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OU9033_S105

Interim Remedial Actions Quarterly Report Report Period: November 1995 - February 1996

McCormick & Baxter Creosoting Company Portland Plant Portland, Oregon

Task Order No.: 64-93-17

April 1996

Prepared for:

STATE OF OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY
811 Southwest Sixth Avenue
Portland, Oregon 97204

#68896
USEPA SF
1050991

SF 4.1.6

ecology and environment, inc.
International Specialists in the Environment
1500 First Interstate Center, 999 Third Avenue, Seattle, Washington 98104
Tel: (206) 624-9537, Fax: (206) 621-9832

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1 Introduction and Summary

1.1 Introduction

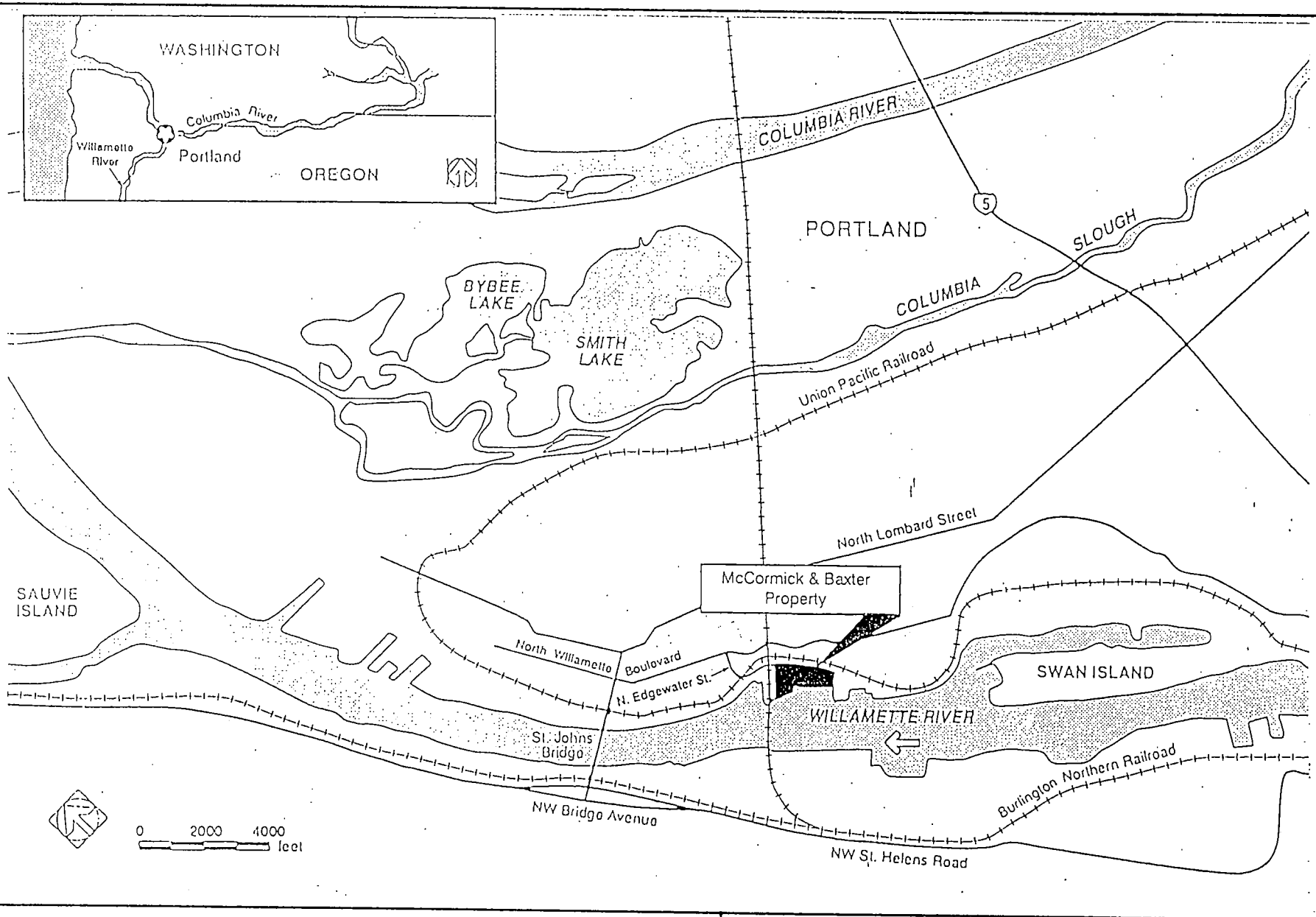
Ecology and Environment, Inc. (E & E) under contract with the Oregon Department of Environmental Quality (DEQ) has prepared this Interim Remedial Actions Quarterly Report for the McCormick & Baxter Creosoting Company, Portland Plant site (McCormick & Baxter) located in Portland, Oregon (Figure 1-1). This report covers the period from November 1, 1995 to February 29, 1996. The site, a former wood treating facility, is located along the Willamette River at 6900 North Edgewater Street (Figure 1-2). This document has been prepared under Task Order Number 64-93-17. The purpose of the task order is to assist DEQ with interim remedial actions, wastewater treatment plant operations and maintenance (O & M), and pre-remedial design activities at the site.

This Interim Remedial Actions Quarterly Report describes the non-aqueous phase liquid (NAPL) extraction activities (Section 2), wastewater treatment plant/enhanced NAPL extraction operations (Section 3), groundwater monitoring (Section 4), other key tasks (Section 5) performed between November 1, 1995 and February 29, 1996, and recommendations and conclusions (Section 6). The appendices, which contain documentation of data generated during this period, will be provided with the final version of this report.

1.2 Quarterly Summary

E & E assumed responsibility for the site on November 15, 1995 when DEQ issued Task Order 64-93-17. The site activities were previously conducted for DEQ by PTI, Inc. E & E has incorporated PTI's site operations information for the period from November 1 to November 15, 1995 in this report. These site data were not included in the previous quarterly report prepared by PTI.

Table 1-1 provides a monthly summary of activities conducted by E & E.



McCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND PLANT, PORTLAND, OREGON

Figure 1-1
SITE LOCATION MAP

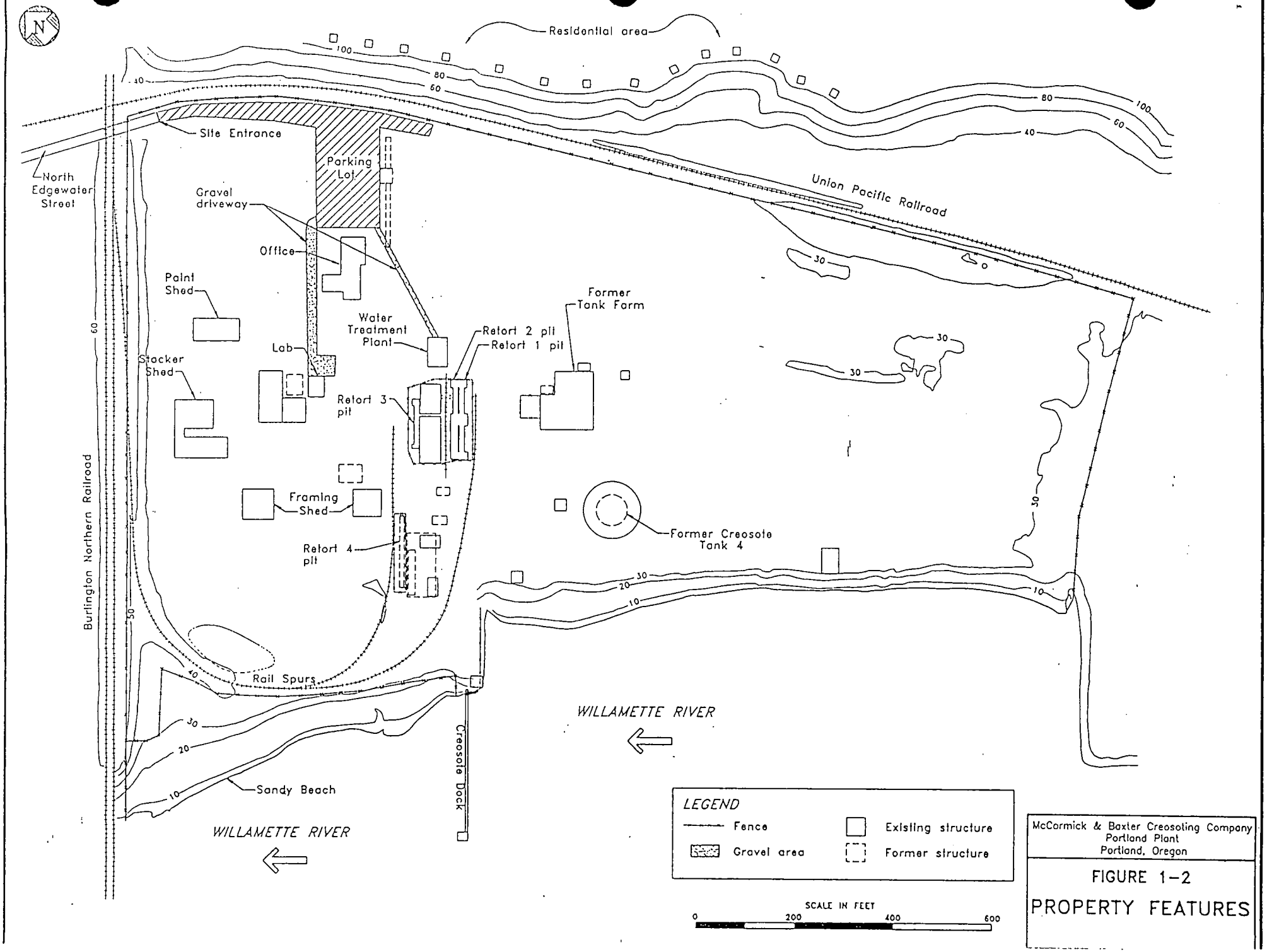

N
Residential area
Site Entrance
North Edgewater Street
Parking Lot
Gravel driveway
Office
Paint Shed
Water Treatment Plant
Lab
Stacker Shed
Retort 2 pit
Retort 1 pit
Former Tank Form
Retort 3 pit
Framing Shed
Retort 4 pit
Former Creosote Tank 4
Union Pacific Railroad
Burlington Northern Railroad
Rail Spurs
Sandy Beach
Creosote Dock
WILLAMETTE RIVER
WILLAMETTE RIVER
LEGEND
Fence
Gravel area
Existing structure
Former structure
SCALE IN FEET
0
200
400
600
McCormick & Baxter Creosoting Company
Portland Plant
Portland, Oregon
FIGURE 1-2
PROPERTY FEATURES

TABLE 1-1

SUMMARY OF QUARTERLY ACTIVITIES
McCORMICK AND BAXTER SITE
PORTLAND, OREGON

MONTH	ACTIVITY	STATUS
November 1995	E & E assumed management of the site.	Complete
	E & E transferred the Baker Tank rental agreements from PTI's to E & E's account.	Complete
	With DEQ's concurrence, E & E temporarily procured ATI, Inc. to provide analytical services for monitoring of the wastewater treatment system discharge.	Complete
	With DEQ's concurrence, E & E procured GeoTech Explorations to provide on-site assistance with O&M activities.	Complete
	Baker Tanks were cleaned out, ALPHA pumps were cleaned and refurbished, and a site inventory was conducted by PTI.	Complete
	Treatment system was operated for two weeks by PTI (See Table 3-1) in November.	Complete
December 1995	E & E prepared technical memoranda for installation of a gravel driveway, retort fencing, and site security.	Complete
	E & E invited two security companies to submit cost proposals for installation of monitoring and surveillance equipment.	Complete
	E & E conducted a competitive bid process to hire a security guard for evenings and weekends. Northwest Protective Services was selected based on cost and references.	Complete
	Treatment system was operated for 4 days in December (12/11 to 12/15).	Complete
	Pure-phase NAPL extraction was not conducted in December.	Complete
	Groundwater elevations were recorded on 12/5/95, 12/21/95, and 12/28/95.	Complete
	NAPL measurements were recorded on 12/5/95.	Complete
January 1996	E & E conducted a round of quarterly groundwater sampling during January 22 to 26, 1996.	Complete
	E & E collected one round of samples from each step within the treatment system.	Complete
	E & E collected a time series set of samples from the TFA total fluids extraction wells to determine the changes in contaminant concentrations during a typical operating day.	Complete
	E & E and H_2Oil Recovery Equipment conducted pilot tests of a belt skimmer device for removal of pure-phase NAPL from site wells.	Complete
	Two gravel driveways were installed between the paved parking lot, treatment building, and laboratory.	Complete
	Pure-phase NAPL extraction was conducted on 5 wells over 1 day.	Complete
	Groundwater elevations were recorded on 1/5/96, 1/11/96, and 1/17/96.	Complete
	NAPL measurements were recorded on 1/18/96.	Complete

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TABLE 1-1

SUMMARY OF QUARTERLY ACTIVITIES
McCORMICK AND BAXTER SITE
PORTLAND, OREGON

MONTH	ACTIVITY	STATUS
February 1996	Freezing temperatures resulted in broken pipes within the treatment system and water lines on-site. Damage to the system prevented further operation in February.	
	100 year flood level in Willamette River and landslide across the northern railroad track diverted attention from repairs to the treatment system.	
	Obtained cost estimates for repairs to the site fencing, selected Fox Fence Co. based on cost and ability to perform the work in a timely manner.	Ongoing
	Initiated materials purchases and repairs the treatment system piping.	Ongoing
	Pure phase NAPL extraction was conducted on 9 wells over 3 separate days.	Complete
	Groundwater elevations were recorded on 2/2/96, 2/9/96, and 2/16/96.	Complete
	NAPL measurements were not recorded during extraction.	

2 NAPL Extraction Site Operations

Releases of NAPL contaminants from the main source areas at the site, in particular the tank farm area (TFA) and the former waste disposal area (FWDA), have significantly impacted the shallow aquifer. Creosote and other organic compounds are found as both light nonaqueous-phase liquids (LNAPLs) and dense nonaqueous-phase liquids (DNAPLs) in soil and groundwater and in sediment in the Willamette River. A pure-phase NAPL extraction system and a total fluids system installed at the site by PTI have been operational since February 1993. As the pure-phase NAPL has migrated toward the river, it has also spread downward vertically, affecting a thick section of sands adjacent to the river. Two distinct NAPL plumes are present at the site, one in the TFA and the other in the FWDA. Smaller NAPL plumes are present near MW-1 (although the source of this contamination is not likely site-related and is currently unknown) and the former location of Butt Tank #1 near the southeast disposal trench area (see Figure 2-1).

2.1 NAPL Measurements

The thickness of NAPL is measured in wells in the TFA and FWDA on a bi-weekly basis and prior to NPAL removal activities. The thickness of LNAPL and DNAPL vary in a daily basis due to a number of conditions including groundwater elevation, review stage changes, and pumping frequency.

Tables 2-1 and 2-2 present the historical thickness of LNAPL and DNAPL in the source area wells and that average thickness measured in the monitoring wells during the quarter. NAPL measurements were recorded in November and December 1995 and January 1996. Due to an oversight, measurements of NAPL thickness were not recorded during the month of February 1996. The wells in which LNAPL and DNAPL were detected are illustrated in Figure 2-2. It does not appear from the figure and field measurements that the NAPL thickness and extent vary from previous quarterly measurements. DNAPL measurements made during the month of December 1995 exceeded historical DNAPL thicknesses for wells EW-5s, EW-18s, EW-9s, and MW-21s. These maximum followed the following events that occurred during the month. It is likely that the high

Table 2-1

HISTORICAL AND MONTHLY LNAPL THICKNESS
MCCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

Well ID	Maximum LNAPL Thickness (ft)	Date	November 1995 LNAPL Thickness (ft)	December 1995 LNAPL Thickness (ft)	January 1996 LNAPL Thickness (ft)
Tank Farm Area					
EW-1s	1.3	?	ND	ND	ND
EW-4s	1.5	09/92	ND	ND	ND
EW-5s	0.9	09/94	ND	ND	ND
EW-7s	1.4	09/92	ND	ND	ND
EW-18s	4.43	07/94	3.22	ND	0.21
MW-Is	1.7	?	ND	ND	ND
MW-Rs	2.81	09/94	2.73	0.04	1.27
MW-7s	2.76	09/92	ND	ND	ND
MW-10s	8.08	02/93	ND	ND	ND
Former Waste Disposal Area					
EW-6s	3.5	08/94	2.36	2.48	ND
EW-10s	7.5	07/93	1.78	1.16	0.35
EW-14s	1.31	03/95	1.16	ND	0.11
EW-15s	8.25	09/94	3.44	ND	1.3
EW-20	0.25	09/94	ND	ND	ND
MW-18s	0.14	09/94	ND	ND	ND
MW-21s	10.28	09/92	0.84	0.55	0.13
MW-Es	2.97	09/92	ND	ND	ND
MW-Gs	2.34	09/92	ND	ND	ND
Other					
MW-1s	NA	NA	NA	NA	NA

Only wells with any LNAPL detected are presented in this table.

Key:

NA = Not analyzed.
ND = No LNAPL detected.

Table 2-2

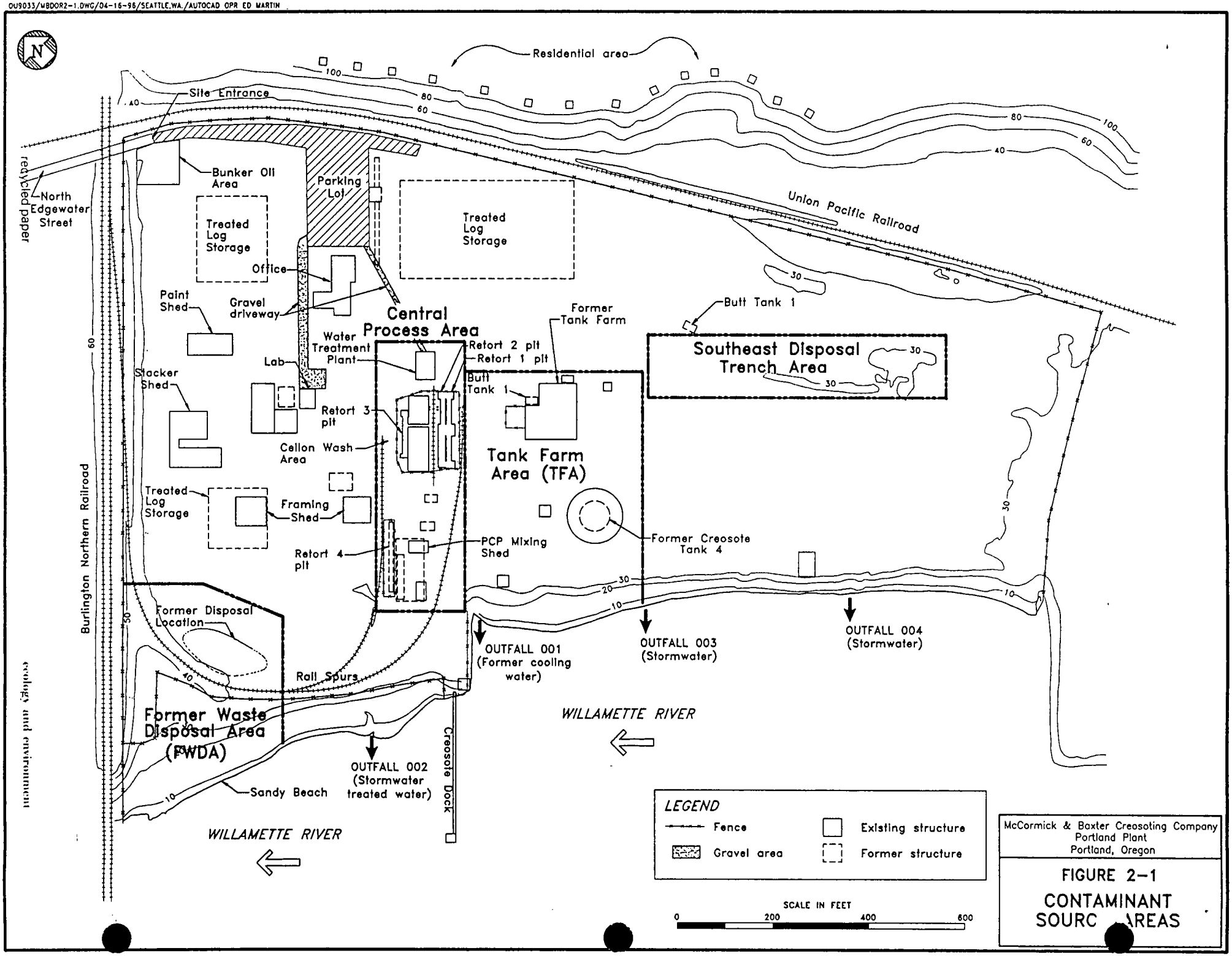
HISTORICAL AND MONTHLY DNAPL THICKNESS
MCCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

Well ID	Maximum DNAPL Thickness (ft)	Date	November 1995 DNAPL Thickness (ft)	December 1995 DNAPL Thickness (ft)	January 1996 DNAPL Thickness (ft)
Tank Farm Area					
EW-1s	4.7	10/94	0.89	ND	ND
EW-4s	6.2	03/93	ND	ND	ND
EW-5s	2.92	12/95	ND	ND	2.53
EW-7s	2.09	12/94	ND	ND	ND
EW-8s	2.7	07/93	0.48	2.24	2.1
EW-17s	1.06	03/93	0.16	0.71	0.55
EW-18s	1.02	12/95	ND	1.02	ND
MW-Is	9.93	08/87	2.97	ND	2.78
MW-7s	3.67	11/91	2.37	1.04	2.92
MW-8i	1.78	11/91	0.32	1.31	0.04
EW-12s	1.15	01/96	ND	0.52	1.15
MW-22i	3.02	10/94	0.33	0.9	ND
Former Waste Disposal Area					
EW-2s	1.9	08/91	ND	ND	ND
EW-6s	3.4	08/93	0.31	0.78	1.55
EW-9s	3.16	01/96	2.45	2.15	3.16
MW-20i	34.32	12/94	13.94	10.16	26.02
MW-21s	0.31	12/95	ND	0.31	ND
MW-Ds	6.01	01/94	2.68	1.97	2.8
MW-Es	4.2	08/87	ND	ND	ND
MW-Gs	14.85	03/91	0.83	1.56	4.05
Southeast Disposal Trench Area					
EW-11s	NA	NA	NA	NA	NA
MW-18s	NA	NA	NA	NA	NA
MW-19s	2.01	07/91	ND	ND	ND

Only wells with any DNAPL detected are presented in this table.

Key:

NA = Not analyzed.
ND = No DNAPL detected.



McCormick & Baxter Creosoting Company
Portland Plant
Portland, Oregon

FIGURE 2-1
CONTAMINANT SOURC AREAS

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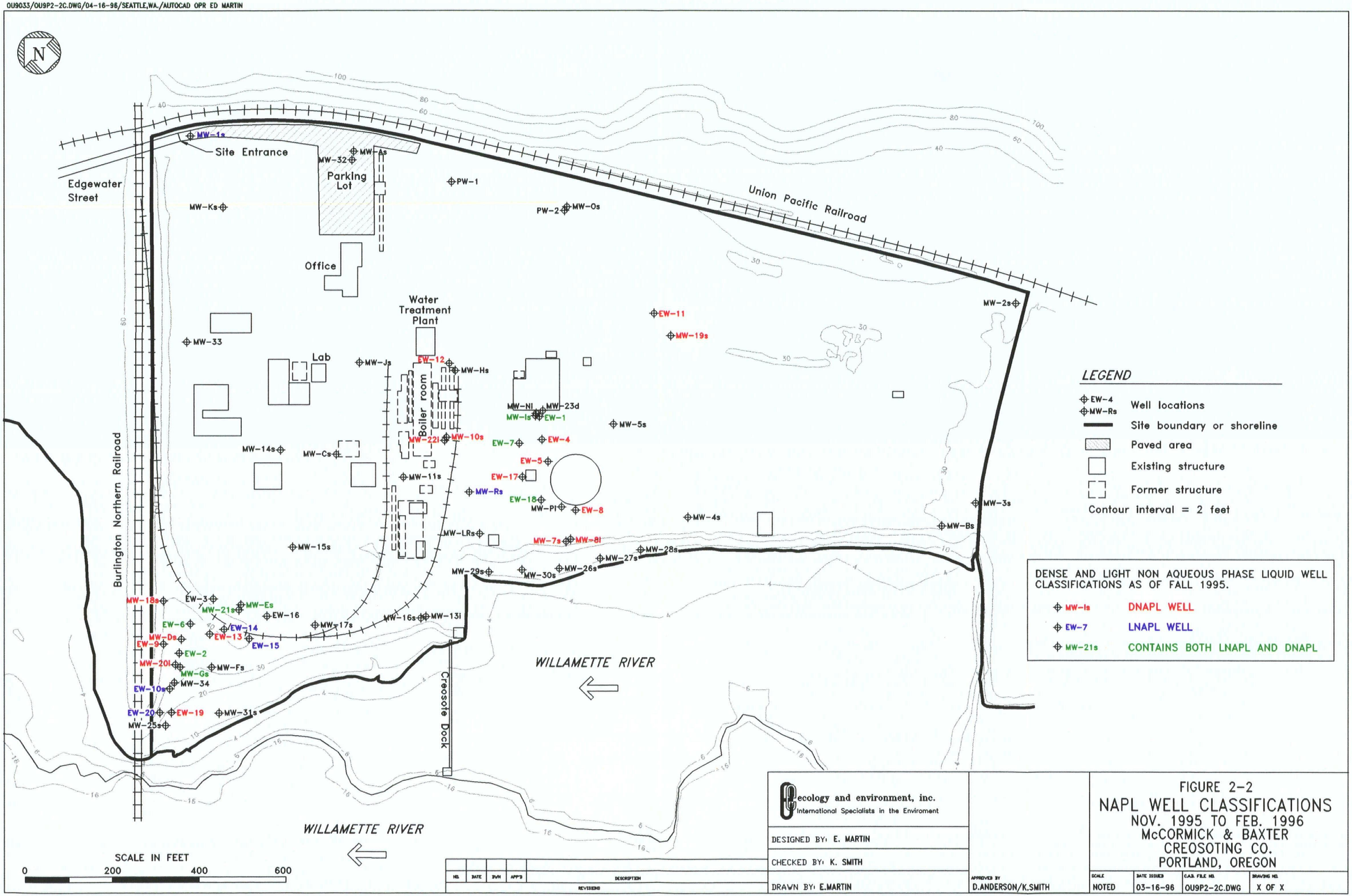

caused the migration of more NAPL into the monitoring wells. NAPL measurements unfortunately were not obtained following the 100-year flood event which occurred in February 1996; results from March 1996 monitoring may reflect increased NAPL thicknesses.

2.2 Pure-Phase NAPL Extraction Summary

Pure-phase NAPL extraction was conducted manually throughout this operation period. No pure-phase NAPL was removed during the month of December. The extraction process requires extensive manual labor to measure the wells for the presence of pure-phase product; set up the extraction pump; operate the pump to ensure that minimal water is extracted; clean the oil/water interface probe, pump, and product hoses; and carry the product to Tank 4. It is preferable that pure-phase NAPL extraction be conducted weekly; however, during this period, NAPL was extracted less frequently. NAPL extraction was conducted whenever possible during this period in conjunction with other site work (e.g., retort fencing installation, gravel driveway installation). Furthermore, inclement weather impacted the schedule. Table 2-3 contains a summary of the NAPL extracted during this period. Total NAPL volumes removed are estimated. The volumes in Table 2-3 represent visual estimates and calculations of NAPL and/or highly contaminated groundwater. In the TFA, well EW-1s continues to be the most productive NAPL well with a total estimated volume of 11.07 gallons removed during the quarter. In the FWDA, wells EW-9s, MW-Ds, EW-14s, and MW-20i are the most productive NAPL wells with total estimated volumes of 14.2, 9.94, 10.67, and 25.69 gallons, respectively. Based on data previously collected and the NAPL recovery from the well, E & E began pumping MW-20i in the FWDA area on a bi-weekly basis.

2.3 NAPL Extraction Field Tests

Several field tests were conducted during the quarter to enhance operations at the site with respect to NAPL removal. In addition, all enhanced NAPL extraction testing that has been conducted to date was reviewed and summarized in a draft memorandum to DEQ. The review of the previous testing indicated that several wells have potential for increased NAPL yields, although the quality of the hard copy data makes an accurate determination difficult. Future enhanced NAPL testing is anticipated to be conducted at the site.

2.3.1 Belt Skimmer

E & E tested a belt skimmer system in wells MW-Is and EW-1s in the TFA and in well EW-6s in the FWDA. The wells have consistently contained measurable LNAPL and DNAPL product. The belt skimmer is a pulley driven machine that utilizes a petroleum adherent plastic belt

Table 2-3

EXTRACTION WELL SUMMARY
MCCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON
(units: gallons)

Well	NAPL Extracted for Quarter
Tank Farm Area	
EW-18s	3.76
EW-1s	11.07
EW-8s	0.52
MW-7s	0.27
MW-8i	2.8
MW-Is	3.81
MW-Rs	1.52
Total:	**23.75**
Former Waste Disposal Area	
EW-10s	0.56
EW-14s	3.2
EW-15s	10.67
EW-6s	4.6
EW-9s	14.2
MW-20i	25.69
MW-20s	8
MW-21s	0.43
MW-6s	2.2
MW-Ds	9.94
MW-Gs	0.99
Total:	**80.48**
GRAND TOTAL:	**104.23**

which actively skims product from above, through the water column, and from the sump of the well. The product is skimmed off the belt at the surface and collected in a 55-gallon drum.

The system was initially tested on MW-Is, a well in which both LNAPL and DNAPL are present. Due to the small, 2-inch, diameter of MW-Is, the belt frequently adhered to itself and the sides of the well, which prevented the pulley system from effectively rotating and lifting the product from the well. Visual observations of the belt during the test start-up and after removal of the system from the well showed that product had accumulated on the belt and therefore, operation was not feasible.

The skimmer system was then tested on an 8-inch diameter well, EW-1s. The system operated as designed and recovery volumes were observable (sheen and coating). However, because there was only minimal NAPL within this well, the volume of recovered NAPL readily measurable.

The skimmer system was then tested on a 4-inch diameter well, EW-6s, in the FWDA. Results similar to the testing in MW-Is were encountered.

Initial testing indicates that the skimmer system with modifications may be effective for NAPL removal at the site. Modifications are being made to the equipment so the skimmer belt does not adhere to itself or to the sides of the well casing.

2.3.2 Percent NAPL in Water

In order to maximize NAPL extraction and minimize the volume of groundwater pumped, an accurate measure of percent NAPL in groundwater is required. E & E prepared a technical memorandum describing a proposed field test method for determining the percent NAPL in groundwater.

PTI previously utilized a visual comparison method in which a sample from an onsite well was compared to previously analyzed site-specific "standard" samples of oil in water. The "standards" contained 0.5%, 1.0%, 5.0%, 10%, 25%, etc. oil in water. After collection, the groundwater sample was allowed to settle for approximately 24 hours to allow gravity separation of the various phases. PTI estimated the percent NAPL in the sample by visually comparing the groundwater sample to the "standards". This technique raised several concerns including time required, consistency between observers, representativeness, and lack of adequate quality control.

E & E researched EPA, ASTM, and other standardized analytical methods and equipment (e.g., field test kits) to determine if a method exists to calculate the percent oil (NAPL) in water in the low percentage range (0.1% to 10%) on a quick turnaround (1 to 2 hour) basis. Because standardized methods and equipment to meet the expected low oil concentrations and quick turnaround times were not readily available, E & E developed an experimental test method to determine the percent NAPL in water. The method calculated the percent NAPL in water by measuring the volume

or weight of water before and after separation of NAPL from the water. NAPL absorption/separation media that were initially evaluated included clay-based granular absorbent media, fibrous polypropylene, shredded polypropylene absorbent pad, shredded cellulose fiber, and a polypropylene absorbent pad.

Test Results and Observations

E & E initiated the percent NAPL tests during the week of quarterly groundwater sampling in January 1996. During this time, E & E conducted initial screening tests of the different media to determine which media should be retained for further evaluation. In initial screening tests, a small quantity of water was placed in a beaker and the water was spiked with a known amount of diesel fuel. Each of the media was placed into a glass funnel positioned over a collection beaker. The spiked water/diesel mix was then poured through the media.

The fibrous polypropylene performed best in absorbing the diesel fuel and allowing water to pass. The clay material was second in its ability to absorb the diesel, but it also absorbed approximately half the water. The shredded polypropylene pad, cellulose fiber, and absorbent pad did not perform well in absorbing the diesel and/or allowing the water to pass. These three media were eliminated from further evaluation.

Fibrous Polypropylene

E & E elected to focus initially on the fibrous polypropylene because of its ability to absorb the diesel and allow almost all the water to pass. E & E set up a short series of tests in which a measured weight of water was spiked with a measured weight of diesel fuel. E & E determined that measuring the quantity of water and diesel by weight (grams) is significantly more accurate than reading the volume from a graduated cylinder. The graduated cylinder has 1 milliliter (mL) measurement increments; however, to determine small percentages of NAPL in water, volume measurements would need to be accurate to 0.1 mL.

To simplify the tests, E & E assumed the density of diesel to be the same as water. The water/diesel mixture was poured through the fibrous polypropylene material and the filtered water was collected. E & E weighed the filtered water and then determined the diesel removal efficiency and initial percent diesel in water. To reduce the error in the test caused by water clinging to the glassware, all materials initially were wetted with distilled water.

E & E was able to measure percent diesel in water down to 0.5% with this method. Higher percentages (up to 10%) did not pose a problem for this test. The limiting factor at the higher percentages was the volume of fibrous polypropylene that was able to fit into the glass funnel.

E & E decided to filter a small quantity of actual NAPL water from well MW-20 through the fibrous polypropylene. This was a screening test and weight measurements were not recorded. The fibrous polypropylene did not perform as expected; it did not have a strong attraction to the NAPL and resulted in little absorption. At this point, further testing of the fibrous polypropylene was discontinued.

Granular Clay

E & E conducted three screening tests with the granular clay using an extracted NAPL/water mixture. The first test entailed placing approximately 1 inch of dry granular clay into a disposable filter unit that contained a 45-micron paper filter. NAPL water was then poured into the clay. A vacuum was applied to the collection container to draw the water through the clay. This initial test resulted in all visible NAPL being removed from the water and clear water collected in the container. The primary drawback was that the volume of water collected was about half the volume poured into the dry clay.

In the second test, E & E saturated the clay with distilled water before placing NAPL water into the media. This prevented the clay from absorbing all the NAPL. While some NAPL was retained in the media, most passed through it.

The third test was conducted with the 45-micron paper filter removed and dry clay media placed into the filter unit. This resulted in the NAPL water passing straight through the clay with very little absorption evident. Further of this testing of this medium was discontinued due to poor screening test results.

Conclusion and Recommendations

It appears that the absorption-type tests will not provide the ability to quickly, easily, and accurately determine the percentage of NAPL in water. The tests indicate that additional methods for identifying and/or quantifying the amount of NAPL in water need to be investigated. E & E will investigate methods that allow separation by gravity, possibly enhanced with a centrifuge. In addition, graduated test tubes could allow for some gross quantification of percent NAPL; however, accurate measurements to within one percent are infeasible. E & E is currently reviewing sludge testing equipment such as settlometers that are calibrated in percent solids (cubic centimeters per liter [cm/L]), which may be effective for determining percent NAPL.

3 Water Treatment Plant and Enhanced NAPL Extraction

3.1 Water Treatment Plant Operation Summary

The following sections present a summary of treatment system operations from November 1, 1995 to February 29, 1996. PTI was responsible for operating and maintaining the system through November 30, 1995. During the final 2 weeks of operation, PTI cleaned the treatment system, conducted maintenance, documented inventory, etc.; therefore, the treatment system was not operating during this period. System operation data collected by PTI in November 1995 have been included in the data summarized below.

3.1.1 Operation Summary

Operation of the water treatment system and enhanced NAPL extraction wells was assumed by E & E on December 11, 1995. Table 3-1 presents a summary of treatment system operations during the quarter.

The dissolved air floatation unit (DAF) unit operated for a total of 206 hours during this period, and a total of 120,999 gallons of water were treated. The DAF unit generated 4,869 gallons of sludge, which were stored in Tank 4. As discussed further in Section 3.1.3, the sludge contained approximately 20,000 mg/L of total suspended solids (0.02 grams solids/cubic cm water or 2% solids by weight). Based on this concentration, the DAF unit generated 369 kg or 813 lb of solids during this period. These solids slowly accumulate in the bottom of Tank 4 throughout the operation period. When sufficient volume has accumulated, the treatment system operator pumps the clear water from the top of Tank 4 back into the treatment system. This allows a greater volume of sludge to accumulate in Tank 4 before disposal.

During this operation period, the DAF unit consumed four 55-gallon drums of WWA-40 (heavy metal precipitator and coagulant), four 55-gallon drums of WW-1100 flocculent, and one 55-gallon drum of caustic soda.

Table 3-1

SUMMARY OF TREATMENT SYSTEM OPERATION

Dates	Operation Status	Days of Operation	Comment
11/1/95 to 11/16/95	System Operational	9	System shut down on 11/16 for cleaning.
12/4/95 to 12/8/95	No Operation	0	Subcontractor procurement period.
12/11/95 to 12/15/95	System Operational	3.5	Power outages interrupted operation on 12/12 and 12/13.
12/18/95 to 12/29/95	No Operation	0	System down due to injury to John Swan and holidays.
1/2/96 to 1/29/96	System Operational	17	Minor down time due to driveway, retort fenching, and quarterly sampling activities.
1/30/96 to 2/29/96	No Operation	0	System froze resulting in damage to piping and equipment. System repairs initiated. Willamette River flood event.

The granular activated carbon (GAC) component of the treatment system was operated for 221 hours, 45 minutes during this period. A total of 134,269 gallons of water were filtered through the GAC. Two WSU-85 carbon vessels (each containing 280 pounds of carbon) were consumed. The discrepancy between the total volume treated by the DAF unit and the GAC component represents water remaining in the treatment system's tanks and pipes. In addition, a slight inaccuracy in the flow meter could have contributed to the discrepancy.

3.1.2 Effluent Discharge Monitoring Results

Nine batches of treated water were discharged to the Willamette River through Outfall 2 during this period. Effluent samples were collected and analyzed for each batch discharged. The analytical results were provided by ATI, a subcontract laboratory, and were available prior to each discharge. Table 3-2 provides a summary of the discharge dates, effluent sample numbers and dates, discharge volumes, and analytical results.

All discharges were below the maximum daily effluent concentrations as defined in the Interim Discharge Permit. In addition, the monthly average concentrations also were below the permit effluent concentrations. No violations of the discharge permit occurred in this period. Each batch was discharged at a rate of approximately 4,800 gallons per day.

3.1.3 Treatment Train Testing and Results

During this operation period, E & E collected water samples at each step in the treatment process (see Figure 3-1). These treatment train samples were collected during a typical operating day on January 25, 1996. The purpose of the testing is to evaluate the current treatment steps. Each sample was analyzed for the following parameters: total dissolved solids (TDS), total suspended solids (TSS), chemical oxygen demand (COD), biological oxygen demand (BOD), total organic carbon (TOC), total metals, dissolved metals, total recoverable petroleum hydrocarbons (TRPH), volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). The samples were collected from sample ports in the system or by using dedicated, disposable samplers in the open tanks. The water samples were shipped to E & E's Analytical Services Center (ASC), a subcontract laboratory, for analysis. The analytical results are provided in Table 3-3.

The values for VOCs in sample OU9TT01 (Tank 1 Influent) have been estimated based on a computed weighted average of the extraction well data presented in Section 3.2.3. This was necessitated due to breakage of the SVOC sample bottle for OU9TT01 during shipment to the laboratory. The weighted average was determined for each detected compound using the following equation:

Table 3-2

SUMMARY OF EFFLUENT DISCHARGE RESULTS
MCCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

Effluent Tank Sample Date	Sample Number	Total Gallons	Discharge Dates	Discharge Rate (Gallons/day)	pH	Total PAHs (µg/L)	PCP (µg/L)	TCP (µg/L)	Total Arsenic (µg/L)	Total Chromium (µg/L)	Total Copper (µg/L)	Total Zinc (µg/L)
Interim Permit Monthly Average		NA	NA	NA	6.5 - 8.5	1000	13	NA	48	210	12	150
Interim Permit Daily Maximum		NA	NA	10000	6.5 - 8.5	1500	19.5	NA	72	315	18	220
11/1/95	BT34B	11,344	11/10/95	4,800	7.3	<80	<5	<5	11	<10	<10	<10
11/9/95	BT35A	15,719	11/22/95	4,800	7.1	<80	<5	<5	<5	<10	<10	80
11/15/95	BT36B	15,806	11/27/95	4,800	7.2	<80	<5	<5	<5	<10	<10	140
NOVEMBER AVG.						<80	<5	<5	7	<10	<10	77
1/2/96	EFF01B	14,423	1/8/96	4,800	7.0 - 7.3	<80	<5	<15	0.3	<10	<10	70
1/3/96	EFF02A	18,970	1/12/96	4,800	7.0 - 7.3	<80	<5	<15	<5	<10	<10	<10
1/11/96	EFF03B	17,040	1/19/96	4,800	7.0 - 7.3	<80	<5	<15	<5	<10	<10	10
1/15/96	EFF04A	18,475	1/26/96	4,800	7.0 - 7.3	<80	<5	<15	<5	<10	<10	20
1/23/96	EFF05B	18,205	2/2/96	4,800	7.0 - 7.3	NA	NA	NA	<5	<10	<10	120
1/29/96	EFF06A	4,287	2/2/96	4,800	7.0 - 7.3	<80	<5	<15	<5	<10	<10	160
JANUARY AVG.						<80	<5	<15	<5	<10	<10	76

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Table 3-3

SUMMARY OF TREATMENT TRAIN ANALYTICAL RESULTS
MCCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

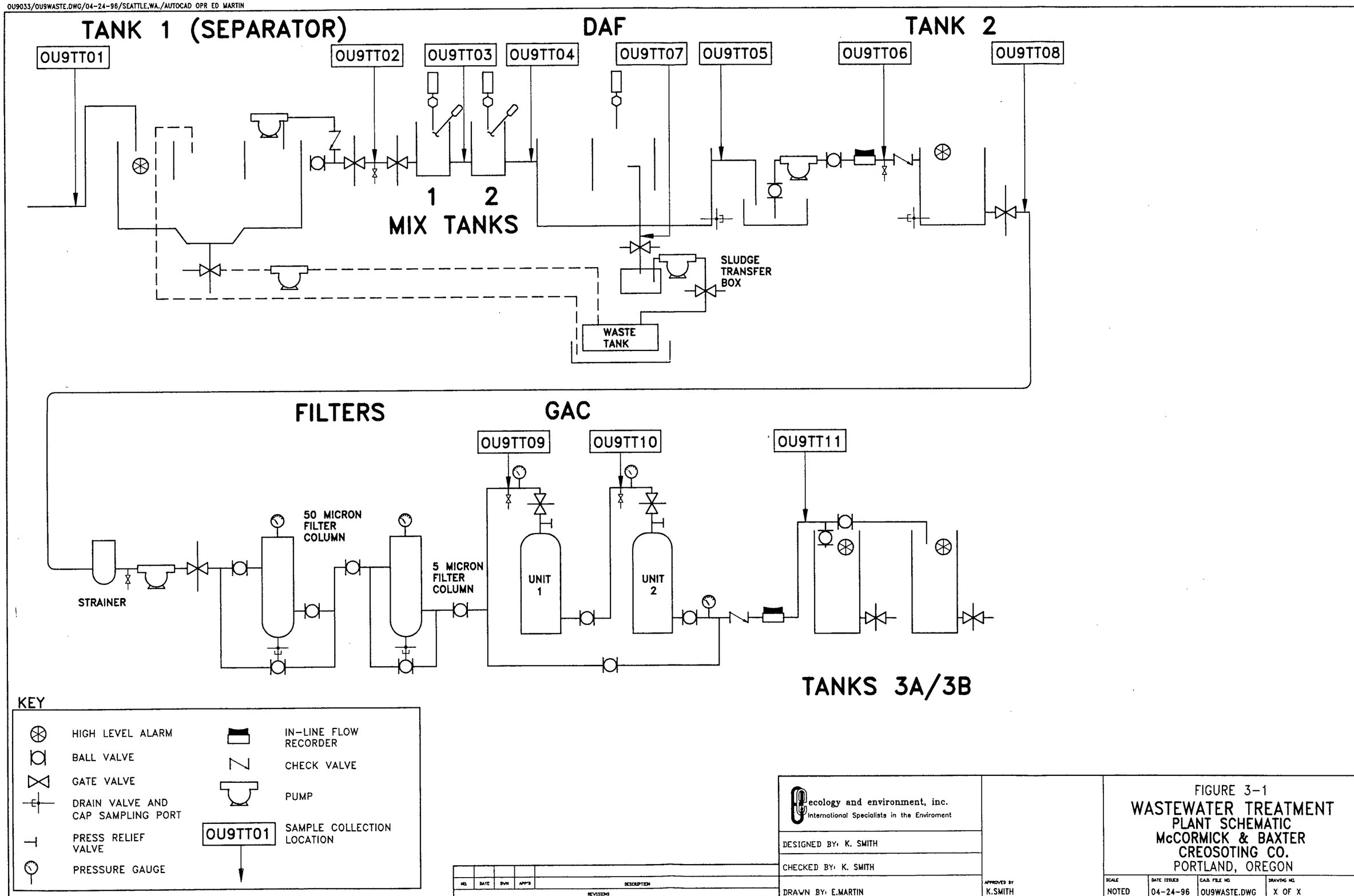
Sample Number	OU9TT01	OU9TT02	OU9TT03	OU9TT04	OU9TT05	OU9TT06	OU9TT08
Location	Tank 1	Mixing Tank 1	Mixing Tank 2	DAF Influent	DAF Effluent	Tank 2 Infl.	Filter Infl.
Inorganic Parameters (mg/L)							
Total Dissolved Solids	370	360	1100	840	820	940	730
Total Suspended Solids	150	50	380	10	11	7.5	10
Chemical Oxygen Demand	420	250	100	35	44	39	32
BOD5	220	49	76	18	28	12	13
Total Organic Carbon	100	24	24	25	14	16	14
Total Metals (µg/L)							
Arsenic	29	15	14	6.7	9.5	7	5 U
Lead	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cadmium	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chromium Total	10 U	10 U	15	10 U	10 U	10 U	10 U
Copper	23	20 U	20 U	20 U	20 U	20 U	20 U
Nickel	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Zinc	63	130	72	12	17	83	44
Dissolved Metals (µg/L)							
Arsenic	7.5	5 U	5 U	5.5	5 U	5 U	5 U
Lead	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Cadmium	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chromium Total	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Copper	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Nickel	20 U	20 U	20 U	20 U	20 U	22	20 U
Zinc	20	66	28	12	24	83	39
Petroleum Hydrocarbons (mg/L)	190	37	14	1 U	1 U	1 U	1 U
VOCs (µg/L)							
1,2-Dichloroethane	6	7.8	69 X	7	11	4.5	1.7
Acetone	9.8	9.3	110 X	9.2	5.9	10	7.3
Benzene	3	2.7	2.6	1.8	2.1	2.1	0.91 J
Chloroform	1 U	1 U	1 U	1 U	1 U	1 U	1 J
Chloromethane	1 U	1 U	1 U	1.3	2.1	1 U	1 U
Ethylbenzene	12	34	21	16	16	16	8.2
Methylene chloride	1 U	1 U	4.7	1.4	0.73 J	1 U	1 U
Toluene	3.2	6.1	4	2.8	4.2	3.8	1.9
Total Xylenes	20	58	36	28	33	41	15
BNAs (µg/L)							
2,4-Dichlorophenol	300 U	50 U	100 U	10 U	10 U	10 U	150
2,4-Dimethylphenol	313	190	180	130	140	210	10 U
2-Methylnaphthalene	1495	660	390	400	300	460	150
2-Methylphenol	126	31 J	40 J	44	40	32	36
4-Methylphenol	318	24 J	33 J	44	41	29	34
Acenaphthene*	1115	640	410	300	300	270	110
Acenaphthylene	300 U	50 U	100 U	4.7 J	4.3 J	10 U	3.2 J

Table 3-3

SUMMARY OF TREATMENT TRAIN ANALYTICAL RESULTS
MCCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

Sample Number	OU9TT01	OU9TT02	OU9TT03	OU9TT04	OU9TT05	OU9TT06	OU9TT08
Location	Tank 1	Mixing Tank 1	Mixing Tank 2	DAF Influent	DAF Effluent	Tank 2 Infl.	Filter Infl.
Anthracene	269	190	87 J	12	7.9 J	10 U	6.3 J
Benzo(a)anthracene	321	120	100 U	10 U	10 U	10 U	10 U
Benzo(a)pyrene	250	31 J	100 U	10 U	10 U	10 U	10 U
Benzo(b)fluoranthene	86	59	20 J	10 U	10 U	10 U	10 U
Benzo(k)fluoranthene	236	18 J	100 U	10 U	10 U	10 U	10 U
bis(2-Ethylhexyl)phthalate	300 U	50 U	100 U	10 U	10 U	10 U	2.8 J
Chrysene	148	89	21 J	10 U	10 U	10 U	10 U
Dibenzofuran	699	360	260	89	93	120	62
Fluoranthene	715	450	180	8.1 J	2.5 J	3.3 J	3.6 J
Fluorene	888	440	230	110	100	110	81
Naphthalene	3883	1400	1300	1500	1100	2400	640
Pentachlorophenol	1500 U	25 J	23 J	27 J	18 J	4.3 J	28 J
Phenanthrene	1973	380	500	80	65	78	52
Phenol	300 U	50 U	100 U	2.5 J	2.5 J	10 U	2.4 J
Pyrene	543	520	100	5.8 J	10 U	10 U	2.2 J
Total BNAs (excluding "U" values)	13,378	5627	3774	2757	2214	3716	1363

OU9033/OU9WASTE.DWG/04-24-96/SEATTLE,WA./AUTOCAD OPR ED MARTIN



NO.	DATE	DWN	APP'D	DESCRIPTION
				REVISIONS

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DESIGNED BY: K. SMITH
CHECKED BY: K. SMITH
DRAWN BY: E.MARTIN

APPROVED BY K.SMITH

FIGURE 3-1
WASTEWATER TREATMENT
PLANT SCHEMATIC
McCORMICK & BAXTER
CREOSOTING CO.
PORTLAND, OREGON

SCALE	DATE ISSUED	CAD FILE NO.	DRAWING NO.
NOTED	04-24-96	OU9WASTE.DWG	X OF X

Table 3-3

SUMMARY OF TREATMENT TRAIN ANALYTICAL RESULTS
MCCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

Sample Number	OU9TT09	OU9TT10	OU9TT11	OU9TT07	OU9TT101
Location	Carbon 1 Infl	Carbon 2 Infl.	Tank 3 Infl.	DAF Sludge	Duplicate of 09
Inorganic Parameters (mg/L)					
Total Dissolved Solids	730	720	730	830	730
Total Suspended Solids	4 U	4 U	4 U	20000	4 U
Chemical Oxygen Demand	36	380	5 U	1100	36
BOD5	12	5.6	4.4	3600	8.7
Total Organic Carbon	14	4.9	3.6	3500	13
Total Metals (µg/L)					
Arsenic	5 U	5 U	5 U	340	5 U
Lead	5 U	5 U	5 U	15	5 U
Cadmium	5 U	5 U	5 U	79	5 U
Chromium Total	10 U	10 U	10 U	910	10 U
Copper	20 U	20 U	20 U	210	20 U
Nickel	20 U	20 U	20 U	330	20 U
Zinc	140	100	84	4300	74
Dissolved Metals (µg/L)					
Arsenic	5 U	5 U	5 U	5 U	5 U
Lead	5 U	5 U	5 U	5 U	5 U
Cadmium	5 U	5 U	5 U	5 U	5 U
Chromium Total	10 U	10 U	10 U	10 U	10 U
Copper	20 U	20 U	20 U	20 U	20 U
Nickel	20 U	20 U	20 U	31	20 U
Zinc	87	97	74	45	77
Petroleum Hydrocarbons (mg/L)	1 U	1 U	1 U	1400	1 U
VOCs (µg/L)					
1,2-Dichloroethane	4.6	4	4	5 U	1 U
Acetone	11	6.7	6.9	43	11
Benzene	0.96 J	1 U	1 U	5 U	0.96 J
Chloroform	1.1	1 U	1 U	5 U	1.1
Chloromethane	1 U	1 U	1 U	5 U	1 U
Ethylbenzene	9.5	1 U	1 U	30	7.8
Methylene chloride	1 U	1 U	1 U	5 U	1 U
Toluene	2	1 U	1 U	4.1 J	2
Total Xylenes	23	1 U	1 U	55	17
BNAs (µg/L)					
2,4-Dichlorophenol	120	4.7 J	10 U	100 U	50 U
2,4-Dimethylphenol	140	10 U	10 U	31 J	140
2-Methylnaphthalene	210	4.6 J	10 U	240	210
2-Methylphenol	34	2 J	10 U	100 U	31 J
4-Methylphenol	32	1.8 J	10 U	100 U	26 J
Acenaphthene*	170	8.6 J	10 U	250	130
Acenaphthylene	3.5 J	10 U	10 U	100 U	3.2 J

Table 3-3

SUMMARY OF TREATMENT TRAIN ANALYTICAL RESULTS
MCCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

Sample Number	OU9TT09	OU9TT10	OU9TT11	OU9TT07	OU9TT101
Location	Carbon 1 Infl	Carbon 2 Infl.	Tank 3 Infl.	DAF Sludge	Duplicate of 09
Anthracene	6.5 J	10 U	10 U	62 J	6.1 J
Benzo(a)anthracene	10 U	10 U	10 U	31 J	50 U
Benzo(a)pyrene	10 U	10 U	10 U	14 J	50 U
Benzo(b)fluoranthene	10 U	10 U	10 U	24 J	50 U
Benzo(k)fluoranthene	10 U	10 U	10 U	100 U	50 U
bis(2-Ethylhexyl)phthalate	10 U	3.4 J	10 U	100 U	50 U
Chrysene	10 U	10 U	10 U	100 U	50 U
Dibenzofuran	85	3.5 J	10 U	150	85
Fluoranthene	4.3 J	10 U	10 U	200	3.3 J
Fluorene	100	4.2 J	10 U	210	100
Naphthalene	770	10 U	10 U	470	770
Pentachlorophenol	24 J	50 U	50 U	500 U	16 J
Phenanthrene	68	2 J	10 U	470	68
Phenol	2.1 J	10 U	10 U	100 U	50 U
Pyrene	10 U	10 U	10 U	120	50 U
Total BNAs (excluding "U" values)	1436	34.8	NA	2272	1588.6

$$\{[(EW\text{-}1\text{-}1) \times 2] + [(EW\text{-}4\text{-}1) \times 5] + [(EW\text{-}7\text{-}1) \times 5]\} / 12 = \text{wt. conc.}$$

where:

EW-1-1 - represents the SVOC concentration
2 - represents 2 gallons per minute (gpm) flow from EW-1;
5 - represents 5 gpm flow from EW-4 and 7;
12 - represents 12 gpm total flow into Tank 1.

E & E elected to use the initial sample interval data to provide a conservative estimate of Tank 1 influent concentrations. To confirm results, a second round of treatment train samples will be collected at a future date.

General Parameters

General parameters analyzed include: TDS, TSS, COD, BOD, and TOC. The analytical results for these general parameters are within the expected range for groundwater. The most significant decrease in total solids occurred in the DAF unit. The TSS concentration decreased from 380 mg/L to 10 mg/L in Mixing Tank 2, and the TDS increased from 370 mg/L in Tank 1 to 1,100 mg/L in Mixing Tank 2. The dissolved solid concentrations level off at approximately 730 mg/L in the DAF unit. The DAF unit sludge sample indicated that the sludge contains 20,000 mg/L of solids, which corresponds to approximately 2% solids by weight and the remainder (i.e., 98%) is primarily water.

Total and Dissolved Metals

Sample results indicate arsenic and zinc are the primary metals in the influent. Arsenic concentrations decreased at each step through the system, and were below detection limits in the effluent. Historically, the treatment system effluent has contained elevated concentrations of total zinc. This is the only metal that increases in concentration during the treatment process. Increased zinc concentrations (both total and dissolved) occur in Mixing Tank 1, Tank 2 influent, and Carbon Vessel 1 influent. Comparison between the total and dissolved zinc concentrations indicates that following the DAF unit influent sample (OU9TT04), zinc concentrations are composed almost entirely of dissolved zinc. The increase in dissolved zinc concentrations is likely attributed to the galvanized steel piping that connects the DAF unit, Tank 2, and Carbon Vessel 1. E & E contacted the supplier and confirmed that there is no zinc in the treatment system chemicals.

Based on the permit discharge limits, the influent groundwater does not contain metal concentrations that warrant active removal in the treatment system. If elimination of the galvanized steel piping reduces zinc concentrations, the use of the heavy metal co-precipitation/coagulant may become unnecessary.

Total Recoverable Petroleum Hydrocarbons

Analytical results indicate that the DAF unit effectively removes TRPH from the groundwater. The influent concentration (190 mg/L) is reduced to below detection limits (1U mg/L) in the DAF unit effluent. The DAF unit is operating effectively in this respect.

Volatile Organic Compounds

VOCs are a relatively minor contaminant in the groundwater and are present in low concentrations. The VOC concentrations are effectively removed to below detectable concentrations in the GAC units.

Semivolatile Organic Compounds

The treatment train sample results identified three process steps that provide the most significant SVOC removal: the DAF unit, Tank 2, and the GAC units. A breakdown of each step is provided below.

DAF Unit: E & E compared the SVOC sample data for Mixing Tank 1 and the DAF unit effluent. Mixing Tank 1, which is considered the DAF unit influent, contained 5,627 μg/L total SVOCs. The DAF unit effluent contained 2,214 μg/L total SVOCs and the DAF unit sludge contained 2,272 μg/L total SVOCs. Therefore, the DAF unit reduces the total SVOC loading by approximately 60%.

Tank 2: Between the DAF unit and Carbon Vessel 1, a significant reduction in total SVOCs occurred. Total SVOC concentrations are reduced from 2,214 μg/L to 1,436 μg/L. This reduction could partially be caused by volatilization since the water entering Tank 2 contains micro-bubbles generated in the DAF unit, aerobic degradation, or inaccuracy within the analytical method. As the water settles in Tank 2, these bubbles are released, removing some volatile compounds. The reduction in Tank 2 (778 μg/L) represents 14% of the total SVOCs removed from the water and a 35% removal efficiency across this process step. An increase in SVOC concentrations was observed in sample OU9TT06 (Tank 2 influent) which is attributed to a relatively high naphthalene detection (2,400 μg/L). All other compounds in the sample are within the range of concentrations observed in sample OU9TT05 (DAF unit effluent). The exact cause of this increase in naphthalene concentration is not known. The second round of treatment train samples may help to resolve this apparent anomaly.

GAC Units 1 and 2: Water entering the GAC units (sample OU9TT09) contained 1,436 μg/L of total SVOCs. Effluent SVOC concentrations were below detection limits (10 μg/L). The

reduction in total SVOCs in the GAC vessels represents approximately 26% removal of the total SVOCs from the groundwater and greater than 99% removal efficiency across this process unit.

Treatment System Conclusions

Based on the total SVOC removal as an indicator of the system performance, 60% of the contaminant removal occurs in the DAF unit, 14% occurs in Tank 2, and 26% occurs in the GAC. The treatment system is effective in removing contaminants to the discharge permit limits. However, the system is too reliant on carbon adsorption for removal of organic compounds. A preferable organic removal rate would be 80% to 90% in the DAF unit and 10% to 20% removal in Tank 2 and the GAC units. Treatment system enhancements will focus on reducing the need to rely on the GAC units for significant organic removal.

The presence of galvanized steel piping in the treatment system appears to be the cause of increasing zinc concentrations through the system. Treatment system enhancements will likely include replacing the galvanized steel piping with synthetic piping, which is compatible with the nature of the groundwater contaminants and system chemicals.

3.1.4 Operation Modifications

No modifications to the operation of the treatment system or the equipment were made during this period.

3.1.5 Off-Site Disposal

No off-site disposal of waste was conducted during this period. The spent carbon generated during this period was stored on-site in the treatment building. E & E initiated a carbon servicing agreement with Clean Environmental Concepts (CEC), in lieu of carbon disposal. In the future, spent carbon vessels will be taken by CEC to Cameron Yakima, Inc. for servicing, which entails carbon removal and regeneration, vessel inspection, installation of virgin carbon, and return shipment to the site.

3.1.6 Problems and Corrective Actions

The freezing weather conditions in late January 1996 caused significant damage to all the PVC pipes in the filtration section of the treatment system; as well as the water lines in the TFA. The pump housing on the TFA diaphragm pump cracked and can no longer hold the required pressure to operate.

E & E replaced all damaged piping and associated pump parts. No freeze protection was installed in the system since there is little risk of freezing temperatures occurring before next winter. E & E recommends installation of electric heat trace, pipe insulation, and/or space heaters to maintain suitable temperatures in the coming winter. In addition, any subsequent modifications will include freeze protection.

3.2 Enhanced NAPL Extraction

3.2.1 Operation Summary

Enhanced NAPL extraction was conducted throughout the operation period at wells EW-1, EW-4, and EW-7 in the TFA. EW-4 was not used in December 1995 because of vandalism to the pump power cables; the cables were cut at the well head and removed, presumably for the copper wire. EW-4 was repaired and reactivated on January 2, 1996. The operation summary for each well is shown in Table 3-4.

3.2.2 Operation Modifications

During this operation period no physical modifications, except repairs, were made to the pumps, piping, or equipment. E & E did reduce the pumping rate at EW-4 and EW-7 on January 25, 1996 from 5 gpm to 4 gpm in both wells. This rate was used through January 29, 1996, at which time the system was shutdown due to freezing temperatures.

3.2.3 Testing and Results

On January 26, 1996, E & E collected a timed series of samples from each of the TFA extraction wells (EW-1, EW-4, and EW-7) to determine contaminant loading changes over time. The extraction wells and treatment system were operating under normal conditions when the samples were collected. The samples were collected during three time intervals during the day, between 8:30 and 9:30 am (sample interval 1), between 11:20 and 11:50 am (sample interval 2), and between 2:30 and 2:50 pm (sample interval 3). Each sample was analyzed for the following parameters: TDS, TSS, COD, BOD, TOC, total metals, dissolved metals, TRPH, VOCs, and SVOCs. The samples were collected from the hoses discharging to the TFA transfer tank. Samples obtained during the first sample interval were collected at pump startup. The hose was purged for one minute prior to sampling. The water samples were analyzed at ASC, a subcontract laboratory. The results are provided in Table 3-5.

TABLE 3 - 4 TFA ENHANCED NAPL EXTRACTION WELL OPERATION SUMMARY			
WELL NUMBER	TOTAL OPERATION TIME	WATER EXTRACTION RATE (GPM)	TOTAL VOLUME OF WATER EXTRACTED
EW-1	179 HOURS, 15 MINUTES	2	21,510
EW-4	121 HOUR, 15 MINTUES	5	34,995
EW-7	179 HOURS, 15 MINUTES	5	52,395

Table 3-5

SUMMARY OF TIME SERIES EXTRATION WELL SAMPLE RESULTS
MCCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

Sample Number	EW-1-1	EW-1-2	EW-1-3	EW-4-1	EW-4-2
Inorganic Parameters (mg/L)					
Total Dissolved Solids	380	390	360	380	400
Total Suspended Solids	5	4 U	4 U	65	45
Chemical Oxygen Demand	130	110	110	370	190
BOD5	37	69	25	120	64
Total Organic Carbon	45	32	32	42	24
Total Metals (µg/L)					
Arsenic	43	38	41	32	31
Lead	5 U	5 U	5 U	5 U	5 U
Cadmium	5 U	5 U	5 U	5 U	5 U
Chromium Total	10 U	10 U	10 U	10 U	10 U
Copper	20 U	20 U	20 U	20 U	20 U
Nickel	20 U	20 U	20 U	20 U	20 U
Zinc	19	25	13	38	23
Dissolved Metals (µg/L)					
Arsenic	42	18	30	15	16
Lead	5 U	5 U	5 U	5 U	5 U
Cadmium	5 U	5 U	5 U	5 U	5 U
Chromium Total	10 U	10 U	10 U	10 U	10 U
Copper	20 U	20 U	20 U	20 U	20 U
Nickel	20 U	20 U	20 U	20 U	20 U
Zinc	22	21	17	24	15
Petroleum Hydrocarbons (mg/L)	7.9	1 U	1 U	38 J	12
VOCs (µg/L)					
1,2-Dichloroethane	4.8	3.2	3.7	11	2.1
Acetone	38	23	54 X	16	1 U
Benzene	1	0.96 J	0.64 J	3.8	3.8
Chloroform	1 U	1 U	1 U	1 U	1 U
Chloromethane	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	7	5.8	3.6	17	14
Methylene chloride	1 U	1 U	1 U	0.6 J	1 U
Toluene	2.6	2.8	1.8	6.8	6.1
Total Xylenes	15	13	11	42	35
BNAs (µg/L)					
2,4-Dichlorophenol	50 U	50 U	50 U	200 U	200 U
2,4-Dimethylphenol	330	290	180	240	190 J
2-Methylnaphthalene	470	330	82	2200	920
2-Methylphenol	100	90	79	200 U	200 U
4-Methylphenol	160	140	130	200 U	200 U
Acenaphthene	390	300	86	1700	660
Acenaphthylene	50 U	50 U	50 U	200 U	200 U
Anthracene	37	23 J	7.4 J	440	120
Benzo(a)anthracene	50 U	50 U	50 U	250	74

Table 3-5

SUMMARY OF TIME SERIES EXTRATION WELL SAMPLE RESULTS
MCCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

Sample Number	EW-1-1	EW-1-2	EW-1-3	EW-4-1	EW-4-2
Benzo(a)pyrene	50 U	50 U	50 U	79 J	200 U
Benzo(b)fluoranthene	50 U	50 U	50 U	130 J	200 U
Benzo(k)fluoranthene	50 U	50 U	50 U	46 J	200 U
bis(2-Ethylhexyl)phthalate	50 U	36 J	50 U	200 U	200 U
Chrysene	15 J	50 U	50 U	250	55
Dibenzofuran	220	170	47 J	1100	400
Fluoranthene	92	38 J	11 J	1200	330
Fluorene	250	190	57	1400	490
Naphthalene	1800	1300	320	4100	3200
Pentachlorophenol	250 U	250 U	250 U	1000 U	1000 U
Phenanthrene	340	220	68	3300	970
Phenol	50 U	50 U	12 J	200 U	200 U
Pyrene	58	24 J	11 J	840	270
Total BNAs (excluding "U" values)	4262	3151	1090.4	17275	7679

Table 3-5

SUMMARY OF TIME SERIES EXTRATION WELL SAMPLE RESULTS
MCCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

Sample Number	EW-4-3	EW-7-1	EW-7-2	EW-7-3
Inorganic Parameters (mg/L)				
Total Dissolved Solids	370	420	420	410
Total Suspended Solids	23	64	34	39
Chemical Oxygen Demand	120	400	110	110
BOD5	42	41	19	19
Total Organic Carbon	22	44	31	38
Total Metals (µg/L)				
Arsenic	34	13	16	16
Lead	5 U	5 U	5 U	5 U
Cadmium	5 U	5 U	5 U	5 U
Chromium Total	10 U	10 U	10 U	10 U
Copper	20 U	20 U	20 U	20 U
Nickel	20 U	20 U	20 U	20 U
Zinc	22	10U	10 U	10 U
Dissolved Metals (µg/L)				
Arsenic	20	16	9.7	8.3
Lead	5 U	5 U	5 U	11
Cadmium	5 U	5 U	5 U	5 U
Chromium Total	10 U	110	10 U	10 U
Copper	20 U	32	20 U	20 U
Nickel	20 U	120	20 U	20 U
Zinc	17	400	10 U	10
Petroleum Hydrocarbons (mg/L)	13	10	1	1 U
VOCs (µg/L)				
1,2-Dichloroethane	1 U	2	1.7	6.6
Acetone	1 U	1 U	1 U	1 U
Benzene	3.9	7.1	7.4	7.1
Chloroform	1 U	1 U	1 U	1 U
Chloromethane	1 U	1 U	1 U	1 U
Ethylbenzene	14	62	66	64
Methylene chloride	1 U	1 U	1 U	1 U
Toluene	5.5	12	9.9	12
Total Xylenes	25	130	110	96
BNAs (µg/L)				
2,4-Dichlorophenol	200 U	500 U	50 U	100 U
2,4-Dimethylphenol	210	380 J	370	300
2-Methylnaphthalene	1400	1200	630	590
2-Methylphenol	200 U	62 J	52	45 J
4-Methylphenol	200 U	500 U	18 J	16 J
Acenaphthene	1200	820	270	260
Acenaphthylene	200 U	500 U	50 U	100 U
Anthracene	280	190 J	20 J	29 J
Benzo(a)anthracene	160 J	500 U	5.6 J	100 U

Table 3-5

SUMMARY OF TIME SERIES EXTRATION WELL SAMPLE RESULTS
MCCORMICK & BAXTER CREOSOTING COMPANY
PORTLAND, OREGON

Sample Number	EW-4-3	EW-7-1	EW-7-2	EW-7-3
Benzo(a)pyrene	**51 J**	500 U	50 U	100 U
Benzo(b)fluoranthene	**79 J**	**57 J**	50 U	100 U
Benzo(k)fluoranthene	200 U	500 U	50 U	100 U
bis(2-Ethylhexyl)phthalate	200 U	500 U	50 U	100 U
Chrysene	**160 J**	**99 J**	**4.5 J**	100 U
Dibenzofuran	**760**	**490 J**	**150**	**150**
Fluoranthene	**830**	**480 J**	**29 J**	**65 J**
Fluorene	**990**	**630**	**150**	**150**
Naphthalene	**3800**	**4500**	**5700**	**4800**
Pentachlorophenol	1000 U	2500 U	250 U	500 U
Phenanthrene	**2100**	**1300**	**180**	**220**
Phenol	200 U	500 U	50 U	100 U
Pyrene	**520**	**440 J**	**27 J**	**47 J**
Total BNAs (excluding "U" values)	**12540**	**10648**	**7606.1**	**6672**

General Parameters

General chemistry parameters include TDS, TSS, COD, BOD, and TOC. The results for each of these parameters for EW-1 remained relatively constant throughout the sample intervals. EW-4 and EW-7 had slight decreases in the results over time for TSS, COD, BOD, and TOC, particularly between sample intervals 1 and 2. The changes between sample intervals 2 and 3 do not appear to be significant. TDS remained constant over time for each well. The range of the analytical results were typical for groundwater.

Total Metals

Arsenic and zinc were the only site-related contaminants identified in the extraction wells. The highest detection of arsenic was 43 μg/L at EW-1, and the lowest was 13 U μg/L at EW-7 (during the first sample interval). The highest detection of zinc was 38 μg/L at EW-4 during sample interval 1, and the lowest was 13 μg/L at EW-1 during sample interval 3. In general, total metal concentrations did not change significantly over time, and no specific trends can be identified.

Dissolved Metals

Arsenic and zinc were the primary metals detected in the dissolved metals analysis. Lead was detected once in EW-7 (11 μg/L) during sample interval 3. Chromium, copper, and nickel were detected in EW-7, however, they were not detected in the other wells, nor were they detected in EW-7 at later sample intervals. Arsenic concentrations ranged from 42 μg/L (EW-1) to 8.3 μg/L (EW-7). Zinc concentrations ranged from 400 μg/L (EW-7) to 10 μg/L (EW-7). The detection of zinc at 400 μg/L was unusually high with respect to the other data. Typical zinc concentrations were approximately 20 μg/L.

Total Recoverable Petroleum Hydrocarbons

EW-4 contained the highest concentration of TRPH (38 mg/L). In each well, TRPH concentrations were highest in sample interval 1, then decreased over the day until they approached the detection limit of 1 mg/L. No significant change was evident between sample intervals 2 and 3.

Volatile Organic Compounds

VOC concentrations were typically highest in sample interval 1, then decreased between sample intervals 1 and 2. No significant decrease in concentrations was observed between sample intervals 2 and 3. In general, the VOC concentrations detected in the samples were very low.

Semivolatile Organic Compounds

Naphthalene and naphthalene derivatives were the most prevalent SVOC compounds detected. All SVOC concentrations were summed for data comparison. With the exception of EW-4, the total SVOC concentrations decreased throughout the sample intervals. EW-4 initially decreased between sample intervals 1 and 2, then increased between intervals 2 and 3.

Conclusions

The time series samples from the extraction wells EW-1, EW-4, and EW-7 demonstrate that contaminant loading decreases most significantly within the initial 3 to 4 hours of pumping. After that time, contaminant concentrations appear to stabilize. The data indicate that pulse pumping for 2 to 3 hours would likely be more effective for enhanced NAPL removal.

The sample results are also useful for the review, selection, and design of biological water treatment system components. The time series testing results will be used to predict the influent concentrations that could be expected under long term, continuous pumping conditions.

3.2.4 Problems and Corrective Actions

The following operating problems associated with the enhanced NAPL extraction wells were observed during this period:

- Flow meters and flow totalizers in the TFA do not record water flow or provide sporadic flow measurements;
- Vandals cut the power cables to EW-4 in December 1995; and
- The temporary electrical power installation at EW-4 needs to be upgraded to a permanent installation.

The most immediate concern is the flow meters. E & E proposes to purchase and install three new flow meters/totalizers at the transfer tank (instead of on the ground surface). The power cables to EW-4 were repaired in December 1995 by the field technician, but the current electrical installation prohibits protection from future vandalism.

4 Quarterly Groundwater Monitoring

Monitoring wells were sampled by E & E for the first quarterly groundwater sampling event during the week of January 22, 1996. The objective of quarterly groundwater sampling is to delineate areas where dissolved-phase organic and inorganic site contaminants are present in groundwater. Groundwater and river stage elevations were measured in wells during the sampling event and also are monitored on a weekly basis at the site in conjunction with daily operational site activities.

4.1 Groundwater Elevation Measurements

Groundwater elevations were measured in approximately 20 wells located throughout the site to determine the direction of groundwater flow. Daily groundwater fluctuations of several feet are common in the monitoring wells and are due primarily to river stage elevation changes, tidal influences, precipitation, and barometric pressure.

Upon assuming control of the site, E & E collected weekly groundwater measurements at wells distributed across the site. The wells were chosen to determine flow across site boundaries, adjacent to the river, and near the source areas and their respective extraction wells. Weekly groundwater elevations were not consistently gathered until January 1996, the second month of E & E's operation. Groundwater elevations for November 1995 were collected by PTI during their field activities. Figure 4-1 represents November 2, 1995 groundwater elevations and typify conditions for that month. Groundwater is moving toward the river, and drawdowns due to the pumping of wells EW-4s and EW-7s are recognizable. This figure likely represents conditions for the fall, just prior to winter precipitation events.

December 1995 groundwater elevations were collected on three occasions, primarily following flood events. Figure 4-2 represents conditions for December 5, 1995. The river was in a flood stage and groundwater movement from the river towards the site is evident. The extraction wells in the TFA were not in operation at this time. Figure 4-3 represents January 5, 1996 groundwater elevations. This figure represents the first event to include all of the wells that are measured on

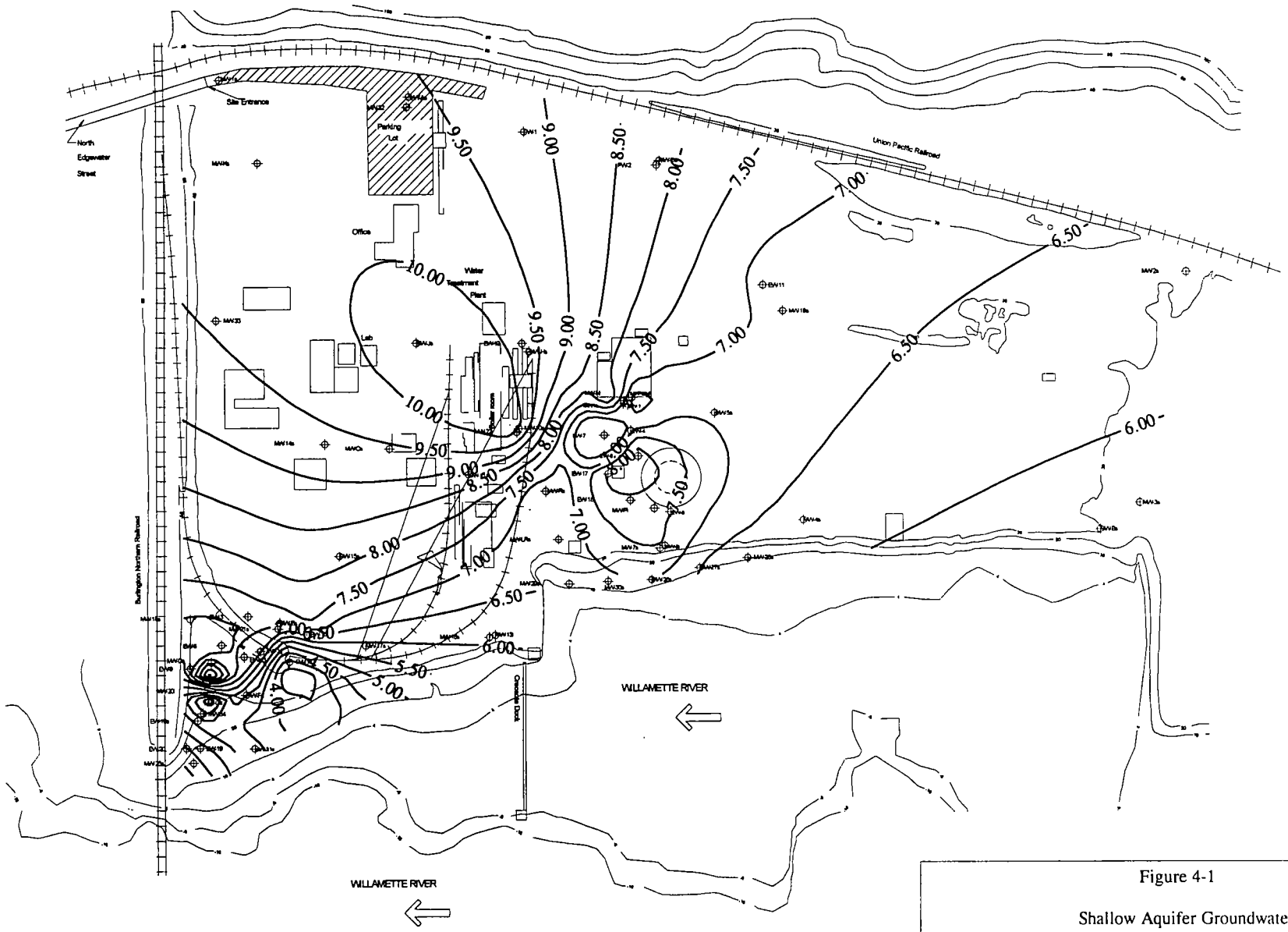

Figure 4-1

Shallow Aquifer Groundwater Elevations
November 2, 1995
McCormick & Baxter Creosoting Company
Portland, Oregon

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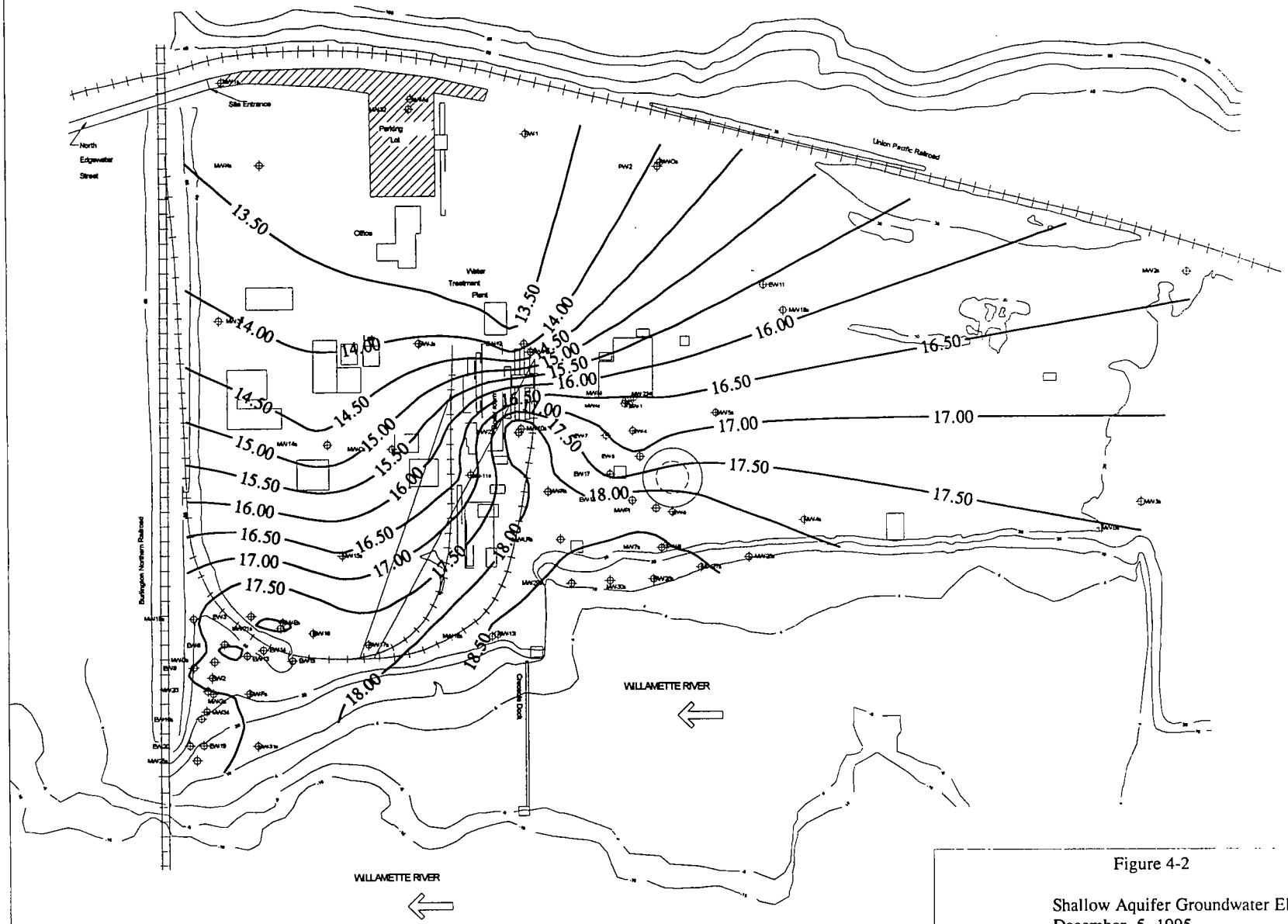

Figure 4-2

Shallow Aquifer Groundwater Elevations
December 5, 1995
McCormick & Baxter Creosoting Company
Portland, Oregon

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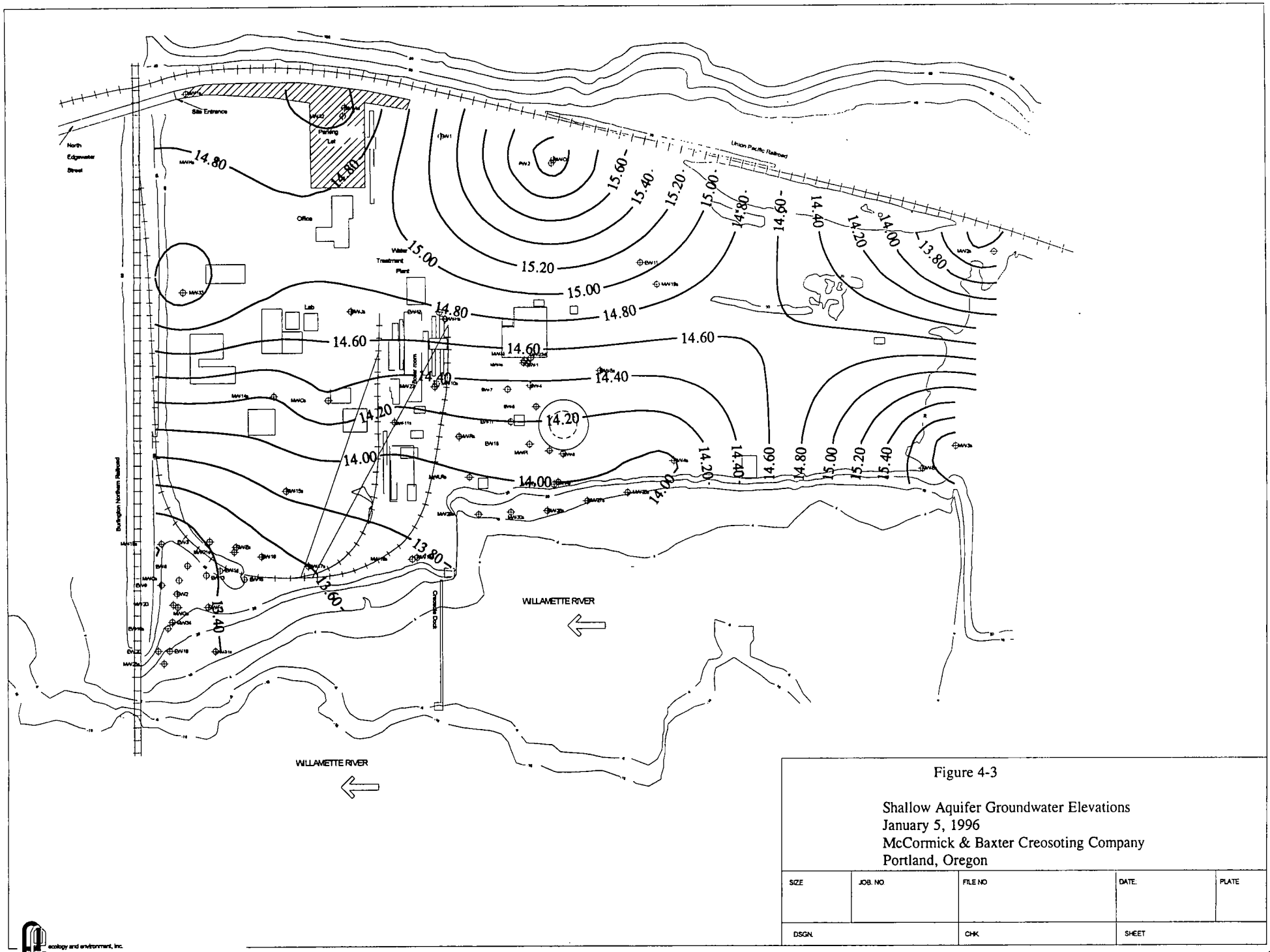

Figure 4-3

Shallow Aquifer Groundwater Elevations
January 5, 1996
McCormick & Baxter Creosoting Company
Portland, Oregon

SIZE	JOB. NO.	FILE NO	DATE.	PLATE
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a weekly basis at the site. Groundwater elevations indicate that, in general, groundwater is once again moving towards the river, following the December flood events.

Figures 4-4, 4-5, and 4-6 represent the weekly measurements for February 1996. February 1996 measurements are significant because they represent the groundwater elevations at the site after the 100-year flood event in which the Willamette River rose up to the top of wells EW-10s and MW-34i in the FWDA, partially flooded the site near the location of MW-3s, and came within several feet of flooding the site near the creosote dock. The Riedel property to the east of the site was partially flooded and several 55-gallon drums were carried off into the river. Figure 4-4 represents the groundwater flow on February 2, 1996 prior to the flooding event, and is similar to the January 1996 measurements. Figure 4-5 represents groundwater flow on February 9, 1996, and is near the peak flood of the Willamette River. MW-3s was, at this time, under water and could not be monitored. This figure shows a strong component of groundwater flow towards the site. In addition, deep monitoring wells MW-23d, PW-1d, and PW-2d showed increases in groundwater elevation of 17, 2, and 2 feet, respectively, from the previous week. Observations of increased groundwater elevation in MW-23d is likely the most interesting, indicating the connectivity of the deeper aquifer and the river. Figure 4-6 represents groundwater flow on February 16, 1996, approximately 1 week following the peak of the Willamette River flooding. The flooding effects can still be observed in the groundwater elevations. A groundwater mound is present beneath the retort area and flow is still generally inward, except in the FWDA where groundwater is flowing toward the river.

Three transducers and data loggers are scheduled to be installed in March 1996 to provide hourly measurements of river stage at the site and shallow groundwater elevations to supplement the weekly measurements. The transducers will help to better quantify site conditions, such as flooding events, which is important for future remedial design.

4.1.1 Groundwater Gradients

Horizontal Gradient

Horizontal groundwater gradients for the site were determined for average groundwater flows during the quarter and from the flood events in December 1995 and February 1996.

The average shallow horizontal groundwater gradient determined from measurements made on December 2, 1995, during a flood event, indicated a gradient in the TFA of approximately 0.009 (47.52 feet/mile) toward the site and a gradient in the FWDA of approximately 0.009 (47.52 feet/mile) toward the site. The gradients were determined between wells EW-12s and MW-LRs in the TFA and MW-14s and EW-16s in the FWDA.

The average shallow horizontal groundwater gradient determined from measurements made on February 2, 1996, just prior to the flood event, indicated a gradient in the TFA of approximately

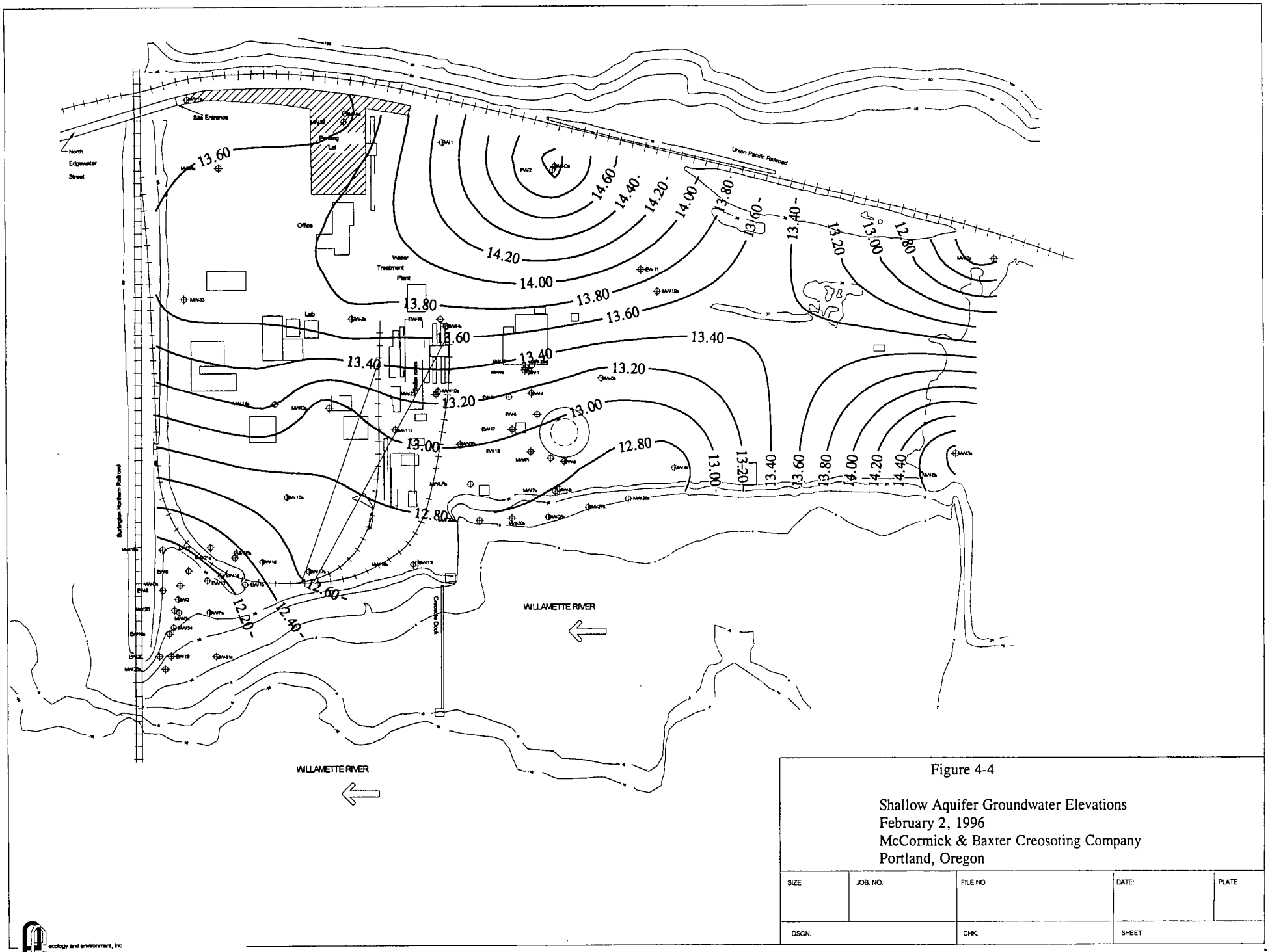

Figure 4-4

Shallow Aquifer Groundwater Elevations
February 2, 1996
McCormick & Baxter Creosoting Company
Portland, Oregon

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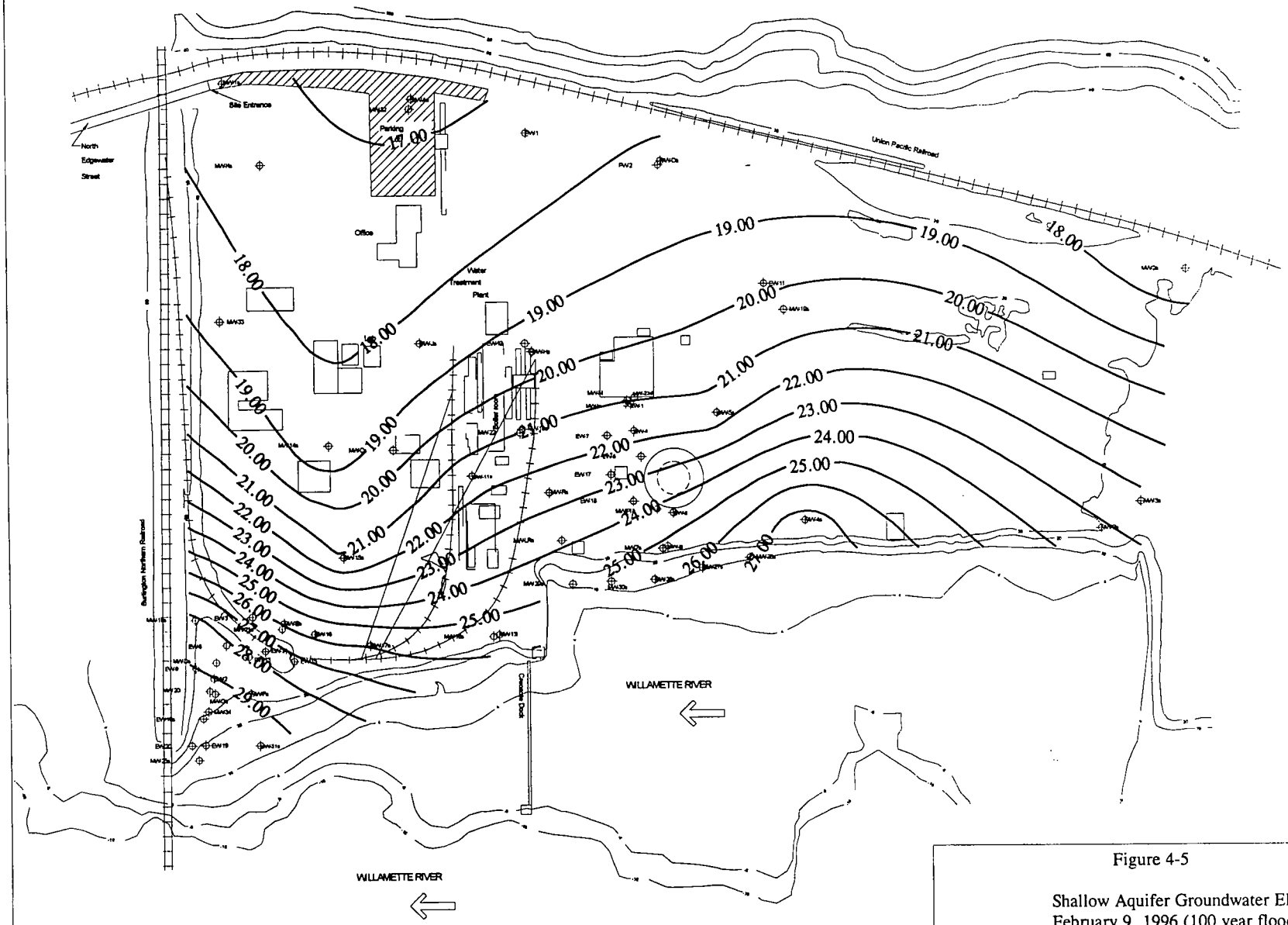

Figure 4-5

Shallow Aquifer Groundwater Elevations
February 9, 1996 (100 year flood)
McCormick & Baxter Creosoting Company
Portland, Oregon

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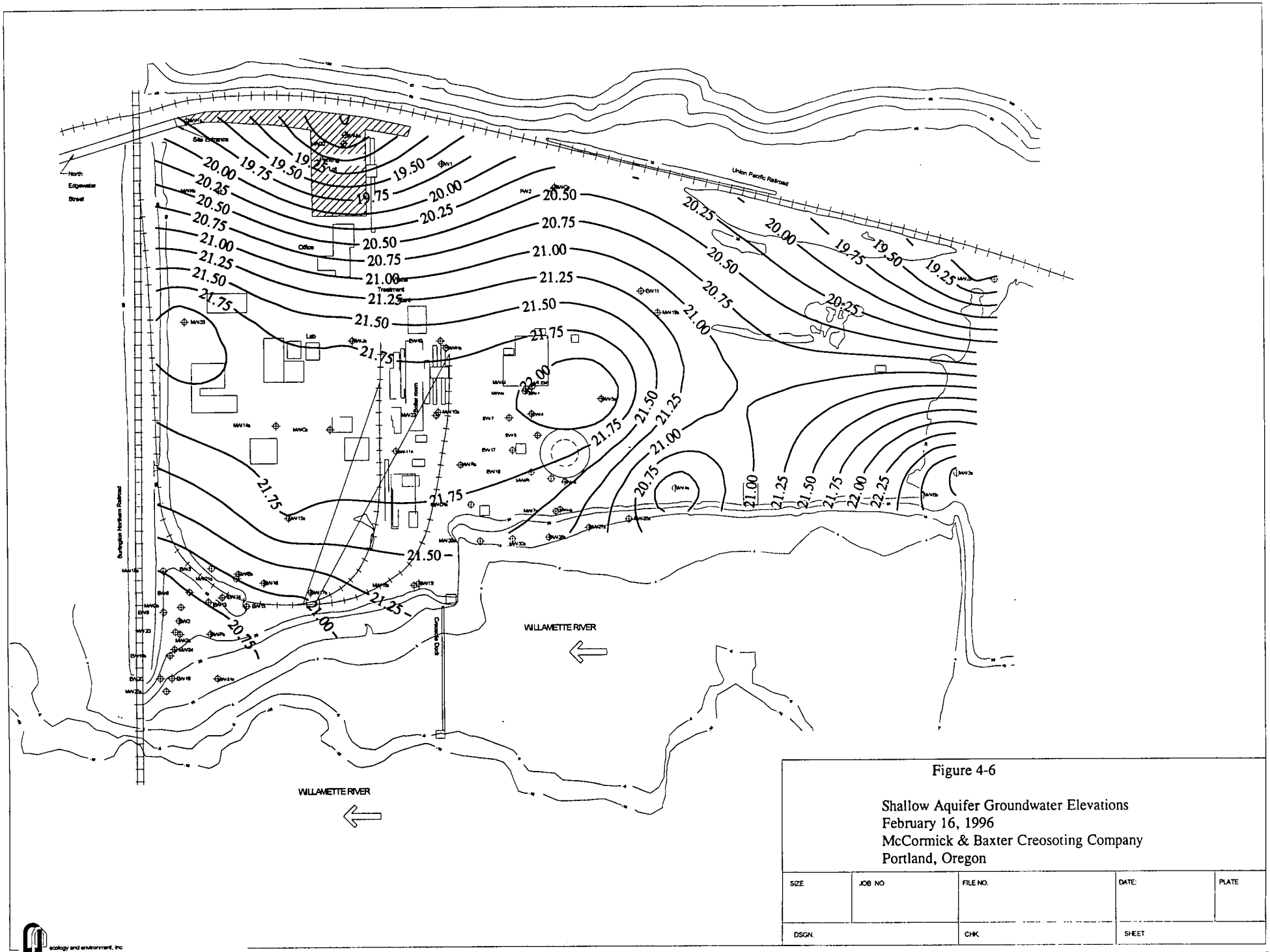

Figure 4-6

Shallow Aquifer Groundwater Elevations
February 16, 1996
McCormick & Baxter Creosoting Company
Portland, Oregon

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0.003 (15.84 feet/mile) toward the river and a gradient in the FWDA of approximately 0.006 (31.68 feet/mile) toward the river. The gradients were determined between wells MW-Is and MW-Os in the TFA and wells MW-17s and MW-Fs in the FWDA.

The average shallow horizontal groundwater gradient determined from measurements made on February 9, 1996, at the height of the flooding, indicated a gradient in the TFA of approximately 0.01 (52.8 feet/mile) toward the site and a gradient in the FWDA of approximately 0.02 (105.6 feet/mile) toward the site. The gradients were determined between wells MW-Os and MW-4s in the TFA and wells MW-14s and MW-18s in the FWDA.

The average shallow horizontal groundwater gradient determined from measurements made on February 16, 1996, one week following the height of the flooding, indicated a gradient in the TFA of approximately 0.009 (47.52 feet/mile) from the groundwater mound near the center of the site toward the river and a gradient in the FWDA of approximately 0.006 (31.68 feet/mile) from the groundwater mound near the center of the site toward the river. The gradients were determined between wells MW-5s and MW-4s in the TFA and wells MW-15s and MW-Fs in the FWDA.

The average intermediate horizontal groundwater gradients were not determined in the TFA or the FWDA, as it is expected that gradients and directions are similar to the shallow aquifer zone. The intermediate aquifer zone is in direct contact with the shallow aquifer zone near the river.

No horizontal gradients were determined for the deeper aquifers at the site. MW-23d is completed in a different aquifer than the only other two deep monitoring wells, PW-1d and PW-2d.

Wells MW-LRs, MW-16s, and perhaps MW-30s, will be added to the weekly measurements to add detail to the area immediately downgradient of the TFA. Wells MW-31s and EW-20s in the FWDA are expected to be able to be measured on a weekly basis following recession of flood waters covering the wells.

Vertical Gradients

A comparison of paired monitoring wells MW-Is, MW-Ni and MW-23d was performed to identify vertical groundwater gradients at the site, specifically the TFA. A vertical groundwater gradient of 0.04 downwards was determined between the shallow and intermediate well for January 5, 1996. The January data are fairly representative of the conditions typical of the TFA during the winter. Gradients of 0.0075 to 0.1 upward were determined in the intermediate and deep well on January 5, 1996 and during the flood event of February 9, 1996. The strong change in the gradient is reflected in an increase of the groundwater elevation of MW-23d by over 17 feet from measurements during the previous weeks.

4.2 River Elevation Measurements

As described above, the river stage is monitored on a weekly basis in conjunction with weekly measurement of groundwater elevations. River stage is currently measured in an open ended 4-inch PVC well casing suspended from the middle of the creosote dock.

Previous work has already determined that river stage is an important controlling factor on the flow of groundwater at the site. In general, during high river stage conditions (winter, spring), groundwater flow is towards the site, and during low river stage conditions (summer, fall) groundwater flow is toward the river.

The flooding events and their effects on groundwater flow during December 1995 and February 1996 are discussed in the previous section. The February 1996 event represented a 100-year flood event. The next quarterly report will incorporate information obtained from the United States Geological Survey (USGS) on the maximum river stage and volume throughput of the river during the flooding events. This information is currently being compiled for the Willamette River by the USGS.

4.3 Quarterly Sampling Activities

Samples were collected from wells installed during the RI investigation to evaluate the extent of groundwater contamination in the shallow, intermediate, and deep groundwater zones at the site (see Table 4-1). Groundwater samples were submitted to DEQ's laboratory in Portland, Oregon for analysis of VOCs, SVOCs, total and dissolved metals, and TRPH.

Groundwater samples were extracted from all wells using submersible pumps (Grundfos Redi-Flow 2) and low-flow sampling techniques. Samples for all analytical parameters were collected directly into sample containers from the pump. The submersible pumps were thoroughly decontaminated prior to field use and between wells. The wells in which contamination concentrations were expected to be high were sampled using dedicated hosing installed within the wells.

Purge water was containerized in DOT 17E/17H 55-gallon drums and treated in the onsite treatment system. After samples were placed in appropriate containers, they were preserved as required, placed on ice, and stored in coolers prior to shipment to the DEQ laboratory. A detailed description of sampling protocol is provided in E & E's Pre-Remedial Design Work Plan dated February 1996.

4.4 Groundwater Quality

Dissolved groundwater contaminant concentrations from the quarterly sampling results appear to be lower than previous analytical data collected at the site. In general, the wells selected for

Table 4-1

BASELINE QUARTERLY GROUNDWATER SAMPLING WELLS
McCormick & Baxter
Portland, Oregon

Well	Tank Farm Area (TFA)	Forward Waste Disposal Area (FWDA)	Other Wells	Rationale
MW-4s	x			Monitor shallow groundwater down/cross-gradient of TFA.
MW-5s	x			Monitor shallow groundwater down/cross-gradient of TFA.
MW-13i	x			Monitor intermediate groundwater transition zone between TFA and FWDA plumes. Collect vertical gradients with MW-16s.
MW-16s	x			Monitor shallow groundwater transition between TFA and FWDA plumes. Collect vertical gradients with MW-13i.
MW-23d	x			Monitor deep groundwater beneath TFA.
MW-29s	x			Monitor shallow groundwater/river zone downgradient of TFA. Possible compliance point.
MW-Ni	x			Monitor intermediate groundwater below TFA.
MW-LRs	x			Monitor shallow groundwater downgradient of TFA. Possible compliance point.
EW-12	x			Monitor shallow groundwater below retorts.
EW-17	x			Monitor shallow groundwater downgradient of TFA.
MW-14s		x		Monitor shallow groundwater upgradient of FWDA.
MW-17s		x		Monitor shallow groundwater transition zone between TFA and FWDA plumes.
MW-18s		x		Monitor shallow groundwater downgradient of FWDA. Also site boundary well.
MW-31s		x		Monitor shallow groundwater/river zone downgradient of FWDA. Possible compliance point.
MW-Fs		x		Monitor shallow groundwater downgradient of FWDA.

Table 4-1

BASELINE QUARTERLY GROUNDWATER SAMPLING WELLS
McCormick & Baxter
Portland, Oregon

Well	Tank Farm Area (TFA)	Forward Waste Disposal Area (FWDA)	Other Wells	Rationale
EW-20		x		Monitor downgradient of FWDA. Also site boundary well.
MW-2s			x	Background and upgradient shallow groundwater.
MW-3s			x	Background shallow groundwater/river transition zone.
MW-As			x	Background and upgradient shallow groundwater.
MW-Ks			x	Background shallow groundwater downgradient of MW-1s.
MW-Os			x	Background and upgradient shallow groundwater.

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quarterly sampling were wells located along the site boundaries and the river and not directly within the free-product NAPL plumes in the TFA and FWDA. The concentrations of contaminants would obviously be expected to be higher in wells in which pure-phase NAPL is present, and previously collected analytical data show this to be the case at the site.

Tables 4-2 and 4-3 presents the organic and inorganic detections for the quarterly sampling event. A brief discussion of dissolved organic and inorganic contaminants in groundwater is presented below.

Organic Contaminants

- PAHs and TRPH were the primary organic contaminants detected during the quarterly groundwater sampling. Pentachlorophenol (PCP) also was detected in a few of the wells. Detection of 1,1,1-tricholoroethane (1,1,1-TCA) is believed to be a laboratory contaminant and is not considered related to site activities. No previous analytical sampling has detected 1,1,1-TCA.

- The highest concentrations of dissolved total PAH contaminants in the shallow aquifer were found in the two source areas (see Figure 4-7).

- Total PAH concentrations in shallow wells ranged from undetected to 5.469 mg/L in EW-12s. TRPH concentrations ranged from non-detect to 7.9 mg/L.

- Along the upgradient site boundary, shallow wells MW-2s and MW-Os did not have detectable concentrations of PAHs or PCP, but TRPH was detected at concentrations of 0.3 and 5.4 mg/L, respectively.

- Shallow monitoring wells in the TFA but outside of the NAPL plume areas indicated an absence or low concentration of site contaminants.

- Intermediate zone wells within the two source areas exhibited a range of contaminant concentrations similar to the shallow wells. Intermediate zone wells downgradient of plume areas generally showed little or no impact by organic contaminants.

- The deep zone well sampled, MW-23d, did not contain detectable concentrations of total PAHs, PCP, or TRPH.

Inorganic Contaminants

- Inorganic contaminants include arsenic, chromium, copper, and zinc, which were the metals primarily used in the wood treating processes. Quarterly sampling results suggest that the shallow groundwater outside of the pure-phase NAPL plumes is largely unaffected by these inorganic contaminants. A comparison of arsenic concentration results from the RI data and data collected during the quarterly sampling shows that arsenic is prevalent in wells in which NAPL is present, but is not present in large concentrations outside of the plumes (Figure 4-8). Note, there are no discernable differences between total and dissolved concentrations.

Table 4-2

ORGANIC RESULTS
QUARTERLY SAMPLING, JANUARY 1996
MCCORMICK & BAXTER CREOSOTING COMPANY, PORTLAND, OREGON
UNITS: mg/L

Chemical Name	EW-12s	EW-17s	EW-20s	MW-13I	MW-14s	MW-16s	MW-17s	MW-18s	MW-23d	MW-2s	MW-3s	MW-4s	MW-5s	MW-As	MW-Fs	MW-Ks	MW-LRs	MW-NI	MW-Os
VOCs																			
1,1,1-Trichloroethane				0.0015	0.0017	0.0017	0.0036		0.0011	0.0076	0.0058	0.0036		0.0027		0.0021			0.0028
1,1-Dichloroethane																0.0006			
1,2,4-Trimethylbenzene	0.0181	0.055	0.0236					0.0426							0.0007		0.0063		
1,2-Dichlorobenzene	0.0496																		
1,2-Dichloroethylene										0.0007									
1,2-Dimethylbenzene	0.0055	0.0209	0.0059					0.0235									0.0043		
1,4-Dichlorobenzene	0.0009																		
1,4/1,3-Dimethylbenzene	0.0063	0.0357	0.0064					0.0114						0.0007			0.0016		
2,4-Dimethylphenol		0.48																	
2-Methylphenol		0.04																	
4-Isopropyltoluene	0.0015	0.0089	0.0016					0.0009											
4-Methylphenol		0.3																	
Benzene		0.0221						0.0009											
Chlorobenzene	0.0451																		
Chloroform												0.0037							
Ethylbenzene	0.0054	0.078	0.0058					0.0056							0.0007		0.004		
Methylene Chloride							0.0006			0.0011	0.0007	0.0007		0.0009					
n-butylbenzene			0.0013																
n-Propylbenzene	0.0013	0.0036	0.0009					0.0015									0.0009		
Phenol		0.01																	
Styrene			0.0006																
Toluene	0.0016	0.0159	0.0014					0.0059			0.0006			0.0007					
TRPH	0.1	7.9	0.1	0.1	0.1	0.1	5.2	0.1	0.1	0.3	1	0.1	0.1	0.2	0.1	0.1	5.7	1	5.4
BNAs																			
1,2,3,4-Tetrahydronaphthalene	0.075																		
1-Methylene-1H-indene	1.2																		
1-Methylnapthalene	0.12																		
2,3,4,6-Tetrachlorophenol			0.019																
2,3,5,6-Tetrachlorophenol			0.007												0.003				
2,3-Dihydro-1-methylindene	0.12																		
2,3-Dihydro-1H-indene	0.84																		
2,4-Dimethylphenol	0.05																		
2-Methylnaphthalene	0.32																		
7-Methylbenzofuran	0.09																		
Acenaphthene	0.28	0.1	0.053					0.043							0.017			0.002	
Acenaphthylene			0.001																
Anthracene	0.019	0.01						0.003							0.002				
Benzo[b]thiophene	0.14																		
Bis(2-ethylhexyl)phthalate			0.009		0.004					0.009	0.002		0.005	0.004				0.002	
di-n-Butylphthalate		0.002																	
Dibenzofuran	0.16	0.06	0.01					0.021							0.012			0.002	
Fluoranthene	0.02	0.02	0.012					0.003							0.004				
Fluorene	0.21	0.07	0.024					0.024							0.014			0.003	
Naphthalene	4.5	2						1.33											
Pentachlorophenol	0.006		0.32					0.014							0.017				
Phenanthrene	0.18	0.078						0.03							0.004			0.002	
Pyrene	0.011	0.013	0.006					0.002							0.003				
Total PAHs	5.469	3.183	0.461	0.001	0.004	0.001	0.001	1.47	0.001	0.009	0.002	0.001	0.005	0.004	0.076	0.001	0.001	0.011	0.001

Note: Detected concentrations presented only.

Table 4-3

INORGANIC RESULTS
QUARTERLY SAMPLING, JANUARY 1996
MCCORMICK & BAXTER CREOSOTING COMPANY, PORTLAND, OREGON
UNITS: mg/L

Chemical Name	EW-12s	EW-17s	EW-20s	MW-13I	MW-14s	MW-16s	MW-17s	MW-18s	MW-23d	MW-2s	MW-3s	MW-4s	MW-5s	MW-As	MW-Fs	MW-Ks	MW-LRs	MW-NI	MW-Os
Arsenic	0.005	0.009	0.006	0.023	0.011	0.005	0.005	0.023	0.005	0.005	0.005	0.005	0.01	0.01	0.006	0.029	0.005	0.005	0.006
Dissolved Arsenic	0.005	0.008	0.005	0.023	0.012	0.005	0.005	0.023	0.006	0.005	0.006	0.005	0.009	0.008	0.007	0.007	0.005	0.006	0.005
Barium	0.09	0.16		0.12	0.04			0.04			0.09	0.04	0.1	0.34	0.04		0.03	0.04	0.04
Dissolved Barium		0.15		0.12	0.04			0.04				0.03	0.1	0.22	0.04			0.04	0.03
Chromium														0.04					
Nickel		0.05																	
Dissolved Nickel		0.04																	
Vanadium														0.06					
Zinc	0.02	0.03	0.02	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.02	0.05	0.02	0.03	0.48	1.5	0.02	0.28	1.5
Dissolved Zinc	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.05	0.03	0.05	0.48	1.4	0.02	1.3	1.4

Note: Detected concentrations presented only.

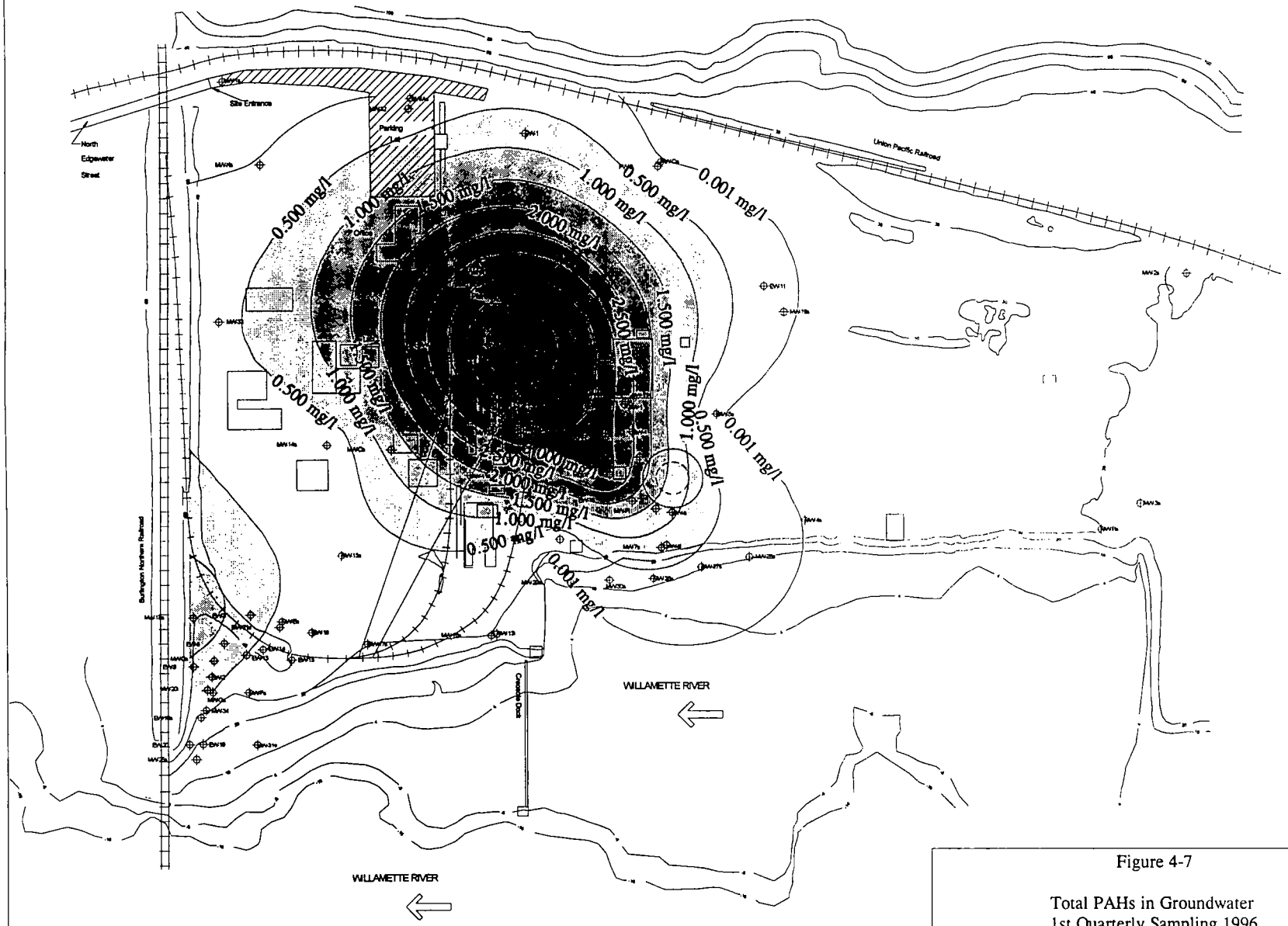

Figure 4-7

Total PAHs in Groundwater
1st Quarterly Sampling 1996
McCormick & Baxter Creosoting Company
Portland, Oregon

SIZE	JOB NO	FILE NO.	DATE.	PLATE
DSGN		CHK	SHEET	

ecology and environment, inc.

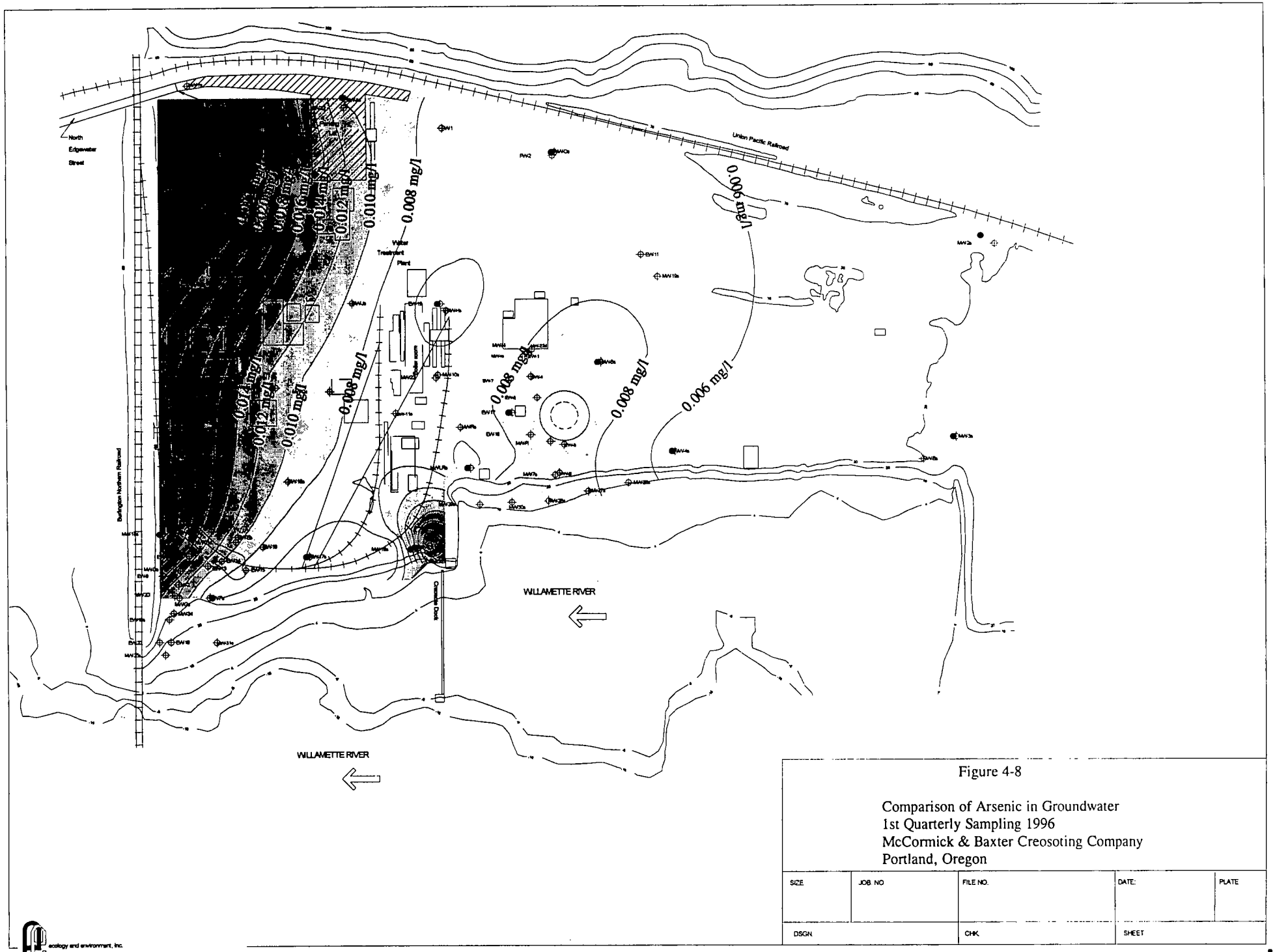

Figure 4-8

Comparison of Arsenic in Groundwater
1st Quarterly Sampling 1996
McCormick & Baxter Creosoting Company
Portland, Oregon

SIZE	JOB NO	FILE NO.	DATE:	PLATE
DSGN		CHK	SHEET	

ecology and environment, inc.

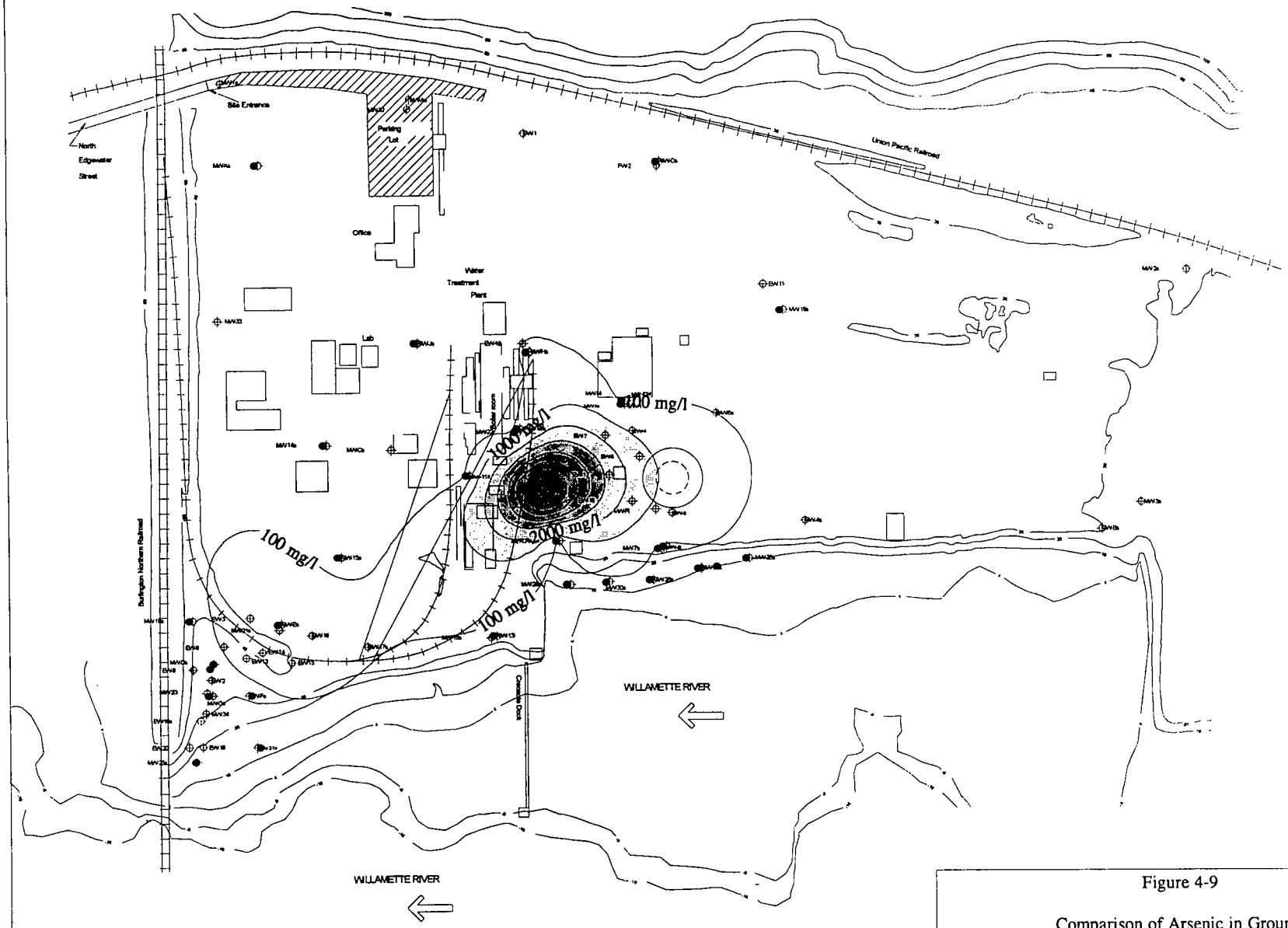

Figure 4-9

Comparison of Arsenic in Groundwater
RI/FS Data
McCormick & Baxter Creosoting Company
Portland, Oregon

SIZE	JOB. NO	FILE NO.	DATE:	PLATE
DSGN.		CHK.	SHEET	

ecology and environment, inc.

- A comparison of total and dissolved inorganic species indicates that the inorganic contaminants, when detected, are similar in concentration. This indicates that low-flow sampling techniques were implemented properly.

4.5 Site Database

All data previously generated by PTI during the RI/FS process have been incorporated into an electronic database using Microsoft Access™. The query structure for normal database operation is still under development and is expanded based on data needs for the operation of the site (e.g., determination of well screen elevations versus groundwater elevations versus LNAPL thickness). Information was imported into Access from electronic files, when available, or entered manually, if not available in a compatible electronic format. All sample numbers and analytical data for the site have been incorporated into the database, including as-built information for all existing monitoring and extraction wells. Spatial (northing/easting coordinates) and elevation/depth information for each sample location also was incorporated into the database, although field observations suggest that some of the well locations may have been identified incorrectly and may only need to be re-surveyed.

Field and laboratory data collected by E & E are incorporated into the database as the data are received. Analytical data are entered when they are received from the laboratory, and data collected from the monitoring wells and daily site activities are entered into the database on a weekly basis. The database is capable of providing tabulated and formatted data via querying procedures for contouring, statistical programs, or other software. The data can then be used in the calculation of volume estimates for potential removal alternatives or interim removal action measures, or any other use, as necessary. The database will be put in a compatible format and provided to DEQ for use in their own database system. The database is available for inspection and is currently maintained in E & E's offices in Seattle and Portland.

5 General Site Operations

5.1 Health and Safety

One accident in which an injury was sustained occurred at the site during this reporting period. The site technician attempted to move a 80-gallon drum of activated carbon without the aid of a drum cart or fork truck. The fork truck was not available because it was stuck in mud behind the treatment building. The site technician sustained a broken toe when he lost control of the drum. E & E has addressed this problem by restricting the fork truck to the treatment building and paved areas of the site. This will ensure that the fork truck is always available for its intended purposes. In addition, E & E also re-emphasized to the treatment system operator subcontractor the duties and responsibilities under their site specific health and safety plan.

During this period, chain link fence panels were installed around all open retort sumps. The sumps posed a significant hazard on-site because they are approximately 10 to 12 feet deep, contain several feet of stormwater, and the openings are flush with the ground surface. Personnel unfamiliar with the site could accidently trip and fall into one of these pits resulting in injury. The chain link fencing is 6 feet high and supported with concrete blocks.

5.2 Site Security

Securing the site from unauthorized entry continued to be a problem through this operation period. Vandals entered the site in December 1995 and gained access into the treatment building. While inside, they vandalized the site pick-up truck, damaged the fork truck preventing its operation, and spray painted graffiti on the DAF unit. The vandals poured chemical into the pick-up truck carburetor damaging the engine. In addition, air hoses were cut, electric cables were removed from well pumps, and minor vandalism occurred in the office building.

Upon DEQ's approval, E & E subcontracted with Northwest Protective Services to provide a security guard during evening hours and on weekends to monitor the site and report unauthorized trespassers. Following this action, trespassers have continued to enter the site; however, vandalism and/or theft of equipment has not occurred. The FWDA continues to be the primary place of entry into the site.

The treatment system operator has reported trespassers on-site during the day while he is conducting his routine work activities. He has confronted the trespassers and informed them of site hazards and has asked them to leave. He has also contacted the Portland Police, however, their response time is typically 30 minutes to 1 hour. The encounters with trespassers pose a risk to the treatment system operator because he is often on-site alone. One such incident occurred during the January 1996 quarterly sampling activities when there were four E & E personnel were on the site.

Trespassers are difficult to observe because they can hide in the vacant structures present on the western half of the site. E & E is concerned about security, and recommends the demolition of all unnecessary structures and removal of tall vegetation along the western fence line. This will significantly increase visibility and will likely reduce trespassing incidents.

The site did not have sufficient lighting to illuminate the area between the laboratory and treatment building after dark. E & E has contacted PGE to request that six new flood lights be installed in this area. The lighting will increase visibility for the guard and also will reduce the threat of trespassers entering the area.

Aside from repairing the holes in the fence holes in the FWDA, no action is pending to address the problem with trespasser access in the FWDA.

5.3 Gravel Driveway

In January 1996, E & E's subcontractor, GeoTech Explorations, Inc., installed two gravel driveways from the paved parking lot to the treatment building and laboratory. The driveways were installed to provide better access to these buildings and to preclude the requirement for vehicle decontamination in these highly traveled areas.

6 Conclusions and Recommendations

The TFA extraction wells appear to be pumping at too high a rate to maintain DNAPL contact over the course of a typical pumping day. The time series samples from the extraction wells EW-1, EW-4, and EW-7 demonstrate that contaminant loading decreases most significantly within the initial 3 to 4 hours of pumping. After that time, contaminant concentrations appear to stabilize. The data indicate that pulse pumping for 2 to 3 hours would likely be more effective for enhanced NAPL removal. However, pulse pumping will need to be carefully monitored because it may hinder movement of NAPL.

These time series sample data are also useful for the review, selection, and design of a biological water treatment system components. The time series testing results will be used to predict the influent concentrations that could be expected under long-term, continuous pumping conditions.

Based on the first round of treatment train sampling data, the system is effective for removing contaminants to the discharge permit limits. However, the system is too reliant on carbon adsorption for removal of organic compounds. Treatment system enhancements will focus on reducing the need to rely on the GAC units for significant organic removal.

E & E also will evaluate whether less frequent carbon replacement is feasible. Based on preliminary review of influent contaminant concentrations, it appears that the change-out frequency can be significantly reduced (i.e., from once every 2 weeks to once a month or less). This would require the periodic collection and analysis of a water sample between the first and second stage GAC units.

It is also recommended that on-site testing be conducted to evaluate whether an organoclay/anthracite bed may be used to effectively remove free oil in the groundwater. This would likely entail installing a 55-gallon drum of the mixture and diverting a portion of the flow prior to the DAF unit. If determined to be cost effective, this technology could replace the DAF unit in a subsequent final design and allow for unattended continuous recovery and treatment of groundwater.

The presence of galvanized steel piping in the treatment system appears to be the cause of increasing zinc concentrations through the system. Treatment system enhancements will include replacing the galvanized steel piping with synthetic piping that is compatible with the nature of the groundwater contaminants and system chemicals.

E & E replaced all damaged piping and associated pump parts and recommends the installation of electric heat trace, pipe insulation, and/or space heaters to maintain suitable temperatures in the coming winter. In addition, any subsequent modifications will include freeze protection.

It appears that the absorption-type field tests conducted by E & E will not be adequate to determine the percentage of NAPL in groundwater water. The tests indicate that additional methods for identifying and/or quantifying the amount of NAPL in water need to be investigated. E & E will investigate methods that allow separation by gravity, possibly enhanced with a centrifuge. E & E is currently reviewing sludge testing equipment such as settlometers that are calibrated in percent solids (cubic cm/L), which may be effective for determining percent NAPL.

Finally, E & E is concerned about security, and recommends the demolition of all unnecessary structures and removal of tall vegetation along the western fence line. This will significantly increase visibility and will likely reduce trespassing incidents.