SS-16 to the southeast) (Figure 13). The baseline HHRA and ERA determined that constituent concentrations in these samples, as well as the other samples collected in the former wigwam burner area, do not pose a potential unacceptable risk.

2.1.2 Source Zone Soils and DNAPL

Figure 5-5 in the RI report identifies locations where residual creosote/creosote stained soil and free creosote were observed. The only well monitoring where DNAPL has been observed is PMW-05. Figure 14 illustrates the lateral extent of the two source zone zones as defined by observations of residual creosote/creosote stained soil and free creosote made during the RI. Note that a “finger” of creosote that was not characterized during the RI may extend from the former process area to the northwest to the source zone located near the river.

2.1.3 Deed Restricted Area Soils

The lateral extent of the deed restricted area is illustrated in Figure 2.

2.1.4 Drainage Ditch Sediments

Based on the ERA results, the extent of surface sediment that may pose a potential unacceptable risk in the drainage ditch was estimated to extend from the upstream end of the ditch downstream to the Crawford Creek Slough dam (Figure 15).

2.1.5 Perched Water-Bearing Zone Groundwater

The area where constituents in the perched water-bearing zone could result in significant adverse effects on the beneficial uses of water in the LOF, as defined by an exceedance of surface water SLVs, was defined as the “affected area” in the groundwater seeps IRM conceptual design report (Geomatrix, 2003b). Prior to the implementation of the IRM, the “affected area” extended from the former process area to the west and north to the second source area near the Columbia River and primary seep area. The extent of the “affected area” was defined as the portion of the perched water-bearing zone where groundwater contained naphthalene at concentrations greater than its SLV of 0.62 mg/L. Other constituents were also present above their SLVs in this area, including ethylbenzene, a number of SVOCs, arsenic, chromium and copper. Figure 16 illustrates the extent of the “affected area” prior to the time the IRM was implemented.

2.2 Hot Spot Identification

A preliminary soil hot spot evaluation was presented in the 2003 supplemental RI report (CH2M Hill, 2003). The following summarizes the final hot spot identification.

Human health hot spot levels for soils were calculated using EPA Region 6 industrial soil screening levels (EPA, 2008) increased by factors of 10 and 100 for noncarcinogenic and carcinogenic compounds, respectively, in accordance with DEQ hot spot guidance (DEQ, 1998a). Calculated human health soil hot spot levels for constituents detected in surface and subsurface soils are listed in Table 14 and used to identify locations where constituent concentrations exceed hot spot levels in Tables 1 through 4. The calculated human health hot spot levels are generally consistent with site-specific human health soil hot spot levels that could have been derived from the HHRA results. For example, for arsenic, one of the compounds that resulted in potential unacceptable risk in surface soils, the reasonable maximum exposure (RME) cancer risk for a future hypothetical outdoor worker, the most conservative receptor considered in the HHRA, was estimated to be 9×10^{-5} based on the maximum arsenic concentration detected in surface soil of 176 mg/kg. Given this estimated cancer risk, the site-specific protective level for arsenic would be 1.96 mg/kg assuming a protective cancer risk level of 1×10^{-6}. Because arsenic is a carcinogen, the site-specific hot spot level would be 100 times this level or 196 mg/kg. This compares with the hot spot level calculated by multiplying the Region 6 human health screening level for an industrial outdoor worker (cancer endpoint) of 1.8 mg/kg by 100 to get a generic hot spot level of 180 mg/kg.

Based on the human health soil hot spot levels calculated using the EPA Region 6 soil screening levels, there are no “highly concentrated” hot spots in surface soils.

Table 14 also lists ecological hot spot levels for arsenic, chromium and dioxins which were identified in the ERA as potentially posing an unacceptable ecological risk for surface soils. Based on these hot spot levels, surface soils at locations SS-03 (arsenic and chromium), SS-04 (arsenic, chromium and dioxins) and SB-10 (chromium) represent “highly concentrated” hot spots. The approximate extent of the surface soil hot spots is illustrated in Figure 13; the estimated lateral extent of each hot spot was determined using the same approach that was used to estimate the extent of surface soils that pose a potential unacceptable risk (see Section 2.1.1).

Were it not for the existing asphalt cap and institutional controls implemented in the deed restricted area, surface soils at the following locations would be considered “highly concentrated” hot spots based on a comparison with the human health spot levels in Table 14:

- EPA-D1 (arsenic and benzo[a]pyrene)
- EPA-DC1 (arsenic)

Given the arsenic and chromium concentrations detected at these locations, they would also be considered “highly concentrated” hot spots based on comparison with the ecological hot spot levels in Table 14. For purposes of hot spot identification, the estimated lateral extent of this surface soil hot spot is assumed to be the entire deed restricted area (Figure 13).

In addition, subsurface soils contain arsenic at B-05 (2.5 and 5 feet bgs) and dioxins at B-8 (2.5 feet bgs) at concentrations exceeding human health soil hot spot levels and, therefore, are considered to be “highly concentrated” hot spots.

In the former process area source zone, “highly concentrated” soil hot spots are present based on the arsenic and PAH concentrations detected at SB-05 (5 feet bgs) and arsenic concentrations detected at B-2 (5 feet bgs).

As will be discussed below, some of the constituents present in these soil hot spots were detected above SLVs in the perched water-bearing zone. Thus, these soil hot spots may also meet DEQ’s definition of “highly mobile” spots. The determination as to whether these soils meet the “not reliably containable” definition will be addressed later in the FS.

“Highly concentrated” hot spots are present in the two source areas where DNAPL is present. Although the DNAPL is mainly present as residual, rather than free phase material, because dissolved phase constituent concentrations in the perched water-bearing zone exceed SLVs, the DNAPL would meet DEQ’s “highly mobile” hot spot definition. The determination as to whether the DNAPL meets the “not reliably containable” definition will be addressed later in the FS.

Based on a comparison of the ecological hot spot levels listed in Table 14 with constituent concentrations detected in Crawford Creek Slough sediments, locations SD-04 (zinc) and SD-05 (zinc) would be considered to be “highly concentrated” hot spots. The HHRA did not identify any constituents in Slough sediments as posing a potential unacceptable risk to human health. Figure 15 shows the approximate extent of the area where Slough sediments exceed ecological hot spot levels.

The RI report defined the current and reasonably likely beneficial use of water in the LOF to be perched water-bearing zone discharge to the Columbia River. Use of the perched water-bearing zone as a current or future drinking water supply was determined to not be a beneficial use. Given this beneficial use determination, the area where contamination in the perched water-bearing zone currently or in the future may result in significant adverse effects on the beneficial use, as defined by an exceedance of surface water SLVs, was defined as the “affected area” in the groundwater seeps IRM conceptual design report (Geomatrix, 2003b). Prior to the implementation of the IRM, the “affected area” extended from the former process area to the west and north to the second source area near the Columbia River and primary seep area. The extent of the “affected area” was defined as the portion of the perched water-bearing zone where groundwater contained naphthalene at concentrations greater than its SLV of 0.62 mg/L. Other constituents were also present above their SLVs in this area, including ethylbenzene, a number of SVOCs, arsenic, chromium and copper. Based on DEQ guidance, the “affected area” represents a groundwater hot spot. As was discussed above, this area has been addressed through the implementation of the IRM which has effectively eliminated significant adverse effects on the beneficial water uses, including in the area between the subsurface barrier wall and the Columbia River. Note also that the extent of the “affected area” has changed because the IRM changed the direction of groundwater flow in the perched water-bearing zone. The determination as to whether treatment can restore or protect beneficial uses within a reasonable time is presented later in the FS.

2.3 Remedial Action Objectives

Table 15 summarizes site-specific remedial action objectives (RAOs). RAOs are presented by media for surface soil, deed-restricted area soil, source zone soil and DNAPL, perched water-bearing zone groundwater, surface water, and sediment.

2.4 General Response Actions

Table 16 summarizes the general response actions identified for the following:

- Surface soils in the unpaved area between the deed restricted area and the asphalt-paved parking lot, and a small area near the former wigwam burner
- Deed restricted area soils
- Source zone soils and DNAPL
- Drainage ditch sediments
- Perched water-bearing zone groundwater

General response actions were identified based on the types of contaminants present in each media using remedy selection tools such as the Federal Remediation Technologies Roundtable (FRTR), Remediation Technologies Screening Matrix and Reference Guide, Version 4.0.[8]

2.4.1 Surface Soils

Surface soils pose a potential unacceptable risk and are considered hot spots in two areas: 1) between the deed restricted area and the asphalt-paved parking lot (arsenic, chromium and dioxins), and 2) near the former wigwam burner (arsenic and chromium). The following general response

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[8] See Table 3-2: Treatment Technologies Screening Matrix, Federal Remediation Technologies Roundtable at http://www.frtr.gov/matrix2/.

actions are applicable to surface soils in these areas: institutional controls, engineering controls, removal, disposal, physical/chemical treatment and biological treatment. Thermal treatment was not considered to be an applicable general response action because it is not effective for soils containing metals.

2.4.2 Source Zone Soils and DNAPL

In its January 24, 2008 comments, DEQ requested that the FS address the former process area source zone. It is important to note that the RI report identified two source zones, one in the former process area extending to the east to PMW-05, and one northwest of PMW-13. As was discussed above, the former process area source zone potentially extends to the west into the deed restricted area; the next section discusses general response actions for the deed restricted area.

In addition, the following constituents are present above EPA Region 6 industrial soil screening levels in the former process area source zone:

- At SB-05 soils contain dioxins, arsenic, PAHs, dibenzofuran, and pentachlorophenol at concentrations above industrial soil screening levels at 4 feet bgs.
- At B-2 soils contain arsenic, PAHs and pentachlorophenol at 5 feet bgs.

At B-3, B-20 and B-21 soil may contain arsenic above industrial soil screening levels, although it uncertain due to elevated detection limits in the pre-RI samples.

Soils at SB-05 contain arsenic and PAH concentrations above their “highly concentrated” hot spot levels at 5 feet bgs. Soils at B-2 contain arsenic above its “highly concentrated” hot spot level at 5 feet bgs.

In the second source zone, arsenic concentrations may exceed industrial soil screening levels for arsenic at 2.5 feet bgs, although it is uncertain due to elevated detection limits in the pre-RI samples.

The following general response actions are applicable to the subsurface soils and DNAPL in the two source zones: institutional controls; engineering controls; removal; disposal; and ex-situ and in-situ physical/chemical, thermal and biological treatment.

2.4.3 Deed Restricted Area Soils

The deed restricted area asphalt cap was constructed to prevent exposure to soils in the former process area. Soil samples collected in the deed restricted area indicate that surface soils contain arsenic, chromium, PAHs and pentachlorophenol above EPA Region 6 industrial soil screening levels at two locations: EPA-D1 and EPA-DC1. Subsurface soils at 2.5 feet bgs contain arsenic, chromium, pentachlorophenol and dioxins above screening levels at two locations: B-5 and B-8; subsurface soils at location B-5 contain arsenic and chromium above their industrial soil screening levels at 5 feet bgs. The potential exists for arsenic to be above its industrial soil screening level at other locations in the deed restricted area, although this is uncertain because of elevated detection limits for some of the pre-RI samples.

As was discussed above, constituent concentrations exceed hot spot levels at four locations: EPA-DC1 (surface), EPA-D1 (surface), B-5 (2.5 and 5 feet bgs), and B-8 (2.5 feet bgs).

The following general response actions are applicable to the surface and subsurface soils in the deed restricted area: institutional controls, engineering controls, removal, disposal, and physical/chemical treatment. Thermal treatment was not considered to be an applicable general response action because it is not effective for soils containing metals. Biological treatment was also not considered to be applicable because it may not be effective for contamination in subsurface soils and would be inconsistent with current and future uses of the area by the mill.

2.4.4 Drainage Ditch Sediments

The following general response actions are applicable to the drainage ditch sediments containing arsenic, chromium, copper and zinc: engineering controls, removal, disposal, and physical/chemical treatment. Thermal treatment and biological treatment are not considered to be applicable general response actions because they not effective for sediments containing metals.

2.4.5 Perched Water-Bearing Zone Groundwater

As was indicated in DEQ’s January 24, 2008 comment letter on the FS work plan, the groundwater seeps IRM was selected based on an alternatives evaluation that included an opportunity for public comment. The following summarizes the remedial alternative identification and evaluation process that was used to select the groundwater seeps IRM.

In 2003, Beazer and GP submitted an alternatives evaluation prepared by Geomatrix (Geomatrix, 2003a; see Appendix A). The evaluation was essentially a focused FS that included the identification and screening of natural attenuation, containment (physical and hydraulic), in-situ treatment, and ex-situ treatment technologies that would meet the following objectives:

- Control seepage of groundwater affected by site constituents to the Columbia River;
- To the extent practicable, ensure compatibility with probable long-term remedial actions;
- To the extent practicable, ensure compatibility with Site use for the mill;
- Minimize operations and maintenance costs; and
- Provide for timely implementation to expedite control of affected groundwater seeps.

The following remedial technologies were carried forward for alternative development after being screened based on their effectiveness, implementability and cost:

- Natural attenuation
- Asphalt cap
- Soil/clay cap
- Soil-bentonite low permeability barrier
- Cut-off trench
- Phytoremediation
- Sparge trench
- Groundwater treatment at the Mill wastewater treatment plant

The technologies were assembled into three potential alternatives:

- **Alternative 1: Low Permeability Containment Barrier** – A low permeability subsurface barrier designed to eliminate the seepage of groundwater from the perched water-bearing zone to the Columbia River in combination with either a groundwater recovery trench or in-situ treatment system to manage groundwater contained within the barrier. Phytoremediation and/or natural attenuation would be used to address the small volume of affected groundwater between the barrier and the Columbia River.
- **Alternative 2: Groundwater Interceptor Trench** – A groundwater interceptor trench designed to capture perched water-bearing zone groundwater; the extracted water would be treated through phase separation to remove any NAPL and then discharged to the mill wastewater treatment plant. Phytoremediation and/or natural attenuation would be used to address the small volume of affected groundwater between the trench and the Columbia River.
- **Alternative 3: Phytoremediation with Groundwater Interception and Irrigation** – Implement phytoremediation over the source areas and a groundwater interceptor trench. Water recovered with the trench would be use to irrigate the trees and other phytoremediation plants or pumped to the mill wastewater treatment system.

Each alternative was evaluated against the following criteria:

- Implementability
- Short-term effectiveness
- Long-term effectiveness
- Reduction of mobility, toxicity and volume
- Cost, including a consideration of capital, annual and present value costs

- Overall protection of human health and the environment

Based on this evaluation, Alternative 1, a subsurface barrier wall with a groundwater recovery trench or in-situ treatment system, with capping and/or phytoremediation was selected. In its September 15, 2003 comment letter on the alternative evaluation report, DEQ agreed with the preferred alternative, subject to further refinement of the components of the IRM in the conceptual design report.

The alternatives evaluation was based on the following conceptual understanding of site conditions:

- Wood-treating chemicals were present in groundwater seeps along the Columbia River; the primary seep area was located where seep samples Seep 7, 9 and 10 were collected (Figure 11).
- The primary sources of the wood-treating chemicals found in the seeps were the two source areas.
- Affected groundwater was limited to groundwater in the perched water-bearing zone that was hydraulically separated from the underlying shallow water-bearing zone by a continuous silt layer.
- Groundwater flow in the perched water-bearing zone was to the north toward the Columbia River; the silt along the Crawford Creek Slough acted as a hydraulic barrier to groundwater flow toward the Slough.
- Water levels in the perched water-bearing zone were largely controlled by rainfall infiltration in unpaved areas or low-lying areas where storm water accumulated.

In January 2003, Beazer and GP submitted a conceptual design report for the groundwater seeps IRM (Geomatrix, 2003b). The conceptual design report concluded that a funnel and gate system was more appropriate for the Site due to reduced operation and maintenance requirements. The report provided the conceptual design for the subsurface barrier and aeration trench.

The final design report for the IRM was completed in April 2004 (Geomatrix, 2004a). DEQ allowed public comment on the proposed IRM through the end of June 2004. The final design report was revised in response to DEQ comments and resubmitted in July 2004 (Geomatrix, 2004b).

The IRM was constructed in late 2004 and early 2005; final construction, consisting of final grading and establishment of a vegetative cover, was completed in September 2005. Normal operation of the IRM commenced in February 2005. Since that time, groundwater elevations inside and outside the barrier wall and water levels in Crawford Creek Slough have been monitored, as has groundwater quality inside and outside the barrier wall in accordance with the DEQ-approved MMP. The monitoring results have indicated that the funnel and gate system has performed as designed and the basic assumptions about site conditions used to identify and evaluate IRM alternatives have not changed based on three years of monitoring. The 2007 Annual Monitoring Report confirms the current effectiveness of the system (Geomatrix, 2007). The report concludes that:

- The IRM barrier wall provides continuous, low-permeability barrier that has effectively maintained a significant hydraulic head difference across the wall.
- The IRM has effectively redirected almost all groundwater flow within the contained area to the west, towards the aeration treatment trench
- The IRM barrier continues to significantly reduce the discharge of groundwater from the area north of the barrier wall, along the Columbia River bank.
- The IRM has maintained acceptable groundwater levels throughout 2007, which included a period of heavy rainfall.
- A very good operating factor has been achieved to date; the operating factor for 2007 was 94%.
- The chemical treatment program implemented in early June 2007 was partially successful in restoring air flow rates; dissolved oxygen levels returned to acceptable levels. However, operating results indicate that the ongoing fouling will require periodic treatment to maintain air flow. A modified procedure implemented in 2008 has proven very effective in maintaining air flow and does not require complete system shutdown.
- Constituent concentrations collected downgradient from the aeration treatment are generally below Level II SLVs, except for ethylbenzene which was detected at well ATT-02 in October 2007 above the SLV; it is expected that ethylbenzene will attenuate to acceptable levels during the approximately 18 months it will take to migrate to the Columbia River. Ethylbenzene had decreased to well below the SLV by April 2008, indicating that the high concentration was not sustained.
- Constituent concentrations in samples collected downgradient of the southeast end of the subsurface barrier wall are below SLVs. Note that recent sampling found that fluorene just exceeded its SLV at SBW-05.
- Groundwater quality in the area between the subsurface barrier wall and the Columbia River bank has improved substantially since IRM installation.

Thus, the selection of the funnel and gate system as a remedy for shallow groundwater appears to be an appropriate selection. The Evaluation of Remedial Action Alternatives Section will provide further evaluation of the projected long-term effectiveness of the subsurface barrier wall and aeration treatment components.

One issue identified by DEQ after IRM implementation was the potential for contaminant migration from the former process area around the southeast end of the subsurface barrier wall. DEQ requested that potential remedial alternatives be considered. As it indicated in Table 16, general response actions applicable to shallow groundwater in this area include engineering controls, physical/chemical treatment and biological treatment.

2.5 Identification and Screening of Technologies and Process Options

Table 17 presents the remedial technology screening results by media.

2.5.1 Surface Soils, Source Zone Soils/DNAPL, and Deed Restricted Area Soils

Potential remedial technologies to address the two localized areas of surface soil contamination containing arsenic, chromium and dioxins include the use of some type of capping technology in combination with drainage and institutional controls, or removal and land disposal. Of the three potential capping technologies, asphalt capping was retained over soil capping and impermeable capping. A soil cap could be less reliable at managing direct exposure risks and would have higher operations and maintenance (O&M) uncertainties than an asphalt cap. A soil cap would also be incompatible with the mill’s current and future uses of the area. An impermeable cap was screened out because the constituents present in surface soil are relatively immobile and, therefore, there is no need to eliminate infiltration.

Two disposal technologies were retained, off-site disposal in either a permitted solid or hazardous waste landfill.

The surface soils in both localized areas are “highly concentrated” hot spots based on the arsenic, chromium and dioxins concentrations detected at SS-03 and SS-04, and chromium concentrations detected at SB-10. As is indicated in Table 17, the only retained in-situ treatment technology that would address metals is solidification/stabilization. While this technology would reduce the mobility of the metals, it would not reduce their concentration or volume. Given the relatively small volume of soil present in both areas, ex-situ treatment would likely be more costly than off-site disposal. For this reason, no treatment-oriented remedial technologies were considered for the two localized surface soil hot spots.

As Table 17 indicates a number of in-situ and ex-situ physical/chemical, thermal and biological treatment technologies were screened strictly for purposes of conducting a focused remedial alternatives evaluation for source zone soils and DNAPL, and deed restricted area soils. The following in-situ physical/chemical treatment technologies were screened out because they may not be effective or are developmental: electrokinetic separation, and soil flushing with co-solvents or surfactants. Thermal treatment technologies like electrical heating and steam injection were screened out because of their relatively high cost when compared to other in-situ treatment technologies. Phytoremediation, a biological treatment technology, was screened out because it may not be effective for subsurface soils and would be incompatible with the mill's current and future uses of the Site. In-situ biological treatment was screened out because it would not address metals in the deed restricted area soils and is a developmental technology that has not been sufficiently tested for source depletion of DNAPL (EPA, 2003). Ex-situ chemical extraction, chemical reduction/oxidation, and dehalogenation were screened out because they may not address organics and/or metals present in soils and because they would be more costly than other treatment technologies. In-situ chemical oxidation and in-situ and ex-situ stabilization/solidification were retained as potential treatment technologies. Other retained technologies for the deed restricted area soils and source zone soils and DNAPL include deed restriction, activity restrictions, asphalt cap and drainage controls, excavation, and off-site land disposal.

2.5.2 Drainage Ditch Sediments

Table 17 also presents the technology screening results for the drainage ditch sediments. Engineering controls like a constructed sand cap or asphalt or concrete ditch liner were screened out because the sediments near the dam are relatively soft and would likely require stabilization before a cap could be constructed. Another engineering control technology that was screened, but was retained, was the replacement of the drainage ditch with a storm drain line.

Removal through excavation in combination with off-site disposal was retained.

As was discussed in Section 2.2, sediments in the upper end of the drainage ditch are a "highly concentrated" sediment hot spot based on the zinc concentrations detected at SD-05 and SD-06.. With the exception of solidification/stabilization, which could be used to immobilize zinc and reduce its bioavailability, all of the potential treatment technologies were screened out, particularly in-situ treatment technologies which are either developmental and/or would have a higher cost relative to in-situ solidification/stabilization.

2.5.3 Perched Water-Bearing Zone Groundwater

The technology screening and evaluation process that resulted in the selection of the funnel and gate IRM, was discussed earlier. Table 17 presents the screening of technologies to address the southeast end of the subsurface barrier wall should groundwater monitoring determine that constituents could migrate past the subsurface barrier wall at concentrations that could result in an adverse impact to beneficial water uses. Containment through the use of a physical barrier was retained; a hydraulic barrier was screened out because it would be less effective and more difficult to implement than a physical barrier. Three in-situ biological treatment technologies were screened: enhanced bioremediation, monitored natural attenuation (MNA), and phytoremediation. Of these, phytoremediation was screened out because it may not be able to reduce chemical concentrations in the perched water-bearing zone to levels that would meet RAOs and would be incompatible with the mill's current and future use of this area. Two in-situ physical/chemical treatment technologies were screened: chemical oxidation and passive/reactive treatment walls. The latter technology was screened out on the basis that it has limited application to the organics associated with wood-treating operations. In-situ chemical oxidation was screened out because it would be more costly than the injection of oxygen to enhance bioremediation which has been shown to be effective. In-situ chemical oxidation would also interfere, at least temporarily, with ongoing biological activity at the Site.

3.0 DEVELOPMENT AND SCREENING OF ALTERNATIVES

3.1 Development of Alternatives

Remedial alternatives were developed by combining the remedial technologies that passed the screening step, as summarized in Table 17. Because the potential remedial alternatives for different media or areas are somewhat independent, media-specific and area-specific alternatives were developed consistent with DEQ guidance (DEQ, 1998b). Typically, remedial alternatives are developed spanning the spectrum from alternatives that include treatment to alternatives that include the use of engineering and institutional controls.

Treatment-oriented alternatives were also developed for soils in the deed restricted area and for the source zone soils and DNAPL. These alternatives were developed in response to DEQ's comments on the FS work plan. Treatment oriented-alternatives were also developed for the sediments in the drainage ditch. Although surface soils in two localized areas are considered to be hot spots, a treatment-oriented alternative was not developed for these soils because in-situ treatment through solidification/stabilization would not reduce constituent concentrations below hot spot levels and given the relatively small volumes of soil in each area, in-situ or ex-situ treatment with other technologies would be more costly than off-site disposal.

The alternatives developed for the perched water-bearing zone are to supplement, not replace, the existing funnel and gate IRM system. As was discussed in the prior section, a focused FS was conducted to support the selection of the IRM. The IRM is performing as designed.

The following summarizes the alternatives developed for each media and area, and the alternatives carried forward for detailed evaluation.

3.1.1 Surface Soils

The following three alternatives were developed for the two localized areas where surface soils pose a potential unacceptable risk.

Alternative SS1 – No action

Alternative SS2 – Place asphalt cap and, if needed, install drainage controls in areas where surface soils are considered to be a hot spot and pose a potential unacceptable risk; implement institutional controls consistent with those implemented in the deed restricted area.

Alternative SS3 – Excavate and land dispose surface soils that are considered to be a hot spot and that pose a potential unacceptable risk.

All three of these alternatives were carried forward into the alternative evaluation process.

3.1.2 Source Zone Soils and DNAPL

Alternatives were developed for the source zones of perched water-bearing zone groundwater contamination in response to DEQ's request that remedial alternatives be evaluated to determine the effectiveness of source zone treatment or removal in relation to the long-term operation of the IRM without treatment or removal. To support the focused remedial alternatives evaluation presented in the next section, the following three alternatives were developed:

Alternative SZ1 – No source zone removal or treatment.

Alternative SZ2 – Excavate and land dispose impacted soils and DNAPL that are a source to perched water-bearing zone groundwater.

Alternative SZ3 – Treat in-situ impacted soils and DNAPL that are a source to perched water-bearing zone groundwater, and implement institutional controls.

3.1.3 Deed Restricted Area Soils

Alternatives were developed for soils in the deed-restricted area in response to DEQ's request that the FS justify the selection of asphalt capping and institutional controls as a final remedy for the deed restricted area. To support this justification, the next section provides a focused remedial alternative evaluation of the following three alternatives:

Alternative DRA1 – Continued maintenance of asphalt cap and drainage controls, and institutional controls.

Alternative DRA2 – Excavate and land dispose of surface and subsurface hot spot soils and soils that pose a potential unacceptable risk.

Alternative DRA3 – Treat in-situ hot spot soils and soils that pose a potential unacceptable risk, replace asphalt cap, and implement institutional controls.

3.1.4 Drainage Ditch Sediments

The following alternatives were developed for the portion of the drainage ditch where sediments pose a potential unacceptable risk.

Alternative Sed1 – No action

Alternative Sed2 – Stabilize in-situ drainage ditch sediments that are considered to be a hot spot and that pose potential unacceptable ecological risks and implement institutional controls.

Alternative Sed3 – Install a sump, pump, catch basins, and pipelines to convey storm water and backfill the ditch; stabilize hot spot sediments and sediments underlying the pipelines; and implement institutional controls.

Alternative Sed4 – Excavate and land dispose of sediments that are considered to be a hot spot and that pose potential unacceptable ecological risks.

All four of these alternatives were carried forward into the alternative evaluation process.

3.1.5 Perched Water-Bearing Zone Groundwater

The following alternatives were developed for perched water-bearing zone groundwater.

Alternative GW1 – Continued IRM operations, in combination with MNA for groundwater flow around the southeast end of the subsurface barrier wall.

Alternative GW2 – Continue IRM operations, in combination with installing a physical barrier to prevent groundwater flow around the southeast end of the subsurface barrier wall.

Alternative GW3 – Continue IRM operations, in combination with in-situ biological treatment through air sparging for groundwater flowing around the southeast end of the subsurface barrier wall.

All of these alternatives were carried forward into the alternative evaluation process.

4.0 EVALUATION OF REMEDIAL ACTION ALTERNATIVES

In accordance with DEQ FS guidance, the remedial alternatives are evaluated against: 1) the protectiveness requirement specified in OAR 340-122-084(4), 2) a balancing of remedy selection factors (effectiveness, long-term reliability, implementability, implementation risk and reasonableness of cost), and 3) the preference to treat hot spots of contamination, if present. The evaluation includes both an individual evaluation of each alternative and a comparative evaluation of each alternative.

The evaluation is presented by media and area given the relative independence of the alternatives for the different media.

The framework for remedial action cost estimation is based on the identification of specific line items of cost and the estimation of unit costs for each line item. Base unit costs were determined using the following hierarchy. The preferred source was published cost-estimating guides (i.e., Means Site Work and Landscape Cost Data [Means]). The second preferred source was budget quotes from vendors and service providers. The third preferred source was site remediation precedent and experience.

Quotes from vendors and service providers were obtained for several key technologies where published cost estimating guides do not reflect current market conditions, such as land disposal.

Project experience and site-specific estimates were used for certain unit costs.

The base unit costs are multiplied by an area adjustment factor and an allowance to obtain “extended unit costs.” The area adjustment factor accounts for the difference in the cost of labor and materials in different parts of the United States or different parts of a state. The current area adjustment factor for Oregon, outside of Portland, is approximately 102.

Allowance factors are included to account for indirect construction costs such as health and safety, bonding and insurance, contractor profit, engineering design, services during construction, mobilization, and demobilization. The actual amount of each cost allowance factor depends on the nature and complexity of the required work, the media being treated, and the location of treatment (off-site versus on-site treatment). These allowances are applied as a percentage of each line-item cost. These allowances are typical of similar cleanup projects, taking into consideration the overall size of this program, and are derived from the referenced industry sources and other engineering cost estimating publications. Table 18 summarizes the breakdown for the various allowances that were applied.

NPV costs were calculated using a 7 percent net discount rate for future costs based on EPA guidance (EPA, 2000) for developing and documenting FS cost estimates.

4.1 Surface Soil Remedial Alternative Evaluation

4.1.1 Surface Soil Alternative Description

4.1.1.1 Alternative SS1

Alternative SS1 is the no action alternative. Under this alternative, the two localized areas where surface soils contain arsenic, chromium and dioxins would remain in place without any engineering or institutional controls. Hot spot soils in both localized areas would also remain in place.

4.1.1.2 Alternative SS2

Alternative SS2 would involve the placement and compaction of approximately 6 inches of ½- to ¾-inch crushed rock and asphalt paving in two, 2-inch lifts. This cap design is consistent with the asphalt paving placed as part of the IRM engineering controls (Geomatrix, 2006). In the area between the deed restricted area and the paved parking lot, the asphalt would be placed to match the edges of the existing pavement and would be sloped to follow the current slope to the south. Runoff from the newly paved area would flow to the south across the deed restricted area to the catch basin that was installed as part of the IRM to convey runoff to the Slough. The approximate extent of the paved area would be 9,000 square feet.

Alternative SS2 also involve the paving an approximately 2,500 square foot area where the wigwam burner was located. The pavement in this area would not need to match any existing pavement.

Finally, Alternative SS2 would involve the implementation of a deed restriction and activity restrictions for the two newly paved areas, consistent with those previously implemented and proven institutional controls for the deed restricted area.

Cap inspection and repairs was assumed to occur every five years for a period of 30 years.

4.1.1.3 Alternative SS3

Alternative SS3 would involve the excavation of surface soils in both areas using a backhoe or other conventional excavation equipment. For cost estimating purposes it is assumed that 6 inches of soil would need to be removed in each area. Based on the estimated lateral extent of impacted soils in each area, illustrated in Figure 13, approximately 150 cubic yards (CY) or 225 tons of soil would need to be removed from the area between the deed restricted area and paved parking lot and 50 CY or 75 tons would need to be removed where the wigwam burner was located. The volume to weight conversion is based on an assumed conversion factor of 1.5 tons/CY.

As was discussed above, soil samples would be collected during the remedial planning phase to further define how much of the area between the deed restricted area and paved parking lot would require excavation. After soil removal is completed in both areas, soil samples would be collected from the bottom of each excavation to confirm that arsenic, chromium and dioxin concentrations were reduced to protective levels. The excavated areas would be backfilled, compacted and graded to match the prior land surface.

The excavated soils would be managed following the same process that was used to manage excess soils and wood debris generated during IRM construction.[9] The soils would be profiled for waste management purposes by collecting a composite sample from each excavation area. The analytical results would be used to determine whether the soils classify as a hazardous waste. For purposes of the FS, it is assumed that the soils would not classify as a hazardous waste but would be disposed at a Subtitle C landfill, consistent with the excess soils generated during IRM construction.

4.1.2 Analysis of Individual Surface Soil Alternatives

Table 19 summarizes the individual analysis of the three surface soil remedial alternatives.

4.1.2.1 Alternative SS1

Alternative SS1, the no action alternative, would not meet DEQ's protectiveness requirement. Based on the HHRA, the risks to human health and the environment would be potentially unacceptable. For this reason, Alternative SS1 would not be effective in achieving protection. The long-term reliability, implementability and implementation risk of Alternative SS1 were not evaluated. There would be no cost associated with the implementation of Alternative SS1. Alternative SS1 would not reduce constituent concentrations below hot spot levels.

4.1.2.2 Alternative SS2

Alternative SS2, asphalt capping and institutional controls, would be protective because it would eliminate the potential for human and ecological receptor exposure to the surface soils containing arsenic, chromium and dioxins that pose potential unacceptable risks. It would also result in a reduction in the amount of rainfall infiltration inside the subsurface barrier wall because runoff from the capped area between the deed restricted area and parking lot would be diverted toward the catch basin. Given that the engineering and institutional controls for Alternative

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[9] Letter from J. Raming/GP and K. Paschl/Beazer to T. Gainer/DEQ regarding management of excess soils and wood debris, Former Koppers Wood-Treating Site, Wauna, Oregon – Groundwater Seeps Interim Remedial Measure, November 23, 2004.

SS2 are consistent with those implemented in the deed restricted area, they should be effective and reliable; the asphalt cap and institutional controls implemented in the deed restricted have proven to be effective and reliable in preventing exposure to impacted soils for 20 years. In addition, asphalt paving would be reliable over the long-term in that it is easy to inspect and repair, and it would be consistent with the current and future use of the area by the mill. As with any institutional control, there is always some level of uncertainty about its long-term reliability particularly if property ownership changes in the future. Alternative SS2 is readily implementable; there are no permitting requirements or necessary authorizations. The alternative could be fully implemented in two months. The implementation risks are minimal given that the alternative simply involves the placement of asphalt paving over an approximately ¼-acre area. As is indicated in Table 19, the capital cost for Alternative SS2 is approximately $65,000 (rounded) and the net present value (NPV) of the long-term cap inspection and maintenance cost is approximately $34,000 (rounded), for a total NPV cost of $99,000 (rounded).[10] Table 20 summarizes the detailed analysis of the capital and O&M costs for Alternative SS2, including the assumed quantities, unit costs, allowances applied to the unit costs, and sources of the unit costs. Alternative SS2 would not reduce constituent concentrations below hot spot levels.

4.1.2.3 Alternative SS3

Alternative SS3, excavation and land disposal, would be protective because it would remove the surface soils containing arsenic, chromium and dioxins that pose potential unacceptable risks. The alternative would be effective in achieving protection and would be reliable over the long-term because it does not include any institutional or engineering controls. Alternative SS3 is readily implementable; there are no permitting requirements or necessary authorizations. The alternative could be fully implemented in two months. The implementation risks are minimal given that the alternative simply involves the excavation and off-site transport of approximately 200 CY of soil. Assuming the soil is transported in 10 CY capacity trucks, a total of 20 truck trips would be required. As is indicated in Table 18, the capital cost for Alternative SS3 is approximately $97,000 (rounded); there are no long-term O&M costs associated with this alternative. Table 21 summarizes the detailed analysis of the capital, including the assumed quantities, unit costs, allowances applied to the unit costs, and sources of the unit costs. Alternative SS3 would remove the surface soil hot spot.

4.1.3 Comparative Analysis of Surface Soil Alternatives

Of the three alternatives evaluated for surface soils, only Alternatives SS2 and SS3 would meet DEQ's protectiveness requirement. Both of these alternatives would be effective in achieving protection and in the same amount of time. Alternative SS2 may be slightly more effective because it

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[10] Note that $99,000 is the sum of the rounded capital and rounded long-term cap inspection and maintenance costs. The actual total NPV cost is $99,540 (see Table 20).

would have the added benefit of reducing rainfall infiltration into the IRM area.

Alternative SS3 would have a greater long-term reliability in that it would not rely on the use of engineering and institutional controls. Given that the same controls were implemented in the deed restricted area and they have been effective for 20 years, and Alternative SS2 would simply increase the area covered by the already existing engineering and institutional controls, the greater long-term reliability offered by Alternative SS3 is not that significant with respect to the overall Site.

Alternatives SS2 and SS3 are comparable with respect to their implementability and implementation risk. Alternative SS3 would have a slightly higher potential implementation risk because excavated soil would need to be transported to an off-site landfill.

Alternatives SS2 and SS3 are also comparable with respect to their costs. As is indicated in Table 19, both alternatives have essentially the same total NPV cost. Alternative SS3 could, however, be more costly than Alternative SS2 if the lateral or vertical extent of the excavations is larger than assumed. While Alternative SS2 does require more risk management, because impacted soils remain in place, the overall increase is small given that soils containing higher concentrations over a larger area are already being managed in the deed restricted area using the same controls.

Alternative SS3 is the only alternative that would result in a reduction of constituent concentrations below hot spot levels.

Table 22 further summarizes the comparative analysis of the surface soil alternatives. Each alternative is scored against the three balancing factors using a 1 to 10 scale. A score of 1 indicates that the alternative fully meets the balancing factor. Whereas a score of 10 indicates that the alternative does not meet the balancing factor.

4.2 Source Zone and DNAPL Remedial Alternative Evaluation

In its January 24, 2008 comments, DEQ requested that the FS address the source zone of groundwater contamination. The purpose of this evaluation was to determine the effectiveness of source zone treatment or removal in relation to the long-term operation period of the current IRM without treatment or removal.

As was discussed above, two source zones were identified in the RI report, one in the former process area extending to the east to PMW-05, and one northwest of PMW-13. Figure 14 illustrates the approximate lateral extent of the two source zones based on locations where free and residual DNAPL were observed in soil samples collected during the RI. As will be discussed below, there is a potential for DNAPL to be present beyond the boundaries illustrated in Figure 14. The residual DNAPL and creosote staining were encountered above the confining silt layer. As is discussed in EPA (2003), constituents in DNAPL partition slowly into the aqueous phase, usually under mass transfer controlled conditions.

According to the RI report, the areas with free and residual DNAPL correspond to the locations with the highest soil concentrations. In the former process area source zone, the highest constituent concentrations were found in two borings located near PMW-05:

- At SB-05 soils contain dioxins, arsenic, diesel, PAHs, dibenzofuran, and pentachlorophenol at 4 feet bgs.
- At B-2 soils contain arsenic, creosote, PAHs and pentachlorophenol at 5 feet bgs.

These soils likely represent the primary source zone for dissolution of constituents into perched water-bearing zone groundwater. This area was paved with asphalt as part of the IRM. Soils in the second source zone generally contain lower constituent concentrations.

4.2.1 Source Zone Alternative Description

As was discussed above, remedial technologies were assembled into three potential remedial alternatives for source zone soils and DNAPL for the purposes of evaluating the effectiveness of source zone treatment or removal versus no action with respect to the operation period of the groundwater IRM. For the source zone alternatives, it was assumed that treatment would at least need to be performed in the two source zones. The exact lateral and vertical extent of each source zone is uncertain, but for cost estimating and alternative evaluation purposes it is assumed to at least include the areas illustrated in Figure 14.

4.2.1.1 Alternative SZ1

Alternative SZ1 includes containment and groundwater treatment using the existing IRM; this alternative would not provide source zone removal or treatment, but would include engineering controls (i.e., existing asphalt pavement that was installed as part of the IRM) and institutional controls similar to those implemented in the deed restricted area. Under Alternative SZ1, the source zone soils and DNAPL would remain in place. Ongoing dissolution of constituents from source zone soils and DNAPL would be addressed through treatment in the aeration trench and/or by intrinsic biodegradation and natural attenuation. Annual inspections would be performed to monitor the condition of the asphalt cap and maintenance would be conducted as needed.

4.2.1.2 Alternative SZ2

Alternative SZ2 would involve the excavation of impacted soils within the two source zones, including the deed restricted area (approximately 2 acres of total area). Prior to conducting soil removal, it would be necessary to remove overhead electrical lines within each source zone excavation area, temporarily remove underground firewater lines, and remove any abandoned underground lines. Existing asphalt pavement would also have to be removed. Perched water-bearing zone groundwater in each excavation area would be dewatered using well points. The firewater lines, electrical lines, and asphalt pavement would be repaired or replaced, as appropriate, after completing soil removal. For the purposes of the FS, it was assumed that it would not be necessary to provide temporary firewater and/or electrical service during soil removal.

For cost estimating purposes, it assumed that the excavation in the former process area source zone would extend to an average depth of 8 feet bgs, which would include removal of the top one foot of the confining silt layer, as it is considered likely that the upper portion of the silt layer has been affected. In practice, this may not be practicable, since removal of a portion of the underlying aquitard would increase the potential for contaminated groundwater to migrate from the perched water bearing zone to the underlying shallow zone. The excavation in the source zone located northwest of the former process area was projected to extend to a depth of 10 feet bgs, including removal of the top foot of the confining silt layer. Approximately 28,000 CY of soil would need to be removed under Alternative SZ2. Sidewall confirmation samples would be collected to confirm that constituent concentrations were reduced to protective levels. The excavated areas would be backfilled with clean, imported fill. Backfill would be compacted, graded and paved as appropriate to match the existing surface contours and pavement. No ongoing operations and maintenance are anticipated specific to this alternative, but it is anticipated that the existing IRM would be maintained to address impacted groundwater in areas outside the source zone excavations.

The excavated soils would be managed in accordance with applicable regulations. Excavated soils would be temporarily stockpiled in a manner that would limit runoff potential. Characterization samples would be collected to support off-site, commercial landfill disposal. The analytical results would be used to determine whether the hazardous waste classification of the soils. For purposes of the FS, it was assumed that the excavated soils would classify as a hazardous waste due to the presence of residual DNAPL, requiring treatment and disposal at a Subtitle C landfill. Groundwater extracted during dewatering was assumed to be treated under a Clean Water Act permit for discharge either to the mill wastewater system or direct discharge to the Columbia River.

4.2.1.3 Alternative SZ3

This alternative relies upon in-situ treatment to address hazardous constituents in the two source areas. EPA (2003) summarizes a range of in-situ physical, chemical, biological and thermal technologies that can be used for DNAPL source depletion. Some have been implemented on a full scale; others have only been tested on a pilot scale. Technologies potentially applicable to residual DNAPL in relatively permeable soils (as opposed to DNAPL pools where soils are saturated), include the use of soil stabilization, soil flushing with co-solvents or surfactants, electrical resistance heating, steam injection, chemical oxidation, and biological treatment. Of these, soil stabilization, steam injection, surfactant flushing, and chemical oxidation have been reasonably tested. Surfactant flushing, chemical oxidation, and steam injection have not proven to be effective for source area treatment. To address DEQ's request that the FS assess the effectiveness of source area treatment, in-situ stabilization was selected as a potentially applicable approach for Alternative SZ3.

Alternative SZ3 would involve mixing source zone soils with cement to stabilize them in place and to immobilize contaminants. In-situ stabilization would be performed over a total area of approximately 2 acres encompassing the two source zones (Figure 14). Prior to conducting in-situ stabilization, the electrical, firewater, and abandoned underground lines, and existing asphalt pavement would have to be removed as described above for Alternative SZ2. Electrical and firewater service would be restored after completing remedial construction. Confirmation sampling would be conducted to ensure the mixing addressed the full extent of impacted soils within the two source zones.

For cost estimating purposes, it was assumed that cement would be added at 15 percent by weight and mixed to an average depth of 8 feet in the former process area source zone and an average depth of 10 feet in the source zone located northwest of the former process area. It is estimated that approximately 28,000 CY of soil would be stabilized under this alternative. Due to the addition of cement and the expansion of soils during mixing, it was assumed that 20 percent of the total volume (approximately 6,000 CY or 9,700 ton) would be excess soils requiring management and off-site disposal. The excess soils would be characterized using composite samples collected as appropriate from excavated, stockpiled soil. The analytical results would be used to determine whether the soils classify as a hazardous waste. For purposes of the FS, it was assumed that the soils would not classify as a hazardous waste and would be disposed at a Subtitle D landfill. Once mixing was complete the mixing areas would be graded and paved to match the adjacent grade and pavement. Each area would also be paved with asphalt to serve as a cover over the mixed soils. The asphalt pavement would also act as an engineering control to prevent exposure to subsurface soils in the vicinity of borings SB-05 and B-2 where constituents would likely remain at concentrations that pose a potential unacceptable human health risk. Although in-situ stabilization would reduce constituent mobility, it would not reduce constituent concentrations, particularly metals. Thus, institutional controls similar to those implemented in the deed restricted area would need to be extended into the area near soil borings SB-05 and B-2. Annual inspections would be performed to monitor the condition of the asphalt capped areas and maintenance would be conducted, as needed.

4.2.2 Analysis of Individual Source Zone Alternatives

Table 23 summarizes the analysis of the three source zone remedial alternatives.

4.2.2.1 Alternative SZ1

Alternative SZ1, does not include source zone removal or treatment, but would provide source zone containment through the existing IRM, and would be protective. As was discussed in Section 2.4.3, the subsurface barrier wall has stopped the migration of constituents from source zone soils and DNAPL to the Columbia River. In addition, constituent concentrations between the subsurface barrier wall and the river have significantly decreased below SLVs. Thus, Alternative SZ1 would achieve the remedial action objective of controlling the migration of constituents that are a source to the perched water-bearing zone at concentrations that could result in significant adverse effects on beneficial uses of water in the LOF. Alternative SZ1 would also achieve the remedial action objective of reducing exposure to constituents that may result in potential unacceptable human health risk. Soils in the vicinity of borings SB-05 and B-2, where constituent concentrations exceed industrial screening levels in subsurface soils, are already covered with asphalt paving. Extension of the deed restricted area institutional controls to this area would further ensure that Alternative SZ1 would be protective.

Semi-annual monitoring conducted since mid-2005 has demonstrated that Alternative SZ1 is effective and reliable. The barrier has effectively maintained a significant hydraulic head difference across the wall, groundwater flow has been redirected towards the aeration trench, and acceptable groundwater levels have been maintained, even during periods of heavy rainfall. It has eliminated the discharge of perched groundwater in the seep area formerly containing constituents at concentrations above their SLVs and created longer flow paths to the river allowing constituent concentrations to attenuate. Additional in-situ treatment is provided by the aeration treatment trench for groundwater that flows out of the IRM area to the west. Constituent concentrations in groundwater entering the river downgradient of the IRM aeration trench have consistently been well below SLVs. However, because source zone soils and DNAPL would be left in place, they would be ongoing sources to groundwater in the perched water-bearing zone for a number of years.

As was discussed earlier, the deed restricted area engineering and institutional controls have been effective and reliable for 20 years. Thus, these controls would also be effective and reliable if implemented in the vicinity of borings SB-05 and B-2.

Alternative SZ1 has already been implemented. Thus, there are no implementation risks.

As is indicated in Table 23 there would be no capital cost for Alternative SZ1 because no further construction is necessary for implementation. The future O&M cost for the IRM is addressed in Section 4.5. The only other O&M cost associated with Alternative SZ1 would be for inspection and maintenance of the existing asphalt cap. The NPV of the long-term (i.e., 30 years) O&M cost for annual inspections and repair (every five years) is approximately $29,000 (rounded). A 30-year O&M timeframe was assumed because source zone soils and DNAPL are expected to be long-term sources of dissolved phase constituents. Table 24 summarizes the O&M costs for Alternative SZ1.

Although Alternative SZ1 would not result in the removal or treatment of source zone hot spot soils or DNAPL, it does provide for hot spot containment. Given effectiveness of the IRM as a subsurface barrier for groundwater flow in the perched water-bearing zone, it appears that Alternative SZ1 would meet the hot spot criteria for reliably containing DNAPL.

4.2.2.2 Alternative SZ2

Alternative SZ2 would include excavation and off-site land disposal of source zone soils and DNAPL that are ongoing sources to perched water-bearing zone groundwater. The alternative would be protective in that it would eliminate exposure to constituents that pose a potential unacceptable risk and ultimately eliminate the need to control the migration of constituents that are a source to the perched water-bearing zone at concentrations that could result in significant adverse effects on beneficial uses of water in the LOF.

Alternative SZ2 would be effective in removing the ongoing sources to groundwater and reducing constituent concentrations to levels that do not pose a potential unacceptable human health risk. This alternative would also be reliable in that it would not rely on engineering and institutional controls to prevent human exposure to subsurface soils, and would reduce the O&M timeframe for the IRM.

Alternative SZ2 would be relatively complicated to implement, and would require significant planning and coordination. Permitting and authorizations would be needed to excavate soil and to treat and discharge water from excavation dewatering and, potentially, to treat soils prior to shipment for disposal. Implementation of this alternative would require temporary disconnection of fire protection water and electrical service in the remediation area and would also interrupt mill activities that are routinely conducted in this area. A portion of the IRM barrier wall would require removal and replacement. This alternative could require six to nine months to implement because of permitting and logistical planning requirements.

The implementation risks would be relatively high, given that the alternative would require excavation and off-site transport of approximately 28,000 CY of contaminated soils; implementation during the dry season would be necessary to mitigate risks associated with runoff and reduce the amount of excavation dewatering. Temporary interruption of firewater would create safety risks for the mill and shutdown of the aeration treatment trench during the several month construction period may affect constituent concentrations downgradient of the trench. Off-site transport would require over 1,100 truck loads, creating a risk potential to the community and environment along the transportation route. It is also possible that removal of a portion of the underlying aquitard could result in the migration of contaminated groundwater from the perched-water bearing zone to the underlying shallow zone.

As is indicated in Table 23 the remedy cost for Alternative SZ2 is approximately $14,097,000 (rounded). This is the same as the NPV cost for this alternative because there would not be any recurring O&M costs associated with source zone remediation under this alternative. Table 25 summarizes the estimated costs for Alternative SZ2, including the assumed quantities, unit costs, allowances applied to the unit costs, and sources of the unit costs.

Alternative SZ2 would result in the removal of hot spot soils and DNAPL. Constituent concentrations would be reduced below hot spot levels and DNAPL classified as a “highly concentrated” and “highly mobile” hot spot material would be removed.

4.2.2.3 Alternative SZ3

Alternative SZ3 includes the treatment of soils in the two source zones by in-situ stabilization. The alternative would be protective because the asphalt cap and institutional controls included in this alternative would eliminate exposure to constituents that would still pose a potential unacceptable risk after stabilization. In addition, in-situ stabilization of source zone soils and DNAPL would ultimately eliminate the need to control the migration of constituents that are a source to the perched water-bearing zone at concentrations that could result in significant adverse effects on beneficial uses of water in the LOF.

This alternative would be effective in that it would cut off the mass transfer pathway from the source zone soils and DNAPL to groundwater in the perched water-bearing zone. This alternative would also be reliable in that it would rely on engineering and institutional controls that have been successfully implemented in the deed restricted area, and would reduce the O&M timeframe for the IRM.

Like Alternative SZ2, Alternative SZ3 has implementation issues. This alternative would require temporary disconnection of firewater lines and electrical service in the remediation area. Implementation would also restrict ongoing mill operations in the area. The alternative could be fully implemented in about three to six months.

The implementation risks for this alternative are moderate. The alternative mainly involves mixing cement into the source zone soils. This will temporarily expose contaminated soils and un-reacted cement, creating the need to manage runoff and prevent impacts to the river. A portion of the barrier wall (near PMW-5) would have to be removed and replaced under this alternative. The implementation risks discussed above for Alternative SZ-2 related to firewater and shutdown of the aeration treatment trench would also apply to this alternative.

As is indicated, in Table 23 the remedy cost for Alternative SZ3 is approximately $9,145,000 and the net present value (NPV) of 30 years of annual inspection and repair (every five years) costs is approximately $27,000 (rounded), for a total NPV cost of $9,172,000 (rounded). Table

26 summarizes the detailed analysis of the capital and O&M costs for Alternative SZ3, including the assumed quantities, unit costs, allowances applied to the unit costs, and sources of the unit costs.

Alternative SZ2 would result in the treatment of hot spot soils and DNAPL. Constituent concentrations would not be reduced below hot spot levels. However, the dissolution of constituents from source zone soils and DNAPL at concentrations that could cause adverse effects to beneficial water uses would be reduced.

4.2.3 Comparative Analysis of Source Zone Alternatives

All three source zone alternatives would be protective. All of them would achieve the remedial action objectives of controlling the migration of constituents that are a source to the perched water-bearing zone at concentrations that could result in significant adverse effects on beneficial uses of water in the LOF and reducing exposure to constituents that may result in potential unacceptable risk.

All three alternatives would also be effective and reliable. Alternative SZ2 could be the most effective because it would remove source zone soils and DNAPL that are ongoing sources of constituents to the groundwater in the perched water-bearing zone and that pose a potential unacceptable human health risk. Alternative SZ3 could be the next most effective because it would reduce the dissolution of constituents to groundwater. However, the overall effectiveness of Alternatives SZ2 and SZ3 could be significantly reduced if all of the source zone soils and DNAPL are not removed or stabilized. The lateral extent of both source zones is uncertain due to the “fingering” phenomenon known to be associated with DNAPL releases. Based on available soil boring and sampling data, the potential extent of the two identified source zones, as shown on Figure 14, indicates that the volume of soil that would have to be removed or stabilized would be approximately 28,000 CY. However, the actual volume could be higher if the source zones extend beyond the anticipated boundaries. As was discussed above, it is likely that a “finger” of DNAPL extends to the northwest from the former process area to the source zone located near the river. Additionally, even though confirmation soil sampling may indicate attainment of soil cleanup levels, residual DNAPL could remain within the source areas and continue to act as ongoing sources to groundwater.

Alternative SZ2 would also be the most reliable because it would not rely on any engineering and institutional controls to prevent human exposure to subsurface soils and would reduce the O&M timeframe for the IRM. The overall reduction in O&M timeframe may not be that significant, however, because the aeration treatment trench system would need to continue operating until constituent concentration decrease in the dissolved phase portion of the plume. Based on the groundwater modeling conducted to evaluate potential remedial alternatives for the perched water-bearing zone, it could take more than 15 years for groundwater to flow from the former process area source zone through the aeration treatment trench to the river. Accounting for retardation and the likely need for more than one pore volume to pass through the plume area to achieve complete desorption from impacted soil, it is likely that the aeration treatment trench system operation, barrier wall maintenance, and groundwater monitoring could be necessary for at least 20 years, even if Alternative SZ2 were implemented.

Alternative SZ3, which treats the source areas by in-situ stabilization, would be somewhat less reliable than Alternative SZ2 because although Alternative SZ3 would reduce constituent mobility, potential direct contact risks would remain because constituent concentrations in treated soils would not be substantially different from existing concentrations. Thus, Alternative SZ2 would need to rely upon the same engineering and institutional controls as Alternative SZ1.

One of the primary differences between the alternatives is their implementability. Alternative SZ1 has already been implemented. Alternative SZ3 would be less difficult to implement than Alternative SZ2. Implementation of Alternative SZ2 is more complicated due to dewatering requirements, the need to treat extracted groundwater, off-site transportation and disposal of a larger quantity of soil, and issues related to firewater and electrical utilities in the remediation area. Permitting to treat the extracted groundwater would lengthen the implementation timeframe for Alternative SZ2. Affected firewater and electrical lines would require temporary abandonment and replacement. In addition, implementation of Alternative SZ2 could impact mill operations that are conducted within the remediation area and require temporary shutdown of the IRM aeration treatment system due to interruption of electrical service. Transportation of excavated soil (approximately 45,000 tons or more than 1,100 truckloads) to a Subtitle C landfill would create a high risk to the community. Finally, Alternative SZ2 has a much higher risk of creating a conduit for the migration of contaminated groundwater from the perched water-bearing zone to the shallow zone.

Most of the implementation issues identified for Alternative SZ2 would be encountered during implementation of Alternative SZ3. The primary difference is that dewatering would be avoided, as in-situ stabilization can be performed without groundwater dewatering, and the volume of material requiring off-site disposal would be smaller. Similar to Alternative SZ2, this alternative would impact mill operations, require temporary interruption and replacement for firewater and electrical utilities in the area, require replacement of a portion of the barrier wall, and require temporary shutdown of the aeration treatment trench during construction. The short term risks to the community associated with Alternative SZ2 would be lower for Alternative SZ3, as the amount of material requiring off-site transportation would be significantly lower. However, short term risks to on-site personnel due to dust and vapors would be comparable to Alternative SZ2.

Another major difference among the alternatives is their cost. The estimated NPV cost for Alternative SZ1 is approximately $29,000, whereas the total NPV cost for Alternatives SZ2 and SZ3 are $14,097,000 and $9,172,000, respectively. As was discussed above, the actual costs for both of these alternatives could be higher if the source zone areas are larger in lateral extent or depth than assumed. The source zone area could be larger if there is a "finger" of creosote extended northwest from the former process area to the source zone located near the river. The actual costs could also be higher if additional dewatering and water treatment are required to excavate subsurface soils, if excavated soils must be treated prior to land disposal, or if the soils cannot be land disposed and have to be incinerated. These costs are disproportionately high given: 1) all of the alternatives are protective, 2) the potential that neither Alternative SZ2 or SZ3 will be entirely effective in addressing all of the source zone soils and DNAPL that are ongoing sources to groundwater, and 3) engineering and institutional controls will still be needed with Alternative SZ3.

DEQ requested that source zone alternatives be evaluated, in part, to determine the effectiveness of source zone treatment or removal in relation to the long-term operation period of the current IRM without treatment or removal. As was discussed above, even after implementing Alternatives SZ2 or SZ3, IRM O&M will need to continue for another 20 years. As will be discussed in Section 4.5, based on the cost estimate developed for Alternative GW1, the NPV of 20 years of IRM O&M and monitoring would be about $1,389,000. The life-cycle cost for continued operation of the IRM systems is about $1,613,000 for long-term O&M (i.e., 30 years). The difference between the life-cycle cost for Alternative GW1 and the 20-year NPV for IRM operations (i.e., $1,613,000 minus $1,389,000 or $224,000) is a reasonable estimate of the potential cost reduction that may be attained by implementing Alternatives SZ2 or SZ3. The relatively small reduction in long-term IRM O&M costs does not justify the significant remedy costs for Alternatives SZ2 and SZ3.

Alternative SZ2 would remove source zone soils and DNAPL that are considered to be hot spot materials. Thus, this alternative would best achieve DEQ's hot spot criteria. Alternative SZ3 would partially meet DEQ's hot spot criteria because some hot spot material would have to be removed and the dissolution of constituents from source zone soils and DNAPL at concentrations that could cause adverse effects to beneficial water uses would be reduced. Constituent concentrations, however, would not be reduced below hot spot levels. Alternative SZ1 would only address DEQ's hot spot criteria for reliably containing DNAPL. Even though Alternatives SZ2 and SZ3 more completely achieve DEQ's hot spot criteria, they would do so at costs that exceed DEQ's higher cost threshold for removal or treatment of hot spots.

Further support for the use of migration control or containment measures for the Site source zones, likely those included in Alternative SZ1, is provided in a decision chart contained in EPA (2003). Criteria supporting the use of migration control or containment measures, rather than source depletion include:

1. DNAPL is in an immobile, residual phase rather than mobile and expanding – As was discussed above, the RI and groundwater monitoring results do not indicate that the DNAPL is mobile or expanding; it appears to be present as a residual phase with limited free phase.

2. The life-cycle containment cost is much lower than the cost of treatment – As was discussed above, the cost of long-term IRM O&M and monitoring is likely to be lower than the cost of treatment or removal.
3. The containment system is highly reliable – As was discussed above, groundwater monitoring has demonstrated that the IRM it is a highly reliable.
4. Low resource value – The perched water-bearing zone is not currently and unlikely to be used as a future source of drinking water; the beneficial use is discharge to surface water.
5. Low probability of meaningful reduction in time to meet cleanup goals – Even if source depletion could be performed, it could take 20 years for constituent concentrations in perched water-bearing zone groundwater to decrease below SLVs.
6. Shrinking dissolved phase plume – Releases of creosote ceased over 40 year ago. Thus, there is no ongoing source loading (i.e., ongoing releases of creosote) at the Site. As a result, the dissolved phase plume should be stable or shrinking. In addition, groundwater monitoring conducted at PMW-05 indicates that plume is steady to declining.
7. No risk to receptors now or in the future – The existing IRM is protective.
8. No users of the resource within expected time frame needed for restoration of aquifer and no other exposure pathways likely – The beneficial water use determination concluded that the current and likely future beneficial use of the perched water-bearing zone is discharge to the river. The HHRA and ERA did not identify any potential unacceptable risks associated with exposure to perched water-bearing zone groundwater.

Table 22 further summarizes the comparative analysis of the source zone alternatives.

4.3 Deed Restricted Area Remedial Alternative Evaluation

The deed restricted area is an approximately 1-acre portion of the Site where an asphalt cap was constructed and institutional controls were implemented to prevent exposure to soils in the former process area. Three potential remedial alternatives were developed for the deed restricted area for purposes of justifying the selection of the existing asphalt cap and institutional controls to be part of the final remedy. Two of the potential deed restricted area remedies (i.e., DRA2 and DRA3) are similar to source zone remedies SZ2 and SZ3, except they would only apply to the deed restricted area. As is illustrated in Figure 14, the former process area source zone includes the deed restricted area. Thus, the deed restricted area remedies are not independent of the source zone remedies.

4.3.1 Deed Restricted Area Alternative Description

4.3.1.1 Alternative DRA1

Alternative DRA1 would include continued maintenance of asphalt cap, drainage controls, and institutional controls.

4.3.1.2 Alternative DRA2

Alternative DRA2 would include the excavation and off-site land disposal of hot spot soils and soils that pose a potential unacceptable risk.

Given the presence of highly concentrated hot spot soils in the deed restricted area, Oregon's environmental cleanup law requires that remedies remove or treat hot spots of contamination to the extent feasible. The evaluation of feasibility is based on the five remedy selection factors (i.e., effectiveness, long-term reliability, implementability, implementation risk, and reasonableness of cost).

According to DEQ guidance, for hot spots in media other than water, the FS must evaluate the feasibility of treatment to the point where the concentration or condition producing the hot spot would no longer occur while applying the higher cost threshold for treatment and then the FS must evaluate the feasibility of treatment to the acceptable risk level without application of the higher cost threshold for treatment.

To address soil hot spots in the deed restricted area, Alternative DRA2 would involve the removal of surface soils from at least the areas around sampling locations EPA-D1 and EPA-DC1. The lateral extent of these two hot spots is uncertain given that only two surface soil samples were collected in the deed restricted area. Assuming each hot spot is localized (say 50 by 50 feet in size and 0.5 feet deep), the volume of surface soil that would have to be removed could be on the order of 100 CY. If each hot spot is larger (say 100 by 100 feet in size and 2 feet deep), the volume of surface soil that would have to be removed could be on the order of 1,500 CY. Another 3,300 CY of hot spot soils could be present near B-5 and B-8 assuming the hot spot extends from the east side of the deed-restricted area west through B-5, B-8 and half way to B-12; half way to the north and south sides of the deed restricted area; and to an average depth of 7.5 feet bgs. Thus, the total volume of hot spot material could be approximately 3,400 to 4,800 CY.

If Alternative DRA2 was only used to address hot spot soils, soils containing constituents at concentrations that pose a potential unacceptable risk could remain. In that case, Alternative DRA2 would include replacing the asphalt cap and continued implementation of institutional controls in the deed restricted area.

If Alternative DRA2 was used to also address soils containing constituents at concentrations that pose a potential unacceptable risk, the soil excavation volume would increase substantially. Given the limited number of soil samples collected in the deed restricted area, it is not possible to estimate the potential volume.

4.3.1.3 Alternative DRA3

Alternative DRA3 would include the treatment of in-situ hot spot soils and soils that pose a potential unacceptable risk.

Based on the technology screening presented in Table 17, Alternative DRA3 would likely involve the use of in-situ solidification/stabilization for the deed restricted area hot spot soils containing arsenic, chromium and dioxins. As was discussed above, arsenic concentrations exceed the human health arsenic “highly concentrated” hot spot concentration at three locations: EPA-DC1 surface (283 mg/kg), EPA-D1 surface (5,860 mg/kg), and B-5 at 2.5 feet bgs (9,090 mg/kg) and 5 feet bgs (2,900 mg/kg). The dioxin TEQ concentration at B-8 at 2.5 feet bgs (2×10^{-3} mg/kg) exceeds its human health hot spot concentration. Chromium concentrations exceed the ecological “highly concentrated” hot spot levels at two locations: EPA-DC1 surface (584 mg/kg) and EPA-D1 surface (10,000 mg/kg). The volume of soil that would require treatment would be the same as for Alternative DRA2.

Although in-situ stabilization would reduce the already low mobility of metals and dioxins, it would not reduce their concentration or volume. Thus, Alternative DRA3 would include replacing the asphalt cap and continued implementation of institutional controls in the deed restricted area to prevent exposure to soils that pose a potential unacceptable risk.

4.3.2 Analysis of Individual Deed Restricted Area Alternatives

Table 27 summarizes the individual analyses of the three deed restricted area remedial alternatives.

4.3.2.1 Alternative DRA1

Alternative DRA1 has met and continues to meet DEQ’s protectiveness requirement. The existing asphalt cap, deed restriction and activity restrictions prevent human and ecological receptor exposure to soils. As was discussed earlier, the engineering and institutional controls have been effective and reliable for 20 years. Alternative DRA1 has already been implemented; thus there are no implementation risks. There are no capital costs associated with this alternative; long-term cap inspection and maintenance costs would be comparable to those estimated for source zone Alternative SZ1 (i.e., approximately $29,000 on a NPV basis for asphalt cap inspection and repair). Alternative DRA1 does not meet DEQ’s preference for treatment or removal of hot spots, but does provide for containment of hot spot soils.

4.3.2.2 Alternative DRA2

Alternative DRA2 would meet DEQ’s protectiveness requirement. Excavation and land disposal is proven and would be effective in removing “highly concentrated” hot spot soils and soils that pose a potential unacceptable risk. It would also be a reliable, long-term alternative, especially if soils posing a potential unacceptable risk were removed and engineering and institutional controls were not needed.

Alternative DRA2 would, however, be complicated to implement because it would have many of the same implementability issues and timeframe as source zone Alternative SZ2, especially because it would require dewatering prior to the excavation and treatment of water extracted during dewatering. It would have a moderate implementation risk due to potential impacts to the community associated with transporting between 3,400 and 4,800 CY of hot spot soil to the landfill; this would equate to approximately 136 to 192 truck loads. The implementation risk would increase if soils posing a potential unacceptable risk were also excavated and transported off-site. Like Alternative SZ2, this alternative would have the potential for creating a conduit for contaminated groundwater migration from the perched water-bearing zone to the shallow zone. Assuming the costs to implement Alternative DRA2 are roughly proportional on a soil volume basis to the costs to implement Alternative SZ2 (i.e., approximately $500/CY), the cost address hot spot soils under Alternative DRA2 could range from $1.7M to $2.4M. As was discussed above, given the limited number of soil samples collected in the deed restricted area it is not possible to estimate the volume of soil that would need to be removed to reduce constituent concentrations below acceptable risk levels. The upper end of the volume range would be removal over the entire 1 acre area to an average depth of 8 feet (similar to source zone Alternative SZ2); this would require the excavation of almost 13,000 CY of soil and cost an estimated $6.5M. These costs would be even higher if the excavated soils could not be land disposed and had to be incinerated.

4.3.2.3 Alternative DRA3

Alternative DRA2 would meet DEQ's protectiveness requirement. In-situ stabilization is a proven and effective technology that could be implemented in the deed restricted area. While this technology would reduce the already low mobility of arsenic, chromium and dioxins, it would not reduce their concentration or volume. Thus, the previously implemented engineering and institutional controls would still be required to prevent exposure to soils that are not hot spot soils but still pose a potential unacceptable risk. Implementation of Alternative DRA3 would have many of the same implementability issues as source zone Alternative SZ3. It would have a low to moderate implementation risk to the community associated with transporting excess soils generated by in-situ stabilization for off-site land disposal. Assuming the costs to implement Alternative DRA3 are roughly proportional on a soil volume basis to the costs to implement Alternative SZ3 (i.e., approximately $330/CY), the cost for Alternative DRA3 could range from $1.1M to $1.6M.

Reducing constituent concentrations below hot spot levels through in-situ stabilization could be significantly more costly if larger quantities of surface and/or subsurface soils need to be treated.

4.3.3 Comparative Analysis of Deed Restricted Area Alternatives

Of the three alternatives evaluated for soils in the deed restricted area, all of them either do or would meet DEQ's protectiveness requirement.

All three alternatives are proven and either are or would be effective in achieving protection.

Alternative DRA2 would have the greatest long-term reliability because it would not rely on engineering and institutional controls, if hot spot soils and soils posing a potential unacceptable risk were removed. The reliability of Alternative DRA2 would be the same as the other alternatives if only hot spot soils are removed, because engineering and institutional controls would still be required. Alternatives DRA1 and DRA3 would have similar long-term reliability because both alternatives would require continued implementation of the engineering and institutional controls previously implemented in the deed restricted area.

Alternative DRA1 has already been implemented; thus, it would have no implementation risk. Alternative DRA3 could be implemented in three to six months and would have a low to moderate implementation risk. Alternative DRA2 would be the most complicated to implement and would take longer to implement because it could require dewatering, treatment of water extracted during dewatering, and water treatment system permitting. Alternative DRA3 would also have a higher implementation risk because of the large quantity of excavated soil that would need to be transported to an off-site landfill.

The O&M cost for the existing asphalt cap and institutional controls (i.e., Alternative DRA1) is low (i.e., approximately $29,000) when compared to the several million dollar cost of Alternatives DRA2 and DRA3. The existing asphalt cap and institutional controls have already been implemented. In addition, the asphalt cap is intact and only requires limited maintenance.

The cost to achieve the acceptable risk level through excavation and land disposal is disproportionate to the risk reduction benefits, in that Alternative DRA2 would be 30 to 40 times more costly than Alternative DRA1, if only hot spot soils were removed, and it would still require implementation of the same engineering and institutional controls that already exist under Alternative DRA1; these controls have proven to be effective and reliable in managing the risks associated with exposure to impacted soils for 20 years. The relative difference in cost would even be higher if soils posing a potential unacceptable risk were also removed under Alternative DRA2. The cost of Alternative DRA3 is even more disproportionate given that the engineering and institutional controls included in Alternative DRA1 would still be required after implementing Alternative DRA3.

Alternative DRA1 does not meet DEQ's preference for treatment or removal of hot spots. However, neither does Alternative DRA3. While Alternative DRA3 would reduce the already low mobility of arsenic, chromium and dioxins, it would not reduce their concentration or volume. The only alternative that would fully meet DEQ's preference for removal or treatment of hot spots, is Alternative DRA2. Even though Alternative DRA2 would achieve DEQ's hot spot criteria, it would do so at a cost that exceeds DEQ's higher cost threshold for removal or treatment of hot spots.

Note that given the long-term reliability of the Alternative DRA1 engineering and institutional controls, in combination with the IRM subsurface barrier wall, the hot spot soils in the deed restricted would not meet DEQ's definition of "not reliably containable."

Given the implementability issues and significant cost associated with Alternative DRA2, when compared to the existing Alternative DRA1 engineering and institutional controls which are protective, proven, and effective, it is justifiable to select Alternative DRA1 to be part of the final remedy.

Table 22 further summarizes the comparative analysis of the deed restricted area alternatives.

4.4 Slough Sediment Remedial Alternative Evaluation

4.4.1 Slough Sediment Alternative Description

4.4.1.1 Alternative Sed1

Alternative Sed1 is the no action alternative. Under this alternative, the Slough sediments containing arsenic, chromium, copper and zinc would remain in place without any engineering or institutional controls. Hot spot sediments located at the upper end of the drainage ditch would also remain in place.

4.4.1.2 Alternative Sed2

Alternative Sed2 would involve mixing ditch sediments containing zinc above its ecological hot spot level near the upper end of the ditch and other sediments containing arsenic, chromium, copper and zinc at concentrations that pose a potential unacceptable risk to ecological receptors with cement to stabilize them in place. In-situ stabilization would be performed from the dam upstream a distance of approximately 1,500 feet (Figure 15). Prior to conducting in-situ stabilization, the drainage ditch would be dewatered and the existing vegetation and sediment attached to root material would need to be removed. It is estimated that approximately 700 CY of plant debris and sediments would need to be removed and disposed off-site in a Subtitle C landfill. Cement would be added at 15 percent by weight and mixed to a depth of 2 feet on the bottom and 0.5 feet on the side slopes. It is estimated that approximately 6,200 CY of sediments would need to be stabilized. The stabilized sediments would be formed/graded using an excavator bucket during the mixing process. The ditch would then be returned to its present service for management of mill storm water.

Alternative Sed2 would involve the implementation of deed restriction and activity restrictions for the ditch sediments, consistent with those previously implemented and proven institutional controls for the deed restricted area.

Annual inspections were assumed. As needed, cracks would be repaired approximately every five years with cement.

4.4.1.3 Alternative Sed3

Alternative Sed3 would involve the replacement of the drainage ditch with: 1) a sump and pump placed at the end of the culvert installed as part of the IRM and a new pipeline to Frasier Lake and 2) a pipeline to convey storm water that currently discharges into the eastern portion of the drainage ditch to the existing sump and pump; the existing sump and pump are located between the two roadways that cross over the ditch near the southeast corner of the subsurface barrier wall (Figure 17). The drainage ditch would be backfilled with clean soil to match the surrounding grade. If needed, the backfill would be graded to drain toward one or both of the sumps. Prior to installing the new sump, catch basins, and pipelines, the drainage ditch would be dewatered and ditch sediments would be stabilized to prevent settlement in the portions of the ditch where pipelines are placed. This would include sediments in the upper end of the ditch that are considered a hot spot. Stabilization of ditch sediments prior to the installation of the pipeline would provide for hot spot treatment by reducing the mobility of the metals in the ditch sediments. The new sump and pump would be installed at the end of the culvert installed as part of the IRM. The sump would be connected to the culvert and to a pipeline that would run from the sump up the ditch, under the road and discharge to Frasier Lake at approximately the same location as the pipeline from the existing sump and pump discharges to Frasier Lake (Figure 17). Although not shown on Figure 17, storm water discharged to Frasier Lake is pumped to the east to the mill wastewater treatment system for treatment in accordance with their Storm Water Pollution Control Plan and permit. Geotextile fabric would be placed over the ditch sediments so that equipment can compact the first few lifts of backfill material. The final step would be to hydroseed the backfill for erosion control.

Alternative SS3 would involve the implementation of deed restriction and activity restrictions for the ditch sediments, consistent with those previously implemented and proven institutional controls for the deed restricted area.

For cost estimating purposes, it was assumed that the backfilled areas would be inspected one year after implementation and repairs would be performed if settlement was observed. It was assumed that the vegetative cover would be permanently established after one year.

4.4.1.4 Alternative Sed4

Alternative Sed4 would involve the excavation of impacted sediments over an approximately 1,500 foot length of the drainage ditch. Prior to conducting sediment removal, the drainage ditch would be dewatered and existing vegetation would be removed.

For cost estimating purposes, it is assumed that 2 feet of sediment would be removed from the bottom of the ditch and 1 foot would be removed from the sidewalls. Approximately 6,150 CY of sediments would need to be removed. Sediment samples would be collected to confirm that arsenic, chromium, copper and zinc concentrations were reduced to protective levels. The excavated areas would be backfilled, compacted and graded to match the prior ditch slope.

The excavated soils would be managed following the same process that was used to manage excess soils and wood debris generated during IRM construction. The ditch would be divided into segments based on metals concentrations. Composite sediment samples would be collected from each segment and analyzed. The analytical results would be used to determine whether the sediments classify as a hazardous waste. For purposes of the FS, it is assumed that the soils would not classify as a hazardous waste and that approximately 85 percent of the soils would be disposed at a Subtitle D landfill. The remaining soils would be disposed at a Subtitle C landfill.

4.4.2 Analysis of Individual Slough Sediment Alternatives

Table 28 summarizes the individual analysis of the four Slough sediment remedial alternatives.

4.4.2.1 Alternative Sed1

Alternative Sed1, the no action alternative, would not meet DEQ’s protectiveness requirement. Based on the ERA, the risks to the environment would be potentially unacceptable. For this reason, Alternative Sed1 would not be effective in achieving protection. The long-term reliability, implementability and implementation risk of Alternative Sed1 were not evaluated. There would be no cost associated with the implementation of Alternative Sed1. Alternative Sed1 would not reduce constituent concentrations below hot spot levels.

4.4.2.2 Alternative Sed2

Alternative Sed2, in-situ stabilization, may be protective because it would reduce the potential for ecological receptor exposure to sediments containing arsenic, chromium, copper and zinc. Stabilization of the sediments would reduce the bioavailability of the metals and would not provide a suitable habitat for benthic organisms. Alternative Sed2 is readily implementable; there are no permitting requirements or necessary authorizations. According to the mill, the Army Corps of Engineers (ACE) does not consider the drainage ditch to be a wetland. The alternative could be fully implemented in three months, if it is conducted in the dry season when storm water inflows to the ditch are limited. The implementation risks are low given that the alternative mainly involves mixing concrete into the ditch sediments and reshaping the bottom and side slopes. There will be some risk to the local community associated with transporting 700 CY of plant debris and associated sediments to the landfill; this would involve approximately 35 truck loads. As is indicated, in Table 28 the capital cost for Alternative Sed2 is approximately $924,000 (rounded) and the net present value (NPV) of one year of inspection and repair costs is approximately $34,000 (rounded), for a total NPV cost of $958,000 (rounded). Table 29 summarizes the detailed analysis of the capital and O&M costs for Alternative Sed2, including the assumed quantities, unit costs, allowances applied to the unit costs, and sources of the unit costs. Stabilization would also reduce the mobility and bioavailability of zinc in the upper portion of the ditch that is a hot spot. As a result, it would partially meet DEQ's preference through treatment by reducing mobility and toxicity; it would not, however, reduce volume.

4.4.2.3 Alternative Sed3

Alternative Sed3, installation of a sump, pump, catch basins, and pipelines, and backfilling the drainage ditch, would be protective because the backfill would be an engineering control that would eliminate ecological receptor exposure to sediments containing arsenic, chromium, copper and zinc. Alternative Sed3 is readily implementable; there are no permitting requirements or necessary authorizations. According to the mill, the ACE does not consider the drainage ditch to be a wetland. The alternative could be fully implemented in three months, if it is conducted in the dry season when storm water inflows to the ditch are limited. The implementation risks are minimal given that the alternative simply involves placing the sump, pump, catch basins and pipelines, and backfilling the ditch. As is indicated, in Table 28 the capital cost for Alternative Sed3 is approximately $698,000 (rounded) and the NPV of one year of inspection and repair costs is $14,000 (rounded), or a total NPV cost of $712,000 (rounded). Table 30 summarizes the detailed analysis of the capital and O&M costs for Alternative Sed3, including the assumed quantities, unit costs, allowances applied to the unit costs, and sources of the unit costs. Stabilization of hot spot ditch sediments and sediments in those portions of the ditch where pipelines would be placed, would also reduce the mobility and bioavailability of metals. As a result, it would partially meet DEQ's preference for hot spot treatment by reducing mobility and toxicity; it would not, however, reduce the hot spot volume.

4.4.2.4 Alternative Sed4

Alternative Sed4, excavation and land disposal, would remove the ditch sediments containing arsenic, chromium, copper and zinc that pose a potential unacceptable risk. The alternative would be effective in achieving protection and would be reliable over the long-term because it does not include any engineering controls. Alternative Sed4 is readily implementable; there are no permitting requirements or necessary authorizations. According to the mill, the ACE does not consider the drainage ditch to be a wetland. The alternative could be fully implemented in three months. The implementation risks are moderate given that the alternative involves the excavation and off-site transport of approximately 6,150 CY of sediments; this would involve approximately 300 truck loads. As is indicated, in Table 28 the capital cost for Alternative Sed4 is approximately $1,763,000 (rounded) and the NPV of one year of inspection and repair costs is $28,000 (rounded), for a total NPV cost of $1,791,000 (rounded). Table 31 summarizes the detailed analysis of the capital and O&M costs for Alternative Sed4, including the assumed quantities, unit costs, allowances applied to the unit costs, and sources of the unit costs. Alternative Sed4 would remove the sediment hot spot.

4.4.3 Comparative Analysis of Slough Sediment Alternatives

Of the four alternatives evaluated for ditch sediments, only Alternatives Sed2, Sed3 and Sed4 would meet DEQ's protectiveness requirement. Sed3 and Sed4 would be effective in achieving protection and in approximately the same amount of time; the potential effectiveness of Sed2 in reducing ecological receptor exposure to metals is less certain.

Alternative Sed4 would have the greatest long-term reliability because it would not rely on the use of engineering controls. Alternative Sed3 would have the next greatest long-term reliability because engineering controls (i.e., backfilling the ditch) would be used to eliminate the potential for ecological receptor. Alternative Sed3 would have a greater long-term reliability than Alternative Sed2 because sump and pipeline would require less maintenance and repair than the stabilized ditch sediments which would be susceptible to cracking and erosion.

All of the ditch sediment alternatives are comparable with respect to their implementability   There are no permitting requirements or authorizations required to implement any of the alternatives. The implementation risk is greatest for Alternative Sed4 because of the large volume of sediments that would need to be hauled to a landfill. Alternative Sed3 would have the next highest implementation risk. Alternative Sed2 would have the lowest implementation.

The primary difference in the three alternatives is their cost. Alternative Sed4 is almost 2 times more costly than Alternative Sed2 and 2.5 times more costly than Alternative Sed3 for essentially the same level of risk reduction.

Alternative Sed4 would meet DEQ's preference for hot spot treatment or removal. Alternatives Sed2 and Sed3 would also result in hot spot treatment through a reduction in mobility and toxicity, but not volume; Alternative Sed3 would further eliminate the condition producing the hot spot because backfilling the ditch would eliminate the potential for ecological receptor exposure to the ditch sediments. Alternative Sed1 would not reduce zinc concentrations below hot spot levels.

Table 22 further summarizes the comparative analysis of the slough sediment alternatives.

4.5 Perched Water-Bearing Zone Remedial Alternative Evaluation

4.5.1 Perched Water-Bearing Zone Alternative Description

4.5.1.1 Alternative GW1

Alternative GW1 would involve continued IRM operations, in combination with MNA for groundwater flowing around the southeast end of the subsurface barrier wall; this is the currently implemented alternative for perched water-bearing zone groundwater. For cost estimating purposes it is assumed that under Alternative GW1, semi-annual monitoring would be performed for two more years in accordance with the DEQ-approved MMP, and then annually thereafter to confirm the effectiveness of the aeration treatment system and monitor the natural attenuation of any constituents that may migrate around the southeast end of the subsurface barrier wall. In addition, Alternative GW1 would include routine sparge line cleanout following the procedure approved by DEQ in February 2008. Dissolved oxygen monitoring conducted since the modified cleanout plan was implemented indicates that the aeration trench can be maintained at conditions conducive to aerobic biodegradation.

4.5.1.2 Alternative GW2

Alternative GW3 would involve construction of a 75-foot-long physical barrier perpendicular to the portion of the subsurface barrier wall that runs parallel to the drainage ditch. The barrier would be constructed at the southeast corner of the barrier wall. The barrier would be installed using jet grouting methods to create a low permeability zone that would extend through the perched water-bearing zone into the underlying silt. The barrier would be keyed into the subsurface barrier wall on its north end and into the silt that runs along the drainage ditch on its south end. The use of jet grouting would allow for the barrier to be constructed without removing the railroad tracks.

Appendix B discusses the results of groundwater modeling conducted to evaluate whether preventing groundwater flow around the southeast end of the subsurface barrier wall would result in significant changes in groundwater flow directions or water level elevations in the perched water-bearing zone. The modeling results indicate that no significant changes in groundwater flow direction (other than stopping flow to the east) would result from this alternative. Groundwater elevations inside the contained area would also not change substantially under this alternative. Closing off flow to the east would slightly increase the flow velocity to the west, decreasing the time for groundwater in the vicinity of PMW-5 to reach the Columbia River from more than 15 years to about 14 years under average rainfall conditions.

4.5.1.3 Alternative GW3

Alternative GW4 would involve continued IRM operations, in combination with in-situ biological treatment through air sparging to prevent migration of constituents around the southeast end of the subsurface barrier wall at concentrations that would result in adverse impacts to the Columbia River. In-situ treatment would be accomplished by injecting oxygen into three rows of air sparge wells (eight total) constructed with their screen set below the water table to the top of the silt. The wells would be connected to a common header that is connected to a blower located in a treatment shed.

4.5.2 Analysis of Individual Perched Water-Bearing Zone Alternatives

Table 32 summarizes the individual analysis of the three perched water-bearing zone groundwater remedial alternatives.

4.5.2.1 Alternative GW1

Alternative GW1, continued IRM operation with MNA at the southeast end of the subsurface barrier wall, is currently meeting DEQ's protectiveness requirement. Three years of semi-annual groundwater monitoring indicates that constituent concentrations in the perched water-bearing zone downgradient of the aeration treatment system and southeast of the subsurface barrier wall are well below SLVs, except for the recent detection of ethylbenzene above its SLV at monitoring well ATT-02 and fluorene above its SLV at monitoring well SBW-05.

Alternative GW1 is currently effective in achieving protection. Monitoring has confirmed that the subsurface barrier wall is acting as an effective no flow boundary. The subsurface barrier wall has eliminated the discharge of perched water-bearing zone groundwater in the seep area containing constituents at concentrations above their SLVs and created longer flow paths to the river allowing constituent concentrations to naturally attenuate. Additional in-situ treatment is provided by the aeration treatment trench for groundwater that flows out of the IRM area to the west. The concentrations of constituents in groundwater between the subsurface barrier and the river have naturally attenuated below SLVs. In addition, the subsurface barrier wall has effectively contained hot spots of contamination in water and protected beneficial uses of water.

Three years of groundwater monitoring indicates that the subsurface barrier wall is a long-term, reliable alternative. Groundwater elevations have generally remained below the top of the barrier wall and land surface even after periods of high rainfall; groundwater elevations approach the land surface near PMW-2 and PMW-6 during periods of high rainfall, much as they did before the IRM was constructed. The IRM has not increased groundwater flow toward the Slough. Although periodic clogging of the aeration treatment system has occurred, dissolved oxygen measurements made after recent sparge line cleanout activities have confirmed that the system can meet treatment objectives if routine cleanouts are performed. There is some uncertainty about whether MNA will be reliable over the long-term for the southeast end of the subsurface barrier wall.

The implementability and implementation risk of Alternative GW1 were not evaluated because the alternative has already been constructed.

As is indicated in Table 32 there is no capital cost for Alternative GW1 because it has been constructed. The NPV of the long-term (i.e., 30 years) O&M cost for inspections and dissolved oxygen monitoring in the aeration trench wells, groundwater elevation measurements, groundwater monitoring, and routine sparge line cleanout for Alternative GW1 is approximately $1,613,000 (rounded). A 30-year O&M timeframe was assumed because DNAPL in the source zones is expected to be a long-term source of dissolved phase constituents. Table 33 summarizes the detailed analysis of the O&M costs for Alternative GW1, including the assumed quantities, unit costs, allowances applied to the unit costs, and sources of the unit costs.

Alternative GW1 provides for active and passive treatment of hot spot contamination in water to levels below those that would result in an adverse effect on beneficial water uses and provides containment for hot spot materials in the source zones. Thus, Alternative GW1 provides for the protection of identified beneficial water uses. In addition, Alternative GW1 protected beneficial water uses within a reasonable time (i.e., the IRM eliminated the discharge of perched water-bearing zone groundwater containing constituent concentrations above SLVs with a year or two of implementation, even in the area between the barrier wall and the river).

4.5.2.2 Alternative GW2

Alternative GW2, continued IRM operation and construction of a physical barrier at southeast end of the subsurface barrier wall, would prevent adverse effects to beneficial water uses and protect human health and the environment. It would eliminate the potential for constituent migration from the former process area source zone around the southeast end of the subsurface barrier wall; all groundwater contained within the subsurface barrier wall would have to flow through the aeration treatment trench. Groundwater monitoring conducted to date has demonstrated that the natural attenuation along the longer groundwater flow paths created by the barrier wall, supplemented by the aeration treatment trench, reduces constituent concentrations below their SLVs.

Alternative GW2 would be effective in achieving protection. Monitoring has confirmed that the subsurface barrier wall is acting as an effective no flow boundary and groundwater flow toward the Slough has not increased. Alternative GW2 would eliminate the potential for constituent migration around the southeast end of the barrier wall. In addition, the subsurface barrier wall has effectively contained hot spots of contamination in water and protected beneficial uses of water.

The subsurface barrier wall portion of Alternative GW2 would be a long-term, reliable alternative. Groundwater modeling results indicate that this alternative would not result in a substantive increase in groundwater elevations or significant increase in the groundwater travel time. The additional segment of physical barrier would not require long-term maintenance or repair, and once it is confirmed that it is serving as a no-flow boundary should be a highly reliable engineering control, particularly given that the perched water-bearing zone is thin and underlain by a continuous silt unit. Although periodic clogging of the aeration treatment system has occurred, dissolved oxygen measurements made after recent sparge line cleanout activities have confirmed that the system can meet treatment objectives if routine cleanouts are performed.

Alternative GW2 is readily implementable; although no permits are needed to implement this alternative, the railroad would likely need to provide an authorization to construct part of the physical barrier in its right of way. The impacts to the community, workers, and the environment are minimal. Alternative GW2 could be implemented in two to three months after receiving approval from the rail road.

As is indicated in Table 32 the capital cost for Alternative GW2 is approximately $301,000 (rounded). The NPV of the long-term (i.e., 30 years) O&M cost for Alternative GW2 is approximately $1,613,000 (rounded). A 30-year O&M timeframe was assumed because DNAPL in the source zones is expected to be a long-term source of dissolved phase constituents. The total NPV cost for this alternative is $1,914,000. Table 34 summarizes the detailed analysis of the capital and O&M costs for Alternative GW2, including the assumed quantities, unit costs, allowances applied to the unit costs, and sources of the unit costs.

Alternative GW2 would provide for active and passive treatment of hot spot contamination in water to levels below those that would result in an adverse effect on beneficial water uses and provides containment for hot spot materials in the source zones. Thus, Alternative GW2 would provide for the protection of identified beneficial water uses. In addition, Alternative GW2 would protect beneficial water uses within a reasonable time.

4.5.2.3 Alternative GW3

Alternative GW3, continued IRM operation and an in-situ treatment at southeast end of the subsurface barrier wall, would prevent adverse effects to beneficial water uses and protect human health and the environment. Based on the effectiveness of the aeration treatment trench, it would likely reduce constituent concentrations below SLVs before groundwater discharges to the river.

Alternative GW3 would be effective in achieving protection. Monitoring has confirmed that the subsurface barrier wall is acting as an effective no flow boundary and groundwater flow toward the Slough has not increased. Alternative GW3 would reduce the concentrations of constituents that might migrate around the southeast end of the barrier wall. The effectiveness of this alternative will depend upon whether sufficient oxygen can be injected into the subsurface to enhance in-situ biodegradation, as well as the types of constituents that may migrate from the former process area source zone. In addition, the subsurface barrier wall has effectively contained hot spots of contamination in water and protected beneficial uses of water.

The subsurface barrier wall portion of Alternative GW3 would be a long-term, reliable alternative. There is some uncertainty regarding the long-term reliability of the air sparging portion of this alternative because the air sparging wells could experience the same clogging problems as the aeration treatment system. Although periodic clogging of the aeration treatment system has occurred, dissolved oxygen measurements made after recent sparge line cleanout activities have confirmed that the system can meet treatment objectives if routine cleanouts are performed. A similar routine cleanout of the air sparging wells could be required for Alternative GW3.

Alternative GW3 is implementable; the substantive requirements for a UIC permit would need to be met for the air sparging system and the railroad would likely need to provide an authorization to install part of the air sparging system in its right of way. The impacts to the community, workers, and the environment are minimal. Alternative GW3 could be implemented in two to three months after meeting the substantive requirements of a UIC permit and obtaining approval from the rail road.

As is indicated in Table 32 the capital cost for Alternative GW3 is approximately $260,000 (rounded). The NPV of the long-term (i.e., 30 years) O&M cost for Alternative GW5 is approximately $2,446,000 (rounded). A 30-year O&M timeframe was assumed because DNAPL in the source zones is expected to be a long-term source of dissolved phase constituents. The total NPV cost for this alternative is $2,706,000. Table 35 summarizes the detailed analysis of the O&M costs for Alternative GW3, including the assumed quantities, unit costs, allowances applied to the unit costs, and sources of the unit costs.

Alternative GW3 would provide for active and passive treatment of hot spot contamination in water to levels below those that would result in an adverse effect on beneficial water uses and provides containment for hot spot materials in the source zones. Thus, Alternative GW3 would provide for the protection of identified beneficial water uses. In addition, Alternative GW3 would protect beneficial water uses within a reasonable time.

4.5.3 Comparative Analysis of Perched Water-Bearing Zone Alternatives

Of the three alternatives evaluated for shallow groundwater, Alternatives GW1, GW2 and GW3 would meet DEQ's protectiveness requirement. Based on the past three years of groundwater monitoring results, Alternative GW1 is currently meeting the protectiveness requirement and it is likely do so into the future. The one area of potential uncertainty is the potential for contaminant migration around the southeast end of the subsurface barrier wall. Alternatives GW2 and GW3 would provide a higher level of protectiveness because Alternative GW2 would eliminate and Alternative GW3 would reduce the potential for contaminant migration via this pathway by supplementing the IRM with an engineering control or in-situ treatment system, respectively, at the southeast end of the subsurface barrier wall.

The groundwater monitoring results indicate that Alternative GW1 is currently effective. The existing subsurface barrier wall adequately manages the risk of untreated constituents by preventing them from migrating directly to the river, and protects existing and reasonably likely future beneficial uses of water. Should future monitoring demonstrate the constituents are migrating around the southeast end of the subsurface barrier wall, Alternative GW2 would increase the adequacy of the engineering controls and Alternative GW3 would provide additional treatment. Of these, Alternative GW2 would be the most effective because it would entirely eliminate the potential for constituent migration. Alternative GW3 may be the less effective than Alternative GW2 because while constituent concentrations would be reduced through treatment, there would still be some constituent migration to the southeast.

Groundwater monitoring results indicate that Alternative GW1 is reliable in the long-term as long as routine sparge line cleanouts are performed. Water level monitoring indicates that Alternative GW1 meets its design objective of generally maintaining groundwater levels below grade even during periods of heavy rainfall and there is no increase in groundwater flow to the Slough. Should future monitoring demonstrate the constituents are migrating around the southeast end of the subsurface barrier wall, Alternative GW2 would have the highest long-term reliability. Extending the subsurface barrier to the south and closing the gap would require no long-term O&M, and would not result in a substantive increase in groundwater elevations or travel times to the river. The long-term reliability of Alternative GW3 is the lowest of any of the alternatives. Well clogging would need to be addressed through routine O&M for Alternative GW4 to be reliable.

Among the alternatives, Alternative GW1 is the easiest to implement. Alternative GW2 is the next easiest alternative to implement; it would only require an authorization from the railroad to conduct construction activities on their right of way. Alternative GW3 would be the most difficult to implement because it would not only require an authorization from the railroad, it would also require meeting the substantive requirements for a UIC permit.

Alternatives GW2 and GW3 are identical with respect to their implementation risks. They could be implemented in two to three months.

The least costly alternative would be Alternative GW1, Alternative GW2 is about 20 percent more costly than Alternative GW1; the only difference in cost is the capital cost of installing the physical barrier. The most costly alternative is Alternative GW3 which is almost 80 percent more costly than Alternative GW1.

Alternative GW1 currently provides for the active and passive treatment of the groundwater hot spot to levels below those that would result in an adverse effect on beneficial water uses and provides for the containment of source zone hot spot materials. Thus, Alternative GW1 provides for the protection of identified beneficial water uses. In addition, Alternative GW1 protected beneficial water uses within a reasonable time.

Should future monitoring demonstrate that constituents are migrating around the southeast end of the subsurface barrier wall at concentrations that could result in an adverse effect on beneficial water uses, Alternatives GW2 and GW3 would both provide active and passive treatment of hot spot contamination in water to levels below those that would result in an adverse effect on beneficial water uses and provide containment for hot spot materials in the source zones. Both alternatives would provide for the protection of identified beneficial water uses and protect beneficial water uses within a reasonable time.

Table 22 further summarizes the comparative analysis of the perched water-bearing zone alternatives.

5.0 RECOMMENDED ALTERNATIVE

Beazer and GP recommend that the final remedy for the Site consist of the following:

Alternative SS3 – Excavate and land dispose surface soils that pose a potential unacceptable risk in the area between the deed restricted area and the paved parking lot, and in the former wigwam burner area.

Alternative SZ1 – No source zone treatment or removal.

Alternative DRA1 – Continued maintenance of the asphalt cap, drainage controls, and institutional controls in the deed restricted area.

Alternative Sed3 – Install a sump, pump, catch basins, and pipelines to convey storm water and backfill the drainage ditch.

Alternative GW1 – Continued IRM operations, in combination with MNA for groundwater flow around the southeast end of the subsurface barrier wall.

The recommended alternative was selected based on the remedial alternative evaluation discussed in Section 4.0 which considered the following remedy evaluation criteria: 1) the protectiveness requirement specified in OAR 340-122-084(4), 2) a balancing of remedy selection factors (effectiveness, long-term reliability, implementability, implementation risk and reasonableness of cost), and 3) the preference to treat hot spots of contamination, if present. Table 22 provides a summary of the comparative evaluation of alternatives. The cumulative score calculated for each potential alternative supports the recommended final remedy. That is, the alternative selected for surface soil, source zone soil and DNAPL, the deed restricted area, drainage ditch sediments, and perched water-bearing zone groundwater was the alternative with the lowest cumulative score.

6.0 REFERENCES

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TABLE 1

Surface Soil Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**EPA-D1**	**EPA-D1**	**EPA-D1**	**EPA-D2**	**EPA-D2**	**EPA-D2**	**EPA-D2**	**EPA-D3**	**EPA-D3**	**EPA-D4**	**EPA-D4**
Sample ID:					1961-J-4	1961J-4	JA958	1961-J-5	JA959	1961-J-6	JA960	1961-J-7	JA961	1961-J-8	1961J-8
QAQC Type:					N	N	N	N	N	FD	FD	N	N	N	N
Depth (ft bgs):															
Date Collected:					10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**											
CONV	Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--	--
CONV	Total Organic Carbon	Percent	--	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/Kg	--	--	--	2.6 =	--	--	--	--	--	--	--	--	3.30E-04 U
DIOXIN	HxCDDs (total)	mg/Kg	--	--	--	0.12 =	--	--	--	--	--	--	--	--	8.00E-05 U
DIOXIN	OCDD	mg/Kg	--	--	--	2.3 =	--	--	--	--	--	--	--	--	0.0022 U
DIOXIN	PeCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	TCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	TEQ	mg/Kg	1.8E-05	1.8E-03	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	HpCDFs (total)	mg/Kg	--	--	--	1.6 =	--	--	--	--	--	--	--	--	4.40E-04 U
FURAN	HxCDFs (total)	mg/Kg	--	--	--	0.18 =	--	--	--	--	--	--	--	--	7.90E-05 U
FURAN	OCDF	mg/Kg	--	--	--	1.2 =	--	--	--	--	--	--	--	--	4.40E-04 U
FURAN	PeCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	TCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Arsenic	mg/Kg	1.8	180	5,860 =	--	--	3.3 =	--	2.1 U	--	1.9 U	--	5.1 =	--
M-TOTAL	Chromium	mg/Kg	450	45,000	10,000 =	--	--	9.3 =	--	7.2 =	--	12 =	--	20 =	--
M-TOTAL	Chromium, Hexavalent	mg/Kg	64	6,400	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Copper	mg/Kg	42,000	420,000	256 =	--	--	8.7 =	--	8.2 =	--	8.8 =	--	11 =	--
M-TOTAL	Iron	mg/Kg	100,000	100,000	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Zinc	mg/Kg	100,000	100,000	--	--	--	--	--	--	--	--	--	--	--
SVOC	2-Chloronaphthalene	mg/Kg	--	--	--	--	0.48 U	--	0.017 =	--	0.014 U	--	0.014 U	--	--
SVOC	Acenaphthene	mg/Kg	33,000	330,000	--	--	5.0 U	--	0.15 U	--	0.15 U	--	0.14 U	--	--
SVOC	Acenaphthylene	mg/Kg	--	--	--	--	25 =	--	0.032 U	--	0.032 U	--	0.032 NJ	--	--
SVOC	Anthracene	mg/Kg	100,000	100,000	--	--	74 =	--	0.070 U	--	0.070 U	--	0.069 U	--	--
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	--	--	2.4 U	--	0.070 U	--	0.070 U	--	0.079 =	--	--
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	--	--	93 =	--	0.084 U	--	0.084 U	--	0.082 U	--	--
SVOC	Benzo(b)fluoranthene	mg/Kg	2.3	230	--	--	130 =	--	0.052 U	--	0.052 U	--	0.052 U	--	--
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	--	--	6.7 U	--	0.20 U	--	0.20 U	--	0.20 U	--	--
SVOC	Benzo(k)fluoranthene	mg/Kg	23	2,300	--	--	11 =	--	0.12 U	--	0.12 U	--	0.12 U	--	--

TABLE 1

Surface Soil Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**EPA-D1**	**EPA-D1**	**EPA-D1**	**EPA-D2**	**EPA-D2**	**EPA-D2**	**EPA-D2**	**EPA-D3**	**EPA-D3**	**EPA-D4**	**EPA-D4**
Sample ID:					1961-J-4	1961J-4	JA958	1961-J-5	JA959	1961-J-6	JA960	1961-J-7	JA961	1961-J-8	1961J-8
QAQC Type:					N	N	N	N	N	FD	FD	N	N	N	N
Depth (ft bgs):															
Date Collected:					10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**											
SVOC	bis(2-Ethylhexyl)phthalate	mg/Kg	140	14,000	--	--	2.7 U	--	0.080 U	--	0.080 J	--	0.079 U	--	--
SVOC	Chrysene	mg/Kg	230	2,300	--	--	230 =	--	0.094 U	--	0.094 U	--	0.13 =	--	--
SVOC	Di-n-butylphthalate	mg/Kg	--	--	--	--	4.6 U	--	0.14 U	--	0.14 =	--	0.13 U	--	--
SVOC	Fluoranthene	mg/Kg	24,000	240,000	--	--	190 NJ	--	0.23 U	--	0.23 U	--	0.23 J	--	--
SVOC	Fluorene	mg/Kg	26,000	260,000	--	--	0.78 U	--	0.023 U	--	0.023 U	--	0.023 U	--	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	--	--	12 U	--	0.35 U	--	0.35 U	--	0.34 U	--	--
SVOC	Naphthalene	mg/Kg	210	2,100	--	--	0.80 U	--	0.024 U	--	0.024 U	--	0.023 U	--	--
SVOC	Pentachlorophenol	mg/Kg	10	1,000	--	--	380 =	--	0.12 U	--	0.12 U	--	0.12 U	--	--
SVOC	Phenanthrene	mg/Kg	--	--	--	--	0.58 U	--	0.017 U	--	0.017 U	--	0.039 =	--	--
SVOC	Pyrene	mg/Kg	32,000	320,000	--	--	180 =	--	0.35 J	--	0.35 U	--	0.34 J	--	--
SVOC	Total Carcinogens	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Creosote	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Diesel	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Gasoline	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--	--
VOC	Chloroform	mg/Kg	0.52	52	--	--	--	--	--	--	--	--	--	--	--
VOC	Ethylbenzene	mg/Kg	230	2,300	--	--	--	--	--	--	--	--	--	--	--
VOC	Xylene(total)	mg/Kg	210	2,100	--	--	--	--	--	--	--	--	--	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health
Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 1

Surface Soil Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**EPA-D4**	**EPA-DC1**	**EPA-DC1**	**EPA-DC1**	**SB-06**	**SB-07**	**SB-08**	**SB-09**	**SB-10**
Sample ID:					JA962	1961-J-9	1961J-9	JA963	SB06-0.5	SB07-0.5	SB08-0.5	SB09-0.5	SB10-0.5
QAQC Type:					N	N	N	N	N	N	N	N	N
Depth (ft bgs):									0.5	0.5	0.5	0.5	0.5
Date Collected:					10/25/85	10/25/85	10/25/85	10/25/85	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**									
CONV	Moisture	%	--	--	--	--	--	--	--	--	--	--	--
CONV	Total Organic Carbon	Percent	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	--	--	--	--	--	--	3.93E-04 =	8.22E-05 =	8.46E-05 =	1.93E-05 =	1.44E-04 =
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	8.35E-06 =	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	--	--	--	--	--	--	5.12E-06 =	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U
DIOXIN	1,2,3,7,8-PeCDD	mg/Kg	--	--	--	--	--	--	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U
DIOXIN	2,3,7,8-TCDD	mg/Kg	--	--	--	--	--	--	1.00E-06 U	1.00E-06 U	1.00E-06 U	1.00E-06 U	1.00E-06 U
DIOXIN	HpCDDs (total)	mg/Kg	--	--	--	--	0.51 =	--	0.0011 =	2.06E-04 =	2.74E-04 =	5.57E-05 =	4.61E-04 =
DIOXIN	HxCDDs (total)	mg/Kg	--	--	--	--	0.035 =	--	9.22E-05 =	2.77E-05 =	2.49E-05 =	9.70E-06 =	7.48E-05 =
DIOXIN	OCDD	mg/Kg	--	--	--	--	0.40 =	--	0.0039 =	5.49E-04 =	7.03E-04 =	1.57E-04 =	0.0012 =
DIOXIN	PeCDDs (total)	mg/Kg	--	--	--	--	--	--	1.21E-05 =	4.85E-06 =	3.69E-06 =	1.96E-06 =	3.03E-05 =
DIOXIN	TCDDs (total)	mg/Kg	--	--	--	--	--	--	5.93E-06 =	1.11E-06 =	1.25E-06 =	1.07E-06 =	1.93E-05 =
DIOXIN	TEQ	mg/Kg	1.8E-05	1.8E-03	--	--	--	--	7.86E-06 =	1.31E-06 =	1.22E-06 =	2.10E-07 =	1.78E-06 =
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	--	--	--	--	--	--	1.41E-04 =	4.24E-05 =	2.95E-05 =	5.00E-06 U	2.18E-05 =
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	--	--	--	--	--	--	9.13E-06 =	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	6.27E-06 =	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U
FURAN	1,2,3,7,8,9-HxCDF	mg/Kg	--	--	--	--	--	--	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U
FURAN	1,2,3,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U
FURAN	2,3,4,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U	5.00E-06 U
FURAN	2,3,7,8-TCDF	mg/Kg	--	--	--	--	--	--	1.00E-06 U	1.00E-06 U	1.00E-06 U	1.00E-06 U	1.00E-06 U
FURAN	HpCDFs (total)	mg/Kg	--	--	--	--	0.044 =	--	6.63E-04 =	1.30E-04 =	1.10E-04 =	1.91E-05 =	1.11E-04 =
FURAN	HxCDFs (total)	mg/Kg	--	--	--	--	0.0051 =	--	1.61E-04 =	3.61E-05 =	3.08E-05 =	5.15E-06 =	2.74E-05 =
FURAN	OCDF	mg/Kg	--	--	--	--	0.087 =	--	6.10E-04 =	1.27E-04 =	9.67E-05 =	1.63E-05 =	9.58E-05 =
FURAN	PeCDFs (total)	mg/Kg	--	--	--	--	--	--	2.06E-05 =	7.03E-06 =	6.53E-06 =	1.33E-06 =	4.08E-06 =
FURAN	TCDFs (total)	mg/Kg	--	--	--	--	--	--	8.73E-06 =	1.86E-06 =	2.27E-06 =	1.00E-05 U	5.33E-06 =
M-TOTAL	Arsenic	mg/Kg	1.8	180	--	283 =	--	--	14 =	11 =	14 =	16 =	75 =
M-TOTAL	Chromium	mg/Kg	450	45,000	--	584 =	--	--	25 =	20 =	25 =	13 =	52 =
M-TOTAL	Chromium, Hexavalent	mg/Kg	64	6,400	--	--	--	--	0.081 =	0.0039 =	0.016 =	0.0083 =	0.0052 J
M-TOTAL	Copper	mg/Kg	42,000	420,000	--	10 =	--	--	20 =	24 =	28 =	21 =	28 =
M-TOTAL	Iron	mg/Kg	100,000	100,000	--	--	--	--	--	--	--	--	--
M-TOTAL	Zinc	mg/Kg	100,000	100,000	--	--	--	--	102 =	84 =	101 =	123 =	132 =
SVOC	2-Chloronaphthalene	mg/Kg	--	--	0.020 =	--	--	0.42 U	0.48 U	0.48 U	0.47 U	0.48 U	0.44 U
SVOC	Acenaphthene	mg/Kg	33,000	330,000	0.15 U	--	--	4.3 U	0.48 U	0.48 U	0.47 U	0.48 U	0.44 U
SVOC	Acenaphthylene	mg/Kg	--	--	0.034 U	--	--	4.1 =	0.48 U	0.48 U	0.47 U	0.48 U	0.44 U
SVOC	Anthracene	mg/Kg	100,000	100,000	0.074 U	--	--	13 =	0.48 U	0.48 U	0.47 U	0.48 U	0.44 U
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	0.074 U	--	--	2.1 U	0.083 J	0.028 J	0.034 J	0.48 U	0.44 U
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	0.089 U	--	--	12 =	0.084 J	0.48 U	0.47 U	0.48 U	0.44 U
SVOC	Benzo(b)fluoranthene	mg/Kg	2.3	230	0.055 U	--	--	17 =	0.10 J	0.48 U	0.47 U	0.48 U	0.44 U
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	--	--	--	--	--	--	--	--	--
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	0.21 U	--	--	5.9 U	0.066 J	0.48 U	0.47 U	0.48 U	0.44 U
SVOC	Benzo(k)fluoranthene	mg/Kg	23	2,300	0.13 U	--	--	3.5 U	0.044 J	0.48 U	0.47 U	0.48 U	0.44 U

TABLE 1
Surface Soil Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**EPA-D4**	**EPA-DC1**	**EPA-DC1**	**EPA-DC1**	**SB-06**	**SB-07**	**SB-08**	**SB-09**	**SB-10**
Sample ID:					JA962	1961-J-9	1961J-9	JA963	SB06-0.5	SB07-0.5	SB08-0.5	SB09-0.5	SB10-0.5
QAQC Type:					N	N	N	N	N	N	N	N	N
Depth (ft bgs):									0.5	0.5	0.5	0.5	0.5
Date Collected:					10/25/85	10/25/85	10/25/85	10/25/85	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**									
SVOC	bis(2-Ethylhexyl)phthalate	mg/Kg	140	14,000	0.085 U	--	--	2.4 U	0.48 U	0.48 U	0.47 U	0.48 U	0.44 U
SVOC	Chrysene	mg/Kg	230	2,300	0.10 U	--	--	30 =	0.094 J	0.031 J	0.030 J	0.48 U	0.44 U
SVOC	Di-n-butylphthalate	mg/Kg	--	--	0.14 U	--	--	4.0 U	0.48 U	0.031 J	0.47 U	0.033 J	0.44 U
SVOC	Fluoranthene	mg/Kg	24,000	240,000	0.24 J	--	--	110 =	0.17 J	0.034 J	0.070 J	0.48 U	0.44 U
SVOC	Fluorene	mg/Kg	26,000	260,000	0.024 U	--	--	0.68 U	0.48 U	0.48 U	0.47 U	0.48 U	0.44 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	0.37 U	--	--	10 U	0.049 J	0.48 U	0.47 U	0.48 U	0.44 U
SVOC	Naphthalene	mg/Kg	210	2,100	0.025 NJ	--	--	0.70 U	0.48 U	0.48 U	0.47 U	0.48 U	0.44 U
SVOC	Pentachlorophenol	mg/Kg	10	1,000	0.13 U	--	--	9.9 J	2.4 U	2.4 U	2.4 U	2.4 U	2.2 U
SVOC	Phenanthrene	mg/Kg	--	--	0.018 U	--	--	1.3 =	0.064 J	0.48 U	0.047 J	0.48 U	0.44 U
SVOC	Pyrene	mg/Kg	32,000	320,000	0.37 J	--	--	95 =	0.15 J	0.058 J	0.056 J	0.48 U	0.032 J
SVOC	Total Carcinogens	mg/Kg	--	--	--	--	--	--	--	--	--	--	--
TPH	Creosote	mg/Kg	--	--	--	--	--	--	--	--	--	--	--
TPH	Diesel	mg/Kg	--	--	--	--	--	--	--	--	--	--	--
TPH	Gasoline	mg/Kg	--	--	--	--	--	--	--	--	--	--	--
VOC	Chloroform	mg/Kg	0.52	52	--	--	--	--	--	--	--	--	--
VOC	Ethylbenzene	mg/Kg	230	2,300	--	--	--	--	--	--	--	--	--
VOC	Xylene(total)	mg/Kg	210	2,100	--	--	--	--	--	--	--	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health
Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 1

Surface Soil Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SS-01**	**SS-01**	**SS-02**	**SS-03**	**SS-04**	**SS-05**
Sample ID:					SS1-0_5-031601-0	SS1-0_5-031601-1	SS2-0_5-031601-0	SS3-0_5-031601-0	SS4-0_5-031601-0	SS5-0_5-031601-0
QAQC Type:					N	FD	N	N	N	N
Depth (ft bgs):					0.5	0.5	0.5	0.5	0.5	0.5
Date Collected:					03/16/01	03/16/01	03/16/01	03/16/01	03/16/01	03/16/01
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**						
CONV	Moisture	%	--	--	24 =	22 =	18 =	20 =	18 =	9.5 =
CONV	Total Organic Carbon	Percent	--	--	0.78 =	0.36 =	0.44 =	0.69 =	2.5 =	0.080 =
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	--	--	1.87E-04 =	--	6.69E-04 =	0.0028 =	0.023 =	1.64E-05 =
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	--	--	1.52E-06 =	--	6.59E-06 =	2.41E-05 =	8.19E-05 =	4.12E-07 U
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	--	--	4.17E-06 =	--	1.34E-05 =	5.49E-05 =	7.92E-04 =	5.81E-07 U
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	--	--	2.18E-06 =	--	8.24E-06 =	3.68E-05 =	1.65E-04 =	4.21E-07 U
DIOXIN	1,2,3,7,8-PeCDD	mg/Kg	--	--	3.89E-07 U	--	1.65E-06 =	8.87E-06 =	1.94E-05 =	1.67E-07 U
DIOXIN	2,3,7,8-TCDD	mg/Kg	--	--	8.78E-08 U	--	2.18E-07 =	1.60E-06 =	1.01E-06 =	1.86E-07 U
DIOXIN	HpCDDs (total)	mg/Kg	--	--	8.46E-04 =	--	0.0035 =	0.017 =	0.041 =	3.02E-05 =
DIOXIN	HxCDDs (total)	mg/Kg	--	--	6.66E-05 =	--	3.29E-04 =	0.0014 =	0.0031 =	2.43E-06 =
DIOXIN	OCDD	mg/Kg	--	--	0.0024 =	--	0.0072 =	0.034 =	0.21 =	1.89E-04 =
DIOXIN	PeCDDs (total)	mg/Kg	--	--	1.32E-06 =	--	1.71E-05 =	6.99E-05 =	1.16E-04 =	--
DIOXIN	TCDDs (total)	mg/Kg	--	--	1.67E-06 =	--	1.18E-05 =	1.12E-05 =	6.71E-04 =	2.30E-06 =
DIOXIN	TEQ	mg/Kg	1.8E-05	1.8E-03	3.97E-06 =	--	1.56E-05 =	6.59E-05 =	5.93E-04 =	2.37E-07 =
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	--	--	4.64E-05 =	--	1.27E-04 =	4.53E-04 =	0.0076 =	5.14E-06 =
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	--	--	3.96E-06 =	--	1.05E-05 =	3.43E-05 =	7.37E-04 =	4.36E-07 U
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	--	--	2.34E-06 =	--	6.99E-06 =	2.28E-05 =	4.99E-04 =	2.02E-07 U
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	--	--	6.32E-07 =	--	2.25E-06 =	1.07E-05 =	1.24E-04 =	1.95E-07 U
FURAN	1,2,3,7,8,9-HxCDF	mg/Kg	--	--	3.09E-07 U	--	1.91E-06 =	5.15E-06 =	1.29E-04 =	3.26E-07 U
FURAN	1,2,3,7,8-PeCDF	mg/Kg	--	--	1.59E-07 U	--	4.83E-07 =	1.66E-06 =	2.00E-05 =	2.19E-07 U
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	--	--	1.08E-06 =	--	3.04E-06 =	1.40E-05 =	1.58E-04 =	1.69E-07 U
FURAN	2,3,4,7,8-PeCDF	mg/Kg	--	--	2.76E-07 =	--	1.21E-06 =	4.80E-06 =	7.26E-05 =	1.97E-07 U
FURAN	2,3,7,8-TCDF	mg/Kg	--	--	1.49E-07 U	--	2.58E-07 =	8.63E-07 U	2.66E-06 =	1.77E-07 U
FURAN	HpCDFs (total)	mg/Kg	--	--	2.43E-04 =	--	6.31E-04 =	0.0022 =	0.041 =	1.92E-05 =
FURAN	HxCDFs (total)	mg/Kg	--	--	5.59E-05 =	--	1.53E-04 =	5.88E-04 =	0.0097 =	1.56E-05 =
FURAN	OCDF	mg/Kg	--	--	2.32E-04 =	--	6.17E-04 =	0.0020 =	0.044 =	2.21E-05 =
FURAN	PeCDFs (total)	mg/Kg	--	--	4.96E-06 =	--	1.71E-05 =	1.26E-04 =	0.0010 =	1.01E-06 =
FURAN	TCDFs (total)	mg/Kg	--	--	5.12E-07 =	--	2.91E-06 =	1.98E-05 =	2.94E-04 =	--
M-TOTAL	Arsenic	mg/Kg	1.8	180	12 =	9.0 =	12 =	176 =	96 =	2.7 =
M-TOTAL	Chromium	mg/Kg	450	45,000	13 =	13 =	22 =	43 =	70 =	10 =
M-TOTAL	Chromium, Hexavalent	mg/Kg	64	6,400	1.7 U	1.7 U	4.0 U	4.1 U	4.0 U	0.25 =
M-TOTAL	Copper	mg/Kg	42,000	420,000	8.2 =	8.7 =	10 =	34 =	26 =	6.0 =
M-TOTAL	Iron	mg/Kg	100,000	100,000	12,000 =	11,700 =	18,200 =	55,700 =	35,000 =	8,760 =
M-TOTAL	Zinc	mg/Kg	100,000	100,000	39 =	37 =	49 =	84 =	183 =	22 =
SVOC	2-Chloronaphthalene	mg/Kg	--	--	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Acenaphthene	mg/Kg	33,000	330,000	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Acenaphthylene	mg/Kg	--	--	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Anthracene	mg/Kg	100,000	100,000	0.87 U	1.2 =	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Benzo(b)fluoranthene	mg/Kg	2.3	230	0.87 U	0.85 U	0.80 U	0.82 U	0.30 J	0.73 U
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	--	--	--	--	--	--
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Benzo(k)fluoranthene	mg/Kg	23	2,300	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U

TABLE 1

Surface Soil Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SS-01**	**SS-01**	**SS-02**	**SS-03**	**SS-04**	**SS-05**
Sample ID:					SS1-0_5-031601-0	SS1-0_5-031601-1	SS2-0_5-031601-0	SS3-0_5-031601-0	SS4-0_5-031601-0	SS5-0_5-031601-0
QAQC Type:					N	FD	N	N	N	N
Depth (ft bgs):					0.5	0.5	0.5	0.5	0.5	0.5
Date Collected:					03/16/01	03/16/01	03/16/01	03/16/01	03/16/01	03/16/01
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**						
SVOC	bis(2-Ethylhexyl)phthalate	mg/Kg	140	14,000	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Chrysene	mg/Kg	230	2,300	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Di-n-butylphthalate	mg/Kg	--	--	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Fluoranthene	mg/Kg	24,000	240,000	0.87 U	0.85 U	0.80 U	0.82 U	0.26 J	0.73 U
SVOC	Fluorene	mg/Kg	26,000	260,000	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Naphthalene	mg/Kg	210	2,100	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Pentachlorophenol	mg/Kg	10	1,000	4.2 U	4.1 U	3.9 U	0.56 J	2.2 J	3.6 U
SVOC	Phenanthrene	mg/Kg	--	--	0.87 U	0.24 J	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Pyrene	mg/Kg	32,000	320,000	0.87 U	0.85 U	0.80 U	0.82 U	0.80 U	0.73 U
SVOC	Total Carcinogens	mg/Kg	--	--	--	--	--	--	--	--
TPH	Creosote	mg/Kg	--	--	--	--	--	--	--	--
TPH	Diesel	mg/Kg	--	--	8.8 J	13 =	8.0 J	22 =	420 =	2.3 J
TPH	Gasoline	mg/Kg	--	--	1.3 U	1.3 U	1.2 U	1.2 U	1.2 U	1.1 U
VOC	Chloroform	mg/Kg	0.52	52	0.0066 U	0.0064 U	0.0061 U	0.0062 U	9.10E-04 J	0.0056 U
VOC	Ethylbenzene	mg/Kg	230	2,300	0.0066 U	0.0064 U	0.0061 U	0.0062 U	0.0061 U	0.0056 U
VOC	Xylene(total)	mg/Kg	210	2,100	--	--	--	--	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 1

Surface Soil Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SS-06**	**SS-07**	**SS-08**	**SS-09**	**SS-10**	**SS-11**	**SS-12**	**SS-13**	**SS-14**	**SS-15**
Sample ID:					SS0600	SS0700	SS0800	SS0900	SS1000	SS1100	SS1200	SS130711030	SS140711030	SS150711030
QAQC Type:					N	N	N	N	N	N	N	N	N	N
Depth (ft bgs):					0	0	0	0	0	0	0	0.5 ft	0.5 ft	0.5 ft
Date Collected:					12/03/01	12/03/01	12/03/01	12/03/01	12/03/01	12/03/01	12/03/01	07/11/03	07/11/03	07/11/03
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
CONV	Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--
CONV	Total Organic Carbon	Percent	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	--	--	4.18E-04 =	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	--	--	4.90E-06 U	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	--	--	6.15E-06 =	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	--	--	4.90E-06 U	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/Kg	--	--	4.90E-06 U	--	--	--	--	--	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/Kg	--	--	1.00E-06 U	--	--	--	--	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/Kg	--	--	0.0024 =	--	--	--	--	--	--	--	--	--
DIOXIN	HxCDDs (total)	mg/Kg	--	--	1.41E-04 =	--	--	--	--	--	--	--	--	--
DIOXIN	OCDD	mg/Kg	--	--	0.0037 =	--	--	--	--	--	--	--	--	--
DIOXIN	PeCDDs (total)	mg/Kg	--	--	2.88E-06 =	--	--	--	--	--	--	--	--	--
DIOXIN	TCDDs (total)	mg/Kg	--	--	2.58E-07 =	--	--	--	--	--	--	--	--	--
DIOXIN	TEQ	mg/Kg	1.8E-05	1.8E-03	5.93E-06 =	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	--	--	6.70E-05 =	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	--	--	5.95E-06 =	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	--	--	4.90E-06 U	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	--	--	4.90E-06 U	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/Kg	--	--	4.90E-06 U	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/Kg	--	--	4.90E-06 U	--	--	--	--	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	--	--	4.90E-06 U	--	--	--	--	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/Kg	--	--	4.90E-06 U	--	--	--	--	--	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/Kg	--	--	1.00E-06 U	--	--	--	--	--	--	--	--	--
FURAN	HpCDFs (total)	mg/Kg	--	--	3.85E-04 =	--	--	--	--	--	--	--	--	--
FURAN	HxCDFs (total)	mg/Kg	--	--	9.12E-05 =	--	--	--	--	--	--	--	--	--
FURAN	OCDF	mg/Kg	--	--	3.51E-04 =	--	--	--	--	--	--	--	--	--
FURAN	PeCDFs (total)	mg/Kg	--	--	4.14E-06 =	--	--	--	--	--	--	--	--	--
FURAN	TCDFs (total)	mg/Kg	--	--	9.22E-07 =	--	--	--	--	--	--	--	--	--
M-TOTAL	Arsenic	mg/Kg	1.8	180	2.7 =	4.9 =	2.6 =	8.5 =	3.2 =	3.2 =	2.7 =	6.7 =	2.2 J	4.0 =
M-TOTAL	Chromium	mg/Kg	450	45,000	5.5 =	--	--	--	--	--	--	--	--	--
M-TOTAL	Chromium, Hexavalent	mg/Kg	64	6,400	0.021 =	--	--	--	--	--	--	--	--	--
M-TOTAL	Copper	mg/Kg	42,000	420,000	4.1 =	--	--	--	--	--	--	--	--	--
M-TOTAL	Iron	mg/Kg	100,000	100,000	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Zinc	mg/Kg	100,000	100,000	31 =	--	--	--	--	--	--	66 =	65 =	44 =
SVOC	2-Chloronaphthalene	mg/Kg	--	--	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Acenaphthene	mg/Kg	33,000	330,000	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Acenaphthylene	mg/Kg	--	--	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Anthracene	mg/Kg	100,000	100,000	0.35 J	--	--	--	--	--	--	--	--	--
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Benzo(b)fluoranthene	mg/Kg	2.3	230	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Benzo(k)fluoranthene	mg/Kg	23	2,300	0.35 U	--	--	--	--	--	--	--	--	--

TABLE 1

Surface Soil Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SS-06**	**SS-07**	**SS-08**	**SS-09**	**SS-10**	**SS-11**	**SS-12**	**SS-13**	**SS-14**	**SS-15**
Sample ID:					SS0600	SS0700	SS0800	SS0900	SS1000	SS1100	SS1200	SS130711030	SS140711030	SS150711030
QAQC Type:					N	N	N	N	N	N	N	N	N	N
Depth (ft bgs):					0	0	0	0	0	0	0	0.5 ft	0.5 ft	0.5 ft
Date Collected:					12/03/01	12/03/01	12/03/01	12/03/01	12/03/01	12/03/01	12/03/01	07/11/03	07/11/03	07/11/03
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
SVOC	bis(2-Ethylhexyl)phthalate	mg/Kg	140	14,000	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Chrysene	mg/Kg	230	2,300	0.030 J	--	--	--	--	--	--	--	--	--
SVOC	Di-n-butylphthalate	mg/Kg	--	--	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Fluoranthene	mg/Kg	24,000	240,000	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Fluorene	mg/Kg	26,000	260,000	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Naphthalene	mg/Kg	210	2,100	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Pentachlorophenol	mg/Kg	10	1,000	1.8 U	--	--	--	--	--	--	--	--	--
SVOC	Phenanthrene	mg/Kg	--	--	0.037 J	--	--	--	--	--	--	--	--	--
SVOC	Pyrene	mg/Kg	32,000	320,000	0.35 U	--	--	--	--	--	--	--	--	--
SVOC	Total Carcinogens	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Creosote	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Diesel	mg/Kg	--	--	1.3 =	--	--	--	--	--	--	--	--	--
TPH	Gasoline	mg/Kg	--	--	4.0 =	--	--	--	--	--	--	--	--	--
VOC	Chloroform	mg/Kg	0.52	52	--	--	--	--	--	--	--	--	--	--
VOC	Ethylbenzene	mg/Kg	230	2,300	--	--	--	--	--	--	--	--	--	--
VOC	Xylene(total)	mg/Kg	210	2,100	--	--	--	--	--	--	--	--	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health
Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 1

Surface Soil Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SS-15**	**SS-16**
Sample ID:					SS150711031	SS160711030
QAQC Type:					FD	N
Depth (ft bgs):					0.5 ft	0.5 ft
Date Collected:					07/11/03	07/11/03
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**		
CONV	Moisture	%	--	--	--	--
CONV	Total Organic Carbon	Percent	--	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/Kg	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/Kg	--	--	--	--
DIOXIN	HpCDDs (total)	mg/Kg	--	--	--	--
DIOXIN	HxCDDs (total)	mg/Kg	--	--	--	--
DIOXIN	OCDD	mg/Kg	--	--	--	--
DIOXIN	PeCDDs (total)	mg/Kg	--	--	--	--
DIOXIN	TCDDs (total)	mg/Kg	--	--	--	--
DIOXIN	TEQ	mg/Kg	1.8E-05	1.8E-03	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/Kg	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/Kg	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/Kg	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/Kg	--	--	--	--
FURAN	HpCDFs (total)	mg/Kg	--	--	--	--
FURAN	HxCDFs (total)	mg/Kg	--	--	--	--
FURAN	OCDF	mg/Kg	--	--	--	--
FURAN	PeCDFs (total)	mg/Kg	--	--	--	--
FURAN	TCDFs (total)	mg/Kg	--	--	--	--
M-TOTAL	Arsenic	mg/Kg	1.8	180	4.1 =	4.9 =
M-TOTAL	Chromium	mg/Kg	450	45,000	--	--
M-TOTAL	Chromium, Hexavalent	mg/Kg	64	6,400	--	--
M-TOTAL	Copper	mg/Kg	42,000	420,000	--	--
M-TOTAL	Iron	mg/Kg	100,000	100,000	--	--
M-TOTAL	Zinc	mg/Kg	100,000	100,000	45 =	52 =
SVOC	2-Chloronaphthalene	mg/Kg	--	--	--	--
SVOC	Acenaphthene	mg/Kg	33,000	330,000	--	--
SVOC	Acenaphthylene	mg/Kg	--	--	--	--
SVOC	Anthracene	mg/Kg	100,000	100,000	--	--
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	--	--
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	--	--
SVOC	Benzo(b)fluoranthene	mg/Kg	2.3	230	--	--
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	--	--
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	--	--
SVOC	Benzo(k)fluoranthene	mg/Kg	23	2,300	--	--

TABLE 1
Surface Soil Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SS-15**	**SS-16**
Sample ID:					SS150711031	SS160711030
QAQC Type:					FD	N
Depth (ft bgs):					0.5 ft	0.5 ft
Date Collected:					07/11/03	07/11/03
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**		
SVOC	bis(2-Ethylhexyl)phthalate	mg/Kg	140	14,000	--	--
SVOC	Chrysene	mg/Kg	230	2,300	--	--
SVOC	Di-n-butylphthalate	mg/Kg	--	--	--	--
SVOC	Fluoranthene	mg/Kg	24,000	240,000	--	--
SVOC	Fluorene	mg/Kg	26,000	260,000	--	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	--	--
SVOC	Naphthalene	mg/Kg	210	2,100	--	--
SVOC	Pentachlorophenol	mg/Kg	10	1,000	--	--
SVOC	Phenanthrene	mg/Kg	--	--	--	--
SVOC	Pyrene	mg/Kg	32,000	320,000	--	--
SVOC	Total Carcinogens	mg/Kg	--	--	--	--
TPH	Creosote	mg/Kg	--	--	--	--
TPH	Diesel	mg/Kg	--	--	--	--
TPH	Gasoline	mg/Kg	--	--	--	--
VOC	Chloroform	mg/Kg	0.52	52	--	--
VOC	Ethylbenzene	mg/Kg	230	2,300	--	--
VOC	Xylene(total)	mg/Kg	210	2,100	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 2

Unsaturated Subsurface Soil (2.5 feet bgs) Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					B-10A	B-11A	B-12A	B-13A	B-14A	B-15A	B-16A	B-17A	B-20A	B-21A
Sample ID:					B-10A	B-11A	B-12A	B-13A	B-14A	B-15A	B-16A	B-17A	B-20A	B-21A
QAQC Type:					N	N	N	N	N	N	N	N	N	N
Depth (ft bgs):					2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Date Collected:					08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/26/98	08/26/98
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
CONV	Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--
CONV	Total Organic Carbon	Percent	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	HxCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	OCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	PeCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	TCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	TEQ	mg/Kg	1.8E-05	1.8E-03	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	HpCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	HxCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	OCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	PeCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	TCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Arsenic	mg/Kg	1.8	180	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
M-TOTAL	Chromium	mg/Kg	450	45,000	20 U	40 =	20 =	20 U	86 =	20 U	217 =	20 U	20 U	20 U
M-TOTAL	Chromium, Hexavalent	mg/Kg	64	6,400	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Copper	mg/Kg	42,000	420,000	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Iron	mg/Kg	100,000	100,000	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Zinc	mg/Kg	100,000	100,000	--	--	--	--	--	--	--	--	--	--
SVOC	2-Chloronaphthalene	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
SVOC	Acenaphthene	mg/Kg	33,000	330,000	8.8 =	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Acenaphthylene	mg/Kg	--	--	35 =	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Anthracene	mg/Kg	100,000	100,000	340 =	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	0.40 U	0.10 U	0.10 U	0.10 UC	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	0.40 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Benzo(b)fluoranthene	mg/Kg	2.3	230	--	--	--	--	--	--	--	--	--	--
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	0.40 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--

TABLE 2

Unsaturated Subsurface Soil (2.5 feet bgs) Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					B-10A	B-11A	B-12A	B-13A	B-14A	B-15A	B-16A	B-17A	B-20A	B-21A
Sample ID:					B-10A	B-11A	B-12A	B-13A	B-14A	B-15A	B-16A	B-17A	B-20A	B-21A
QAQC Type:					N	N	N	N	N	N	N	N	N	N
Depth (ft bgs):					2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Date Collected:					08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/26/98	08/26/98
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	0.40 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Benzo(k)fluoranthene	mg/Kg	23	2,300	--	--	--	--	--	--	--	--	--	--
SVOC	bis(2-Ethylhexyl)phthalate	mg/Kg	140	14,000	--	--	--	--	--	--	--	--	--	--
SVOC	Chrysene	mg/Kg	230	23,000	0.40 U	0.10 U	0.10 U	0.15 =	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Di-n-butylphthalate	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
SVOC	Fluoranthene	mg/Kg	24,000	240,000	200 =	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Fluorene	mg/Kg	26,000	260,000	86 =	0.10 U	0.10 U	0.29 =	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	0.40 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Naphthalene	mg/Kg	210	2,100	320 =	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Pentachlorophenol	mg/Kg	10	1,000	4.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	--
SVOC	Phenanthrene	mg/Kg	--	--	90 =	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Pyrene	mg/Kg	32,000	320,000	48 =	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
SVOC	Total Carcinogens	mg/Kg	--	--	0.40 U	0.10 U	0.10 U	0.15 =	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	--
TPH	Creosote	mg/Kg	--	--	19,000 =	200 U	200 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
TPH	Diesel	mg/Kg	--	--	40 U	200 U	200 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
TPH	Gasoline	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
VOC	Chloroform	mg/Kg	0.52	52	--	--	--	--	--	--	--	--	--	--
VOC	Ethylbenzene	mg/Kg	230	2,300	--	--	--	--	--	--	--	--	--	--
VOC	Xylene(total)	mg/Kg	210	2,100	--	--	--	--	--	--	--	--	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 2
Unsaturated Subsurface Soil (2.5 feet bgs) Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					B-22A	B-25A	B-27A	B-29A	B-2A	B-30A	B-31A	B-3A	B-4A	B-4A
Sample ID:					B-22A	B-25A	B-27A	B-29A	B-2A	B-30A	B-31A	B-3A	B-4A	B-4A
QAQC Type:					N	N	N	N	N	N	N	N	N	FD
Depth (ft bgs):					2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Date Collected:					08/26/98	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98	08/24/98	08/24/98	08/24/98
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
CONV	Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--
CONV	Total Organic Carbon	Percent	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	--	--	--	--	--	--	3.30E-05 =	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	1.80E-07 U	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	9.30E-07 U	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	--	--	--	--	--	--	3.00E-07 U	--	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/Kg	--	--	--	--	--	--	1.80E-07 U	--	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/Kg	--	--	--	--	--	--	1.40E-07 U	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/Kg	--	--	--	--	--	--	7.00E-05 =	--	--	--	--	--
DIOXIN	HxCDDs (total)	mg/Kg	--	--	--	--	--	--	1.10E-06 U	--	--	--	--	--
DIOXIN	OCDD	mg/Kg	--	--	--	--	--	--	2.50E-04 =	--	--	--	--	--
DIOXIN	PeCDDs (total)	mg/Kg	--	--	--	--	--	--	1.80E-07 U	--	--	--	--	--
DIOXIN	TCDDs (total)	mg/Kg	--	--	--	--	--	--	2.50E-07 U	--	--	--	--	--
DIOXIN	TEQ	mg/Kg	1.8E-05	1.8E-03	--	--	--	--	7.34E-07 =	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	--	--	--	--	--	--	1.10E-05 =	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	--	--	--	--	--	--	1.70E-06 U	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	5.70E-07 U	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	2.80E-07 U	--	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/Kg	--	--	--	--	--	--	2.20E-07 U	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	9.00E-08 U	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	2.10E-07 U	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	9.70E-08 U	--	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/Kg	--	--	--	--	--	--	8.50E-08 U	--	--	--	--	--
FURAN	HpCDFs (total)	mg/Kg	--	--	--	--	--	--	5.20E-05 =	--	--	--	--	--
FURAN	HxCDFs (total)	mg/Kg	--	--	--	--	--	--	1.30E-05 =	--	--	--	--	--
FURAN	OCDF	mg/Kg	--	--	--	--	--	--	4.40E-05 =	--	--	--	--	--
FURAN	PeCDFs (total)	mg/Kg	--	--	--	--	--	--	5.30E-07 U	--	--	--	--	--
FURAN	TCDFs (total)	mg/Kg	--	--	--	--	--	--	4.80E-07 U	--	--	--	--	--
M-TOTAL	Arsenic	mg/Kg	1.8	180	20 U	20 U	20 U	20 U	--	20 U	20 U	20 U	--	92 =
M-TOTAL	Chromium	mg/Kg	450	45,000	20 U	20 U	20 U	20 U	--	20 U	20 U	20 U	--	68 =
M-TOTAL	Chromium, Hexavalent	mg/Kg	64	6,400	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Copper	mg/Kg	42,000	420,000	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Iron	mg/Kg	100,000	100,000	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Zinc	mg/Kg	100,000	100,000	--	--	--	--	--	--	--	--	--	--
SVOC	2-Chloronaphthalene	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
SVOC	Acenaphthene	mg/Kg	33,000	330,000	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	0.20 U	--
SVOC	Acenaphthylene	mg/Kg	--	--	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	0.58 =	--
SVOC	Anthracene	mg/Kg	100,000	100,000	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	0.90 =	--
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	3.2 =	--
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	0.20 U	--
SVOC	Benzo(b)fluoranthene	mg/Kg	2.3	230	--	--	--	--	--	--	--	--	--	--
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	1.9 =	--

TABLE 2

Unsaturated Subsurface Soil (2.5 feet bgs) Detections Screened
Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					B-22A	B-25A	B-27A	B-29A	B-2A	B-30A	B-31A	B-3A	B-4A	B-4A
Sample ID:					B-22A	B-25A	B-27A	B-29A	B-2A	B-30A	B-31A	B-3A	B-4A	B-4A
QAQC Type:					N	N	N	N	N	N	N	N	N	FD
Depth (ft bgs):					2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Date Collected:					08/26/98	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98	08/24/98	08/24/98	08/24/98
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	0.20 U	--
SVOC	Benzo(k)fluoranthene	mg/Kg	23	2,300	--	--	--	--	--	--	--	--	--	--
SVOC	bis(2-Ethylhexyl)phthalate	mg/Kg	140	14,000	--	--	--	--	--	--	--	--	--	--
SVOC	Chrysene	mg/Kg	230	23,000	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	3.9 =	--
SVOC	Di-n-butylphthalate	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
SVOC	Fluoranthene	mg/Kg	24,000	240,000	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	0.30 =	--
SVOC	Fluorene	mg/Kg	26,000	260,000	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	0.36 =	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	2.0 =	--
SVOC	Naphthalene	mg/Kg	210	2,100	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	0.20 U	--
SVOC	Pentachlorophenol	mg/Kg	10	1,000	--	1.0 U	1.0 U	1.0 U	--	1.0 U	1.0 U	1.0 U	3.9 =	--
SVOC	Phenanthrene	mg/Kg	--	--	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	0.36 =	--
SVOC	Pyrene	mg/Kg	32,000	320,000	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	0.30 =	--
SVOC	Total Carcinogens	mg/Kg	--	--	--	0.10 U	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	11 =	--
TPH	Creosote	mg/Kg	--	--	20 U	20 U	20 U	20 U	--	20 U	20 U	20 U	--	40 U
TPH	Diesel	mg/Kg	--	--	20 U	20 U	20 U	20 U	--	20 U	20 U	20 U	--	40 U
TPH	Gasoline	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
VOC	Chloroform	mg/Kg	0.52	52	--	--	--	--	--	--	--	--	--	--
VOC	Ethylbenzene	mg/Kg	230	2,300	--	--	--	--	--	--	--	--	--	--
VOC	Xylene(total)	mg/Kg	210	2,100	--	--	--	--	--	--	--	--	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health
Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 2

Unsaturated Subsurface Soil (2.5 feet bgs) Detections Screened
Against EPA Region 6 Screening Levels and Hot Spot Levels
Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					B-4A	B-5A	B-6A	B-7A	B-8A	B-9A
Sample ID:					B-4A FD	B-5A	B-6A	B-7A	B-8A	B-9A
QAQC Type:					FD	N	N	N	N	N
Depth (ft bgs):					2.5	2.5	2.5	2.5	2.5	2.5
Date Collected:					08/24/98	08/26/98	08/24/98	08/25/98	08/25/98	08/25/98
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**						
CONV	Moisture	%	--	--	--	--	--	--	--	--
CONV	Total Organic Carbon	Percent	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	--	--	--	--	--	--	0.070 =	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	8.80E-05 J	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	0.0016 =	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	--	--	--	--	--	--	8.10E-05 J	--
DIOXIN	1,2,3,7,8-PeCDD	mg/Kg	--	--	--	--	--	--	2.60E-06 U	--
DIOXIN	2,3,7,8-TCDD	mg/Kg	--	--	--	--	--	--	7.20E-07 U	--
DIOXIN	HpCDDs (total)	mg/Kg	--	--	--	--	--	--	0.28 =	--
DIOXIN	HxCDDs (total)	mg/Kg	--	--	--	--	--	--	0.015 =	--
DIOXIN	OCDD	mg/Kg	--	--	--	--	--	--	0.71 E	--
DIOXIN	PeCDDs (total)	mg/Kg	--	--	--	--	--	--	1.10E-04 =	--
DIOXIN	TCDDs (total)	mg/Kg	--	--	--	--	--	--	5.80E-06 U	--
DIOXIN	TEQ	mg/Kg	1.8E-05	1.8E-03	--	--	--	--	0.0020 =	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	--	--	--	--	--	--	0.020 =	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	--	--	--	--	--	--	0.0016 =	--
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	7.10E-04 =	--
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	1.20E-04 =	--
FURAN	1,2,3,7,8,9-HxCDF	mg/Kg	--	--	--	--	--	--	2.40E-05 U	--
FURAN	1,2,3,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	2.10E-05 U	--
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	5.20E-05 J	--
FURAN	2,3,4,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	1.50E-05 U	--
FURAN	2,3,7,8-TCDF	mg/Kg	--	--	--	--	--	--	9.60E-07 U	--
FURAN	HpCDFs (total)	mg/Kg	--	--	--	--	--	--	0.15 =	--
FURAN	HxCDFs (total)	mg/Kg	--	--	--	--	--	--	0.024 =	--
FURAN	OCDF	mg/Kg	--	--	--	--	--	--	0.10 =	--
FURAN	PeCDFs (total)	mg/Kg	--	--	--	--	--	--	6.70E-05 =	--
FURAN	TCDFs (total)	mg/Kg	--	--	--	--	--	--	7.90E-05 U	--
M-TOTAL	Arsenic	mg/Kg	1.8	180	--	9,090 =	20 U	110 =	20 U	20 U
M-TOTAL	Chromium	mg/Kg	450	45,000	--	7,020 =	53 =	412 =	95 =	20 U
M-TOTAL	Chromium, Hexavalent	mg/Kg	64	6,400	--	--	--	--	--	--
M-TOTAL	Copper	mg/Kg	42,000	420,000	--	--	--	--	--	--
M-TOTAL	Iron	mg/Kg	100,000	100,000	--	--	--	--	--	--
M-TOTAL	Zinc	mg/Kg	100,000	100,000	--	--	--	--	--	--
SVOC	2-Chloronaphthalene	mg/Kg	--	--	--	--	--	--	--	--
SVOC	Acenaphthene	mg/Kg	33,000	330,000	0.20 U	140 =	0.10 U	0.20 U	23 =	0.10 U
SVOC	Acenaphthylene	mg/Kg	--	--	1.1 =	54 =	0.10 U	0.72 =	38 =	0.10 U
SVOC	Anthracene	mg/Kg	100,000	100,000	0.56 =	214 =	0.10 U	8.5 =	13 =	0.10 U
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	2.4 =	49 =	0.10 U	0.20 UC	0.20 UC	0.10 U
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	0.20 U	2.0 U	0.10 U	0.20 U	14 =	0.10 U
SVOC	Benzo(b)fluoranthene	mg/Kg	2.3	230	--	--	--	--	--	--
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	2.0 =	32 =	0.10 U	0.20 U	0.20 U	0.10 U

TABLE 2

Unsaturated Subsurface Soil (2.5 feet bgs) Detections Screened Against EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					B-4A	B-5A	B-6A	B-7A	B-8A	B-9A
Sample ID:					B-4A FD	B-5A	B-6A	B-7A	B-8A	B-9A
QAQC Type:					FD	N	N	N	N	N
Depth (ft bgs):					2.5	2.5	2.5	2.5	2.5	2.5
Date Collected:					08/24/98	08/26/98	08/24/98	08/25/98	08/25/98	08/25/98
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**						
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	0.20 U	52 =	0.10 U	0.72 =	0.84 =	0.10 U
SVOC	Benzo(k)fluoranthene	mg/Kg	23	2,300	--	--	--	--	--	--
SVOC	bis(2-Ethylhexyl)phthalate	mg/Kg	140	14,000	--	--	--	--	--	--
SVOC	Chrysene	mg/Kg	230	23,000	3.4 =	32 =	0.10 U	0.64 =	108 =	0.10 U
SVOC	Di-n-butylphthalate	mg/Kg	--	--	--	--	--	--	--	--
SVOC	Fluoranthene	mg/Kg	24,000	240,000	0.36 =	209 =	0.10 U	7.2 =	284 =	0.10 U
SVOC	Fluorene	mg/Kg	26,000	260,000	0.44 =	64 =	0.10 U	2.6 =	40 =	0.10 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	1.5 =	2.0 U	0.10 U	0.20 U	0.58 =	0.10 U
SVOC	Naphthalene	mg/Kg	210	2,100	0.20 U	31 =	0.10 U	1.1 =	11 =	0.10 U
SVOC	Pentachlorophenol	mg/Kg	10	1,000	3.8 =	20 U	1.0 U	370 =	454 =	1.0 U
SVOC	Phenanthrene	mg/Kg	--	--	0.18 =	2.0 UC	0.10 U	0.20 UC	30 =	0.10 U
SVOC	Pyrene	mg/Kg	32,000	320,000	0.52 =	192 =	0.10 U	2.6 =	200 =	0.10 U
SVOC	Total Carcinogens	mg/Kg	--	--	9.3 =	113 =	0.10 U	0.64 =	122 =	0.10 U
TPH	Creosote	mg/Kg	--	--	--	1,530 =	200 U	8,500 *	11,000 *	200 U
TPH	Diesel	mg/Kg	--	--	--	400 U	200 U	40 U	40 U	200 U
TPH	Gasoline	mg/Kg	--	--	--	--	--	--	--	--
VOC	Chloroform	mg/Kg	0.52	52	--	--	--	0.050 U	--	--
VOC	Ethylbenzene	mg/Kg	230	2,300	--	--	--	0.73 =	--	--
VOC	Xylene(total)	mg/Kg	210	2,100	--	--	--	0.23 =	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 3

Unsaturated Subsurface Soil (5 and 7.5 feet bgs) Detections

Screened to EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**B-18B**	**B-19B**	**B-23C**	**B-23C**	**B-23C**	**B-26B**	**B-2B**	**B-5B**	**B-9B**	**SB-05**
Sample ID:					B-18B	B-19B	B-23C	B-23C	B-23C FD	B-26B	B-2B	B-5B	B-9B	SB054031501-0
QAQC Type:					N	N	N	FD	FD	N	N	N	N	N
Depth (ft bgs):					5	5	7.5	7.5	7.5	5	5	5	5	4
Date Collected:					08/26/98	08/26/98	08/26/98	08/26/98	08/26/98	08/27/98	08/24/98	08/24/98	08/25/98	03/15/01
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
CONV	Moisture	%	--	--	--	--	--	--	--	--	--	--	--	26 =
CONV	Total Organic Carbon	Percent	--	--	--	--	--	--	--	--	--	--	--	26 =
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	0.047 =
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	1.32E-04 =
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	6.85E-04 =
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	1.69E-04 =
DIOXIN	HpCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	0.39 =
DIOXIN	HxCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	0.022 =
DIOXIN	OCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	0.55 =
DIOXIN	PeCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	3.29E-04 =
DIOXIN	TCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	1.19E-05 =
DIOXIN	TEQ	mg/Kg	1.80E-05	1.80E-03	--	--	--	--	--	--	--	--	--	7.45E-04 =
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	0.0062 =
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	4.19E-04 =
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	1.78E-04 =
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	8.70E-05 =
FURAN	1,2,3,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	1.38E-05 =
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	9.49E-05 =
FURAN	2,3,4,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	2.58E-05 =
FURAN	HpCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	0.038 =
FURAN	HxCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	0.0066 =
FURAN	OCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	0.043 =
FURAN	PeCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	3.21E-04 =
FURAN	TCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	1.51E-05 =
M-TOTAL	Arsenic	mg/Kg	1.8	180	20 U	20 U	--	20 U	--	20 U	1,200 =	2,900 =	20 U	240 =
M-TOTAL	Chromium	mg/Kg	450	45,000	20 U	20 U	--	20 U	--	20 U	4,100 =	7,500 =	20 U	181 =
M-TOTAL	Chromium, Hexavalent	mg/Kg	64	6,400	--	--	--	--	--	--	--	--	--	8.8 U
M-TOTAL	Copper	mg/Kg	42,000	420,000	--	--	--	--	--	--	--	--	--	65 =
M-TOTAL	Zinc	mg/Kg	100,000	100,000	--	--	--	--	--	--	--	--	--	102 =

TABLE 3

Unsaturated Subsurface Soil (5 and 7.5 feet bgs) Detections
Screened to EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**B-18B**	**B-19B**	**B-23C**	**B-23C**	**B-23C**	**B-26B**	**B-2B**	**B-5B**	**B-9B**	**SB-05**
Sample ID:					B-18B	B-19B	B-23C	B-23C	B-23C FD	B-26B	B-2B	B-5B	B-9B	SB054031501-0
QAQC Type:					N	N	N	FD	FD	N	N	N	N	N
Depth (ft bgs):					5	5	7.5	7.5	7.5	5	5	5	5	4
Date Collected:					08/26/98	08/26/98	08/26/98	08/26/98	08/26/98	08/27/98	08/24/98	08/24/98	08/25/98	03/15/01
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
SVOC	2,4-Dimethylphenol	mg/Kg	14,000	140,000	--	--	--	--	--	--	--	--	--	170 =
SVOC	2-Methylnaphthalene	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	8,600 D
SVOC	2-Methylphenol	mg/Kg	34,000	340,000	--	--	--	--	--	--	--	--	--	120 =
SVOC	4-Methylphenol	mg/Kg	3,400	34,000	--	--	--	--	--	--	--	--	--	220 =
SVOC	Acenaphthene	mg/Kg	33,000	330,000	0.10 U	0.10 U	--	0.10 U	--	0.10 U	22 =	0.20 U	0.90 =	4,400 D
SVOC	Acenaphthylene	mg/Kg	--	--	0.10 U	0.10 U	--	0.10 U	--	0.10 U	410 =	2.6 =	0.10 U	110 =
SVOC	Anthracene	mg/Kg	100,000	100,000	0.10 U	0.10 U	--	0.10 U	--	0.10 U	160 =	3.0 =	1.1 =	100,000 D
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	0.10 U	0.10 U	--	0.10 U	--	0.10 U	120 =	0.20 U	0.10 U	1,600 D
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	0.10 U	0.10 U	--	0.10 U	--	0.10 U	15 =	0.20 U	0.10 U	530 =
SVOC	Benzo(b)fluoranthene	mg/Kg	2.3	230	--	--	--	--	--	--	--	--	--	760 D
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	0.10 U	0.10 U	--	0.27 =	--	0.10 U	84 =	0.20 U	0.10 U	--
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	0.10 U	0.10 U	--	0.10 U	--	0.10 U	7.2 =	0.20 U	0.10 U	130 =
SVOC	Benzo(k)fluoranthene	mg/Kg	23	2,300	--	--	--	--	--	--	--	--	--	390 =
SVOC	Chrysene	mg/Kg	230	23,000	0.10 U	0.10 U	--	0.10 U	--	0.10 U	84 =	0.20 U	0.10 U	11,000 D
SVOC	Dibenzofuran	mg/Kg	1,700	17,000	--	--	--	--	--	--	--	--	--	6,200 D
SVOC	Fluoranthene	mg/Kg	24,000	240,000	0.10 U	0.10 U	--	0.10 U	--	0.10 U	580 =	0.20 U	0.20 =	5,100 D
SVOC	Fluorene	mg/Kg	26,000	260,000	0.10 U	0.58 =	--	0.10 U	--	0.10 U	260 =	0.20 U	1.3 =	14,000 D
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	0.10 U	0.10 U	--	0.10 U	--	0.10 U	19 =	0.20 U	0.10 U	160 =
SVOC	Naphthalene	mg/Kg	210	2,100	0.10 U	0.10 U	--	0.10 U	--	0.10 U	260 =	4.6 =	14 =	13,000 D
SVOC	Pentachlorophenol	mg/Kg	10	1,000	1.0 U	1.0 U	--	1.0 U	--	1.0 U	830 =	2.0 U	1.0 U	340 U
SVOC	Phenanthrene	mg/Kg	--	--	0.10 U	0.10 U	--	0.10 U	--	0.10 U	730 =	0.20 UC	0.10 UC	24,000 D
SVOC	Phenol	mg/Kg	100,000	100,000	--	--	--	--	--	--	--	--	--	180 =
SVOC	Pyrene	mg/Kg	32,000	320,000	0.10 U	0.10 U	--	0.10 U	--	0.10 U	520 =	0.20 U	0.30 =	3,300 D
SVOC	Total Carcinogens	mg/Kg	--	--	0.10 U	0.10 U	--	0.27 =	--	0.10 U	322 =	0.20 U	0.10 U	--
TPH	Creosote	mg/Kg	--	--	20 U	20 U	20 U	--	20 U	20 U	23,000 =	40 U	200 U	--
TPH	Diesel	mg/Kg	--	--	20 U	20 U	20 U	--	20 U	20 U	80 U	40 U	200 U	440,000 =
TPH	Heavy Oil	mg/Kg	--	--	40 U	40 U	180 =	--	140 =	40 U	160 U	80 U	400 U	--

TABLE 3

Unsaturated Subsurface Soil (5 and 7.5 feet bgs) Detections
Screened to EPA Region 6 Screening Levels and Hot Spot Levels
Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**B-18B**	**B-19B**	**B-23C**	**B-23C**	**B-23C**	**B-26B**	**B-2B**	**B-5B**	**B-9B**	**SB-05**
Sample ID:					B-18B	B-19B	B-23C	B-23C	B-23C FD	B-26B	B-2B	B-5B	B-9B	SB054031501-0
QAQC Type:					N	N	N	FD	FD	N	N	N	N	N
Depth (ft bgs):					5	5	7.5	7.5	7.5	5	5	5	5	4
Date Collected:					08/26/98	08/26/98	08/26/98	08/26/98	08/26/98	08/27/98	08/24/98	08/24/98	08/25/98	03/15/01
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
VOC	1,2,4-Trimethylbenzene	mg/Kg	170	1,700	--	--	--	--	--	--	--	--	--	38 D
VOC	1,3,5-Trimethylbenzene	mg/Kg	70	700	--	--	--	--	--	--	--	--	--	16 D
VOC	Benzene	mg/Kg	1.5	150	--	--	--	--	--	--	0.050 U	--	--	1.3 DJ
VOC	Chlorobenzene	mg/Kg	460	4,600	--	--	--	--	--	--	--	--	--	0.0050 J
VOC	Chloroform	mg/Kg	0.52	52	--	--	--	--	--	--	0.050 U	--	--	0.012 J
VOC	Ethylbenzene	mg/Kg	230	2,300	--	--	--	--	--	--	1.8 =	--	--	16 D
VOC	Isopropylbenzene	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	2.8 DJ
VOC	m,p-Xylene	mg/Kg	210	2,100	--	--	--	--	--	--	--	--	--	33 D
VOC	Methylene Chloride	mg/Kg	21	2,100	--	--	--	--	--	--	--	--	--	0.010 J
VOC	n-Propylbenzene	mg/Kg	240	2,400	--	--	--	--	--	--	--	--	--	0.84 DJ
VOC	o-Xylene	mg/Kg	280	2,800	--	--	--	--	--	--	--	--	--	16 D
VOC	p-Isopropyltoluene	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	2.0 DJ
VOC	sec-Butylbenzene	mg/Kg	220	2,200	--	--	--	--	--	--	--	--	--	0.36 =
VOC	Styrene	mg/Kg	1,700	17,000	--	--	--	--	--	--	--	--	--	10 D
VOC	Toluene	mg/Kg	520	5,200	--	--	--	--	--	--	0.15 =	--	--	13 D
VOC	Trichloroethylene	mg/Kg	0.092	9.2	--	--	--	--	--	--	0.050 U	--	--	0.042 =
VOC	Xylene(total)	mg/Kg	--	--	--	--	--	--	--	--	3.7 =	--	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health
Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 3

Unsaturated Subsurface Soil (5 and 7.5 feet bgs) Detections

Screened to EPA Region 6 Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SB-06**	**SB-06**	**SB-07**	**SB-07**	**SB-08**	**SB-08**	**SB-09**	**SB-09**	**SB-10**	**SB-10**
Sample ID:					SB06-2.0	SB06-4.0	SB07-2.0	SB07-4.0	SB08-2.0	SB08-4.0	SB09-2.0	SB09-4.0	SB10-2.0	SB10-4.0
QAQC Type:					N	N	N	N	N	N	N	N	N	N
Depth (ft bgs):					2.0	4.0	2.0	4.0	2.0	4.0	2.0	4.0	2.0	4.0
Date Collected:					11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
CONV	Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--
CONV	Total Organic Carbon	Percent	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	HxCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	OCDD	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	PeCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	TCDDs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	TEQ	mg/Kg	1.80E-05	1.80E-03	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	HpCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	HxCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	OCDF	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	PeCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	TCDFs (total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Arsenic	mg/Kg	1.8	180	2.8 =	2.7 =	2.6 =	3.5 =	3.6 =	2.9 =	3.1 =	3.9 =	3.8 =	3.5 =
M-TOTAL	Chromium	mg/Kg	450	45,000	4.8 =	4.8 =	5.8 =	4.3 =	3.7 =	4.2 =	3.5 =	3.2 =	4.9 =	4.9 =
M-TOTAL	Chromium, Hexavalent	mg/Kg	64	6,400	0.013 =	0.016 =	0.010 =	0.010 =	0.0081 =	0.0044 U	0.0044 U	0.0027 J	0.0077 =	0.029 =
M-TOTAL	Copper	mg/Kg	42,000	420,000	8.8 =	6.7 =	5.6 =	8.3 =	5.5 =	5.5 =	4.7 =	4.8 =	4.9 =	5.2 =
M-TOTAL	Zinc	mg/Kg	100,000	100,000	32 =	31 =	31 =	165 =	31 =	30 =	30 =	28 =	32 =	31 =

TABLE 3

Unsaturated Subsurface Soil (5 and 7.5 feet bgs) Detections
Screened to EPA Region 6 Screening Levels and Hot Spot Levels
Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SB-06**	**SB-06**	**SB-07**	**SB-07**	**SB-08**	**SB-08**	**SB-09**	**SB-09**	**SB-10**	**SB-10**
Sample ID:					SB06-2.0	SB06-4.0	SB07-2.0	SB07-4.0	SB08-2.0	SB08-4.0	SB09-2.0	SB09-4.0	SB10-2.0	SB10-4.0
QAQC Type:					N	N	N	N	N	N	N	N	N	N
Depth (ft bgs):					2.0	4.0	2.0	4.0	2.0	4.0	2.0	4.0	2.0	4.0
Date Collected:					11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
SVOC	2,4-Dimethylphenol	mg/Kg	14,000	140,000	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	2-Methylnaphthalene	mg/Kg	--	--	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	2-Methylphenol	mg/Kg	34,000	340,000	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	4-Methylphenol	mg/Kg	3,400	34,000	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Acenaphthene	mg/Kg	33,000	330,000	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Acenaphthylene	mg/Kg	--	--	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Anthracene	mg/Kg	100,000	100,000	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Benzo(b)fluoranthene	mg/Kg	2.3	230	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Benzo(k)fluoranthene	mg/Kg	23	2,300	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Chrysene	mg/Kg	230	23,000	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Dibenzofuran	mg/Kg	1,700	17,000	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Fluoranthene	mg/Kg	24,000	240,000	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.021 J	0.36 U	0.37 U	0.39 U
SVOC	Fluorene	mg/Kg	26,000	260,000	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Naphthalene	mg/Kg	210	2,100	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Pentachlorophenol	mg/Kg	10	1,000	1.8 U	1.8 U	1.8 U	1.9 U	1.9 U	1.9 U	1.8 U	1.8 U	1.9 U	1.9 U
SVOC	Phenanthrene	mg/Kg	--	--	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Phenol	mg/Kg	100,000	100,000	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.36 U	0.36 U	0.37 U	0.39 U
SVOC	Pyrene	mg/Kg	32,000	320,000	0.36 U	0.37 U	0.37 U	0.39 U	0.38 U	0.37 U	0.019 U	0.36 U	0.37 U	0.39 U
SVOC	Total Carcinogens	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Creosote	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Diesel	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
TPH	Heavy Oil	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--

TABLE 3

Unsaturated Subsurface Soil (5 and 7.5 feet bgs) Detections
Screened to EPA Region 6 Screening Levels and Hot Spot Levels
Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SB-06**	**SB-06**	**SB-07**	**SB-07**	**SB-08**	**SB-08**	**SB-09**	**SB-09**	**SB-10**	**SB-10**
Sample ID:					SB06-2.0	SB06-4.0	SB07-2.0	SB07-4.0	SB08-2.0	SB08-4.0	SB09-2.0	SB09-4.0	SB10-2.0	SB10-4.0
QAQC Type:					N	N	N	N	N	N	N	N	N	N
Depth (ft bgs):					2.0	4.0	2.0	4.0	2.0	4.0	2.0	4.0	2.0	4.0
Date Collected:					11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01	11/28/01
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
VOC	1,2,4-Trimethylbenzene	mg/Kg	170	1,700	--	--	--	--	--	--	--	--	--	--
VOC	1,3,5-Trimethylbenzene	mg/Kg	70	700	--	--	--	--	--	--	--	--	--	--
VOC	Benzene	mg/Kg	1.5	150	--	--	--	--	--	--	--	--	--	--
VOC	Chlorobenzene	mg/Kg	460	4,600	--	--	--	--	--	--	--	--	--	--
VOC	Chloroform	mg/Kg	0.52	52	--	--	--	--	--	--	--	--	--	--
VOC	Ethylbenzene	mg/Kg	230	2,300	--	--	--	--	--	--	--	--	--	--
VOC	Isopropylbenzene	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
VOC	m,p-Xylene	mg/Kg	210	2,100	--	--	--	--	--	--	--	--	--	--
VOC	Methylene Chloride	mg/Kg	21	2,100	--	--	--	--	--	--	--	--	--	--
VOC	n-Propylbenzene	mg/Kg	240	2,400	--	--	--	--	--	--	--	--	--	--
VOC	o-Xylene	mg/Kg	280	2,800	--	--	--	--	--	--	--	--	--	--
VOC	p-Isopropyltoluene	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--
VOC	sec-Butylbenzene	mg/Kg	220	2,200	--	--	--	--	--	--	--	--	--	--
VOC	Styrene	mg/Kg	1,700	17,000	--	--	--	--	--	--	--	--	--	--
VOC	Toluene	mg/Kg	520	5,200	--	--	--	--	--	--	--	--	--	--
VOC	Trichloroethylene	mg/Kg	0.092	9.2	--	--	--	--	--	--	--	--	--	--
VOC	Xylene(total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health
Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 4
Saturated SubsurfaceSoil Detections Screened to EPA Region 6 Screening Levels and Hot Spot Levels
Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**B-10C**	**B-11C**	**B-12D**	**B-13C**	**B-14C**	**B-15C**	**B-16D**	**B-17C**	**B-19E**	**B-1C**
Sample ID:					B-10C	B-11C	B-12D	B-13C	B-14C	B-15C	B-16D	B-17C	B-19E	B-1C
QAQC Type:					N	N	N	N	N	N	N	FD	N	N
Depth (ft bgs):					7.5	7.5	10	7.5	7.5	7.5	10	7.5	12.5	7.5
Date Collected:					08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/26/98	08/24/98
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
M-TOTAL	Arsenic	mg/Kg	1.8	180	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
M-TOTAL	Chromium	mg/Kg	450	45,000	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	230 =
SVOC	Acenaphthene	mg/Kg	33,000	330,000	0.65 =	17 =	20 =	--	--	--	103 =	--	--	120 =
SVOC	Acenaphthylene	mg/Kg	--	--	4.1 =	3.7 =	38 =	--	--	--	5.5 =	--	--	490 =
SVOC	Anthracene	mg/Kg	100,000	100,000	20 =	2.7 =	9.6 =	--	--	--	66 =	--	--	15,000 =
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	0.10 UC	1.4 =	3.3 =	--	--	--	19 =	--	--	3,330 =
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	0.10 U	0.31 =	1.7 =	--	--	--	1.2 =	--	--	120 =
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	0.10 U	0.89 =	2.3 =	--	--	--	6.3 =	--	--	340 =
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	0.16 =	0.17 =	0.30 =	--	--	--	0.93 =	--	--	88 =
SVOC	Chrysene	mg/Kg	230	2,300	1.3 =	1.2 =	2.4 =	--	--	--	16 =	--	--	2,200 =
SVOC	Fluoranthene	mg/Kg	24,000	240,000	3.3 =	7.7 =	18 =	--	--	--	126 =	--	--	1,100 =
SVOC	Fluorene	mg/Kg	26,000	260,000	5.4 =	11 =	25 =	--	--	--	138 =	--	--	1,600 =
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	0.10 U	0.10 U	0.10 U	--	--	--	2.7 =	--	--	140 =
SVOC	Naphthalene	mg/Kg	210	2,100	53 =	123 =	147 =	--	--	--	144 =	--	--	470 =
SVOC	Pentachlorophenol	mg/Kg	10	1,000	1.0 U	17 =	23 =	--	--	--	1.0 U	--	--	20 U
SVOC	Phenanthrene	mg/Kg	--	--	0.10 UC	23 =	56 =	--	--	--	108 =	--	--	2,600 =
SVOC	Pyrene	mg/Kg	32,000	320,000	2.5 =	6.5 =	14 =	--	--	--	110 =	--	--	1,000 =
SVOC	Total Carcinogens	mg/Kg	--	--	1.3 =	3.8 =	9.7 =	--	--	--	45 =	--	--	6,130 =
TPH	Creosote	mg/Kg	--	--	200 =	810 =	1,250 =	170 =	190 =	20 U	3,600 =	20 U	20 U	34,000 =
VOC	Ethylbenzene	mg/Kg	230	2,300	--	--	--	--	--	--	--	--	--	0.13 =
VOC	Toluene	mg/Kg	520	5,200	--	--	--	--	--	--	--	--	--	0.16 =
VOC	Xylene(total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--	0.17 =

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health
Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 4

Saturated SubsurfaceSoil Detections Screened to EPA Region 6
Screening Levels and Hot Spot Levels
Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**B-1D**	**B-20C**	**B-21E**	**B-21E**	**B-22E**	**B-23E**	**B-26D**	**B-2D**	**B-30D**	**B-3D**
Sample ID:					B-1D	B-20C	B-21E	B-21E	B-22E	B-23E	B-26D	B-2D	B-30D	B-3D
QAQC Type:					FD	N	N	FD	N	N	N	N	N	N
Depth (ft bgs):					10	7.5	12.5	12.5	12.5	12.5	10	10	10	10
Date Collected:					08/24/98	08/26/98	08/26/98	08/26/98	08/26/98	08/26/98	08/27/98	08/24/98	08/27/98	08/24/98
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**										
M-TOTAL	Arsenic	mg/Kg	1.8	180	20 U	20 U	--	20 U	20 U	20 U	20 U	20 U	20 U	158 =
M-TOTAL	Chromium	mg/Kg	450	45,000	20 U	20 U	--	20 U	20 U	20 U	20 U	20 U	20 U	20 U
SVOC	Acenaphthene	mg/Kg	33,000	330,000	0.10 U	0.10 U	--	3.5 =	122 =	1.3 =	--	0.10 U	--	140 =
SVOC	Acenaphthylene	mg/Kg	--	--	0.10 U	0.10 U	--	133 =	6.5 =	2.4 =	--	0.10 U	--	160 =
SVOC	Anthracene	mg/Kg	100,000	100,000	0.10 U	0.23 =	--	240 =	20 =	1.9 =	--	0.10 U	--	30 =
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	0.10 U	0.10 U	--	0.10 UC	12 =	0.10 U	--	0.10 U	--	25 =
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	0.10 U	0.10 U	--	0.54 =	1.5 =	0.10 U	--	0.10 U	--	8.8 =
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	0.10 U	0.10 U	--	4.0 =	2.2 =	0.10 U	--	0.10 U	--	16 =
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	0.10 U	0.10 U	--	0.10 U	0.10 U	0.10 U	--	0.10 U	--	1.6 =
SVOC	Chrysene	mg/Kg	230	2,300	0.10 U	0.10 U	--	14 =	7.1 =	0.10 U	--	0.10 U	--	18 =
SVOC	Fluoranthene	mg/Kg	24,000	240,000	0.10 U	0.15 =	--	65 =	78 =	0.10 U	--	0.10 U	--	130 =
SVOC	Fluorene	mg/Kg	26,000	260,000	0.10 U	0.27 =	--	100 =	99 =	1.6 =	--	0.10 U	--	120 =
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	0.10 U	0.10 U	--	0.10 U	0.69 =	0.31 =	--	0.10 U	--	3.8 =
SVOC	Naphthalene	mg/Kg	210	2,100	0.10 U	0.66 =	--	219 =	145 =	8.5 =	--	0.10 U	--	340 =
SVOC	Pentachlorophenol	mg/Kg	10	1,000	1.0 U	1.0 U	--	30 =	1.0 U	1.0 U	--	1.0 U	--	110 =
SVOC	Phenanthrene	mg/Kg	--	--	0.10 U	0.10 UC	--	0.10 UC	172 =	0.10 UC	--	0.10 U	--	320 =
SVOC	Pyrene	mg/Kg	32,000	320,000	0.10 U	0.18 =	--	40 =	58 =	0.10 U	--	0.10 U	--	120 =
SVOC	Total Carcinogens	mg/Kg	--	--	0.10 U	0.10 U	--	19 =	23 =	0.31 =	--	0.10 U	--	72 =
TPH	Creosote	mg/Kg	--	--	20 U	20 U	1,900 =	--	1,300 =	30 =	--	20 U	--	2,400 =
VOC	Ethylbenzene	mg/Kg	230	2,300	0.050 U	--	--	--	--	--	--	--	--	--
VOC	Toluene	mg/Kg	520	5,200	0.050 U	--	--	--	--	--	--	--	--	--
VOC	Xylene(total)	mg/Kg	--	--	0.050 U	--	--	--	--	--	--	--	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health
Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 4

Saturated SubsurfaceSoil Detections Screened to EPA Region 6
Screening Levels and Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**B-3E**	**B-4C**	**B-4C**	**B-4D**	**B-5D**	**B-6D**	**B-7C**	**B-8D**	**B-9D**
Sample ID:					B-3E	B-4C	B-4C	B-4D	B-5D	B-6D	B-7C	B-8D	B-9D
QAQC Type:					N	N	FD	N	N	N	FD	N	N
Depth (ft bgs):					12.5	7.5	7.5	10	10	10	7.5	10	10
Date Collected:					08/24/98	08/24/98	08/24/98	08/24/98	08/24/98	08/24/98	08/25/98	08/25/98	08/25/98
Chemical Group	**Parameter**	**Units**	**Industrial Screening Level**	**Hot Spot Level**									
M-TOTAL	Arsenic	mg/Kg	1.8	180	20 U	--	177 =	57 =	20 U	20 U	20 U	20 U	20 U
M-TOTAL	Chromium	mg/Kg	450	45,000	20 U	--	377 =	20 U	20 U	20 U	20 U	20 U	20 U
SVOC	Acenaphthene	mg/Kg	33,000	330,000	0.10 U	10 =	--	1.0 =	0.10 U	0.10 U	2.7 =	1.2 =	0.10 U
SVOC	Acenaphthylene	mg/Kg	--	--	0.10 U	154 =	--	2.0 =	0.10 U	0.10 U	5.2 =	0.26 =	0.73 =
SVOC	Anthracene	mg/Kg	100,000	100,000	0.10 U	36 =	--	34 =	0.10 U	0.10 U	7.7 =	0.10 U	0.10 U
SVOC	Benzo(a)anthracene	mg/Kg	2.3	230	0.10 U	34 =	--	0.20 UC	0.10 UC	0.10 U	4.1 =	0.10 UC	0.10 UC
SVOC	Benzo(a)pyrene	mg/Kg	0.23	23	0.10 U	1.4 =	--	3.8 =	0.10 U	0.10 U	0.30 =	0.10 U	0.10 U
SVOC	Benzo(b+k)fluoranthene	mg/Kg	--	--	0.10 U	7.8 =	--	3.2 =	0.48 =	0.10 U	1.4 =	0.81 =	0.34 =
SVOC	Benzo(g,h,i)perylene	mg/Kg	--	--	0.10 U	0.40 U	--	0.20 U	2.0 =	0.10 U	0.10 U	0.10 U	0.10 U
SVOC	Chrysene	mg/Kg	230	2,300	0.10 U	14 =	--	8.5 =	1.2 =	0.10 U	2.4 =	1.2 =	1.1 =
SVOC	Fluoranthene	mg/Kg	24,000	240,000	0.10 U	90 =	--	18 =	0.10 U	0.10 U	17 =	0.10 U	0.10 U
SVOC	Fluorene	mg/Kg	26,000	260,000	0.10 U	110 =	--	4.3 =	0.10 U	0.10 U	21 =	0.10 U	0.10 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg	2.3	230	0.10 U	0.76 =	--	0.20 U	0.45 =	0.10 U	0.10 U	0.23 =	0.54 =
SVOC	Naphthalene	mg/Kg	210	2,100	0.10 U	390 =	--	25 =	8.5 =	0.10 U	220 =	26 =	4.6 =
SVOC	Pentachlorophenol	mg/Kg	10	1,000	1.0 U	91 =	--	2.0 U	1.0 U	1.0 U	8.2 =	1.0 U	1.0 U
SVOC	Phenanthrene	mg/Kg	--	--	0.10 U	250 =	--	0.20 U	0.10 U	0.10 U	46 =	0.10 U	0.10 U
SVOC	Pyrene	mg/Kg	32,000	320,000	0.10 U	73 =	--	12 =	0.10 U	0.10 U	14 =	0.10 U	0.10 U
SVOC	Total Carcinogens	mg/Kg	--	--	0.10 U	58 =	--	16 =	2.1 =	0.10 U	8.2 =	2.2 =	2.0 =
TPH	Creosote	mg/Kg	--	--	200 U	--	3,800 =	120 =	200 U	200 U	590 =	130 =	200 U
VOC	Ethylbenzene	mg/Kg	230	2,300	--	--	--	--	--	--	--	--	--
VOC	Toluene	mg/Kg	520	5,200	--	--	--	--	--	--	--	--	--
VOC	Xylene(total)	mg/Kg	--	--	--	--	--	--	--	--	--	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Lowest industrial soil screening level from EPA Region 6 Human Health
Medium-Specific Screening Levels 2008
Shading indicates detected concentration exceeds hot spot level.

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-01**	**PMW-01**	**PMW-01**	**PMW-01**	**PMW-01**	**PMW-01**
Sample ID:				PMW1W0	PMW1-GW-101001	PMW-1-013002-0	PMW-01-W-53002-0	PMW-01-092302-0	PMW010715030
QAQC Type:				N	N	N	N	N	N
Date Collected:				05/09/01	10/10/01	01/30/02	05/30/02	09/23/02	07/15/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
CONV	Alkalinity as CaCO3	mg CaCO3/L	--	156 =	202 =	170 =	--	--	--
CONV	Nitrate as N	mg/L as N	--	0.030 U	0.10 U	0.10 U	--	--	--
CONV	Sulfate	mg/L	--	22 =	34 =	36 =	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/L	--	--	--	--	--	--	--
DIOXIN	OCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	TEQ	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/L	--	--	--	--	--	--	--
FURAN	HpCDFs (total)	mg/L	--	--	--	--	--	--	--
FURAN	HxCDFs (total)	mg/L	--	--	--	--	--	--	--
FURAN	OCDF	mg/L	--	--	--	--	--	--	--
GAS	Carbon Dioxide	mg/L	--	20 =	--	90 =	--	--	--
GAS	Methane	mg/L	--	0.015 U	--	2.3 =	--	--	--
M-DISS	Arsenic	mg/L	0.15	--	0.010 U	0.010 U	--	--	--
M-DISS	Chromium	mg/L	--	--	0.010 U	0.010 U	--	--	--
M-DISS	Iron	mg/L	1.0	0.33 =	**16 =**	**6.4 =**	--	--	--
M-DISS	Zinc	mg/L	0.12	--	0.020 U	0.020 U	--	--	--
M-TOTAL	Arsenic	mg/L	0.15	0.0090 U	0.014 =	0.010 U	--	--	--
M-TOTAL	Chromium	mg/L	--	0.0010 U	0.010 U	0.010 U	--	--	--
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	0.0050 B	0.0010 U	0.0010 U	--	--	--
M-TOTAL	Copper	mg/L	0.0090	0.0035 =	0.010 U	0.010 U	--	--	--
M-TOTAL	Iron	mg/L	1.0	**6.5 =**	**24 =**	**6.0 =**	--	--	--
M-TOTAL	Iron (Ferrous)	mg/L	1.0	--	**2.6 =**	0.50 U	--	--	--
M-TOTAL	Zinc	mg/L	0.12	0.045 =	0.049 =	0.021 =	--	--	--
SVOC	2,4,5-Trichlorophenol	mg/L	--	0.050 U	0.047 U	0.051 U	--	--	0.049 U
SVOC	2,4-Dichlorophenol	mg/L	3.7	0.010 U	0.0095 U	0.010 U	--	--	0.0098 U
SVOC	2,4-Dimethylphenol	mg/L	0.042	0.010 U	0.0095 U	0.010 U	--	--	0.0098 U
SVOC	2,4-Dinitrophenol	mg/L	--	0.050 U	0.047 U	0.051 R	--	--	0.049 U
SVOC	2,6-Dinitrotoluene	mg/L	0.23	0.010 U	0.0095 U	0.010 U	--	--	0.0098 U
SVOC	2-Methylnaphthalene	mg/L	--	0.0042 J	0.0095 U	0.010 U	0.0097 U	0.010 U	4.60E-06 J
SVOC	2-Methylphenol	mg/L	0.013	0.010 U	0.0095 U	0.010 U	--	--	0.0098 U
SVOC	3,3'-Dichlorobenzidine	mg/L	--	0.020 U	0.019 U	0.021 U	--	--	0.020 U
SVOC	4,6-Dinitro-2-methylphenol	mg/L	--	0.050 U	0.047 U	0.051 U	--	--	0.049 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-01**	**PMW-01**	**PMW-01**	**PMW-01**	**PMW-01**	**PMW-01**
Sample ID:				PMW1W0	PMW1-GW-101001	PMW-1-013002-0	PMW-01-W-53002-0	PMW-01-092302-0	PMW010715030
QAQC Type:				N	N	N	N	N	N
Date Collected:				05/09/01	10/10/01	01/30/02	05/30/02	09/23/02	07/15/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
SVOC	4-Methylphenol	mg/L	--	0.0032 J	0.0095 U	0.010 U	--	--	0.0098 U
SVOC	4-Nitroaniline	mg/L	--	0.050 U	0.047 U	0.051 U	--	--	0.049 U
SVOC	Acenaphthene	mg/L	0.52	0.0036 J	0.0095 U	0.010 U	0.0097 U	0.010 U	2.19E-05 J
SVOC	Acenaphthylene	mg/L	--	0.010 U	0.0095 U	0.010 U	0.0097 U	0.010 U	4.60E-06 J
SVOC	Aniline	mg/L	--	0.010 U	--	--	--	--	0.0098 U
SVOC	Anthracene	mg/L	0.013	0.010 U	0.0095 U	0.010 U	0.0097 U	0.010 U	3.74E-05 =
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	0.010 U	0.0095 U	0.010 U	0.0097 U	0.010 U	**4.97E-05 =**
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	0.010 U	**6.71E-04 J**	0.010 U	0.0097 U	0.010 U	**2.90E-05 =**
SVOC	Benzo(b)fluoranthene	mg/L	--	0.010 U	0.0095 U	0.010 U	0.0097 U	0.010 U	3.00E-05 =
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.010 U	0.0095 U	0.010 U	0.0097 U	0.010 U	1.47E-05 J
SVOC	Benzo(k)fluoranthene	mg/L	--	0.010 U	0.0095 U	0.010 U	0.0097 U	0.010 U	2.89E-05 =
SVOC	Benzoic Acid	mg/L	0.042	0.0058 J	0.047 U	0.051 U	--	--	0.049 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	0.010 U	0.0095 U	0.010 U	--	--	**0.0062 J**
SVOC	Butyl benzyl phthalate	mg/L	0.019	0.010 U	0.0095 U	0.010 U	--	--	0.0098 U
SVOC	Carbazole	mg/L	--	--	--	0.010 U	--	--	--
SVOC	Chrysene	mg/L	--	0.010 U	0.0095 UJ	0.010 U	0.0097 U	0.010 U	5.44E-05 =
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.010 U	0.0095 U	0.010 U	0.0097 U	0.010 U	8.10E-06 J
SVOC	Dibenzofuran	mg/L	0.0037	0.0016 J	0.0095 U	0.010 U	0.0097 U	0.010 U	0.0098 U
SVOC	Di-n-butylphthalate	mg/L	0.035	0.010 U	8.13E-04 J	0.010 U	--	--	0.0098 U
SVOC	Di-n-octylphthalate	mg/L	0.71	0.010 U	0.0095 U	0.010 U	--	--	0.0098 U
SVOC	Fluoranthene	mg/L	0.0062	0.010 U	0.0095 U	0.010 U	0.0097 U	0.010 U	2.06E-04 =
SVOC	Fluorene	mg/L	0.0039	0.0015 J	0.0095 U	0.010 U	0.0097 U	0.010 U	7.84E-05 =
SVOC	Hexachlorocyclopentadiene	mg/L	0.0052	0.010 U	0.0095 U	0.010 U	--	--	0.0098 U
SVOC	Hexachloroethane	mg/L	0.54	0.010 U	0.0095 U	0.010 U	--	--	0.0098 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.010 U	0.0095 U	0.010 U	0.0097 U	0.010 U	1.33E-05 J
SVOC	Naphthalene	mg/L	0.62	0.034 =	0.0095 U	0.010 U	0.0097 U	0.010 U	4.20E-05 =
SVOC	Pentachlorophenol	mg/L	0.015	0.050 U	0.047 U	0.051 U	0.048 U	0.052 U	0.049 U
SVOC	Phenanthrene	mg/L	0.0063	0.010 U	0.0095 U	0.010 U	0.0097 U	0.010 U	2.46E-05 J
SVOC	Phenol	mg/L	0.11	0.010 U	0.0095 U	0.010 U	--	--	0.0098 U
SVOC	Pyrene	mg/L	--	0.010 U	0.0095 U	0.010 U	0.0097 U	0.010 U	1.75E-04 =
TPH	Diesel	mg/L	--	--	--	--	--	--	--
TPH	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--	0.35 =	--	--	--	--	--
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--
VOC	1,1-Dichloroethene	mg/L	0.025	0.0010 U	0.0010 U	3.00E-04 U	--	0.0010 U	5.00E-04 U
VOC	1,2,4-Trimethylbenzene	mg/L	--	4.90E-04 J	0.0010 U	3.00E-04 U	5.00E-04 U	0.0010 U	5.00E-04 U
VOC	1,3,5-Trimethylbenzene	mg/L	--	1.80E-04 J	0.0010 U	3.00E-04 U	5.00E-04 U	0.0010 U	5.00E-04 U
VOC	Benzene	mg/L	0.13	0.0010 U	0.0010 U	3.00E-04 U	5.00E-04 U	0.0010 U	5.00E-04 U
VOC	Bromomethane	mg/L	--	3.00E-04 J	0.0010 U	3.00E-04 U	--	0.0010 U	5.00E-04 U
VOC	Ethylbenzene	mg/L	0.0073	2.10E-04 J	0.0010 U	3.00E-04 U	5.00E-04 U	0.0010 U	5.00E-04 U
VOC	Isopropylbenzene	mg/L	--	0.0010 U	0.0010 U	3.00E-04 U	--	0.0010 U	5.00E-04 U
VOC	m,p-Xylene	mg/L	--	3.20E-04 J	0.0020 U	6.00E-04 U	0.0010 U	0.0020 U	0.0020 U
VOC	n-Propylbenzene	mg/L	--	0.0010 U	0.0010 U	3.00E-04 U	--	0.0010 U	5.00E-04 U
VOC	o-Xylene	mg/L	--	2.00E-04 J	0.0010 U	3.00E-04 U	--	0.0010 U	5.00E-04 U
VOC	p-Isopropyltoluene	mg/L	--	0.0010 U	0.0010 U	3.00E-04 U	--	0.0010 U	5.00E-04 U
VOC	sec-Butylbenzene	mg/L	--	0.0010 U	0.0010 U	3.00E-04 U	--	0.0010 U	5.00E-04 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-01**	**PMW-01**	**PMW-01**	**PMW-01**	**PMW-01**	**PMW-01**
Sample ID:				PMW1W0	PMW1-GW-101001	PMW-1-013002-0	PMW-01-W-53002-0	PMW-01-092302-0	PMW010715030
QAQC Type:				N	N	N	N	N	N
Date Collected:				05/09/01	10/10/01	01/30/02	05/30/02	09/23/02	07/15/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
VOC	Styrene	mg/L	--	0.0010 U	0.0010 U	3.00E-04 U	--	0.0010 U	--
VOC	Tetrachloroethylene	mg/L	0.84	0.0010 U	0.0010 U	3.00E-04 U	5.00E-04 U	0.0010 U	5.00E-04 U
VOC	Toluene	mg/L	0.0098	3.40E-04 J	0.0010 U	3.00E-04 U	--	0.0010 U	5.00E-04 U

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-02**	**PMW-02**	**PMW-02**	**PMW-02**	**PMW-02**	**PMW-02**	**PMW-04**
Sample ID:				PMW2W0	PMW-02-GW-100801	PMW-2-012902-0	PMW-02-W-52902-0	PMW-02-092302-0	PMW020711030	PMW4-050701-0
QAQC Type:				N	N	N	N	N	N	N
Date Collected:				05/09/01	10/08/01	01/29/02	05/29/02	09/23/02	07/11/03	05/07/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**							
CONV	Alkalinity as CaCO3	mg CaCO3/L	--	24 =	61 =	38 =	--	--	--	108 =
CONV	Nitrate as N	mg/L as N	--	0.030 U	1.5 =	0.10 U	--	--	--	0.030 U
CONV	Sulfate	mg/L	--	20 =	47 =	11 =	--	--	--	0.18 U
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/L	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/L	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/L	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/L	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/L	--	--	--	--	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/L	--	--	--	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/L	--	--	--	--	--	--	--	--
DIOXIN	OCDD	mg/L	--	--	--	--	--	--	--	--
DIOXIN	TEQ	mg/L	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/L	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/L	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/L	--	--	--	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/L	--	--	--	--	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/L	--	--	--	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/L	--	--	--	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/L	--	--	--	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/L	--	--	--	--	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/L	--	--	--	--	--	--	--	--
FURAN	HpCDFs (total)	mg/L	--	--	--	--	--	--	--	--
FURAN	HxCDFs (total)	mg/L	--	--	--	--	--	--	--	--
FURAN	OCDF	mg/L	--	--	--	--	--	--	--	--
GAS	Carbon Dioxide	mg/L	--	1.2 =	132 =	49 =	--	--	--	--
GAS	Methane	mg/L	--	0.016 U	1.9 =	0.38 =	--	--	--	--
M-DISS	Arsenic	mg/L	0.15	--	0.078 =	0.12 =	--	--	--	--
M-DISS	Chromium	mg/L	--	--	0.010 U	0.014 =	--	--	--	--
M-DISS	Iron	mg/L	1.0	0.75 =	**14 =**	**3.7 =**	--	--	--	**26 =**
M-DISS	Zinc	mg/L	0.12	--	0.020 U	0.020 U	--	--	--	--
M-TOTAL	Arsenic	mg/L	0.15	0.13 =	0.080 =	0.13 =	--	--	--	0.0090 U
M-TOTAL	Chromium	mg/L	--	0.023 =	0.018 =	0.022 =	--	--	--	0.0010 U
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	**0.26 B**	0.0010 U	0.0010 U	--	--	--	1.0 U
M-TOTAL	Copper	mg/L	0.0090	0.0031 =	0.010 U	0.010 U	--	--	--	0.0012 =
M-TOTAL	Iron	mg/L	1.0	**1.6 =**	**14 =**	**4.4 =**	--	--	--	**34 =**
M-TOTAL	Iron (Ferrous)	mg/L	1.0	--	**9.7 =**	**2.5 =**	--	--	--	--
M-TOTAL	Zinc	mg/L	0.12	0.0088 =	0.022 =	0.020 U	--	--	--	0.0020 U
SVOC	2,4,5-Trichlorophenol	mg/L	--	0.050 U	1.0 U	0.049 U	--	--	0.048 U	0.050 U
SVOC	2,4-Dichlorophenol	mg/L	3.7	0.010 U	0.21 U	0.0097 U	--	--	0.0097 U	0.010 U
SVOC	2,4-Dimethylphenol	mg/L	0.042	0.010 U	0.21 U	0.0097 U	--	--	0.0044 J	0.010 U
SVOC	2,4-Dinitrophenol	mg/L	--	0.050 U	1.0 U	0.049 R	--	--	0.048 U	0.050 U
SVOC	2,6-Dinitrotoluene	mg/L	0.23	0.010 U	0.21 U	0.0097 U	--	--	9.77E-04 J	0.010 U
SVOC	2-Methylnaphthalene	mg/L	--	0.14 D	0.27 =	0.21 =	0.13 =	0.16 =	0.11 =	0.010 U
SVOC	2-Methylphenol	mg/L	0.013	0.010 U	0.21 U	0.0097 U	--	--	0.0097 U	0.010 U
SVOC	3,3'-Dichlorobenzidine	mg/L	--	0.020 U	0.42 U	0.019 U	--	--	0.019 U	0.020 U
SVOC	4,6-Dinitro-2-methylphenol	mg/L	--	0.050 U	1.0 U	0.049 U	--	--	0.012 J	0.050 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-02**	**PMW-02**	**PMW-02**	**PMW-02**	**PMW-02**	**PMW-02**	**PMW-04**
Sample ID:				PMW2W0	PMW-02-GW-100801	PMW-2-012902-0	PMW-02-W-52902-0	PMW-02-092302-0	PMW020711030	PMW4-050701-0
QAQC Type:				N	N	N	N	N	N	N
Date Collected:				05/09/01	10/08/01	01/29/02	05/29/02	09/23/02	07/11/03	05/07/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**							
SVOC	4-Methylphenol	mg/L	--	0.010 U	0.21 U	0.0097 U	--	--	0.19 U	0.010 U
SVOC	4-Nitroaniline	mg/L	--	0.050 U	1.0 U	0.049 U	--	--	0.97 U	0.050 U
SVOC	Acenaphthene	mg/L	0.52	0.19 D	0.44 =	0.34 =	0.28 =	0.30 =	0.28 =	0.010 U
SVOC	Acenaphthylene	mg/L	--	0.0045 J	0.21 U	0.0075 J	0.0085 J	0.0091 J	0.011 =	0.010 U
SVOC	Aniline	mg/L	--	0.010 U	--	--	--	--	0.0072 J	0.010 U
SVOC	Anthracene	mg/L	0.013	0.011 =	0.21 U	**0.016 =**	**0.015 =**	**0.019 =**	**0.017 =**	0.010 U
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	**0.0012 J**	0.21 U	**0.0013 J**	**0.0014 J**	**0.0022 J**	**0.0021 =**	0.010 U
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	0.010 U	0.21 U	0.0097 U	0.0095 U	0.0098 U	**6.38E-04 =**	0.010 U
SVOC	Benzo(b)fluoranthene	mg/L	--	0.010 U	0.21 U	0.0097 U	0.0095 U	0.0098 U	6.93E-04 =	0.010 U
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.010 U	0.21 U	0.0097 U	0.0095 U	0.0098 U	1.51E-04 J	0.010 U
SVOC	Benzo(k)fluoranthene	mg/L	--	0.010 U	0.21 U	0.0097 U	0.0095 U	0.0098 U	5.18E-04 =	0.010 U
SVOC	Benzoic Acid	mg/L	0.042	0.050 U	1.0 U	0.049 U	--	--	0.048 U	0.050 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	0.010 U	0.21 U	0.0097 U	--	--	0.0097 U	0.010 U
SVOC	Butyl benzyl phthalate	mg/L	0.019	0.010 U	0.21 U	0.0097 U	--	--	0.0097 U	0.010 U
SVOC	Carbazole	mg/L	--	--	--	0.014 =	--	--	--	--
SVOC	Chrysene	mg/L	--	0.0015 J	0.21 U	0.0011 J	0.0095 U	0.0020 J	0.0018 =	0.010 U
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.010 U	0.21 U	0.0097 U	0.0095 U	0.0098 U	1.10E-04 J	0.010 U
SVOC	Dibenzofuran	mg/L	0.0037	**0.064 =**	**0.15 J**	**0.12 =**	**0.11 =**	**0.12 =**	**0.097 =**	0.010 U
SVOC	Di-n-butylphthalate	mg/L	0.035	0.010 U	0.21 U	0.0097 U	--	--	0.0097 U	0.010 U
SVOC	Di-n-octylphthalate	mg/L	0.71	0.010 U	0.21 U	0.0097 U	--	--	0.0097 U	0.010 U
SVOC	Fluoranthene	mg/L	0.0062	**0.018 =**	0.21 U	**0.015 =**	**0.016 =**	**0.016 =**	**0.017 =**	0.010 U
SVOC	Fluorene	mg/L	0.0039	**0.070 =**	**0.15 J**	**0.13 =**	**0.13 =**	**0.13 =**	**0.12 =**	0.010 U
SVOC	Hexachlorocyclopentadiene	mg/L	0.0052	0.010 U	0.21 U	0.0097 U	--	--	0.0097 U	0.010 U
SVOC	Hexachloroethane	mg/L	0.54	0.010 U	0.21 U	0.0097 U	--	--	0.0097 U	0.010 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.010 U	0.21 U	0.0097 U	0.0095 U	0.0098 U	1.55E-04 J	0.010 U
SVOC	Naphthalene	mg/L	0.62	0.35 D	**1.4 =**	**0.69 =**	0.30 =	**1.3 =**	**0.63 =**	0.010 U
SVOC	Pentachlorophenol	mg/L	0.015	**0.12 D**	1.0 U	**0.074 =**	**0.12 =**	**0.094 =**	**0.13 =**	0.050 U
SVOC	Phenanthrene	mg/L	0.0063	**0.085 =**	**0.094 J**	**0.11 =**	**0.098 =**	**0.11 =**	**0.10 =**	0.010 U
SVOC	Phenol	mg/L	0.11	0.010 U	0.21 U	0.0097 U	--	--	0.0097 U	0.010 U
SVOC	Pyrene	mg/L	--	0.011 =	0.21 U	0.011 =	0.012 =	0.015 =	0.012 =	0.010 U
TPH	Diesel	mg/L	--	2.5 =	--	--	--	--	--	--
TPH	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--	0.89 =	--	--	--	--	--	--
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--	--
VOC	1,1-Dichloroethene	mg/L	0.025	--	0.0010 U	3.00E-04 U	--	0.0010 U	5.00E-04 U	--
VOC	1,2,4-Trimethylbenzene	mg/L	--	--	0.027 =	0.014 =	0.012 =	0.037 =	0.012 =	--
VOC	1,3,5-Trimethylbenzene	mg/L	--	--	0.0084 =	0.0049 =	0.0037 =	0.014 =	0.0044 =	--
VOC	Benzene	mg/L	0.13	--	5.00E-04 J	1.20E-04 J	1.20E-04 J	8.30E-04 J	2.60E-04 J	--
VOC	Bromomethane	mg/L	--	--	0.0010 U	3.00E-04 U	--	0.0010 U	5.00E-04 U	--
VOC	Ethylbenzene	mg/L	0.0073	--	**0.0079 =**	0.0028 =	0.0025 =	**0.014 =**	0.0044 =	--
VOC	Isopropylbenzene	mg/L	--	--	0.0018 =	9.20E-04 =	--	0.0030 =	0.0011 =	--
VOC	m,p-Xylene	mg/L	--	--	0.012 =	0.0044 =	0.0041 =	0.022 =	0.0065 =	--
VOC	n-Propylbenzene	mg/L	--	--	9.00E-04 J	5.90E-04 =	--	0.0015 =	6.00E-04 =	--
VOC	o-Xylene	mg/L	--	--	0.0069 =	0.0016 =	--	0.0024 =	9.90E-04 =	--
VOC	p-Isopropyltoluene	mg/L	--	--	0.0017 =	4.70E-04 =	--	5.20E-04 J	3.00E-04 J	--
VOC	sec-Butylbenzene	mg/L	--	--	0.0010 U	3.00E-04 U	--	1.30E-04 J	5.00E-04 U	--

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-02**	**PMW-02**	**PMW-02**	**PMW-02**	**PMW-02**	**PMW-02**	**PMW-04**
Sample ID:				PMW2W0	PMW-02-GW-100801	PMW-2-012902-0	PMW-02-W-52902-0	PMW-02-092302-0	PMW020711030	PMW4-050701-0
QAQC Type:				N	N	N	N	N	N	N
Date Collected:				05/09/01	10/08/01	01/29/02	05/29/02	09/23/02	07/11/03	05/07/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**							
VOC	Styrene	mg/L	--	--	0.0010 U	3.00E-04 U	--	0.0010 U	--	--
VOC	Tetrachloroethylene	mg/L	0.84	--	0.0010 U	4.70E-04 =	5.30E-04 =	0.0029 =	8.70E-04 =	--
VOC	Toluene	mg/L	0.0098	--	0.0019 =	3.00E-04 U	--	0.0010 U	5.00E-04 U	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-04**	**PMW-04**	**PMW-04**	**PMW-05**	**PMW-05**	**PMW-06**
Sample ID:				PMW4W0507010	PMW4-GW-100901	PMW-4-012802-0	PMW5W0	PMW-5-013002-0	PMW6W0
QAQC Type:				N	N	N	N	N	N
Date Collected:				05/07/01	10/09/01	01/28/02	05/09/01	01/30/02	05/09/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
CONV	Alkalinity as CaCO3	mg CaCO3/L	--	--	88 =	100 =	82 =	92 =	49 =
CONV	Nitrate as N	mg/L as N	--	--	0.10 U	1.7 =	0.050 B	0.10 U	0.030 U
CONV	Sulfate	mg/L	--	--	1.7 =	3.3 =	40 =	19 =	9.1 =
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/L	--	--	--	--	--	--	--
DIOXIN	OCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	TEQ	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/L	--	--	--	--	--	--	--
FURAN	HpCDFs (total)	mg/L	--	--	--	--	--	--	--
FURAN	HxCDFs (total)	mg/L	--	--	--	--	--	--	--
FURAN	OCDF	mg/L	--	--	--	--	--	--	--
GAS	Carbon Dioxide	mg/L	--	136 =	113 =	104 =	36 =	98 =	2.3 =
GAS	Methane	mg/L	--	10 =	18 =	9.9 =	0.27 =	6.5 =	0.28 =
M-DISS	Arsenic	mg/L	0.15	--	0.010 U	0.010 U	--	**1.7 =**	--
M-DISS	Chromium	mg/L	--	--	0.010 U	0.010 U	--	0.032 =	--
M-DISS	Iron	mg/L	1.0	--	**23 =**	**30 =**	**11 =**	**26 =**	**5.8 =**
M-DISS	Zinc	mg/L	0.12	--	0.020 U	0.020 U	--	0.020 U	--
M-TOTAL	Arsenic	mg/L	0.15	--	0.011 =	0.010 U	**0.97 =**	**1.7 =**	**0.21 =**
M-TOTAL	Chromium	mg/L	--	--	0.010 U	0.010 U	0.034 =	0.035 =	0.019 =
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	--	0.0010 U	0.0010 U	**0.26 B**	0.0010 U	**0.26 B**
M-TOTAL	Copper	mg/L	0.0090	--	0.010 U	0.010 U	0.0031 =	0.010 U	0.0018 =
M-TOTAL	Iron	mg/L	1.0	--	**26 =**	**30 =**	**20 =**	**26 =**	**9.9 =**
M-TOTAL	Iron (Ferrous)	mg/L	1.0	--	**14 =**	**13 =**	--	**11 =**	--
M-TOTAL	Zinc	mg/L	0.12	--	0.020 U	0.020 U	0.016 =	0.020 U	0.0020 U
SVOC	2,4,5-Trichlorophenol	mg/L	--	--	0.048 U	0.048 U	0.050 U	0.018 J	0.050 U
SVOC	2,4-Dichlorophenol	mg/L	3.7	--	0.0095 U	0.0097 U	0.010 U	0.0097 U	0.0065 J
SVOC	2,4-Dimethylphenol	mg/L	0.042	--	0.0095 U	0.0097 U	**0.12 D**	**0.14 =**	0.010 U
SVOC	2,4-Dinitrophenol	mg/L	--	--	0.048 J	0.048 R	0.050 U	0.048 R	0.050 U
SVOC	2,6-Dinitrotoluene	mg/L	0.23	--	0.0095 U	0.0097 U	0.010 U	0.0097 U	0.010 U
SVOC	2-Methylnaphthalene	mg/L	--	--	0.0095 U	0.0097 U	0.83 D	0.63 =	0.010 U
SVOC	2-Methylphenol	mg/L	0.013	--	0.0095 U	0.0097 U	**0.27 D**	**0.057 =**	0.010 U
SVOC	3,3'-Dichlorobenzidine	mg/L	--	--	0.019 U	0.019 U	0.020 U	0.019 U	0.020 U
SVOC	4,6-Dinitro-2-methylphenol	mg/L	--	--	0.048 U	0.048 U	0.050 U	0.048 U	0.050 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-04**	**PMW-04**	**PMW-04**	**PMW-05**	**PMW-05**	**PMW-06**
Sample ID:				PMW4W0507010	PMW4-GW-100901	PMW-4-012802-0	PMW5W0	PMW-5-013002-0	PMW6W0
QAQC Type:				N	N	N	N	N	N
Date Collected:				05/07/01	10/09/01	01/28/02	05/09/01	01/30/02	05/09/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
SVOC	4-Methylphenol	mg/L	--	--	0.0095 U	0.0097 U	0.40 D	0.059 =	0.010 U
SVOC	4-Nitroaniline	mg/L	--	--	0.048 U	0.048 U	0.050 U	0.048 U	0.050 U
SVOC	Acenaphthene	mg/L	0.52	--	0.0095 U	0.0097 U	**0.70 D**	0.43 =	0.033 =
SVOC	Acenaphthylene	mg/L	--	--	0.0095 U	0.0097 U	0.022 =	0.020 =	0.010 U
SVOC	Aniline	mg/L	--	--	--	--	0.010 U	--	0.010 U
SVOC	Anthracene	mg/L	0.013	--	0.0095 U	0.0097 U	**0.051 =**	**0.025 =**	0.010 U
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	--	7.41E-04 U	0.0097 U	**0.035 =**	**0.0022 J**	0.010 U
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	--	**0.0014 J**	0.0097 U	**0.013 =**	0.0097 U	0.010 U
SVOC	Benzo(b)fluoranthene	mg/L	--	--	0.0095 U	0.0097 U	0.019 =	0.0097 U	0.010 U
SVOC	Benzo(g,h,i)perylene	mg/L	--	--	0.0095 U	0.0097 U	0.010 U	0.0097 U	0.010 U
SVOC	Benzo(k)fluoranthene	mg/L	--	--	0.0095 U	0.0097 U	0.0082 J	0.0097 U	0.010 U
SVOC	Benzoic Acid	mg/L	0.042	--	0.048 U	0.048 U	0.050 U	0.048 U	0.050 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	--	0.0095 U	0.0017 J	0.0020 J	0.0097 U	0.010 U
SVOC	Butyl benzyl phthalate	mg/L	0.019	--	0.0095 U	0.0097 U	0.010 U	0.0097 U	0.010 U
SVOC	Carbazole	mg/L	--	--	--	0.0097 U	--	0.21 =	--
SVOC	Chrysene	mg/L	--	--	0.0095 U	0.0097 U	0.031 =	0.0015 J	0.010 U
SVOC	Dibenz(a,h)anthracene	mg/L	--	--	0.0095 U	0.0097 U	0.010 U	0.0097 U	0.010 U
SVOC	Dibenzofuran	mg/L	0.0037	--	0.0095 U	0.0097 U	**0.38 D**	**0.21 =**	**0.011 =**
SVOC	Di-n-butylphthalate	mg/L	0.035	--	0.0095 U	0.0097 U	0.010 U	0.0097 U	0.010 U
SVOC	Di-n-octylphthalate	mg/L	0.71	--	0.0095 U	0.0049 J	0.010 U	0.0097 U	0.010 U
SVOC	Fluoranthene	mg/L	0.0062	--	0.0095 U	0.0097 U	**0.21 D**	**0.031 =**	0.010 U
SVOC	Fluorene	mg/L	0.0039	--	0.0095 U	0.0097 U	**0.40 D**	**0.20 =**	**0.015 =**
SVOC	Hexachlorocyclopentadiene	mg/L	0.0052	--	0.0095 J	0.0097 U	0.010 U	0.0097 U	0.010 U
SVOC	Hexachloroethane	mg/L	0.54	--	0.0095 U	0.0097 U	0.010 U	0.0097 U	0.010 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	--	0.0095 U	0.0097 U	0.0031 J	0.0097 U	0.010 U
SVOC	Naphthalene	mg/L	0.62	--	0.0095 U	0.0097 U	**3.8 D**	**5.7 J**	0.0026 J
SVOC	Pentachlorophenol	mg/L	0.015	--	0.048 U	0.048 U	0.0087 J	**0.021 J**	0.050 U
SVOC	Phenanthrene	mg/L	0.0063	--	0.0095 U	0.0097 U	**0.66 D**	**0.26 =**	0.010 U
SVOC	Phenol	mg/L	0.11	--	0.0095 U	0.0097 U	**0.62 D**	0.028 =	0.010 U
SVOC	Pyrene	mg/L	--	--	0.0095 U	0.0097 U	0.16 D	0.021 =	0.010 U
TPH	Diesel	mg/L	--	--	--	0.023 =	--	17 =	--
TPH	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--	--	--	0.10 U	--	0.10 U	--
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--
VOC	1,1-Dichloroethene	mg/L	0.025	--	0.0010 U	2.50E-04 J	0.0010 U	3.00E-04 U	--
VOC	1,2,4-Trimethylbenzene	mg/L	--	--	0.0010 U	3.00E-04 U	0.012 =	0.035 =	--
VOC	1,3,5-Trimethylbenzene	mg/L	--	--	0.0010 U	3.00E-04 U	0.0048 =	0.014 =	--
VOC	Benzene	mg/L	0.13	--	0.0010 U	3.00E-04 U	0.0032 =	0.0085 =	--
VOC	Bromomethane	mg/L	--	--	0.0010 U	3.00E-04 U	2.50E-04 J	3.00E-04 U	--
VOC	Ethylbenzene	mg/L	0.0073	--	0.0010 U	3.00E-04 U	0.0069 =	**0.032 =**	--
VOC	Isopropylbenzene	mg/L	--	--	0.0010 U	3.00E-04 U	7.10E-04 J	0.0032 =	--
VOC	m,p-Xylene	mg/L	--	--	0.0020 U	6.00E-04 U	0.013 =	0.056 =	--
VOC	n-Propylbenzene	mg/L	--	--	0.0010 U	3.00E-04 U	2.70E-04 J	7.20E-04 =	--
VOC	o-Xylene	mg/L	--	--	0.0010 U	3.00E-04 U	0.0072 =	0.0018 =	--
VOC	p-Isopropyltoluene	mg/L	--	--	0.0010 U	3.00E-04 U	8.20E-04 J	3.00E-04 U	--
VOC	sec-Butylbenzene	mg/L	--	--	0.0010 U	3.00E-04 U	0.0010 U	0.0089 =	--

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-04**	**PMW-04**	**PMW-04**	**PMW-05**	**PMW-05**	**PMW-06**
Sample ID:				PMW4W0507010	PMW4-GW-100901	PMW-4-012802-0	PMW5W0	PMW-5-013002-0	PMW6W0
QAQC Type:				N	N	N	N	N	N
Date Collected:				05/07/01	10/09/01	01/28/02	05/09/01	01/30/02	05/09/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
VOC	Styrene	mg/L	--	--	0.0010 U	3.00E-04 U	0.0020 =	3.00E-04 U	--
VOC	Tetrachloroethylene	mg/L	0.84	--	0.0010 U	3.00E-04 U	0.0010 U	0.023 =	--
VOC	Toluene	mg/L	0.0098	--	0.0010 U	3.00E-04 U	0.0085 =	3.00E-04 U	--

Notes:

= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-06**	**PMW-06**	**PMW-07**	**PMW-07**	**PMW-07**	**PMW-07**
Sample ID:				PMW6-GW-100901	PMW-6-012802-0	PMW7-050701-0	PMW7W0507010	PMW7-GW-100901	PMW-7-012902-0
QAQC Type:				N	N	N	N	N	N
Date Collected:				10/09/01	01/28/02	05/07/01	05/07/01	10/09/01	01/29/02
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
CONV	Alkalinity as CaCO3	mg CaCO3/L	--	75 =	50 =	76 =	--	130 =	69 =
CONV	Nitrate as N	mg/L as N	--	0.10 U	0.10 U	0.030 U	--	0.10 U	0.10 U
CONV	Sulfate	mg/L	--	2.0 =	2.2 =	0.52 B	--	1.8 =	1.7 =
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/L	--	--	--	--	--	--	--
DIOXIN	OCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	TEQ	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/L	--	--	--	--	--	--	--
FURAN	HpCDFs (total)	mg/L	--	--	--	--	--	--	--
FURAN	HxCDFs (total)	mg/L	--	--	--	--	--	--	--
FURAN	OCDF	mg/L	--	--	--	--	--	--	--
GAS	Carbon Dioxide	mg/L	--	90 =	46 =	--	116 =	164 =	52 =
GAS	Methane	mg/L	--	13 =	7.8 =	--	9.9 =	15 =	4.4 =
M-DISS	Arsenic	mg/L	0.15	**0.21 =**	0.12 =	--	--	0.010 U	0.010 U
M-DISS	Chromium	mg/L	--	0.019 =	0.013 =	--	--	0.010 U	0.010 U
M-DISS	Iron	mg/L	1.0	**16 =**	**13 =**	**12 =**	--	**30 =**	**14 =**
M-DISS	Zinc	mg/L	0.12	0.020 U	0.020 U	--	--	0.020 U	0.020 U
M-TOTAL	Arsenic	mg/L	0.15	**0.22 =**	0.12 =	0.0090 U	--	0.010 U	0.010 U
M-TOTAL	Chromium	mg/L	--	0.023 =	0.016 =	0.0010 U	--	0.010 U	0.010 U
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	0.0010 U	0.0010 U	1.0 U	--	0.0010 U	0.0010 U
M-TOTAL	Copper	mg/L	0.0090	0.010 U	0.010 U	0.0010 U	--	0.010 U	0.010 U
M-TOTAL	Iron	mg/L	1.0	**17 =**	**13 =**	**24 =**	--	**33 =**	**14 =**
M-TOTAL	Iron (Ferrous)	mg/L	1.0	**9.8 =**	**5.1 =**	--	--	**20 =**	**8.0 =**
M-TOTAL	Zinc	mg/L	0.12	0.020 U	0.020 U	0.0085 =	--	0.020 U	0.020 U
SVOC	2,4,5-Trichlorophenol	mg/L	--	0.047 U	0.048 U	0.050 U	--	0.047 U	0.048 U
SVOC	2,4-Dichlorophenol	mg/L	3.7	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	2,4-Dimethylphenol	mg/L	0.042	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	2,4-Dinitrophenol	mg/L	--	0.047 J	0.048 R	0.050 U	--	0.047 J	0.048 R
SVOC	2,6-Dinitrotoluene	mg/L	0.23	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	2-Methylnaphthalene	mg/L	--	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	2-Methylphenol	mg/L	0.013	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	3,3'-Dichlorobenzidine	mg/L	--	0.019 U	0.019 U	0.020 U	--	0.019 U	0.019 U
SVOC	4,6-Dinitro-2-methylphenol	mg/L	--	0.047 U	0.048 U	0.050 U	--	0.047 U	0.048 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-06**	**PMW-06**	**PMW-07**	**PMW-07**	**PMW-07**	**PMW-07**
Sample ID:				PMW6-GW-100901	PMW-6-012802-0	PMW7-050701-0	PMW7W0507010	PMW7-GW-100901	PMW-7-012902-0
QAQC Type:				N	N	N	N	N	N
Date Collected:				10/09/01	01/28/02	05/07/01	05/07/01	10/09/01	01/29/02
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
SVOC	4-Methylphenol	mg/L	--	0.0095 U	0.0097 U	0.0045 J	--	0.0095 U	0.0078 J
SVOC	4-Nitroaniline	mg/L	--	0.047 U	0.048 U	0.050 U	--	0.047 U	0.048 U
SVOC	Acenaphthene	mg/L	0.52	0.038 =	0.037 =	0.010 U	--	0.0095 U	0.0097 U
SVOC	Acenaphthylene	mg/L	--	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Aniline	mg/L	--	--	--	0.010 U	--	--	--
SVOC	Anthracene	mg/L	0.013	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	**0.0018 J**	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	**0.0020 J**	0.0097 U	0.010 U	--	**0.0010 J**	0.0097 U
SVOC	Benzo(b)fluoranthene	mg/L	--	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Benzo(k)fluoranthene	mg/L	--	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Benzoic Acid	mg/L	0.042	0.047 U	0.048 U	**0.16 D**	--	0.047 U	0.048 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	0.0017 J	0.0097 U	0.010 U	--	0.0011 J	0.0097 U
SVOC	Butyl benzyl phthalate	mg/L	0.019	0.0013 J	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Carbazole	mg/L	--	--	0.0097 U	--	--	--	0.0097 U
SVOC	Chrysene	mg/L	--	0.0020 J	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Dibenzofuran	mg/L	0.0037	**0.014 =**	**0.012 =**	0.010 U	--	0.0095 U	0.0097 U
SVOC	Di-n-butylphthalate	mg/L	0.035	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Di-n-octylphthalate	mg/L	0.71	0.0095 U	0.0049 J	0.010 U	--	5.02E-04 U	0.0097 U
SVOC	Fluoranthene	mg/L	0.0062	0.0012 J	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Fluorene	mg/L	0.0039	**0.018 =**	**0.017 =**	0.010 U	--	0.0095 U	0.0097 U
SVOC	Hexachlorocyclopentadiene	mg/L	0.0052	0.0095 J	0.0097 U	0.010 U	--	0.0095 J	0.0097 U
SVOC	Hexachloroethane	mg/L	0.54	0.0095 U	6.67E-04 J	0.010 U	--	0.0095 U	0.0097 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Naphthalene	mg/L	0.62	0.0062 J	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Pentachlorophenol	mg/L	0.015	0.047 U	0.048 U	0.050 U	--	0.047 U	0.048 U
SVOC	Phenanthrene	mg/L	0.0063	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Phenol	mg/L	0.11	0.0095 U	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
SVOC	Pyrene	mg/L	--	0.0011 J	0.0097 U	0.010 U	--	0.0095 U	0.0097 U
TPH	Diesel	mg/L	--	--	--	0.31 J	--	--	0.020 U
TPH	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--	--	--	0.071 =	--	--	0.15 =
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--
VOC	1,1-Dichloroethene	mg/L	0.025	0.0010 U	3.00E-04 U	--	--	0.0010 U	3.00E-04 U
VOC	1,2,4-Trimethylbenzene	mg/L	--	0.0010 U	1.20E-04 J	--	--	0.0010 U	3.00E-04 U
VOC	1,3,5-Trimethylbenzene	mg/L	--	0.0010 U	3.00E-04 U	--	--	0.0010 U	3.00E-04 U
VOC	Benzene	mg/L	0.13	0.0010 U	3.00E-04 U	--	--	0.0010 U	3.00E-04 U
VOC	Bromomethane	mg/L	--	0.0010 U	3.00E-04 U	--	--	0.0010 U	3.00E-04 U
VOC	Ethylbenzene	mg/L	0.0073	0.0010 U	3.00E-04 U	--	--	0.0010 U	3.00E-04 U
VOC	Isopropylbenzene	mg/L	--	0.0010 U	2.40E-04 J	--	--	0.0010 U	3.00E-04 U
VOC	m,p-Xylene	mg/L	--	0.0020 U	1.90E-04 J	--	--	0.0020 U	6.00E-04 U
VOC	n-Propylbenzene	mg/L	--	0.0010 U	2.20E-04 J	--	--	0.0010 U	3.00E-04 U
VOC	o-Xylene	mg/L	--	0.0010 U	4.00E-04 =	--	--	0.0010 U	0.092 =
VOC	p-Isopropyltoluene	mg/L	--	0.0010 =	3.00E-04 U	--	--	0.011 =	3.00E-04 U
VOC	sec-Butylbenzene	mg/L	--	0.0010 U	3.00E-04 U	--	--	0.0010 U	3.00E-04 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-06**	**PMW-06**	**PMW-07**	**PMW-07**	**PMW-07**	**PMW-07**
Sample ID:				PMW6-GW-100901	PMW-6-012802-0	PMW7-050701-0	PMW7W0507010	PMW7-GW-100901	PMW-7-012902-0
QAQC Type:				N	N	N	N	N	N
Date Collected:				10/09/01	01/28/02	05/07/01	05/07/01	10/09/01	01/29/02
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
VOC	Styrene	mg/L	--	0.0010 U	3.00E-04 U	--	--	0.0010 U	3.00E-04 U
VOC	Tetrachloroethylene	mg/L	0.84	0.0010 U	3.70E-04 =	--	--	0.0010 U	0.015 =
VOC	Toluene	mg/L	0.0098	0.0010 J	3.00E-04 U	--	--	0.0080 =	3.00E-04 U

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-07**	**PMW-07**	**PMW-07**	**PMW-07**	**PMW-07**	**PMW-08**
Sample ID:				PMW-07-W-52902-0	PMW-07-092502-0	PMW07-071503-0	PMW07-072403-0	PMW-DUP-012902-1	PMW8-0
QAQC Type:				N	N	N	N	FD	N
Date Collected:				05/29/02	09/25/02	07/15/03	07/24/03	01/29/02	05/08/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
CONV	Alkalinity as CaCO3	mg CaCO3/L	--	--	--	--	--	69 =	133 =
CONV	Nitrate as N	mg/L as N	--	--	--	--	--	0.10 U	0.030 U
CONV	Sulfate	mg/L	--	--	--	--	--	1.7 =	1.3 =
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/L	--	--	1.02E-06 =	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/L	--	--	9.21E-07 =	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/L	--	--	9.21E-07 =	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/L	--	--	9.85E-07 =	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/L	--	--	9.88E-07 =	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/L	--	--	5.16E-07 =	--	--	--	--
DIOXIN	HpCDDs (total)	mg/L	--	--	--	--	--	--	--
DIOXIN	OCDD	mg/L	--	--	5.00E-06 U	--	--	--	--
DIOXIN	TEQ	mg/L	--	--	2.81E-06 =	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/L	--	--	2.50E-06 U	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/L	--	--	8.31E-07 =	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/L	--	--	2.50E-06 U	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/L	--	--	6.16E-07 =	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/L	--	--	9.14E-07 =	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/L	--	--	1.43E-06 =	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/L	--	--	6.79E-07 =	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/L	--	--	1.24E-06 =	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/L	--	--	9.43E-07 =	--	--	--	--
FURAN	HpCDFs (total)	mg/L	--	--	8.57E-07 =	--	--	--	--
FURAN	HxCDFs (total)	mg/L	--	--	1.13E-06 =	--	--	--	--
FURAN	OCDF	mg/L	--	--	2.30E-06 =	--	--	--	--
GAS	Carbon Dioxide	mg/L	--	--	--	--	--	51 =	38 =
GAS	Methane	mg/L	--	--	--	--	--	4.2 =	4.8 =
M-DISS	Arsenic	mg/L	0.15	--	--	--	--	0.010 U	--
M-DISS	Chromium	mg/L	--	--	--	--	--	0.010 U	--
M-DISS	Iron	mg/L	1.0	--	--	--	--	**14 =**	**6.4 =**
M-DISS	Zinc	mg/L	0.12	--	--	--	--	0.020 U	--
M-TOTAL	Arsenic	mg/L	0.15	--	--	--	--	0.010 U	0.0090 U
M-TOTAL	Chromium	mg/L	--	--	--	--	--	0.010 U	0.0010 U
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	--	--	--	--	0.0010 U	0.40 U
M-TOTAL	Copper	mg/L	0.0090	--	--	--	--	0.010 U	0.0010 U
M-TOTAL	Iron	mg/L	1.0	--	--	--	--	**14 =**	**25 =**
M-TOTAL	Iron (Ferrous)	mg/L	1.0	--	--	--	--	**7.4 =**	--
M-TOTAL	Zinc	mg/L	0.12	--	--	--	--	0.020 U	0.0020 U
SVOC	2,4,5-Trichlorophenol	mg/L	--	--	--	--	0.049 U	0.048 U	0.050 U
SVOC	2,4-Dichlorophenol	mg/L	3.7	--	--	--	0.0098 U	0.0096 U	0.010 U
SVOC	2,4-Dimethylphenol	mg/L	0.042	--	--	--	0.0098 U	0.0096 U	0.010 U
SVOC	2,4-Dinitrophenol	mg/L	--	--	--	--	0.049 U	0.048 R	0.050 U
SVOC	2,6-Dinitrotoluene	mg/L	0.23	--	--	--	0.0098 U	0.0096 U	0.010 U
SVOC	2-Methylnaphthalene	mg/L	--	0.0095 U	0.011 U	--	2.86E-05 =	0.0096 U	0.26 D
SVOC	2-Methylphenol	mg/L	0.013	--	--	--	0.0098 U	0.0096 U	0.010 U
SVOC	3,3'-Dichlorobenzidine	mg/L	--	--	--	--	0.020 U	0.019 U	0.020 U
SVOC	4,6-Dinitro-2-methylphenol	mg/L	--	--	--	--	0.049 U	0.048 U	0.050 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-07**	**PMW-07**	**PMW-07**	**PMW-07**	**PMW-07**	**PMW-08**
Sample ID:				PMW-07-W-52902-0	PMW-07-092502-0	PMW07-071503-0	PMW07-072403-0	PMW-DUP-012902-1	PMW8-0
QAQC Type:				N	N	N	N	FD	N
Date Collected:				05/29/02	09/25/02	07/15/03	07/24/03	01/29/02	05/08/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
SVOC	4-Methylphenol	mg/L	--	--	--	--	0.0098 U	0.0074 J	0.010 U
SVOC	4-Nitroaniline	mg/L	--	--	--	--	0.049 U	0.048 U	0.050 U
SVOC	Acenaphthene	mg/L	0.52	0.0095 U	0.011 U	--	4.57E-05 =	0.0096 U	0.11 DJ
SVOC	Acenaphthylene	mg/L	--	0.0095 U	0.011 U	--	3.20E-06 J	0.0096 U	0.010 U
SVOC	Aniline	mg/L	--	--	--	--	0.0098 U	--	0.010 U
SVOC	Anthracene	mg/L	0.013	0.0095 U	0.011 U	--	1.14E-05 J	0.0096 U	0.0034 J
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	0.0095 U	0.011 U	--	2.50E-06 J	0.0096 U	0.010 U
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	0.0095 U	0.011 U	--	4.60E-06 J	0.0096 U	0.010 U
SVOC	Benzo(b)fluoranthene	mg/L	--	0.0095 U	0.011 U	--	4.30E-06 J	0.0096 U	0.010 U
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.0095 U	0.011 U	--	3.50E-06 J	0.0096 U	0.010 U
SVOC	Benzo(k)fluoranthene	mg/L	--	0.0095 U	0.011 U	--	4.70E-06 J	0.0096 U	0.010 U
SVOC	Benzoic Acid	mg/L	0.042	--	--	--	0.049 U	0.048 U	0.050 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	--	--	--	**0.012 =**	0.0096 U	0.010 U
SVOC	Butyl benzyl phthalate	mg/L	0.019	--	--	--	0.0098 U	0.0096 U	0.010 U
SVOC	Carbazole	mg/L	--	--	--	--	--	0.0096 U	--
SVOC	Chrysene	mg/L	--	0.0095 U	0.011 U	--	2.30E-06 J	0.0096 U	0.010 U
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.0095 U	0.011 U	--	2.10E-06 J	0.0096 U	0.010 U
SVOC	Dibenzofuran	mg/L	0.0037	0.0095 U	0.011 U	--	0.0098 U	0.0096 U	**0.042 =**
SVOC	Di-n-butylphthalate	mg/L	0.035	--	--	--	0.0098 U	0.0096 U	0.010 U
SVOC	Di-n-octylphthalate	mg/L	0.71	--	--	--	0.0098 U	0.0096 U	0.010 U
SVOC	Fluoranthene	mg/L	0.0062	0.0095 U	0.011 U	--	2.00E-06 J	0.0096 U	0.010 U
SVOC	Fluorene	mg/L	0.0039	0.0095 U	0.011 U	--	2.40E-05 J	0.0096 U	**0.045 =**
SVOC	Hexachlorocyclopentadiene	mg/L	0.0052	--	--	--	0.0098 UJ	0.0096 U	0.010 U
SVOC	Hexachloroethane	mg/L	0.54	--	--	--	0.0098 U	0.0096 U	0.010 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.0095 U	0.011 U	--	--	0.0096 U	0.010 U
SVOC	Naphthalene	mg/L	0.62	0.0095 U	0.011 U	5.00E-04 U	0.0098 U	0.0096 U	**1.3 D**
SVOC	Pentachlorophenol	mg/L	0.015	0.047 U	0.053 U	--	0.049 U	0.048 U	0.050 U
SVOC	Phenanthrene	mg/L	0.0063	0.0095 U	0.011 U	--	0.0098 U	0.0096 U	**0.028 =**
SVOC	Phenol	mg/L	0.11	--	--	--	0.0098 U	0.0096 U	0.010 U
SVOC	Pyrene	mg/L	--	0.0095 U	0.011 U	--	0.0098 U	0.0096 U	0.010 U
TPH	Diesel	mg/L	--	--	--	--	--	0.020 U	4.1 =
TPH	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--	--	--	--	--	0.13 =	7.3 =
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--
VOC	1,1-Dichloroethene	mg/L	0.025	--	0.0010 U	5.00E-04 U	--	3.00E-04 U	--
VOC	1,2,4-Trimethylbenzene	mg/L	--	5.00E-04 U	0.0010 U	5.00E-04 U	--	3.00E-04 U	--
VOC	1,3,5-Trimethylbenzene	mg/L	--	5.00E-04 U	0.0010 U	5.00E-04 U	--	3.00E-04 U	--
VOC	Benzene	mg/L	0.13	5.00E-04 U	0.0010 U	5.00E-04 U	--	3.00E-04 U	--
VOC	Bromomethane	mg/L	--	--	0.0010 U	5.00E-04 U	--	3.00E-04 U	--
VOC	Ethylbenzene	mg/L	0.0073	5.00E-04 U	0.0010 U	5.00E-04 U	--	3.00E-04 U	--
VOC	Isopropylbenzene	mg/L	--	--	0.0010 U	5.00E-04 U	--	3.00E-04 U	--
VOC	m,p-Xylene	mg/L	--	0.0010 U	0.0020 U	0.0020 U	--	6.00E-04 U	--
VOC	n-Propylbenzene	mg/L	--	--	0.0010 U	5.00E-04 U	--	3.00E-04 U	--
VOC	o-Xylene	mg/L	--	--	0.0010 U	5.00E-04 U	--	0.074 =	--
VOC	p-Isopropyltoluene	mg/L	--	--	0.0010 U	5.00E-04 U	--	3.00E-04 U	--
VOC	sec-Butylbenzene	mg/L	--	--	0.0010 U	5.00E-04 U	--	3.00E-04 U	--

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-07**	**PMW-07**	**PMW-07**	**PMW-07**	**PMW-07**	**PMW-08**
Sample ID:				PMW-07-W-52902-0	PMW-07-092502-0	PMW07-071503-0	PMW07-072403-0	PMW-DUP-012902-1	PMW8-0
QAQC Type:				N	N	N	N	FD	N
Date Collected:				05/29/02	09/25/02	07/15/03	07/24/03	01/29/02	05/08/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
VOC	Styrene	mg/L	--	--	0.0010 U	--	--	3.00E-04 U	--
VOC	Tetrachloroethylene	mg/L	0.84	4.70E-04 J	0.0010 U	5.00E-05 J	--	0.013 =	--
VOC	Toluene	mg/L	0.0098	--	0.0010 U	5.00E-04 U	--	3.00E-04 U	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-08**	**PMW-08**	**PMW-08**	**PMW-08**	**PMW-08**	**PMW-08**
Sample ID:				PMW8-GW-101001	PMW-8-013002-0	PMW-8-20102-0	PMW-08-W-53002-0	PMW-08-092402-0	PMW08-071503-0
QAQC Type:				N	N	N	N	N	N
Date Collected:				10/10/01	01/30/02	01/30/02	05/30/02	09/24/02	07/15/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
CONV	Alkalinity as CaCO3	mg CaCO3/L	--	128 =	100 =	--	--	--	--
CONV	Nitrate as N	mg/L as N	--	0.10 U	0.10 U	--	--	--	--
CONV	Sulfate	mg/L	--	1.1 =	4.3 =	--	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/L	--	--	--	1.85E-06 A	--	2.50E-06 U	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/L	--	--	--	2.50E-05 U	--	1.43E-06 =	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/L	--	--	--	2.50E-05 U	--	1.44E-06 =	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/L	--	--	--	2.50E-05 U	--	1.49E-06 =	--
DIOXIN	1,2,3,7,8-PeCDD	mg/L	--	--	--	2.50E-05 U	--	6.71E-07 =	--
DIOXIN	2,3,7,8-TCDD	mg/L	--	--	--	5.00E-06 U	--	5.16E-07 =	--
DIOXIN	HpCDDs (total)	mg/L	--	--	--	7.63E-06 =	--	5.46E-06 =	--
DIOXIN	OCDD	mg/L	--	--	--	2.93E-05 A	--	3.74E-05 =	--
DIOXIN	TEQ	mg/L	--	--	--	2.20E-08 =	--	2.76E-06 =	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/L	--	--	--	2.50E-05 U	--	2.50E-06 U	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/L	--	--	--	2.50E-05 U	--	1.04E-06 =	--
FURAN	1,2,3,4,7,8-HxCDF	mg/L	--	--	--	2.50E-05 U	--	2.50E-06 U	--
FURAN	1,2,3,6,7,8-HxCDF	mg/L	--	--	--	2.50E-05 U	--	5.18E-07 =	--
FURAN	1,2,3,7,8,9-HxCDF	mg/L	--	--	--	2.50E-05 U	--	7.96E-07 =	--
FURAN	1,2,3,7,8-PeCDF	mg/L	--	--	--	2.50E-05 U	--	1.74E-06 =	--
FURAN	2,3,4,6,7,8-HxCDF	mg/L	--	--	--	2.50E-05 U	--	5.86E-07 =	--
FURAN	2,3,4,7,8-PeCDF	mg/L	--	--	--	2.50E-05 U	--	1.53E-06 =	--
FURAN	2,3,7,8-TCDF	mg/L	--	--	--	5.00E-06 U	--	8.38E-07 =	--
FURAN	HpCDFs (total)	mg/L	--	--	--	--	--	8.57E-07 =	--
FURAN	HxCDFs (total)	mg/L	--	--	--	--	--	1.18E-06 =	--
FURAN	OCDF	mg/L	--	--	--	5.20E-06 A	--	5.18E-06 =	--
GAS	Carbon Dioxide	mg/L	--	122 =	99 =	--	--	--	--
GAS	Methane	mg/L	--	16 =	6.5 =	--	--	--	--
M-DISS	Arsenic	mg/L	0.15	0.010 U	0.010 U	--	--	--	--
M-DISS	Chromium	mg/L	--	0.010 U	0.010 U	--	--	--	--
M-DISS	Iron	mg/L	1.0	**30 =**	**21 =**	--	--	--	--
M-DISS	Zinc	mg/L	0.12	0.020 U	0.020 U	--	--	--	--
M-TOTAL	Arsenic	mg/L	0.15	0.010 U	0.010 U	--	--	--	--
M-TOTAL	Chromium	mg/L	--	0.010 U	0.010 U	--	--	--	--
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	0.0010 U	**0.012 =**	--	--	--	--
M-TOTAL	Copper	mg/L	0.0090	0.010 U	0.010 U	--	--	--	--
M-TOTAL	Iron	mg/L	1.0	**30 =**	**19 =**	--	--	--	--
M-TOTAL	Iron (Ferrous)	mg/L	1.0	**16 =**	**12 =**	--	--	--	--
M-TOTAL	Zinc	mg/L	0.12	0.020 U	0.020 U	--	--	--	--
SVOC	2,4,5-Trichlorophenol	mg/L	--	0.048 U	0.049 U	--	--	--	0.048 U
SVOC	2,4-Dichlorophenol	mg/L	3.7	0.0096 U	0.0098 U	--	--	--	0.0096 U
SVOC	2,4-Dimethylphenol	mg/L	0.042	0.0096 U	0.0098 U	--	--	--	0.0096 U
SVOC	2,4-Dinitrophenol	mg/L	--	0.048 U	0.049 R	--	--	--	0.048 U
SVOC	2,6-Dinitrotoluene	mg/L	0.23	0.0096 U	0.0098 U	--	--	--	0.0096 U
SVOC	2-Methylnaphthalene	mg/L	--	0.19 =	0.14 =	--	0.15 =	0.14 =	0.15 =
SVOC	2-Methylphenol	mg/L	0.013	0.0096 U	0.0098 U	--	--	--	0.0096 U
SVOC	3,3'-Dichlorobenzidine	mg/L	--	0.019 U	0.020 U	--	--	--	0.019 U
SVOC	4,6-Dinitro-2-methylphenol	mg/L	--	0.048 U	0.049 U	--	--	--	0.048 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-08**	**PMW-08**	**PMW-08**	**PMW-08**	**PMW-08**	**PMW-08**
Sample ID:				PMW8-GW-101001	PMW-8-013002-0	PMW-8-20102-0	PMW-08-W-53002-0	PMW-08-092402-0	PMW08-071503-0
QAQC Type:				N	N	N	N	N	N
Date Collected:				10/10/01	01/30/02	01/30/02	05/30/02	09/24/02	07/15/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
SVOC	4-Methylphenol	mg/L	--	0.0096 U	0.0098 U	--	--	--	0.0096 U
SVOC	4-Nitroaniline	mg/L	--	0.048 U	0.049 U	--	--	--	0.0013 J
SVOC	Acenaphthene	mg/L	0.52	0.090 J	0.069 =	--	0.067 =	0.084 =	0.096 =
SVOC	Acenaphthylene	mg/L	--	0.0096 U	0.0098 U	--	0.010 U	0.0095 U	8.70E-04 =
SVOC	Aniline	mg/L	--	--	--	--	--	--	0.0096 U
SVOC	Anthracene	mg/L	0.013	0.0034 J	0.0019 J	--	0.0026 J	0.0032 J	0.0026 =
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	0.0096 U	0.0098 U	--	0.010 U	0.0095 U	1.21E-04 U
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	0.0096 U	0.0098 U	--	0.010 U	0.0095 U	1.21E-04 U
SVOC	Benzo(b)fluoranthene	mg/L	--	0.0096 U	0.0098 U	--	0.010 U	0.0095 U	1.21E-04 U
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.0096 U	0.0098 U	--	0.010 U	0.0095 U	9.50E-06 J
SVOC	Benzo(k)fluoranthene	mg/L	--	0.0096 U	0.0098 U	--	0.010 U	0.0095 U	1.21E-04 U
SVOC	Benzoic Acid	mg/L	0.042	0.048 U	0.049 U	--	--	--	0.048 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	0.0096 U	0.0098 U	--	--	--	**0.0051 J**
SVOC	Butyl benzyl phthalate	mg/L	0.019	0.0096 U	0.0098 U	--	--	--	0.0096 U
SVOC	Carbazole	mg/L	--	--	0.011 =	--	--	--	--
SVOC	Chrysene	mg/L	--	0.0096 UJ	0.0098 U	--	0.010 U	0.0095 U	1.21E-04 U
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.0096 U	0.0098 U	--	0.010 U	0.0095 U	1.04E-05 J
SVOC	Dibenzofuran	mg/L	0.0037	**0.038 =**	**0.021 =**	--	**0.024 =**	**0.032 =**	**0.029 =**
SVOC	Di-n-butylphthalate	mg/L	0.035	8.08E-04 J	0.0098 U	--	--	--	0.0096 U
SVOC	Di-n-octylphthalate	mg/L	0.71	0.0096 U	0.0098 U	--	--	--	0.0096 U
SVOC	Fluoranthene	mg/L	0.0062	0.0012 J	0.0098 U	--	0.010 U	0.0015 J	0.0012 =
SVOC	Fluorene	mg/L	0.0039	**0.038 =**	**0.024 =**	--	**0.026 =**	**0.035 =**	**0.037 =**
SVOC	Hexachlorocyclopentadiene	mg/L	0.0052	0.0096 U	0.0098 U	--	--	--	0.0096 U
SVOC	Hexachloroethane	mg/L	0.54	0.0096 U	0.0098 U	--	--	--	0.0096 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.0096 U	0.0098 U	--	0.010 U	0.0095 U	1.21E-04 U
SVOC	Naphthalene	mg/L	0.62	**1.2 =**	**0.68 =**	--	**0.94 =**	**0.76 =**	**0.70 =**
SVOC	Pentachlorophenol	mg/L	0.015	0.048 U	0.049 U	--	0.051 U	0.048 U	0.048 U
SVOC	Phenanthrene	mg/L	0.0063	**0.029 =**	**0.016 =**	--	**0.022 =**	**0.028 =**	**0.029 =**
SVOC	Phenol	mg/L	0.11	0.0096 U	0.0098 U	--	--	--	0.0096 U
SVOC	Pyrene	mg/L	--	0.0096 U	0.0098 U	--	0.010 U	0.0095 U	6.97E-04 =
TPH	Diesel	mg/L	--	--	1.4 =	--	--	--	--
TPH	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	2.4 =	--
TPH	Gasoline	mg/L	--	--	2.3 J	--	--	--	--
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	2.1 =	--
VOC	1,1-Dichloroethene	mg/L	0.025	0.0010 U	3.00E-04 U	--	--	0.0010 U	5.00E-04 U
VOC	1,2,4-Trimethylbenzene	mg/L	--	0.024 =	0.025 =	--	0.017 =	0.010 =	0.017 =
VOC	1,3,5-Trimethylbenzene	mg/L	--	0.012 =	0.012 =	--	0.0081 =	0.0057 =	0.0098 =
VOC	Benzene	mg/L	0.13	5.00E-04 J	4.40E-04 =	--	2.50E-04 J	3.30E-04 J	4.10E-04 J
VOC	Bromomethane	mg/L	--	0.0010 U	3.00E-04 U	--	--	0.0010 U	5.00E-04 U
VOC	Ethylbenzene	mg/L	0.0073	**0.036 =**	**0.028 =**	--	**0.019 =**	**0.016 =**	**0.027 =**
VOC	Isopropylbenzene	mg/L	--	0.011 =	0.0099 =	--	--	0.0062 =	0.0085 =
VOC	m,p-Xylene	mg/L	--	0.0027 =	0.0023 =	--	0.0028 =	0.0014 J	0.0018 J
VOC	n-Propylbenzene	mg/L	--	0.0043 =	0.0040 =	--	--	0.0027 =	0.0033 =
VOC	o-Xylene	mg/L	--	0.012 =	0.0084 =	--	--	0.0027 =	0.0026 =
VOC	p-Isopropyltoluene	mg/L	--	0.011 =	0.0011 =	--	--	7.00E-04 J	8.40E-04 =
VOC	sec-Butylbenzene	mg/L	--	0.0011 =	3.00E-04 U	--	--	0.0010 U	5.00E-04 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-08**	**PMW-08**	**PMW-08**	**PMW-08**	**PMW-08**	**PMW-08**
Sample ID:				PMW8-GW-101001	PMW-8-013002-0	PMW-8-20102-0	PMW-08-W-53002-0	PMW-08-092402-0	PMW08-071503-0
QAQC Type:				N	N	N	N	N	N
Date Collected:				10/10/01	01/30/02	01/30/02	05/30/02	09/24/02	07/15/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
VOC	Styrene	mg/L	--	0.0010 U	3.00E-04 U	--	--	0.0010 U	--
VOC	Tetrachloroethylene	mg/L	0.84	0.0010 U	5.50E-04 =	--	4.40E-04 J	4.20E-04 J	4.80E-04 J
VOC	Toluene	mg/L	0.0098	7.00E-04 J	3.00E-04 U	--	--	0.0010 U	5.00E-04 U

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-08**	**PMW-08**	**PMW-09**	**PMW-09**	**PMW-09**	**PMW-09**
Sample ID:				PMW8-GW-101001-1	PMW-DUP-W-5302-1	PMW9-0	PMW9-GW-100901	PMW-9-013102-0	PMW-09-W-53002-0
QAQC Type:				FD	FD	N	N	N	N
Date Collected:				10/10/01	05/30/02	05/08/01	10/09/01	01/31/02	05/30/02
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
CONV	Alkalinity as CaCO3	mg CaCO3/L	--	126 =	--	131 =	131 =	92 =	--
CONV	Nitrate as N	mg/L as N	--	0.10 U	--	0.030 U	0.10 U	0.10 U	--
CONV	Sulfate	mg/L	--	1.1 =	--	0.94 B	1.7 =	4.4 =	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/L	--	--	--	--	--	--	--
DIOXIN	OCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	TEQ	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/L	--	--	--	--	--	--	--
FURAN	HpCDFs (total)	mg/L	--	--	--	--	--	--	--
FURAN	HxCDFs (total)	mg/L	--	--	--	--	--	--	--
FURAN	OCDF	mg/L	--	--	--	--	--	--	--
GAS	Carbon Dioxide	mg/L	--	130 =	--	166 =	146 =	113 =	--
GAS	Methane	mg/L	--	17 =	--	17 =	16 =	10 =	--
M-DISS	Arsenic	mg/L	0.15	0.010 U	--	--	0.010 U	0.010 U	--
M-DISS	Chromium	mg/L	--	0.010 U	--	--	0.010 U	0.010 U	--
M-DISS	Iron	mg/L	1.0	**30 =**	--	**3.1 =**	**25 =**	**20 =**	--
M-DISS	Zinc	mg/L	0.12	0.020 U	--	--	0.020 U	0.020 U	--
M-TOTAL	Arsenic	mg/L	0.15	0.010 U	--	0.0090 U	0.010 U	0.010 U	--
M-TOTAL	Chromium	mg/L	--	0.010 U	--	0.0010 U	0.010 U	0.010 U	--
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	0.0010 U	--	0.40 U	0.0010 U	0.0010 U	--
M-TOTAL	Copper	mg/L	0.0090	0.010 U	--	0.0010 U	0.010 U	0.010 U	--
M-TOTAL	Iron	mg/L	1.0	**30 =**	--	**21 =**	**26 =**	**20 =**	--
M-TOTAL	Iron (Ferrous)	mg/L	1.0	**16 =**	--	--	**15 =**	**11 =**	--
M-TOTAL	Zinc	mg/L	0.12	0.020 U	--	0.0020 U	0.020 U	0.020 U	--
SVOC	2,4,5-Trichlorophenol	mg/L	--	0.048 U	--	0.050 U	0.047 U	0.050 U	--
SVOC	2,4-Dichlorophenol	mg/L	3.7	0.0095 U	--	0.010 U	0.0094 U	0.0099 U	--
SVOC	2,4-Dimethylphenol	mg/L	0.042	0.0095 U	--	0.010 U	0.0094 U	0.0099 U	--
SVOC	2,4-Dinitrophenol	mg/L	--	0.048 U	--	0.050 U	0.047 J	0.050 R	--
SVOC	2,6-Dinitrotoluene	mg/L	0.23	0.0095 U	--	0.010 U	0.0094 U	0.0099 U	--
SVOC	2-Methylnaphthalene	mg/L	--	0.23 =	0.14 =	0.0093 J	0.0099 =	0.0085 J	0.032 =
SVOC	2-Methylphenol	mg/L	0.013	0.0095 U	--	0.010 U	0.0094 U	0.0099 U	--
SVOC	3,3'-Dichlorobenzidine	mg/L	--	0.0010 J	--	0.020 U	0.019 U	0.020 U	--
SVOC	4,6-Dinitro-2-methylphenol	mg/L	--	0.048 U	--	0.050 U	0.047 U	0.050 U	--

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-08**	**PMW-08**	**PMW-09**	**PMW-09**	**PMW-09**	**PMW-09**
Sample ID:				PMW8-GW-101001-1	PMW-DUP-W-5302-1	PMW9-0	PMW9-GW-100901	PMW-9-013102-0	PMW-09-W-53002-0
QAQC Type:				FD	FD	N	N	N	N
Date Collected:				10/10/01	05/30/02	05/08/01	10/09/01	01/31/02	05/30/02
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
SVOC	4-Methylphenol	mg/L	--	0.0095 U	--	0.010 U	0.0094 U	0.0099 U	--
SVOC	4-Nitroaniline	mg/L	--	0.048 U	--	0.050 U	0.047 U	0.050 U	--
SVOC	Acenaphthene	mg/L	0.52	0.098 J	0.059 =	0.010 =	0.012 =	0.0097 J	0.017 =
SVOC	Acenaphthylene	mg/L	--	0.0095 U	0.0100 U	0.010 U	0.0094 U	0.0099 U	0.0096 U
SVOC	Aniline	mg/L	--	--	--	0.010 U	--	--	--
SVOC	Anthracene	mg/L	0.013	0.0036 J	0.0024 J	0.010 U	0.0094 U	0.0099 U	0.0096 U
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	**0.0013 J**	0.0100 U	0.010 U	0.0094 U	0.0099 U	0.0096 U
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	**0.0012 J**	0.0100 U	0.010 U	**9.50E-04 J**	0.0099 U	0.0096 U
SVOC	Benzo(b)fluoranthene	mg/L	--	0.0012 J	0.0100 U	0.010 U	0.0094 U	0.0099 U	0.0096 U
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.0017 J	0.0100 U	0.010 U	0.0094 U	0.0099 U	0.0096 U
SVOC	Benzo(k)fluoranthene	mg/L	--	0.0012 J	0.0100 U	0.010 U	0.0094 U	0.0099 U	0.0096 U
SVOC	Benzoic Acid	mg/L	0.042	0.048 U	--	0.050 U	0.047 U	0.050 U	--
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	0.0015 J	--	0.010 U	0.0094 U	0.0099 U	--
SVOC	Butyl benzyl phthalate	mg/L	0.019	0.0010 J	--	0.010 U	0.0094 U	0.0099 U	--
SVOC	Carbazole	mg/L	--	--	--	--	--	0.0016 J	--
SVOC	Chrysene	mg/L	--	0.0015 J	0.0100 U	0.010 U	0.0094 U	0.0099 U	0.0096 U
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.0016 J	0.0100 U	0.010 U	0.0094 U	0.0099 U	0.0096 U
SVOC	Dibenzofuran	mg/L	0.0037	**0.041 =**	**0.022 =**	0.010 U	8.75E-04 J	0.0099 U	0.0010 J
SVOC	Di-n-butylphthalate	mg/L	0.035	7.44E-04 J	--	0.010 U	0.0094 U	0.0099 U	--
SVOC	Di-n-octylphthalate	mg/L	0.71	0.0010 J	--	0.010 U	0.0094 U	0.0099 U	--
SVOC	Fluoranthene	mg/L	0.0062	0.0013 J	0.0100 U	0.010 U	0.0094 U	0.0099 U	0.0096 U
SVOC	Fluorene	mg/L	0.0039	**0.041 =**	**0.022 =**	0.0025 J	0.0024 J	0.0019 J	0.0027 J
SVOC	Hexachlorocyclopentadiene	mg/L	0.0052	0.0095 U	--	0.010 U	0.0094 J	0.0099 U	--
SVOC	Hexachloroethane	mg/L	0.54	0.0095 U	--	0.010 U	0.0094 U	0.0099 U	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.0016 J	0.0100 U	0.010 U	0.0094 U	0.0099 U	0.0096 U
SVOC	Naphthalene	mg/L	0.62	**1.4 =**	**0.84 =**	0.19 D	0.14 =	0.18 =	**0.69 =**
SVOC	Pentachlorophenol	mg/L	0.015	0.048 U	0.050 U	0.050 U	0.047 U	0.050 U	0.048 U
SVOC	Phenanthrene	mg/L	0.0063	**0.030 =**	**0.020 =**	0.010 U	0.0094 U	0.0099 U	0.0096 U
SVOC	Phenol	mg/L	0.11	0.0095 U	--	0.010 U	0.0094 U	0.0099 U	--
SVOC	Pyrene	mg/L	--	9.25E-04 J	0.0100 U	0.010 U	0.0094 U	0.0099 U	0.0096 U
TPH	Diesel	mg/L	--	--	--	1.2 =	--	0.43 =	--
TPH	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--	--	--	1.5 =	--	1.0 =	--
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--
VOC	1,1-Dichloroethene	mg/L	0.025	0.0010 U	--	0.0010 U	0.0010 U	3.00E-04 U	--
VOC	1,2,4-Trimethylbenzene	mg/L	--	0.029 =	0.018 =	4.30E-04 J	0.0010 U	6.10E-04 =	0.016 =
VOC	1,3,5-Trimethylbenzene	mg/L	--	0.014 =	0.0085 =	0.0010 U	0.0010 U	3.00E-04 U	0.0025 =
VOC	Benzene	mg/L	0.13	6.00E-04 J	2.60E-04 J	0.0016 =	6.00E-04 J	0.0019 =	0.0015 =
VOC	Bromomethane	mg/L	--	0.0010 U	--	0.0010 U	0.0010 U	3.00E-04 U	--
VOC	Ethylbenzene	mg/L	0.0073	**0.044 =**	**0.019 =**	**0.016 =**	0.0013 =	**0.025 =**	**0.025 =**
VOC	Isopropylbenzene	mg/L	--	0.013 =	--	0.0070 =	0.0042 =	0.0049 =	--
VOC	m,p-Xylene	mg/L	--	0.0033 =	0.0030 =	4.20E-04 J	0.0020 U	0.0029 =	0.0074 =
VOC	n-Propylbenzene	mg/L	--	0.0050 =	--	0.0025 =	0.0015 =	0.0014 =	--
VOC	o-Xylene	mg/L	--	0.015 =	--	0.0022 =	9.00E-04 J	3.00E-04 U	--
VOC	p-Isopropyltoluene	mg/L	--	0.012 =	--	0.0010 U	0.0010 U	2.40E-04 J	--
VOC	sec-Butylbenzene	mg/L	--	0.0010 U	--	3.60E-04 J	0.0010 U	3.00E-04 U	--

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-08**	**PMW-08**	**PMW-09**	**PMW-09**	**PMW-09**	**PMW-09**
Sample ID:				PMW8-GW-101001-1	PMW-DUP-W-5302-1	PMW9-0	PMW9-GW-100901	PMW-9-013102-0	PMW-09-W-53002-0
QAQC Type:				FD	FD	N	N	N	N
Date Collected:				10/10/01	05/30/02	05/08/01	10/09/01	01/31/02	05/30/02
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
VOC	Styrene	mg/L	--	0.0010 U	--	0.0010 U	0.0010 U	3.00E-04 U	--
VOC	Tetrachloroethylene	mg/L	0.84	0.0010 U	4.40E-04 J	0.0010 U	0.0010 U	8.20E-04 =	9.50E-04 =
VOC	Toluene	mg/L	0.0098	9.00E-04 J	--	5.60E-04 J	0.0010 U	3.00E-04 U	--

Notes:

= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-09**	**PMW-09**	**PMW-09**	**PMW-09**	**PMW-09**	**PMW-10**	**PMW-10**
Sample ID:				PMW-09-092502-0	PMW09-071503-0	PMW9-1	PMW-DUP-092502-1	PMW09-071503-1	PMW10-0	PMW10-GW-101001
QAQC Type:				N	N	FD	FD	FD	N	N
Date Collected:				09/25/02	07/15/03	05/08/01	09/25/02	07/15/03	05/08/01	10/10/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**							
CONV	Alkalinity as CaCO3	mg CaCO3/L	--	--	--	132 =	--	--	165 =	258 =
CONV	Nitrate as N	mg/L as N	--	--	--	0.030 U	--	--	0.030 U	0.10 U
CONV	Sulfate	mg/L	--	--	--	0.94 B	--	--	0.53 B	1.6 =
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/L	--	1.20E-06 =	--	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/L	--	1.46E-06 =	--	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/L	--	1.52E-06 =	--	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/L	--	1.57E-06 =	--	--	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/L	--	9.88E-07 =	--	--	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/L	--	5.92E-07 =	--	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/L	--	--	--	--	--	--	--	--
DIOXIN	OCDD	mg/L	--	5.00E-06 U	--	--	--	--	--	--
DIOXIN	TEQ	mg/L	--	3.17E-06 =	--	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/L	--	6.67E-07 =	--	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/L	--	9.96E-07 =	--	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/L	--	6.42E-07 =	--	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/L	--	6.36E-07 =	--	--	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/L	--	9.41E-07 =	--	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/L	--	1.36E-06 =	--	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/L	--	6.91E-07 =	--	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/L	--	1.25E-06 =	--	--	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/L	--	1.23E-06 =	--	--	--	--	--	--
FURAN	HpCDFs (total)	mg/L	--	--	--	--	--	--	--	--
FURAN	HxCDFs (total)	mg/L	--	--	--	--	--	--	--	--
FURAN	OCDF	mg/L	--	2.09E-06 =	--	--	--	--	--	--
GAS	Carbon Dioxide	mg/L	--	--	--	86 =	--	--	56 =	125 =
GAS	Methane	mg/L	--	--	--	7.4 =	--	--	3.7 =	15 =
M-DISS	Arsenic	mg/L	0.15	--	--	--	--	--	--	0.010 U
M-DISS	Chromium	mg/L	--	--	--	--	--	--	--	0.010 U
M-DISS	Iron	mg/L	1.0	--	--	**3.2 =**	--	--	**24 =**	**40 =**
M-DISS	Zinc	mg/L	0.12	--	--	--	--	--	--	0.020 U
M-TOTAL	Arsenic	mg/L	0.15	--	--	0.0090 U	--	--	0.0090 U	0.010 U
M-TOTAL	Chromium	mg/L	--	--	--	0.0010 U	--	--	0.0010 U	0.010 U
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	--	--	0.40 U	--	--	0.40 U	0.0010 U
M-TOTAL	Copper	mg/L	0.0090	--	--	0.0010 U	--	--	0.0010 U	0.010 U
M-TOTAL	Iron	mg/L	1.0	--	--	**22 =**	--	--	**23 =**	**40 =**
M-TOTAL	Iron (Ferrous)	mg/L	1.0	--	--	--	--	--	--	**15 =**
M-TOTAL	Zinc	mg/L	0.12	--	--	0.0020 U	--	--	0.0020 U	0.020 U
SVOC	2,4,5-Trichlorophenol	mg/L	--	--	0.049 U	0.050 U	--	0.048 U	0.050 U	0.047 U
SVOC	2,4-Dichlorophenol	mg/L	3.7	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	0.0094 U
SVOC	2,4-Dimethylphenol	mg/L	0.042	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	0.0094 U
SVOC	2,4-Dinitrophenol	mg/L	--	--	0.049 U	0.050 U	--	0.048 U	0.050 U	0.047 U
SVOC	2,6-Dinitrotoluene	mg/L	0.23	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	0.0094 U
SVOC	2-Methylnaphthalene	mg/L	--	0.034 =	0.026 =	0.0098 =	0.042 =	0.025 =	0.27 D	0.19 =
SVOC	2-Methylphenol	mg/L	0.013	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	0.0094 U
SVOC	3,3'-Dichlorobenzidine	mg/L	--	--	0.020 U	0.020 U	--	0.019 U	0.020 U	0.019 U
SVOC	4,6-Dinitro-2-methylphenol	mg/L	--	--	0.049 U	0.050 U	--	0.048 U	0.050 U	0.047 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-09**	**PMW-09**	**PMW-09**	**PMW-09**	**PMW-09**	**PMW-10**	**PMW-10**
Sample ID:				PMW-09-092502-0	PMW09-071503-0	PMW9-1	PMW-DUP-092502-1	PMW09-071503-1	PMW10-0	PMW10-GW-101001
QAQC Type:				N	N	FD	FD	FD	N	N
Date Collected:				09/25/02	07/15/03	05/08/01	09/25/02	07/15/03	05/08/01	10/10/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**							
SVOC	4-Methylphenol	mg/L	--	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	0.0094 U
SVOC	4-Nitroaniline	mg/L	--	--	0.049 U	0.050 U	--	0.048 U	0.050 U	0.047 U
SVOC	Acenaphthene	mg/L	0.52	0.017 =	0.021 J	0.011 =	0.021 =	0.019 J	0.29 D	0.27 =
SVOC	Acenaphthylene	mg/L	--	0.0097 U	2.67E-04 =	0.010 U	0.010 U	2.41E-04 =	0.0026 J	0.0094 U
SVOC	Aniline	mg/L	--	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	--
SVOC	Anthracene	mg/L	0.013	0.0097 U	6.15E-05 J	0.010 U	0.010 U	6.17E-05 J	**0.018 =**	**0.023 =**
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	0.0097 U	1.20E-04 U	0.010 U	0.010 U	1.22E-04 U	0.010 U	0.0094 U
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	0.0097 U	1.20E-04 U	0.010 U	0.010 U	1.22E-04 U	0.010 U	0.0094 U
SVOC	Benzo(b)fluoranthene	mg/L	--	0.0097 U	1.20E-04 U	0.010 U	0.010 U	1.22E-04 U	0.010 U	0.0094 U
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.0097 U	8.30E-06 J	0.010 U	0.010 U	1.17E-05 J	0.010 U	0.0094 U
SVOC	Benzo(k)fluoranthene	mg/L	--	0.0097 U	1.20E-04 U	0.010 U	0.010 U	1.22E-04 U	0.010 U	0.0094 U
SVOC	Benzoic Acid	mg/L	0.042	--	0.049 U	0.050 U	--	0.048 U	0.050 U	0.047 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	0.0094 U
SVOC	Butyl benzyl phthalate	mg/L	0.019	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	0.0094 U
SVOC	Carbazole	mg/L	--	--	--	--	--	--	--	--
SVOC	Chrysene	mg/L	--	0.0097 U	1.20E-04 U	0.010 U	0.010 U	1.22E-04 U	0.010 U	0.0094 UJ
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.0097 U	7.80E-06 J	0.010 U	0.010 U	1.22E-04 U	0.010 U	0.0094 U
SVOC	Dibenzofuran	mg/L	0.0037	8.92E-04 J	0.0012 J	0.010 U	0.0011 J	0.0011 J	**0.16 D**	**0.14 =**
SVOC	Di-n-butylphthalate	mg/L	0.035	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	8.29E-04 J
SVOC	Di-n-octylphthalate	mg/L	0.71	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	0.0094 U
SVOC	Fluoranthene	mg/L	0.0062	0.0097 U	1.20E-04 U	0.010 U	0.010 U	1.22E-04 U	**0.018 =**	**0.019 =**
SVOC	Fluorene	mg/L	0.0039	0.0026 J	0.0032 =	0.0026 J	0.0033 J	0.0027 =	**0.18 D**	**0.18 =**
SVOC	Hexachlorocyclopentadiene	mg/L	0.0052	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	0.0094 U
SVOC	Hexachloroethane	mg/L	0.54	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	0.0094 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.0097 U	1.20E-04 U	0.010 U	0.010 U	1.22E-04 U	0.010 U	0.0094 U
SVOC	Naphthalene	mg/L	0.62	0.45 =	0.44 =	0.21 D	0.55 =	0.50 =	0.26 D	**0.65 =**
SVOC	Pentachlorophenol	mg/L	0.015	0.048 U	0.049 U	0.050 U	0.051 U	0.048 U	0.050 U	0.047 U
SVOC	Phenanthrene	mg/L	0.0063	0.0097 U	5.04E-04 =	0.010 U	0.010 U	4.51E-04 =	**0.17 D**	**0.21 =**
SVOC	Phenol	mg/L	0.11	--	0.0097 U	0.010 U	--	0.0097 U	0.010 U	0.0094 U
SVOC	Pyrene	mg/L	--	0.0097 U	1.20E-04 U	0.010 U	0.010 U	1.22E-04 U	0.0096 =	0.011 =
TPH	Diesel	mg/L	--	--	--	1.2 =	--	--	--	--
TPH	Diesel Range Organics (C12-C24)	mg/L	--	1.3 =	--	--	1.0 =	--	--	--
TPH	Gasoline	mg/L	--	--	--	1.2 =	--	--	--	--
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	1.2 =	--	--	0.78 =	--	--	--
VOC	1,1-Dichloroethene	mg/L	0.025	0.0010 U	5.00E-04 U	0.0010 U	0.0010 U	5.00E-04 U	--	0.0010 U
VOC	1,2,4-Trimethylbenzene	mg/L	--	0.0075 =	0.0086 =	4.80E-04 J	0.0079 =	0.0091 =	--	0.015 =
VOC	1,3,5-Trimethylbenzene	mg/L	--	6.20E-04 J	6.40E-04 =	0.0010 U	7.00E-04 J	6.60E-04 =	--	0.0091 =
VOC	Benzene	mg/L	0.13	9.70E-04 J	8.40E-04 =	0.0020 =	9.90E-04 J	8.50E-04 =	--	0.0010 U
VOC	Bromomethane	mg/L	--	0.0010 U	5.00E-04 U	0.0010 U	0.0010 U	5.00E-04 U	--	0.0010 U
VOC	Ethylbenzene	mg/L	0.0073	**0.0096 =**	**0.010 =**	**0.018 =**	**0.010 =**	**0.011 =**	--	0.0065 =
VOC	Isopropylbenzene	mg/L	--	0.0059 =	0.0054 =	0.0077 =	0.0061 =	0.0057 =	--	0.0012 =
VOC	m,p-Xylene	mg/L	--	9.50E-04 J	0.0029 =	3.80E-04 J	9.80E-04 J	0.0029 =	--	0.011 =
VOC	n-Propylbenzene	mg/L	--	0.0025 =	0.0021 =	0.0028 =	0.0027 =	0.0021 =	--	0.0010 U
VOC	o-Xylene	mg/L	--	0.0010 U	5.00E-04 U	0.0023 =	0.0010 U	4.00E-04 J	--	0.0061 =
VOC	p-Isopropyltoluene	mg/L	--	4.70E-04 J	3.20E-04 J	0.0010 U	5.00E-04 J	3.30E-04 J	--	0.0023 =
VOC	sec-Butylbenzene	mg/L	--	0.0010 U	5.00E-04 U	4.20E-04 J	0.0010 U	5.00E-04 U	--	0.0010 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-09**	**PMW-09**	**PMW-09**	**PMW-09**	**PMW-09**	**PMW-10**	**PMW-10**
Sample ID:				PMW-09-092502-0	PMW09-071503-0	PMW9-1	PMW-DUP-092502-1	PMW09-071503-1	PMW10-0	PMW10-GW-101001
QAQC Type:				N	N	FD	FD	FD	N	N
Date Collected:				09/25/02	07/15/03	05/08/01	09/25/02	07/15/03	05/08/01	10/10/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**							
VOC	Styrene	mg/L	--	0.0010 U	--	0.0010 U	0.0010 U	--	--	0.0010 U
VOC	Tetrachloroethylene	mg/L	0.84	3.40E-04 J	4.00E-04 J	0.0010 U	3.30E-04 J	3.90E-04 J	--	0.0010 U
VOC	Toluene	mg/L	0.0098	0.0010 U	5.00E-04 U	3.90E-04 J	0.0010 U	5.00E-04 U	--	8.00E-04 J

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-10**	**PMW-12**	**PMW-12**	**PMW-12**	**PMW-13**	**PMW-13**
Sample ID:				PMW-10-012902-0	PMW-12-013002-0	PMW-12-W-53002-0	PMW-12-092402-0	PMW-13-013102-0	PMW130714030
QAQC Type:				N	N	N	N	N	N
Date Collected:				01/29/02	01/30/02	05/30/02	09/24/02	01/31/02	07/14/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
CONV	Alkalinity as CaCO3	mg CaCO3/L	--	108 =	112 =	--	--	104 =	--
CONV	Nitrate as N	mg/L as N	--	2.7 =	0.10 U	--	--	0.10 UJ	--
CONV	Sulfate	mg/L	--	36 =	10 =	--	--	2.8 =	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/L	--	--	--	--	--	--	--
DIOXIN	OCDD	mg/L	--	--	--	--	--	--	--
DIOXIN	TEQ	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/L	--	--	--	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/L	--	--	--	--	--	--	--
FURAN	HpCDFs (total)	mg/L	--	--	--	--	--	--	--
FURAN	HxCDFs (total)	mg/L	--	--	--	--	--	--	--
FURAN	OCDF	mg/L	--	--	--	--	--	--	--
GAS	Carbon Dioxide	mg/L	--	91 =	52 =	--	--	101 =	--
GAS	Methane	mg/L	--	0.91 =	0.39 =	--	--	8.4 =	--
M-DISS	Arsenic	mg/L	0.15	0.010 U	0.010 U	--	--	0.010 U	--
M-DISS	Chromium	mg/L	--	0.010 U	0.010 U	--	--	0.010 UJ	--
M-DISS	Iron	mg/L	1.0	**2.1 =**	**6.9 =**	--	--	**28 =**	--
M-DISS	Zinc	mg/L	0.12	0.057 =	0.020 U	--	--	0.020 U	--
M-TOTAL	Arsenic	mg/L	0.15	0.010 U	0.010 U	--	--	0.010 U	--
M-TOTAL	Chromium	mg/L	--	0.010 U	0.010 U	--	--	0.010 UJ	--
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	0.0010 U	0.0010 U	--	--	0.0010 UJ	--
M-TOTAL	Copper	mg/L	0.0090	0.010 U	0.010 U	--	--	0.010 U	--
M-TOTAL	Iron	mg/L	1.0	**2.7 =**	**7.5 =**	--	--	**28 =**	--
M-TOTAL	Iron (Ferrous)	mg/L	1.0	**1.7 =**	**4.6 =**	--	--	**4.2 =**	--
M-TOTAL	Zinc	mg/L	0.12	0.060 =	0.020 U	--	--	0.020 U	--
SVOC	2,4,5-Trichlorophenol	mg/L	--	0.048 U	0.051 U	--	--	0.049 U	0.097 U
SVOC	2,4-Dichlorophenol	mg/L	3.7	0.0095 U	0.010 U	--	--	0.0099 U	0.019 U
SVOC	2,4-Dimethylphenol	mg/L	0.042	0.0095 U	0.010 U	--	--	0.0099 U	0.019 U
SVOC	2,4-Dinitrophenol	mg/L	--	0.048 R	0.051 R	--	--	0.049 R	0.097 U
SVOC	2,6-Dinitrotoluene	mg/L	0.23	0.0095 U	0.010 U	--	--	0.0099 U	0.019 U
SVOC	2-Methylnaphthalene	mg/L	--	0.014 =	0.010 U	0.010 U	0.0097 U	0.22 J	0.24 =
SVOC	2-Methylphenol	mg/L	0.013	0.0095 U	0.010 U	--	--	0.0099 U	0.019 U
SVOC	3,3'-Dichlorobenzidine	mg/L	--	0.019 U	0.020 U	--	--	0.020 U	0.039 U
SVOC	4,6-Dinitro-2-methylphenol	mg/L	--	0.048 U	0.051 U	--	--	0.049 U	0.097 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-10**	**PMW-12**	**PMW-12**	**PMW-12**	**PMW-13**	**PMW-13**
Sample ID:				PMW-10-012902-0	PMW-12-013002-0	PMW-12-W-53002-0	PMW-12-092402-0	PMW-13-013102-0	PMW130714030
QAQC Type:				N	N	N	N	N	N
Date Collected:				01/29/02	01/30/02	05/30/02	09/24/02	01/31/02	07/14/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
SVOC	4-Methylphenol	mg/L	--	0.0095 U	0.010 U	--	--	0.0099 U	0.019 U
SVOC	4-Nitroaniline	mg/L	--	0.048 U	0.051 U	--	--	0.049 U	0.097 U
SVOC	Acenaphthene	mg/L	0.52	0.026 =	0.0021 J	0.0021 J	0.0061 J	0.10 =	0.11 =
SVOC	Acenaphthylene	mg/L	--	0.0095 U	0.010 U	0.010 U	0.0097 U	0.0099 U	0.0013 =
SVOC	Aniline	mg/L	--	--	--	--	--	--	0.019 U
SVOC	Anthracene	mg/L	0.013	0.0024 J	0.010 U	0.010 U	0.0097 U	0.0022 J	0.0022 =
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	0.0095 U	0.010 U	0.010 U	0.0097 U	0.0099 U	7.90E-06 J
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	0.0095 U	0.010 U	0.010 U	0.0097 U	0.0099 U	1.12E-05 J
SVOC	Benzo(b)fluoranthene	mg/L	--	0.0095 U	0.010 U	0.010 U	0.0097 U	0.0099 U	1.07E-05 J
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.0095 U	0.010 U	0.010 U	0.0097 U	0.0099 U	6.80E-06 J
SVOC	Benzo(k)fluoranthene	mg/L	--	0.0095 U	0.010 U	0.010 U	0.0097 U	0.0099 U	1.11E-05 J
SVOC	Benzoic Acid	mg/L	0.042	0.048 U	0.051 U	--	--	0.049 U	0.097 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	0.0095 U	0.010 U	--	--	0.0099 U	0.019 U
SVOC	Butyl benzyl phthalate	mg/L	0.019	0.0095 U	0.010 U	--	--	0.0099 U	0.019 U
SVOC	Carbazole	mg/L	--	0.0047 J	0.010 U	--	--	0.029 =	--
SVOC	Chrysene	mg/L	--	0.0095 U	0.010 U	0.010 U	0.0097 U	0.0099 U	6.70E-06 J
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.0095 U	0.010 U	0.010 U	0.0097 U	0.0099 U	8.20E-06 J
SVOC	Dibenzofuran	mg/L	0.0037	**0.010 =**	0.010 U	0.010 U	0.0097 U	**0.039 =**	**0.041 =**
SVOC	Di-n-butylphthalate	mg/L	0.035	0.0095 U	0.010 U	--	--	0.0099 U	0.019 U
SVOC	Di-n-octylphthalate	mg/L	0.71	0.0048 J	0.010 U	--	--	0.0099 U	0.019 U
SVOC	Fluoranthene	mg/L	0.0062	0.0048 J	0.010 U	0.010 U	0.0097 U	0.0099 U	3.30E-04 =
SVOC	Fluorene	mg/L	0.0039	**0.015 =**	0.010 U	0.010 U	0.0097 U	**0.043 =**	**0.044 =**
SVOC	Hexachlorocyclopentadiene	mg/L	0.0052	0.0095 U	0.010 U	--	--	0.0099 U	0.019 U
SVOC	Hexachloroethane	mg/L	0.54	0.0095 U	0.010 U	--	--	0.0099 U	0.019 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.0095 U	0.010 U	0.010 U	0.0097 U	0.0099 U	7.80E-06 J
SVOC	Naphthalene	mg/L	0.62	0.057 =	0.010 R	0.010 U	0.0097 U	**2.4 J**	**2.5 J**
SVOC	Pentachlorophenol	mg/L	0.015	0.048 U	0.051 U	0.051 U	0.049 U	0.049 U	0.097 U
SVOC	Phenanthrene	mg/L	0.0063	**0.0064 J**	0.010 U	0.010 U	0.0097 U	**0.017 =**	**0.022 =**
SVOC	Phenol	mg/L	0.11	0.0095 U	0.010 U	--	--	0.0099 U	0.019 U
SVOC	Pyrene	mg/L	--	0.0020 J	0.010 U	0.010 U	0.0097 U	0.0099 U	1.15E-04 =
TPH	Diesel	mg/L	--	0.43 =	0.067 =	--	--	3.7 =	--
TPH	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--	0.10 U	0.10 U	--	--	8.2 =	--
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--
VOC	1,1-Dichloroethene	mg/L	0.025	3.00E-04 U	3.00E-04 U	--	0.0010 U	3.00E-04 U	5.00E-04 U
VOC	1,2,4-Trimethylbenzene	mg/L	--	0.0023 =	3.00E-04 U	5.00E-04 U	0.0010 U	0.038 =	0.026 =
VOC	1,3,5-Trimethylbenzene	mg/L	--	0.0015 =	3.00E-04 U	5.00E-04 U	0.0010 U	0.0097 =	0.0032 =
VOC	Benzene	mg/L	0.13	3.00E-04 U	3.00E-04 U	5.00E-04 U	0.0010 U	0.0025 =	0.0018 =
VOC	Bromomethane	mg/L	--	3.00E-04 U	3.00E-04 U	--	0.0010 U	3.00E-04 U	5.00E-04 U
VOC	Ethylbenzene	mg/L	0.0073	0.0010 =	3.00E-04 U	5.00E-04 U	0.0010 U	**0.087 =**	**0.059 =**
VOC	Isopropylbenzene	mg/L	--	2.00E-04 J	3.00E-04 U	--	0.0010 U	0.016 =	0.014 =
VOC	m,p-Xylene	mg/L	--	0.0017 =	6.00E-04 U	0.0010 U	0.0020 U	0.014 =	0.011 =
VOC	n-Propylbenzene	mg/L	--	3.00E-04 U	3.00E-04 U	--	0.0010 U	0.0066 =	0.0071 =
VOC	o-Xylene	mg/L	--	3.00E-04 U	3.00E-04 U	--	0.0010 U	0.0016 =	0.0016 =
VOC	p-Isopropyltoluene	mg/L	--	3.00E-04 U	3.00E-04 U	--	0.0010 U	0.0013 =	0.0017 =
VOC	sec-Butylbenzene	mg/L	--	3.00E-04 U	3.00E-04 U	--	0.0010 U	3.00E-04 U	5.00E-04 U

TABLE 5

Perched Water-Bearing Zone Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**PMW-10**	**PMW-12**	**PMW-12**	**PMW-12**	**PMW-13**	**PMW-13**
Sample ID:				PMW-10-012902-0	PMW-12-013002-0	PMW-12-W-53002-0	PMW-12-092402-0	PMW-13-013102-0	PMW130714030
QAQC Type:				N	N	N	N	N	N
Date Collected:				01/29/02	01/30/02	05/30/02	09/24/02	01/31/02	07/14/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**						
VOC	Styrene	mg/L	--	3.00E-04 U	3.00E-04 U	--	0.0010 U	3.00E-04 U	--
VOC	Tetrachloroethylene	mg/L	0.84	2.90E-04 J	3.00E-04 U	5.00E-04 U	0.0010 U	0.0019 =	0.0023 =
VOC	Toluene	mg/L	0.0098	3.00E-04 U	3.00E-04 U	--	0.0010 U	3.00E-04 U	5.00E-04 U

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 6

Shallow Water-Bearing Zone

Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**SMW-01**	**SMW-01**	**SMW-01**	**SMW-01**	**SMW-01**	**SMW-02**	**SMW-02**
Sample ID:				SMW1-0	SMW1-GW-100901	SMW-1-013002-0	SMW-01-092402-0	SMW01-071503-0	SMW-2-013102-0	SMW-02-092402-0
QAQC Type:				N	N	N	N	N	N	N
Date Collected:				05/08/01	10/09/01	01/30/02	09/24/02	07/15/03	01/31/02	09/24/02
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**							
M-DISS	Iron	mg/L	1.0	--	**64 =**	**68 =**	--	--	**59 =**	--
M-TOTAL	Arsenic	mg/L	0.15	0.0091 =	0.010 U	0.010 U	--	--	0.010 U	--
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	2.0 U	0.0010 U	**0.012 =**	--	--	0.0010 UJ	--
M-TOTAL	Copper	mg/L	0.0090	0.0016 =	0.010 U	0.010 U	--	--	0.010 U	--
M-TOTAL	Iron	mg/L	1.0	**63 =**	**66 =**	**66 =**	--	--	**59 =**	--
M-TOTAL	Iron (Ferrous)	mg/L	1.0	--	--	--	--	--	**7.8 =**	--
M-TOTAL	Zinc	mg/L	0.12	0.0069 =	0.020 U	0.020 U	--	--	0.11 =	--
SVOC	2,4-Dinitropheno	mg/L	--	0.050 U	0.047 J	0.051 R	--	0.048 U	0.048 R	--
SVOC	2-Methylnaphthalene	mg/L	--	0.010 U	0.0094 U	0.010 U	0.0099 U	1.65E-05 J	0.0096 U	0.010 U
SVOC	Acenaphthene	mg/L	0.52	0.010 U	0.0094 U	0.010 U	0.0099 U	3.53E-05 =	0.0096 U	0.010 U
SVOC	Acenaphthylene	mg/L	--	0.010 U	0.0094 U	0.010 U	0.0099 U	2.48E-05 U	0.0096 U	0.010 U
SVOC	Anthracene	mg/L	0.013	0.010 U	0.0094 U	0.010 U	0.0099 U	3.00E-06 J	0.0096 U	0.010 U
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	0.010 U	0.0094 U	0.010 U	0.0099 U	3.00E-06 J	0.0096 U	0.010 U
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	0.010 U	**8.10E-04 J**	0.010 U	0.0099 U	3.40E-06 J	0.0096 U	0.010 U
SVOC	Benzo(b)fluoranthene	mg/L	--	0.010 U	0.0094 U	0.010 U	0.0099 U	2.48E-05 U	0.0096 U	0.010 U
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.010 U	0.0094 U	0.010 U	0.0099 U	3.00E-06 J	0.0096 U	0.010 U
SVOC	Benzo(k)fluoranthene	mg/L	--	0.010 U	0.0094 U	0.010 U	0.0099 U	3.70E-06 J	0.0096 U	0.010 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	0.010 U	0.0094 U	0.010 U	--	0.0097 U	**0.015 =**	--
SVOC	Chrysene	mg/L	--	0.010 U	0.0094 U	0.010 U	0.0099 U	3.00E-06 J	0.0096 U	0.010 U
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.010 U	0.0094 U	0.010 U	0.0099 U	2.70E-06 J	0.0096 U	0.010 U
SVOC	Dimethyl phthalate	mg/L	0.0030	0.010 U	0.0094 U	0.010 U	--	0.0097 U	**0.0034 J**	--
SVOC	Fluoranthene	mg/L	0.0062	0.010 U	0.0094 U	0.010 U	0.0099 U	3.40E-06 J	0.0096 U	0.010 U
SVOC	Fluorene	mg/L	0.0039	0.010 U	0.0094 U	0.010 U	0.0099 U	2.06E-05 J	0.0096 U	0.010 U
SVOC	Hexachlorocyclopentadiene	mg/L	0.0052	0.010 U	0.0094 J	0.010 U	--	0.0097 U	0.0096 U	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.010 U	0.0094 U	0.010 U	0.0099 U	2.80E-06 J	0.0096 U	0.010 U
SVOC	Naphthalene	mg/L	0.62	0.0011 J	0.0094 U	0.010 R	0.0099 U	6.78E-05 =	0.0028 J	0.010 U
SVOC	Phenanthrene	mg/L	0.0063	0.010 U	0.0094 U	0.010 U	0.0099 U	8.50E-06 J	0.0096 U	0.010 U
SVOC	Pyrene	mg/L	--	0.010 U	0.0094 U	0.010 U	0.0099 U	2.50E-06 J	0.0096 U	0.010 U

TABLE 6

Shallow Water-Bearing Zone

Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**SMW-01**	**SMW-01**	**SMW-01**	**SMW-01**	**SMW-01**	**SMW-02**	**SMW-02**
Sample ID:				SMW1-0	SMW1-GW-100901	SMW-1-013002-0	SMW-01-092402-0	SMW01-071503-0	SMW-2-013102-0	SMW-02-092402-0
QAQC Type:				N	N	N	N	N	N	N
Date Collected:				05/08/01	10/09/01	01/30/02	09/24/02	07/15/03	01/31/02	09/24/02
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**							
TPH	Diesel	mg/L	--	0.23 J	--	0.034 =	--	--	0.030 =	--
TPH	Gasoline	mg/L	--	0.050 U	--	0.10 U	--	--	0.55 =	--
VOC	1,2,4-Trimethylbenzene	mg/L	--	0.0010 U	0.0010 U	3.00E-04 U	1.00E-04 J	5.00E-04 U	8.00E-05 J	0.0010 U
VOC	Ethylbenzene	mg/L	0.0073	0.0010 U	0.0010 U	3.00E-04 U	0.0010 U	5.00E-04 U	1.00E-04 J	0.0010 U
VOC	o-Xylene	mg/L	--	0.0010 U	0.0010 U	3.00E-04 U	0.0010 U	5.00E-04 U	4.50E-04 =	0.0010 U
VOC	Tetrachloroethylene	mg/L	0.84	0.0010 U	0.0010 U	3.00E-04 U	0.0010 U	5.00E-04 U	3.00E-04 U	0.0010 U

Notes:

= - Analyte found

B - Analyte detected in blank

SVOC - Semivolatile organic compounds

CONV - General chemistry

D - Sample was diluted by laboratory

FD - Field duplicate

J - Estimated result

M -DISS - Dissolved metals

M - TOTAL AVS = Total metals (acid volatile sulfides)

M - TOTAL = Total metals

N - Primary sample

TPH - Total petroleum hydrocarbons

U - Analyte not found at the listed detection limit

VOC - Volatile organic compounds

Shading indicates detected concentration exceeds screening value.

TABLE 6

Shallow Water-Bearing Zone

Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**SMW-02**	**SMW-03**	**SMW-03**	**SMW-03**	**SMW-03**
Sample ID:				SMW020714030	SMW-3-013102-0	SMW-03-092502-0	SMW03-071503	SMW03-072403-0
QAQC Type:				N	N	N	N	N
Date Collected:				07/14/03	01/31/02	09/25/02	07/15/03	07/24/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**					
M-DISS	Iron	mg/L	1.0	--	**56 =**	--	--	--
M-TOTAL	Arsenic	mg/L	0.15	--	0.012 =	--	--	--
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	--	0.0010 U	--	--	--
M-TOTAL	Copper	mg/L	0.0090	--	0.010 U	--	--	--
M-TOTAL	Iron	mg/L	1.0	--	**58 =**	--	--	--
M-TOTAL	Iron (Ferrous)	mg/L	1.0	--	--	--	--	--
M-TOTAL	Zinc	mg/L	0.12	--	0.020 U	--	--	--
SVOC	2,4-Dinitropheno	mg/L	--	0.048 U	0.049 R	--	--	0.048 U
SVOC	2-Methylnaphthalene	mg/L	--	2.07E-05 J	0.0097 U	0.010 U	--	1.35E-05 J
SVOC	Acenaphthene	mg/L	0.52	3.93E-05 =	0.0097 U	0.010 U	--	1.90E-05 J
SVOC	Acenaphthylene	mg/L	--	2.10E-06 J	0.0097 U	0.010 U	--	2.20E-06 J
SVOC	Anthracene	mg/L	0.013	3.60E-06 J	0.0097 U	0.010 U	--	2.41E-05 U
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	4.20E-06 J	0.0097 U	0.010 U	--	6.20E-06 J
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	6.60E-06 J	0.0097 U	0.010 U	--	6.20E-06 J
SVOC	Benzo(b)fluoranthene	mg/L	--	6.10E-06 J	0.0097 U	0.010 U	--	7.70E-06 J
SVOC	Benzo(g,h,i)perylene	mg/L	--	4.10E-06 J	0.0097 U	0.010 U	--	3.10E-06 J
SVOC	Benzo(k)fluoranthene	mg/L	--	4.80E-06 J	0.0097 U	0.010 U	--	5.70E-06 J
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	0.0097 U	0.0097 U	--	--	**0.0062 J**
SVOC	Chrysene	mg/L	--	4.30E-06 J	0.0097 U	0.010 U	--	6.40E-06 J
SVOC	Dibenz(a,h)anthracene	mg/L	--	4.60E-06 J	0.0097 U	0.010 U	--	2.20E-06 J
SVOC	Dimethyl phthalate	mg/L	0.0030	0.0097 U	0.0097 U	--	--	0.0096 U
SVOC	Fluoranthene	mg/L	0.0062	5.30E-06 J	0.0097 U	0.010 U	--	4.00E-06 J
SVOC	Fluorene	mg/L	0.0039	2.24E-05 J	0.0097 U	0.010 U	--	8.80E-06 J
SVOC	Hexachlorocyclopentadiene	mg/L	0.0052	0.0097 U	0.0097 U	--	--	0.0096 UJ
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	4.40E-06 J	0.0097 U	0.010 U	--	2.90E-06 J
SVOC	Naphthalene	mg/L	0.62	8.68E-05 =	0.0097 U	0.010 U	5.00E-04 U	5.00E-05 =
SVOC	Phenanthrene	mg/L	0.0063	1.07E-05 J	0.0097 U	0.010 U	--	3.00E-06 J
SVOC	Pyrene	mg/L	--	4.40E-06 J	0.0097 U	0.010 U	--	3.00E-06 J

TABLE 6

Shallow Water-Bearing Zone

Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**SMW-02**	**SMW-03**	**SMW-03**	**SMW-03**	**SMW-03**
Sample ID:				SMW020714030	SMW-3-013102-0	SMW-03-092502-0	SMW03-071503	SMW03-072403-0
QAQC Type:				N	N	N	N	N
Date Collected:				07/14/03	01/31/02	09/25/02	07/15/03	07/24/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**					
TPH	Diesel	mg/L	--	--	0.040 =	--	--	--
TPH	Gasoline	mg/L	--	--	0.10 U	--	--	--
VOC	1,2,4-Trimethylbenzene	mg/L	--	5.00E-04 U	3.00E-04 U	0.0010 U	5.00E-04 U	--
VOC	Ethylbenzene	mg/L	0.0073	5.00E-04 U	3.00E-04 U	0.0010 U	5.00E-04 U	--
VOC	o-Xylene	mg/L	--	5.00E-04 U	1.20E-04 J	0.0010 U	5.00E-04 U	--
VOC	Tetrachloroethylene	mg/L	0.84	5.00E-04 U	8.00E-05 J	0.0010 U	5.00E-04 U	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening valu

TABLE 7

Geoprobe Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:			**B-1**	**B-10P**	**B-12P**	**B-14P**	**B-15P**	**B-17P**	**B-19P**	**B-19P**	**B-19P**	**B-1P**
Sample ID:			B-1	B-10P	B-12P	B-14P	B-15P	B-17P	B-19P	B-19P	B-19P FD	B-1P
QAQC Type:			N	N	N	N	N	N	N	FD	FD	N
Depth (ft bgs):			19-21	3-5	4-6	4-6	3-5	6-8	10-12	10-12	10-12	8-10
Date Collected:			08/24/98	08/25/98	08/25/98	08/25/98	08/25/98	08/25/98	08/26/98	08/26/98	08/26/98	08/24/98
Chemical Group	**Parameter**	**Units**										
M-TOTAL	Arsenic	mg/L	0.0030 =	0.44 =	0.49 =	1.1 =	0.0063 =	0.46 =	--	--	--	0.28 =
M-TOTAL	Chromium	mg/L	0.017 =	4.0 =	0.13 =	1.1 =	0.0047 =	0.020 =	--	--	--	0.68 =
SVOC	2,6-Dinitrotoluene	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	2-Methylnaphthalene	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	3-Nitroaniline	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	4-Nitrophenol	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	Acenaphthene	mg/L	0.0050 U	1.5 =	0.0050 U	--	0.0050 U	0.0050 U	0.037 =	--	0.029 =	0.039 =
SVOC	Acenaphthylene	mg/L	0.0050 U	0.23 =	0.82 =	--	0.0050 U	0.0050 U	0.0050 U	--	0.0050 U	0.43 =
SVOC	Anthracene	mg/L	0.0050 U	0.42 =	0.17 =	--	0.0050 U	0.0050 U	0.087 =	--	0.090 =	0.49 =
SVOC	Benzo(a)anthracene	mg/L	0.0050 U	0.12 =	0.0050 UC	--	0.0050 U	0.0050 U	0.0050 UC	--	0.0050 UC	0.0050 UC
SVOC	Benzo(a)pyrene	mg/L	0.0050 U	0.0077 =	0.014 =	--	0.0050 U	0.0050 U	0.0050 U	--	0.0050 U	0.080 =
SVOC	Benzo(b)fluoranthene	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	Benzo(b+k)fluoranthene	mg/L	0.0050 U	0.045 =	0.022 =	--	0.0050 U	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U
SVOC	Benzo(g,h,i)perylene	mg/L	0.0050 U	0.0050 U	0.0090 =	--	0.0050 U	0.0050 U	0.0050 U	--	0.0050 U	0.011 =
SVOC	Benzo(k)fluoranthene	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	bis(2-Chloroethyl) ether	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	Butyl benzyl phthalate	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	Chrysene	mg/L	0.0050 U	0.084 =	0.048 =	--	0.0050 U	0.0050 U	0.0070 =	--	0.0052 =	0.12 =
SVOC	Di-n-octylphthalate	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	Fluoranthene	mg/L	0.0050 U	0.90 =	0.32 =	--	0.0050 U	0.0050 U	0.0050 U	--	0.0050 U	0.35 =
SVOC	Fluorene	mg/L	0.0050 U	1.1 =	0.51 =	--	0.0050 U	0.0050 U	0.029 =	--	0.026 =	0.41 =
SVOC	Hexachloroethane	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	0.0050 U	0.019 =	0.0090 =	--	0.0050 U	0.0050 U	0.0050 U	--	0.0050 U	0.019 =
SVOC	Naphthalene	mg/L	0.0050 U	2.2 =	4.8 =	--	0.0050 U	0.0050 U	0.0050 U	--	0.0050 U	8.6 =
SVOC	Pentachlorophenol	mg/L	0.0050 U	0.0050 U	0.73 =	--	0.0050 U	0.0050 U	0.0050 U	--	0.0050 U	0.074 =
SVOC	Phenanthrene	mg/L	0.0050 U	2.1 =	0.96 =	--	0.0050 U	0.0050 U	0.0050 UC	--	0.0050 UC	1.2 =
SVOC	Pyrene	mg/L	0.0050 U	0.70 =	0.27 =	--	0.0050 U	0.0050 U	0.0050 U	--	0.0050 U	0.27 =
SVOC	Total Carcinogens	mg/L	0.0050 U	0.28 =	0.093 =	--	0.0050 U	0.0050 U	0.0070 =	--	0.0050 =	0.21 =
TPH	Creosote	mg/L	0.20 U	23 =	27 =	--	0.20 U	0.20 U	--	0.20 U	--	9.3 =

Notes:

= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds

TABLE 7

Geoprobe Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:			**B-22P**	**B-23P**	**B-24P**	**B-25P**	**B-26P**	**B-27P**	**B-28P**	**B-29P**	**B-2P**	**B-30P**
Sample ID:			B-22P	B-23P	B-24P	B-25P	B-26P	B-27P	B-28P	B-29P	B-2P	B-30P
QAQC Type:			N	N	N	N	N	N	N	N	N	N
Depth (ft bgs):			8-10	13-15	5-7	9-11	6-8	6-8	4-6	5-7	7-9	9-11
Date Collected:			08/26/98	08/26/98	08/27/98	08/26/98	08/27/98	08/27/98	08/27/98	08/27/98	08/24/98	08/27/98
Chemical Group	**Parameter**	**Units**										
M-TOTAL	Arsenic	mg/L	--	--	--	0.014 =	0.0029 =	0.15 =	0.0048 =	--	2.2 =	0.0035 =
M-TOTAL	Chromium	mg/L	--	--	--	0.015 =	0.0062 =	0.032 =	0.0093 =	--	1.6 =	0.010 =
SVOC	2,6-Dinitrotoluene	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	2-Methylnaphthalene	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	3-Nitroaniline	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	4-Nitrophenol	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	Acenaphthene	mg/L	--	0.096 =	0.023 =	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.024 =	0.0050 U
SVOC	Acenaphthylene	mg/L	--	0.0050 U	0.0050 U	--	0.032 =	0.021 =	0.027 =	0.0050 U	1.2 =	0.0050 U
SVOC	Anthracene	mg/L	--	0.0050 U	0.021 =	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	2.2 =	0.0050 U
SVOC	Benzo(a)anthracene	mg/L	--	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
SVOC	Benzo(a)pyrene	mg/L	--	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
SVOC	Benzo(b)fluoranthene	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	Benzo(b+k)fluoranthene	mg/L	--	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
SVOC	Benzo(k)fluoranthene	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	bis(2-Chloroethyl) ether	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	Butyl benzyl phthalate	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	Chrysene	mg/L	--	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
SVOC	Di-n-octylphthalate	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	Fluoranthene	mg/L	--	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.34 =	0.0050 U
SVOC	Fluorene	mg/L	--	0.013 =	0.024 =	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.51 =	0.0050 U
SVOC	Hexachloroethane	mg/L	--	--	--	--	--	--	--	--	--	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
SVOC	Naphthalene	mg/L	--	1.8 =	0.12 =	--	0.27 =	0.15 =	0.0050 U	0.0050 U	8.8 =	0.0050 U
SVOC	Pentachlorophenol	mg/L	--	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.35 =	0.0050 U
SVOC	Phenanthrene	mg/L	--	0.0050 U	0.0050 UC	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 UC	0.0050 U
SVOC	Pyrene	mg/L	--	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.18 =	0.0050 U
SVOC	Total Carcinogens	mg/L	--	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
TPH	Creosote	mg/L	6.9 =	4.6 =	0.54 =	--	0.68 =	0.53 =	0.20 U	0.20 U	46 =	0.20 U

Notes:

= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds

TABLE 7

Geoprobe Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:			**B-32P**	**B-33P**	**B-33P**	**B-33P**	**B-3P**	**B-6P**	**B-8P**	**GP-02**	**GP-04**	**GP-06**
Sample ID:			B-32P	B-33P	B-33P	B-33P FD	B-3P	B-6P	B-8P	GP-02	GP-04	GP-06
QAQC Type:			N	N	FD	FD	N	N	N	N	N	N
Depth (ft bgs):			6-8	6-8	6-8	6-8	6-8	8-10	3-5	--	--	--
Date Collected:			08/27/98	08/27/98	08/27/98	08/27/98	08/24/98	08/24/98	08/25/98	11/26/01	11/26/01	11/26/01
Chemical Group	**Parameter**	**Units**										
M-TOTAL	Arsenic	mg/L	0.18 =	--	--	--	0.96 =	3.0 =	5.8 =	--	--	--
M-TOTAL	Chromium	mg/L	0.054 =	--	--	--	1.2 =	1.4 =	22 =	--	--	--
SVOC	2,6-Dinitrotoluene	mg/L	--	--	--	--	--	--	--	0.011 U	0.0097 U	0.0099 U
SVOC	2-Methylnaphthalene	mg/L	--	--	--	--	--	--	--	0.011 U	0.0045 J	0.0099 U
SVOC	3-Nitroaniline	mg/L	--	--	--	--	--	--	--	0.053 U	7.26E-04 J	0.049 U
SVOC	4-Nitrophenol	mg/L	--	--	--	--	--	--	--	0.013 J	0.012 J	0.049 U
SVOC	Acenaphthene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.35 =	0.55 =	0.011 U	0.0099 =	0.0017 J
SVOC	Acenaphthylene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.47 =	0.10 =	4.9 =	0.011 U	0.0097 U	0.0099 U
SVOC	Anthracene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.22 =	0.053 =	5.0 =	0.011 U	0.0097 U	0.0099 U
SVOC	Benzo(a)anthracene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.0050 UC	0.0050 U	0.14 =	0.011 U	0.0097 U	0.0099 U
SVOC	Benzo(a)pyrene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0090 =	6.77E-04 U	0.0097 U	0.0099 U
SVOC	Benzo(b)fluoranthene	mg/L	--	--	--	--	--	--	--	7.29E-04 J	0.0097 U	0.0099 U
SVOC	Benzo(b+k)fluoranthene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.057 =	--	--	--
SVOC	Benzo(g,h,i)perylene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.011 U	0.0097 U	0.0099 U
SVOC	Benzo(k)fluoranthene	mg/L	--	--	--	--	--	--	--	7.82E-04 J	0.0097 U	0.0099 U
SVOC	bis(2-Chloroethyl) ether	mg/L	--	--	--	--	--	--	--	0.011 U	0.0097 U	0.0099 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	--	--	--	--	--	--	--	0.0056 J	0.0022 J	9.08E-04 J
SVOC	Butyl benzyl phthalate	mg/L	--	--	--	--	--	--	--	0.011 U	0.0097 U	0.0099 U
SVOC	Chrysene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.028 =	0.0050 U	0.14 =	0.011 U	0.0097 U	0.0099 U
SVOC	Di-n-octylphthalate	mg/L	--	--	--	--	--	--	--	5.71E-04 J	0.0097 U	0.0099 U
SVOC	Fluoranthene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.036 =	0.0050 U	1.7 =	0.011 U	0.0097 U	0.0099 U
SVOC	Fluorene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.15 =	0.090 =	3.2 =	0.011 U	0.0017 J	0.0099 U
SVOC	Hexachloroethane	mg/L	--	--	--	--	--	--	--	0.011 U	0.0036 J	0.0099 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.011 U	0.0097 U	0.0099 U
SVOC	Naphthalene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	6.6 =	3.2 =	4.5 =	0.011 U	0.27 =	0.0023 J
SVOC	Pentachlorophenol	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.30 =	0.0050 U	6.8 =	0.053 U	0.048 U	0.049 U
SVOC	Phenanthrene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.25 =	0.0050 UC	0.082 =	0.011 U	0.0097 U	0.0099 U
SVOC	Pyrene	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.025 =	0.0050 U	1.2 =	0.011 U	0.0097 U	0.0099 U
SVOC	Total Carcinogens	mg/L	0.0050 U	0.0050 U	--	0.0050 U	0.028 =	0.0050 U	0.35 =	--	--	--
TPH	Creosote	mg/L	0.20 U	--	0.20 U	--	13 =	12 =	87 =	--	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds

TABLE 7

Geoprobe Groundwater Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:			**GP-08**	**GP-08**	**GP-10**	**GP-12**	**GP-14**	**GP-16**	**GP-18**	**GP-20**
Sample ID:			GP-08	GP-DUPE	GP-10	GP-12	GP-14	GP-16	GP-18	GP-20
QAQC Type:			N	FD	N	N	N	N	N	N
Depth (ft bgs):			--	--	--	--	--	--	--	--
Date Collected:			11/27/01	11/27/01	11/27/01	11/27/01	11/27/01	11/27/01	11/27/01	11/27/01
Chemical Group	**Parameter**	**Units**								
M-TOTAL	Arsenic	mg/L	--	--	--	--	--	--	--	--
M-TOTAL	Chromium	mg/L	--	--	--	--	--	--	--	--
SVOC	2,6-Dinitrotoluene	mg/L	0.0098 U	0.0096 U	5.95E-04 J	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	2-Methylnaphthalene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	3-Nitroaniline	mg/L	0.049 U	0.048 U	0.050 U	0.049 U	0.050 U	0.052 U	0.051 U	0.063 U
SVOC	4-Nitrophenol	mg/L	0.049 U	0.048 U	0.050 U	0.049 U	0.013 J	0.052 U	0.051 U	0.016 J
SVOC	Acenaphthene	mg/L	0.0019 J	0.0017 J	0.0099 U	0.0098 U	0.0023 J	0.010 U	0.010 U	0.013 U
SVOC	Acenaphthylene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Anthracene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Benzo(a)anthracene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Benzo(a)pyrene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Benzo(b)fluoranthene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Benzo(b+k)fluoranthene	mg/L	--	--	--	--	--	--	--	--
SVOC	Benzo(g,h,i)perylene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Benzo(k)fluoranthene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	bis(2-Chloroethyl) ether	mg/L	0.0098 U	0.0096 U	0.0011 J	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0017 J	0.0019 J	0.019 =	0.0015 J	0.0022 J	0.0040 J	0.0012 J	0.0011 J
SVOC	Butyl benzyl phthalate	mg/L	0.0010 J	0.0013 J	0.0011 J	0.0098 U	0.0011 J	0.010 U	0.010 U	0.0014 J
SVOC	Chrysene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Di-n-octylphthalate	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Fluoranthene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Fluorene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Hexachloroethane	mg/L	7.50E-04 J	0.0096 U	0.0013 J	0.0098 U	0.0028 J	0.010 U	0.010 U	0.013 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Naphthalene	mg/L	0.0100 =	0.0087 J	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Pentachlorophenol	mg/L	0.049 U	0.048 U	0.050 U	0.049 U	0.050 U	0.052 U	0.051 U	0.063 U
SVOC	Phenanthrene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Pyrene	mg/L	0.0098 U	0.0096 U	0.0099 U	0.0098 U	0.0099 U	0.010 U	0.010 U	0.013 U
SVOC	Total Carcinogens	mg/L	--	--	--	--	--	--	--	--
TPH	Creosote	mg/L	--	--	--	--	--	--	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds

TABLE 8

Seep Water Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**Seep-03**	**Seep-05**	**Seep-05**	**Seep-07**	**Seep-07**	**Seep-07**	**Seep-07**	**Seep-09**
Sample ID:				SP-3-12-4-01	SP5125010	SP5125011	SP7125010	SP-07-W-52902-0	SP-07-092402-0	SP070711030	SP9127010
QAQC Type:				N	N	FD	N	N	N	N	N
Date Collected:				12/04/01	12/05/01	12/05/01	12/05/01	05/29/02	09/24/02	07/11/03	12/05/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**								
M-DISS	Chromium, Hexavalent	mg/L	0.011	8.00E-04 J	0.0010 U	0.0010 U	0.0010 U	--	--	--	--
M-DISS	Iron	mg/L	1.0	--	--	--	--	--	--	--	--
M-DISS	Zinc	mg/L	0.12	0.020 U	0.020 U	0.020 U	0.020 U	--	--	--	--
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	8.00E-04 J	0.0010 U	0.0010 U	0.0010 U	--	--	--	--
M-TOTAL	Copper	mg/L	0.0090	0.010 U	0.010 U	0.010 U	0.010 U	--	--	--	--
M-TOTAL	Iron	mg/L	1.0	--	--	--	--	--	--	--	--
M-TOTAL	Zinc	mg/L	0.12	0.020 U	0.020 U	0.020 U	0.020 U	--	--	--	--
SVOC	2,4-Dimethylphenol	mg/L	0.042	0.010 U	0.0097 U	0.010 U	0.0067 J	--	--	0.0094 J	--
SVOC	2,4-Dinitrotoluene	mg/L	0.23	0.010 U	0.0097 U	0.010 U	0.0096 U	--	--	0.011 U	--
SVOC	2-Methylnaphthalene	mg/L	--	0.010 U	0.42 =	0.010 U	--	5.8 =	0.25 =	0.50 =	--
SVOC	2-Nitroaniline	mg/L	--	0.052 U	0.048 U	0.051 U	6.51E-04 J	--	--	0.054 U	--
SVOC	3-Nitroaniline	mg/L	--	0.052 U	0.048 U	0.051 U	5.84E-04 J	--	--	0.054 U	--
SVOC	4-Methylphenol	mg/L	--	0.010 U	0.0097 U	0.010 U	0.0052 J	--	--	0.0052 J	--
SVOC	4-Nitroaniline	mg/L	--	0.052 U	0.048 U	0.051 U	0.048 U	--	--	0.054 U	--
SVOC	Acenaphthene	mg/L	0.52	0.010 U	0.13 =	0.010 U	--	**2.4 =**	0.12 =	0.18 =	--
SVOC	Acenaphthylene	mg/L	--	0.010 U	0.0097 U	0.010 U	0.0028 J	0.95 U	0.0020 J	0.0058 J	--
SVOC	Anthracene	mg/L	0.013	0.010 U	0.0097 U	0.010 U	0.0050 J	**0.74 J**	**0.046 =**	0.0076 J	--
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	0.010 U	0.0097 U	0.010 U	0.0096 U	**0.24 J**	0.0097 U	**0.0052 J**	--
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	0.010 U	0.0097 U	0.010 U	0.0096 U	0.95 U	0.0097 U	**0.019 J**	--
SVOC	Benzo(b)fluoranthene	mg/L	--	0.010 U	0.0097 U	0.010 U	0.0096 U	0.95 U	0.0097 U	0.012 J	--
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.010 U	0.0097 U	0.010 U	0.0096 U	0.95 U	0.0097 U	0.028 =	--
SVOC	Benzo(k)fluoranthene	mg/L	--	0.010 U	0.0097 U	0.010 U	0.0096 U	0.95 U	0.0097 U	0.019 J	--
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	0.010 U	0.0097 U	0.010 U	0.0096 U	--	--	0.011 U	--
SVOC	Chrysene	mg/L	--	0.010 U	0.0097 U	0.010 U	0.0096 U	0.23 J	0.0097 U	0.0069 J	--
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.010 U	0.0097 U	0.010 U	0.0096 U	0.95 U	0.0097 U	0.028 =	--
SVOC	Dibenzofuran	mg/L	0.0037	0.010 U	0.0097 U	0.010 U	**0.070 =**	**1.4 =**	**0.063 =**	**0.086 =**	--
SVOC	Di-n-butylphthalate	mg/L	0.035	0.010 U	0.0097 U	0.010 U	0.0096 U	--	--	0.011 U	--
SVOC	Di-n-octylphthalate	mg/L	0.71	0.010 U	0.0097 U	0.010 U	0.0096 U	--	--	0.011 U	--
SVOC	Fluoranthene	mg/L	0.0062	0.010 U	0.0097 U	0.010 U	0.0012 J	**1.3 =**	0.0035 J	0.0030 J	--
SVOC	Fluorene	mg/L	0.0039	0.010 U	0.0097 U	0.010 U	**0.062 =**	**1.5 =**	**0.057 =**	**0.077 =**	--
SVOC	Hexachloroethane	mg/L	0.54	0.010 U	0.0020 J	0.0016 J	0.0096 U	--	--	0.011 U	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.010 U	0.0097 U	0.010 U	0.0096 U	0.95 U	0.0097 U	0.034 =	--
SVOC	Naphthalene	mg/L	0.62	0.010 U	**3.4 =**	0.010 U	**1.1 =**	**13 =**	**1.6 =**	**4.6 =**	--
SVOC	Nitrobenzene	mg/L	0.54	0.010 U	0.0097 U	0.010 U	0.0096 U	--	--	0.0038 J	--
SVOC	Phenanthrene	mg/L	0.0063	0.010 U	0.0097 U	0.010 U	**0.042 =**	**3.9 =**	**0.045 =**	**0.056 =**	--
SVOC	Pyrene	mg/L	--	0.010 U	0.0097 U	0.010 U	0.0096 U	1.2 =	0.0023 J	0.025 U	--
TPH	Diesel	mg/L	--	0.041 =	0.075 =	0.060 =	8.8 =	--	--	--	--
TPH	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	7.8 =	--	--
TPH	Gasoline	mg/L	--	0.050 U	0.050 U	0.071 =	9.6 =	--	--	--	1.2 =
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	7.2 =	--	--
VOC	1,2,4-Trimethylbenzene	mg/L	--	0.0013 U	0.0013 U	0.0013 U	0.15 =	0.075 =	0.060 =	0.15 =	0.0013 J
VOC	1,3,5-Trimethylbenzene	mg/L	--	5.00E-04 U	5.00E-04 U	5.00E-04 U	0.058 =	0.050 =	0.025 =	0.061 =	0.0016 =
VOC	Benzene	mg/L	0.13	4.00E-04 U	4.00E-04 U	4.00E-04 U	0.0022 =	9.90E-04 =	0.0013 =	0.0035 =	1.20E-04 J
VOC	Ethylbenzene	mg/L	0.0073	6.00E-04 U	6.00E-04 U	6.00E-04 U	**0.14 =**	**0.078 =**	**0.058 =**	**0.16 =**	**0.015 =**
VOC	Isopropylbenzene	mg/L	--	5.00E-04 U	5.00E-04 U	5.00E-04 U	0.020 =	--	0.010 =	0.025 =	0.0049 =

TABLE 8

Seep Water Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**Seep-03**	**Seep-05**	**Seep-05**	**Seep-07**	**Seep-07**	**Seep-07**	**Seep-07**	**Seep-09**
Sample ID:				SP-3-12-4-01	SP5125010	SP5125011	SP7125010	SP-07-W-52902-0	SP-07-092402-0	SP070711030	SP9127010
QAQC Type:				N	N	FD	N	N	N	N	N
Date Collected:				12/04/01	12/05/01	12/05/01	12/05/01	05/29/02	09/24/02	07/11/03	12/05/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**								
VOC	m,p-Xylene	mg/L	--	0.0010 U	0.0010 U	0.0010 U	0.12 =	0.072 =	0.036 =	0.10 =	0.0010 U
VOC	n-Propylbenzene	mg/L	--	4.00E-04 U	4.00E-04 U	4.00E-04 U	0.0076 =	--	0.0040 =	0.0089 =	0.0029 =
VOC	o-Xylene	mg/L	--	0.0012 U	0.0012 U	0.0012 U	0.0071 =	--	0.0039 =	0.0071 =	0.0012 U
VOC	p-Isopropyltoluene	mg/L	--	0.0013 U	0.0013 U	0.0013 U	0.0013 U	--	9.00E-04 J	0.0016 =	5.80E-04 J
VOC	Tetrachloroethylene	mg/L	0.84	4.00E-05 J	0.0011 U	0.0011 U	0.0040 =	0.0018 =	0.0013 =	0.0052 =	1.40E-04 J

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 8

Seep Water Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**Seep-09**	**Seep-09**	**Seep-09**	**Seep-09**	**Seep-10**	**Seep-10**	**Seep-10**	**Seep-10**
Sample ID:				SP-9-12701-0	SP-09-W-52902-0	SP-09-092302-0	SP090711030	SP10125010	SP-10-W-52902-0	SP-10-092502-0	SP100711030
QAQC Type:				N	N	N	N	N	N	N	N
Date Collected:				12/07/01	05/29/02	09/23/02	07/11/03	12/05/01	05/29/02	09/25/02	07/11/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**								
M-DISS	Chromium, Hexavalent	mg/L	0.011	0.0010 U	--	--	--	0.0010 U	--	--	--
M-DISS	Iron	mg/L	1.0	--	--	--	--	--	--	--	--
M-DISS	Zinc	mg/L	0.12	0.020 U	--	--	--	0.020 U	--	--	--
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	0.0010 U	--	--	--	0.0010 U	--	--	--
M-TOTAL	Copper	mg/L	0.0090	0.010 U	--	--	--	0.010 U	--	--	--
M-TOTAL	Iron	mg/L	1.0	--	--	--	--	--	--	--	--
M-TOTAL	Zinc	mg/L	0.12	0.020 U	--	--	--	0.020 U	--	--	--
SVOC	2,4-Dimethylphenol	mg/L	0.042	0.0094 U	--	--	0.0096 U	0.0096 U	--	--	0.011
SVOC	2,4-Dinitrotoluene	mg/L	0.23	6.59E-04 J	--	--	0.0096 U	0.0096 U	--	--	0.011
SVOC	2-Methylnaphthalene	mg/L	--	0.043 =	0.036 =	0.033 =	0.045 =	0.044 =	0.23 =	0.20 =	0.065
SVOC	2-Nitroaniline	mg/L	--	0.047 U	--	--	0.048 U	0.048 U	--	--	0.054
SVOC	3-Nitroaniline	mg/L	--	0.047 U	--	--	0.048 U	0.048 U	--	--	0.054
SVOC	4-Methylphenol	mg/L	--	0.0094 U	--	--	0.0096 U	0.0096 U	--	--	0.011
SVOC	4-Nitroaniline	mg/L	--	0.047 U	--	--	0.048 U	8.15E-04 J	--	--	0.054
SVOC	Acenaphthene	mg/L	0.52	0.055 =	0.045 =	0.033 =	0.033 =	0.040 =	0.13 =	0.15 =	0.086
SVOC	Acenaphthylene	mg/L	--	0.0094 U	0.0097 U	0.010 U	5.50E-04 =	0.0096 U	0.0095 U	0.0015 J	0.0029
SVOC	Anthracene	mg/L	0.013	0.0017 J	0.0022 J	0.0019 J	0.0019 =	0.0013 J	0.010 =	**0.023 =**	0.0047
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	0.0094 U	0.0097 U	0.010 U	**5.93E-05 J**	0.0096 U	**0.0014 J**	**0.0049 J**	**2.19E-04**
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	0.0094 U	0.0097 U	0.010 U	1.26E-04 U	0.0096 U	0.0095 U	0.010 U	**6.11E-05**
SVOC	Benzo(b)fluoranthene	mg/L	--	0.0094 U	0.0097 U	0.010 U	1.99E-05 J	0.0096 U	0.0095 U	0.010 U	6.75E-05
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.0094 U	0.0097 U	0.010 U	1.34E-05 J	0.0096 U	0.0095 U	0.010 U	3.14E-05
SVOC	Benzo(k)fluoranthene	mg/L	--	0.0094 U	0.0097 U	0.010 U	1.97E-05 J	0.0096 U	0.0095 U	0.0013 J	7.06E-05
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	0.0094 U	--	--	0.0096 U	0.0096 U	--	--	0.011
SVOC	Chrysene	mg/L	--	0.0094 U	0.0097 U	0.010 U	5.76E-05 J	0.0096 U	0.0012 J	0.0060 J	2.98E-04
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.0094 U	0.0097 U	0.010 U	1.51E-05 J	0.0096 U	0.0095 U	0.010 U	2.65E-05
SVOC	Dibenzofuran	mg/L	0.0037	**0.027 =**	**0.019 =**	**0.013 =**	**0.017 =**	**0.018 =**	**0.065 =**	**0.079 =**	**0.051**
SVOC	Di-n-butylphthalate	mg/L	0.035	0.0094 U	--	--	0.0096 U	0.0096 U	--	--	0.011
SVOC	Di-n-octylphthalate	mg/L	0.71	0.0094 U	--	--	0.0096 U	0.0096 U	--	--	0.011
SVOC	Fluoranthene	mg/L	0.0062	0.0094 U	0.0015 J	0.0019 J	0.0018 =	0.0010 J	**0.013 =**	**0.031 =**	0.0049
SVOC	Fluorene	mg/L	0.0039	**0.028 =**	**0.019 =**	**0.015 =**	**0.015 =**	**0.019 =**	**0.064 =**	**0.087 =**	**0.044**
SVOC	Hexachloroethane	mg/L	0.54	0.0094 U	--	--	0.0096 U	0.0096 U	--	--	0.011
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.0094 U	0.0097 U	0.010 U	1.26E-04 U	0.0096 U	0.0095 U	0.010 U	3.21E-05
SVOC	Naphthalene	mg/L	0.62	**0.70 =**	0.20 =	0.098 =	0.45 =	0.34 =	**0.78 =**	0.61 =	0.11
SVOC	Nitrobenzene	mg/L	0.54	0.0094 U	--	--	0.0096 U	0.0096 U	--	--	0.011
SVOC	Phenanthrene	mg/L	0.0063	**0.014 =**	**0.013 =**	**0.012 =**	**0.015 =**	**0.011 =**	**0.065 =**	**0.12 =**	**0.032**
SVOC	Pyrene	mg/L	--	0.0094 U	0.0097 U	0.0015 J	0.0012 =	0.0096 U	0.0092 J	0.031 =	0.0032
TPH	Diesel	mg/L	--	2.0 =	--	--	--	0.58 =	--	--	--
TPH	Diesel Range Organics (C12-C24)	mg/L	--	--	--	0.71 =	--	--	--	3.3 =	--
TPH	Gasoline	mg/L	--	--	--	--	--	1.5 =	--	--	--
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	--	--	0.57 =	--	--	--	3.4 =	--
VOC	1,2,4-Trimethylbenzene	mg/L	--	--	0.0059 =	0.0014 =	0.0069 =	0.0084 =	0.023 =	0.012 =	0.015
VOC	1,3,5-Trimethylbenzene	mg/L	--	--	0.0053 =	0.0011 =	0.0076 =	0.0045 =	0.011 =	0.0072 =	0.0087
VOC	Benzene	mg/L	0.13	--	2.30E-04 J	1.70E-04 J	4.30E-04 J	1.10E-04 J	1.60E-04 J	1.80E-04 J	2.80E-04
VOC	Ethylbenzene	mg/L	0.0073	--	**0.012 =**	0.0072 =	**0.018 =**	**0.015 =**	**0.015 =**	**0.012 =**	**0.010**
VOC	Isopropylbenzene	mg/L	--	--	--	0.0034 =	0.0062 =	0.0043 =	--	0.0061 =	0.0052

TABLE 8

Seep Water Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**Seep-09**	**Seep-09**	**Seep-09**	**Seep-09**	**Seep-10**	**Seep-10**	**Seep-10**	**Seep-10**
Sample ID:				SP-9-12701-0	SP-09-W-52902-0	SP-09-092302-0	SP090711030	SP10125010	SP-10-W-52902-0	SP-10-092502-0	SP100711030
QAQC Type:				N	N	N	N	N	N	N	N
Date Collected:				12/07/01	05/29/02	09/23/02	07/11/03	12/05/01	05/29/02	09/25/02	07/11/03
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**								
VOC	m,p-Xylene	mg/L	--	--	0.0010 U	0.0020 U	0.0020 U	7.50E-04 J	0.0014 =	5.10E-04 J	6.30E-04
VOC	n-Propylbenzene	mg/L	--	--	--	0.0014 =	0.0026 =	0.0021 =	--	0.0030 =	0.0026
VOC	o-Xylene	mg/L	--	--	--	0.0010 U	7.70E-04 =	0.0013 =	--	0.0028 =	0.0031
VOC	p-Isopropyltoluene	mg/L	--	--	--	3.10E-04 J	5.10E-04 =	4.90E-04 J	--	0.0010 =	9.10E-04
VOC	Tetrachloroethylene	mg/L	0.84	--	2.20E-04 J	1.80E-04 J	3.50E-04 J	1.40E-04 J	1.90E-04 J	2.00E-04 J	2.10E-04

Notes:
 = - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 8

Seep Water Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**Seep-12**	**Seep-12**	**Seep-13**	**Seep-13**	**Seep-14**	**Seep-18**	**Seep-18**	**Seep-19**
Sample ID:					SP-12-092302-0	SP120714030	SP-13-12701-0	SP13127010	SP14125010	SP18126010	SP18127010	SP19126010
QAQC Type:					N	N	N	N	N	N	N	N
Date Collected:					09/23/02	07/14/03	12/07/01	12/07/01	12/05/01	12/06/01	12/06/01	12/06/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**									
M-DISS	Chromium, Hexavalent	mg/L	0.011		--	--	0.0010 U	--	0.0010 U	0.0010 U	--	0.0010 U
M-DISS	Iron	mg/L	1.0		--	--	--	--	--	--	--	--
M-DISS	Zinc	mg/L	0.12		--	--	0.020 U	--	0.020 U	0.020 U	--	0.020 U
M-TOTAL	Chromium, Hexavalent	mg/L	0.011		--	--	0.0010 U	--	0.0010 U	0.0010 U	--	0.0010 U
M-TOTAL	Copper	mg/L	0.0090		--	--	0.010 U	--	0.010 U	0.010 U	--	0.010 U
M-TOTAL	Iron	mg/L	1.0		--	--	--	--	--	--	--	--
M-TOTAL	Zinc	mg/L	0.12		--	--	0.020 U	--	0.020 U	0.020 U	--	0.020 U
SVOC	2,4-Dimethylphenol	mg/L	0.042	U	--	0.010 U	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	2,4-Dinitrotoluene	mg/L	0.23	U	--	0.010 U	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	2-Methylnaphthalene	mg/L	--	=	0.0065 J	2.56E-05 U	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	2-Nitroaniline	mg/L	--	U	--	0.051 U	0.048 U	--	0.053 U	0.049 U	--	0.049 U
SVOC	3-Nitroaniline	mg/L	--	U	--	0.051 U	0.048 U	--	0.053 U	0.049 U	--	0.049 U
SVOC	4-Methylphenol	mg/L	--	U	--	0.010 U	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	4-Nitroaniline	mg/L	--	U	--	0.051 U	0.048 U	--	0.053 U	0.049 U	--	0.049 U
SVOC	Acenaphthene	mg/L	0.52	=	0.0090 J	0.0099 =	0.0017 J	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Acenaphthylene	mg/L	--	=	0.010 U	2.05E-04 =	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Anthracene	mg/L	0.013	=	0.010 U	1.65E-04 =	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	**J**	0.010 U	2.30E-05 J	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	**J**	0.010 U	9.40E-06 J	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Benzo(b)fluoranthene	mg/L	--	J	0.010 U	1.09E-05 J	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Benzo(g,h,i)perylene	mg/L	--	J	0.010 U	5.90E-06 J	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Benzo(k)fluoranthene	mg/L	--	J	0.010 U	1.17E-05 J	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	U	--	0.010 U	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Chrysene	mg/L	--	=	0.010 U	2.19E-05 J	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Dibenz(a,h)anthracene	mg/L	--	J	0.010 U	5.90E-06 J	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Dibenzofuran	mg/L	0.0037	**=**	0.010 U	0.010 U	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Di-n-butylphthalate	mg/L	0.035	U	--	0.010 U	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Di-n-octylphthalate	mg/L	0.71	U	--	0.010 U	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Fluoranthene	mg/L	0.0062	=	0.010 U	3.89E-04 =	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Fluorene	mg/L	0.0039	**=**	0.0011 J	0.0019 =	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Hexachloroethane	mg/L	0.54	U	--	0.010 U	0.0095 U	--	7.45E-04 J	0.0097 U	--	0.0098 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	J	0.010 U	5.80E-06 J	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Naphthalene	mg/L	0.62	=	0.011 =	0.0074 =	0.0055 J	--	0.0024 J	0.0097 U	--	0.0098 U
SVOC	Nitrobenzene	mg/L	0.54	U	--	0.010 U	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Phenanthrene	mg/L	0.0063	**=**	0.010 U	2.05E-04 =	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
SVOC	Pyrene	mg/L	--	=	0.010 U	2.96E-04 =	0.0095 U	--	0.011 U	0.0097 U	--	0.0098 U
TPH	Diesel	mg/L	--		--	--	0.095 =	--	0.036 =	0.045 =	--	0.040 =
TPH	Diesel Range Organics (C12-C24)	mg/L	--		0.25 =	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--		--	--	--	0.082 =	0.035 J	--	0.050 U	0.016 J
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--		0.12 =	--	--	--	--	--	--	--
VOC	1,2,4-Trimethylbenzene	mg/L	--	=	0.0010 U	5.00E-04 U	--	0.0013 U	0.0013 U	--	0.0013 U	0.0013 U
VOC	1,3,5-Trimethylbenzene	mg/L	--	=	0.0010 U	5.00E-04 U	--	5.00E-04 U	5.00E-04 U	--	5.00E-04 U	5.00E-04 U
VOC	Benzene	mg/L	0.13	J	0.0010 U	5.00E-04 U	--	4.00E-04 U	4.00E-04 U	--	4.00E-04 U	4.00E-04 U
VOC	Ethylbenzene	mg/L	0.0073	**=**	1.50E-04 J	7.00E-05 J	--	6.00E-04 U	6.00E-04 U	--	6.00E-04 U	6.00E-04 U
VOC	Isopropylbenzene	mg/L	--	=	0.0016 =	8.10E-04 =	--	1.60E-04 J	5.00E-04 U	--	5.00E-04 U	5.00E-04 U

TABLE 8

Seep Water Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**Seep-12**	**Seep-12**	**Seep-13**	**Seep-13**	**Seep-14**	**Seep-18**	**Seep-18**	**Seep-19**
Sample ID:					SP-12-092302-0	SP120714030	SP-13-12701-0	SP13127010	SP14125010	SP18126010	SP18127010	SP19126010
QAQC Type:					N	N	N	N	N	N	N	N
Date Collected:					09/23/02	07/14/03	12/07/01	12/07/01	12/05/01	12/06/01	12/06/01	12/06/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**									
VOC	m,p-Xylene	mg/L	--	J	1.80E-04 J	0.0020 U	--	0.0010 U	0.0010 U	--	0.0010 U	0.0010 U
VOC	n-Propylbenzene	mg/L	--	=	6.00E-04 J	3.10E-04 J	--	1.10E-04 J	4.00E-04 U	--	4.00E-04 U	4.00E-04 U
VOC	o-Xylene	mg/L	--	=	0.0010 U	5.00E-04 U	--	0.0012 U	0.0012 U	--	0.0012 U	0.0012 U
VOC	p-Isopropyltoluene	mg/L	--	=	0.0010 U	5.00E-04 U	--	0.0013 U	0.0013 U	--	0.0013 U	0.0013 U
VOC	Tetrachloroethylene	mg/L	0.84	J	1.10E-04 J	8.00E-05 J	--	0.0011 U	0.0011 U	--	0.0011 U	0.0011 U

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 8

Seep Water Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**Seep-20**	**Seep-20**	**Seep-22**	**Seep-22**	**Seep-23**	**Seep-23**	**Seep-25**	**Seep-BG**
Sample ID:				SP-20-12701-0	SP20127010	SP22126010	SP22126010	SP23126010	SP23126010	SP25126010	SPBG127010
QAQC Type:				N	N	N	N	N	N	N	N
Date Collected:				12/07/01	12/07/01	12/05/01	12/06/01	12/05/01	12/06/01	12/06/01	12/05/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**								
M-DISS	Chromium, Hexavalent	mg/L	0.011	0.0010 U	--	--	0.0010 U	--	0.0010 U	0.0010 U	--
M-DISS	Iron	mg/L	1.0	--	--	--	--	--	--	--	--
M-DISS	Zinc	mg/L	0.12	0.020 U	--	--	0.020 U	--	0.020 U	0.020 U	--
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	0.0010 U	--	--	0.0010 U	--	0.0010 U	0.0010 U	--
M-TOTAL	Copper	mg/L	0.0090	0.010 U	--	--	0.010 U	--	**0.012 =**	0.010 U	--
M-TOTAL	Iron	mg/L	1.0	--	--	--	--	--	--	--	--
M-TOTAL	Zinc	mg/L	0.12	0.020 U	--	--	0.020 U	--	0.020 U	0.020 U	--
SVOC	2,4-Dimethylphenol	mg/L	0.042	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	2,4-Dinitrotoluene	mg/L	0.23	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	2-Methylnaphthalene	mg/L	--	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	2-Nitroaniline	mg/L	--	0.047 U	--	--	0.048 U	--	0.049 U	0.047 U	--
SVOC	3-Nitroaniline	mg/L	--	0.047 U	--	--	0.048 U	--	0.049 U	0.047 U	--
SVOC	4-Methylphenol	mg/L	--	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	4-Nitroaniline	mg/L	--	0.047 U	--	--	0.048 U	--	0.049 U	0.047 U	--
SVOC	Acenaphthene	mg/L	0.52	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Acenaphthylene	mg/L	--	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Anthracene	mg/L	0.013	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Benzo(b)fluoranthene	mg/L	--	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Benzo(k)fluoranthene	mg/L	--	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Chrysene	mg/L	--	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Dibenzofuran	mg/L	0.0037	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Di-n-butylphthalate	mg/L	0.035	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Di-n-octylphthalate	mg/L	0.71	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Fluoranthene	mg/L	0.0062	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Fluorene	mg/L	0.0039	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Hexachloroethane	mg/L	0.54	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Naphthalene	mg/L	0.62	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Nitrobenzene	mg/L	0.54	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Phenanthrene	mg/L	0.0063	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
SVOC	Pyrene	mg/L	--	0.0094 U	--	--	0.0095 U	--	0.0098 U	0.0095 U	--
TPH	Diesel	mg/L	--	0.047 =	--	--	0.052 =	--	0.056 =	0.048 =	--
TPH	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--	--	--
TPH	Gasoline	mg/L	--	--	0.040 J	0.050 U	--	0.054 =	--	0.050 U	0.11 =
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--	--	--	--	--	--
VOC	1,2,4-Trimethylbenzene	mg/L	--	--	0.0013 U	0.0013 U	--	0.0013 U	--	0.0013 U	0.0013 U
VOC	1,3,5-Trimethylbenzene	mg/L	--	--	5.00E-04 U	5.00E-04 U	--	5.00E-04 U	--	5.00E-04 U	5.00E-04 U
VOC	Benzene	mg/L	0.13	--	4.00E-04 U	4.00E-04 U	--	4.00E-04 U	--	4.00E-04 U	4.00E-04 U
VOC	Ethylbenzene	mg/L	0.0073	--	6.00E-04 U	6.00E-04 U	--	6.00E-04 U	--	6.00E-04 U	6.00E-04 U
VOC	Isopropylbenzene	mg/L	--	--	5.00E-04 U	5.00E-04 U	--	5.00E-04 U	--	5.00E-04 U	5.00E-04 U

TABLE 8

Seep Water Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**Seep-20**	**Seep-20**	**Seep-22**	**Seep-22**	**Seep-23**	**Seep-23**	**Seep-25**	**Seep-BG**
Sample ID:				SP-20-12701-0	SP20127010	SP22126010	SP22126010	SP23126010	SP23126010	SP25126010	SPBG127010
QAQC Type:				N	N	N	N	N	N	N	N
Date Collected:				12/07/01	12/07/01	12/05/01	12/06/01	12/05/01	12/06/01	12/06/01	12/05/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**								
VOC	m,p-Xylene	mg/L	--	--	0.0010 U	0.0010 U	--	0.0010 U	--	0.0010 U	0.0010 U
VOC	n-Propylbenzene	mg/L	--	--	4.00E-04 U	4.00E-04 U	--	4.00E-04 U	--	4.00E-04 U	4.00E-04 U
VOC	o-Xylene	mg/L	--	--	0.0012 U	0.0012 =	--	0.0012 U	--	0.0012 U	0.0012 U
VOC	p-Isopropyltoluene	mg/L	--	--	0.0013 U	0.0013 U	--	0.0013 U	--	0.0013 U	0.0013 U
VOC	Tetrachloroethylene	mg/L	0.84	--	0.0011 U	0.0011 U	--	0.0011 U	--	1.00E-04 J	0.0011 U

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 8

Seep Water Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**Seep-BG**	**SW-01**	**SW-01**
Sample ID:				SP-BG-120701-0	SW0100412010	SW1-GW-101001
QAQC Type:				N	N	N
Date Collected:				12/07/01	04/12/01	10/10/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**			
M-DISS	Chromium, Hexavalent	mg/L	0.011	0.0010 U	--	0.0010 U
M-DISS	Iron	mg/L	1.0	--	--	**10 =**
M-DISS	Zinc	mg/L	0.12	0.024 =	--	0.020 U
M-TOTAL	Chromium, Hexavalent	mg/L	0.011	0.0010 U	0.40 U	0.0010 U
M-TOTAL	Copper	mg/L	0.0090	0.010 U	--	0.010 U
M-TOTAL	Iron	mg/L	1.0	--	--	**20 =**
M-TOTAL	Zinc	mg/L	0.12	0.020 U	--	0.033 =
SVOC	2,4-Dimethylphenol	mg/L	0.042	0.0095 U	0.010 U	0.0098 U
SVOC	2,4-Dinitrotoluene	mg/L	0.23	0.0095 U	0.010 U	0.0098 U
SVOC	2-Methylnaphthalene	mg/L	--	0.0095 U	0.20 D	0.096 =
SVOC	2-Nitroaniline	mg/L	--	0.047 U	0.050 U	0.049 U
SVOC	3-Nitroaniline	mg/L	--	0.047 U	0.050 U	0.049 U
SVOC	4-Methylphenol	mg/L	--	0.0095 U	0.010 U	0.0098 U
SVOC	4-Nitroaniline	mg/L	--	0.047 U	0.050 U	0.049 U
SVOC	Acenaphthene	mg/L	0.52	0.0095 U	0.10 D	0.070 =
SVOC	Acenaphthylene	mg/L	--	0.0095 U	0.010 U	0.0098 U
SVOC	Anthracene	mg/L	0.013	0.0095 U	0.010 U	0.0054 J
SVOC	Benzo(a)anthracene	mg/L	2.70E-05	0.0095 U	0.010 U	**0.0016 J**
SVOC	Benzo(a)pyrene	mg/L	1.40E-05	0.0095 U	0.010 U	**0.0013 J**
SVOC	Benzo(b)fluoranthene	mg/L	--	0.0095 U	0.010 U	0.0013 J
SVOC	Benzo(g,h,i)perylene	mg/L	--	0.0095 U	0.010 U	0.0013 J
SVOC	Benzo(k)fluoranthene	mg/L	--	0.0095 U	0.010 U	0.0010 J
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0030	0.0095 U	0.010 U	0.0019 J
SVOC	Chrysene	mg/L	--	0.0095 U	0.010 U	0.0017 J
SVOC	Dibenz(a,h)anthracene	mg/L	--	0.0095 U	0.010 U	0.0012 J
SVOC	Dibenzofuran	mg/L	0.0037	0.0095 U	**0.025 =**	**0.027 =**
SVOC	Di-n-butylphthalate	mg/L	0.035	0.0095 U	0.010 U	8.59E-04 J
SVOC	Di-n-octylphthalate	mg/L	0.71	0.0095 U	0.010 U	6.35E-04 J
SVOC	Fluoranthene	mg/L	0.0062	0.0095 U	0.010 U	**0.0083 J**
SVOC	Fluorene	mg/L	0.0039	0.0095 U	**0.032 =**	**0.032 =**
SVOC	Hexachloroethane	mg/L	0.54	0.0095 U	0.010 U	0.0098 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/L	--	0.0095 U	0.010 U	0.0012 J
SVOC	Naphthalene	mg/L	0.62	0.0095 U	**0.95 D**	0.26 =
SVOC	Nitrobenzene	mg/L	0.54	0.0095 U	0.010 U	0.0098 U
SVOC	Phenanthrene	mg/L	0.0063	0.0095 U	0.0037 J	**0.036 =**
SVOC	Pyrene	mg/L	--	0.0095 U	0.010 U	0.0066 J
TPH	Diesel	mg/L	--	0.038 =	3.1 =	0.94 =
TPH	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--
TPH	Gasoline	mg/L	--	--	2.0 =	2.3 J
TPH_SG	Diesel Range Organics (C12-C24)	mg/L	--	--	--	--
VOC	1,2,4-Trimethylbenzene	mg/L	--	--	--	0.0037 =
VOC	1,3,5-Trimethylbenzene	mg/L	--	--	--	0.0037 =
VOC	Benzene	mg/L	0.13	--	--	0.0010 U
VOC	Ethylbenzene	mg/L	0.0073	--	--	**0.019 =**
VOC	Isopropylbenzene	mg/L	--	--	--	0.0052 =

TABLE 8

Seep Water Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:				**Seep-BG**	**SW-01**	**SW-01**
Sample ID:				SP-BG-120701-0	SW0100412010	SW1-GW-101001
QAQC Type:				N	N	N
Date Collected:				12/07/01	04/12/01	10/10/01
Chemical Group	**Parameter**	**Units**	**Oregon Level II-SW**			
VOC	m,p-Xylene	mg/L	--	--	--	0.0020 U
VOC	n-Propylbenzene	mg/L	--	--	--	0.0021 =
VOC	o-Xylene	mg/L	--	--	--	0.0018 =
VOC	p-Isopropyltoluene	mg/L	--	--	--	0.0010 U
VOC	Tetrachloroethylene	mg/L	0.84	--	--	0.0010 U

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds
Shading indicates detected concentration exceeds screening value.

TABLE 9

Columbia River Bank Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:			**Seep-05**	**Seep-05**	**Seep-07**	**Seep-09**	**Seep-10**	**Seep-13**	**Seep-14**	**Seep-18**	**Seep-18**	**Seep-19**
Sample ID:			RB5125010	RB5125011	RB7125010	RB-9-12701-0	RB10125010	RB-13-127010	RB14125010	RB18126010	RB-18-120701-0	RB19126010
QAQC Type:			N	FD	N	N	N	N	N	N	N	N
Date Collected:			12/05/01	12/05/01	12/05/01	12/07/01	12/05/01	12/07/01	12/05/01	12/06/01	12/07/01	12/06/01
Chemical Group	**Parameter**	**Units**										
M-TOTAL	Arsenic	mg/Kg	6.0 =	6.8 =	7.5 =	10 =	11 =	5.1 =	4.7 =	11 =	--	7.6 =
M-TOTAL	Chromium	mg/Kg	28 =	28 =	31 =	19 =	30 =	23 =	31 =	24 =	--	19 =
M-TOTAL	Chromium, Hexavalent	mg/Kg	0.071 =	0.021 =	0.022 =	--	0.087 =	0.10 =	0.043 =	0.067 =	--	0.051 =
M-TOTAL	Copper	mg/Kg	29 =	27 =	27 =	37 =	40 =	20 =	26 =	35 =	--	24 =
M-TOTAL	Zinc	mg/Kg	50 =	50 =	69 =	125 =	122 =	51 =	70 =	89 =	--	63 =
SVOC	4-Chloroaniline	mg/Kg	1.1 U	1.1 U	1.1 U	1.4 U	0.13 J	1.2 U	1.2 U	1.5 U	--	1.1 U
SVOC	Acenaphthene	mg/Kg	0.56 U	0.54 U	0.57 U	0.082 J	0.062 J	0.61 U	0.62 U	0.75 U	--	0.55 U
SVOC	Naphthalene	mg/Kg	0.56 U	0.54 U	0.063 J	0.31 J	0.28 J	0.61 U	0.62 U	0.75 U	--	0.55 U
TPH	Diesel	mg/Kg	2.9 =	2.5 =	2.7 =	6.1 =	5.4 =	4.9 =	2.5 =	7.7 =	--	2.8 =
TPH	Gasoline	mg/Kg	7.6 U	6.5 U	6.8 U	4.8 U	8.3 =	4.5 U	6.0 U	5.5 U	4.7 =	4.0 U
VOC	1,1-Dichloroethene	mg/Kg	0.0021 U	0.0022 U	0.0023 U	0.0048 U	0.0025 U	0.0037 U	0.0045 U	0.0029 U	4.10E-04 J	0.0039 U
VOC	1,2,3-Trichlorobenzene	mg/Kg	5.00E-04 U	6.00E-04 U	6.00E-04 U	0.0012 U	6.00E-04 U	9.00E-04 U	0.0011 U	7.00E-04 U	9.00E-04 U	0.0010 U
VOC	1,2,4-Trichlorobenzene	mg/Kg	7.00E-04 U	7.00E-04 U	8.00E-04 U	0.0016 U	8.00E-04 U	0.0012 U	0.0015 U	0.0010 U	0.0012 U	0.0013 U
VOC	1,2,4-Trimethylbenzene	mg/Kg	0.0023 U	0.0024 U	0.0025 U	0.0052 U	0.0082 =	0.0040 U	0.0049 U	0.0031 U	0.0038 U	0.0043 U
VOC	1,2-Dichlorobenzene	mg/Kg	5.00E-04 U	6.00E-04 U	6.00E-04 U	0.0012 U	6.00E-04 U	9.00E-04 U	0.0011 U	2.40E-04 J	9.00E-04 U	0.0010 U
VOC	1,3,5-Trimethylbenzene	mg/Kg	9.00E-04 U	9.00E-04 U	3.00E-04 J	0.0020 U	0.0052 =	0.0015 U	0.0019 U	0.0012 U	0.0015 U	0.0016 U
VOC	1,4-Dichlorobenzene	mg/Kg	5.00E-04 U	6.00E-04 U	6.00E-04 U	0.0012 U	6.00E-04 U	9.00E-04 U	0.0011 U	5.70E-04 J	3.00E-04 J	0.0010 U
VOC	Ethylbenzene	mg/Kg	0.0010 U	0.0011 U	3.20E-04 J	0.0020 J	0.0045 =	0.0019 U	0.0023 U	0.0014 U	0.0018 U	0.0020 U
VOC	Isopropylbenzene	mg/Kg	9.00E-04 U	9.00E-04 U	9.90E-04 J	0.024 =	0.0051 =	0.0011 J	0.0019 U	0.0012 U	0.0015 U	0.0016 U
VOC	m,p-Xylene	mg/Kg	0.0017 U	0.0019 U	2.90E-04 J	0.0024 J	7.50E-04 J	0.0031 U	0.0038 U	2.90E-04 U	0.0030 U	0.0033 U
VOC	Methylene Chloride	mg/Kg	5.00E-04 U	6.00E-04 U	6.00E-04 U	0.0011 J	6.00E-04 U	9.00E-04 U	0.0011 U	0.0043 =	9.00E-04 U	0.0036 =
VOC	n-Propylbenzene	mg/Kg	7.00E-04 U	7.00E-04 U	8.00E-04 =	0.015 =	0.0028 =	8.70E-04 J	0.0015 U	0.0010 U	0.0012 U	0.0013 U
VOC	o-Xylene	mg/Kg	0.0021 U	0.0022 U	1.90E-04 J	0.0048 U	0.0018 J	0.0037 U	7.50E-04 J	0.0029 U	0.0035 U	0.0039 U
VOC	p-Isopropyltoluene	mg/Kg	0.0023 U	0.0024 U	3.60E-04 J	0.0049 J	0.0015 J	3.70E-04 J	0.0049 U	0.0031 U	0.0038 U	0.0043 U
VOC	Tetrachloroethylene	mg/Kg	0.0019 U	4.10E-04 J	2.30E-04 J	9.60E-04 J	2.90E-04 J	5.90E-04 J	4.90E-04 J	4.50E-04 J	4.70E-04 J	6.90E-04 J
VOC	Toluene	mg/Kg	0.0010 U	0.0011 U	0.0011 U	0.0024 U	0.0013 U	0.0019 U	0.0023 U	0.0014 U	0.0018 U	0.0020 U
VOC	Trichloroethylene	mg/Kg	0.0017 U	0.0019 U	0.0019 U	0.0040 U	0.0021 U	0.0031 U	0.0038 U	0.0024 U	0.0030 U	0.0033 U

Notes:

= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds

TABLE 9

Columbia River Bank Detections

Former Koppers Wood-Treating Site, Waun

Station ID:			Seep-19	Seep-20	Seep-22	Seep-22	Seep-23	Seep-23	Seep-25	Seep-25	Seep-BG
Sample ID:			RB-19-120701-0	RB-20-12701-0	RB22126010	RB-22-120701-0	RB23126010	RB-23-120701-0	RB25126010	RB-25-120701-0	RB-BG-120701-0
QAQC Type:			N	N	N	N	N	N	N	N	N
Date Collected:			12/07/01	12/07/01	12/06/01	12/07/01	12/06/01	12/07/01	12/06/01	12/07/01	12/07/01
Chemical Group	**Parameter**	**Units**									
M-TOTAL	Arsenic	mg/Kg	--	--	8.4 =	--	14 =	--	3.0 =	--	13 =
M-TOTAL	Chromium	mg/Kg	--	--	22 =	--	23 =	--	5.3 =	--	24 =
M-TOTAL	Chromium, Hexavalent	mg/Kg	--	--	0.035 =	--	0.0089 =	--	0.0053 U	--	--
M-TOTAL	Copper	mg/Kg	--	--	30 =	--	38 =	--	9.6 =	--	30 =
M-TOTAL	Zinc	mg/Kg	--	--	63 =	--	171 =	--	25 =	--	152 =
SVOC	4-Chloroaniline	mg/Kg	--	1.1 U	1.2 U	--	1.5 U	--	0.87 U	--	133 U
SVOC	Acenaphthene	mg/Kg	--	0.55 U	0.58 U	--	0.73 U	--	0.44 U	--	67 U
SVOC	Naphthalene	mg/Kg	--	0.55 U	0.58 U	--	0.73 U	--	0.44 U	--	67 U
TPH	Diesel	mg/Kg	--	4.9 =	1.9 =	--	3.9 =	--	2.6 =	--	6.0 =
TPH	Gasoline	mg/Kg	3.8 U	--	4.4 U	3.3 U	5.0 U	4.6 U	3.1 U	5.3 =	5.1 =
VOC	1,1-Dichloroethene	mg/Kg	0.0030 U	0.0020 U	0.0023 U	0.0029 U	0.0027 U	0.0039 U	0.0013 U	0.0016 U	4.40E-04 J
VOC	1,2,3-Trichlorobenzene	mg/Kg	8.00E-04 U	5.00E-04 U	6.00E-04 U	7.00E-04 U	5.50E-04 J	0.0010 U	3.00E-04 U	4.00E-04 U	7.00E-04 J
VOC	1,2,4-Trichlorobenzene	mg/Kg	0.0010 U	7.00E-04 U	8.00E-04 U	0.0010 U	3.20E-04 J	0.0013 U	4.00E-04 U	5.00E-04 U	6.70E-04 J
VOC	1,2,4-Trimethylbenzene	mg/Kg	0.0033 U	0.0021 U	0.0025 U	0.0031 U	0.0030 U	0.0042 U	0.0014 U	0.0017 U	0.0041 U
VOC	1,2-Dichlorobenzene	mg/Kg	8.00E-04 U	5.00E-04 U	6.00E-04 U	7.00E-04 U	7.00E-04 U	0.0010 U	3.00E-04 U	4.00E-04 U	0.0010 U
VOC	1,3,5-Trimethylbenzene	mg/Kg	0.0013 U	8.00E-04 U	9.00E-04 U	0.0012 U	0.0011 U	0.0016 U	6.00E-04 U	7.00E-04 U	0.0016 U
VOC	1,4-Dichlorobenzene	mg/Kg	8.00E-04 U	5.00E-04 U	6.00E-04 U	7.00E-04 U	4.10E-04 J	0.0010 U	3.00E-04 U	4.00E-04 U	4.80E-04 J
VOC	Ethylbenzene	mg/Kg	0.0015 U	0.0010 U	0.0011 U	0.0015 U	0.0014 U	0.0019 U	7.00E-04 U	8.00E-04 U	3.20E-04 J
VOC	Isopropylbenzene	mg/Kg	0.0013 U	8.00E-04 U	9.00E-04 U	0.0012 U	0.0011 U	0.0016 U	6.00E-04 U	7.00E-04 U	0.0016 U
VOC	m,p-Xylene	mg/Kg	0.0025 U	0.0016 U	0.0019 U	0.0024 U	0.0023 U	0.0032 U	0.0011 U	5.10E-04 J	0.0020 J
VOC	Methylene Chloride	mg/Kg	8.00E-04 U	5.00E-04 U	6.00E-04 U	7.00E-04 U	7.00E-04 U	0.0030 =	3.00E-04 U	4.00E-04 U	0.0010 U
VOC	n-Propylbenzene	mg/Kg	0.0010 U	7.00E-04 U	8.00E-04 U	0.0010 U	9.00E-04 U	0.0013 U	4.00E-04 U	5.00E-04 U	0.0013 U
VOC	o-Xylene	mg/Kg	0.0030 U	0.0020 U	0.0023 U	0.0029 U	0.0027 U	0.0039 U	0.0013 U	0.0016 U	0.0038 U
VOC	p-Isopropyltoluene	mg/Kg	0.0033 U	0.0021 U	0.0025 U	0.0031 U	0.0030 U	0.0042 U	0.0014 U	0.0017 U	0.0041 U
VOC	Tetrachloroethylene	mg/Kg	4.00E-04 J	4.60E-04 J	0.0021 U	4.10E-04 J	2.30E-04 J	0.0010 J	0.0012 U	4.80E-04 J	6.30E-04 J
VOC	Toluene	mg/Kg	0.0015 U	0.0010 U	0.0011 U	0.0015 U	0.0014 U	0.0019 U	7.00E-04 U	1.30E-04 J	0.0019 U
VOC	Trichloroethylene	mg/Kg	0.0025 U	0.0016 U	0.0019 U	0.0024 U	0.0023 U	0.0032 U	0.0011 U	8.30E-04 J	0.0011 J

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile su
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds

TABLE 10

Columbia River Water Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:			**Seep-03**	**Seep-05**	**Seep-05**	**Seep-07**	**Seep-09**	**Seep-10**	**Seep-13**	**Seep-14**	**Seep-18**	**Seep-19**
Sample ID:			CR-3-12-4-01	CR5125010	CR5125011	CR7125010	CR-9-12701-0	CR10125010	CR-13-12701-0	CR14125010	CR18126010	CR19126010
QAQC Type:			N	N	FD	N	N	N	N	N	N	N
Date Collected:			12/04/01	12/05/01	12/05/01	12/05/01	12/07/01	12/05/01	12/07/01	12/05/01	12/06/01	12/06/01
Chemical Group	**Parameter**	**Units**										
M-TOTAL	Copper	mg/L	0.010 U	0.011 =	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
M-TOTAL	Zinc	mg/L	0.020 U	0.020 U	0.020 U	0.028 =	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
SVOC	2-Methylnaphthalene	mg/L	0.0098 U	0.012 U	0.010 U	0.0097 U	0.018 =	0.0052 J	0.0095 U	0.0097 U	0.0098 U	0.011 U
SVOC	Acenaphthene	mg/L	0.0098 U	0.012 U	0.010 U	0.0097 U	0.019 =	0.0040 J	0.0095 U	0.0097 U	0.0098 U	0.011 U
SVOC	Anthracene	mg/L	0.0098 U	0.012 U	0.010 U	0.0097 U	0.0010 J	0.0098 U	0.0095 U	0.0097 U	0.0098 U	0.011 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0010 J	0.012 U	0.0011 J	7.54E-04 J	0.0096 U	0.0098 U	0.0013 J	0.0097 U	0.0098 U	0.0034 J
SVOC	Dibenzofuran	mg/L	0.0098 U	0.012 U	0.010 U	0.0097 U	0.0091 J	0.0018 J	0.0095 U	0.0097 U	0.0098 U	0.011 U
SVOC	Di-n-butylphthalate	mg/L	0.0098 U	0.012 U	0.010 U	0.0097 U	0.0096 U	0.0098 U	8.40E-04 J	0.0097 U	0.0098 U	0.011 U
SVOC	Fluoranthene	mg/L	0.0098 U	0.012 U	0.010 U	0.0097 U	9.55E-04 J	0.0098 U	0.0095 U	0.0097 U	0.0098 U	0.011 U
SVOC	Fluorene	mg/L	0.0098 U	0.012 U	0.010 U	0.0097 U	0.0099 =	0.0019 J	0.0095 U	0.0097 U	0.0098 U	0.011 U
SVOC	Naphthalene	mg/L	0.0098 U	0.012 U	0.010 U	0.0097 U	0.085 =	0.047 =	0.0095 U	0.0097 U	0.0098 U	0.011 U
SVOC	Phenanthrene	mg/L	0.0098 U	0.012 U	0.010 U	0.0097 U	0.0071 J	0.0014 J	0.0095 U	0.0097 U	0.0098 U	0.011 U
TPH	Diesel	mg/L	0.042 =	0.032 =	0.056 =	0.051 =	6.3 =	0.068 =	0.046 =	0.034 =	0.042 =	0.013 J

Notes:
 = - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds

TABLE 10

Columbia River Water Detections

Former Koppers Wood-Treating Site, Wauna,

Station ID:			**Seep-20**	**Seep-22**	**Seep-23**	**Seep-25**	**Seep-BG**
Sample ID:			CR-20-12701-0	CR22126010	CR23126010	CR25126010	CR-BG-120701-0
QAQC Type:			N	N	N	N	N
Date Collected:			12/07/01	12/06/01	12/06/01	12/06/01	12/07/01
Chemical Group	**Parameter**	**Units**					
M-TOTAL	Copper	mg/L	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
M-TOTAL	Zinc	mg/L	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
SVOC	2-Methylnaphthalene	mg/L	0.010 U	0.0097 U	0.0097 U	0.010 U	0.010 U
SVOC	Acenaphthene	mg/L	0.010 U	0.0097 U	0.0097 U	0.010 U	0.010 U
SVOC	Anthracene	mg/L	0.010 U	0.0097 U	0.0097 U	0.010 U	0.010 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/L	0.0047 J	8.53E-04 J	0.0097 U	9.62E-04 J	9.96E-04 J
SVOC	Dibenzofuran	mg/L	0.010 U	0.0097 U	0.0097 U	0.010 U	0.010 U
SVOC	Di-n-butylphthalate	mg/L	0.010 U	0.0097 U	0.0097 U	0.010 U	0.010 U
SVOC	Fluoranthene	mg/L	0.010 U	0.0097 U	0.0097 U	0.010 U	0.010 U
SVOC	Fluorene	mg/L	0.010 U	0.0097 U	0.0097 U	0.010 U	0.010 U
SVOC	Naphthalene	mg/L	0.010 U	0.0097 U	0.0097 U	0.010 U	0.010 U
SVOC	Phenanthrene	mg/L	0.010 U	0.0097 U	0.0097 U	0.010 U	0.010 U
TPH	Diesel	mg/L	0.047 =	0.050 =	0.051 =	0.056 =	0.029 =

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfid
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds

TABLE 11
Crawford Creek Slough Sediment Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**EPA-S1**	**EPA-S1**	**EPA-S1**	**EPA-S2**	**EPA-S2**	**EPA-S2**	**EPA-S3**	**EPA-S3**	**EPA-S3**	**S-1**	**S-2**
Sample ID:					1961-J-1	1961J-1	JA955	1961-J-2	1961J-2	JA956	1961-J-3	1961J-3	JA957	SEDIMENT-1	SEDIMENT-2
QAQC Type:					N	N	N	N	N	N	N	N	N	N	N
Date Collected:					10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	08/27/98	08/27/98
Chemical Group	**Parameter**	**Units**	**Fish TEFs**	**Oregon Level II-SD-FW**											
CONV	Total Organic Carbon	mg/Kg		--	--	--	--	--	--	--	--	--	--	--	--
CONV	Total Organic Carbon	Percent		--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	0.001	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	0.5	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	0.01	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	0.01	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/Kg	1	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	2,3,7,8-TCDD	mg/Kg	1	--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	HpCDDs (total)	mg/Kg		--	--	2.20E-04 U	--	--	2.10E-04 U	--	--	6.80E-04 =	--	--	--
DIOXIN	HxCDDs (total)	mg/Kg		--	--	1.30E-04 U	--	--	9.10E-05 U	--	--	6.40E-04 =	--	--	--
DIOXIN	OCDD	mg/Kg	0.0001	--	--	9.20E-04 U	--	--	6.90E-04 U	--	--	0.0052 =	--	--	--
DIOXIN	PeCDDs (total)	mg/Kg		--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	TCDDs (total)	mg/Kg		--	--	--	--	--	--	--	--	--	--	--	--
DIOXIN	TEQ	mg/Kg		9.00E-06	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	0.001	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	0.001	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	0.1	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	0.1	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/Kg	0.1	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	1,2,3,7,8-PeCDF	mg/Kg	0.05	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	0.1	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	2,3,4,7,8-PeCDF	mg/Kg	0.5	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	2,3,7,8-TCDF	mg/Kg	0.05	--	--	--	--	--	--	--	--	--	--	--	--
FURAN	HpCDFs (total)	mg/Kg		--	--	2.30E-04 U	--	--	2.00E-04 U	--	--	2.10E-04 U	--	--	--
FURAN	HxCDFs (total)	mg/Kg		--	--	9.50E-05 U	--	--	6.20E-05 U	--	--	6.50E-05 U	--	--	--
FURAN	OCDF	mg/Kg	0.0001	--	--	6.10E-04 U	--	--	4.60E-04 U	--	--	4.80E-04 U	--	--	--
FURAN	PeCDFs (total)	mg/Kg		--	--	--	--	--	--	--	--	--	--	--	--
FURAN	TCDFs (total)	mg/Kg		--	--	--	--	--	--	--	--	--	--	--	--
GENCHEM	Acid Volatile Sulfide	mg/Kg		--	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Arsenic	mg/Kg		6.0	5.5 =	--	--	**6.5 =**	--	--	**6.2 =**	--	--	2.0 =	**13 =**
M-TOTAL	Chromium	mg/Kg		37	6.9 =	--	--	36 =	--	--	**100 =**	--	--	--	--
M-TOTAL	Chromium, Hexavalent	mg/Kg		--	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Copper	mg/Kg		36	6.9 =	--	--	**47 =**	--	--	**245 =**	--	--	--	--
M-TOTAL	Iron	mg/Kg		--	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL	Zinc	mg/Kg		123	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL-AVS	Cadmium	mg/L		--	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL-AVS	Copper	mg/L		--	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL-AVS	Lead	mg/L		--	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL-AVS	Nickel	mg/L		--	--	--	--	--	--	--	--	--	--	--	--
M-TOTAL-AVS	Zinc	mg/L		--	--	--	--	--	--	--	--	--	--	--	--
SVOC	2-Methylphenol	mg/Kg		--	--	--	0.23 U	--	--	0.33 U	--	--	0.72 U	--	--
SVOC	4-Methylphenol	mg/Kg		--	--	--	0.22 U	--	--	0.32 U	--	--	0.68 J	--	--
SVOC	Acenaphthene	mg/Kg		0.29	--	--	0.15 U	--	--	0.22 U	--	--	0.46 U	--	--
SVOC	Anthracene	mg/Kg		0.057	--	--	0.071 U	--	--	0.10 U	--	--	0.22 U	--	--

TABLE 11

Crawford Creek Slough Sediment Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**EPA-S1**	**EPA-S1**	**EPA-S1**	**EPA-S2**	**EPA-S2**	**EPA-S2**	**EPA-S3**	**EPA-S3**	**EPA-S3**	**S-1**	**S-2**
Sample ID:					1961-J-1	1961J-1	JA955	1961-J-2	1961J-2	JA956	1961-J-3	1961J-3	JA957	SEDIMENT-1	SEDIMENT-2
QAQC Type:					N	N	N	N	N	N	N	N	N	N	N
Date Collected:					10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	10/25/85	08/27/98	08/27/98
Chemical Group	**Parameter**	**Units**	**Fish TEFs**	**Oregon Level II-SD-FW**											
SVOC	Benzo(a)anthracene	mg/Kg		0.032	--	--	0.071 U	--	--	0.10 U	--	--	0.22 U	--	--
SVOC	Benzo(a)pyrene	mg/Kg		0.032	--	--	0.085 U	--	--	0.12 U	--	--	0.26 U	--	--
SVOC	Benzo(b)fluoranthene	mg/Kg		--	--	--	0.053 U	--	--	0.077 U	--	--	0.17 U	--	--
SVOC	Benzo(g,h,i)perylene	mg/Kg		0.30	--	--	0.20 U	--	--	0.29 U	--	--	0.63 U	--	--
SVOC	Benzo(k)fluoranthene	mg/Kg		0.027	--	--	0.12 U	--	--	0.17 U	--	--	0.37 U	--	--
SVOC	bis(2-Ethylhexyl)phthalate	mg/Kg		0.75	--	--	0.082 J	--	--	0.12 J	--	--	0.25 U	--	--
SVOC	Butyl benzyl phthalate	mg/Kg		--	--	--	0.11 U	--	--	0.15 U	--	--	0.33 U	--	--
SVOC	Chrysene	mg/Kg		0.057	--	--	0.096 U	--	--	0.14 U	--	--	0.30 U	--	--
SVOC	Dimethyl phthalate	mg/Kg		--	--	--	0.026 U	--	--	0.038 U	--	--	0.28 =	--	--
SVOC	Di-n-butylphthalate	mg/Kg		0.11	--	--	**0.14 =**	--	--	**0.20 =**	--	--	0.43 U	--	--
SVOC	Di-n-octylphthalate	mg/Kg		--	--	--	0.31 U	--	--	0.45 U	--	--	1.1 =	--	--
SVOC	Fluoranthene	mg/Kg		0.11	--	--	0.23 U	--	--	**0.34 J**	--	--	**0.73 J**	--	--
SVOC	Fluorene	mg/Kg		0.077	--	--	0.023 U	--	--	0.034 U	--	--	0.073 U	--	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg		0.017	--	--	0.36 U	--	--	0.51 U	--	--	1.1 U	--	--
SVOC	N-Nitrosodiphenylamine	mg/Kg		--	--	--	0.053 U	--	--	0.077 U	--	--	0.17 U	--	--
SVOC	Phenanthrene	mg/Kg		0.042	--	--	0.017 U	--	--	0.025 U	--	--	**0.096 NJ**	--	--
SVOC	Pyrene	mg/Kg		0.053	--	--	0.36 U	--	--	**0.51 J**	--	--	**1.1 J**	--	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds

TABLE 11

Crawford Creek Slough Sediment Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**S-3**	**SD-01**	**SD-02**	**SD-03**	**SD-04**	**SD-04**	**SD-05**
Sample ID:					SEDIMENT-3	SD01-0-030801-0	SD02-0-030801-0	SD03-0-030801-0	SD04-0-030801-0	SD04-0-030801-1	SD-5-020102-0
QAQC Type:					N	N	N	N	N	FD	N
Date Collected:					08/27/98	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	02/01/02
Chemical Group	**Parameter**	**Units**	**Fish TEFs**	**Oregon Level II-SD-FW**							
CONV	Total Organic Carbon	mg/Kg		--	--	--	--	--	--	--	--
CONV	Total Organic Carbon	Percent		--	--	6.5 =	6.4 =	12 =	6.4 =	7.0 =	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	0.001	--	0.0013 =	0.0010 =	7.23E-04 =	0.0051 =	8.74E-04 =	8.63E-04 =	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	0.5	--	1.50E-05 =	1.23E-05 =	7.76E-06 =	6.79E-05 =	1.01E-05 =	8.36E-06 =	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	0.01	--	4.40E-05 =	8.70E-05 =	7.76E-05 =	1.90E-04 =	7.99E-05 =	8.31E-05 =	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	0.01	--	3.50E-05 =	4.77E-05 =	3.60E-05 =	1.47E-04 =	4.17E-05 =	4.54E-05 =	--
DIOXIN	1,2,3,7,8-PeCDD	mg/Kg	1	--	5.90E-06 =	7.33E-06 =	5.75E-06 =	2.50E-05 =	6.15E-06 =	6.27E-06 =	--
DIOXIN	2,3,7,8-TCDD	mg/Kg	1	--	9.50E-07 J	3.05E-06 =	3.01E-06 =	4.23E-06 =	2.95E-06 =	3.02E-06 =	--
DIOXIN	HpCDDs (total)	mg/Kg		--	0.0022 =	0.0019 =	0.0014 =	0.0088 =	0.0017 =	0.0016 =	--
DIOXIN	HxCDDs (total)	mg/Kg		--	2.60E-04 =	5.65E-04 =	4.85E-04 =	0.0012 =	5.20E-04 =	5.22E-04 =	--
DIOXIN	OCDD	mg/Kg	0.0001	--	0.013 D	0.011 =	0.0071 =	0.053 =	0.0090 =	0.0089 =	--
DIOXIN	PeCDDs (total)	mg/Kg		--	1.50E-05 =	5.33E-05 =	4.30E-05 =	1.20E-04 =	4.68E-05 =	4.62E-05 =	--
DIOXIN	TCDDs (total)	mg/Kg		--	4.10E-06 =	1.56E-05 =	1.20E-05 =	2.84E-05 =	1.34E-05 =	1.54E-05 =	--
DIOXIN	TEQ	mg/Kg		9.00E-06	**3.00E-05 =**	**6.06E-05 =**	**3.84E-05 =**	**1.22E-04 =**	**4.80E-05 =**	**4.92E-05 =**	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	0.001	--	2.20E-04 =	1.59E-04 =	1.16E-04 =	8.48E-04 =	1.39E-04 =	1.38E-04 =	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	0.001	--	1.60E-05 =	1.42E-05 =	8.84E-06 =	7.54E-05 =	1.15E-05 =	1.19E-05 =	--
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	0.1	--	8.30E-06 =	1.33E-05 =	1.21E-05 =	3.71E-05 =	1.16E-05 =	1.17E-05 =	--
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	0.1	--	7.50E-06 =	8.84E-06 =	5.58E-06 =	2.86E-05 =	6.66E-06 =	6.79E-06 =	--
FURAN	1,2,3,7,8,9-HxCDF	mg/Kg	0.1	--	3.80E-07 U	3.38E-06 =	3.23E-06 =	7.09E-06 =	2.86E-06 =	3.03E-06 =	--
FURAN	1,2,3,7,8-PeCDF	mg/Kg	0.05	--	5.60E-06 =	2.31E-05 =	1.29E-05 =	1.93E-05 =	1.73E-05 =	1.72E-05 =	--
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	0.1	--	6.60E-06 =	8.61E-06 =	6.02E-06 =	3.70E-05 =	6.91E-06 =	7.03E-06 =	--
FURAN	2,3,4,7,8-PeCDF	mg/Kg	0.5	--	2.80E-06 J	1.40E-05 =	9.79E-06 =	1.82E-05 =	1.16E-05 =	1.15E-05 =	--
FURAN	2,3,7,8-TCDF	mg/Kg	0.05	--	1.60E-04 G	5.76E-04 =	2.96E-04 =	4.58E-04 =	4.24E-04 =	4.60E-04 =	--
FURAN	HpCDFs (total)	mg/Kg		--	6.50E-04 =	5.43E-04 =	4.20E-04 =	0.0029 =	4.79E-04 =	4.69E-04 =	--
FURAN	HxCDFs (total)	mg/Kg		--	2.10E-04 =	2.09E-04 =	1.75E-04 =	8.47E-04 =	1.89E-04 =	1.84E-04 =	--
FURAN	OCDF	mg/Kg	0.0001	--	9.00E-04 =	6.66E-04 =	4.25E-04 =	0.0045 =	5.31E-04 =	5.37E-04 =	--
FURAN	PeCDFs (total)	mg/Kg		--	6.40E-05 =	1.19E-04 =	8.69E-05 =	2.71E-04 =	9.88E-05 =	9.47E-05 =	--
FURAN	TCDFs (total)	mg/Kg		--	3.00E-04 =	0.0010 =	5.27E-04 =	8.73E-04 =	7.50E-04 =	8.12E-04 =	--
GENCHEM	Acid Volatile Sulfide	mg/Kg		--	--	--	--	--	--	--	6,100 J
M-TOTAL	Arsenic	mg/Kg		6.0	**20 =**	**16 =**	**12 =**	**12 =**	**11 =**	**13 =**	**23 J**
M-TOTAL	Chromium	mg/Kg		37	--	30 =	27 =	**70 =**	29 =	28 =	**363 J**
M-TOTAL	Chromium, Hexavalent	mg/Kg		--	--	142 U	156 U	173 U	159 U	158 U	0.47 =
M-TOTAL	Copper	mg/Kg		36	--	**47 =**	**40 =**	**63 =**	**45 =**	**45 =**	**685 J**
M-TOTAL	Iron	mg/Kg		--	--	52,300 =	42,500 =	55,300 =	49,300 =	48,500 =	--
M-TOTAL	Zinc	mg/Kg		123	--	**713 =**	**471 =**	**1,390 =**	**579 =**	**588 =**	**18,300 =**
M-TOTAL-AVS	Cadmium	mg/L		--	--	0.026 =	0.017 =	0.10 U	0.019 =	0.017 =	--
M-TOTAL-AVS	Copper	mg/L		--	--	0.32 =	0.29 =	0.41 =	0.31 =	0.26 =	--
M-TOTAL-AVS	Lead	mg/L		--	--	0.20 =	0.18 =	0.32 =	0.20 =	0.19 =	--
M-TOTAL-AVS	Nickel	mg/L		--	--	0.080 =	0.067 =	0.20 =	0.088 =	0.076 =	--
M-TOTAL-AVS	Zinc	mg/L		--	--	5.5 =	3.7 =	13 =	4.8 =	4.5 =	--
SVOC	2-Methylphenol	mg/Kg		--	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	4-Methylphenol	mg/Kg		--	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	Acenaphthene	mg/Kg		0.29	--	**0.76 J**	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	Anthracene	mg/Kg		0.057	--	**1.6 J**	2.5 U	**3.0 =**	**0.66 J**	**0.97 J**	**2.7 =**

TABLE 11

Crawford Creek Slough Sediment Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**S-3**	**SD-01**	**SD-02**	**SD-03**	**SD-04**	**SD-04**	**SD-05**
Sample ID:					SEDIMENT-3	SD01-0-030801-0	SD02-0-030801-0	SD03-0-030801-0	SD04-0-030801-0	SD04-0-030801-1	SD-5-020102-0
QAQC Type:					N	N	N	N	N	FD	N
Date Collected:					08/27/98	03/08/01	03/08/01	03/08/01	03/08/01	03/08/01	02/01/02
Chemical Group	**Parameter**	**Units**	**Fish TEFs**	**Oregon Level II-SD-FW**							
SVOC	Benzo(a)anthracene	mg/Kg		0.032	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	**0.17 J**
SVOC	Benzo(a)pyrene	mg/Kg		0.032	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	Benzo(b)fluoranthene	mg/Kg		--	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	Benzo(g,h,i)perylene	mg/Kg		0.30	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	Benzo(k)fluoranthene	mg/Kg		0.027	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/Kg		0.75	--	**3.7 =**	**0.97 J**	**12 =**	**1.3 J**	**1.4 J**	**33 =**
SVOC	Butyl benzyl phthalate	mg/Kg		--	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	Chrysene	mg/Kg		0.057	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	**0.29 J**
SVOC	Dimethyl phthalate	mg/Kg		--	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	Di-n-butylphthalate	mg/Kg		0.11	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	Di-n-octylphthalate	mg/Kg		--	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	Fluoranthene	mg/Kg		0.11	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	**0.52 J**
SVOC	Fluorene	mg/Kg		0.077	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg		0.017	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	N-Nitrosodiphenylamine	mg/Kg		--	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	2.1 U
SVOC	Phenanthrene	mg/Kg		0.042	--	2.4 U	2.5 U	2.9 U	2.6 U	2.6 U	**0.28 J**
SVOC	Pyrene	mg/Kg		0.053	--	**0.61 J**	2.5 U	2.9 U	2.6 U	2.6 U	**0.39 J**

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds

TABLE 11

Crawford Creek Slough Sediment Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SD-05**	**SD-06**	**SD-06**	**SD-07**	**SD-07**	**SD-08**	**SD-08**	**SD-09**
Sample ID:					SD-5-20102-0	SD-6-020102-0	SD-6-20102-0	SD07-071003-0	SD070710030	SD08-071003-0	SD080710030	SD09-071003-0
QAQC Type:					N	N	N	N	N	N	N	N
Date Collected:					02/01/02	02/01/02	02/01/02	07/10/03	07/10/03	07/10/03	07/10/03	07/10/03
Chemical Group	**Parameter**	**Units**	**Fish TEFs**	**Oregon Level II-SD-FW**								
CONV	Total Organic Carbon	mg/Kg		--	--	--	--	--	42,700 =	--	29,100 =	--
CONV	Total Organic Carbon	Percent		--	--	--	--	--	--	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	0.001	--	0.0014 =	--	0.0018 =	2.78E-04 =	--	2.55E-04 =	--	2.46E-05 =
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	0.5	--	1.31E-05 =	--	1.59E-05 =	1.86E-06 =	--	1.85E-06 =	--	1.78E-07 =
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	0.01	--	2.18E-04 =	--	0.0014 =	2.86E-05 =	--	4.02E-05 =	--	8.33E-07 =
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	0.01	--	1.09E-04 =	--	6.60E-04 =	1.20E-05 =	--	1.94E-05 =	--	4.01E-07 =
DIOXIN	1,2,3,7,8-PeCDD	mg/Kg	1	--	1.42E-05 =	--	5.04E-05 =	1.73E-06 =	--	2.34E-06 =	--	3.06E-07 =
DIOXIN	2,3,7,8-TCDD	mg/Kg	1	--	7.20E-06 =	--	3.20E-05 =	1.03E-06 =	--	1.37E-06 =	--	4.88E-08 =
DIOXIN	HpCDDs (total)	mg/Kg		--	0.0031 =	--	0.0036 =	--	--	--	--	--
DIOXIN	HxCDDs (total)	mg/Kg		--	0.0014 =	--	0.0085 =	--	--	--	--	--
DIOXIN	OCDD	mg/Kg	0.0001	--	0.012 =	--	0.012 =	0.0021 =	--	0.0020 =	--	1.76E-04 =
DIOXIN	PeCDDs (total)	mg/Kg		--	1.11E-04 =	--	4.23E-04 =	--	--	--	--	--
DIOXIN	TCDDs (total)	mg/Kg		--	3.00E-05 =	--	9.78E-05 =	--	--	--	--	--
DIOXIN	TEQ	mg/Kg		9.00E-06	**6.14E-05 =**	--	**1.62E-04 =**	**1.06E-05 =**	--	**1.06E-05 =**	--	**7.53E-07** =
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	0.001	--	1.95E-04 =	--	2.29E-04 =	4.30E-05 =	--	4.01E-05 =	--	1.95E-06 =
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	0.001	--	1.28E-05 =	--	1.41E-05 =	2.75E-06 =	--	2.96E-06 =	--	8.11E-08 =
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	0.1	--	1.29E-05 =	--	2.05E-05 =	6.98E-06 =	--	3.94E-06 =	--	2.47E-07 U
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	0.1	--	1.08E-05 =	--	1.43E-05 =	2.04E-06 =	--	2.10E-06 =	--	2.47E-07 U
FURAN	1,2,3,7,8,9-HxCDF	mg/Kg	0.1	--	3.52E-06 =	--	4.80E-06 =	1.50E-06 =	--	9.98E-07 =	--	7.77E-08 =
FURAN	1,2,3,7,8-PeCDF	mg/Kg	0.05	--	1.58E-05 =	--	2.64E-05 =	2.48E-06 =	--	2.27E-06 =	--	3.19E-07 =
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	0.1	--	1.22E-05 =	--	1.63E-05 =	3.11E-06 =	--	2.43E-06 =	--	2.96E-07 =
FURAN	2,3,4,7,8-PeCDF	mg/Kg	0.5	--	1.31E-05 =	--	2.40E-05 =	4.03E-06 =	--	2.91E-06 =	--	2.96E-07 =
FURAN	2,3,7,8-TCDF	mg/Kg	0.05	--	3.21E-04 =	--	5.76E-04 =	5.00E-05 =	--	4.71E-05 =	--	1.01E-06 =
FURAN	HpCDFs (total)	mg/Kg		--	5.67E-04 =	--	6.02E-04 =	--	--	--	--	--
FURAN	HxCDFs (total)	mg/Kg		--	2.53E-04 =	--	3.30E-04 =	--	--	--	--	--
FURAN	OCDF	mg/Kg	0.0001	--	5.85E-04 =	--	4.76E-04 =	1.14E-04 =	--	1.53E-04 =	--	7.45E-06 =
FURAN	PeCDFs (total)	mg/Kg		--	1.53E-04 =	--	2.86E-04 =	--	--	--	--	--
FURAN	TCDFs (total)	mg/Kg		--	6.99E-04 =	--	0.0012 =	--	--	--	--	--
GENCHEM	Acid Volatile Sulfide	mg/Kg		--	--	6,800 J	--	--	--	--	--	--
M-TOTAL	Arsenic	mg/Kg		6.0	--	9.1 UJ	--	--	4.7 J	--	**8.5 J**	--
M-TOTAL	Chromium	mg/Kg		37	--	**39 J**	--	--	13 =	--	30 =	--
M-TOTAL	Chromium, Hexavalent	mg/Kg		--	--	0.32 =	--	--	--	--	--	--
M-TOTAL	Copper	mg/Kg		36	--	**55 J**	--	--	16 =	--	34 =	--
M-TOTAL	Iron	mg/Kg		--	--	--	--	--	27,000 =	--	36,400 =	--
M-TOTAL	Zinc	mg/Kg		123	--	**1,710 =**	--	--	**167 =**	--	**301 =**	--
M-TOTAL-AVS	Cadmium	mg/L		--	--	--	--	--	--	--	--	--
M-TOTAL-AVS	Copper	mg/L		--	--	--	--	--	--	--	--	--
M-TOTAL-AVS	Lead	mg/L		--	--	--	--	--	--	--	--	--
M-TOTAL-AVS	Nickel	mg/L		--	--	--	--	--	--	--	--	--
M-TOTAL-AVS	Zinc	mg/L		--	--	--	--	--	--	--	--	--
SVOC	2-Methylphenol	mg/Kg		--	--	1.5 U	--	--	0.92 U	--	0.29 J	--
SVOC	4-Methylphenol	mg/Kg		--	--	1.5 U	--	--	0.92 U	--	1.0 U	--
SVOC	Acenaphthene	mg/Kg		0.29	--	1.5 U	--	--	0.92 U	--	1.0 U	--
SVOC	Anthracene	mg/Kg		0.057	--	**0.69 J**	--	--	0.92 U	--	**1.6 =**	--

TABLE 11

Crawford Creek Slough Sediment Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SD-05**	**SD-06**	**SD-06**	**SD-07**	**SD-07**	**SD-08**	**SD-08**	**SD-09**
Sample ID:					SD-5-20102-0	SD-6-020102-0	SD-6-20102-0	SD07-071003-0	SD070710030	SD08-071003-0	SD080710030	SD09-071003-0
QAQC Type:					N	N	N	N	N	N	N	N
Date Collected:					02/01/02	02/01/02	02/01/02	07/10/03	07/10/03	07/10/03	07/10/03	07/10/03
Chemical Group	**Parameter**	**Units**	**Fish TEFs**	**Oregon Level II-SD-FW**								
SVOC	Benzo(a)anthracene	mg/Kg		0.032	--	**0.14 J**	--	--	0.92 U	--	**0.49 J**	--
SVOC	Benzo(a)pyrene	mg/Kg		0.032	--	1.5 U	--	--	0.92 U	--	**0.27 J**	--
SVOC	Benzo(b)fluoranthene	mg/Kg		--	--	1.5 U	--	--	0.92 U	--	0.18 J	--
SVOC	Benzo(g,h,i)perylene	mg/Kg		0.30	--	0.18 J	--	--	0.92 U	--	0.10 J	--
SVOC	Benzo(k)fluoranthene	mg/Kg		0.027	--	1.5 U	--	--	0.92 U	--	**0.27 J**	--
SVOC	bis(2-Ethylhexyl)phthalate	mg/Kg		0.75	--	**791 J**	--	--	0.48 J	--	0.54 J	--
SVOC	Butyl benzyl phthalate	mg/Kg		--	--	1.5 U	--	--	0.92 U	--	0.53 J	--
SVOC	Chrysene	mg/Kg		0.057	--	**0.45 J**	--	--	0.92 U	--	**0.45 J**	--
SVOC	Dimethyl phthalate	mg/Kg		--	--	0.23 J	--	--	0.92 U	--	1.0 U	--
SVOC	Di-n-butylphthalate	mg/Kg		0.11	--	**0.33 J**	--	--	0.92 U	--	1.0 U	--
SVOC	Di-n-octylphthalate	mg/Kg		--	--	1.5 U	--	--	0.92 U	--	1.0 U	--
SVOC	Fluoranthene	mg/Kg		0.11	--	**0.84 J**	--	--	0.92 U	--	**1.4 =**	--
SVOC	Fluorene	mg/Kg		0.077	--	**0.11 J**	--	--	0.92 U	--	0.063 J	--
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg		0.017	--	1.5 U	--	--	0.92 U	--	**0.097 J**	--
SVOC	N-Nitrosodiphenylamine	mg/Kg		--	--	0.42 J	--	--	0.92 U	--	0.047 J	--
SVOC	Phenanthrene	mg/Kg		0.042	--	**0.55 J**	--	--	0.92 U	--	**1.6 =**	--
SVOC	Pyrene	mg/Kg		0.053	--	**0.71 J**	--	--	0.92 U	--	**0.98 J**	--

Notes:
= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds

TABLE 11

Crawford Creek Slough Sediment Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SD-09**	**SD-10**	**SD-10**	**SD-10**
Sample ID:					SD090710030	SD10-071003-0	SD100710030	SD100710031
QAQC Type:					N	N	N	FD
Date Collected:					07/10/03	07/10/03	07/10/03	07/10/03
Chemical Group	**Parameter**	**Units**	**Fish TEFs**	**Oregon Level II-SD-FW**				
CONV	Total Organic Carbon	mg/Kg		--	1,260 =	--	216 =	205 U
CONV	Total Organic Carbon	Percent		--	--	--	--	--
DIOXIN	1,2,3,4,6,7,8-HpCDD	mg/Kg	0.001	--	--	1.73E-06 =	--	--
DIOXIN	1,2,3,4,7,8-HxCDD	mg/Kg	0.5	--	--	4.92E-08 =	--	--
DIOXIN	1,2,3,6,7,8-HxCDD	mg/Kg	0.01	--	--	2.35E-07 U	--	--
DIOXIN	1,2,3,7,8,9-HxCDD	mg/Kg	0.01	--	--	5.10E-08 =	--	--
DIOXIN	1,2,3,7,8-PeCDD	mg/Kg	1	--	--	1.60E-07 =	--	--
DIOXIN	2,3,7,8-TCDD	mg/Kg	1	--	--	3.61E-08 =	--	--
DIOXIN	HpCDDs (total)	mg/Kg		--	--	--	--	--
DIOXIN	HxCDDs (total)	mg/Kg		--	--	--	--	--
DIOXIN	OCDD	mg/Kg	0.0001	--	--	1.09E-05 =	--	--
DIOXIN	PeCDDs (total)	mg/Kg		--	--	--	--	--
DIOXIN	TCDDs (total)	mg/Kg		--	--	--	--	--
DIOXIN	TEQ	mg/Kg		9.00E-06	--	**4.02E-07** =	--	--
FURAN	1,2,3,4,6,7,8-HpCDF	mg/Kg	0.001	--	--	7.48E-07 =	--	--
FURAN	1,2,3,4,7,8,9-HpCDF	mg/Kg	0.001	--	--	5.19E-08 =	--	--
FURAN	1,2,3,4,7,8-HxCDF	mg/Kg	0.1	--	--	2.35E-07 U	--	--
FURAN	1,2,3,6,7,8-HxCDF	mg/Kg	0.1	--	--	1.15E-08 =	--	--
FURAN	1,2,3,7,8,9-HxCDF	mg/Kg	0.1	--	--	1.58E-08 =	--	--
FURAN	1,2,3,7,8-PeCDF	mg/Kg	0.05	--	--	2.74E-07 =	--	--
FURAN	2,3,4,6,7,8-HxCDF	mg/Kg	0.1	--	--	2.66E-07 =	--	--
FURAN	2,3,4,7,8-PeCDF	mg/Kg	0.5	--	--	2.56E-07 =	--	--
FURAN	2,3,7,8-TCDF	mg/Kg	0.05	--	--	7.63E-08 =	--	--
FURAN	HpCDFs (total)	mg/Kg		--	--	--	--	--
FURAN	HxCDFs (total)	mg/Kg		--	--	--	--	--
FURAN	OCDF	mg/Kg	0.0001	--	--	1.83E-06 =	--	--
FURAN	PeCDFs (total)	mg/Kg		--	--	--	--	--
FURAN	TCDFs (total)	mg/Kg		--	--	--	--	--
GENCHEM	Acid Volatile Sulfide	mg/Kg		--	--	--	--	--
M-TOTAL	Arsenic	mg/Kg		6.0	2.9 J	--	2.0 J	1.3 J
M-TOTAL	Chromium	mg/Kg		37	6.5 =	--	4.6 =	5.4 =
M-TOTAL	Chromium, Hexavalent	mg/Kg		--	--	--	--	--
M-TOTAL	Copper	mg/Kg		36	5.3 =	--	4.8 =	4.6 =
M-TOTAL	Iron	mg/Kg		--	12,500 =	--	9,890 =	9,120 =
M-TOTAL	Zinc	mg/Kg		123	66 =	--	38 =	36 =
M-TOTAL-AVS	Cadmium	mg/L		--	--	--	--	--
M-TOTAL-AVS	Copper	mg/L		--	--	--	--	--
M-TOTAL-AVS	Lead	mg/L		--	--	--	--	--
M-TOTAL-AVS	Nickel	mg/L		--	--	--	--	--
M-TOTAL-AVS	Zinc	mg/L		--	--	--	--	--
SVOC	2-Methylphenol	mg/Kg		--	0.46 U	--	0.41 U	0.45 U
SVOC	4-Methylphenol	mg/Kg		--	0.46 U	--	0.41 U	0.45 U
SVOC	Acenaphthene	mg/Kg		0.29	0.46 U	--	0.41 U	0.45 U
SVOC	Anthracene	mg/Kg		0.057	0.46 U	--	0.41 U	0.45 U

TABLE 11

Crawford Creek Slough Sediment Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Station ID:					**SD-09**	**SD-10**	**SD-10**	**SD-10**
Sample ID:					SD090710030	SD10-071003-0	SD100710030	SD100710031
QAQC Type:					N	N	N	FD
Date Collected:					07/10/03	07/10/03	07/10/03	07/10/03
Chemical Group	**Parameter**	**Units**	**Fish TEFs**	**Oregon Level II-SD-FW**				
SVOC	Benzo(a)anthracene	mg/Kg		0.032	0.46 U	--	0.41 U	0.45 U
SVOC	Benzo(a)pyrene	mg/Kg		0.032	0.46 U	--	0.41 U	0.45 U
SVOC	Benzo(b)fluoranthene	mg/Kg		--	0.46 U	--	0.41 U	0.45 U
SVOC	Benzo(g,h,i)perylene	mg/Kg		0.30	0.46 U	--	0.41 U	0.45 U
SVOC	Benzo(k)fluoranthene	mg/Kg		0.027	0.46 U	--	0.41 U	0.45 U
SVOC	bis(2-Ethylhexyl)phthalate	mg/Kg		0.75	0.24 J	--	0.41 U	0.45 U
SVOC	Butyl benzyl phthalate	mg/Kg		--	0.24 J	--	0.41 U	0.45 U
SVOC	Chrysene	mg/Kg		0.057	0.46 U	--	0.41 U	0.45 U
SVOC	Dimethyl phthalate	mg/Kg		--	0.46 U	--	0.41 U	0.45 U
SVOC	Di-n-butylphthalate	mg/Kg		0.11	0.46 U	--	0.41 U	0.45 U
SVOC	Di-n-octylphthalate	mg/Kg		--	0.46 U	--	0.41 U	0.45 U
SVOC	Fluoranthene	mg/Kg		0.11	0.46 U	--	0.41 U	0.45 U
SVOC	Fluorene	mg/Kg		0.077	0.46 U	--	0.41 U	0.45 U
SVOC	Indeno(1,2,3-cd)pyrene	mg/Kg		0.017	0.46 U	--	0.41 U	0.45 U
SVOC	N-Nitrosodiphenylamine	mg/Kg		--	0.46 U	--	0.41 U	0.45 U
SVOC	Phenanthrene	mg/Kg		0.042	0.46 U	--	0.41 U	0.45 U
SVOC	Pyrene	mg/Kg		0.053	0.46 U	--	0.41 U	0.45 U

Notes:

= - Analyte found
B - Analyte detected in blank
SVOC - Semivolatile organic compounds
CONV - General chemistry
D - Sample was diluted by laboratory
FD - Field duplicate
J - Estimated result
M -DISS - Dissolved metals
M - TOTAL AVS = Total metals (acid volatile sulfides)
M - TOTAL = Total metals
N - Primary sample
TPH - Total petroleum hydrocarbons
U - Analyte not found at the listed detection limit
VOC - Volatile organic compounds

TABLE 12

Columbia River Sediment Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Sample ID:	**OR DEQ**	**WA DOE**		**MacDonald et al.**		**KWT-VC01-A**	**KWT-VC01-B**	**KWT-VC01-C**	**KWT-SS01**	**KWT-SS02**
Depth (ft bgs):	**2001**	**2003**		**2000**		**0 - 2 ft.**	**2 - 4 ft.**	**4 - 6 ft.**	**0 - 0.3 ft.**	**0 - 0.3 ft.**
Date Collected:	**SLV**	**SQS**	**CSL**	**TEC**	**PEC**	**04/19/05**	**04/19/05**	**04/19/05**	**04/19/05**	**04/19/05**
Metals (results in mg/kg)										
Arsenic	6.0	20	51	9.8	33	**4.3**	**5.0**	**2.2** B	**2.5** B	**1.9** B
Chromium	37	95	100	43	111	**17.0**	**17.6**	**17.1**	**11.4**	**13.1**
Copper	36	80	830	32	149	**20.2**	**27.8**	**16.8**	**15.4**	**11.4**
Zinc	123	140	160	121	459	**133**	**122**	**45**	**60**	**58**
Semivolatile Organics (results in ug/Kg)										
2-Methylnaphthalene		470	560			**3.7** J	**2.7** J	1.9 U	1.9 U	1.9 U
4-Methylphenol **						**22**	**7.3** J	4.4 U	4.5 U	4.4 U
Acenaphthene	290	1,060	1,320			**3.8** J	**2.1** J	1.6 U	1.6 U	1.6 U
Acenaphthylene	160	470	640			**14**	**7.9** J	2.2 U	2.2 U	2.2 U
Anthracene	57	1,200	1,580	57	845	**8.3** J	**4.5** J	2.2 U	2.2 U	2.2 U
Benzo(a)anthracene	32	4,260	5,800	108	1,050	**18**	**13**	2.2 U	**2.7** J	2.2 U
Benzo(a)pyrene	32	3,300	4,810	150	1,450	**40**	**26**	2.5 U	2.5 U	2.5 U
Benzo(b)fluoranthene		11,000	14,000			**38**	**23**	3.8 U	**4.4** J	3.8 U
Benzo(g,h,i)perylene	300	4,020	5,200			**49**	**28**	3.5 U	3.6 U	3.5 U
Benzo(k)fluoranthene	27	11,000				**11**	**8.1** J	3.8 U	3.9 U	3.8 U
Chrysene	57	5,940	6,400	166	1,290	**28**	**18**	2.2 U	**5.3** J	2.2 U
Dibenz(a,h)anthracene	33	800	840	33		**4.9** J	3.3 U	3.4 U	3.4 U	3.4 U
Dibenzofuran	5,100	400	440			**3.0** J	2.0 U	2.0 U	2.0 U	2.0 U
Fluoranthene	111	11,000	15,000	423	2,230	**48**	**32**	3.4 J	**12**	3.4 U
Fluorene	77	1,000	3,000	77	536	**5.9** J	**3.3** J	2.6 U	2.6 U	2.6 U
Indeno(1,2,3-cd)pyrene	17	4,120	5,300			**40**	**23**	2.9 U	3.0 U	2.9 U
Naphthalene	176	500	1,310	176	561	**27**	**14**	2.0 U	2.0 U	2.0 U
Phenanthrene	42	6,100	7,600	204	1,170	**34**	**20**	2.0 U	**7.2** J	2.0 U
Phenol	48					**9.8** J	**10** J	**7.5** J	**9.8** J	**8.7** J
Pyrene	53	8,800	16,000	195	1,520	**59**	**41**	2.0 U	**9.0** J	2.0 U

TABLE 12

Columbia River Sediment Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Sample ID:	**OR DEQ**	**WA DOE**		**MacDonald et al.**		**KWT-VC01-A**	**KWT-VC01-B**	**KWT-VC01-C**	**KWT-SS01**	**KWT-SS02**
Depth (ft bgs):	**2001**	2003		2000		**0 - 2 ft.**	**2 - 4 ft.**	**4 - 6 ft.**	**0 - 0.3 ft.**	**0 - 0.3 ft.**
Date Collected:	**SLV**	**SQS**	**CSL**	**TEC**	**PEC**	**04/19/05**	**04/19/05**	**04/19/05**	**04/19/05**	**04/19/05**
Total Petroleum Hydrocarbons (results in mg/kg)										
Diesel						**30** H	**26** J	**5.3** J	**21** J	**6.9** J
Residual Range Organics						**88** J	**100** J	**41** J	**65** J	**23** J
Volatile Organics (results in ug/kg)*										
Acetone						**18** J	**35**	**27** J	16 U	16 U

Notes:

*	All Volatile Organic Compounds were undetected except acetone.
**	4-Methylphenol cannot be separated from 3-Methylphenol.
Bold	indicates detected concentration
U	The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
J	The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
B	The analyte was found in the associated method blank.
H	The chromatographic fingerprint resembles petroleum product, but elution pattern indicates heavier molecular weight constituents than the calibration standard.
D	The reported result is from a dilution.

TABLE 12

Columbia River Sediment Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Sample ID:	OR DEQ	WA DOE		MacDonald et al.		KWT-SS03	KWT-SS04	KWT-SS05	KWT-SS06
Depth (ft bgs):	2001	2003		2000		0 - 0.3 ft.	0 - 0.3 ft.	0 - 0.3 ft.	0 - 0.3 ft.
Date Collected:	SLV	SQS	CSL	TEC	PEC	04/19/05	04/19/05	04/19/05	04/19/05
Metals (results in mg/kg)									
Arsenic	6.0	20	51	9.8	33	**10.6**	**1.8** B	**3.1**	**1.7** B
Chromium	37	95	100	43	111	**9.7**	**10.9**	**8.5**	**11.4**
Copper	36	80	830	32	149	**10.4**	**9.9**	**12.3**	**11.1**
Zinc	123	140	160	121	459	**46**	**54**	**46**	**52**
Semivolatile Organics (results in ug/Kg)									
2-Methylnaphthalene		470	560			**8.8** J	2.1 U	1.9 U	2.0 U
4-Methylphenol **						3.9 U	5.0 U	4.6 U	4.7 U
Acenaphthene	290	1,060	1,320			**53**	1.8 U	1.6 U	1.6 U
Acenaphthylene	160	470	640			**12**	2.4 U	2.2 U	2.3 U
Anthracene	57	1,200	1,580	57	845	**85**	2.4 U	2.2 U	2.3 U
Benzo(a)anthracene	32	4,260	5,800	108	1,050	**390**	2.4 U	**4.2** J	2.3 U
Benzo(a)pyrene	32	3,300	4,810	150	1,450	**430**	2.8 U	**4.3** J	2.6 U
Benzo(b)fluoranthene		11,000	14,000			**660** D	4.3 U	**5.6** J	4.0 U
Benzo(g,h,i)perylene	300	4,020	5,200			**320**	4.0 U	3.6 U	3.7 U
Benzo(k)fluoranthene	27	11,000				**260**	4.3 U	3.9 U	4.0 U
Chrysene	57	5,940	6,400	166	1,290	**720** D	2.4 U	**4.6** J	2.3 U
Dibenz(a,h)anthracene	33	800	840	33		**79**	3.8 U	3.5 U	3.6 U
Dibenzofuran	5,100	400	440			**61**	2.3 U	2.1 U	2.1 U
Fluoranthene	111	11,000	15,000	423	2,230	**1800** D	3.8 U	3.5 U	3.6 U
Fluorene	77	1,000	3,000	77	536	**48**	3.0 U	2.7 U	2.8 U
Indeno(1,2,3-cd)pyrene	17	4,120	5,300			**380**	3.3 U	3.0 U	3.1 U
Naphthalene	176	500	1,310	176	561	**19**	2.3 U	2.1 U	2.1 U
Phenanthrene	42	6,100	7,600	204	1,170	**1500** D	2.3 U	2.1 U	2.1 U
Phenol	48					**23** J	**11** J	**8.6** J	**6.3** J
Pyrene	53	8,800	16,000	195	1,520	**1300** D	2.3 U	**3.9** J	2.1 U

TABLE 12

Columbia River Sediment Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Sample ID:	**OR DEQ**	**WA DOE**		**MacDonald et al.**		**KWT-SS03**	**KWT-SS04**	**KWT-SS05**	**KWT-SS06**
Depth (ft bgs):	**2001**	2003		2000		**0 - 0.3 ft.**	**0 - 0.3 ft.**	**0 - 0.3 ft.**	**0 - 0.3 ft.**
Date Collected:	**SLV**	**SQS**	**CSL**	**TEC**	**PEC**	**04/19/05**	**04/19/05**	**04/19/05**	**04/19/05**
Total Petroleum Hydrocarbons (results in mg/kg)									
Diesel						**10** J	**8.6** J	**16** J	**17** J
Residual Range Organics						**28** J	140 U	**67** J	**41** J
Volatile Organics (results in ug/kg)*									
Acetone						14 U	18 U	16 U	16 U

Notes:

*	All Volatile Organic Compounds were undetected except acetone.
**	4-Methylphenol cannot be separated from 3-Methylphenol.
Bold	indicates detected concentration
U	The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
J	The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.
B	The analyte was found in the associated method blank.
H	The chromatographic fingerprint resembles petroleum product, but elution pattern indicates heavier molecular weight constituents than the calibration standard.
D	The reported result is from a dilution.

TABLE 13

Crawford Creek Slough Surface Water Detections

Former Koppers Wood-Treating Site, Wauna, Oregon

Constituent	**DDSW-01 August 26, 2004 Sample**	**DDSW-02 October 18, 2004 Sample**
Metals		
Arsenic	5*U* ug/L	1.2 ug/L
Copper	10*U* ug/L	0.4 ug/L
Iron	1,970 ug/L	1,880 ug/L
Zinc	10*U* ug/L	3.0 ug/L
Organics		
Diesel Range Organics	0.27*Z* mg/L	0.25*U* mg/L
OCDD	5.991*U* pg/L	55.195 pg/L

U = Constituent was not detected at or above the Method Reporting Limit (MRL)
Z = Chromatogram fingerprint does not resemble a petroleum product

TABLE 14

Human Health and Ecological Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

	Human Health		**Ecological – Surface Soil**		**Ecological – Crawford Creek Slough Sediment**	
Constituent	**Industrial Screening Level[a]**	**Hot Spot Level[b]**	**Acceptable Risk Level[c]**	**Hot Spot Level[d]**	**Acceptable Risk Level[e]**	**Hot Spot Level[d]**
Metals (mg/kg)						
Arsenic	1.8	180	10	100	17	170
Chromium	450	45,000	0.4 to 4.0	27[f]	95	950
Chromium, Hexavalent	64	6,400				
Copper	42,000	420,000			197	1,970
Iron	100,000	100,000				
Zinc	100,000	100,000			123	1,230
Organics (mg/kg)						
Dioxin TEQ	1.8 x 10^{-5}	1.8 X 10^{-3}	1.6 x 10^{-5}	1.6 x 10^{-4}		
Acenaphthene	33,000	330,000				
Anthracene	100,000	100,000				
Benzo(a)anthracene	2.3	230				
Benzo(a)pyrene	0.23	23				
Benzo(b)fluoranthene	2.3	230				
Benzo(k)fluoranthene	23	2,300				
Chrysene	230	2,300				
Fluoranthene	24,000	240,000				
Fluorene	26,000	260,000				
Indeno(1,2,3-cd)pyrene	2.3	230				
Naphthalene	210	2,100				
Pyrene	32,000	320,000				
Dibenzofuran	1,700	17,000				
Pentachlorophenol	10	1,000				
2,4-Dimethylphenol	14,000	140,000				
2-Methylphenol	34,000	340,000				
4-Methylphenol	3,400	34,000				
Phenol	100,000	100,000				
Bis(2-Ethylhexyl)phthalate	140	14,000				
Cholorform	0.52	52				
1,2,4-Trimethylbenzene	170	1,700				
1,3,5-Trimethylbenzene	70	700				
Benzene	1.5	150				

TABLE 14

Human Health and Ecological Hot Spot Levels

Former Koppers Wood-Treating Site, Wauna, Oregon

Constituent	Human Health		Ecological – Surface Soil		Ecological – Crawford Creek Slough Sediment	
	Industrial Screening Level[a]	Hot Spot Level[b]	Acceptable Risk Level[c]	Hot Spot Level[d]	Acceptable Risk Level[e]	Hot Spot Level[d]
Chlorobenzene	460	4,600				
Ethylbenzene	230	2,300				
Toluene	520	5,200				
m,p-Xylene	210	2,100				
o-Xylene	280	2,800				
Xylene (total)	210	2,100				
Methylene Chloride	21	2,100				
n-Propylbenzene	240	2,400				
sec-Butylbenzene	220	2,200				
Styrene	1,700	17,000				
Trichloroethylene	0.092	9.2				

[a] Lowest industrial soil screening level from EPA Region 6 Human Health Medium-Specific Screening Levels 2008

[b] Hot spot levels calculated by adjusting industrial screening levels per DEQ hot spot guidance (DEQ, 1998a)

[c] Based on the Ecological Risk Assessment (ERA), the acceptable risk level for arsenic is surface soil is the lowest Level II SLV for plants and birds (Windward, 2007). The acceptable risk level for chromium in surface soil ranges from 0.4 to 4 mg/kg for invertebrates, plants and birds. Acceptable risk level for dioxin TEQ in surface soil based on population level evaluation of risk to shrew based on the ERA.

[d] Hot spot levels calculated by adjusting acceptable risk level from ERA by 10.

[e] Based on the ERA, the acceptable risk levels for arsenic, chromium, copper and zinc are probable effects levels (PELs). Note that according to the ERA the acceptable risk level for zinc based on population level evaluation of risk to sandpiper is 1,076 mg/kg, which is higher than its PEL.

[f] Based on a September 15, 2008 telephone conversation with P. Seidel/DEQ, there is an inherent inconsistency in determining the ecological hot spot level for chromium because adjusting the lowest Level II SLV by a factor of 10 results in a concentration that is less than the background value of 27 mg/kg. DEQ recommended using the background value as the hot spot level, but acknowledges this inconsistency.

TABLE 15

Remedial Action Objectives

Former Koppers Wood-Treating Site, Wauna, Oregon

Medium	Remedial Action Objectives	Rationale
Surface Soil	**Human Health:** Reduce exposure to arsenic and 1,2,3,4,6,7,8-HpCDD that may result in potential unacceptable risk. **Ecological:** Reduce exposure to arsenic, chromium and dioxins that may result in potential unacceptable risk. **Migration:** Control migration of metals and dioxins in surface soil at concentrations that could result in potential unacceptable risk levels or significant adverse effects on beneficial uses of water in the LOF. **Hot Spots of Contamination:** Treat soil hot spots to non-hot spot levels by reducing their concentration, volume or mobility.	
Source Zone Soil/DNAPL	**Human Health:** Reduce exposure to dioxins, arsenic, polynuclear aromatic hydrocarbons (PAHs), dibenzofuran and pentachlorophenol that may result in potential unacceptable risk. **Ecological:** None. **Migration:** Control migration of constituents that are a source to the perched water-bearing zone at concentrations that could result in significant adverse effects on beneficial uses of water in the LOF. **Hot Spots of Contamination:** Treat soil hot spots and DNAPL that are a source to the perched water-bearing zone to non-hot spot levels by reducing their concentration, volume or mobility.	**Ecological:** Exposure to source zone soil and DNAPL was not considered to be a complete pathway in the ERA.
Deed Restricted Area Soil	**Human Health:** Reduce exposure to arsenic, chromium, PAHs and pentachlorophenol that may result in potential unacceptable risk. **Ecological:** None **Migration:** Control migration of metals, PAHs, and pentachlorophenol in surface soil at concentrations that could result in potential unacceptable risk levels or significant adverse effects on beneficial uses of water in the LOF. **Hot Spots of Contamination:** Treat soil hot spots to non-hot spot levels by reducing their concentration, volume or mobility.	**Ecological:** Exposure to soil was not considered to be a complete pathway in the ERA.

TABLE 15

Remedial Action Objectives

Former Koppers Wood-Treating Site, Wauna, Oregon

Perched Water-Bearing Zone Groundwater	**Human Health:** None **Ecological:** Reduce exposure to volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and metals that could seep into the Columbia River at concentrations that could result in significant adverse effects on beneficial uses of water in the LOF. **Migration:** Control migration of VOCs, SVOCs and metals to the Columbia River at concentrations that could result in significant adverse effects on beneficial uses of water in the LOF. **Hot Spots of Contamination:** Treat hot spots of contamination to non-hot spot levels by reducing their concentration, volume or mobility.	**Human Health:** The HHRA did not identify a potential unacceptable risk associated with potential human exposure to shallow groundwater. **Ecological:** Exposure to shallow groundwater was not considered to be a complete pathway in the ERA.
Surface Water	**Human Health:** None **Ecological:** None **Migration:** None	**Human Health:** The HHRA did not identify a potential unacceptable risk associated with potential human exposure to Crawford Creek or Columbia River surface water. **Ecological:** The ERA did not identify a potential unacceptable risk associated with ecological receptor exposure to Crawford Creek or Columbia River surface water. **Migration:** The RI results do not indicate that surface water migration in Crawford Creek Slough or Columbia River is of concern.
Sediment	**Human Health:** None **Ecological:** Reduce exposure to arsenic, chromium, copper and zinc in drainage ditch sediments that may result in potential unacceptable risk. **Migration:** Control migration of metals in drainage ditch sediments at concentrations that could result in potential unacceptable risk levels or significant adverse effects on beneficial uses of water in the LOF. **Hot Spots of Contamination:** Treat sediment hot spots to non-hot spot levels by reducing their concentration, volume or mobility.	**Human Health:** The HHRA did not identify a potential unacceptable risk associated with potential human exposure to Crawford Creek Slough or Columbia River sediments. **Ecological:** The baseline ERA did not identify a potential unacceptable risk associated with ecological receptor exposure to Columbia River sediments. **Migration:** The RI results do not indicate that sediment migration in the Columbia River is of concern.

TABLE 16

General Response Actions for Each Media and Area

Former Koppers Wood-Treating Site, Wauna, Oregon

Media	Area	Institutional Controls	Engineering Controls	Removal	Disposal	Treatment		
						Physical/Chemical	Thermal	Biological
Soils/NAPL	Surface soils between deed restricted area and parking lot	●	●	●	●	●		●
	Surface soils near former wigwam burner	●	●	●	●	●		●
	Surface and subsurface soils in the deed restricted area	●	●	●	●	●		
	Source zone subsurface soil and DNAPL	●	●	●	●	●	●	●
Sediments	Drainage ditch		●	●	●	●		
Shallow Groundwater[a]	Perched water-bearing zone		●			●		●

[a] Engineering controls (physical and hydraulic containment), removal (through extraction), and biological treatment were considered in during IRM evaluation. Engineering controls, physical/chemical treatment and biological treatment are potential general response actions for final remedy for the perched water-bearing zone.

TABLE 17

Remedial Technology Screening Results

Former Koppers Wood-Treating Site, Wauna, Oregon

Media	General Response Actions	Identified Remedial Technologies	Relevant Screening Criteria			Comments	Retained (Yes/No)
			Effectiveness	Implementability	Cost		
Soils/DNAPL	Institutional Controls	Deed restriction	H	H	L		Yes
		Activity restrictions	H	H	L		Yes
	Engineering Controls	Soil cap	M	H	L	Less reliable than other engineering controls in managing risks and higher long-term O&M uncertainties. Not compatible with current and future mill uses of Site.	No
		Asphalt cap	H	H	M		Yes
		Impermeable cap	H	H	H	Elimination of infiltration through soils is unnecessary given metals and organics present in soil are relatively immobile and shallow depth to groundwater.	No
		Drainage controls	H	H	L		Yes
	Removal	Excavation	H	H	L		Yes
	Disposal	Solid waste disposal	H	H	M		Yes
		Hazardous waste disposal	H	H	H		Yes
	Physical/Chemical Treatment	In-situ chemical oxidation	L	H	M	Would not address metals in soil.	Yes
		In-situ electrokinetic separation	M	M	H	Developmental technology with limited commercial applications.	No
		In-situ soil flushing	L	H	H	May not be effective for highly immobile metals and organics (e.g. certain PAHs and dioxins), or may require use of different co-solvents or surfactants to address range of metals and organics present in soils. Would require treatability testing. Developmental technology.	No
		In-situ or ex-situ solidification/stabilization	M	M	M		Yes
		Ex-situ chemical extraction	M	M	H	May not be effective for high molecular weight organic compounds. Would require use of different extractants to address range of metals and organics present in soils. Would require treatability testing. High unit cost relative to other treatment technologies.	No
		Ex-situ chemical reduction/oxidation	M	H	H	May not be effective in converting metals and organics into less toxic or mobile forms. May require use of different oxidation/reduction agents to address range of metals and organics present in soils. Would require treatability testing. High unit cost relative to other treatment technologies.	No
		Ex-situ dehalogenation	L	M	H	Would not address metals in soils.	No
	Thermal Treatment	Electrical heating	M	M	H	Would not address metals in deed restricted area soils and would be more costly than other in-situ treatment technologies for source zone soils and DNAPL.	No
		Steam injection	M	M	H	Would not address metals in deed restricted area soils and would be more costly than other in-situ treatment technologies for source zone soils and DNAPL.	No
	Biological Treatment	Phytoremediation	L	L	L	Phytoremediation may be effective for some metals (e.g., arsenic), but not for organics. Would likely be less effective for impacted subsurface soils. Would be incompatible with mill's current and future uses of area.	No
		In-situ biological treatment	L	M	H	Would not address metals in deed restricted area soils and is developmental for the source zone depletion where DNAPL is present.	No

TABLE 17
Remedial Technology Screening Results
Former Koppers Wood-Treating Site, Wauna, Oregon

Sediments	Engineering Controls	Sediment cap	M	H	M	Need stabilize relatively soft ditch sediments prior to cap construction would make this technology more costly to implement than in-situ stabilization alone.	No
		Asphalt/concrete cap	H	H	M	Need stabilize relatively soft ditch sediments prior to cap construction would make this technology more costly to implement than in-situ stabilization alone.	No
		Storm drain line	H	H	M		Yes
	Removal	Excavation	H	H	L		Yes
	Disposal	Solid waste disposal	H	H	M		Yes
		Hazardous waste disposal	H	H	H		Yes
		On-site disposal (mill landfill)	H	H	L		Yes
	Physical/Chemical Treatment	In-situ electrokinetic separation	M	L	H	Developmental technology with limited commercial applications. Potential for impacts to the environment during implementation.	No
		In-situ soil flushing	L	L	H	Would require treatability testing. Developmental technology. Difficult to implement on in-situ sediments. Potential for impacts to the environment during implementation.	No
		In-situ or ex-situ solidification/stabilization	M	L	M	Would not reduce metals concentrations and may not reduce toxicity. Would require treatability testing. Potential for impacts to the environment during implementation. Ex-situ treatment may be needed before disposal.	Yes
		Ex-situ chemical extraction	M	M	H	Would require treatability testing. High unit cost relative to other treatment technologies.	No
		Ex-situ chemical reduction/oxidation	M	M	H	Would require treatability testing. High unit cost relative to other treatment technologies.	No
Shallow Groundwater	Engineering controls	Physical barrier	H	H	M		Yes
		Hydraulic barrier	M	M	L	Would be less effective and more difficult to implement than a physical barrier.	No
	In-situ biological treatment	Enhanced bioremediation	M	H	L		Yes
		Monitored natural attenuation	H	H	L		Yes
		Phytoremediation	M	L	L	May not be effective in meeting remedial action objectives for all constituents. Would be incompatible with mill's current and future uses of area.	No
	In-situ physical/chemical treatment	Chemical oxidation	M	H	M	Cost to implement near southeast end of subsurface barrier is likely to be higher than other in-situ treatment technologies.	No
		Passive/reactive treatment walls	M	H	H	Limited application in treating organics associated with wood-treating solutions.	No

L = Low

M = Medium

H = High

TABLE 18

Indirect Cost Allowances

Former Koppers Wood-Treating Site, Wauna, Oregon

Allowances	On-Ssite Nonhazardous Activities	Off-Site Material Treatment/Disposal and Cap Maintenance	On-Site Hazardous Activities of Low Complexity (Applied to Management of Contaminated Soil)	OnSte Hazardous Activities of Low Complexity (Applied to Management of Contaminated Water)	Studies and Monitoring
Health and Safety	NA	NA	2%	2%	NA
Remediation Contractor Profit	5%	NA	5%	5%	NA
Bonding and Insurance	2%	NA	2%	2%	NA
Permitting	1%	NA	3%	3%	NA
Engineering Design	2%	1%	3%	8%	NA
Engineer’s Services During Construction	2%	1%	3%	4%	NA
Contractor Mobilization/ Demobilization	8%	NA	7%	7%	NA
Total	20%	2%	25%	31%	NA

NA = Not applicable or included elsewhere.

TABLE 19

Surface Soil Remedial Alternative Evaluation Results

Former Koppers Wood-Treating Site, Wauna, Oregon

		Remedy Selection Factors								
							Reasonableness of Cost – Net Present Value (Rounded)			
Media/Area	**Remedial Alternative**	**Protectiveness**	**Effectiveness**	**Long-Term Reliability**	**Implementability**	**Implementation Risk**	**Capital Cost**	**O&M Cost**	**Total Cost**	**Preference to Treat Hot Spots**
Surface Soil	SS1 – No action	Alternative would not be protective because the reasonable maximum exposure (RME) cancer risk for a future hypothetical outdoor worker is estimated to be 1 x 10^{-4} and there could be potential unacceptable population-level risks to ecological receptors.	Alternative would not be effective achieving protection.	NA	NA	NA	$0	$0	$0	Alternative would not reduce constituent concentrations below hot spot levels.
	SS2 – Construct asphalt cap and implement deed and activity restrictions	Alternative would be protective because it would eliminate exposure by humans and ecological receptors to surface soils posing a potential unacceptable risk. Residual risk associated with exposure to remaining surface soils would be reduced to acceptable levels within the Locality of the Facility (LOF).	Alternative would be effective in achieving protection. An asphalt cap and institutional controls would be consistent with the controls implemented in the deed restricted area and, therefore, would be adequate and reliable in managing residual hazardous substances. Alternative could be implemented in two months.	Similar engineering and institutional controls have been in place for 20 years in the deed restricted area. Over that time, they have been reliable in preventing exposure to impacted soils. Primary uncertainty related to long-term management is whether controls will be maintained by future property owners.	Alternative is readily implementable; no permits or authorizations are required. All necessary services, materials, equipment and specialists are readily available.	Impacts to the community, workers, and the environment are minimal. Alternative can be completed in two months.	$65,000	$34,000	$99,000[a]	Alternative would not reduce constituent concentrations below hot spot levels.
	SS3 – Excavate and land dispose soils	Alternative would be protective because it would eliminate surface soils posing a potential unacceptable risk. Residual risk associated with exposure to remaining surface soils would be reduced to acceptable levels within LOF.	Alternative would be effective in achieving protection. No engineering or institutional controls are needed. Alternative could be implemented in two months.	Alternative is highly reliable because engineering and institutional controls are not required to manage risk and there are no long-term management uncertainties.	Alternative is readily implementable; no permits or authorizations are required. All necessary services, materials, equipment and specialists are readily available.	Impacts to the community, workers, and the environment are minimal. Alternative can be completed in two months.	$97,000	$0	$97,000	Alternative would remove the surface soil hot spots.

[a] Note that $99,000 is the sum of the rounded capital and rounded long-term cap inspection and maintenance costs. The actual total NPV cost is $99,540 (see Table 20).

TABLE 20

SS2: Cap Surface Soils and Implement Institutional Controls

Former Koppers Wood-Treating Site, Wauna, Oregon

Cost Summary

(Net Present Value Costs)

PRESENT VALUE	INVESTIGATION AND REMEDIATION ACTIVITY
	Soil
$65,291	Remedy Cost
$34,249	O&M Cost
$99,540	**Total Cost**

TABLE 20

SS2: Cap Surface Soils and Implement Institutional Controls

Former Koppers Wood-Treating Site, Wauna, Oregon

Estimated Detailed Cost
Soils
(Costs in 2008 Dollars)

Cost Item	Quantity	Units	Extended Unit Cost	Allowance	Total Cost	Source
REMEDY						
Institutional Controls						
Deed and activity restrictions	1	LS	$15,000	0%	$15,000	Professional Judgement
Subtotal					$15,000	
Engineering Controls						
Grading and site preparation	1,300	SY	$1.76	25%	$2,860	RS Means 31 22 16.10 1050
Crushed stone base	300	ton	$29.66	25%	$11,123	RS Means 32 11 23.23 2011
Asphalt binder course	1,300	SY	$6.48	25%	$10,530	RS Means 32 12 16.13 0120
Asphalt wearing course	1,300	SY	$7.27	25%	$11,814	RS Means 32 12 16.13 0380
Subtotal, Contractor Costs					$36,326	
Markup on Contractor Costs	15%				$5,449	
Subtotal, Construction					$41,775	
Soil Remedy Subtotal					$56,775	
Contingency			15%		$8,516	
Total Soil Remedy Cost					$65,291	
OPERATION & MAINTENANCE						
Cap Inspection and Maintenance						
Inspection	1	Annual	$1,200	0%	$1,200	Professional judgement
Maintenance	1	5 year	$5,000	20%	$1,200	Professional judgement
Subtotal					$2,400	
O&M Subtotal					$2,400	
Contingency			15%		$360	
Total O&M Cost					$2,760	

TABLE 20
SS2: Cap Surface Soils and Implement Institutional Controls
Former Koppers Wood-Treating Site, Wauna, Oregon

Future Cost Summary
(Costs in 2008 Dollars)

Year	Soils		**Constant Dollar Future Cost (2008 Dollars)**
	Remedy Cost	O&M Cost	
2008	$65,291		$65,291
2009		$2,760	$2,760
2010		$2,760	$2,760
2011		$2,760	$2,760
2012		$2,760	$2,760
2013		$2,760	$2,760
2014		$2,760	$2,760
2015		$2,760	$2,760
2016		$2,760	$2,760
2017		$2,760	$2,760
2018		$2,760	$2,760
2019		$2,760	$2,760
2020		$2,760	$2,760
2021		$2,760	$2,760
2022		$2,760	$2,760
2023		$2,760	$2,760
2024		$2,760	$2,760
2025		$2,760	$2,760
2026		$2,760	$2,760
2027		$2,760	$2,760
2028		$2,760	$2,760
2029		$2,760	$2,760
2030		$2,760	$2,760
2031		$2,760	$2,760
2032		$2,760	$2,760
2033		$2,760	$2,760
2034		$2,760	$2,760
2035		$2,760	$2,760
2036		$2,760	$2,760
2037		$2,760	$2,760
2038		$2,760	$2,760
2039			$0
2040			$0
Subtotals	$65,291	$82,800	$148,091

TABLE 21

SS3: Excavate and Land Dispose Surface Soils

Former Koppers Wood-Treating Site, Wauna, Oregon

Cost Summary

(Net Present Velue Costs)

PRESENT VALUE	INVESTIGATION AND REMEDIATION ACTIVITY
	Soil
$96,597	Remedy Cost
$0	O&M Cost
$96,597	**Total Cost**

TABLE 21

SS3: Excavate and Land Dispose Surface Soils

Former Koppers Wood-Treating Site, Wauna, Oregon

Estimated Detailed Cost
Soils

(Costs in 2008 Dollars)

Cost Item	Quantity	Units	Extended Unit Cost	Allowance	Total Cost	Source
	REMEDY					
Excavate and Land Dispose Surface Soils						
Excavate and load trucks	200	CY	$14.32	25%	$3,580	RS Means 31 23 16.16 6035 and 9024
Transport to Subtitle C Landfill	300	ton	$49.00	2%	$14,994	Waste Management, June 2008
Land dispose in Subtitle C Landfill	300	ton	$132	2%	$40,392	Waste Management, June 2008
Backfill excavations	200	CY	$29.66	20%	$7,118	RS Means 32 11 23.23 2011
Subtotal, Contractor Costs					$66,084	
Markup on Contractor Costs	15%				$9,913	
Subtotal, Construction					$75,997	
Sample for waste characterization	2	LS	$1,500	0%	$3,000	Professional judgement
Sample for confirmation	2	LS	$2,500.00	0%	$5,000	Professional judgement
Subtotal					$8,000	
Soil Remedy Subtotal					$83,997	
Contingency			15%		$12,600	
Total Soil Remedy Cost					$96,597	
	OPERATION & MAINTENANCE					
Subtotal					$0	
O&M Subtotal					$0	
Contingency			15%		$0	
Total O&M Cost					$0	

TABLE 21

SS3: Excavate and Land Dispose Surface Soils

Former Koppers Wood-Treating Site, Wauna, Oregon

Future Cost Summary

(Costs in 2008 Dollars)

	Soils		
Year	Remedy Cost	O&M Cost	**Constant Dollar Future Cost (2008 Dollars)**
2008	$96,597		$96,597
2009			$0
2010			$0
2011			$0
2012			$0
2013			$0
2014			$0
2015			$0
2016			$0
2017			$0
2018			$0
2019			$0
2020			$0
2021			$0
2022			$0
2023			$0
2024			$0
2025			$0
2026			$0
2027			$0
2028			$0
2029			$0
2030			$0
2031			$0
2032			$0
2033			$0
2034			$0
2035			$0
2036			$0
2037			$0
2038			$0
2039			$0
2040			$0
Subtotals	$96,597	$0	$96,597

TABLE 22

Alternative Comparative Evaluation Summary

Former Koppers Wood-Treating Site, Wauna, Oregon

Media/Area	Remedial Alternative	Protectiveness	Remedy Selection Factors					Preference to Treat Hot Spots	Total Score
			Effectiveness	**Long-Term Reliability**	**Implementability**	**Implementation Risk**	**Reasonableness of Cost**		
Surface Soil	SS1 – No action	10	10	NA	NA	NA	1	10	31
	SS2 – Construct asphalt cap and implement deed and activity restrictions	1	1	3	1	1	3	5	15
	SS3 – Excavate and land dispose soils	1	3	1	1	3	3	1	13
Source Zone Soil and DNAPL	SZ1 – No source zone removal or treatment, maintain existing asphalt cap, and implement deed and activity restrictions	1	5	3	1	1	1	7	19
	SZ2 – Excavate and land dispose	1	1	1	7	7	9	1	27
	SZ3 – Stabilize in-situ, construct asphalt cap, implement deed and activity restrictions	1	3	3	5	5	7	3	27
Deed Restricted Area Surface and Subsurface Soil	DRA1 – Maintain existing asphalt cap, deed restriction and activity restrictions	1	3	3	1	1	1	7	17
	DRA2 – Excavate and land dispose hot spot soils, replace asphalt cap and continue deed and activity restrictions	1	1	1	7	7	7	1	25
	DRA3 – Stabilize in-situ, replace asphalt cap and continue deed and activity restrictions	1	3	3	5	5	5	3	25
Slough Sediment	Sed1 – No action	10	10	NA	NA	NA	1	10	31
	Sed2 – Line drainage ditch and implement deed and activity restrictions	1	3	5	1	1	5	5	21
	Sed3 – Install drain line, backfill drainage ditch, and implement deed and activity restrictions	1	1	3	1	3	3	3	15
	Sed4 – Excavate and land dispose sediments	1	1	1	1	5	7	1	17
Perched Water-Bearing Zone	GW1 – Continue IRM operation and MNA for southeast end of subsurface barrier wall	1	3	3	NA	NA	1	3	11
	GW2 – Continue IRM operation and physical barrier at southeast end of subsurface barrier wall	1	1	1	3	1	3	3	13
	GW3 – Continue IRM operation and in-situ treatment southeast end of subsurface barrier wall	1	3	5	5	1	5	1	21

A 1 to 5 scoring scale was used. A score of 1 indicates that the alternative fully meets the balancing factor. Whereas a score of 10 indicates that the alternative does not meet the balancing factor.

NA = Remedy selection factor was not evaluated.

TABLE 23
Source Zone Soils and DNAPL Remedial Alternative Evaluation Results
Former Koppers Wood-Treating Site, Wauna, Oregon

			Remedy Selection Factors							
							Reasonableness of Cost – Net Present Value (Rounded)			
Media/Area	**Remedial Alternative**	**Protectiveness**	**Effectiveness**	**Long-Term Reliability**	**Implementability**	**Implementation Risk**	**Capital Cost**	**O&M Cost**	**Total Cost**	**Preference to Treat Hot Spots**
Source Zone Soil and DNAPL	SZ1 – No source zone removal or treatment, maintain existing asphalt cap, and implement deed and activity restrictions	Alternative would be protective because IRM prevents significant adverse effects of beneficial uses of water in LOF. Alternative would prevent exposure to soil that pose a potential unacceptable risk	Semi-annual monitoring has demonstrated that the subsurface barrier wall is effective in providing containment. Alternative would rely on the same engineering and institutional controls that were implemented in the deed restricted area and that have been effective in achieving protection.	Subsurface barrier wall is expected to be reliable over the long-term. Similar engineering and institutional controls have been in place in the deed restricted area for 20 years. Over that time, they have been reliable in preventing exposure to impacted soils. Primary uncertainty related to long-term management is whether controls will be maintained by future property owners.	Alternative has been implemented.	None	$0	$29,000	$29,000	Alternative would not remove or treat hot spot soils or DNAPL, but would provide containment.
	SZ2 – Excavate and land dispose	Alternative would be protective because IRM prevents significant adverse effects of beneficial uses of water in LOF. Alternative would eliminate exposure by humans to subsurface soils posing a potential unacceptable risk. Residual risk associated with exposure to remaining subsurface soils would be reduced to acceptable levels within the Locality of the Facility (LOF).	Semi-annual monitoring has demonstrated that the subsurface barrier wall is effective in providing containment. Alternative may be effective in removing ongoing sources to groundwater and achieving protection; potential for effectiveness to be impacted by DNAPL fingers located outside the estimated excavation area. Alternative could be implemented in six to nine months.	Subsurface barrier wall is expected to be reliable over the long-term. Alternative is highly reliable because engineering and institutional controls are not required to manage risk and there are no long-term management uncertainties. Also, alternative would reduce O&M timeframe for IRM.	Alternative is relatively complicated to implement because dewatering and water treatment would be required, utilities would need to be temporarily disconnected, mill operations would be interrupted, a portion of the barrier wall would need to be replaced, the water treatment system would need to be permitted, and excavated soils may need to be treated prior to off-site land disposal. All necessary services, materials, equipment and specialists are readily available.	Potential for impacts to the community, workers, and the environment. Alternative can be completed in six to nine months.	$14,097,000	$0	$14,097,000	Alternative would remove hot spot soils and DNAPL.
	SZ3 – Stabilize in-situ, construct asphalt cap, implement deed and activity restrictions	Alternative would be protective because IRM prevents significant adverse effects of beneficial uses of water in LOF. Alternative would prevent exposure to soil that pose a potential unacceptable risk	Semi-annual monitoring has demonstrated that the subsurface barrier wall is effective in providing containment. Alternative may be effective in reducing ongoing sources to groundwater and achieving protection; potential for effectiveness to be impacted by DNAPL fingers located outside the estimated treatment area. Alternative would rely on the same engineering and institutional controls that were implemented in the deed restricted area and that have been effective in achieving protection. Alternative could be implemented in three to six months.	Subsurface barrier wall is expected to be reliable over the long-term. Similar engineering and institutional controls have been in place in the deed restricted area for 20 years. Over that time, they have been reliable in preventing exposure to impacted soils. Primary uncertainty related to long-term management is whether controls will be maintained by future property owners. Also, alternative would reduce O&M timeframe for IRM.	Alternative is moderately complicated to implement because utilities would need to be temporarily disconnected, mill operations would be interrupted, and a portion of the barrier wall would need to be replaced All necessary services, materials, equipment and specialists are readily available.	Potential for impacts to the community, workers, and the environment. Alternative can be completed in three to six months.	$9,145,000	$27,000	$9,172,000	Alternative would reduce constituent dissolution into groundwater from source zone soils and DNAPL, but not reduce volume or constituent concentrations below hot spot levels.

TABLE 24

SZ1: No Source Zone Removal or Treatment

Former Koppers Wood-Treating Site, Wauna, Oregon

Cost Summary

(Net Present Value Costs)

PRESENT VALUE	INVESTIGATION AND REMEDIATION ACTIVITY
	Soil
$0	Remedy Cost
$29,211	O&M Cost
$29,211	**Total Cost**

TABLE 24

SZ1: No Source Zone Removal or Treatment

Former Koppers Wood-Treating Site, Wauna, Oregon

Estimated Detailed Cost
Soils
(Costs in 2008 Dollars)

Cost Item	Quantity	Units	Extended Unit Cost	Allowance	Total Cost	Source
REMEDY OPERATION & MAINTENANCE						
Cap Inspection and Maintenance						
Cap Inspection	1	Annual	$1,200	20%	$1,440	Professional Judgement
Cap Repair	1	5 year	$2,000	25%	$500	Professional Judgement
Subtotal					$1,940	
O&M Subtotal					$1,940	
Contingency			15%		$291	
Total O&M Cost					$2,200	

TABLE 24

SZ1: No Source Zone Removal or Treatment

Former Koppers Wood-Treating Site, Wauna, Oregon

Future Cost Summary

(Costs in 2008 Dollars)

	Soils		
Year	Remedy Cost	O&M Cost	**Constant Dollar Future Cost (2008 Dollars)**
2008		$2,200	$2,200
2009		$2,200	$2,200
2010		$2,200	$2,200
2011		$2,200	$2,200
2012		$2,200	$2,200
2013		$2,200	$2,200
2014		$2,200	$2,200
2015		$2,200	$2,200
2016		$2,200	$2,200
2017		$2,200	$2,200
2018		$2,200	$2,200
2019		$2,200	$2,200
2020		$2,200	$2,200
2021		$2,200	$2,200
2022		$2,200	$2,200
2023		$2,200	$2,200
2024		$2,200	$2,200
2025		$2,200	$2,200
2026		$2,200	$2,200
2027		$2,200	$2,200
2028		$2,200	$2,200
2029		$2,200	$2,200
2030		$2,200	$2,200
2031		$2,200	$2,200
2032		$2,200	$2,200
2033		$2,200	$2,200
2034		$2,200	$2,200
2035		$2,200	$2,200
2036		$2,200	$2,200
2037		$2,200	$2,200
2038			$0
2039			$0
2040			$0
Subtotals	$0	$66,000	$66,000

TABLE 25

SZ2: Excavate and Land Dispose Source Zone Soils and DNAPL

Former Koppers Wood-Treating Site, Wauna, Oregon

Cost Summary

(Net Present Value Costs)

PRESENT VALUE	INVESTIGATION AND REMEDIATION ACTIVITY
	Soil
$14,097,000	Remedy Cost
$0	O&M Cost
$14,097,000	**Total Cost**

TABLE 25

SZ2: Excavate and Land Dispose Source Zone Soils and DNAPL

Former Koppers Wood-Treating Site, Wauna, Oregon

Estimated Detailed Cost
Soils
(Costs in 2008 Dollars)

Cost Item	Quantity	Units	Extended Unit Cost	Allowance	Total Cost	Source
	REMEDY					
Excavate and Land Dispose Surface Soils						
Excavate and load trucks	28,100	CY	$14.32	25%	$502,990	RS Means 31 23 16.16 6035 and 9024
Transport to Subtitle C Landfill	42,150	ton	$49.00	2%	$2,106,657	Waste Management, June 2008
Land dispose in Subtitle C Landfill	42,150	ton	$132	2%	$5,675,076	Waste Management, June 2008
Backfill excavations	28,100	CY	$29.66	20%	$1,000,135	RS Means 32 11 23.23 2011
Compact in 12-in lifts	28,100	CY	$4.50	20%	$151,740	RS Means 31 23 23.13 1100
Well Points - Installation, rental, removal	1	LS	$444,000	20%	$532,800	RS Means 31 23 19.40 1300 + 1600
Dewatering - pumping	8	wk	$10,000	31%	$104,800	RS Means 31 23 19.40 0500
Dewatering - treatment & disposal	1	LS	$60,800	31%	$79,648	Means 33 13 2014
Cut existing asphalt (3-in thick)	1400	LF	$1.50	25%	$2,625	RS Means 02 41 19.25 0015
Transport to Subtitle D Landfill	1060	ton	$20	7%	$22,684	Waste Management, June 2008
Land dispose in Subtitle D Landfill	1060	ton	$30	7%	$34,026	Waste Management, June 2008
Remove underground firewater line	100	LF	$10	25%	$1,250	RS Means 17 02 0301
Remove above ground electrical lines	1	LS	$27,560	25%	$34,450	RS Means 26 05 05.10 0465 + 1910; 41 2 23.10 1500
Underground line removal	300	LF	$10	25%	$3,750	RS Means 17 02 0301
Grading and site restoration	7,100	SY	$1.76	25%	$15,620	RS Means 31 22 16.10 1050
Crushed stone base	1,600	ton	$29.66	25%	$59,320	RS Means 32 11 23.23 2011
Asphalt binder course	7,100	SY	$6.48	25%	$57,510	RS Means 32 12 16.13 0120
Asphalt wearing course	7,100	SY	$7.27	25%	$64,521	RS Means 32 12 16.13 0380
Restore firewater line	1	LS	$6,500	20%	$7,800	RS Means 09 01 0401 + 0251
Restore electrical lines	1	LS	$32,000	20%	$38,400	RS Means 20 02 04; 26 05 05.10 1910; 41 2 23.10 1500
Hydroseeding	0.6	acre	$2,500	20%	$1,722	Professional judgement
Barrier Wall Replacement	4,400	SF	$10	25%	$55,000	IRM Conceptual Design Costs
Subtotal, Contractor Costs					$10,552,524	
Markup on Contractor Costs	15%				$1,582,879	
Subtotal, Construction					$12,135,403	
Permitting	1	LS	$100,000	0%	$100,000	Professional judgement
Sample for waste characterization	1	LS	$3,000	0%	$3,000	Professional judgement
Sample for confirmation	1	LS	$20,000	0%	$20,000	Professional judgement
Subtotal					$123,000	
Soil Remedy Subtotal					$12,258,403	
Contingency			15%		$1,838,760	
Total Soil Remedy Cost					$14,097,000	
OPERATION & MAINTENANCE						
					$0	
Subtotal					$0	
O&M Subtotal					$0	
Contingency			15%		$0	
Total O&M Cost					$0	

TABLE 25

SZ2: Excavate and Land Dispose Source Zone Soils and DNAPL

Former Koppers Wood-Treating Site, Wauna, Oregon

Future Cost Summary

(Costs in 2008 Dollars)

	Soils		
Year	Remedy Cost	O&M Cost	**Constant Dollar Future Cost (2008 Dollars)**
2008	$14,097,000		$14,097,000
2009			$0
2010			$0
2011			$0
2012			$0
2013			$0
2014			$0
2015			$0
2016			$0
2017			$0
2018			$0
2019			$0
2020			$0
2021			$0
2022			$0
2023			$0
2024			$0
2025			$0
2026			$0
2027			$0
2028			$0
2029			$0
2030			$0
2031			$0
2032			$0
2033			$0
2034			$0
2035			$0
2036			$0
2037			$0
2038			$0
2039			$0
2040			$0
Subtotals	$14,097,000	$0	$14,097,000

TABLE 26

SZ3: In-Situ Stabilization of Source Zone Soils and DNAPL

Former Koppers Wood-Treating Site, Wauna, Oregon

Cost Summary

(Net Present Value Costs)

PRESENT VALUE	INVESTIGATION AND REMEDIATION ACTIVITY
	Soil
$9,145,000	Remedy Cost
$27,300	O&M Cost
$9,172,300	**Total Cost**

TABLE 26

SZ3: In-Situ Stabilization of Source Zone Soils and DNAPL

Former Koppers Wood-Treating Site, Wauna, Oregon

Estimated Detailed Cost
Soils
(Costs in 2008 Dollars)

Cost Item	**Quantity**	**Units**	**Extended Unit Cost**	**Allowance**	**Total Cost**	**Source**
	REMEDY					
Excavate and Land Dispose Surface Soils						
Cut existing asphalt (3-in thick)	1400	LF	$1.50	25%	$2,625	RS Means 02 41 19.25 0015
Transport to Subtitle D Landfill	1060	ton	$20	7%	$22,684	Waste Management, June 2008
Land dispose in Subtitle D Landfill	1060	ton	$30	7%	$34,026	Waste Management, June 2008
Cement (material and delivery)	6300	Tons	$350	7%	$2,359,350	Professional judgement
Remove underground firewater line	100	LF	$10	25%	$1,250	RS Means 17 02 0301
Remove above ground electrical lines	1	LS	$27,560	25%	$34,450	RS Means 26 05 05.10 0465 + 1910; 41 2 23.10 1500
Underground line removal	300	LF	$10	25%	$3,750	RS Means 17 02 0301
Deep Soil Mixing	28,100	CY	$100	25%	$3,512,500	Hayward Baker
Test-pit/Backfill for confirmation samples	29	CY	$50	25%	$1,833	RS Means 31 23 16.16 6035 and 9024; 32 11 23.23 2011; 31 23 23.13 1100
Transport to Subtitle D Landfill	9,690	ton	$20	7%	$207,366	Waste Management, June 2008
Land dispose in Subtitle D Landfill	9,690	ton	$30	7%	$311,049	Waste Management, June 2008
Grading and site preparation	9,900	SY	$1.76	25%	$21,780	RS Means 31 22 16.10 1050
Crushed stone base	2,250	ton	$29.66	25%	$83,419	RS Means 32 11 23.23 2011
Asphalt binder course	9,900	SY	$6.48	25%	$80,190	RS Means 32 12 16.13 0120
Asphalt wearing course	9,900	SY	$7.27	25%	$89,966	RS Means 32 12 16.13 0380
Barrier Wall Replacement	4,400	SF	$10	25%	$55,000	IRM Conceptual Design Costs
Restore firewater line	1	LS	$4,540	20%	$5,448	RS Means 09 01 0401 + 0251
Restore electrical lines	1	LS	$32,000	20%	$38,400	RS Means 20 02 04; 26 05 05.10 1910; 41 2 23.10 1500
Subtotal, Contractor Costs					$6,865,086	
Markup on Contractor Costs	15%				$1,029,763	
Subtotal, Construction					$7,895,000	
Sample for confirmation	8	LS	$2,500	0%	$20,000	Professional judgement
Sample for waste characterization (spoils)	2	LS	$1,500	0%	$3,000	Professional judgement
Stabilization mix design	1	LS	$7,000	25%	$8,750	Professional Judgement
Confirmation sampling	1	LS	$20,000	25%	$25,000	Professional Judgement
Subtotal					$56,750	
Soil Remedy Subtotal					$7,951,750	
Contingency			15%		$1,192,763	
Total Soil Remedy Cost					$9,145,000	
	OPERATION & MAINTENANCE					
Cap Inspection and Maintenance						
Cap Inspection	1	Annual	$1,200	20%	$1,440	Professional Judgement
Cap Repair	1	5 year	$2,000	25%	$500	Professional Judgement
Subtotal					$1,940	
O&M Subtotal					$1,940	
Contingency			15%		$291	
Total O&M Cost					$2,200	

TABLE 26

SZ3: In-Situ Stabilization of Source Zone Soils and DNAPL

Former Koppers Wood-Treating Site, Wauna, Oregon

Future Cost Summary

(Costs in 2008 Dollars)

	Soils		
Year	Remedy Cost	O&M Cost	**Constant Dollar Future Cost (2008 Dollars)**
2008	$9,145,000		$9,145,000
2009		$2,200	$2,200
2010		$2,200	$2,200
2011		$2,200	$2,200
2012		$2,200	$2,200
2013		$2,200	$2,200
2014		$2,200	$2,200
2015		$2,200	$2,200
2016		$2,200	$2,200
2017		$2,200	$2,200
2018		$2,200	$2,200
2019		$2,200	$2,200
2020		$2,200	$2,200
2021		$2,200	$2,200
2022		$2,200	$2,200
2023		$2,200	$2,200
2024		$2,200	$2,200
2025		$2,200	$2,200
2026		$2,200	$2,200
2027		$2,200	$2,200
2028		$2,200	$2,200
2029		$2,200	$2,200
2030		$2,200	$2,200
2031		$2,200	$2,200
2032		$2,200	$2,200
2033		$2,200	$2,200
2034		$2,200	$2,200
2035		$2,200	$2,200
2036		$2,200	$2,200
2037		$2,200	$2,200
2038		$2,200	$2,200
2039			$0
2040			$0
Subtotals	$9,145,000	$66,000	$9,211,000

TABLE 27

Deed Restricted Area Remedial Alternative Evaluation Results

Former Koppers Wood-Treating Site, Wauna, Oregon

Media/Area	Remedial Alternative	Protectiveness	Remedy Selection Factors							Preference to Treat Hot Spots
			Effectiveness	Long-Term Reliability	Implementability	Implementation Risk	Reasonableness of Cost – Net Present Value (Rounded)			
							Capital Cost	O&M Cost	Total Cost	
Deed Restricted Area Surface and Subsurface Soil	DRA1 – Maintain existing asphalt cap, deed restriction and activity restrictions	Alternative is currently protective because exposure to soil is prevented by asphalt cap, deed restriction and activity restrictions.	Alternative has been proven and effective in achieving protection for 20 years.	Engineering and institutional controls have been in place for 20 years. Over that time, they have been reliable in preventing exposure to impacted soils. Primary uncertainty related to long-term management is whether controls will be maintained by future property owners.	Alternative has been implemented.	None	$0	$60,000	$60,000	Alternative would not reduce mobility, volume or constituent concentrations below hot spot levels.
	DRA2 – Excavate and land dispose hot spot soils, replace asphalt cap and continue deed and activity restrictions	Alternative would be protective because exposure to soil would prevented by asphalt cap, deed restriction and activity restrictions.	Alternative would be effective in achieving protection because it would rely on the previously implemented engineering and institutional controls. Alternative could be implemented in six to nine months.	Engineering and institutional controls have been in place for 20 years. Over that time, they have been reliable in preventing exposure to impacted soils. Primary uncertainty related to long-term management is whether controls will be maintained by future property owners.	Alternative is relatively complicated to implement because dewatering and water treatment would be required, utilities would need to be temporarily disconnected, mill operations would be interrupted, a portion of the barrier wall would need to be replaced, the water treatment system would need to be permitted, and excavated soils may need to be treated prior to off-site land disposal. All necessary services, materials, equipment and specialists are readily available.	Potential for impacts to the community, workers, and the environment. Alternative can be completed in six to nine months.	$1,700,000 to $2,400,000	$0	$1,700,000 to $2,400,000 (hot spot removal only)	Alternative would remove hot spot soils.
	DRA3 – Stabilize in-situ, replace asphalt cap and continue deed and activity restrictions	Alternative would be protective because exposure to soil would prevented by asphalt cap, deed restriction and activity restrictions.	Alternative would be effective in achieving protection because it would rely on the previously implemented engineering and institutional controls. Alternative could be implemented in three to six months.	Engineering and institutional controls have been in place for 20 years. Over that time, they have been reliable in preventing exposure to impacted soils. Primary uncertainty related to long-term management is whether controls will be maintained by future property owners.	Alternative is moderately complicated to implement because utilities would need to be temporarily disconnected, mill operations would be interrupted, and a portion of the barrier wall would need to be replaced All necessary services, materials, equipment and specialists are readily available.	Potential for impacts to the community, workers, and the environment. Alternative can be completed in three to six months.	$1,100,000 to $1,600,000	$60,000	$1,160,000 to $1,660,000	Alternative would reduce constituent mobility, but not reduce volume or constituent concentrations below hot spot levels.

TABLE 28

Slough Sediment Remedial Alternative Evaluation Results

Former Koppers Wood-Treating Site, Wauna, Oregon

			Remedy Selection Factors							
			Effectiveness	**Long-Term Reliability**	**Implementability**	**Implementation Risk**	**Reasonableness of Cost – Net Present Value (Rounded)**			
Media/Area	**Remedial Alternative**	**Protectiveness**					**Capital Cost**	**O&M Cost**	**Total Cost**	**Preference to Treat Hot Spots**
Slough Sediment	Sed1 – No action	Alternative would not be protective because there could be a potential unacceptable risk to ecological receptors.	Alternative would not be effective achieving protection.	NA	NA	NA	$0	$0	$0	Alternative would not reduce constituent concentrations below hot spot levels.
	Sed2 – Line drainage ditch and implement deed and activity restrictions	Alternative may be protective because it would reduce exposure by ecological receptors to metals in sediments posing a potential unacceptable risk. Residual risk associated with exposure to remaining Slough sediments would be reduced to acceptable levels within the Locality of the Facility (LOF).	Alternative may be effective in achieving protection. Stabilization of ditch sediments may be adequate and reliable in managing residual hazardous substances. Alternative could be implemented in three months if conducted in dry season.	Stabilization would be a reliable engineering control as long as it is inspected and repaired.	Alternative is readily implementable; no permits or authorizations are needed. All necessary services, materials, equipment and specialists are readily available.	Impacts to the community, workers, and the environment are low. Alternative can be completed in three months.	$924,000	$34,000	$958,000	Alternative would treat the sediment hot spot by reducing zinc mobility and bioavailability, but not volume.
	Sed3 – Install drain line, backfill drainage ditch, and implement deed and activity restrictions	Alternative would be protective because it would eliminate exposure by ecological receptors to metals in sediments posing a potential unacceptable risk. Residual risk associated with exposure to remaining Slough sediments would be reduced to acceptable levels within LOF.	Alternative would be effective in achieving protection. Engineering controls (i.e., backfilling the drainage ditch) would be adequate and reliable in managing residual hazardous substances. Alternative could be implemented in three months if conducted in dry season.	Backfilling ditch would be reliable engineering control that would require limited maintenance. The sump, pipeline and backfill would require limited O&M.	Alternative is readily implementable; no permits or authorizations are needed. All necessary services, materials, equipment and specialists are readily available.	Impacts to the community, workers, and the environment are minimal. Alternative can be completed in three months.	$698,000	$14,000	$712,000	Alternative would treat the sediment hot spot by reducing zinc mobility and bioavailability, but not volume. Alternative would eliminate condition producing hot spot because backfilling the ditch would eliminate ecological exposure to ditch sediments.
	Sed4 – Excavate and land dispose sediments	Alternative would be protective because it would eliminate exposure by ecological receptors to metals in sediments posing a potential unacceptable risk. Residual risk associated with exposure to remaining Slough sediments would be reduced to acceptable levels within LOF.	Alternative would be effective in achieving protection. No engineering controls are needed. Alternative could be implemented in three months if conducted in dry season.	Alternative is highly reliable because engineering controls are not required to manage risk and there are no long-term management uncertainties.	Alternative is readily implementable; no permits or authorizations are needed. All necessary services, materials, equipment and specialists are readily available.	Impacts to the community, workers, and the environment are moderate. Alternative can be completed in three months.	$1,763,000	$28,000	$1,791,000	Alternative would remove the sediment hot spot.

TABLE 29

Sed2: Stabilize Drainage Ditch Sediments

Former Koppers Wood-Treating Site, Wauna, Oregon

Cost Summary

(Net Present Value Costs)

PRESENT VALUE	INVESTIGATION AND REMEDIATION ACTIVITY
	Sediment
$924,223	Remedy Cost
$34,249	O&M Cost
$958,472	**Total Cost**

TABLE 29

Sed2: Stabilize Drainage Ditch Sediments

Former Koppers Wood-Treating Site, Wauna, Oregon

Estimated Detailed Cost
Slough Sediments
(Costs in 2008 Dollars)

Cost Item	Quantity	Units	Extended Unit Cost	Allowance	Total Cost	Source
	REMEDY					
Institutional Controls						
Deed and activity restrictions	1	LS	$15,000	0%	$15,000	
Subtotal					$15,000	
Engineering Controls						
Slough Dewatering	1	LS	$15,000	31%	$19,650	RS Means 31 23 19.20 1100 and 1600
Excavate and load trucks (plant debris)	700	CY	$14.32	25%	$12,530	RS Means 31 23 16.16 6035 and 9024
Transport to Subtitle D Landfill	1050	Tons	$20	2%	$21,420	Waste Management, June 2008
Land dispose in Subtitle D Landfill	1050	Tons	$30	2%	$32,130	Waste Management, June 2008
Cement (material and delivery)	1350	Tons	$350	2%	$481,950	Professional judgement
Mix cement	6200	CY	$15	20%	$111,600	RS Means 31 23 16.16 6035 and 9024
Subtotal, Contractor Costs					$679,280	
Markup on Contractor Costs	15%				$101,892	
Subtotal, Construction					$781,172	
Sample for waste characterization	5	LS	$1,500	0%	$7,500	Professional judgement
Subtotal					$7,500	
Soil Remedy Subtotal					$803,672	
Contingency			15%		$120,551	
Total Soil Remedy Cost					$924,223	
	OPERATION & MAINTENANCE					
Cap Inspection and Maintenance						
Annual inspection and crack repair	1	Annual	$1,200	0%	$1,200	Professional judgement
Liner maintenance	1	5 Year	$5,000	20%	$1,200	Professional judgement
Subtotal					$2,400	
O&M Subtotal					$2,400	
Contingency			15%		$360	
Total O&M Cost					$2,760	

TABLE 29

Sed2: Stabilize Drainage Ditch Sediments

Former Koppers Wood-Treating Site, Wauna, Oregon

Future Cost Summary

(Costs in 2008 Dollars)

	Sediment		
Year	Remedy Cost	O&M Cost	**Constant Dollar Future Cost (2008 Dollars)**
2008	$924,223		$924,223
2009		$2,760	$2,760
2010		$2,760	$2,760
2011		$2,760	$2,760
2012		$2,760	$2,760
2013		$2,760	$2,760
2014		$2,760	$2,760
2015		$2,760	$2,760
2016		$2,760	$2,760
2017		$2,760	$2,760
2018		$2,760	$2,760
2019		$2,760	$2,760
2020		$2,760	$2,760
2021		$2,760	$2,760
2022		$2,760	$2,760
2023		$2,760	$2,760
2024		$2,760	$2,760
2025		$2,760	$2,760
2026		$2,760	$2,760
2027		$2,760	$2,760
2028		$2,760	$2,760
2029		$2,760	$2,760
2030		$2,760	$2,760
2031		$2,760	$2,760
2032		$2,760	$2,760
2033		$2,760	$2,760
2034		$2,760	$2,760
2035		$2,760	$2,760
2036		$2,760	$2,760
2037		$2,760	$2,760
2038		$2,760	$2,760
2039			$0
2040			$0
Subtotals	$924,223	$82,800	$1,007,023

TABLE 30

Sed3: Install Sump and Pipeline, and Backfill Ditch

Former Koppers Wood-Treating Site, Wauna, Oregon

Cost Summary

(Net Present Value Costs)

PRESENT VALUE	INVESTIGATION AND REMEDIATION ACTIVITY
	Sediment
$698,049	Remedy Cost
$14,187	O&M Cost
$712,236	**Total Cost**

TABLE 30

Sed3: Install Sump and Pipeline, and Backfill Ditch

Former Koppers Wood-Treating Site, Wauna, Oregon

Estimated Detailed Cost
Slough Sediments
(Costs in 2008 Dollars)

Cost Item	Quantity	Units	Extended Unit Cost	Allowance	Total Cost	Source
	REMEDY					
Institutional Controls						
Deed and activity restrictions	1	LS	$15,000	0%	$15,000	
Subtotal					$15,000	
Engineering Controls						
Slough dewatering	1	LS	$25,000	31%	$32,750	RS Means 31 23 19.20 1100 and 1600
Cement	25	Tons	$350	2%	$8,925	Professional Judgement
Stabilize sediment under pipe	270	CY	$15	25%	$5,063	RS Means 31 23 16.16 6035 and 9024
Drain line bedding	100	CY	$37	25%	$4,625	RS Means 31 23 23.16 0050
Drain line	875	LF	$23	25%	$25,156	RS Means 33 41 13.50 1070
Road excavation and backfill	50	CY	$29.66	20%	$1,780	RS Means 31 23 16.16 6035 and 9024
Road pavement	350	SF	$5	20%	$2,100	Professional Judgement
Pipe ballast on berm	1	LS	$5,000	20%	$6,000	Professional Judgement
Catch basin	2	LS	$500	25%	$1,250	RS Means 33 44 13.13 2100
Sump/manhole	1	LS	$10,000	25%	$12,500	RS Means 33 49 13.10 1170, 1400, 3800 and Professional Judgement
Sump pump	1	LS	$1,000	25%	$1,250	Professional Judgement
Fabric liner	119,000	SF	$0.30	25%	$44,625	Professional Judgement
Ditch backfill	10,150	CY	$29.66	20%	$361,259	RS Means 32 11 23.23 2011
Ditch hydroseed	2.5	Acre	$2,500	20%	$7,500	RS Means 32 92 19.13 0020
Contractor's Total					$514,782	
Markup on Contractor	15%				$77,217	
Subtotal, Construction					$591,999	
Soil Remedy Subtotal					$606,999	
Contingency			15%		$91,050	
Total Soil Remedy Cost					$698,049	
	OPERATION & MAINTENANCE					
Erosion inspection	1	Annual	$1,200	0%	$1,200	Professional Judgement
Backfill/hydroseed repair	1	LS	$10,000	20%	$12,000	RS Means 32 92 19.13 0020 and Professional Judgement
Subtotal					$13,200	
O&M Subtotal					$13,200	
Contingency			15%		$1,980	
Total O&M Cost					$15,180	

TABLE 30

Sed3: Install Sump and Pipeline, and Backfill Ditch

Former Koppers Wood-Treating Site, Wauna, Oregon

Future Cost Summary

(Costs in 2008 Dollars)

	Sediment		
Year	Remedy Cost	O&M Cost	**Constant Dollar Future Cost (2008 Dollars)**
2008	$698,049		$698,049
2009		$15,180	$15,180
2010			$0
2011			$0
2012			$0
2013			$0
2014			$0
2015			$0
2016			$0
2017			$0
2018			$0
2019			$0
2020			$0
2021			$0
2022			$0
2023			$0
2024			$0
2025			$0
2026			$0
2027			$0
2028			$0
2029			$0
2030			$0
2031			$0
2032			$0
2033			$0
2034			$0
2035			$0
2036			$0
2037			$0
2038			$0
2039			$0
2040			$0
Subtotals	$698,049	$15,180	$713,229

TABLE 31

Sed4: Excavate and Land Dispose Ditch Sediments

Former Koppers Wood-Treating Site, Wauna, Oregon

Cost Summary

(Net Present Value Costs)

PRESENT VALUE	INVESTIGATION AND REMEDIATION ACTIVITY
	Sediment
$1,762,896	Remedy Cost
$28,374	O&M Cost
$1,791,270	**Total Cost**

TABLE 31

Sed4: Excavate and Land Dispose Ditch Sediments

Former Koppers Wood-Treating Site, Wauna, Oregon

Estimated Detailed Cost
Slough Sediments
(Costs in 2008 Dollars)

Cost Item	Quantity	Units	Extended Unit Cost	Allowance	Total Cost	Source
	REMEDY					
Excavate and Land Dispose Slough Sediments						
Slough dewatering	1	LS	$15,000	31%	$19,650	RS Means 31 23 19.20 1100 and 1600
Cement (material and delivery)	475	ton	$350	5%	$174,563	Professional judgement
Cement mixing	6,150	CY	$15	25%	$115,313	RS Means 31 23 16.16 6035 and 9024
Excavate and load trucks	6,150	CY	$14.32	25%	$110,085	RS Means 31 23 16.16 6035 and 9024
Transport to Subtitle C Landfill	1,384	ton	$49	2%	$69,160	Waste Management, June 2008
Land dispose in Subtitle C Landfill	1,384	ton	$132	2%	$186,308	Waste Management, June 2008
Transport to Subtitle D Landfill	7,841	ton	$20	2%	$159,962	Waste Management, June 2008
Land dispose in Subtitle D Landfill	7,841	ton	$30	2%	$239,942	Waste Management, June 2008
Backfill excavations	6,150	CY	$29.66	20%	$218,891	RS Means 32 11 23.23 2011
Contractor's Costs					$1,293,872	
Markup on Contractor's Costs	15%				$194,081	
Subtotal, Construction					$1,487,953	
Sample for waste characterization	20	LS	$1,500	0%	$30,000	Professional judgement
Sample for confirmation	10	LS	$1,500	0%	$15,000	Professional judgement
Subtotal					$45,000	
Soil Remedy Subtotal					$1,532,953	
Contingency			15%		$229,943	
Total Soil Remedy Cost					$1,762,896	
	OPERATION & MAINTENANCE					
Erosion/stability inspection	12	Monthly	$1,200	0%	$14,400	Professional judgement
Backfill repair	1	LS	$10,000	20%	$12,000	Professional judgement
Subtotal					$26,400	
O&M Subtotal					$26,400	
Contingency			15%		$3,960	
Total O&M Cost					$30,360	

TABLE 31

Sed4: Excavate and Land Dispose Ditch Sediments

Former Koppers Wood-Treating Site, Wauna, Oregon

Future Cost Summary

(Costs in 2008 Dollars)

	Sediment		
Year	Remedy Cost	O&M Cost	**Constant Dollar Future Cost (2008 Dollars)**
2008	$1,762,896		$1,762,896
2009		$30,360	$30,360
2010			$0
2011			$0
2012			$0
2013			$0
2014			$0
2015			$0
2016			$0
2017			$0
2018			$0
2019			$0
2020			$0
2021			$0
2022			$0
2023			$0
2024			$0
2025			$0
2026			$0
2027			$0
2028			$0
2029			$0
2030			$0
2031			$0
2032			$0
2033			$0
2034			$0
2035			$0
2036			$0
2037			$0
2038			$0
2039			$0
2040			$0
Subtotals	$1,762,896	$30,360	$1,793,256

TABLE 32

Perched Water-Bearing Zone Remedial Alternative Evaluation Results

Former Koppers Wood-Treating Site, Wauna, Oregon

		Remedy Selection Factors								
							Reasonableness of Cost – Net Present Value (Rounded)			
Media/Area	Remedial Alternative	Protectiveness	Effectiveness	Long-Term Reliability	Implementability	Implementation Risk	Capital Cost	O&M Cost	Total Cost	Preference to Treat Hot Spots
Perched Water-Bearing Zone	GW1 – Continue IRM operation and MNA for southeast end of subsurface barrier wall	Alternative would prevent adverse effects to beneficial water uses and protect human health and the environment. Three years of groundwater monitoring indicates that constituent concentrations downgradient of the aeration treatment system and southeast end of the subsurface barrier wall are well below SLVs or in the case of the ethylbenzene detected at ATT-02 will likely be below its SLV before groundwater discharges to the Columbia River.	Alternative is currently effective in achieving protection. Subsurface barrier has created longer flow paths to the river allowing constituent concentrations to naturally attenuate; aeration treatment system has increased contaminant degradation in-situ. IRM monitoring has confirmed that subsurface barrier is an effective engineering control that has eliminated seeps and allowed constituent concentrations between the wall and the river to naturally attenuate. The IRM has contained hot spots of contamination in water and protected the beneficial uses of water. The aeration trench has met objective of reducing constituent concentrations to levels that will not exceed SLVs at the river.	Based on three years of monitoring, subsurface barrier wall prevents direct contaminant migration to the river over the long-term. Periodic clogging of aeration treatment system has increased the need for routine sparge line cleanout to main air flow rates. System can meet treatment objectives over the long-term if routine cleanouts are performed. Uncertain whether MNA will be reliable in the long-term for the southeast end of the subsurface barrier wall.	Alternative has been implemented. Effectiveness of alternative is monitored through weekly inspections and dissolved oxygen measurements, quarterly measurements of water levels, and semi-annual groundwater quality monitoring.	Alternative has been implemented.	$0	$1,613,000	$1,613,000	Alternative currently provides for active and passive treatment of groundwater hot spot to levels below those that would result in an adverse effect on beneficial water uses. Alternative also provides for containment of hot spot materials in source zones. Alternative provides for protection of identified beneficial water uses and protected beneficial water uses in a reasonable time.
	GW2 – Continue IRM operation and physical barrier at southeast end of subsurface barrier wall	Alternative would prevent adverse effects to beneficial water uses and protect human health and the environment. Three years of groundwater monitoring indicates that constituent concentrations downgradient of the aeration treatment system are well below SLVs or in the case of the ethylbenzene detected at ATT-02 will likely be below its SLV before groundwater discharges to the Columbia River. Alternative would eliminate potential for untreated constituents to migrate around the southeast end of the subsurface barrier wall.	Alternative would be effective in achieving protection. Subsurface barrier has created longer flow paths to the river allowing constituent concentrations to naturally attenuate; aeration treatment system has increased contaminant degradation in-situ. IRM monitoring has confirmed that subsurface barrier is an effective engineering control that has eliminated seeps and allowed constituent concentrations between the wall and the river to naturally attenuate. The IRM has contained hot spots of contamination in water and protected the beneficial uses of water. The aeration trench has met objective of reducing constituent concentrations to levels that will not exceed SLVs at the river. Alternative would increase adequacy of engineering controls in managing risk that untreated constituents would migrate around the southeast end of the subsurface barrier wall.	Based on three years of monitoring, subsurface barrier wall prevents direct contaminant migration to the river over the long-term. Alternative would increase reliability of subsurface barrier wall. Periodic clogging of aeration treatment system has increased the need for routine sparge line cleanout to main air flow rates. System can meet treatment objectives over the long-term if routine cleanouts are performed.	Alternative is readily implementable; authorization will be needed from the railroad to construct physical barrier. All necessary services, materials, equipment and specialists are readily available. Effectiveness of alternative can be monitored through long-term groundwater monitoring.	Impacts to the community, workers, and the environment are minimal. Alternative can be completed in two to three months after receiving approval from the rail road.	$301,000	$1,613,000	$1,914,000	Alternative would provide for additional active treatment of groundwater hot spot to levels below those that would result in an adverse effect on beneficial water uses. Alternative also provides for containment of hot spot materials in source zones. Alternative would provide for protection of identified beneficial water uses and protect beneficial water uses in a reasonable time.

TABLE 32

Perched Water-Bearing Zone Remedial Alternative Evaluation Results

Former Koppers Wood-Treating Site, Wauna, Oregon

		Remedy Selection Factors								
							Reasonableness of Cost – Net Present Value (Rounded)			
Media/Area	**Remedial Alternative**	**Protectiveness**	**Effectiveness**	**Long-Term Reliability**	**Implementability**	**Implementation Risk**	**Capital Cost**	**O&M Cost**	**Total Cost**	**Preference to Treat Hot Spots**
	GW3 – Continue IRM operation and in-situ treatment southeast end of subsurface barrier wall	Alternative would prevent adverse effects to beneficial water uses and protect human health and the environment. Three years of groundwater monitoring indicates that constituent concentrations downgradient of the aeration treatment system are well below SLVs or in the case of the ethylbenzene detected at ATT-02 will likely be below its SLV before groundwater discharges to the Columbia River. Alternative would reduce and potentially eliminate potential for untreated constituents to migrate around the southeast end of the subsurface barrier wall.	Alternative would be effective in achieving protection. Subsurface barrier has created longer flow paths to the river allowing constituent concentrations to naturally attenuate; aeration treatment system has increased contaminant degradation in-situ. IRM monitoring has confirmed that subsurface barrier is an effective engineering control that has eliminated seeps and allowed constituent concentrations between the wall and the river to naturally attenuate. The IRM has contained hot spots of contamination in water and protected the beneficial uses of water. The aeration trench has met objective of reducing constituent concentrations to levels that will not exceed SLVs at the river. Alternative would increase level of treatment.	Based on three years of monitoring, subsurface barrier wall prevents direct contaminant migration to the river over the long-term. Long-term reliability of alternative is uncertain because air sparging wells could experience the same clogging problems as the aeration treatment system. Periodic clogging of aeration treatment system has increased the need for routine sparge line cleanout to main air flow rates. A similar routine cleanout of the air sparging wells could be required.	Alternative is readily implementable; UIC permit would be required and an authorization will be needed from the railroad to construct the air sparging system. All necessary services, materials, equipment and specialists are readily available. Effectiveness of alternative can be monitored through long-term groundwater monitoring.	Impacts to the community, workers, and the environment are minimal. Alternative can be completed in two to three months after receiving approval from the railroad and meeting the substantive requirements of an underground injection control (UIC) permit.	$260,000	$2,446,000	$2,706,000	Alternative would provide for additional active treatment of groundwater hot spot to levels below those that would result in an adverse effect on beneficial water uses. Alternative also provides for containment of hot spot materials in source zones. Alternative would provide for protection of identified beneficial water uses and protect beneficial water uses in a reasonable time.

TABLE 33

GW1: Continue IRM Operations and MNA at Southeast End of Barrier

Former Koppers Wood-Treating Site, Wauna, Oregon

Cost Summary

(Net Present Value Costs)

PRESENT VALUE	INVESTIGATION AND REMEDIATION ACTIVITY
	Groundwater
$0	Remedy Cost
$1,613,191	O&M Cost
$1,613,191	**Total Cost**

TABLE 33

GW1: Continue IRM Operations and MNA at Southeast End of Barrier

Former Koppers Wood-Treating Site, Wauna, Oregon

Estimated Detailed Cost
Groundwater
(Costs in 2008 Dollars)

Cost Item		Quantity	Units	Extended Unit Cost	Allowance	Total Cost	Source
REMEDY							
Subtotal						$0	
Groundwater Remedy Subtotal							
Contingency				15%		$0	
Groundwater Remedy Cost						$0	
OPERATION & MAINTENANCE							
Remedial system operations	Annual	1.0	LS	$41,475	20%	$49,770	Current Costs
Monitoring and reporting - monthly and semiannual	Annual	1.0	LS	$28,675	0%	$28,675	Current Costs
Site supervision	Annual	1.0	LS	$31,160	0%	$31,160	Current Costs
Sparge line quarterly maintenance	Annual	1.0	LS	$6,400	20%	$7,680	Current Costs
Well maintenance	Annual	1.0	LS	$2,000	20%	$2,400	Professional Judgement
Analytical costs	Annual	1.0	LS	$9,850	0%	$9,850	Columbia Analytical Services, 2008
Electricity (aeration system)	Annual	1.0	LS	$5,400	0%	$5,400	PSE
New AS blower	Every 5 Years	0.2	LS	$2,000	20%	$480	Professional Judgement
Subtotal						$135,415	
Groundwater O&M Subtotal (Years 1 and 2)						$135,415	
Contingency				15%		$20,312	
Groundwater O&M Cost (Years 1 and 2)						$155,727	
Groundwater O&M Subtotal (Years 3 through 30)						$100,573	
Contingency				15%		$15,086	
Groundwater O&M Cost (Years 3 through 30)						$115,658	

TABLE 33

GW1: Continue IRM Operations and MNA at Southeast End of Barrier

Former Koppers Wood-Treating Site, Wauna, Oregon

Future Cost Summary

(Costs in 2008 Dollars)

	Groundwater		
Year	Remedy Cost	O&M Cost	**Constant Dollar Future Cost (2008 Dollars)**
2008		$155,727	$155,727
2009		$155,727	$155,727
2010		$115,658	$115,658
2011		$115,658	$115,658
2012		$115,658	$115,658
2013		$115,658	$115,658
2014		$115,658	$115,658
2015		$115,658	$115,658
2016		$115,658	$115,658
2017		$115,658	$115,658
2018		$115,658	$115,658
2019		$115,658	$115,658
2020		$115,658	$115,658
2021		$115,658	$115,658
2022		$115,658	$115,658
2023		$115,658	$115,658
2024		$115,658	$115,658
2025		$115,658	$115,658
2026		$115,658	$115,658
2027		$115,658	$115,658
2028		$115,658	$115,658
2029		$115,658	$115,658
2030		$115,658	$115,658
2031		$115,658	$115,658
2032		$115,658	$115,658
2033		$115,658	$115,658
2034		$115,658	$115,658
2035		$115,658	$115,658
2036		$115,658	$115,658
2037		$115,658	$115,658
2038			$0
2039			$0
2040			$0
Subtotals	$0	$3,549,889	$3,549,889

TABLE 34

GW2: Continue IRM Operations and Install Physical Barrier

Former Koppers Wood-Treating Site, Wauna, Oregon

Cost Summary

(Net Present Value Costs)

PRESENT VALUE	INVESTIGATION AND REMEDIATION ACTIVITY
	Groundwater
$300,797	Remedy Cost
$1,613,191	O&M Cost
$1,913,988	**Total Cost**

TABLE 34

GW2: Continue IRM Operations and Install Physical Barrier

Former Koppers Wood-Treating Site, Wauna, Oregon

Estimated Detailed Cost
Groundwater
(Costs in 2008 Dollars)

Cost Item		Quantity	Units	Extended Unit Cost	Allowance	Total Cost	Source
		REMEDY					
Physical Barrier							
Jet-grouting barrier wall		1	LS	$175,000	25%	$218,750	Hayward Baker
Contractor's Costs						$218,750	
Markup on Contractor's Costs		15%				$32,813	
Subtotal, Construction						$251,563	
Barrier wall verification testing		1	LS	$10,000	0%	$10,000	Professional Judgement
Subtotal						$10,000	
Groundwater Remedy Subtotal						$261,563	
Contingency				15%		$39,234	
Groundwater Remedy Cost						$300,797	
		OPERATION & MAINTENANCE					
Remedial system operations	Annual	1.0	LS	$41,475	20%	$49,770	Current Costs
Monitoring and reporting - monthly and semiannual	Annual	1.0	LS	$28,675	0%	$28,675	Current Costs
Site supervision	Annual	1.0	LS	$31,160	0%	$31,160	Current Costs
Sparge line quarterly maintenance	Annual	1.0	LS	$6,400	20%	$7,680	Current Costs
Well maintenance	Annual	1.0	LS	$2,000	20%	$2,400	Professional Judgement
Analytical costs	Annual	1.0	LS	$9,850	0%	$9,850	Columbia Analytical Services, 2008
Electricity (aeration system)	Annual	1.0	LS	$5,400	0%	$5,400	PSE
New AS blower	Every 5 Years	0.2	LS	$2,000	20%	$480	Professional Judgement
Subtotal						$135,415	
Groundwater O&M Subtotal (Years 1 and 2)						$135,415	
Contingency				15%		$20,312	
Groundwater O&M Cost (Years 1 and 2)						$155,727	
Groundwater O&M Subtotal (Years 3 through 30)						$100,573	
Contingency				15%		$15,086	
Groundwater O&M Cost (Years 3 through 30)						$115,658	

TABLE 34

GW2: Continue IRM Operations and Install Physical Barrier

Former Koppers Wood-Treating Site, Wauna, Oregon

Future Cost Summary

(Costs in 2008 Dollars)

	Groundwater		
Year	Remedy Cost	O&M Cost	**Constant Dollar Future Cost (2008 Dollars)**
2008	$300,797	$155,727	$456,524
2009		$155,727	$155,727
2010		$115,658	$115,658
2011		$115,658	$115,658
2012		$115,658	$115,658
2013		$115,658	$115,658
2014		$115,658	$115,658
2015		$115,658	$115,658
2016		$115,658	$115,658
2017		$115,658	$115,658
2018		$115,658	$115,658
2019		$115,658	$115,658
2020		$115,658	$115,658
2021		$115,658	$115,658
2022		$115,658	$115,658
2023		$115,658	$115,658
2024		$115,658	$115,658
2025		$115,658	$115,658
2026		$115,658	$115,658
2027		$115,658	$115,658
2028		$115,658	$115,658
2029		$115,658	$115,658
2030		$115,658	$115,658
2031		$115,658	$115,658
2032		$115,658	$115,658
2033		$115,658	$115,658
2034		$115,658	$115,658
2035		$115,658	$115,658
2036		$115,658	$115,658
2037		$115,658	$115,658
2038			$0
2039			$0
2040			$0
Subtotals	$300,797	$3,549,889	$3,850,686

TABLE 35

GW3: Continue IRM Operations and Install Air Sparging System

Former Koppers Wood-Treating Site, Wauna, Oregon

Cost Summary

(Net Present Value Costs)

PRESENT VALUE	INVESTIGATION AND REMEDIATION ACTIVITY
	Groundwater
$260,498	Remedy Cost
$2,445,648	O&M Cost
$2,706,146	**Total Cost**

TABLE 35
GW3: Continue IRM Operations and Install Air Sparging System
Former Koppers Wood-Treating Site, Wauna, Oregon

Estimated Detailed Cost
Groundwater
(Costs in 2008 Dollars)

Cost Item		Quantity	Units	Extended Unit Cost	Allowance	Total Cost	Source
		REMEDY					
Air Sparge Well Installation		8	ea	$3,000	25%	$30,000	Cascade Drilling Inc. and Professional Judgement
Transport to Subtitle C Landfill		15	Tons	$49	2%	$750	Waste Management, June 2008
Land Dispose in Subtitle C Landfill		15	Tons	$132	2%	$2,020	Waste Management, June 2008
Air Sparge Manifold		1	LS	$10,000	20%	$12,000	Proefssional Judgement
Piping		1,000	LF	$15	25%	$18,750	Professional judgement
Piping Excavation and Backfill		500	CY	$30	25%	$18,750	RS Means 31 23 16.16 6035 and 9024
Asphalt		3,500	SF	$5	20%	$21,000	Professional judgement
Air Sparging Blower		1	LS	$2,000	20%	$2,400	Professional judgement
Treatment Shed		1	LS	$20,000	20%	$24,000	Professional judgement
Electricity Hook-Up		1	LS	$50,000	20%	$60,000	Professional judgement
System Startup		1	LS	$5,000	20%	$6,000	Professional judgement
Contractor Costs						$195,669	
Markup on Contractor Costs		15%				$29,350	
Subtotal, Construction						$225,020	
Characterization Sampling		1	LS	$1,500	0%	$1,500	Professional judgement
Subtotal						$1,500	
Groundwater Remedy Subtotal						$226,520	
Contingency				15%		$33,978	
Groundwater Remedy Cost						$260,498	
		OPERATION & MAINTENANCE					
Remedial System Operations	Annual	2.0	LS	$41,475	20%	$99,540	Current Costs
Monitoring and Reporting - Monthly and	Annual	1.0	LS	$28,675	0%	$28,675	Current Costs
Site Supervision	Annual	1.0	LS	$31,160	0%	$31,160	Current Costs
Sparge Line Quarterly Maintenance	Annual	2.0	LS	$6,400	20%	$15,360	Current Costs
Well Maintenance (MW and AS wells)	Annual	2.0	LS	$2,000	20%	$4,800	Professional judgement
Analytical Costs	Annual	1.0	LS	$9,850	0%	$9,850	Columbia Analytical Services, 2008
Electricity (Aeration and AS Systems)	Annual	2.0	LS	$5,400	0%	$10,800	PSE
2 New AS Blowers (Aeration Trench anc	Every 5 Years	0.4	LS	$2,000	20%	$960	Professional judgement
Subtotal						$201,145	
Groundwater O&M Subtotal (Years 1 and 2)						$201,145	
Contingency				15%		$30,172	
Groundwater O&M Cost (Years 1 and 2)						$231,317	
Groundwater O&M Subtotal (Years 3 through 30)						$166,303	
Contingency				15%		$24,945	
Groundwater O&M Cost (Years 3 through 30)						$191,248	

TABLE 35

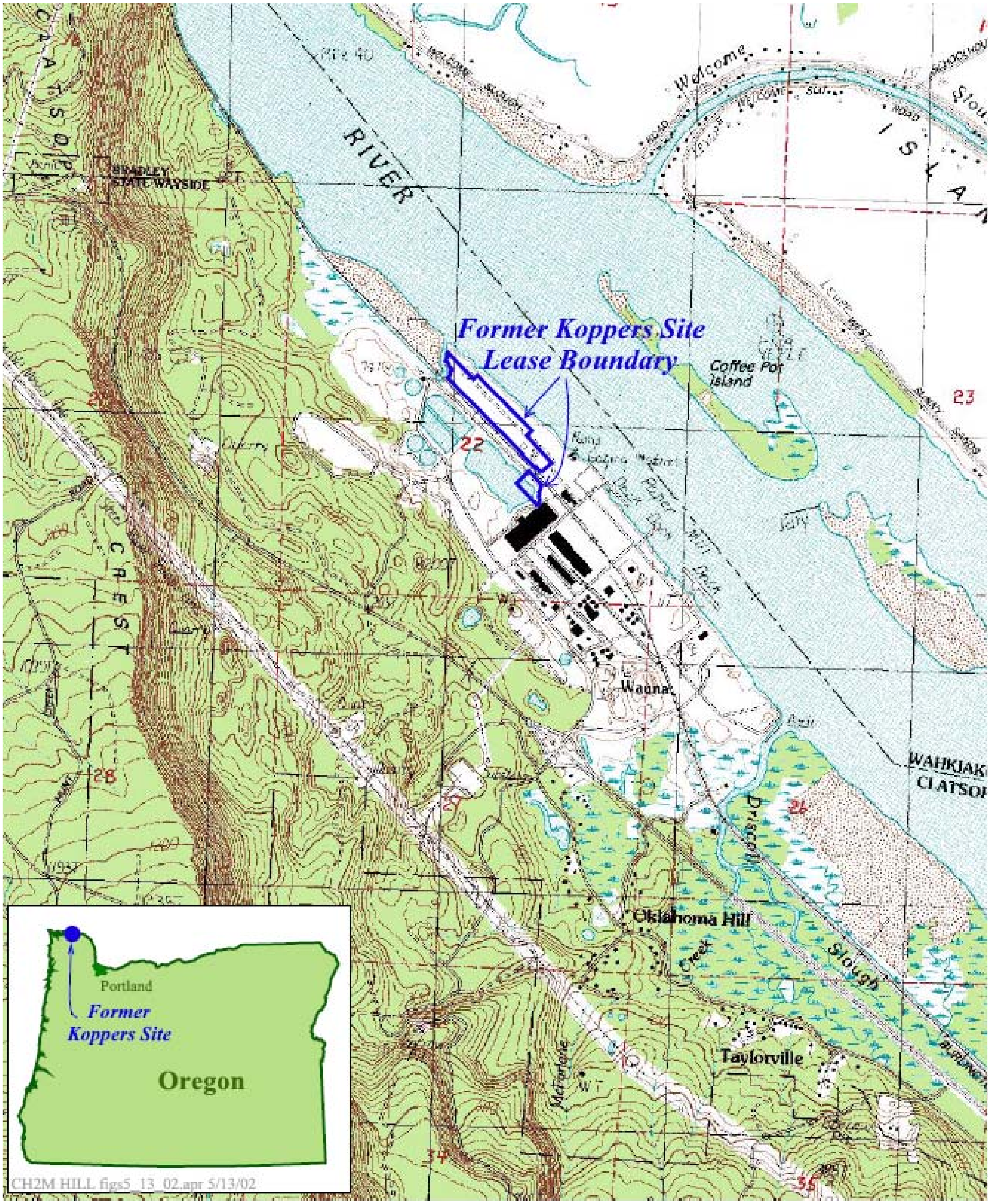
GW3: Continue IRM Operations and Install Air Sparging System

Former Koppers Wood-Treating Site, Wauna, Oregon

Future Cost Summary

(Costs in 2008 Dollars)

Year	**Groundwater** Remedy Cost	 O&M Cost	**Constant Dollar Future Cost (2008 Dollars)**
2008	$260,498		$260,498
2009		$231,317	$231,317
2010		$231,317	$231,317
2011		$191,248	$191,248
2012		$191,248	$191,248
2013		$191,248	$191,248
2014		$191,248	$191,248
2015		$191,248	$191,248
2016		$191,248	$191,248
2017		$191,248	$191,248
2018		$191,248	$191,248
2019		$191,248	$191,248
2020		$191,248	$191,248
2021		$191,248	$191,248
2022		$191,248	$191,248
2023		$191,248	$191,248
2024		$191,248	$191,248
2025		$191,248	$191,248
2026		$191,248	$191,248
2027		$191,248	$191,248
2028		$191,248	$191,248
2029		$191,248	$191,248
2030		$191,248	$191,248
2031		$191,248	$191,248
2032		$191,248	$191,248
2033		$191,248	$191,248
2034		$191,248	$191,248
2035		$191,248	$191,248
2036		$191,248	$191,248
2037		$191,248	$191,248
2038		$191,248	$191,248
2039			$0
2040			$0
Subtotals	$260,498	$5,817,574	$6,078,072



1 mile

Approximate Scale

Figure 1

Site Location
Former Koppers Wood-Treating Site
Wauna, Oregon

BRIDGEWATER GROUP, INC.

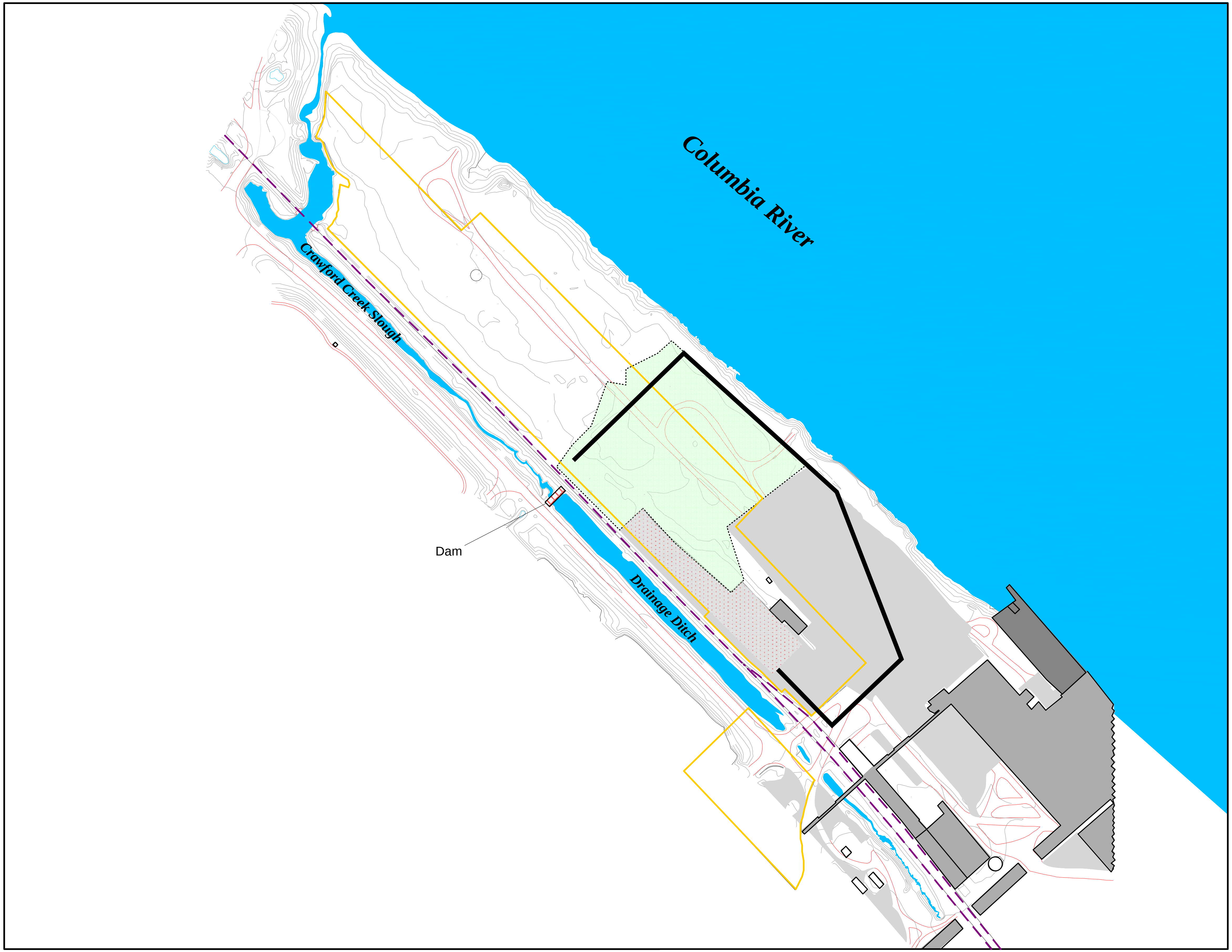


Figure 2

Site Features

Former Koppers Wood-
Treating Site
Wauna, Oregon

Legend

- ▨ Deed Restricted Area
- ☐ Lease Boundary
- Road Edge
- Railroad
- Topographic Contour
- Stream
- ▇ Waterbody
- ▇ Parking Lot
- ▇ Building
- ▇ Dock
- 🟩 Area Graded and Vegetated During IRM Construction
- ━ IRM Subsurface Barrier and Aeration Trench

BRIDGEWATER GROUP, INC.

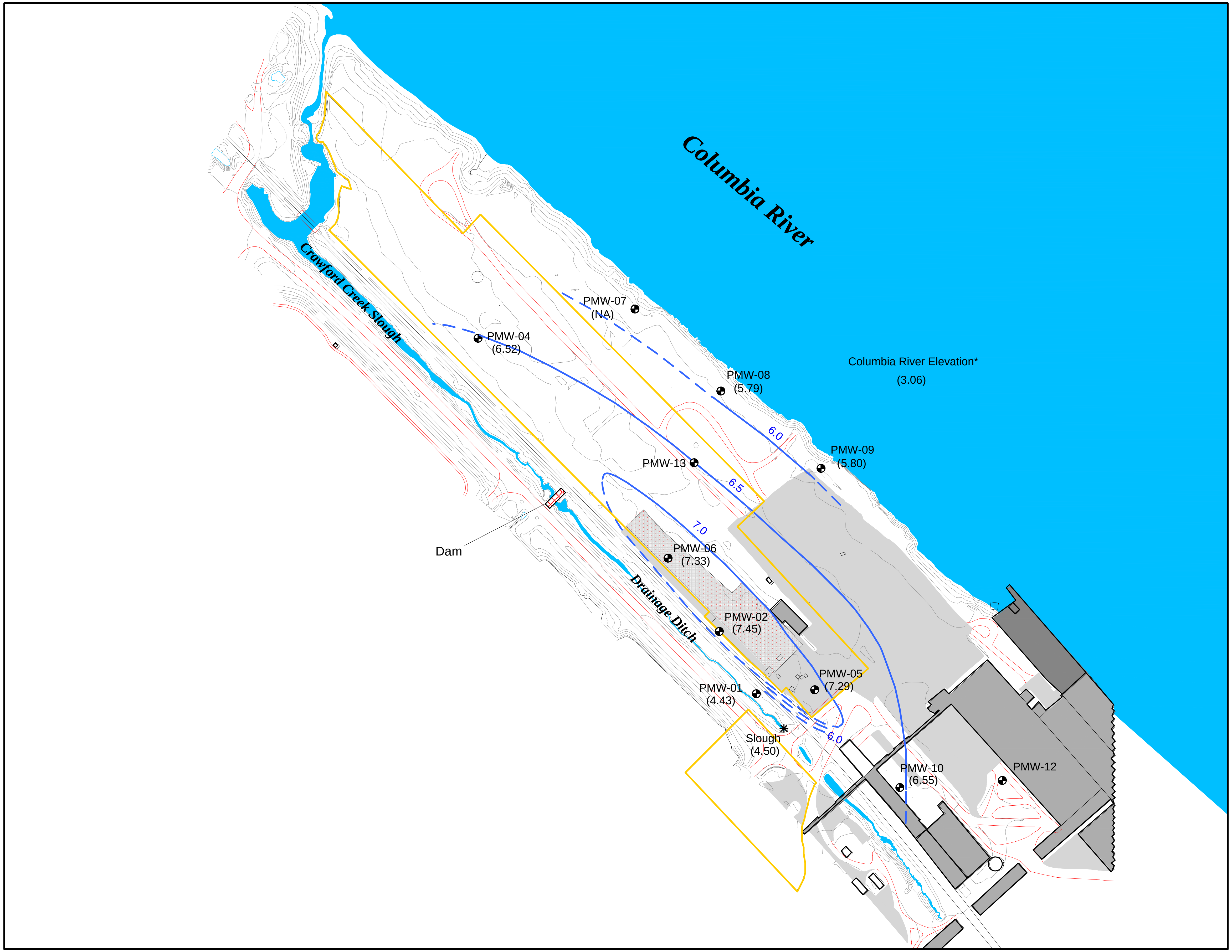


Figure 3

Potentiometric Surface Map
April 5, 2001 Perched Zone

Former Koppers Wood-Treating Site
Wauna, Oregon

Legend

- ▨ Deed Restricted Area
- ▭ Lease Boundary
- ╱╲ Road Edge
- ╱╲ Railroad
- ╱╲ Topographic Contour
- ╱╲ Stream
- ■ Waterbody
- ■ Parking Lot
- ■ Building
- ■ Dock
- ● Perched Zone Monitoring Well
- ✳ Slough Staff Gauge
- — Groundwater Elevation Contour Feet Above NGVD, 1929; Location Approximate (Contour Interval = 0.5 feet)

*Columbia River:
High Tide = 7.13
Low Tide = 0.93

W N S E

0 125 250 500
Feet

Bridgewater Group, Inc.

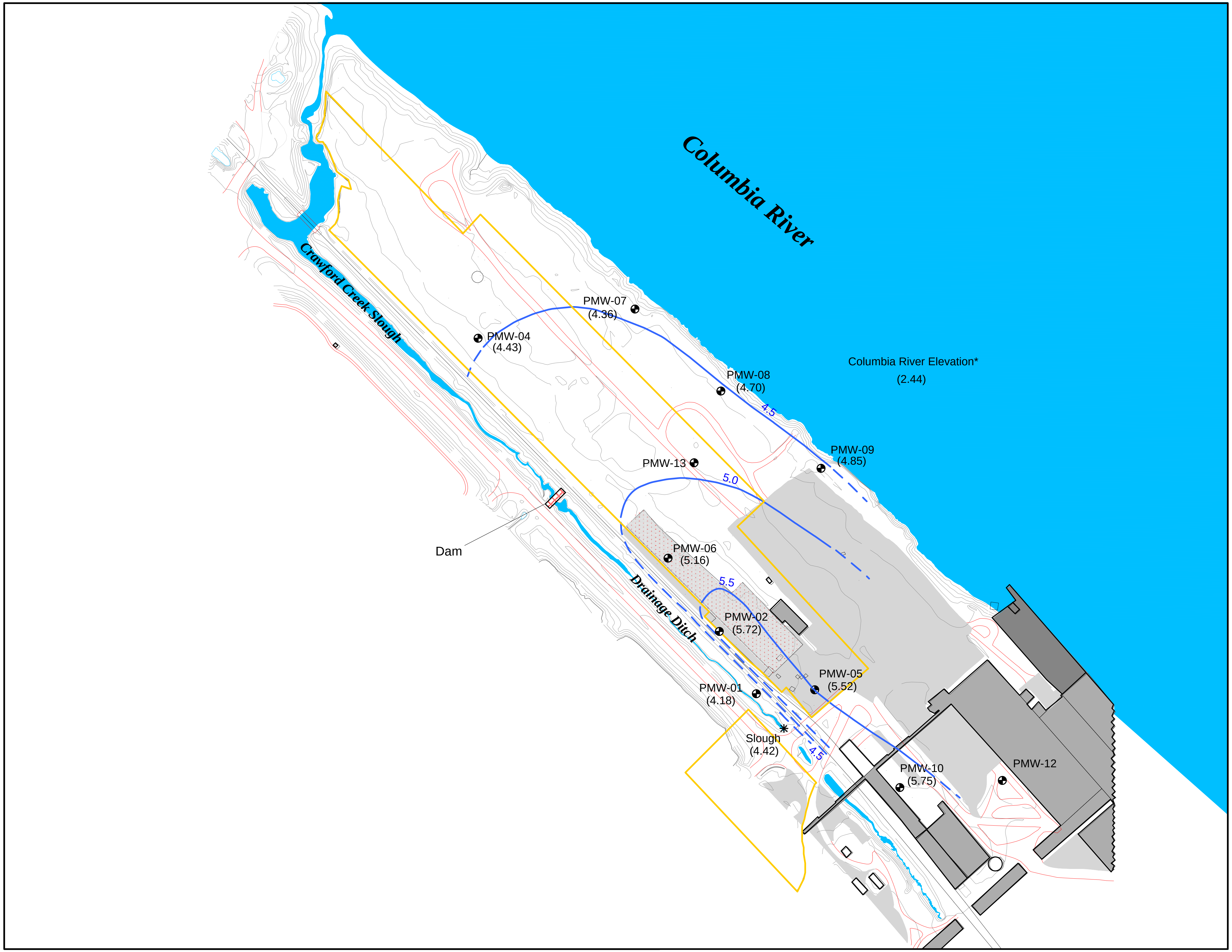


Figure 4

Potentiometric Surface Map October 8, 2001 Perched Zone

Former Koppers Wood-Treating Site
Wauna, Oregon

Legend

▨ Deed Restricted Area
Lease Boundary
Road Edge
Railroad
Topographic Contour
Stream
Waterbody
Parking Lot
Building
Dock
● Perched Zone Monitoring Well
✳ Slough Staff Gauge
Groundwater Elevation Contour
Feet Above NGVD, 1929;
Location Approximate
(Contour Interval = 0.5 feet)

*Columbia River:
High Tide = 6.72
Low Tide = -0.19

BRIDGEWATER GROUP, INC.

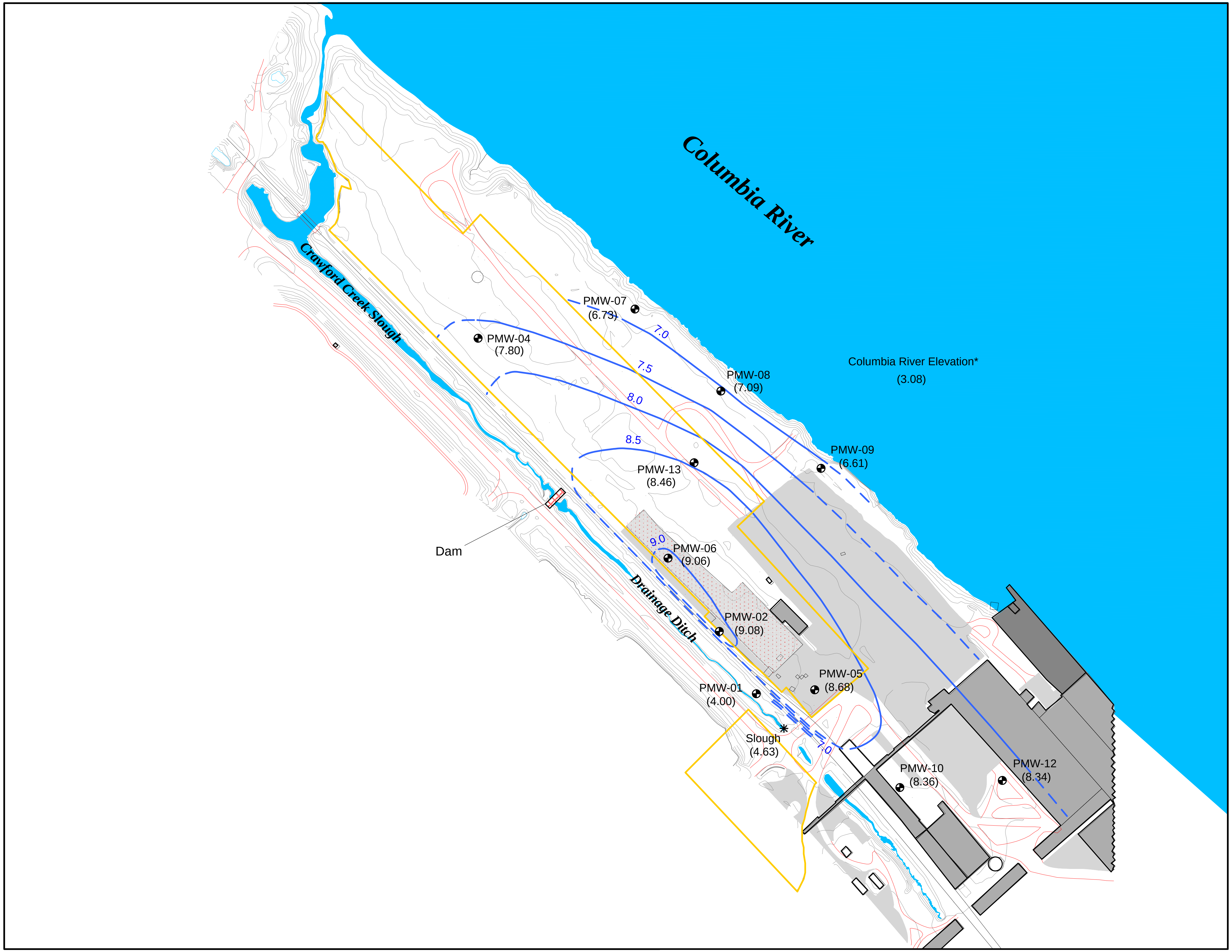


Figure 5
Potentiometric Surface Map February 1, 2002 Perched Zone

Former Koppers Wood-Treating Site
Wauna, Oregon

Legend

▨ Deed Restricted Area
☐ Lease Boundary
Road Edge
Railroad
Topographic Contour
Stream
■ Waterbody
■ Parking Lot
■ Building
■ Dock

● Perched Zone Monitoring Well
✳ Slough Staff Gauge
Groundwater Elevation Contour
Feet Above NGVD, 1929;
Location Approximate
(Contour Interval = 0.5 feet)

*Columbia River:
High Tide = 8.44
Low Tide = 1.47

W N S E

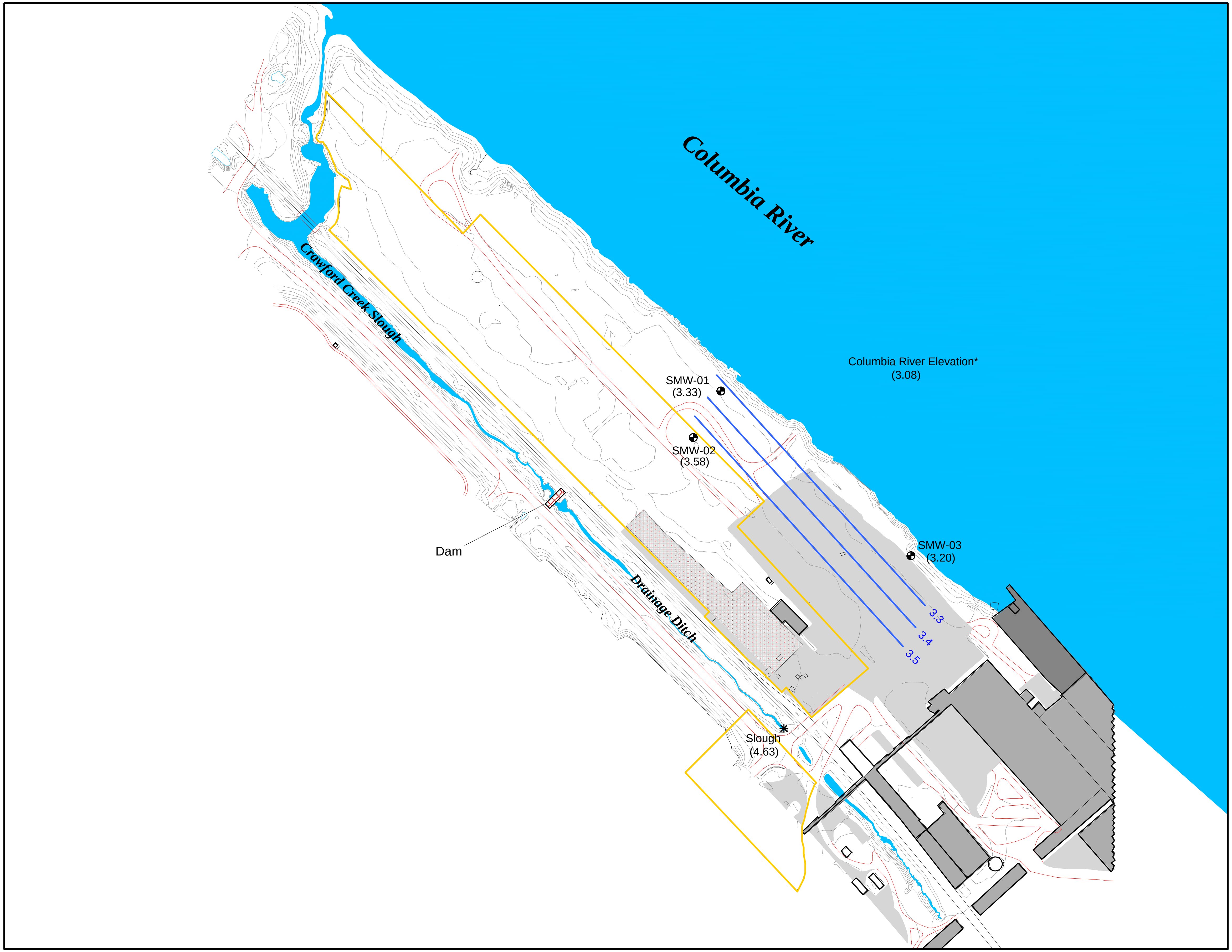
0 125 250 500
Feet

Bridgewater Group, Inc.

Figure 6

Potentiometric Surface Map February 1, 2002 Shallow Zone

Former Koppers Wood-Treating Site
Wauna, Oregon



Legend

- ▨ Deed Restricted Area
- ▭ Lease Boundary
- Road Edge
- Railroad
- Topographic Contour
- Stream
- Waterbody
- Parking Lot
- Building
- Dock
- ● Shallow Zone Monitoring Well
- ✳ Slough Staff Gauge
- Groundwater Elevation Contour Feet Above NGVD, 1929; Location Approximate (Contour Interval = 0.5 feet)

*Columbia River:
High Tide = 8.44
Low Tide = 1.47

Bridgewater Group, Inc.

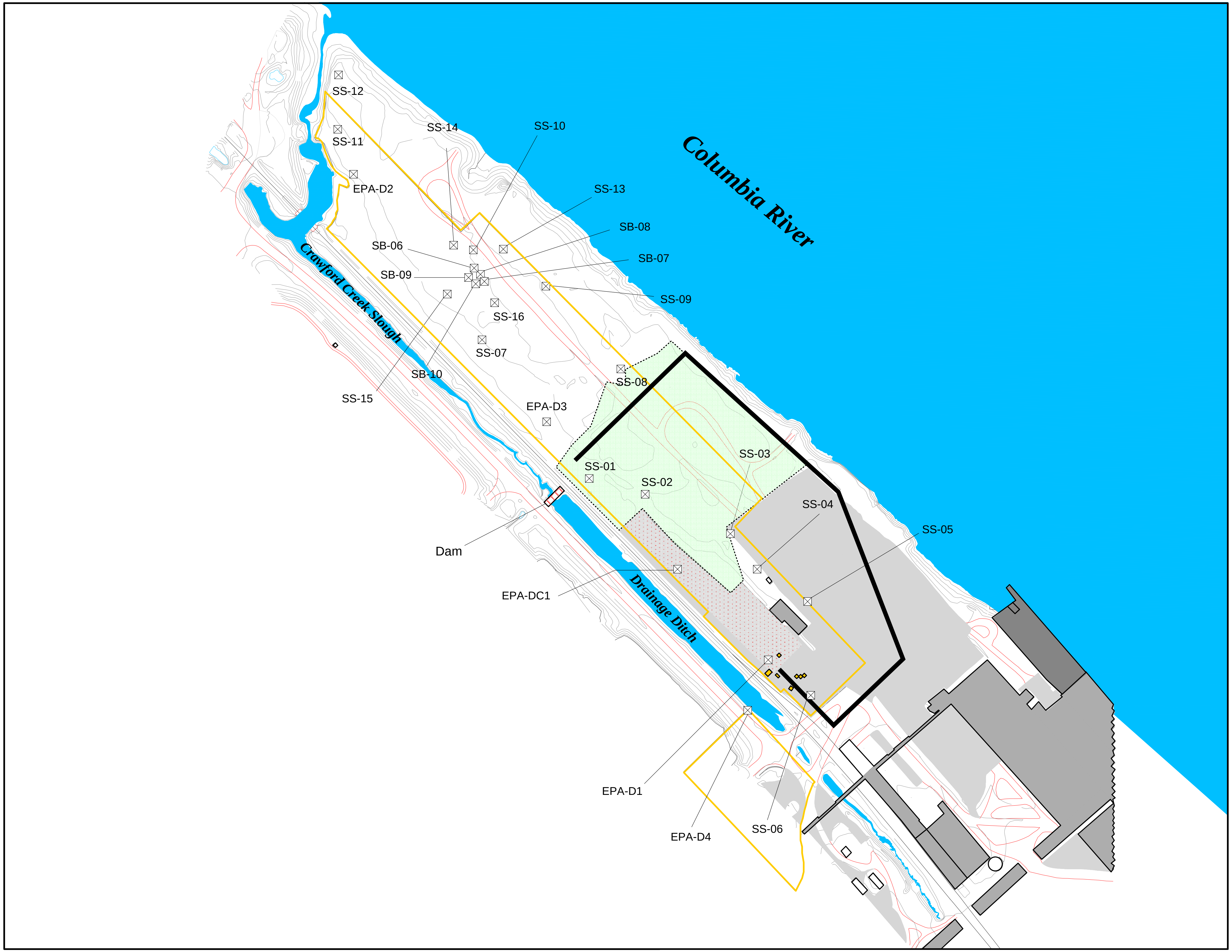


Figure 7
Surface Soil Sampling Locations

Former Koppers Wood-Treating Site
Wauna, Oregon

Legend

- 🟨 Test Pits
- ▨ Deed Restricted Area
- ☐ Lease Boundary
- Road Edge
- Railroad
- Topographic Contour
- Stream
- Waterbody
- Parking Lot
- Building
- Dock
- Area Graded and Vegetated During IRM Construction
- IRM Subsurface Barrier and Aeration Trench
- ☒ SS-01 - Surface Soil Sample Location

W N S E

0 125 250 500
Feet

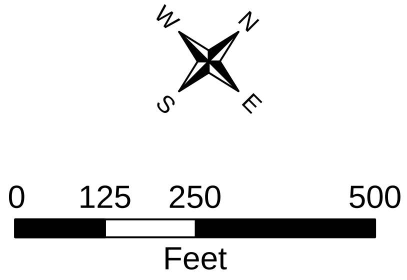
Bridgewater Group, Inc.

Figure 8
Subsurface Soil Sampling Locations

Former Koppers Wood-Treating Site
Wauna, Oregon

Legend

- 🟨 Test Pits
- ▨ Deed Restricted Area
- ☐ Lease Boundary
- ╱╲ Road Edge
- ╱╲ Railroad
- ╱╲ Topographic Contour
- ╱╲ Stream
- 🟦 Waterbody
- ⬜ Parking Lot
- ⬜ Building
- ⬛ Dock
- 🟩 Area Graded and Vegetated During IRM Construction
- ▬ IRM Subsurface Barrier and Aeration Trench
- ■ SB-05 - Subsurface Soil Sample Location



Bridgewater Group, Inc.

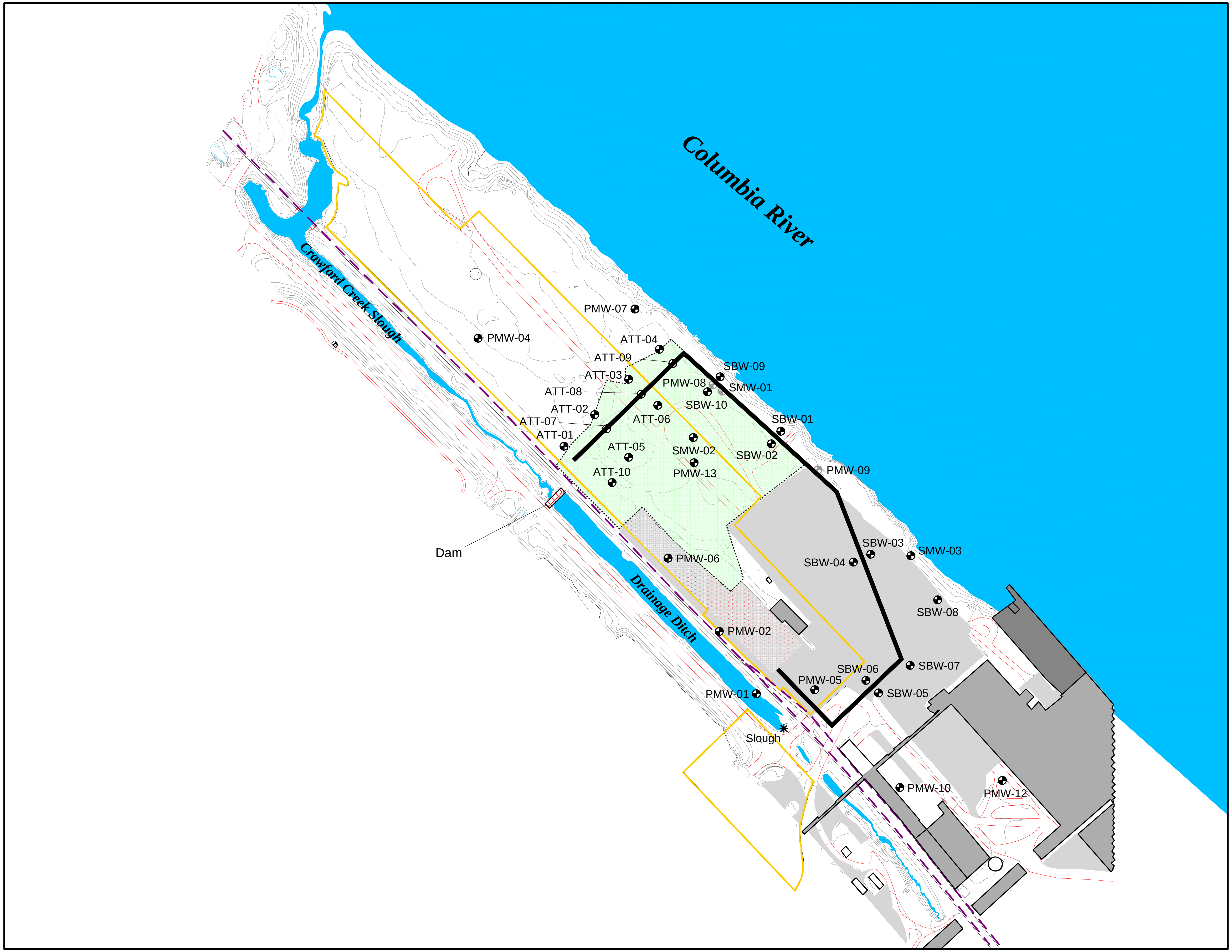


Figure 9
Groundwater Sampling Locations

Former Koppers Wood-Treating Site
Wauna, Oregon

Legend

- Deed Restricted Area
- Lease Boundary
- Road Edge
- Railroad
- Topographic Contour
- Stream
- Waterbody
- Parking Lot
- Building
- Dock
- IRM Subsurface Barrier and Aeration Trench
- Monitoring Well
- Well Abandoned During IRM Construction
- ✳ Slough Staff Gauge

W N S E

0 125 250 500
Feet

BRIDGEWATER GROUP, INC.

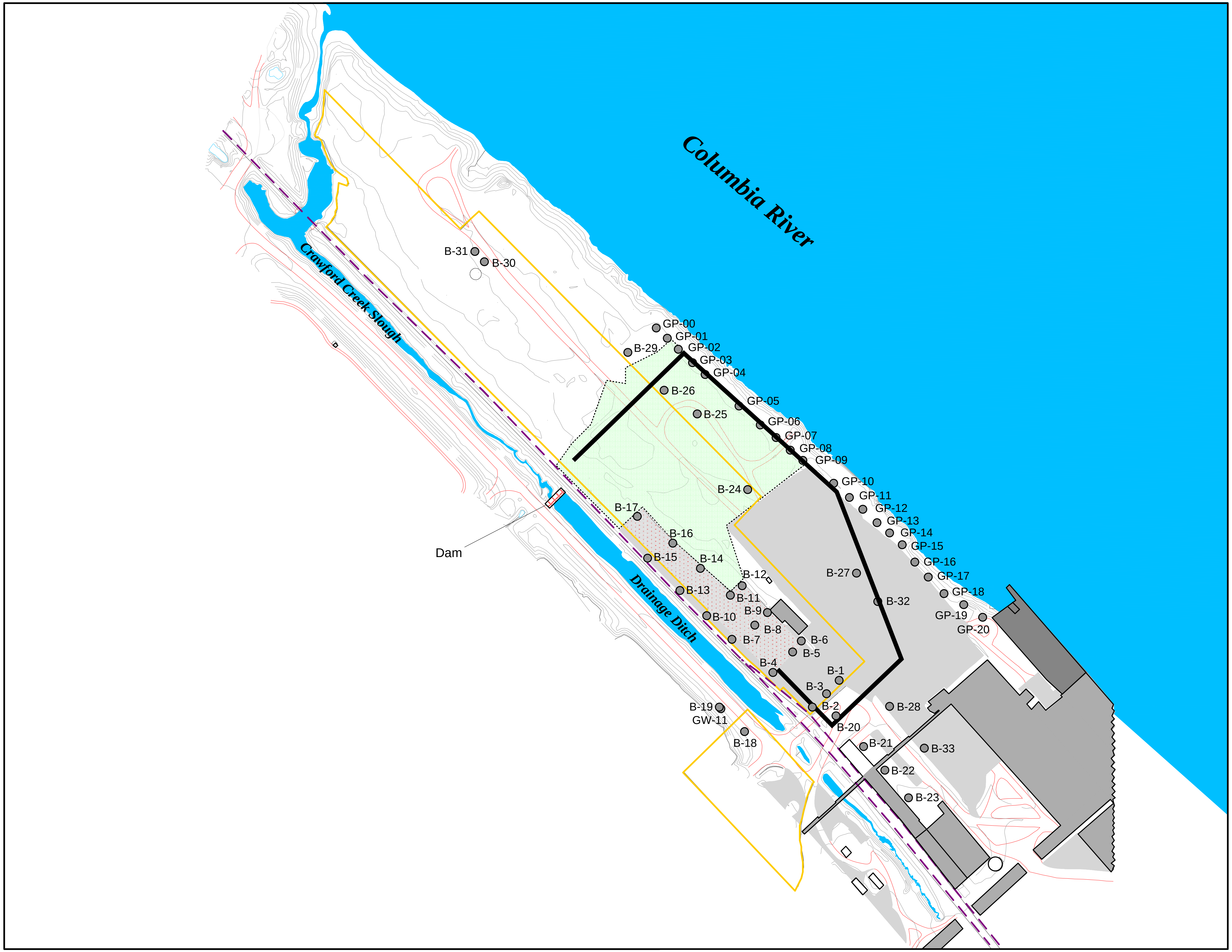


Figure 10
Geoprobe Locations

Former Koppers Wood-
Treating Site
Wauna, Oregon

Legend

- ▨ Deed Restricted Area
- ☐ Lease Boundary
- Road Edge
- Railroad
- Topographic Contour
- Stream
- ▬ Waterbody
- ▬ Parking Lot
- ▬ Building
- ▬ Dock
- ▬ IRM Subsurface Barrier and Aeration Trench
- ● Geoprobe Location

W N S E

0 125 250 500
Feet

BRIDGEWATER GROUP, INC.

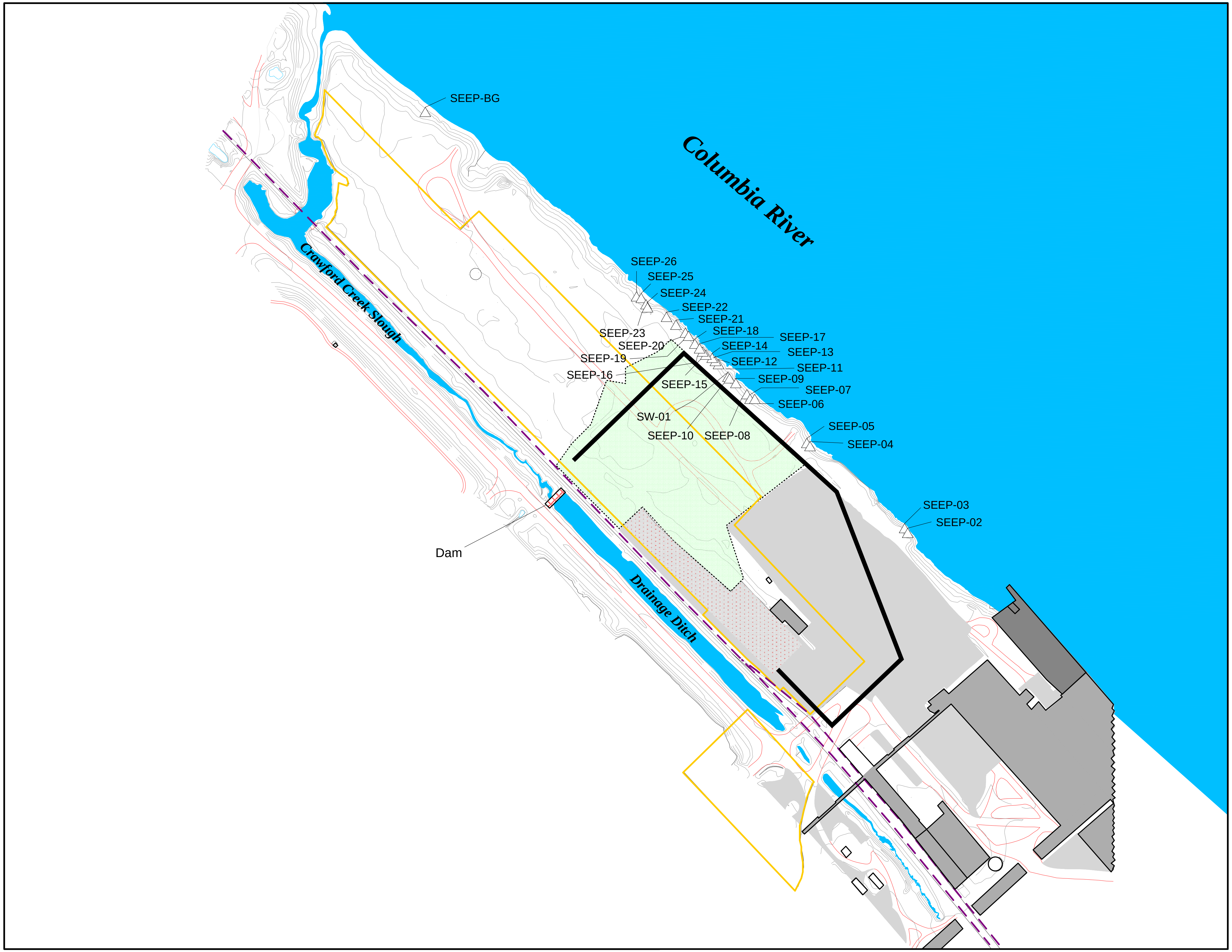


Figure 11
Seep Sampling Locations

Former Koppers Wood-Treating Site
Wauna, Oregon

Legend

- ▨ Deed Restricted Area
- ☐ Lease Boundary
- Road Edge
- Railroad
- Topographic Contour
- Stream
- 🟦 Waterbody
- ⬜ Parking Lot
- ▩ Building
- ⬛ Dock

- ━ IRM Subsurface Barrier and Aeration Trench
- △ Seep Location

W N S E

0 125 250 500
Feet

BRIDGEWATER GROUP, INC.

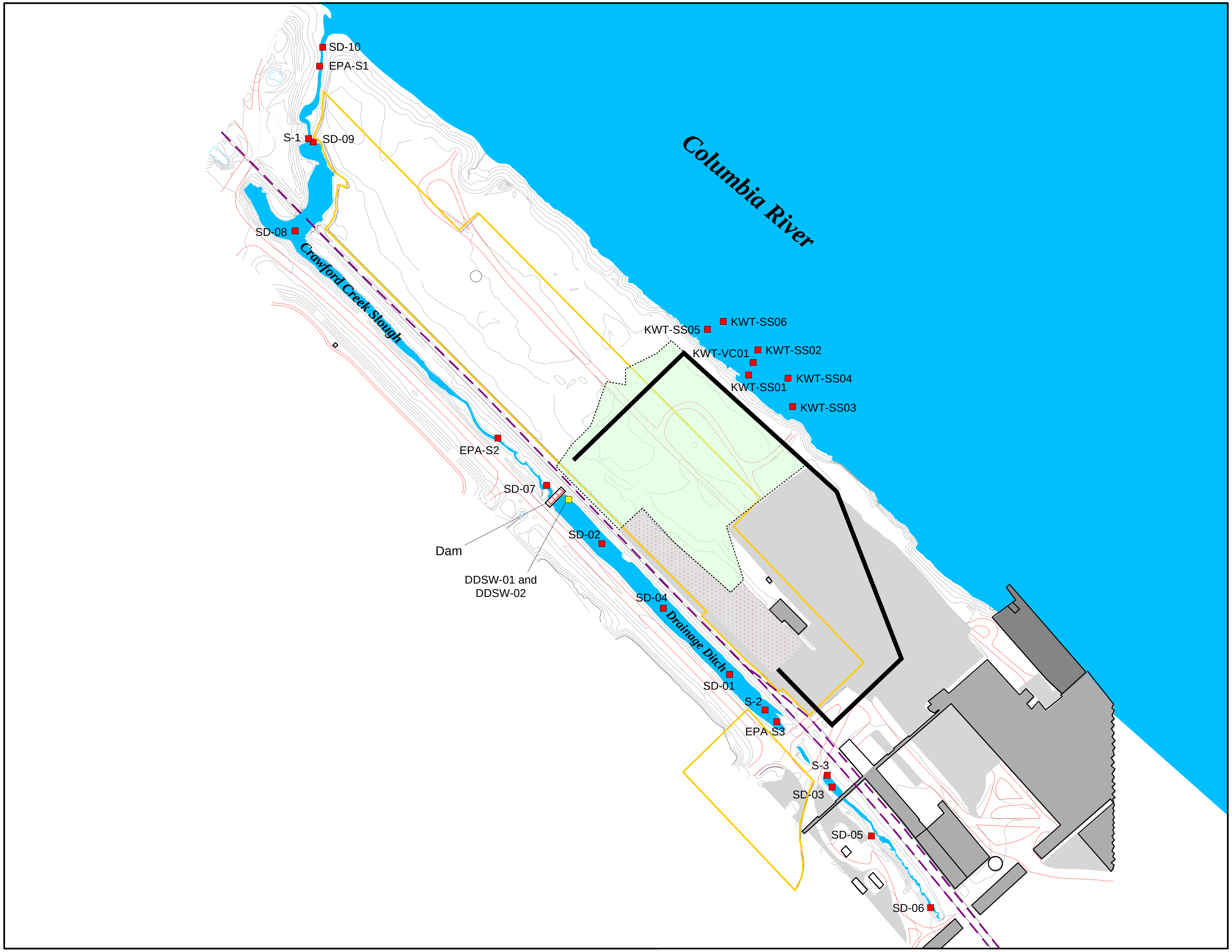


Figure 12

Slough and Columbia River Sediment, and Slough Surface Water Sampling Locations

Former Koppers Wood-Treating Site
Wauna, Oregon

Legend

- ▨ Deed Restricted Area
- ☐ Lease Boundary
- Road Edge
- Railroad
- Topographic Contour
- Stream
- ■ Waterbody
- ■ Parking Lot
- ■ Building
- ■ Dock
- ■ Area Graded and Vegetated During IRM Construction
- IRM Subsurface Barrier and Aeration Trench
- ■ S-2 - Sediment Sample
- ■ DDWS-01 – Surface Water Sample

W N S E

0 125 250 500
Feet

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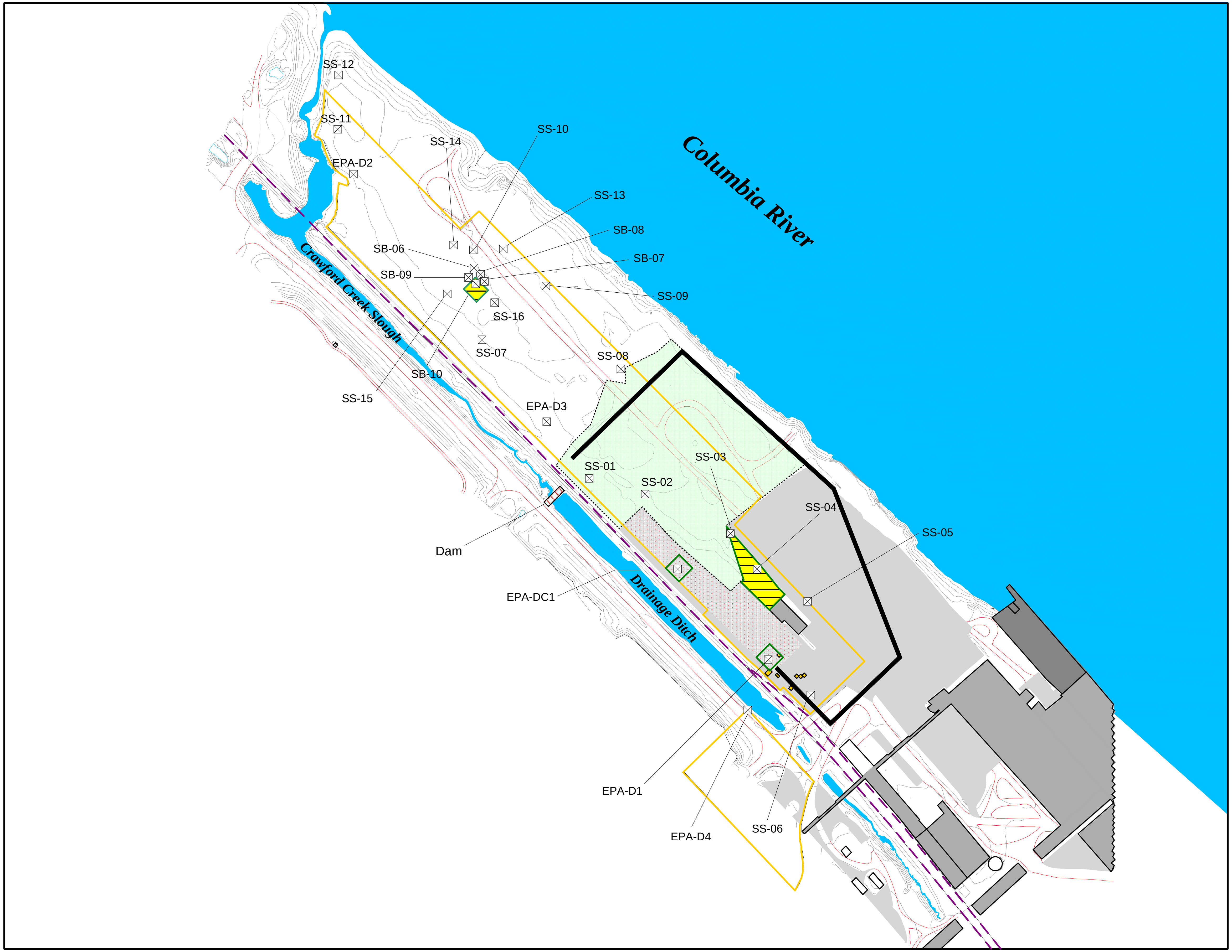

Figure 13

Surface Soil Posing Potential Unacceptable Risk and Hot Spots

Former Koppers Wood-Treating Site
Wauna, Oregon

Legend

▨ Deed Restricted Area
☐ Lease Boundary
Road Edge
Railroad
Topographic Contour
Stream
■ Waterbody
■ Parking Lot
■ Building
■ Dock
▨ Area with Unacceptable Risk
☐ Potential Hot Spot Area
■ Area Graded and Vegetated During IRM Construction
IRM Subsurface Barrier and Aeration Trench
☒ SS-04 - Surface Soil Sample

W N S E

0 125 250 500
Feet

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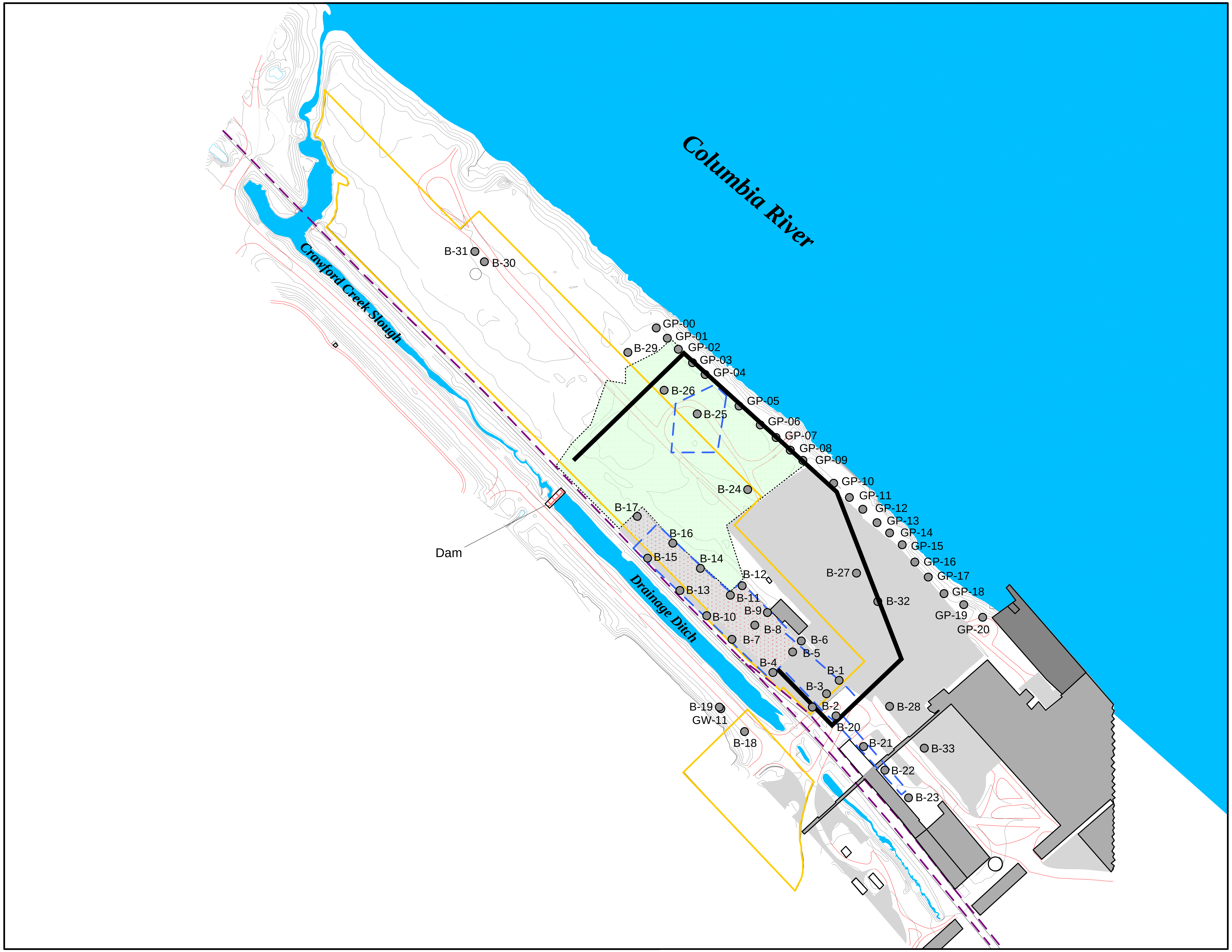

Figure 14
Potential Source Zone Areas

Former Koppers Wood-Treating Site
Wauna, Oregon

Legend

▨ Deed Restricted Area
▭ Lease Boundary
╱╲ Road Edge
╱╲ Railroad
╱╲ Topographic Contour
╱╲ Stream
▬ Waterbody
▬ Parking Lot
▬ Building
▬ Dock
▭ Potential Source Zone – Free or Residual Creosote
▬ IRM Subsurface Barrier and Aeration Trench
● Geoprobe Location

W N S E

0 125 250 500
Feet

BRIDGEWATER GROUP, INC.

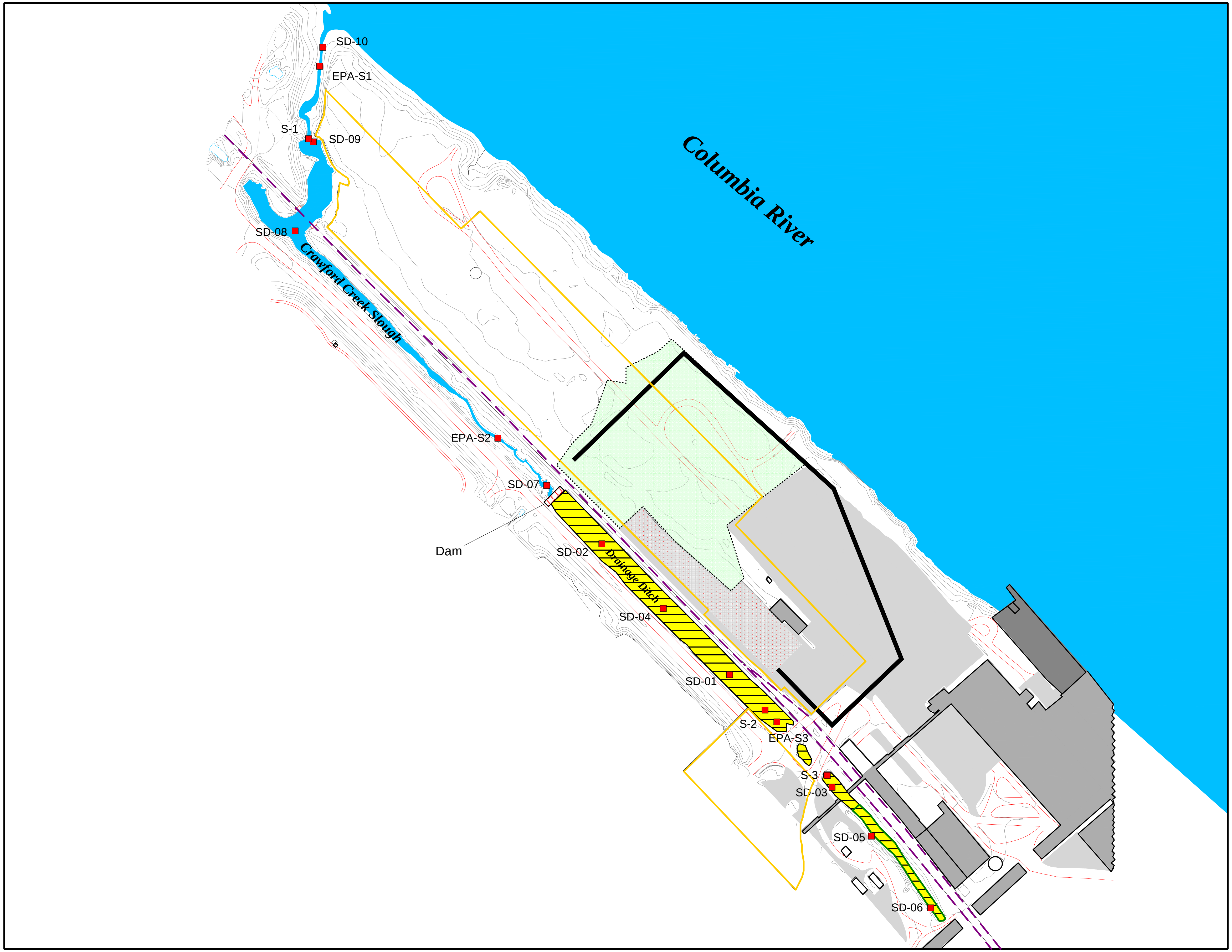

Figure 15

Slough Sediment Posing Potential Unacceptable Risk and Hot Spot

Former Koppers Wood-
Treating Site
Wauna, Oregon

Legend

- 🟨 Test Pits
- ▨ Deed Restricted Area
- ☐ Lease Boundary
- Road Edge
- Railroad
- Topographic Contour
- Stream
- Waterbody
- Parking Lot
- Building
- Dock
- ▨ Area with Unacceptable Risk
- ☐ Hot Spot Area
- Area Graded and Vegetated During IRM Construction
- IRM Subsurface Barrier and Aeration Trench
- ■ S-2 - Sediment Sample

W N S E

0 125 250 500
Feet

Bridgewater Group, Inc.

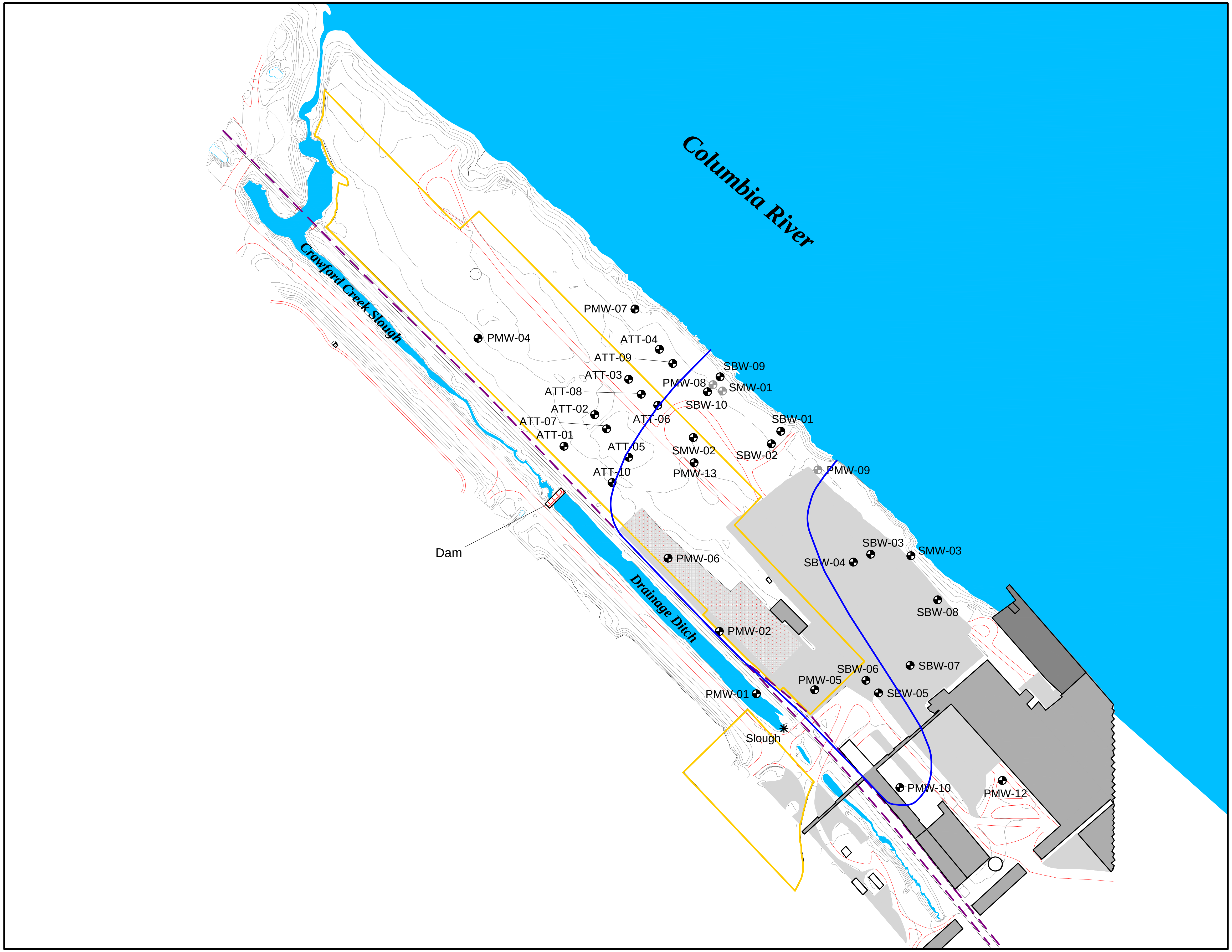

Figure 16

Groundwater Potentially Posing Adverse Effects to Surface Water (Pre-IRM)

Former Koppers Wood-Treating Site
Wauna, Oregon

Legend

- ▨ Deed Restricted Area
- Lease Boundary
- Road Edge
- Railroad
- Topographic Contour
- Stream
- Waterbody
- Parking Lot
- Building
- Dock
- Area Where Naphthalene Concentrations Exceeded its SLV in the Perched Water-Bearing Zone (Pre-IRM)
- ● Monitoring Well
- ● Well Abandoned During IRM Construction
- ✳ Slough Staff Gauge

Bridgewater Group, Inc.

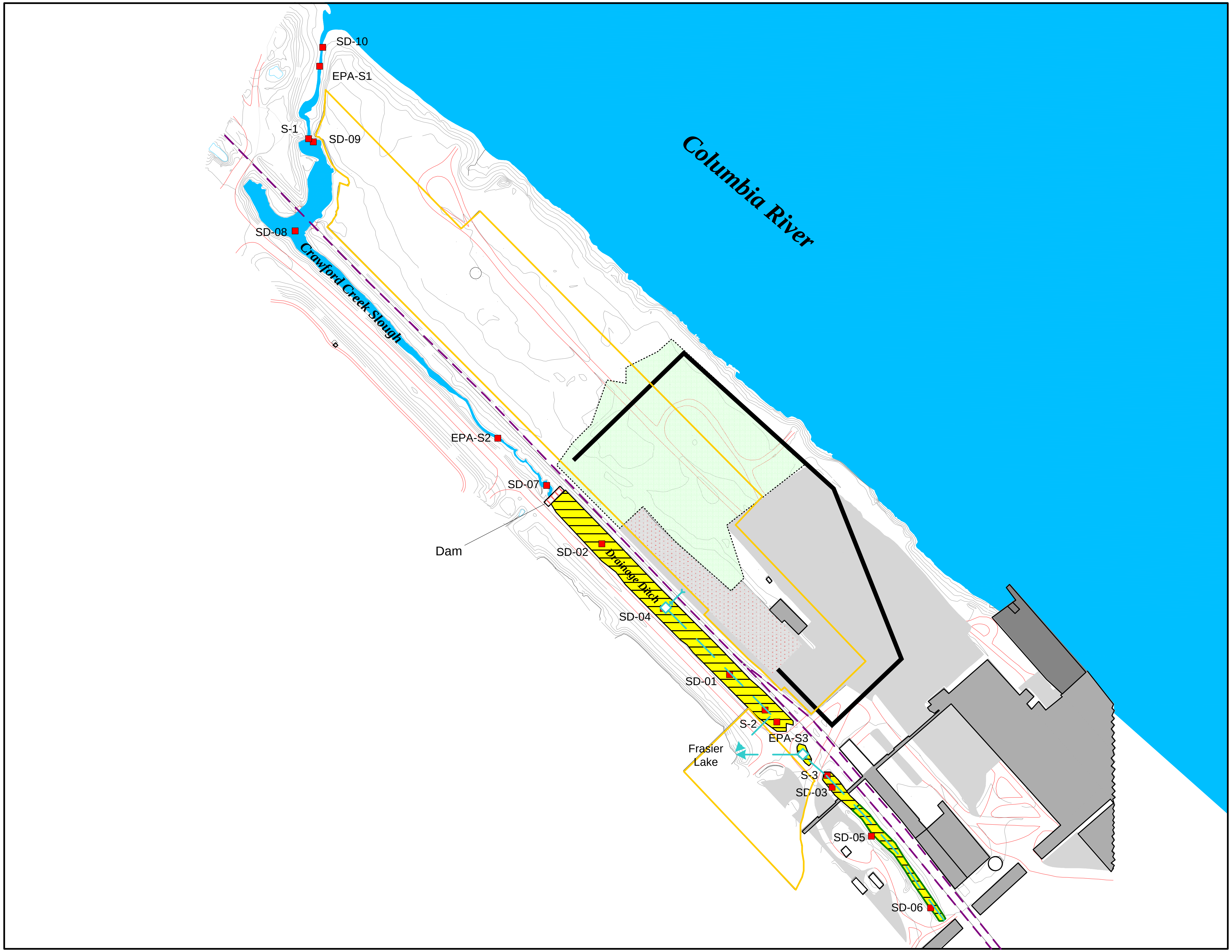

Figure 17
Slough Sediment Alternative Sed3

Former Koppers Wood-
Treating Site
Wauna, Oregon

Legend

- Test Pits
- Deed Restricted Area
- Lease Boundary
- Road Edge
- Railroad
- Topographic Contour
- Stream
- Waterbody
- Parking Lot
- Building
- Dock
- Area with Unacceptable Risk
- Hot Spot Area
- Area Graded and Vegetated During IRM Construction
- IRM Subsurface Barrier and Aeration Trench
- S-2 - Sediment Sample
- Existing/New Sump and Pump
- Existing Culvert Installed as Part of IRM
- Pipeline from Sump to Frasier Lake

W N S E

0 125 250 500
Feet

Bridgewater Group, Inc.

APPENDIX A – GROUNDWATER SEEPS INTERIM REMEDIAL MEASURE ALTERNATIVES EVALUATION

GEOMATRIX

Groundwater Seeps Interim Remedial Measure Alternatives Evaluation

Former Koppers Facility
Wauna, Oregon

Prepared for:

Beazer East, Inc.
One Oxford Centre, Suite 3000
Pittsburgh, Pennsylvania 15219-6401

and

Georgia Pacific Corporation
300 West Laurel Street
Bellingham, Washington 98225

July 31, 2003

Project No. 9151.000

Geomatrix Consultants

GEOMATRIX

Groundwater Seeps Interim Remedial Measure Alternatives Evaluation

Former Koppers Facility
Wauna, Oregon

Prepared for:

Beazer East, Inc.
One Oxford Centre, Suite 3000
Pittsburgh, Pennsylvania 15219-6401

and

Georgia Pacific Corporation
300 West Laurel Street
Bellingham, Washington 98225

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Geomatrix Consultants, Inc.
One Union Square
600 University Street, Suite 1020
Seattle, Washington 98101

July 31, 2003

Project No. 9151.000

Geomatrix Consultants

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GROUNDWATER SEEPS INTERIM REMEDIAL MEASURE ALTERNATIVES EVALUATION

Former Koppers Facility
Wauna, Oregon

1.0 INTRODUCTION

In accordance with the ongoing voluntary program addressing historical soil and groundwater issues associated with the former Koppers site located in Wauna, Oregon, Georgia-Pacific Corporation (GP) and Beazer East Inc. (Beazer) have prepared this Groundwater Seeps Interim Remedial Measure (IRM) Alternatives Evaluation Report. This report presents a focused screening and evaluation of potential remedial technologies and alternatives to address the groundwater seeps from the perched water bearing zone discharging to the Columbia River from the former Koppers facility (the Site). This report has been prepared by Geomatrix Consultants Inc. on behalf of GP and Beazer.

Objectives for the groundwater seeps IRM are presented in this document. Additionally, this report identifies and screens potential remedial technologies that may be applicable to management of the seeps and attainment of IRM objectives. Technologies determined to be inappropriate for the Site, or incapable of attaining IRM objectives, have been screened from further consideration. The technologies passing the initial screening have been assembled into general, comprehensive IRM alternatives for more detailed evaluation. Based on the evaluation, a preferred IRM approach has been identified and is proposed for further evaluation and refinement. A preliminary, general IRM implementation plan that provides for additional evaluation and establishing consensus with the Oregon Department of Environmental Quality (DEQ) has been included in this report. Finally, a preliminary schedule for implementation of the preferred IRM approach is presented.

GP and Beazer propose to develop and refine the preferred IRM approach identified in this report upon acceptance by DEQ, as described in the proposed IRM Implementation Plan.

2.0 BACKGROUND

The purpose of this section is to provide background data pertinent to the selection of an IRM alternative.

2.1 SITE LOCATION AND HISTORY

The Site is located at the Wauna Mill site in Wauna, Oregon (Figure 1). Wood-preserving operations were conducted at the Site between 1936 and 1966. The wood treating operators were American Lumber and Timber Treating Company (from 1936–1954) and Koppers Company, Inc. (from 1954–1966). Since 1966, the Site has been used for equipment storage for the pulp and paper operation on the adjacent property. The Site layout and locations of historical operations are shown on Figure 2.

Four wood-preserving processes were used at the Site:

- Wolman salts (fluorochromuim-arsenic phenol)
- Chromium copper arsenate
- Creosote
- Pentachlorophenol

Two retorts, or pressure cylinders, were used to prepare the wood and apply the preservatives. These retorts were located in the southeast portion of the Site, along with aboveground tanks used to store the wood-treating chemicals. An additional aboveground creosote storage tank was located across the slough from the process area and was reportedly filled via pipeline from the Columbia River dock. Treated wood products were dried in the south central portion of the Site.

No releases of wood preservatives are documented at this Site. The wood-treating constituents found at the Site are likely from drips and splashes during normal daily operations at, or adjacent to, storage tanks and piping and from handling freshly treated wood.

A more detailed history of the facility operations can be found in the Remedial Investigation Report, Former Koppers Wood-Treating Site (May 2002).[1]

2.2 PREVIOUS INVESTIGATIONS

Several investigations have been conducted at the Site. A comprehensive investigation was completed in 2002 and is documented in the Remedial Investigation Report (RI) for the former Koppers Wood-Treating Site dated May 2002.

---

[1] The Remedial Investigation Report, CH2M Hill, May 2002.

The Site geology and hydrogeology are described in the RI Report; a brief summary is presented here. Most of the Site is covered by 1 to 2 feet of asphalt and/or gravel underlain by 3 to 10 feet of apparent fill. The fill consists of well-graded to poorly-graded sand with lenses of gravel and wood debris. The fill material is probably dredged sediments, but the timing of fill activities could not be determined. A continuous silt layer, 3 to 14 feet thick, underlies the sandy fill. Beneath the silt, several thin alternating layers of clayey silt, silty clay and sandy silt extend downward to 30 feet below ground surface (bgs).

Two water bearing zones have been identified beneath the Site: a perched water-bearing zone above the silt layer, and a shallow, confined water-bearing zone beneath the silt layer. The perched zone is within the 3 to 10 foot thick sandy fill material. Groundwater flow direction in the perched zone is generally northeast, toward the Columbia River, with a horizontal hydraulic gradient of approximately 0.0027 feet per foot. There is minimal hydraulic connection between the perched zone and the slough. The perched water-bearing zone is recharged by rainfall. Net discharge is from the perched water-bearing zone to the Columbia River, although the groundwater flow direction adjacent to the river reverses at high tide.

The shallow confined water-bearing zone beneath the silt extends to the total depth drilled at the Site (30 feet bgs). Groundwater in this zone is influenced by tidal fluctuations in the Columbia River and also flows toward the river.

Pumping tests, chemical analyses of groundwater samples, and geotechnical testing show that the continuous silt layer between the two water-bearing zones is a competent hydraulic barrier. The vertical hydraulic conductivity of the layer is approximately 10^{-9} ft/s ($5x10^{-8}$ cm/sec). There is no significant recharge of the confined zone beneath the silt by the perched water-bearing zone.

2.3 GROUNDWATER SEEPS

Constituents of wood-treating chemicals have been found in groundwater seeps along a portion of the Columbia River bank, as well as in river bank soils and river water samples collected adjacent to the seeps. The affected seep area is shown on Figure 5-7[2] of the RI Report. The distribution of affected seeps is consistent with the affected groundwater area shown on Figure 5-6 of the RI Report.

---

[2] Relevant figures from the RI Report are included in Appendix A of this report.

Based on the results of the RI, the affected seep area is approximately 250 feet long. Seep samples collected southeast and northwest of the affected seep area contained no detectable constituent concentrations. Constituents detected in the seeps consist primarily of naphthalene and total petroleum hydrocarbons (TPH). The constituents detected in the seeps were generally consistent with monitoring results for the perched groundwater.

2.4 AREAS OF CONCERN

The areas of concern to this IRM include the seep area noted above, the "source" areas identified in the RI Report, and the affected groundwater area identified in the RI Report. The two "source" areas identified in the RI Report are locations where some free, but primarily residual, creosote has been observed, as noted on Figure 5-5 in the RI Report. The first source area is the deed restricted area located northwest of the westernmost Wauna Mill building. This area is currently capped with asphalt. The second area is located southwest of the affected seep area, as shown on Figure 5-5 of the RI Report. These "source" areas likely slowly dissolve site constituents into groundwater passing through them and towards the Columbia River. Figure 5-6 of the RI Report shows the location of affected groundwater apparently contributing to the affected seeps identified in the RI Report. Affected groundwater may discharge from the perched zone beneath the Site through the seeps. The two "source" areas and the affected groundwater must be considered in developing an IRM to control the seepage of affected groundwater to the Columbia River.

3.0 INTERIM MEASURE OBJECTIVES

An IRM will be implemented to address ongoing seepage of site constituents to the Columbia River. This IRM will be implemented by GP and Beazer as a voluntary action. As an IRM, the action will not be considered the final remedial action for the former Koppers site, but it is anticipated that the IRM will be incorporated into any final remedy. Any affected areas not addressed by the IRM will be considered during the feasibility study for the facility that will be performed once the remedial investigation and risk assessment have been finalized.

The objectives for the IRM are as follows:

- Control seepage of groundwater affected with site constituents to the Columbia River;
- To the extent practicable, ensure compatibility with probable long-term remedial actions;

- To the extent practicable, ensure compatibility with Site use for the Wauna Mill;
- Minimize operations and maintenance costs; and
- Provide for timely implementation to expedite control of affected groundwater seeps.

Remedial alternatives capable of attaining these objectives are evaluated in this document and a preferred IRM selected. The alternatives were developed from a short list of remedial technologies that were screened for effectiveness, implementability, and cost, as described in the following sections.

4.0 REMEDIAL TECHNOLOGY SCREENING CRITERIA

The following criteria were used to evaluate potential remedial technologies considered for the IRM:

- Effectiveness;
- Implementability; and
- Cost, including capital and annual operation and maintenance costs.

Each of the three screening criteria is described in the following paragraphs.

Effectiveness

Effectiveness addresses the capability of a technology to meet the interim measure objectives for the Site, whether the technology adequately protects human health and the environment in the short and long term, if the technology significantly and permanently reduces the toxicity, mobility, or volume of hazardous constituents; and is technically proven and reliable.

Implementability

Implementability addresses the ability to implement a technology, technical factors involved in implementation, and administrative issues. Considerations include the relative ease of installation (constructability) and technical feasibility of implementing the selected technologies at the Site (including compatibility with Site features, accessibility of the area, etc.), administrative feasibility of coordinating implementation of the alternative among various state, federal and tribal agencies, and availability of the services and materials necessary to implement a technology.

Cost

This criterion considers the costs associated with implementing an alternative. The cost screening addresses capital costs and annual costs for operation, maintenance, and monitoring. For technology screening, costs are considered qualitatively as high, moderate, or low, relative to the technologies considered.

5.0 REMEDIAL TECHNOLOGY SCREENING

In this section, appropriate remedial technologies to address the groundwater seeps are identified and screened to select the technologies to be used to develop the IRM alternatives. Only those technologies considered capable of attaining IRM objectives have been included in this evaluation. The remedial technologies identified as potentially applicable are listed in Table 1. A brief description of each technology is included.

The potentially applicable technologies listed in Table 1 have been screened using the criteria identified in Section 4. Technologies were first screened for effectiveness (Table 2). Those that were accepted based on effectiveness were then screened for implementability (Table 3), eliminating technologies with unacceptable implementability. Only those technologies that were accepted based on effectiveness and implementability were then screened for cost (Table 4).

The following remedial technologies were carried forward for interim measure alternative development:

- Natural Attenuation;
- Asphalt cap
- Soil/clay cap;
- Soil-bentonite low permeability barrier;
- Cut-off trench;
- Phytoremediation;
- Sparge trench; and
- Groundwater treatment at the Plant Facility.

6.0 POTENTIAL INTERIM MEASURE ALTERNATIVES

The remedial technologies suited for potential use at the Site were identified in Section 5. These technologies must be combined appropriately to develop comprehensive IRM alternatives that address IRM objectives. In this section, potential IRM alternatives are developed. Each of the potential IRM alternatives presented below has been designed to achieve the IRM objectives. The potentially applicable IRM alternatives are evaluated to identify the preferred approach to address the affected groundwater seeps.

6.1 LOW PERMEABILITY CONTAINMENT BARRIER

This potential IRM alternative consists of a low permeability subsurface barrier designed to isolate the source areas defined in the RI Report from the Columbia River and a groundwater management system designed to establish hydraulic control for the upper, perched groundwater zone. The low permeability barrier wall would reduce the amount of perched groundwater that must be controlled hydraulically to eliminate the seeps. Various technologies could be used to establish a groundwater management system including a groundwater recovery trench, phytoremediation, and/or surface capping. This alternative attains the IRM objectives by cutting off the flow of affected groundwater from the source areas to the affected seep area. The final configuration and location of the low permeability barrier and groundwater management system would be determined during the design for the interim measure.

Due to construction and environmental constraints, a small quantity of affected groundwater will remain within the perched zone between the subsurface barrier and the Columbia River, although the low permeability barrier will stop the flow of the vast majority of the affected groundwater to the seeps. Natural attenuation of this small quantity of affected groundwater has been included as a component of this IRM alternative. The components of this potential IRM alternative are described in more detail below.

6.1.1 Subsurface Barrier

Based on the technology screening presented in Section 5, a conventional soil-bentonite slurry wall was selected as the appropriate subsurface barrier technology. Soil-bentonite slurry walls have been employed extensively as remedial measure components, and have been demonstrated to provide good long-term effectiveness. Subsurface barriers can be implemented in a variety of configurations ranging from a totally enclosing barrier to diversion/collection barriers. Subsurface barriers have also been used in "funnel and gate" approaches to direct groundwater flow to a specific area. They are readily implementable, with several qualified contractors available. At the former Koppers Site, a soil-bentonite slurry wall could be constructed in any appropriate configuration using conventional construction equipment. Soil-bentonite slurry walls have been used successfully for similar sites and similar site constituents.

Groundwater modeling of the perched zone and alternate barrier wall configurations will be completed in order to identify the optimum configuration for the Site. The barrier wall configurations to be evaluated include a "U" shaped barrier wall placed downgradient of the source areas identified in the RI Report, and a funnel and gate configuration placed downgradient of the source areas. Other configurations may also be considered during the IRM design. The barrier wall would be keyed into the plastic silt layer identified beneath the affected groundwater. Based on data presented in the RI report, the silt is continuous at the Site and would serve as an effective aquitard protecting the underlying shallow aquifer.

Due to construction and access constraints, the barrier wall cannot be located less than about 20 feet from the river bank along the Columbia River. For this reason, the small quantity of affected groundwater between the barrier wall and the river would not be addressed by the barrier wall. However, the barrier wall would essentially stop the flow of affected groundwater toward this segment of the river, significantly reducing the seep discharge in this portion of the Site.

Potential issues associated with a soil-bentonite slurry wall include the following:

- Potential loss of slurry if gravels or underground conduits are encountered during construction;
- Management of excess soils generated during soil-bentonite slurry wall construction; and
- Due to the proximity to the Columbia River, a biological assessment may be required to address potential effects of the construction on endangered or threatened species.

6.1.2 Groundwater Management

In order to attain interim measure objectives, groundwater must be managed to ensure that groundwater constituents do not migrate to the Columbia River. For totally enclosing subsurface barriers, an inward hydraulic gradient is typically established and maintained to ensure that groundwater flows into the containment area to prevent migration of groundwater constituents. For a "U" shaped configuration, the barrier wall is used to direct groundwater flow towards a collection system located near the center of the "U." The funnel and gate barrier wall configuration is used to direct groundwater flow to a collection zone at the gate that either intercepts, or treats, affected groundwater.

A preliminary, worst-case (high) estimate of the potential groundwater and surface water flow into a containment area was prepared based on the assumption of a totally enclosing barrier configuration. This estimate was based upon site hydrogeological data taken from the RI Report. The results of the water balance estimate are presented in Table 5. The estimated total influx of water through the underlying silt, the barrier wall, and rainwater (with the existing soil cover) is about 3.4 gallons per minute (gpm) on an annual average basis. Most of the water entering the containment area is due to infiltration of rainfall through overlying soils. Based on this preliminary estimate, approximately 4 gpm would require recovery on an annual average basis to maintain an inward hydraulic gradient for a totally enclosing barrier wall configuration.

Two of the groundwater management options considered involve extraction of affected groundwater contained by a barrier wall. The first option is extraction via a recovery trench followed by treatment in the existing Wauna Mill wastewater treatment facility. The second option utilizes phytoremediation to extract groundwater through evapotranspiration supplemented by a groundwater recovery trench during periods of high rainfall or low evapotranspiration. Limited capping (asphalt or soil/clay) may also form a component of either of these two groundwater management options to limit infiltration. The choice of capping material would likely depend on future use of the area. A third groundwater management option based upon in-situ treatment has been included for consideration with a funnel and gate type configuration. These groundwater management options are described below.

6.1.2.1 Groundwater Extraction Trench

Groundwater from the perched zone can be efficiently recovered using a recovery trench. An extraction trench can be constructed using a standard backhoe to the top of the silt aquitard. The trench would be backfilled with gravel. Perforated collection lines would be placed in the gravel to direct groundwater entering the trench to a central collection sump. The sump would be equipped with a pump that would operate under level control, discharging to an above-ground pretreatment and storage system. It is estimated that the trench would be 50 feet long and that it would be placed near the center of the containment or collection area.

The pretreatment system for recovered groundwater would consist of a phase separator to remove any free non-aqueous phase liquids (NAPL) recovered from the trench and a storage tank. The storage tank would receive the discharge from the phase separator and serve as a reservoir for pumping the water to the existing industrial wastewater treatment system serving the Wauna Mill for final treatment. The groundwater recovery system would contribute approximately 4,500 gallons per day to the treatment plant which is presently processing approximately 30 million gallons per day.

6.1.2.2 Phytoremediation

For this groundwater recovery option, a portion of the containment area would be planted with trees to remove water via evapotranspiration. The area available for planting would depend upon land use requirements at the Wauna Mill, the use of caps, and the amount of groundwater to be recovered. A groundwater extraction trench (see Section 6.1.2.1) would be included to ensure that groundwater gradients are properly maintained while the trees mature and during periods when evapotranspiration is not sufficiently active. Phytoremediation has the additional advantage of promoting biodegradation of organic constituents similar to those present at the Site. Poplars have been used in similar applications.

6.1.3 Natural Attenuation/Phytoremediation

For this IRM alternative, the small volume of affected groundwater extending beyond the barrier wall toward the river bank would be addressed by a combination of phytoremediation and natural attenuation. The seepage rate would be reduced to close to zero (only rain infiltration would contribute to the seeps) by all barrier wall configurations other than the funnel and gate configuration. A double row of trees would be placed upgradient from the affected seep area and downgradient from the barrier wall. The existing evergreen trees in this area may be partially removed and replaced with trees such as poplars. However, evergreen trees would likely remain for aesthetics during the fall and winter months.

During the growing season (about seven months of the year), the trees would remove some affected groundwater via evapotranspiration, further reducing the already small flow rate. Additionally, the root system of the trees would provide a subsurface environment conducive to biodegradation of groundwater constituents, further reducing the discharge of constituents. The groundwater constituents in this area would be further attenuated by the natural processes of biodegradation, adsorption, dispersion, and dilution. The attenuated groundwater would continue to discharge to the Columbia River, but at a rate and at constituent concentrations much lower than under existing conditions.

6.1.4 Capping

Surface capping would be effective in limiting infiltration of surface water to the perched zone. This would reduce the groundwater flow rate and the amount of groundwater that must be recovered to control the seep discharge. The cap could cover a portion or all of the containment area, as appropriate, to efficiently manage groundwater. The cap could be either asphalt or soil/clay, whichever is consistent with site development/use considerations. The containment IRM alternative would include capping of at least a portion of the containment area.

6.1.5 In-Situ Groundwater Management

An in-situ management approach may be used if a funnel and gate configuration is selected for the barrier wall. In-situ treatment methods would be used to attain IRM objectives. The most appropriate approach for in-situ management is enhanced biodegradation using a sparge trench. The barrier wall would direct groundwater flow toward the gate, where the trench would be constructed. The trench would be backfilled with gravel and include an aeration pipe placed at the bottom. Air would be blown into groundwater within the trench to promote aerobic degradation of groundwater constituents. The gravel would help distribute the air and provide a medium to promote biological growth. If necessary, nutrients could also be added into the trench to promote biological activity. The treated groundwater would then flow toward the river as it does presently.

6.2 GROUNDWATER INTERCEPTOR TRENCH

This potential IRM alternative consists of a groundwater recovery trench placed to intercept the affected groundwater upstream of the seep area. This alternative would attain the IRM objectives by using a physical structure to recover affected groundwater prior to discharge through the seeps. Due to construction and environmental constraints, a small portion of affected groundwater would remain between the extraction trench and the Columbia River. Affected groundwater in the bank area would be addressed by partial recovery from the trench and natural attenuation. The components of this alternative are described in more detail below.

6.2.1 Interceptor Trench

For this alternative, an interceptor trench approximately 300 feet in length would be constructed inland from the affected seep area and as close to the river as possible. It is estimated that the trench would be placed approximately 20 feet from the crest of the river bank. The bottom of the trench would be placed immediately above the silt aquitard. Perforated collection piping would be placed in a gravel bed to direct flow of groundwater to centralized recovery sumps. The trench would be backfilled with gravel to the high groundwater level, covered with geofabric/geomembrane, and then backfilled to grade with soil. Pumps would be installed in the recovery sump(s) to remove water for treatment in the Wauna Mill wastewater treatment system. A phase separator and surface tank would be included to remove any free product that may be recovered from the trench and provide temporary storage prior to pumping to the wastewater treatment system.

The groundwater recovery rate for the interceptor trench was estimated based upon data from the RI Report. Based on the hydraulic conductivity of the fill material overlying the silt aquitard (4.3 x 10^{-2} cm/sec), the expected groundwater gradient (0.005) and the dimensions of the interceptor trench (250 ft long by 10 ft deep), a conservative (i.e., high) estimate of the groundwater recovery rate for the trench is about 30 gpm or about 43,000 gallons per day. The extracted groundwater would be pumped to the Wauna Mill wastewater treatment system for final treatment. Phase separation would be provided for recovered groundwater to prevent pumping NAPL to the industrial wastewater treatment system.

6.2.2 Natural Attenuation/Phytoremediation

For this IRM alternative, the small volume of affected groundwater downgradient of the interceptor trench would be addressed several ways. Affected groundwater within this limited area would be partially recovered by the interceptor trench, which would draw groundwater from both sides of the trench. However, some affected groundwater within the downgradient area may not be captured by the trench. This water would be addressed by a combination of phytoremediation and natural attenuation. A double row of trees would be placed upgradient from the affected seep area and downgradient from the interceptor trench. The existing evergreen trees in this area may be partially removed and replaced with trees such as poplars. However, evergreen trees would likely remain for aesthetics during the fall and winter months.

During the growing season (about seven months of the year), the trees would remove some affected groundwater via evapotranspiration, further reducing the already small flow rate. Additionally, the root system of the trees would provide a subsurface environment conducive to biodegradation of groundwater constituents, further reducing the discharge of constituents. The groundwater constituents in this area would be further attenuated by the natural processes of biodegradation, adsorption, dispersion, and dilution. The attenuated groundwater would continue to discharge to the Columbia River, but at a rate and at constituent concentrations much lower than under existing conditions.

6.3 PHYTOREMEDIATION WITH GROUNDWATER INTERCEPTION AND IRRIGATION

This potential IRM alternative consists of a phytoremediation program implemented over the "source areas" with a groundwater interceptor trench. Recovered groundwater would either be used for irrigation of the trees and other phytoremediation plants or pumped to the Wauna Mill wastewater treatment system. This alternative would attain many of the IRM objectives by using the phytoremediation plants, or a physical structure, to recover affected groundwater prior to discharge through the seeps. However, a large tree plantation may interfere with on-going plant operations and Site use. Due to construction and environmental constraints, a small portion of affected groundwater would remain between the extraction trench and the Columbia River. Affected groundwater in this small area would be addressed by partial recovery from the trench and natural attenuation. The components of this alternative are described in more detail below.

6.3.1 Phytoremediation

For this IRM alternative, the source and affected areas would be planted with trees and other plants to the extent practicable to remove groundwater via evapotranspiration and to promote biodegradation of site constituents. The area to be planted would be located west of the river, within the affected groundwater zone defined in the RI Report. The land area available for planting may be limited by ongoing and future plant activities that require access to the source areas. Based on a preliminary evaluation, it is anticipated that four to five acres would be required for planting in order to effectively use phytoremediation for groundwater recovery. The acreage would be planted with trees spaced approximately 10 feet apart. The root system of the phytoremediation plants would facilitate in-situ biodegradation of site constituents. During the growing season (seven months per year), the plants would remove groundwater from the affected area. A recovery trench, as described below, would be included to intercept groundwater flowing toward the river and to provide irrigation water for phytoremediation. During periods when evapotranspiration is not sufficiently active, the trench would direct excess water to the Wauna Mill wastewater treatment system. Based upon a preliminary evaluation (Table 6), four to five acres of poplar trees planted at a 10-foot spacing could have the capacity to evaporate all recovered groundwater (on an annual average basis) after the third growing season. This approach would promote biodegradation of organic constituents year round.

6.3.2 Interceptor Trench and Irrigation System

Affected groundwater flowing toward the seep area would be intercepted by a trench similar to that described above in Section 6.2.1. The interceptor trench would recover groundwater in the same manner. The primary mode of operation for the interceptor trench would be to irrigate the phytoremediation area. As the plants mature over the first three years, their water consumption substantially increases, likely utilizing all recovered groundwater. An emitter or drip type irrigation system would be used to minimize the potential for volatilization and drift losses. The phytoremediation area would be graded to control the flow of irrigation and rain water and contain it within the planted area. Site constituents present in irrigation water would be returned to already affected areas with active biodegradation for ultimate destruction of the constituents. The water levels within and adjacent to the phytoremediation area would require monitoring to ensure that a proper groundwater gradient (toward the phytoremediation area) is maintained and to prevent over-irrigation. During periods when groundwater recovery exceeds irrigation needs, the excess water would be pumped to the Wauna Mill wastewater treatment system.

6.3.3 Natural Attenuation/Phytoremediation

For this IRM alternative, the small volume of affected groundwater downgradient of the interceptor trench would be addressed several ways. Affected groundwater within this limited area would be partially recovered by the interceptor trench, which would draw groundwater from both sides of the trench. However, some affected groundwater within the downgradient area may not be captured by the trench. This water would be addressed by a combination of phytoremediation and natural attenuation. A double row of trees would be placed upgradient from the affected seep area and downgradient from the interceptor trench. The existing evergreen trees in this area may be partially removed and replaced with trees such as poplars. However, evergreen trees would likely remain for aesthetics during the fall and winter months.

During the growing season (about seven months of the year), the trees would remove some affected groundwater via evapotranspiration, further reducing the already small flow rate. Additionally, the root system of the trees would provide a subsurface environment conducive to biodegradation of groundwater constituents, further reducing the discharge of constituents. The groundwater constituents in this area would be further attenuated by the natural processes of biodegradation, adsorption, dispersion, and dilution. The attenuated groundwater would continue to discharge to the Columbia River, but at a rate and at constituent concentrations much lower than under existing conditions.

7.0 INTERIM MEASURE ALTERNATIVE EVALUATION CRITERIA

For this IRM alternatives evaluation, a limited set of criteria have been used. These criteria are based upon Comprehensive Environmental Response, Cleanup, and Liability Act (CERCLA) guidance for remedial investigations and feasibility studies (RI/FS). The full set of evaluation criteria cited in the CERCLA RI/FS guidance were not considered appropriate because the selected IRM alternative will not be the final remedial measure for the Site. Further, since the IRM will be a voluntary action, it will not be necessary to follow the public notification and hearing process.

The IRM alternative evaluation criteria used for this evaluation are as follows:

- Implementability;
- Short-term effectiveness;
- Long-term effectiveness;
- Reduction of mobility, toxicity, and volume;
- Cost, including a consideration of capital, annual, and present value costs; and
- Overall protection of human health and the environment.

Each of these evaluation criteria is described in the following paragraphs.

Implementability

Implementability addresses the ability to implement an alternative, technical factors involved in implementation, and administrative issues. Considerations include the relative ease of installation (constructability) and technical feasibility of implementing the selected technologies at the Site (including compatibility with Site features, accessibility of the area, etc.), administrative feasibility of coordinating implementation of the alternative among various state and federal agencies, and availability of the services and materials necessary to implement an alternative.

Short-Term Effectiveness

Short-term effectiveness evaluates the alternative during construction and implementation until remedial action objectives are achieved. Specific considerations include potential exposures to the community, environment, and on-site workers during construction, and the relative time before remedial objectives are achieved.

Long-Term Effectiveness

Long-term effectiveness addresses the protection of human health and the environment after the remedial action objectives have been met. In evaluating alternatives for their long-term effectiveness, an analysis considers: the ability to perform intended functions, such as containment or removal; the adequacy and reliability of long-term engineering or institutional controls; and long-term performance, operation, and maintenance requirements.

Reduction of Mobility, Toxicity, and Volume

This criterion evaluates an alternative's ability to meet the statutory preference for permanent treatment as a principal element of remediation. For each alternative, reduction of the mobility, toxicity, and volume of impacted material is discussed. This criterion includes the permanence of the remedy and the nature of residuals remaining after treatment.

Cost

This criterion considers the capital and operations/maintenance costs associated with implementing an interim measure alternative. For this evaluation of alternative interim measures, a qualitative cost evaluation has been used, based upon relative estimates of the implementation costs.

Overall Protection of Human Health and the Environment

This criterion summarizes the protectiveness of an alternative, discussing the extent to which it mitigates short- and long-term potential exposure to concentrations of residual constituents, protects human health during and after implementation, and achieves remedial objectives.

8.0 INTERIM MEASURE ALTERNATIVE EVALUATION

This section presents the evaluation of the three IRM alternatives described in Sections 6.1, 6.2, and 6.3. For this evaluation, the alternatives are referred to as follows:

- Alternative 1: Low Permeability Containment Barrier (See Section 6.1)
- Alternative 2: Groundwater Interceptor Trench (See Section 6.2)
- Alternative 3: Phytoremediation with Groundwater Interception and Irrigation (See Section 6.3)

The components of each IRM alternative were identified in Section 6. The criteria presented in Section 7 were used to qualitatively evaluate the three IRM alternatives. Based on the results of this evaluation, the preferred alternative is identified.

8.1 IMPLEMENTABILITY

The implementability evaluation is summarized on Table 7. All three IRM alternatives are readily implementable and constructable at this Site using standard construction equipment, material, and techniques. Alternative 3 has the lowest implementability rating because it requires extensive construction and removes the largest land area from active use. Alternative 3 would also require a complete stormwater containment and management system due to irrigation use of recovered groundwater, which would require careful management and maintenance.

8.2 SHORT-TERM EFFECTIVENESS

All three IRM alternatives would have an almost immediate effect on eliminating the discharge of affected groundwater through the seeps, because they either contain (Alternative 1) or remove (Alternatives 2 and 3) the affected groundwater upon completion of construction and commissioning. Alternative 1 may generate more potentially affected soil than Alternatives 2 and 3, requiring appropriate management. Due to the magnitude of excavation associated with Alternative 1, there would be some potential for exposure of construction workers to site constituents. As noted previously, a small amount of affected groundwater may continue to seep to the river after implementation of the IRM because none of the alternatives can be placed closer than about 20 feet to the river bank. This seepage, however, is expected to be minimal.

The evaluation for short-term effectiveness for the three alternatives is summarized on Table 7. Alternatives 2 and 3 rank higher than Alternative 1 due to the less invasive construction.

8.3 LONG-TERM EFFECTIVENESS

Table 7 presents the long-term effectiveness evaluation for the three IRM alternatives. Alternatives 1 and 3 have good long-term effectiveness based on their capability of passively containing or removing site constituents in the long-term. Alternative 2 ranks lowest for long-term effectiveness due to reliance on active operation and maintenance. Alternative 1 ranks highest because it incorporates a constructed physical barrier to contain site constituents. Alternative 1 will require short-term operation and maintenance as well as monitoring until the phytoremediation system matures. Alternative 2 will require long-term monitoring and operation and maintenance (O&M). Alternative 3 is expected to be effective in removing the contamination in the long-term, but continued effectiveness will depend on continued plant activity. Alternative 1 also addresses most of the affected areas of the Site, and is expected to be most compatible with the long-term remedy. Long-term monitoring will be required to evaluate the performance of all three alternatives.

8.4 REDUCTION IN MOBILITY, TOXICITY, AND VOLUME

Alternative 1 would contain site constituents by a physical barrier and it would reduce the toxicity and volume of the affected groundwater by natural degradation processes and phytoremediation. The secondary treatment provided by the Wauna Mill wastewater treatment facility would reduce the toxicity by destroying site constituents. Alternative 3 would reduce the mobility, toxicity, and volume similar to Alternative 1 by reducing groundwater flow and promoting natural degradation and attenuation of site constituents. However, Alternative 3 would be less effective than Alternative 1 in reducing constituent mobility. Alternative 1 ranks highest for this criterion, as shown in Table 7.

8.5 COST

The three IRM alternatives are evaluated qualitatively for cost (capital and operations/maintenance) in Table 7. Alternative 1 has the highest construction cost due to construction of a physical barrier, but it will have the lowest operation and maintenance cost. Alternative 2 will have moderate installation cost with the highest long-term operations, maintenance, and monitoring cost. Alternative 3 is the least expensive to install and has a low to moderate long-term monitoring cost.

8.6 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

All three IRM alternatives are protective of human health and the environment. The evaluation for this criterion is summarized on Table 7. Alternative 1 would be most protective of human health and the environment. Source areas would be contained under this alternative and the phytoremediation would reduce the mass and toxicity of site constituents. Alternative 1 would be the least protective to the workers during installation because it would require excavation of saturated soil from the barrier wall alignment and the groundwater extraction trench, potentially exposing workers to groundwater constituents. It should be noted, however, that well established health and safety procedures are readily available to ensure that this work could be completed safely with minimal risk of exposure.

Alternative 2 would provide a moderate to low level of protection to human health and the environment. The installation of the interceptor trench would potentially expose the workers during installation, but the excavation would be much smaller than that of Alternative 1. In the long-term, pumping of the groundwater and the associated conveyance system has potential for failure or damage, potentially causing exposure. Long-term protection for Alternative 2 also depends upon continued operation and maintenance.

Alternative 3 would offer a moderate level of protection to human health and the environment. The potential risks to workers during installation of the extraction trench would be the same as for Alternative 2. In the long-term, the irrigation of the groundwater could potentially expose groundwater constituents to the air, possibly volatilizing some of the organic constituents. Due to the low concentration of organic constituents in the groundwater, it is expected that irrigation using Site groundwater would pose minimal risk to off-site personnel. Standard health and safety procedures would be used to ensure minimal risk to site workers. This potential for exposure could persist for several years, until natural degradation reduces the toxicity of the extracted groundwater. Long-term protection for Alternative 3 would also require active operation and maintenance to intercept groundwater and direct it to irrigation or wastewater treatment.

8.7 PREFERRED IRM ALTERNATIVE

Based upon the evaluation of the three IRM alternatives presented above, the preferred IRM alternative to address the seeps is Alternative 1, the subsurface barrier wall groundwater management system that may include capping, a groundwater recovery trench, and/or phytoremediation. This alternative requires the most extensive construction effort and has the highest construction cost of the alternatives considered, but it also has the highest ranking for long-term effectiveness and protectiveness. Through proper design of a cap and a phytoremediation system, this alternative can be designed to be compatible with ongoing plant operations while minimizing long term operation and maintenance, This IRM alternative also addresses the Site source areas. It is proposed that Alternative 1 be implemented to control the groundwater seeps for the former Koppers site.

9.0 INTERIM MEASURE IMPLEMENTATION PLAN

Additional development of the preferred IRM will be completed follwing acceptance of the proposed approach by DEQ. Initially, the final barrier wall configuration must be determined, as described in Section 6.1. This will require evaluation of the different potential configurations and modeling effects on groundwater flow. A conceptual design report will then be prepared to document the results of the modeling effort and propose the appropriate barrier wall configuration for the IRM. The conceptual design report will be submitted to DEQ for review and comment.

Work will commence on the final design for the low permeability barrier wall system after DEQ acceptance of the conceptual design. As part of the design, additional site information must be collected to confirm the continuity and depth to the aquitard and to identify any potential obstructions. This work will be completed as part of the IRM design.

A design-build approach is planned for implementation of the final IRM design. Engineering will be completed to the extent needed to construct the subsurface barrier, phytoremediation system, and groundwater recovery system. The plans and specifications will be sufficient to describe and specify the work to be completed, but a full design package for competitive bidding will not be prepared. The owner, engineer and construction contractor will work together on the design package to ensure that all parties understand the project requirements and design. The design package will be submitted to DEQ for review.

Permitting and regulatory issues will be addressed and resolved once the design package has been completed. This work will be done in parallel with DEQ review of the design package. It may be necessary to perform a biological assessment if required by the National Marine Fisheries Service. Permits common for a subsurface construction project will also be obtained. Upon acceptance of the design package by DEQ the final contracts for construction will be negotiated so that construction may commence. It is expected that the interim measure will be constructed in July 2004.

10.0 INTERIM REMEDIAL MEASURE IMPLEMENTATION SCHEDULE

A preliminary schedule for implementation of the preferred IRM alternative has been prepared and is presented in Figure 3. The schedule starts with submittal of this IRM alternatives evaluation to DEQ and ends with submittal of an IRM implementation report. As shown on the schedule, IRM construction can commence in the summer of 2004 provided that agency reviews and approvals can be obtained in a timely manner. Delays in these approvals will cause delays in completion of subsequent tasks. Based on the assumed approval times, it is projected that the selected IRM alternative could be operational by mid-September 2004.

The schedule presented in Figure 3 is preliminary and is intended for planning purposes only. A final schedule will be prepared and submitted to DEQ as part of the IRM design submittal shown in the project schedule.

TABLE 1

TECHNOLOGY DESCRIPTION

Former Koppers Site
Wauna, Oregon

Technology	Description
Natural Attenuation	Monitoring of the seeps will continue. Decreases in contaminant level over time through natural attenuation will be tracked.
Containment	
Physical Containment	
– Capping • Asphalt • Soil/Clay • Shoreline Cap	Low permeability surface barrier placed above source area to limit surface water infiltration, promote runoff, and prevent human contact with potentially affected soil. Shoreline capping with sand and gravel or organoclay^{TM} to prevent direct contact and/or to absorb organics (organoclay)
– Low Permeability Subsurface Barrier[1] • Slurry wall – Soil-Bentonite • Sealed sheet pile – Steel/Plastic	Low permeability subsurface barrier used to isolate zones of affected soil and/or groundwater to reduce migration or spread of contaminants of concern (COCs). • Conventional subsurface barrier constructed using a mixture of bentonite and native soil. • Conventional steel or plastic sheet piles installed using pile driving methods around affected area and keyed into a low permeable soil underlying the affected area. A sealing material is placed in the piling joints to reduce the permeability of the sheet pile barrier.
Hydraulic Containment	
– Cut-off Trench	A gravel-filled trench is installed downgradient of source area to intercept affected groundwater. The trench is sloped to collection points and contains a drainage pipe. Groundwater collected in the trench is pumped for treatment and disposal. Flexible membrane liners can be used to limit flow in or out of the trench.
– Groundwater Extraction Wells	Extraction wells are placed downgradient from the source area to intercept affected groundwater. Each well is pumped for treatment and disposal.
– Phytoremediation Barrier	A downgradient barrier is created using trees to extract affected groundwater and to promote biodegradation of groundwater constituents.
In-Situ [2]Treatment	
Chemical Oxidation	
– Fenton's Reagent ($FeSO_4$ and H_2O_2) – Permanganate (MnO_4)	Chemical oxidants are injected as aqueous solutions in the affected source area. Contaminants are destroyed in place and transformed into generally innocuous compounds (e.g., CO_2, H_2O, and salts) through chemical reaction. Chemical oxidants must be distributed throughout the affected area in sufficiently high concentrations to complete oxidation of contaminants.

TABLE 1

TECHNOLOGY DESCRIPTION

Former Koppers Site
Wauna, Oregon

Technology	Description
Bioremediation	
– Biosparging Wells	A barrier of air sparging wells is installed downgradient of the source area to intercept the flow of affected groundwater. Air is forced into the groundwater to develop a region of aerated groundwater to promote biological activity to degrade organic contaminants. The biosparging barrier must provide adequate oxygen, nutrients, and reaction time to ensure degradation of groundwater constituents.
– Sparge Trench	A trench is installed to intercept the affected groundwater. A perforated plastic line is placed at the bottom of the trench and air blown into the trench to aerate the water.
Phytoremediation	
– Source Area Remediation	Trees and/or grasses selected to be tolerant of site conditions are planted over the source area to promote biological activity in the root zone and to extract groundwater from the source area, creating an inward gradient.
Stabilization of NAPL	Cement grout is injected into the subsurface to stabilize and contain the NAPL.
Ex-situ[3] Groundwater Treatment	
– Plant Facility	Groundwater would be discharge to the existing Wauna Mill industrial wastewater treatment facility.

Notes:

[1] Only the most cost effective construction techniques that would be effective for this application presented here. More expensive techniques, such as jet grouting, soil-mix wall and vibrated beam wall were not evaluated further.

[2] In-situ refers to the removal of contaminants in-place through destruction of contaminants or transfer of contaminants to another medium, i.e., water or air.

[3] Ex-situ refers to treatment completed above ground.

TABLE 2

TECHNOLOGY SCREENING – EFFECTIVENESS

Former Koppers Site
Wauna, Oregon

Technology	Developmental Status	Positives	Potential Drawbacks	Site Specific Comments	Retain/Eliminate
Natural Attenuation	Commonly used	• No active remediation required			Retain
Containment					
Physical Containment					
– Capping • Asphalt	Commonly used	• Proven technology to create a low-permeability cap. • Readily implemented using conventional equipment and materials. • Supports limited use of capped area (e.g., parking, equipment storage)	• Long-term maintenance required.	• Appropriate cap for interim action and for supporting anticipated uses of area.	Retain
• Soil/Clay	Commonly used	• Proven technology, accepted by regulators • Readily implemented using conventional equipment and materials • Highly effective for limiting infiltration	• Potential for erosion • Soil cover required to limit desiccation and root penetration • Burrowing animals can breach cap • Long-term maintenance required	• Less compatible with anticipated use of area than asphalt cap	Retain
• Shoreline Cap	Commonly used	• Proven technology, accepted by regulators • Can be constructed to resist erosion	• Is not impermeable	• Placement over existing shoreline likely to be difficult	Retain
– Low Permeability Barrier • Slurry Wall: Soil-Bentonite	Commonly used	• Readily implemented using conventional equipment and common materials • Good long term effectiveness • Low maintenance	• Bentonite is not compatible with saline groundwater. Data indicates site water is not saline.	• Silt layer at about 10 feet below grade provides low permeability barrier to key wall into	Retain
• Sealed Sheet Pile: Plastic	Commonly used	• Readily implemented using conventional equipment and common materials • Good long term effectiveness • Low maintenance	• PVC sheet piles not suitable for soil with rubble or cobbles. No indication of rubble or cobbles at this site.	• Shallow depth to low permeability layer and lack of cobbles favors plastic sheet piles	Retain
• Sealed Sheet Pile: Steel	Commonly used	• Readily implemented using conventional equipment and common materials • Good long term effectiveness • Low maintenance	• Potential for corrosion, unless cathodic protection is used.	• Silt layer at about 10 feet below grade provides low permeability barrier to key wall into	Retain
Hydraulic Containment					
– Cut-Off Trench	Commonly used	• Proven technology, accepted by regulators • Readily implemented using conventional equipment and materials	• Treatment of extracted groundwater required along with permits for discharge • Long-term maintenance required • Monitoring likely required	• Can be implemented even with limited access. • Length of trench allows groundwater extraction even at lower seasonal water levels	Retain
– Groundwater Extraction Wells	Commonly used	• Proven technology, accepted by regulators • Readily implemented using conventional equipment and materials	• Treatment of extracted groundwater required along with permits for discharge • Long-term maintenance required • Monitoring likely required	• Can be implemented even with limited access. • Groundwater wells have higher O&M requirements than a cutoff trench and may not operate effectively at lower water levels	Eliminate • Not as effective as cut-off trench given seasonal water level fluctuations in perched water table

TABLE 2

TECHNOLOGY SCREENING – EFFECTIVENESS

Former Koppers Site
Wauna, Oregon

Technology	Developmental Status	Positives	Potential Drawbacks	Site Specific Comments	Retain/Eliminate
– Phytoremediation Barrier	Innovative	• Tree barriers can provide limited seasonal hydraulic control. • Root zones can encourage biodegradation by creating favorable microbial environments	• Evapotranspiration less effective during winter • Constituents of concern may migrate through barrier if bioremediation is not rapid enough • Regulatory acceptance is variable due to newness of approach	• Trees seem well suited to site conditions • Uncertain if seasonal variations would change effectiveness of root zone biodegradation as a barrier • May require cut-off trench to attain objectives in reasonable time frame	Retain
In-Situ[1] Treatment					
Chemical Oxidation					
– Fenton's Reagent	Relatively new	• Complete and rapid oxidation of target organic compounds is possible	• Most effective at lower pHs (2-4) • Difficult to handle due to stability of peroxide. • Also oxidizes non-target organic material	• Soils with residual creosote may consume excessive peroxide • Rapid reactions may cause difficulty with steam and uncontrolled oxidation.	Eliminate • Peroxide instability • Not highly effective with NAPL
– Permanganate	Relatively new	• Complete and rapid oxidation of target organic compounds is possible. • Permanganate is more stable than other oxidants and can travel further in the aquifer prior to oxidation.	• Also oxidizes non-target organic material • Excess permanganate and reduced manganese remain in groundwater after treatment	• Soils with residual creosote may consume excessive permanganate • Excess permanganate may discharge through seeps if not controlled	Eliminate • Potential for discharge of permanganate to Columbia River
Bioremediation					
– Biosparging Wells	Commonly used	• Increases naturally occurring aerobic biodegradation processes through addition of oxygen • Oxidizes organic constituents of concern	• Additional nutrients may be required to support biological activity • Active and ongoing O&M is required to maintain effectiveness	• Can be implemented even with limited access. • It is likely that suitable microbial populations already exist	Retain
– Sparge Trench	Commonly used	• Increases naturally occurring aerobic biodegradation processes through addition of oxygen • Oxidizes organic constituents of concern	• Additional nutrients may be required to support biological activity • Active and ongoing O&M is required to maintain effectiveness	• Can be implemented even with limited access. • It is likely that suitable microbial populations already exist	Retain
Phytoremediation					
– Source Area Remediation	Innovative	• Root zones can encourage biodegradation by creating favorable microbial environments • Passive system requiring minimal O&M	• Phytoremediation less effective during winter. Can be addressed through diverse tree and/or grass population • Regulatory acceptance is variable due to newness of approach • May require periodic addition of fertilizers	• Trees seem well suited to site conditions • Uncertain if seasonal hydraulic control would be sufficient to dry up seeps during winter	Retain
Stabilization of NAPL	Innovative	• Laboratory testing probably required to determine effectiveness at immobilizing NAPL • Conventional installation technique	• Difficult to confirm effectiveness immediately • Will require some monitoring	• Would likely require a lot of grout to complete the task due to the porous nature of the site soils	Eliminate • Unproven for NAPL stabilization • Porous soil conditions
Ex-situ[2] Groundwater Treatment					
– Plant Facility	Commonly used	• Easy to install and operate	• Will require long-term monitoring	• Duration of such an operation will be long and unknown	Retain

Notes:

[1] In Situ refers to the removal of contaminants through destruction of contaminants or transfer of contaminants to another medium (i.e., water or air).

[2] Ex-situ refers to treatment completed above ground.

Reference:

Federal Remediation Technologies Roundtable, Treatment Technologies Screening Matrix, http://www.frtr.gov

TABLE 3

TECHNOLOGY SCREENING - IMPLEMENTABILITY

Former Koppers Facility
Wauna, Oregon

Technology	Components	Limitations	Availability	Operation & Maintenance	Residual Produced	Storage & Handling	Estimated Cleanup Time[1]	Permits/ Approvals	Retain/ Eliminate
Natural Attenuation	• Periodic groundwater monitoring	• No technical limitations	• No limits	• Periodic groundwater monitoring	• None	• None	• Long	• None	Retain
Containment									
Physical Containment									
– Capping									
• Asphalt Cap	• 6" to 9" thick asphalt system or proprietary design^2 to ensure correct strength/ permeability combination. May need subsurface improvement depending on traffic use.	• Can be designed for a 20-year life	• Commercially available	• Visual inspection • Repair of breaches	• No residuals aside from excess graded material	• Minimal. No residuals after construction	• Short	• Grading/Building Permits	Retain
• Soil/Clay Cap	• 6" to 12" thick low permeability soil/cap layer above graded surface	• Requires maintenance • Erosion or animal burrowing can disrupt	• Commercially available	• Visual inspection • Repair of breaches	• No residual aside from excess graded material	• Minimal. No residuals after construction.	• Medium	• Grading Permit	Retain
• Shoreline Cap	• 9" to 12" of sand and gravel underlain by 6" to 12" of organo-clay	• Requires maintenance • May be difficult to install	• Commercially available	• Visual inspection • Repair of eroded portions	• Organo-clay could become saturated with organic contaminants, requiring disposal and replacement	• Minimal. No residuals after construction	• Long • Permitting process likely to be very long	• Grading permit • Shoreline (ESA/BA) • 404 or Corps nationwide 38 permit • Water Quality Control Board approval required	Eliminate • Delay in start of construction because of permitting issues unacceptable for IRM.
– Low Permeability Barrier									
• Slurry Wall: Soil-Bentonite	• Trenching to excavate soils, mix bentonite and key into low permeability layer	• Must be keyed into lower confining layer for effective containment	• Commercially available	• Visual inspection • Water level monitoring • Groundwater monitoring	• 30% of soil must be removed from trench and may require handling, treatment and disposal	• Staging/mixing/ excess material storage during construction • Off-site disposal of excess	• Short	• Grading/Building Permits • Shoreline (ESA/BA)	Retain
• Sealed Sheet Pile: Steel/Plastic	• Pre-trenching then PVC wall driven through fill to underlying low permeability layer or direct-driving steel sheetpiles	• Subsurface obstructions like cobbles or debris may hinder or prevent wall installation	• Commercially available	• Visual inspection	• No residuals aside from excess graded material	• Minimal. No residuals after construction	• Short	• Grading/Building Permits • Shoreline (ESA/BA)	Retain
Hydraulic Containment									
– Cut-Off Trench	• Excavation and backfill with gravel and piping.	• Groundwater recovered from trench requires treatment and disposal with permit	• Commercially available	• Periodic maintenance • Equipment replacement	• Extracted groundwater must be treated and disposed	• Materials and excess soils during construction • Off-site disposal of trench soils	• Short	• Grading/Building Permits • Shoreline (ESA/BA)	Retain

TABLE 3

TECHNOLOGY SCREENING - IMPLEMENTABILITY

Former Koppers Facility
Wauna, Oregon

Technology	Components	Limitations	Availability	Operation & Maintenance	Residual Produced	Storage & Handling	Estimated Cleanup Time[1]	Permits/ Approvals	Retain/ Eliminate
– Phytoremediation Barrier	• Planting of a barrier of trees along down-gradient edge of affected area	• Regulatory acceptance uncertain • Barrier may be less effective during winter	• Commercially available, not common	• Visual inspection • Fertilizer may be required for optimum growth • Management of leaf fall	• None – Constituents not expected to bio-accumulate • Leaf fall	• Leaf fall	• Medium. May require use of other method to attain objectives	• Grading/Building Permits • Shoreline (ESA/BA)	Retain
In-situ[3] Treatment									
Bioremediation									
– Biosparging Wells	• Installation of treatment area through excavation and placement of piping and gravel	• Requires ongoing operations and maintenance • Potential for volatilizing site constituents (vapors or odors)	• Commercially available	• Monitoring will be needed to demonstrate effectiveness. • System will require periodic maintenance due to microbial fouling	• No groundwater constituents if biosparging is effective • Constituent vapors or odors may be generated • Development water must be disposed	• None	• Long	• Grading/Building Permits • Shoreline (ESA/BA)	Eliminate • Long cleanup time and ongoing maintenance required • Potential for vapors/odors
– Sparge Trench	• Installation of treatment area through excavation and placement of piping and gravel	• Requires ongoing operations and maintenance	• Commercially available	• Monitoring will be needed to demonstrate effectiveness. • System will require periodic maintenance due to microbial fouling	• None if barrier is effective • Drill cuttings and development water must be disposed	• None	• Long	• Grading/Building Permits • Shoreline (ESA/BA)	Retain
Phytoremediation									
– Source Area Remediation	• Planting of a network of trees or tree saplings over source area	• Hydraulic control may be low in winter • Regulatory acceptance uncertain	• Commercially available, not common	• Visual inspection • Fertilizer may be required for optimum growth	• None – Constituents not expected to bio-accumulate • Leaf fall	• Leaf fall	• Long. Additional technology needed to attain objectives	• Grading/Building Permits • Shoreline (ESA/BA)	Eliminate as an stand-alone technology • Long time to address seeps is unacceptable
Ex-situ[4] Groundwater Treatment									
– Plant Facility	• Piping from treatment system to disposal plant facility or truck to complete transfer	• Capacity of plant facility not likely to be an issue	• Available	• O+M included in facility operations	• Biosolids from NPDES permitted facility	• None	• N/A[5]	• NPDES allowance with renewed permit	Retain

Notes:

[1] Cleanup Time is the estimated time to attain the interim measure objective: Immediate = <1 month Short = 1 month to 1 year Medium = 1 - 2 years Long = >2 years

[2] Example: Matcon ^{TM} system.

[3] In-situ refers to the removal of contaminants through destruction of contaminants or transfer of contaminants to another medium (i.e., water or air).

[4] Ex-situ refers to treatment completed above ground.

[5] N/A = not applicable.

TABLE 4

TECHNOLOGY SCREENING – COST

Former Koppers Facility
Wauna, Oregon

Technology	Unit Cost	Retain/Eliminate
Natural Attenuation	Low	Retain
Containment		
Physical Containment		
– Capping		
• Asphalt Cap	Moderate/High	Retain – more expensive asphalt cap may be more compatible with future mill use than cheaper soil/clay cap
• Soil/Clay Cap	Moderate	Retain
– Low Permeability Barrier		
• Slurry Wall: Soil Bentonite	Moderate	Retain
• Sealed Sheet Pile Wall: Plastic/Steel	High	Eliminate - more expensive than soil/bentonite with no performance benefit
Hydraulic Containment		
– Cut-off Trench	Moderate	Retain
– Phytoremediation Barrier	Low	Retain
In-Situ Groundwater Treatment		
Bioremediation		
– Sparge Trench	Moderate	Retain
Phytoremediation		
– Source Area Remediation	Moderate	Retain
Ex-situ Groundwater Treatment		
– Plant Facility	Low	Retain

TABLE 5

CONTAINMENT AREA WATER BALANCE ESTIMATE

Former Koppers Site
Wauna, Oregon

Item	Annual Average Flow (gpm)
Aquitard Flow[1]	0.09
Barrier Wall Flow[2]	0.004
Surface Water Infiltration[3]	3.3
TOTAL	**3.4**

Notes:

[1] Based on aquitard hydraulic conductivity of 1.0×10^{-8} cm/sec, an upward gradient of 0.17, and a thickness of 10 feet.

[2] Based on a barrier wall hydraulic conductivity of 1.0×10^{-6} cm/sec, a gradient of 0.33, and a wall thickness of 3 feet.

[3] Based on a contained area of 5.5 acres, an annual rainfall of 57.5 inches per year, and assuming that 18.4% of rainfall infiltrates into natural soil.

TABLE 6

EVAPOTRANSPIRATION, PRECIPITATION, AND TOTAL ESTIMATED WATER USE FOR HYBRID POPLAR TREES

Former Koppers Facility
Wauna, Oregon

	ETo					Year 1[3]	Year 2[3]	Year 3[3]	Year 4[3]
	OSU[1]		Precipitation[2]			Vt	Vt	Vt	Vt
Month	(in/mo)	(ft/d)	(in/mo)	(ft/d)	gal/d/A	gal/d/A	gal/d/A	gal/d/A	gal/d/A
January	0	0.00000	9.19	0.02553	8,320	0	0	0	0
February	0	0.00000	6.85	0.01903	6,201	0	0	0	0
March	0	0.00000	6.24	0.01733	5,649	0	0	0	0
April	2.5	0.00694	3.92	0.01089	3,549	181	509	2,037	5,545
May	3.1	0.00833	2.53	0.00703	2,290	217	611	2,444	6,654
June	5.8	0.01611	1.78	0.00494	1,611	420	1,181	4,726	12,864
July	7.5	0.02016	0.73	0.00203	661	526	1,478	5,914	16,098
August	7.5	0.02016	1.05	0.00292	951	526	1,478	5,914	16,098
September	6	0.01667	2.13	0.00592	1,928	435	1,222	4,889	13,308
October	2.5	0.00672	4.55	0.01264	4,119	175	493	1,971	5,366
November	0	0.00000	8.80	0.02444	7,966	0	0	0	0
December	0	0.00000	9.69	0.02692	8,772	0	0	0	0

1. Monthly Average Reference Evapotranspiration (ETo) as reported by Oregon State University for Orchard Crops in the Willamette Valley. Growing season from April through mid-October. in/mo = inches per month. ft/d = feet per day.
2. Precipitation from Clatskanie, Oregon (351643). Based on daily record from July 1, 1948 to December 31, 2002.
3. Calculated total volume of water used in gallons per day (gal/d) per 1.0 acre, where:
   Vt = (ETo)(θ)(LAI)(A)
   θ = hybrid poplar specific, age-dependent water use multiplication factor (as a percentage)
   LAI = Leaf Area Index is age-specific, approximated leaf area per unit area of ground surface
   A = 1.0 acre, based on 10 foot x 10 foot spacing (density of 435 tress per acre)

Year	LAI	Θ
2	0.3	0.75
3	0.6	1.5
4	0.7	3.5

4. References:
   A. Walter, et al., National Irrigation Symposium: Proceedings of the 4th Decennial Symposium, November 14th – 16th, Phoenix, AZ: ASCE's standard reference evapotranspiration equation, pp. 209-215 (2000). American Society of Agricultural Engineers, St. Joseph, MI. From International Journal of Phytoremediation: Vol. 3, No. 1, pp. 87-104 (2001) "Groundwater Capture Using Hybrid Poplar Trees: Evaluation of a System in Ogden, Utah" by A. Ferro, et al.

TABLE 7

IRM ALTERNATIVES EVALUATION
Former Koppers Site
Wauna, Oregon

Alternative	Implement-ability	Short-Term Effectiveness	Long-Term Effectiveness	Reduction of Mobility, Toxicity, and Volume	Cost	Overall Protection
1	Moderate	Moderate	High	High	High	High
2	High	High	Low	Low	Low	Low
3	Moderate	High	Moderate	Moderate	Moderate	Moderate

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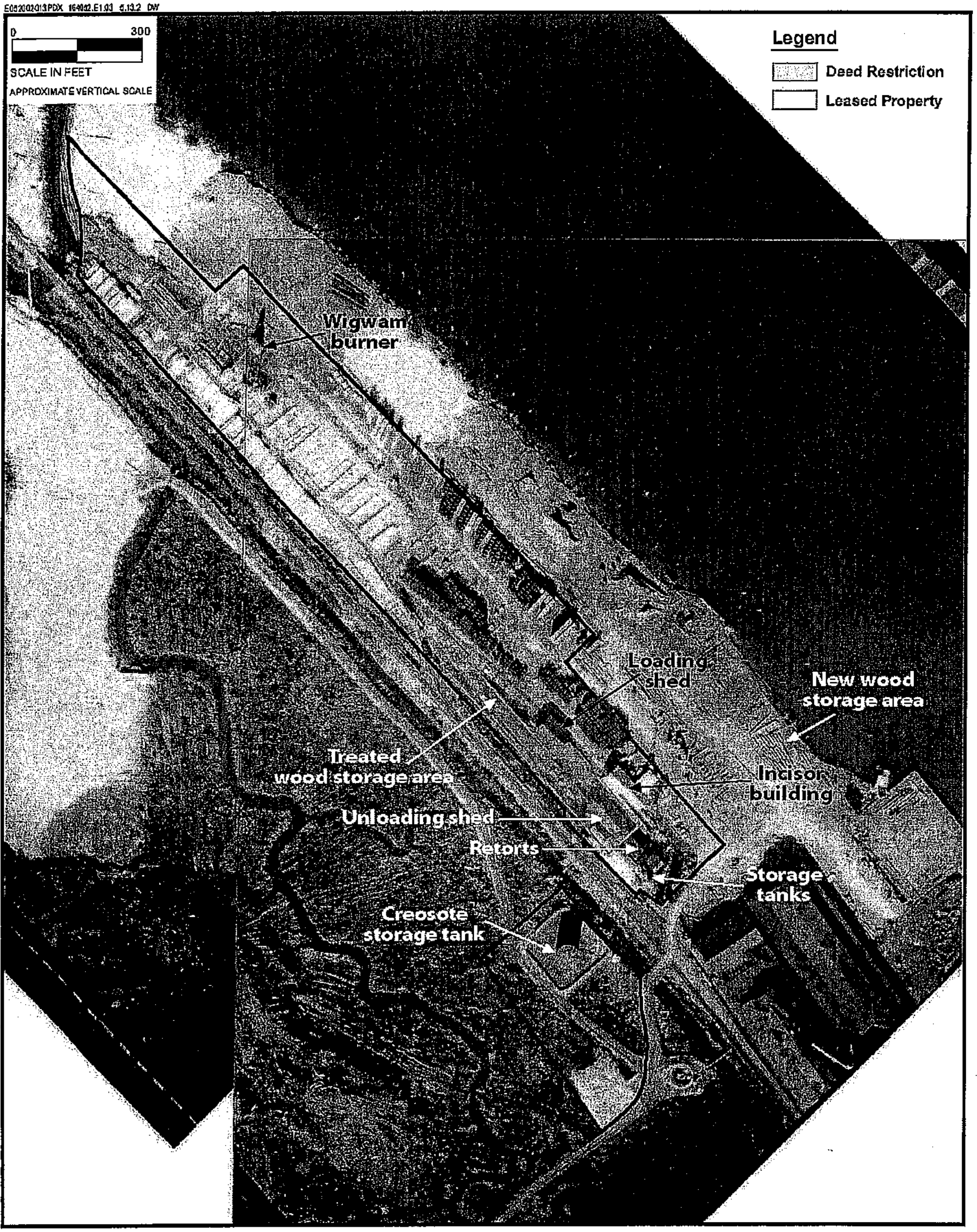

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NORTH

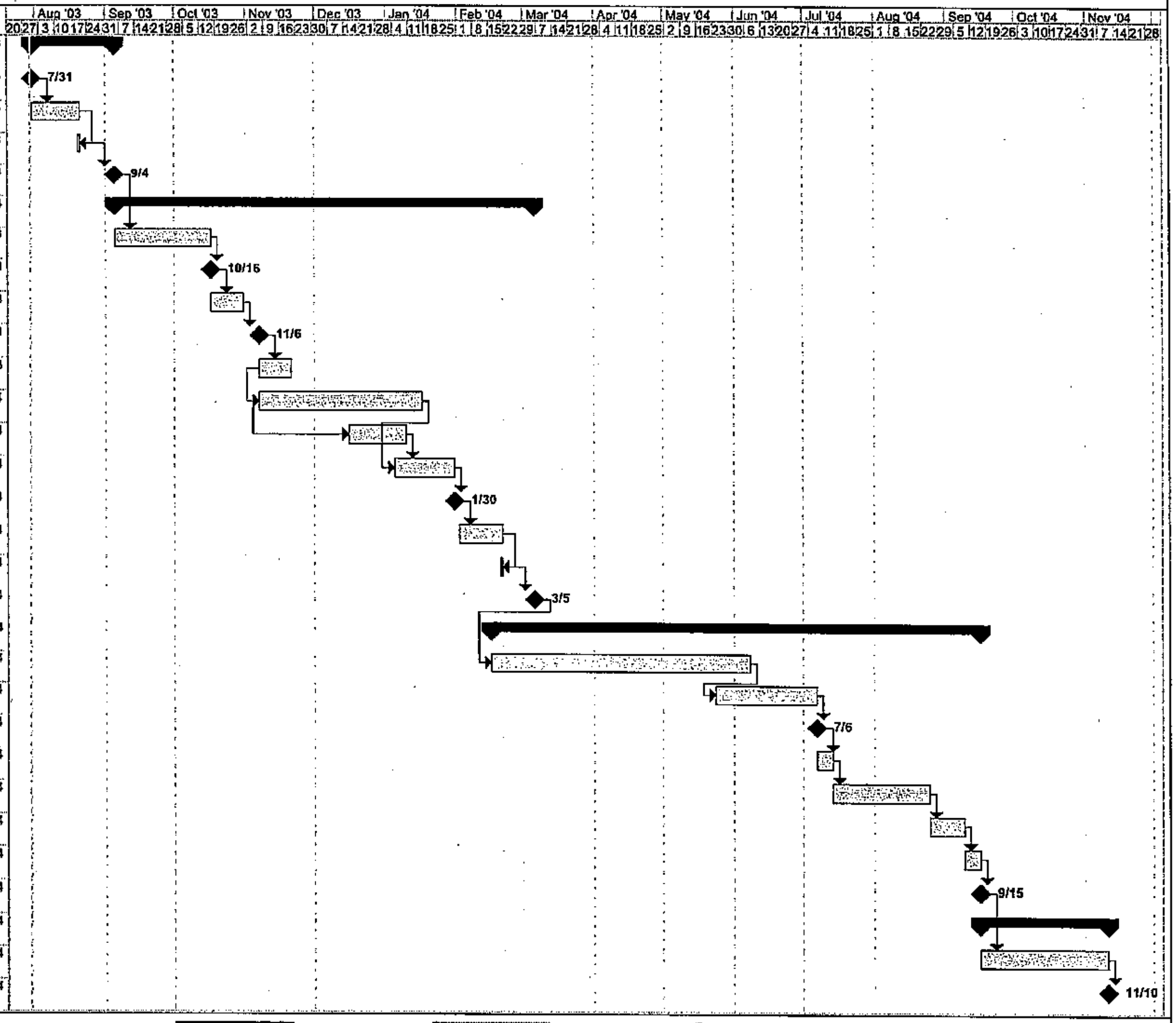
Figure 2
Location of Historical Operations (2/1/61)
FORMER KOPPERS WOOD-TREATING SITE
WAUNA, OREGON

CH2MHILL

From RI Report, CH2MHill 2002

Figure 3
IRM Implementation Schedule
Former Koppers Site, Wauna OR

ID	Task Name	Duration	Start	Finish
1	**IRM Alternatives Evaluation**	25 days	Thu 7/31/03	Thu 9/4/03
2	Submit IRM Evaluation Report to DEQ	0 days	Thu 7/31/03	Thu 7/31/03
3	DEQ Review	15 days	Thu 7/31/03	Wed 8/20/03
4	DEQ Meeting	1 day	Wed 8/20/03	Wed 8/20/03
5	DEQ Approval of IRM Alt. Evaluation	0 days	Thu 9/4/03	Thu 9/4/03
6	**IRM Design**	125 days	Fri 9/5/03	Fri 3/5/04
7	Conceptual Design	30 days	Fri 9/5/03	Thu 10/16/03
8	Submit Conceptual Design Report to DEQ	0 days	Thu 10/16/03	Thu 10/16/03
9	DEQ Review	10 days	Fri 10/17/03	Thu 10/30/03
10	DEQ Approval, Conceptual Design	0 days	Thu 11/6/03	Thu 11/6/03
11	Additional Data Collection	10 days	Fri 11/7/03	Thu 11/20/03
12	Engineering	45 days	Fri 11/7/03	Fri 1/16/04
13	Monitoring Plan	15 days	Tue 12/16/03	Fri 1/9/04
14	IRM Design and Implementation Plan	20 days	Mon 1/5/04	Fri 1/30/04
15	Submit IRM Plan to DEQ	0 days	Fri 1/30/04	Fri 1/30/04
16	DEQ Review	15 days	Mon 2/2/04	Fri 2/20/04
17	DEQ Meeting	1 day	Fri 2/20/04	Fri 2/20/04
18	DEQ Approval of IRM Plan	0 days	Fri 3/5/04	Fri 3/5/04
19	**IRM Implementation**	150 days	Mon 2/16/04	Wed 9/15/04
20	Permitting	80 days	Mon 2/16/04	Mon 6/7/04
21	Contracting	30 days	Mon 5/24/04	Tue 7/6/04
22	Commence Field Construction	0 days	Tue 7/6/04	Tue 7/6/04
23	Mobilization	5 days	Wed 7/7/04	Tue 7/13/04
24	IRM Construction	30 days	Wed 7/14/04	Tue 8/24/04
25	Commissioning	10 days	Wed 8/25/04	Wed 9/8/04
26	Demobilization	5 days	Thu 9/9/04	Wed 9/15/04
27	IRM Startup	0 days	Wed 9/15/04	Wed 9/15/04
28	**IRM Implementation Report**	40 days	Thu 9/16/04	Wed 11/10/04
29	Report preparation	40 days	Thu 9/16/04	Wed 11/10/04
30	Submit IRM Implementation Report to DEQ	0 days	Wed 11/10/04	Wed 11/10/04



Project: IRM Schedule - Ver-03
Date: Wed 7/30/03

Task	▨	Progress	▬	Summary	▬	External Tasks	▨	Deadline	⇩
Split	⋯	Milestone	◆	Project Summary	▬	External Milestone	◆		

Appendix A

Relevant Figures from the RI Report

Figure 5-5
Former Koppers Site
Wauna, Oregon
Free and Residual Creosote Locations

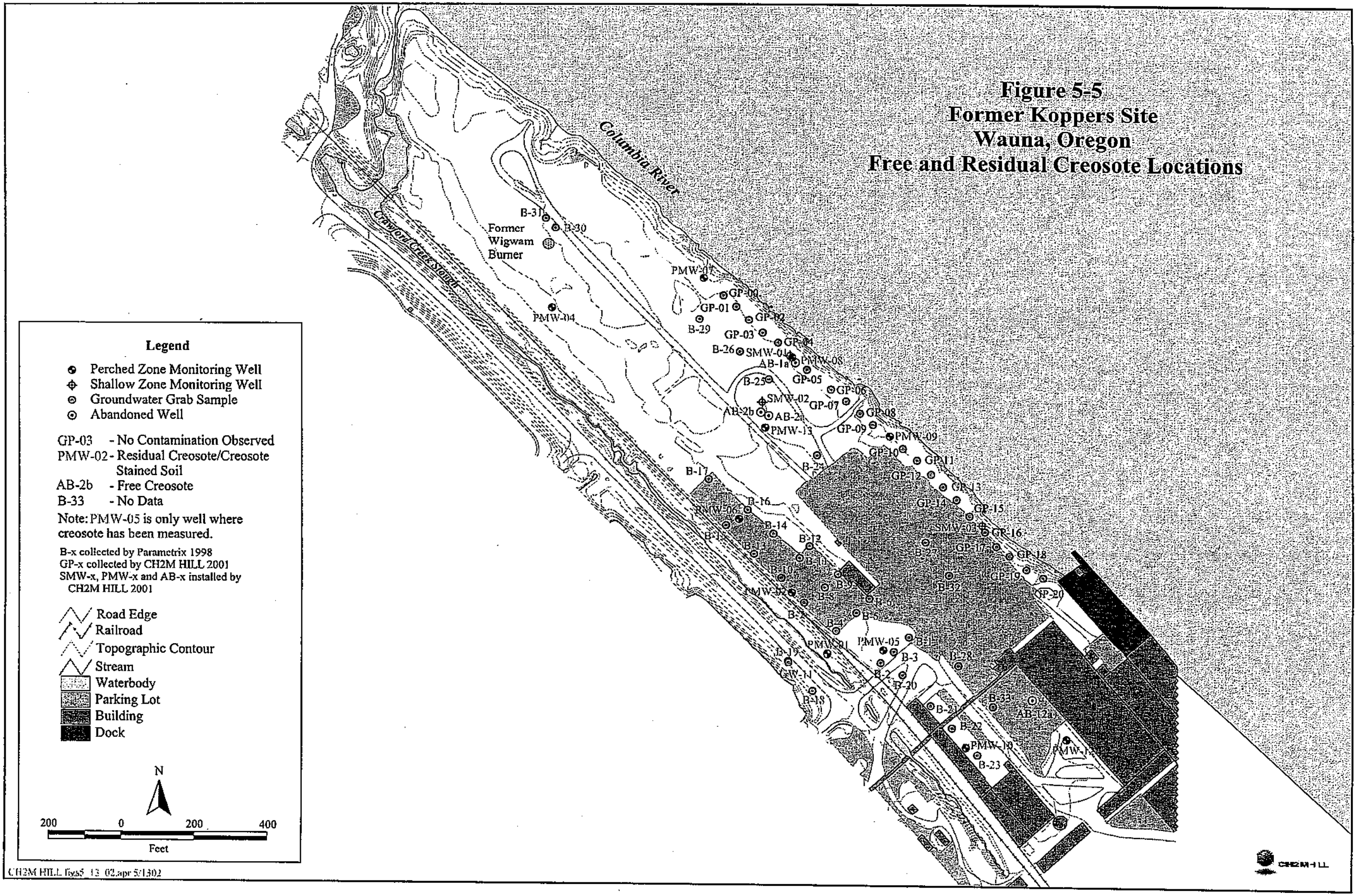


Figure 5-6
Former Koppers Site
Wauna, Oregon
Groundwater Detections of CPAHs and Naphthalene
(January 2002)

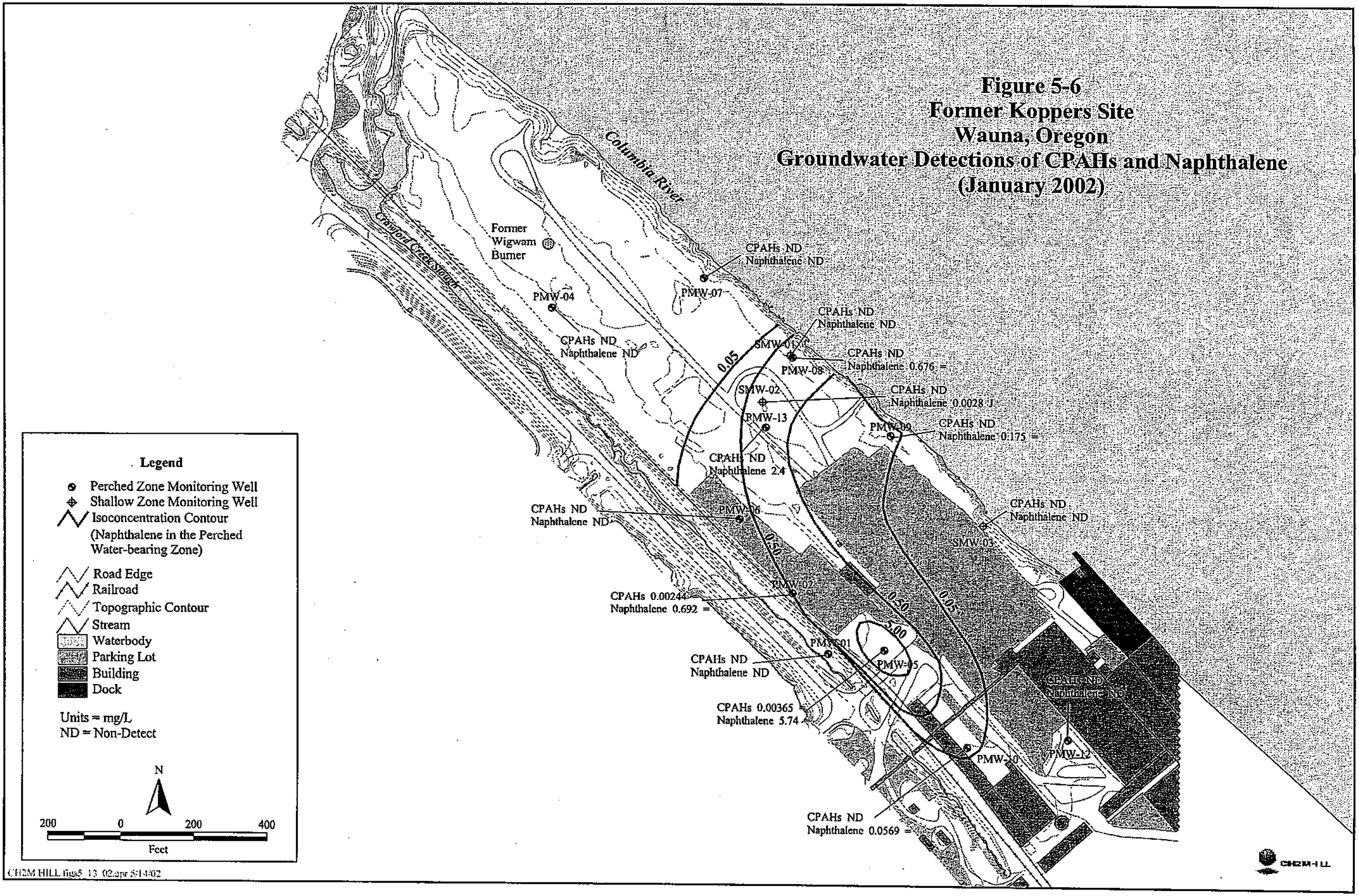


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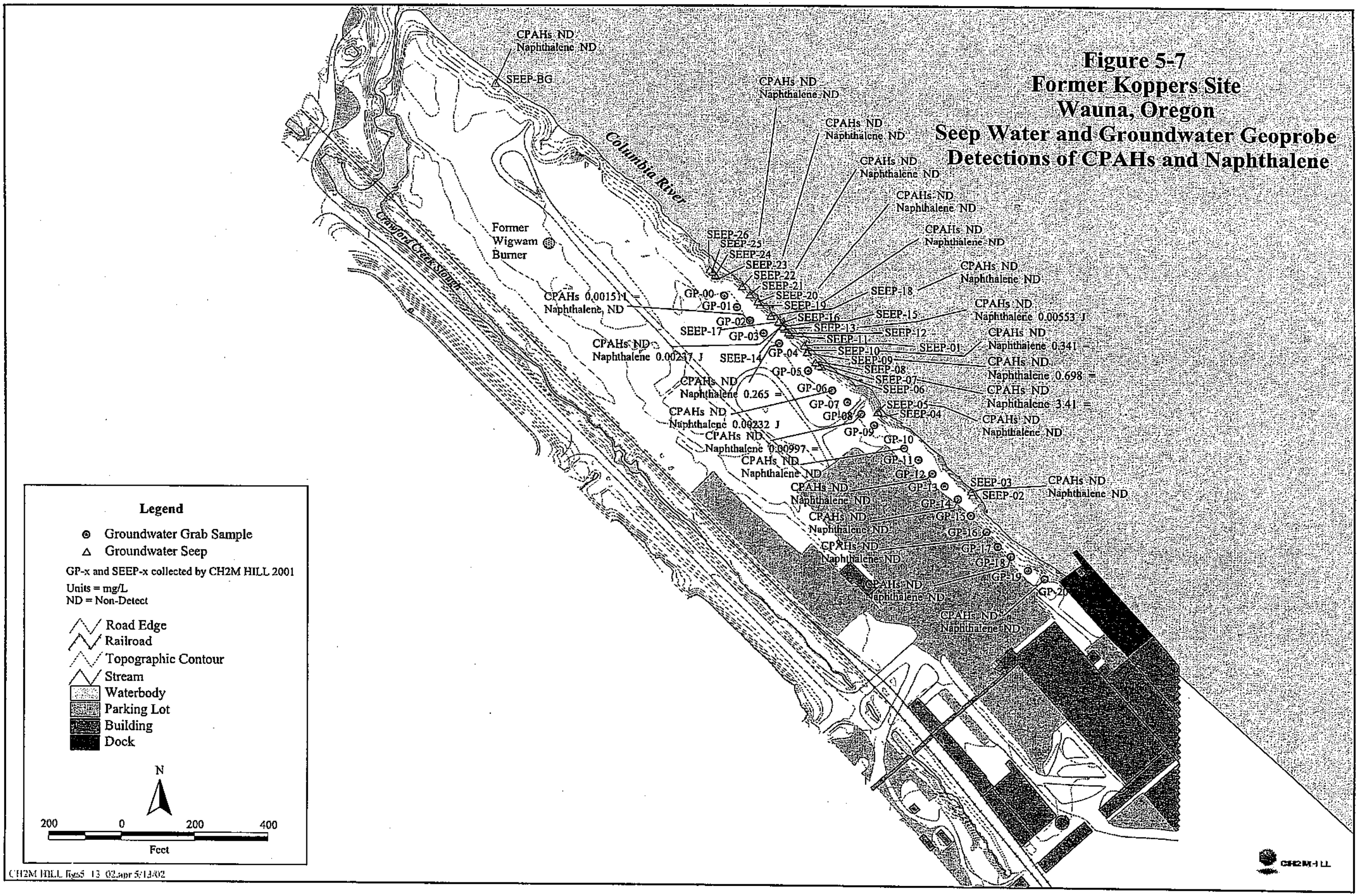
Figure 5-7
Former Koppers Site
Wauna, Oregon
Seep Water and Groundwater Geoprobe Detections of CPAHs and Naphthalene



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APPENDIX B – HYDROGEOLOGIC MODELING REPORT

Memo

To **Kurt Paschl, Beazer East, Inc.** Charge no **9151.006**
Julie Raming, Georgia Pacific LLC
From **Miao Zhang, P.E.** cc **Stu Brown, Bridgewater**
Chin Man Mok, P.E. **Project File**
Larry McGaughey, P.E.
Tel **(206) 342-1760**
Fax **(206) 342-1761**
Date **June 27, 2008**

Subject **Hydrogeologic Modeling Report**
Former Koppers Facility
Wauna, Oregon

1.0 INTRODUCTION

This report presents the groundwater modeling performed to support evaluation of remedial action alternatives as part of the Feasibility Study (FS), for the Former Koppers Facility in Wauna, Oregon (the site). AMEC Geomatrix, Inc. (AMEC; formerly Geomatrix Consultants, Inc.) developed a numerical groundwater flow model (Wauna Model) for the modeling presented in this report. This work was performed on behalf of Beazer East, Inc. (Beazer), and Georgia Pacific LLC (GP). A description of the site, including the location and history, is presented in the FS report. The Wauna Model was developed in 2004 as a tool for the final design of the Interim Remedial Measure (IRM) that was implemented in 2004/2005 to address seepage of groundwater from a perched water-bearing zone at the site into the Columbia River. The IRM, which consists of a low-permeability subsurface barrier, an aeration treatment trench, and a network of monitoring wells and piezometers, was constructed in 2004/2005 and became fully operational in February 2005.

The site hydrogeologic and environmental conditions, the computer codes, the design of the Wauna Model, and initial model calibration were presented in Appendix C of the Revised IRM Design Report (Geomatrix, 2004) and are therefore not repeated here. The modeling summarized in this report was performed to assess the remedial action alternatives addressed in the FS report. The design concepts for the remedial action alternatives are presented in the FS report and are not repeated here.

Directions referenced in this report are to the Mill coordinate system (i.e., plant north) rather than true directions. Plant north is rotated approximately 45^{o} clockwise from true north.

2.0 OBJECTIVES

The overall objective of the groundwater modeling is to support development and evaluation of remedial action alternatives for the site. Specific objectives include:

1. Verify the calibrated groundwater model using hydrologic data collected after construction of the IRM, so that the model accurately reflects existing conditions at the site; and

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AMEC Geomatrix

2. Evaluate the effects of the remedial action alternatives on groundwater flow at the site.

3.0 APPROACH

The groundwater flow model developed for design of the IRM was used as a starting point (Geomatrix, 2004). This model had been developed and calibrated to site conditions as they existed prior to construction of the IRM. To support the FS, the model was first updated to represent the as-built subsurface barrier alignment and surface paving conditions following IRM construction (Geomatrix, 2006). Second, the model was verified by comparing the simulated heads to the observed heads for the period of January 2005 to March 2008 using the rainfall data recorded during this period. After verifying that the model accurately simulates current conditions, the model was used to evaluate the hydrologic impact and particle travel times for the following alternatives:

- Alternative GW1: Maintain the existing IRM configuration, including subsurface barrier and aeration treatment trench;
- Alternative GW3: Retain the existing IRM, but extend the eastern leg of the subsurface barrier wall from the southeastern corner to the low-permeability layer along the drainage ditch to the south of the IRM area.

The hydrologic impacts of these two alternatives were assessed by evaluating (1) the minimum distance between ground surface and water table (freeboard); and (2) estimated travel time for particles released on the site before they arrive at the Columbia River.

4.0 MODELING TOOLS AND MODEL DESIGN

The Wauna Model utilizes the 1996 version of MODFLOW, a modular finite-difference computer code developed by the United States Geological Survey (Harbaugh and McDonald, 1996). Groundwater flow paths were calculated using the particle tracking code MODPATH, Version 3.2 (Pollock, 1994). Groundwater Vistas (Version 5.19, Environmental Simulations, Inc., Reinholds, Pennsylvania), a commercially available graphical user interface (GUI), was utilized as a pre- and post-processor to prepare MODFLOW and MODPATH data files and evaluate simulation results.

The model design is described in detail in Appendix C of the Revised IRM Design Report (Geomatrix, 2004). Important aspects of the model design as described in the design report are summarized below.

- The model domain covers an area of approximately 640 feet by 2,960 feet and consists of 155 rows and 32 columns. The model consists of one layer representing the entire depth of the perched water-bearing zone. The layer bottom elevation was set at a uniform elevation of +1 foot. Current topographic data were incorporated into the model using the DRAIN package of MODFLOW. The model domain is oriented parallel to the Columbia River. The model is bounded by the Columbia

River to the north, the drainage ditch/Crawford Creek Slough to the south, and Crawford Creek to the west.

- The Columbia River at the north boundary of the model domain and Crawford Creek at the western boundary of the model domain were simulated using the RIVER package of MODFLOW. A no-flow boundary condition was assigned to the southern boundary of the model, along the drainage ditch/slough.
- The perched groundwater zone was simulated as an unconfined unit with uniform hydraulic parameters (hydraulic conductivity, specific yield, and porosity). The calibrated hydraulic conductivity was 55 feet/day (1.94 x 10^{-2} centimeters per second [cm/sec]), and the specific yield was 0.2. The effective porosity in the model was 0.25.
- The model domain was divided into five different net recharge zones to represent areas with different precipitation recharge potential: (1) paved areas, (2) unpaved areas, (3) a high-recharge area south of the existing cap, (4) building areas, and (5) semi-paved areas with roads. The net recharge rate is equal to the infiltration rate minus the evapotranspiration (ET) rate. The infiltration rate for each area was estimated as a fraction of the precipitation. Historical precipitation data collected from 1948 to 2003 at the Clatskanie weather station were used in model calibration. The ET rate used for modeling was assumed to be a fraction of the reference ET rate. The maximum ET rate reported by Oregon State University for orchard crops in the Willamette Valley was used as the reference ET rate. The infiltration and ET fractions appropriate to the site were estimated through model calibration, as presented in Appendix C of the Revised IRM Design Report (Geomatrix, 2004).

5.0 VERIFICATION OF MODEL CALIBRATION

When the groundwater model was developed during design of the IRM, the model was calibrated using water level data collected before construction of the IRM components. Therefore, it was necessary to assess how well the model could simulate groundwater flow under current conditions following construction of the IRM (Geomatrix, 2006).

5.1 Verification Approach

The overall verification approach used was to run the model with the existing IRM components and surface features for the period from January 2005 to March 2008 and then to compare the simulated heads with the measured potentiometric heads. Groundwater heads have been measured regularly since the IRM became operational in February 2005 (AMEC, 2008). The verification run consists of two simulation periods: (1) the pre-IRM period from 1998 to 2004 and (2) the post-IRM period from 2005 to 2008. The model was run without the IRM components to obtain an initial potentiometric head condition for simulation of groundwater conditions with the IRM components in place.

First, the pre-IRM model was run under pseudo-steady-state conditions using the averaged historical precipitation between 1949 through 2007. The resulting potentiometric head results were subsequently used as the initial potentiometric heads for the subsequent, transient simulation using monthly average precipitation data collected at Clatskanie for the period of January 1998 through December 2004. The month-to-month variation of both precipitation and ET was accounted for in the transient simulation. The transient model has 84 stress periods, each of which corresponds to 1 month.

Finally, the as-built subsurface barrier alignment was added to the groundwater flow model. The simulated heads at the end of December 2004 were used as the initial potentiometric heads for the simulation with the IRM components included. The current surface conditions (paved versus unpaved surfaces) were also incorporated into the model with the IRM. The barrier wall configuration and surface paving conditions were taken from the IRM as-built report (Geomatrix, 2006). The post-IRM model was run in a transient mode using precipitation data measured at Clatskanie from January 2005 to March 2008. The month-to-month variation of precipitation and ET was accounted for in the transient simulations. The transient model has 39 stress periods, each of which corresponds to 1 month. The simulated heads for the verification targets were obtained from the simulation output and compared to the measured heads at those targets.

5.2 Verification Targets

Verification of the groundwater flow model calibration was performed by comparing simulated heads with the observed groundwater level data at 20 monitoring wells. The 20 target monitoring wells are divided into five groups.

- Wells ATT-01, ATT-02, ATT-03, ATT-04, and PMW-7 are located west of the aeration treatment trench.
- Wells ATT-05, ATT-06, ATT-10, PMW-13, and SBW-10 are located immediately to the east of the aeration treatment trench, inside the area partially enclosed by the barrier wall.
- Wells PMW-2, PMW-6, and SBW-02 are located within the central portion of the area enclosed by the subsurface barrier;
- Wells PMW-05, SBW-04, and SBW06 are located just inside the barrier wall, near the southeastern, northeastern, and eastern legs of the subsurface barrier, respectively.
- Wells SBW-03, SBW-05, SBW-07, and SBW-08 are located to the east and outside of the area enclosed by the subsurface barrier.

Groundwater elevation data recorded at the following times were used for model verification:

1. Approximately monthly data from February 2005 through January 2006 (February 2, 2005; March 22, 2005; April 15, 2005; May 15, 2005; June 22, 2005; July 8, 2005;

August 22, 2005; October 1, 2005; October 22, 2005; November 15, 2005; December 15, 2005; and January 22, 2006).

2. Approximately quarterly data from February 2006 through November 2007 (March 1, 2006; April 8, 2006; April 15, 2006; July 22, 2006; October 27, 2006; January 26, 2007; June 28, 2007; August 16, 2007; and November 1, 2007).
3. Monthly data from January 2008 through March 2008 (January 17, 2008; February 7, 2008; and March 14, 2008).

Groundwater level data were taken from the Semiannual Monitoring Report for the first half of 2008 (AMEC, 2008).

5.3 Verification Results and Conclusions

Figures 1 through 5 compare the simulated hydrographs for the target wells with the observed groundwater level data. Figure 6 is a scatter plot comparing the simulated and observed heads for the verification targets. The average difference between the simulated and observed water levels is 0.09 feet. The standard deviation of the difference is 0.45 feet (approximately 5% error). The verification results are considered acceptable. These results demonstrated that although the groundwater flow model was calibrated using hydrologic data from the site prior to construction of the IRM components, the model satisfactorily predicted the post-IRM hydrologic conditions.

6.0 PREDICTIVE SIMULATIONS FOR EVALUATION OF ALTERNATIVES

The groundwater flow model including the IRM components was used to evaluate the hydrologic impacts of the following two remedial action alternatives:

1. Alternative GW1 – Maintain the existing IRM configuration, which consists of the subsurface barrier and the aeration treatment trench.
2. Alternative GW3 – Maintain the existing IRM, but extend the eastern leg of the subsurface barrier from the southeast corner to the silt layer adjoining the drainage ditch. Extending the subsurface barrier to the silt layer effectively closes the groundwater flow to the east of the capped area through the existing “gap” between the subsurface barrier and the drainage ditch. This alternative was simulated in the model by establishing a barrier wall along the entire east side of the enclosed area.

The two alternatives are described in detail in the FS report.

6.1 Modeling Approach

For evaluation of each alternative, the model was run in two steps. In the first step, a steady-state simulation was performed using the average precipitation based on measured historical precipitation at Clatskanie from 1949 to 2007. The resulting, simulated groundwater elevations were used as the initial potentiometric heads for the subsequent transient model simulation in the second step. In the second step two simulations were completed: (1) a 5-year transient simulation to assess the depth to groundwater for the remedial action alternatives; and (2) a 30-year transient simulation to assess particle tracking from locations within the IRM area. Both simulations were based on long-term average monthly precipitation data measured at Clatskanie through December 2007. The transient model simulations had one stress period per month (i.e., 60 stress periods for the 5-year simulation and 360 stress periods for the 30-year simulation). Month-to-month variations in precipitation and ET were accounted for in the model simulations.

Following the transient simulation for each alternative, the following modeled results were obtained for evaluation of the hydrologic impacts:

1. The minimum depth to perched groundwater within the area enclosed by the subsurface barrier;
2. Particle travel times from within the area enclosed by the subsurface barrier to the Columbia River, as estimated using MODPATH.

6.2 Analysis Results

The minimum depth to perched groundwater under the average precipitation scenario for Alternatives GW1 and GW3 are shown on Figures 7 and 8, respectively. The minimum depth to perched groundwater is approximately 0.5 ft for both alternatives. Increases in groundwater level under Alternative GW3 were predicted to occur only in the vicinity of the extended subsurface barrier. These results suggest that preventing flow to the east by extending the subsurface barrier to the drainage ditch will not cause significant rises in water level within the IRM area.

The groundwater flow paths and particle travel times are shown on Figures 9 and 10 for Alternatives GW1 and GW3, respectively. The results show that establishing a barrier wall along the entire east side of the enclosed area by extending the barrier to the drainage ditch will not substantially reduce the particle travel times from the release locations within the IRM area to the Columbia River.

7.0 REFERENCES

AMEC (AMEC Geomatrix, Inc.), 2008, Semiannual Report, Groundwater Seeps Interim Remedial Measure: Prepared for Beazer East, Inc., and Georgia Pacific Corporation, June.

Geomatrix (Geomatrix Consultants, Inc.), 2006, Groundwater Seeps Interim Remedial Measure Revised Construction Report: Prepared for Beazer East, Inc., June.

Geomatrix, 2004, Revised IRM Design Report, Former Koppers Facility, Wauna, Oregon, July 26.

Harbaugh, A.W., and McDonald, M.G., 1996, User's documentation for MODFLOW-96, an update to the U.S. Geological Survey Modular Finite-Difference Ground-Water Flow Model: U.S. Geological Survey Open-File Report 96-485, 63 p.

Pollock, D.W., 1994, User's Guide for MODPATH/MODPATH-PLOT, Version 3: A particle tracking post-processing package for MODFLOW, the U.S. Geological Survey finite-difference ground-water flow model: U.S. Geological Survey Open-File Report 94-464.

Attachments:	Table 1	Precipitation and Evapotranspiration Values for the Historical Average
	Figure 1	Comparison of Simulated and Observed Groundwater Levels at Verification Targets West of Aeration Treatment Trench
	Figure 2	Comparison of Simulated and Observed Groundwater Levels at Verification Targets East of Aeration Treatment Trench
	Figure 3	Comparison of Simulated and Observed Groundwater Levels at Verification Targets Within Central Portion of Enclosed IRM Area
	Figure 4	Comparison of Simulated and Observed Groundwater Levels at Verification Targets Within Eastern Portion of Enclosed IRM Area
	Figure 5	Comparison of Simulated and Observed Groundwater Levels at Exterior Verification Targets East of Subsurface Barrier
	Figure 6	Comparison of Simulated and Observed Verification Targets
	Figure 7	Minimum Depth to Water Under Average Precipitation Scenario Alternative GW1 – Current IRM Configuration
	Figure 8	Minimum Depth to Water Alternative GW3 – Extending Subsurface Barrier to Crawford Creek Slough
	Figure 9	Groundwater Flow Paths Under Average Precipitation Scenario Alternative GW1 – Current IRM Configurations
	Figure 10	Groundwater Flow Paths Under Average Precipitation Scenario Alternative GW3 – Extending Subsurface Barrier to Crawford Creek Slough

TABLES

TABLE 1

PRECIPITATION AND EVAPOTRANSPIRATION VALUES

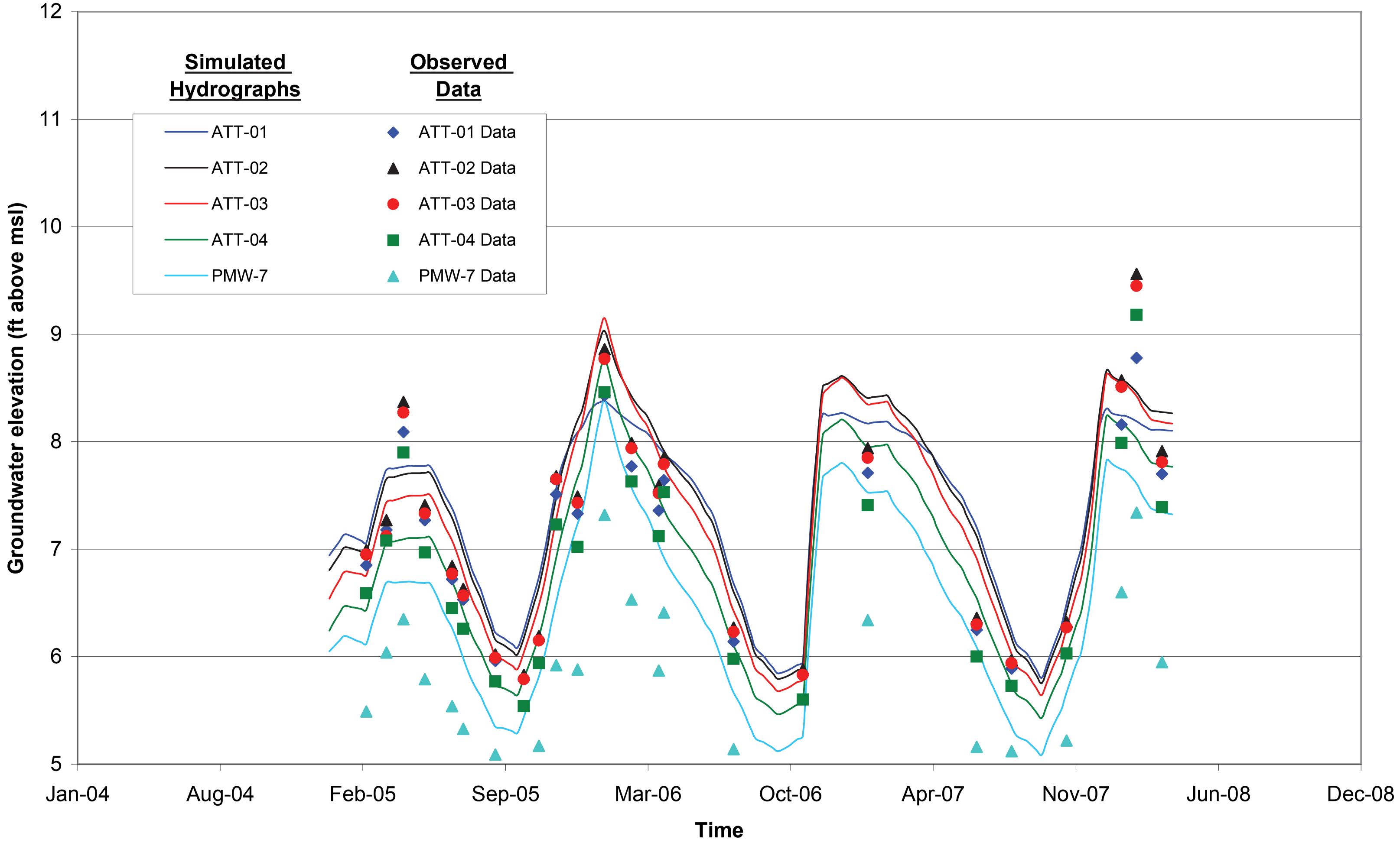
Former Koppers Facility
Wauna, Oregon

Month	Historical Average Precipitation (feet/month)[1]	Evapotranspiration for Orchard Crops (feet/month)[2]
January	0.76	0.00
February	0.55	0.00
March	0.52	0.00
April	0.32	0.21
May	0.21	0.26
June	0.15	0.48
July	0.06	0.62
August	0.09	0.62
September	0.18	0.50
October	0.38	0.21
November	0.73	0.00
December	0.81	0.00

Notes

1. Data from the Western Regional Climate Center for the Clatskanie, Oregon, Station, Western Regional Climate Center, 2008, Western U.S. Climate Historical Summaries, website: htt://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?or1643, accessed April 18.
2. Evapotranspiration rate as reported by Oregon State University for orchard crops in the Willamette Valley.

FIGURES



COMPARISON OF SIMULATED AND OBSERVED
GROUNDWATER LEVELS AT VERIFICATION
TARGETS WEST OF AERATION TREATMENT TRENCH
Former Koppers Facility
Wauna, Oregon

By: RLW	Date: 06/26/08	Project No. 9151.006
AMEC Geomatrix		Figure 1

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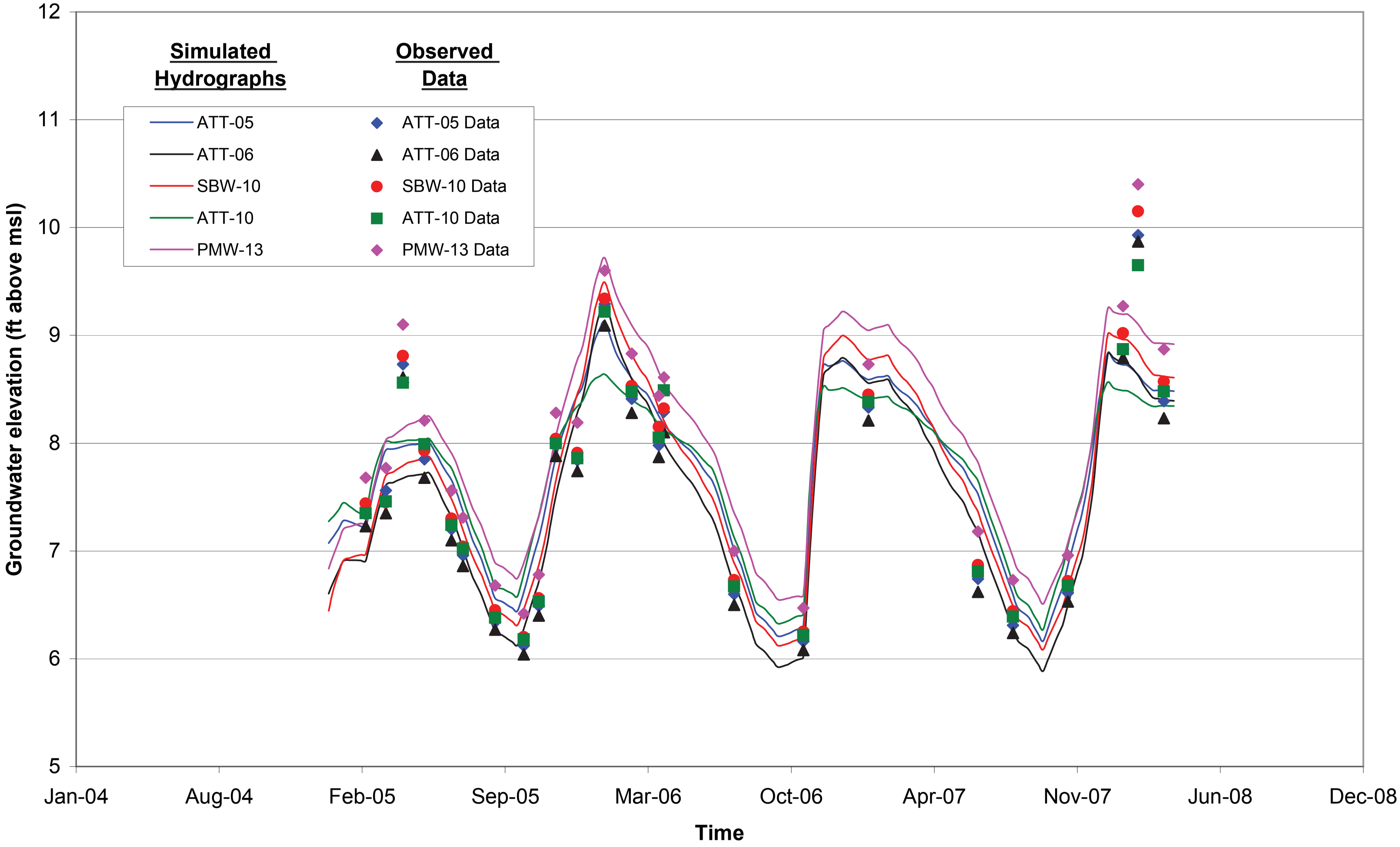
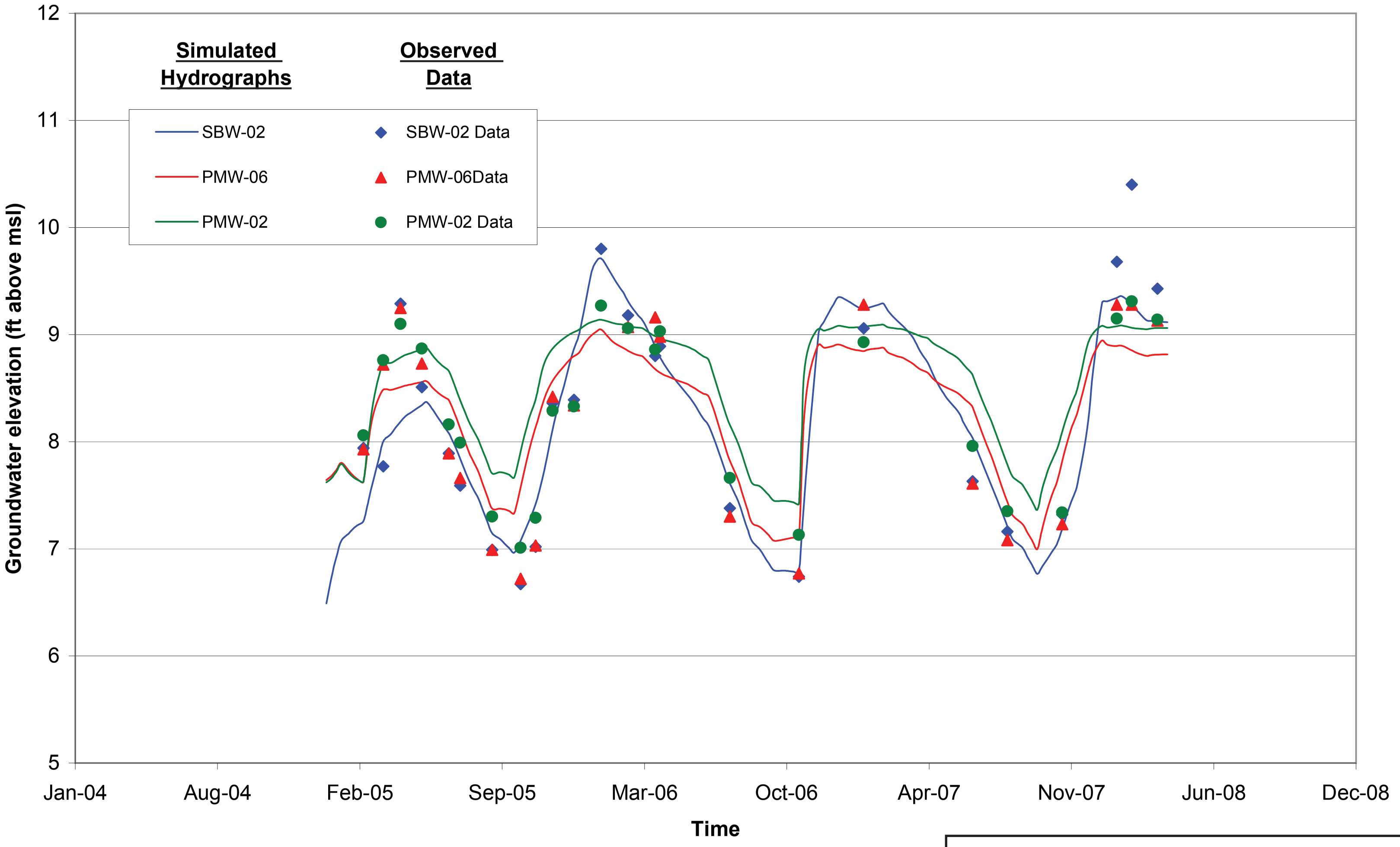


COMPARISON OF SIMULATED AND OBSERVED
GROUNDWATER LEVELS AT VERIFICATION
TARGETS EAST OF AERATION TREATMENT TRENCH
Former Koppers Facility
Wauna, Oregon

By: RLW	Date: 06/26/08	Project No. 9151.006
AMEC Geomatrix		Figure **2**



COMPARISON OF SIMULATED AND OBSERVED
GROUNDWATER LEVELS AT VERIFICATION
TARGETS WITHIN CENTRAL PORTION OF
ENCLOSED IRM AREA
Former Koppers Facility
Wauna, Oregon

By: RLW	Date: 06/26/08	Project No. 9151.006
AMEC Geomatrix		Figure **3**

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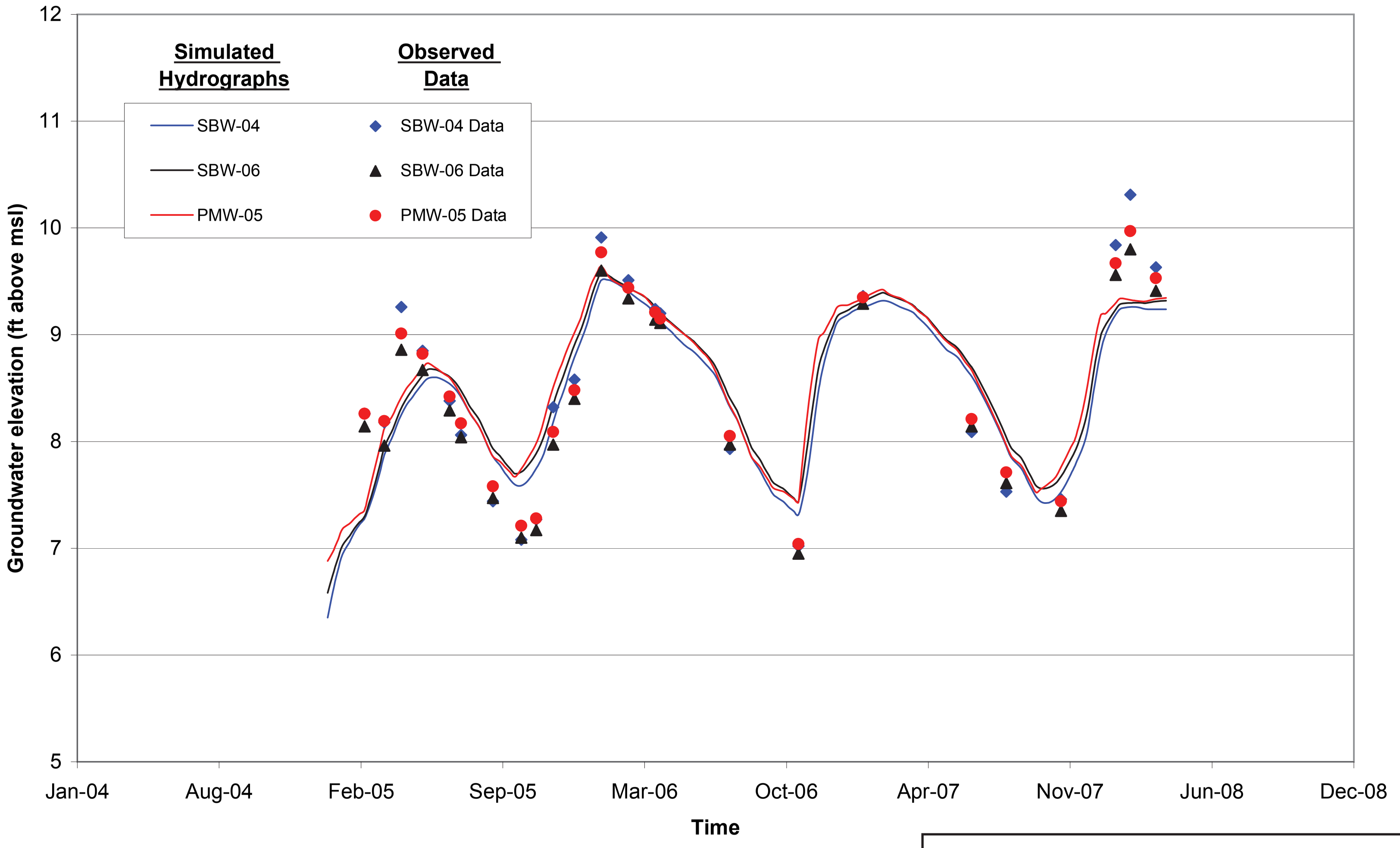

COMPARISON OF SIMULATED AND OBSERVED
GROUNDWATER LEVELS AT VERIFICATION
TARGETS WITHIN EASTERN PORTION OF
ENCLOSED IRM AREA
Former Koppers Facility
Wauna, Oregon

By: RLW | Date: 06/26/08 | Project No. 9151.006

AMEC Geomatrix

Figure 4

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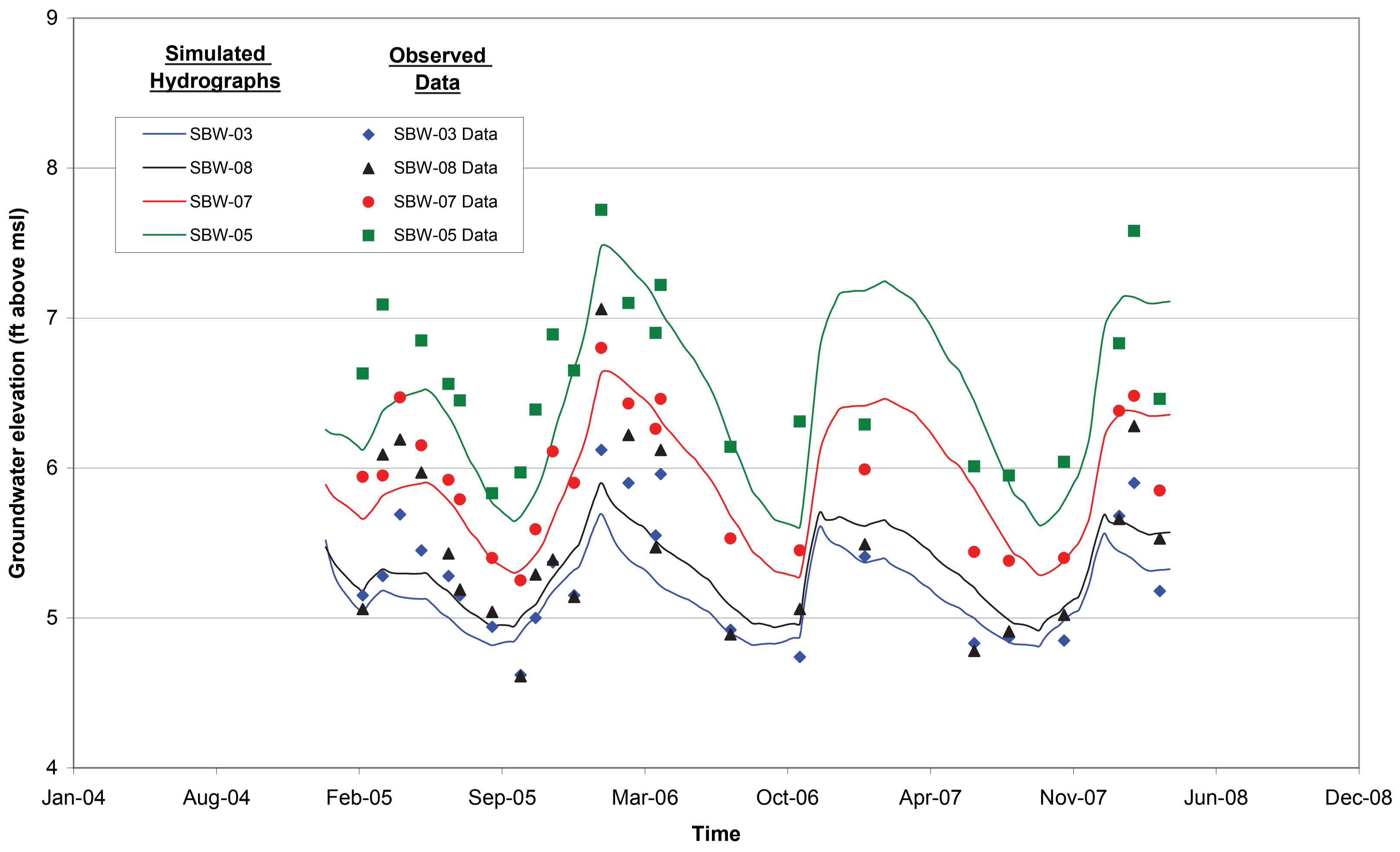
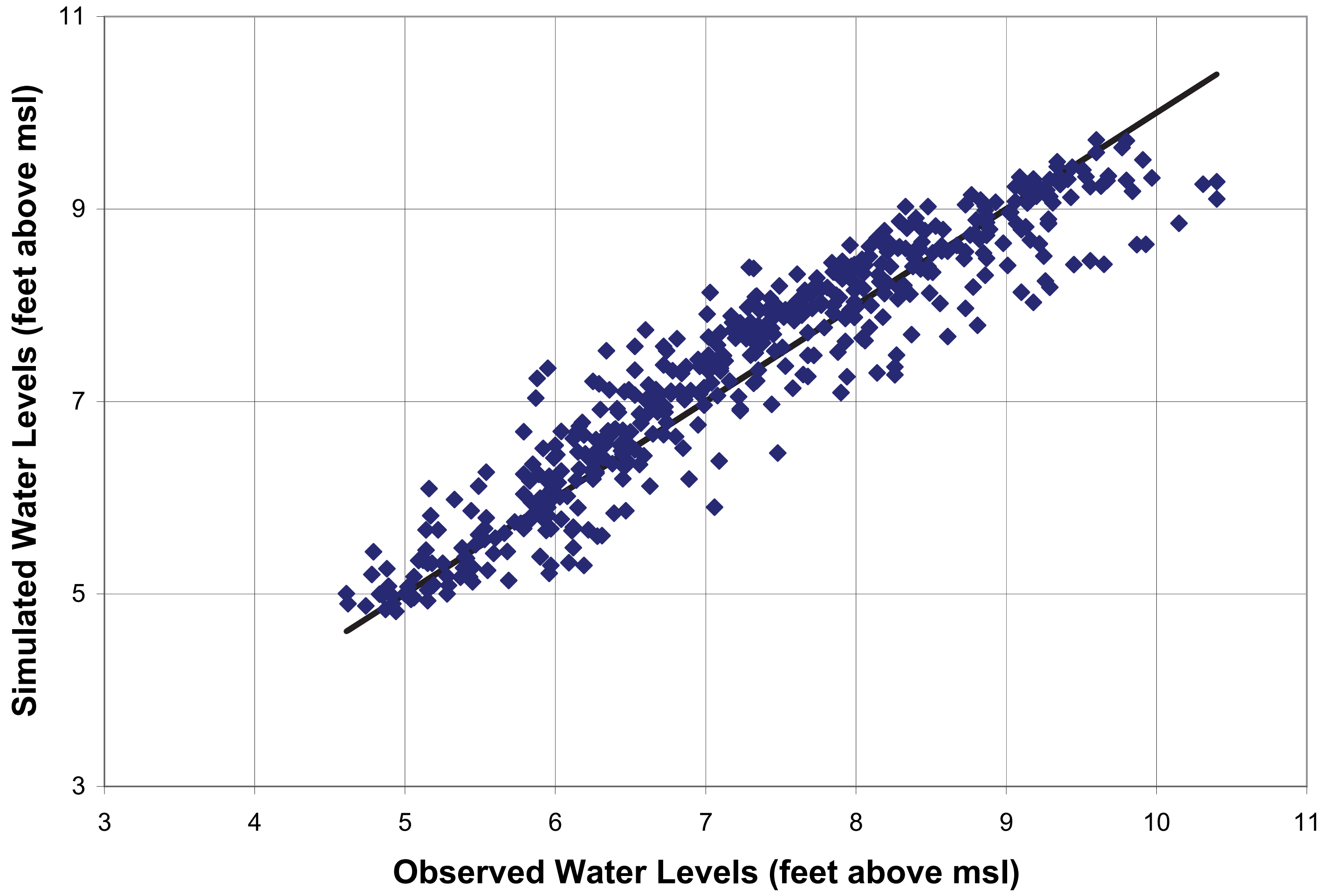


COMPARISON OF SIMULATED AND OBSERVED
GROUNDWATER LEVELS AT EXTERIOR
VERIFICATION TARGETS EAST OF
SUBSURFACE BARRIER
Former Koppers Facility
Wauna, Oregon

By: RLW	Date: 06/26/08	Project No. 9151.006
AMEC Geomatrix		Figure **5**

S:\9151\018_FS_Modeling\Figure 6.ai



COMPARISON OF SIMULATED AND OBSERVED
VERIFICATION TARGETS
Former Koppers Facility
Wauna, Oregon

By: RLW	Date: 06/26/08	Project No. 9151.006
AMEC Geomatrix		Figure **6**

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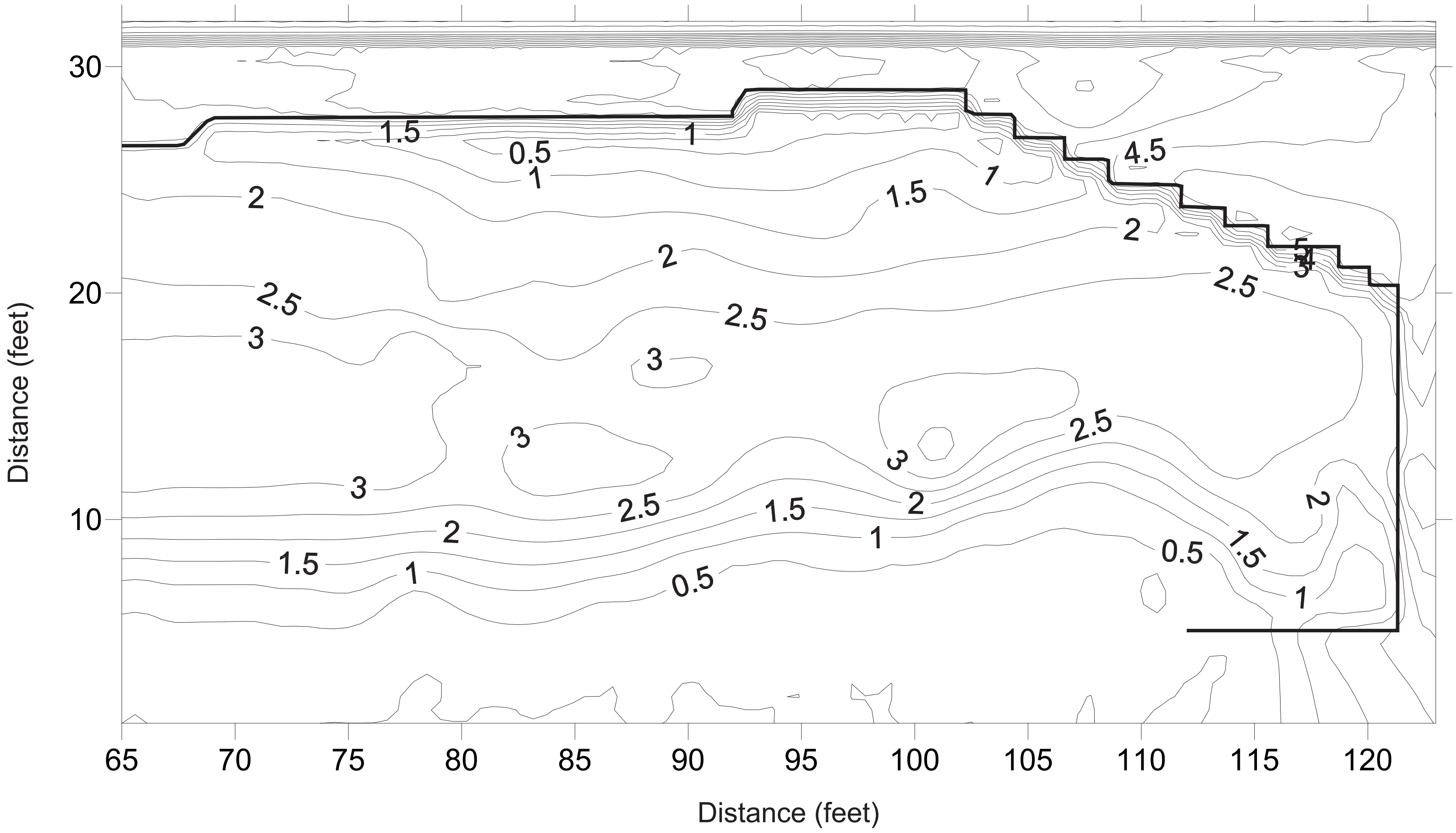

MINIMUM DEPTH TO WATER UNDER AVERAGE PRECIPITATION SCENERIO ALTERNATIVE GW1 - CURRENT IRM CONFIGURATION
Former Koppers Facility
Wauna, Oregon

By: RLW | Date: 06/26/08 | Project No. 9151.006

AMEC Geomatrix | Figure 7

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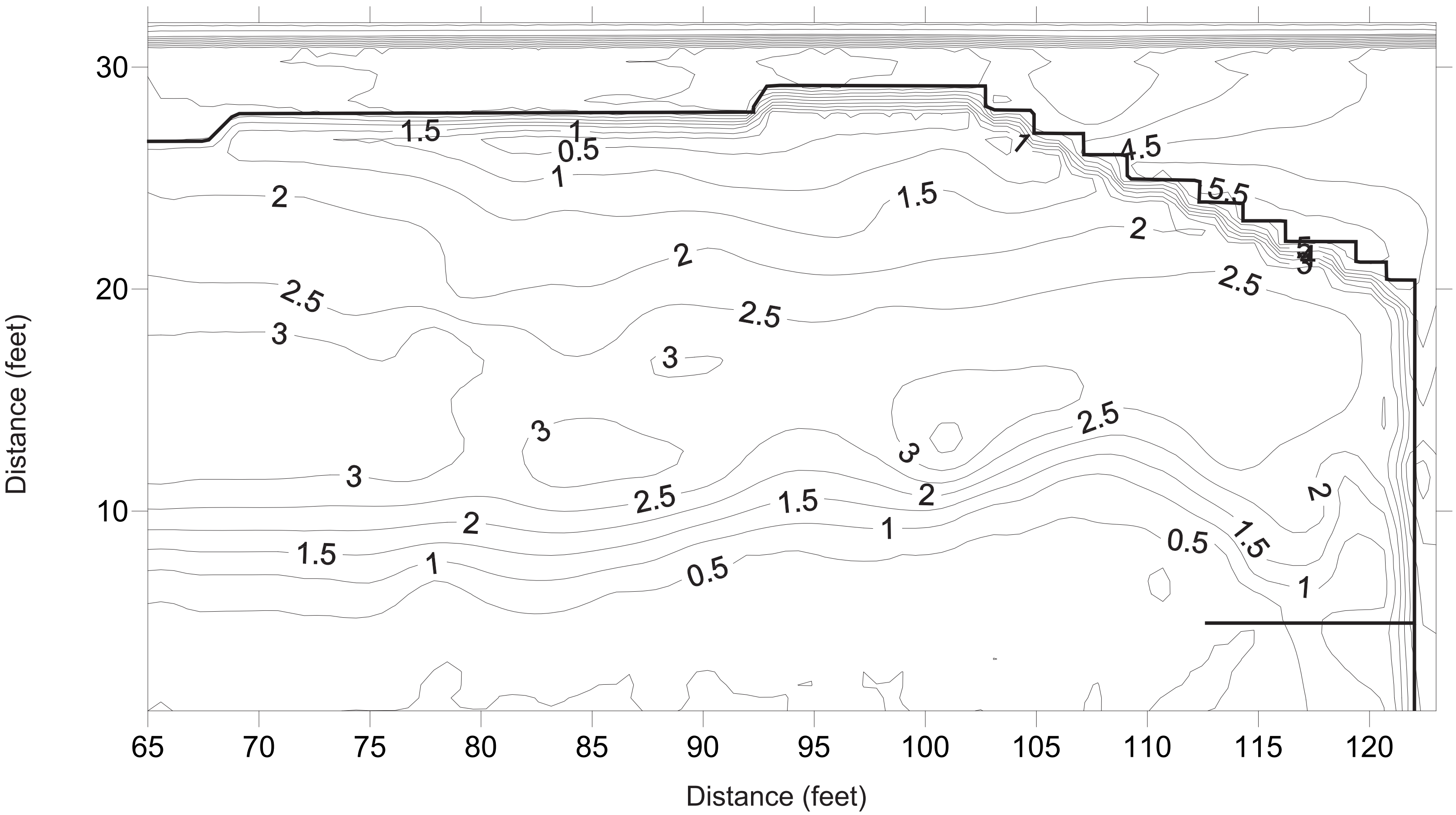

MINIMUM DEPTH TO WATER UNDER AVERAGE PRECIPITATION SCENARIO ALTERNATIVE GW3 - EXTENDING SUBSURFACE BARRIER TO CRAWFORD CREEK SLOUGH
Former Koppers Facility
Wauna, Oregon

By: RLW	Date: 06/26/08	Project No. 9151.006
AMEC Geomatrix		Figure **8**

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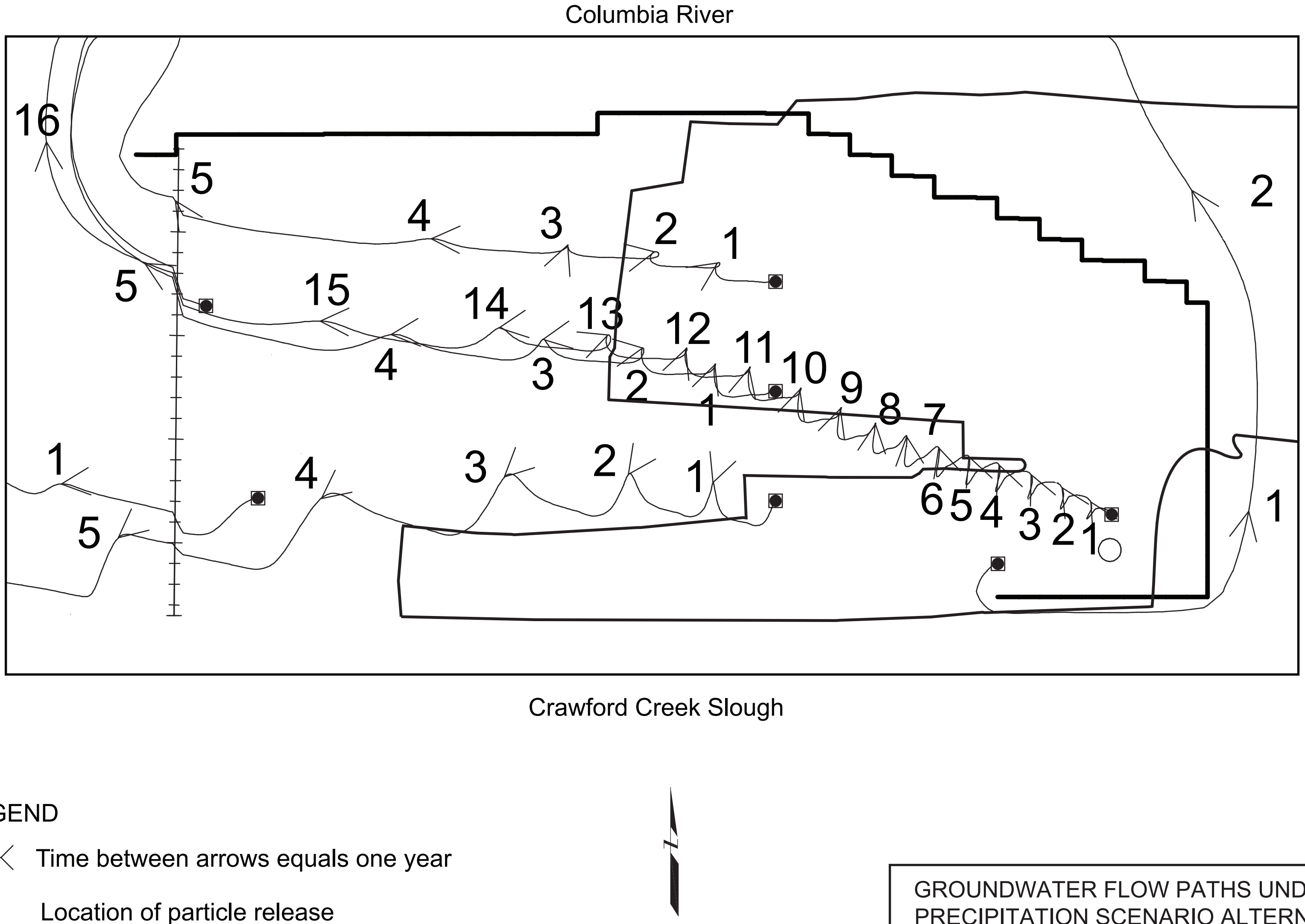

LEGEND

<—< Time between arrows equals one year

● Location of particle release

— Outline of paved area

━ Subsurface barrier

┼┼ Aerobic sparge trench

Note:
Alternative components include:
(1) a low permeability
subsurface barrier, and
(2) an aerobic sparge trench.

GROUNDWATER FLOW PATHS UNDER AVERAGE PRECIPITATION SCENARIO ALTERNATIVE GW1 - CURRENT IRM CONFIGURATION
Former Koppers Facility
Wauna, Orgeon

By: RLW	Date: 06/26/08	Project No. 9151.006
AMEC Geomatrix		Figure **9**

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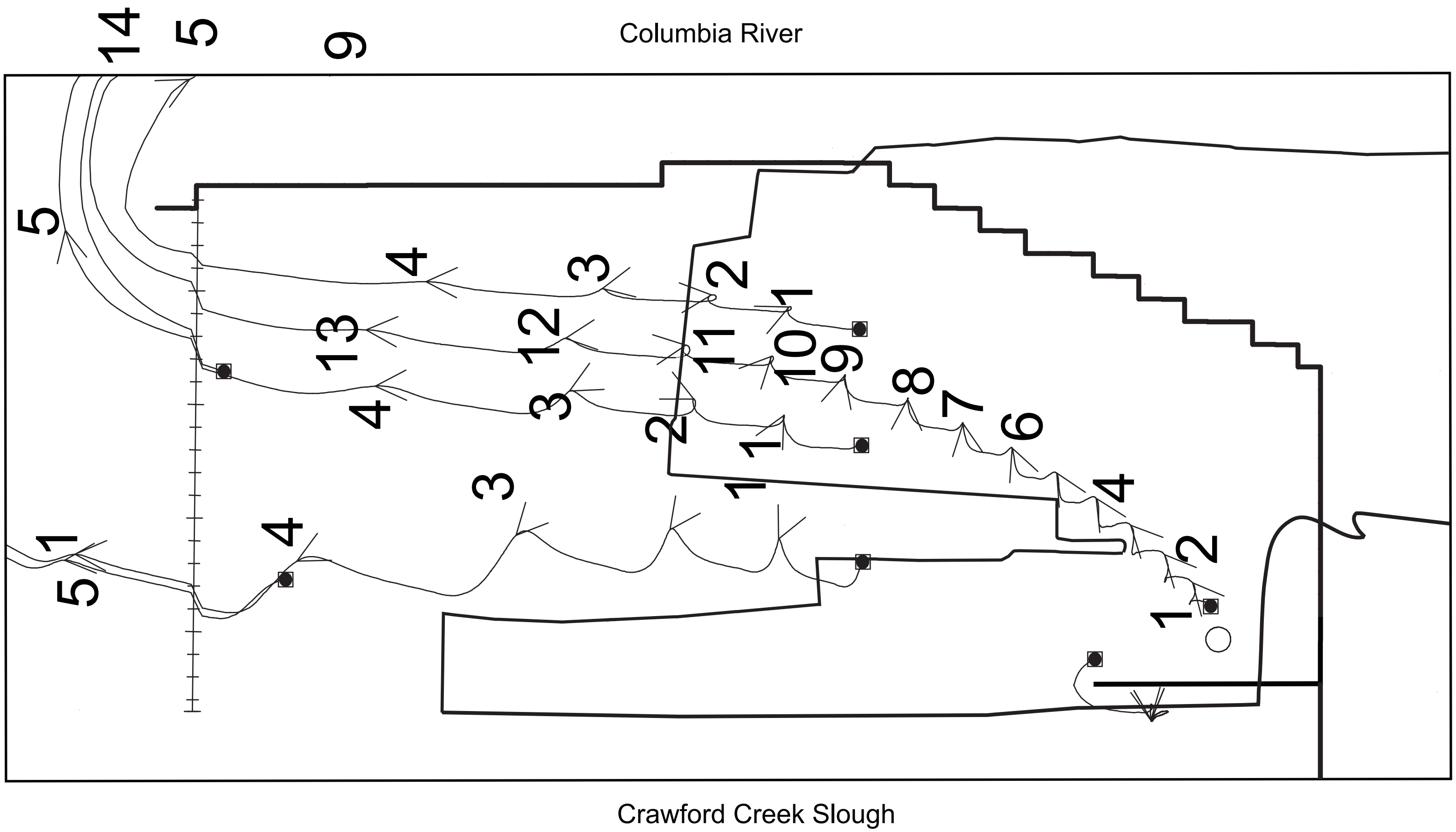

LEGEND

- ↤ Time between arrows equals one year
- ● Location of particle release
- — Outline of paved area
- ━ Subsurface barrier
- ┼ Aerobic sparge trench

Note:
Alternative components include:
(1) a low permeability subsurface barrier,
(2) additional low permeability subsurface barrier in the southeast, and
(3) an aerobic sparge trench.

GROUNDWATER FLOW PATHS UNDER AVERAGE PRECIPITATION SCENARIO ALTERNATIVE GW3 - EXTENDING SUBSURAFCE BARRIER TO CRAWFORD CREEK SLOUGH
Former Koppers Facility
Wauna, Oregon

By: RLW	Date: 06/26/08	Project No. 9151.006
AMEC Geomatrix		Figure **10**