Independent Action Report Update

Site Name: Texaco Station #63232 0037

Inc. #: 2298 Date of Report: 11/10/95

County: King Date Report Rec'd: 11/29/95

Reviewed by: Roger Nye

Comments (please include: free prod., tank info., contaminant migration, GW depth & flow, conc. trends, PCS treated?):

Soil VES and GW sparging systems operated for 7 months (12/94 through June 95). 46 lbs of volatile hydrocarbons removed from subsurface.

REMEDIATION STATUS REPORT

TEXACO SERVICE STATION 63-232-0037
8701 GREENWOOD AVENUE NORTH
SEATTLE, WASHINGTON

Prepared for

Ms. Theresa Geijer
Texaco Environmental Services

November 10, 1995

Prepared by

EMCON
18912 North Creek Parkway, Suite 100
Bothell, Washington 98011-8016

Project 40368-013.011

1995 Remediation Status Report
Texaco Service Station 63-232-0037
8701 Greenwood Avenue North
Seattle, Washington

The material and data in this report were prepared under the supervision and direction of the undersigned.

EMCON

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Engineer

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1 INTRODUCTION

1.1 Purpose and Scope of Work

On behalf of Texaco Environmental Services (TES), EMCON operated and maintained a groundwater recovery well, air sparge and soil vapor extraction systems, evaluated overall performance, and deactivated the systems at former Texaco Service Station 63-232-0037. The site is located at 8701 Greenwood Avenue North in Seattle, Washington (Figure 1). The work was performed to remediate residual concentrations of petroleum hydrocarbons in soil and groundwater beneath the site.

Services completed in this scope of work included the following:

- Operating and maintaining the remediation systems
- Collecting effluent vapor and water samples from the vapor extraction system and tank dewatering wells
- Coordinating laboratory analyses
- Preparing this report summarizing findings and presenting conclusions

1.2 Site Location and Description

The site is a former gasoline service station located in the southeast quarter of the southwest quarter of Section 31, Township 26 North, Range 3 East. The former station is located on the northwest corner of the intersection of North 87th Street and Greenwood Avenue North in Seattle, Washington. The site is bordered by commercial businesses to the north, North 87th Street to the south, Greenwood Avenue North to the east, and a residential area to the west. The property generally slopes to the south and west, with a total elevation drop of approximately 2.5 feet (ft).

1.3 Site History

Texaco leased the property in 1946. At that time, a small service station and one wood-framed house were present at the site. Available information did not indicate the type, number, or capacity of underground storage tanks (USTs) present at the site in 1946. After acquiring the lease for the property, Texaco razed the service station and house and constructed a full service gasoline station. The facility consisted of a station building with two service bays and one pump island. Based on the information Texaco provided, USTs present at the site at that time included one 4,000-gallon (gal), one 3,500-gal, and one 2,000-gal fuel tank, and one 550-gal waste oil tank.

Texaco purchased the property in 1967 and constructed a new service station on the site. The facility included a sales building with two bays and two pump islands. The existing USTs were removed and replaced with two 10,000-gal gasoline tanks, one 550-gal waste oil tank, and one 1,000-gal heating oil tank. The new USTs were constructed of single-walled carbon steel. One 4,000-gal gasoline tank was installed in 1971.

In 1986, the steel gasoline tanks were removed and replaced with four 10,000-gal, single-wall fiberglass USTs. The new USTs consisted of three gasoline tanks and one diesel tank. The product lines were removed and replaced with fiberglass lines. The steel waste oil and fuel oil USTs were also removed and replaced with fiberglass tanks.

In 1994, the station building was razed, and the four 10,000-gal fuel USTs, one 1,000-gal heating oil UST, and one 550-gal waste oil UST were removed from the site. Two approximately 1,250-gal concrete sumps/separators and associated influent and effluent piping were discovered during excavation activities. One sump/separator was removed. The second (southernmost) sump was left in place to avoid disturbing the underlying peat and silt confining layer. Figure 2 is a site plan showing the former station facilities (post 1986).

1.4 Previous Investigations

In March 1991, five groundwater monitoring wells (AGW-1 through AGW-5) were installed to evaluate subsurface conditions at the site (Figure 2). Results of the investigation were presented to the Washington State Department of Ecology (Ecology) in Texaco's report entitled, "Report on Initial Site Assessment," dated July 1991. A review of boring log data from the report indicated that shallow groundwater at the site was confined beneath a peat and silt layer located 10 to 15 ft below the ground surface (bgs). According to the report, soil samples collected adjacent to the waste oil and heating oil USTs contained concentrations of total petroleum hydrocarbons as oil (TPH-O) exceeding

the Model Toxics Control Act (MTCA) Method A Cleanup Levels.[1] Monitoring well AGW-3 reportedly was decommissioned due to flowing artesian conditions. Depth to water measurements ranged from approximately 0.5 to 3 ft below the top of the wells casings in the remaining four wells.

In January 1994, EMCON performed oversight and soil sampling during tank decommissioning at the site. Three 10,000-gal gasoline tanks, one 10,000-gal diesel tank, one 1,000-gal heating oil tank, one 550-gal waste oil tank, two hoists, one sump/separator, and product lines and dispensers were removed during field activities. A second sump/separator was left in place to avoid disturbing the underlying silt and peat confining layer. Soil samples collected from the excavation limits at the UST complex, the heating oil tank, the pump island, and the hoist areas following over-excavation contained analytes at concentrations below MTCA Method A Cleanup Levels. Soil samples collected from the excavation limits at the waste oil/sump area following over-excavation contained analytes at concentrations exceeding MTCA Method A Cleanup Levels. The impacted soil in the waste oil/sump area was left in place to avoid disturbing the peat confining layer. The soil was left in place also due to concerns that the sidewall separating the gasoline UST excavation and the waste oil/sump excavation would fail and water from the gasoline UST excavation would flood the excavation. Well AGW-4 was decommissioned and later overexcavated during field activities. Information regarding the tank decommissioning was presented in EMCON's "Underground Storage Tank Decommissioning Report" dated September 9, 1994.

In March 1994, EMCON directed drilling and installation of two 4-inch-diameter monitoring wells (AGW-6 and AGW-7; Figure 2) at the site. Subsurface soil encountered during drilling generally consisted of 5 to 8 ft of moist to saturated gravely and silty sand overlying 5 to 8 ft of dry to damp peat. The peat was underlain by wet silts, sands, and gravel to the maximum explored depth of 27 ft bgs. Soil laboratory results indicated that total petroleum hydrocarbons as diesel (TPH-D) and TPH-O concentrations exceeded MTCA Method A Cleanup Levels in soil samples collected at 5.5 and 7 ft bgs in borings AGW-6 and AGW-7, respectively. Information regarding the tank decommissioning and well installation was contained in EMCON's report entitled "Underground Storage Tank Decommissioning," dated September 9, 1994.

Eleven groundwater sampling events were conducted at the site between April 1991 and November 1994. A review of the historic groundwater laboratory results indicated that groundwater samples collected from wells AGW-1, AGW-2, AGW-4, AGW-5, and AGW-6 contained one or more of the following analytes at concentrations above the MTCA Method A Cleanup Levels: TPH as gasoline (TPH-G), TPH-D, TPH-O, and benzene, toluene, ethylbenzene, and total xylenes (BTEX). The maximum benzene

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[1] Chapter 173-340 WAC, The Model Toxics Control Act Cleanup Regulation; Method A Cleanup Levels. Amended December 1993.

concentrations were detected in the groundwater sample collected from well AGW-1 in August 1991, subsequent to a reported release from the unleaded gasoline tank turbine. Concentrations of TPH-G and benzene in sampled groundwater generally have declined since 1991. Reports that summarize the groundwater sampling events are presented in the reference section of this report.

2 REMEDIATION SYSTEM

Based on the results of the underground storage tank decommissioning and additional site assessment, Texaco requested that EMCON install a remediation system to remove residual petroleum hydrocarbons in groundwater and soil at the site. EMCON installed a combined air sparging and vapor extraction system (VES) at the site between February and December 1994. An existing tank pit dewatering well was used to lower the water table at the site, to enhance vapor extraction, and to reduce condensate collection. The remediation system operation and maintenance, installation, system startup, system description, and overall system performance between December 2, 1994 and January 30, 1995 were presented in EMCON's report dated August 8, 1995, and titled "1994 Progress Report."

2.1 System Description

The remediation system at the site consists of three vapor extraction lines, three air sparging lines, and a groundwater recovery pump installed within the former tank pit dewatering well (Figure 2). By applying a vacuum to the VES lines, volatile hydrocarbons are extracted from the unsaturated zone and the capillary fringe. Injecting air into the sparge lines forces the air through the saturated zone, allowing contaminants in the aquifer to volatilize. The volatilized contaminants migrate to the unsaturated zone, where they are extracted by the VES. The vapor extraction lines at the site are located in an area of shallow groundwater and are submerged under non-pumping groundwater conditions.

The groundwater recovery system consists of a pump installed in the tank pit dewatering well near the southwest corner of the former tank basin (Figure 2) The groundwater recovery well lowers the water table to increase the unsaturated zone for vapor extraction and avoid submerging the VES lines. The pump is connected to a compressor located in the enclosure. The pump is controlled by a Coyote controller, which automatically starts and stops it as necessary to avoid submerging the VES piping. A high water level sensor is located on the north sparge line to maintain the proper water level. The water pumped from the dewatering well is discharged directly to the Metro sanitary sewer system.

The remediation system equipment is housed in a fenced enclosure located near the southwest corner of the former UST complex (Figure 2). The system primarily consists of two blowers, an electrical panel, and a vent stack (Figure 3). The VES lines are connected to a Rotron EN 606 blower. The emissions from the vapor extraction blower

are vented to the atmosphere through a 15-ft-tall, 6-inch (in.)-diameter stack. Sampling ports are located on each line in the VES manifold and at the influent line to the VES stack. The sparge lines are connected to a Rotron EN 404 blower.

2.2 Operation and Maintenance

The remediation system was activated on December 2, 1994. EMCON initiated an operation and maintenance (O & M) schedule when the system was started. A schedule of weekly O & M site visits was established for the first month, bimonthly for the next two months, and monthly thereafter. Operation and maintenance for the period of December 2, 1994, and January 30, 1995, was reported in EMCON's August 8, 1995 report titled "1994 Progress Report."

2.2.1 VES Field Methods

The system monitoring consist of recording airflow, vacuum pressure, and volatile organic vapor concentrations. Airflow rates at each of the extraction sampling ports and at the system stack are monitored by using a Kurz™ Instruments, Inc., Mini Anemometer Series 490. Airflow readings are recorded in linear ft per minute (fpm). The flow readings are converted to volumetric cubic ft per minute (cfm) by using the diameter of the extraction pipe at the given sample port and monitoring location. The vapor extraction system stack and extraction points are 4 in. in diameter.

Vacuum pressure is monitored at the sampling ports for the individual extraction lines and at the sparge line manifold by using a series of portable magnehelic gauges with a pressure range of 0.01 to 50 in. of water.

Volatile organic vapor concentrations are measured at the system stack, at each individual extraction sampling port, and at the sparge line manifold. The concentrations are measured by using a flame ionization detector (FID), Foxboro™ Model 88 OVA.

Hydrocarbon mass removal rates are calculated using the following formula:[2]

$$\text{lbs/day} = [\text{cfm}] \times [\text{FID (ppmv)}] \times [\text{molecular weight (gasoline)}] \times [1.581 \times 10^{-7}] \times [24 \text{ hrs/day}]$$

1) cfm = the volumetric airflow from the system stack.

2) FID = volatile organic vapor concentrations are measured in parts per million - volume (ml/L).

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[2] Reference: "Estimating Air Emissions from Petroleum UST Cleanups." United States Environmental Protection Agency, Office of Underground Storage Tanks, June 1989.

3) Molecular weight of gasoline = 102.2 mg/mole.

4) 1.581×10^{-7} lb-mole min/ft^3 ppmv hr = $\frac{1}{10^6\ ppm-v} \times \frac{60\ \text{min}}{hr} \times \frac{1lb-mole}{379.5ft^3}$

The following formula was used to calculate total pounds removed from the site.

$$\text{Total Pounds} = \frac{FE + IE}{2} \times \text{Days}$$

1) FE = emissions in lbs/day during previous site visit.

2) IE = emissions in lbs/day during the next site visit.

3) Days = number of days between the two site visits.

4) Total pounds were calculated by assuming a linear increase or decrease in stack emissions from monitoring date to monitoring date.

2.2.2 Operation and Maintenance Site Visits

EMCON conducted site inspection visits to monitor system operations and maintain equipment on February 15, February 23 and 27, March 10, April 12, May 3, June 27, and June 29, 1995. Operation parameters were recorded on February 15, March 23, March 10, and April 12, 1995. Appendix A contains the field measurements collected during EMCON's three monitoring visits.

On February 15, the groundwater recovery pump and the soil vapor extraction system were operating properly. The flow meter was replaced. The final system setup vapor extraction system operating parameters were recorded. The final system setup measured 1,200 fpm with a volatile organic concentration of 5 ppmv at the discharge stack. Since startup, the groundwater recovery system had pumped approximately 306,585 gal.

On February 23, 1995, EMCON personnel conducted a site visit. The air sparge blower was off upon arrival at the site. The air sparge system was reactivated before collecting soil vapor extraction system readings. Since startup on December 2, 1994, the groundwater recovery pump had removed approximately 338,481 gal. The average pumping rate since February 15, 1994, was 2.8 gpm. Effluent water samples were collected for laboratory analysis due to a noticeable petroleum hydrocarbon-like odor. The samples were submitted to Columbia Analytical Services (CAS) in Bothell, Washington, for analysis to evaluate compliance with the Metro discharge permit. The samples were analyzed for BTEX by using EPA Methods 5030/8020, for TPH-G by using Washington State Department of Ecology (Ecology) WTPH-G and for TPH-D and

TPH-O by using Method WTPH-D extended. Laboratory results are presented in Table 1. All results were below Metro discharge requirements. The system was pulsed off in preparation for groundwater sampling on February 24, 1995.

On February 27, 1995, a site visit was conducted to raise the recovery well pump 10 to 12 in. The recovery well and vapor extraction system were operating properly. The water level was too high above the sparge points for air sparging. EMCON personnel continued to monitor the water level to determine if air sparging would be feasible.

On March 10, 1995, the recovery well, the air sparge system and the VES were operating properly. The system operating parameters were recorded. The vapor extraction was operating on lines SV-1 through SV-3 with air flow measured at 1,000 fpm and 1 ppm detected with an FID at SV-3 only. Since startup, the groundwater recovery well had pumped approximately 376,937 gal. Since February 23, 1995, the system operated at a pumping rate of approximately 1.8 gpm.

On April 12, 1995, the VES, air sparge and groundwater recovery system were operating properly upon arrival, with vacuum applied to all three VES lines. Each vapor extraction line was isolated before measuring the overall system vacuum pressure, sparge pressure, air flow, and volatile organic concentrations. The final system setup measured linear airflow at 900 fpm and a volatile organic concentration of 4 ppmv at the discharge stack. Since startup, the groundwater recovery system had pumped approximately 469,657 gal. Since March 10, 1995, the system operated at a pumping rate of 2.0 gpm.

On May 2, 1995, the air sparge blower was down upon arrival. It was reactivated, and system operating parameters were recorded. The final system setup measured linear airflow at 900 fpm and a volatile organic concentration of 4 ppmv at the discharge stack. Since startup, the groundwater recovery system had pumped approximately 522,470 gal. Effluent groundwater samples were collected and submitted to CAS in Bothell, Washington, for laboratory analyses. The samples were analyzed for BTEX by using EPA Methods 5030/8020, for TPH-G by using Ecology Method WTPH-G, and for nonpolar fats, oils and grease by using Standard Method 5520F. All compounds analyzed were in compliance with the Metro discharge permit (Table 1).

On June 27, 1995, the remediation system was deactivated for site construction. The system equipment, associated piping and fence enclosure were removed from the site. The power pole was removed by A.L. Sleister and Sons Construction, Inc., of Mukilteo, Washington.

2.2.3 System Performance

The vapor extraction system removed approximately 37.5 pounds (lb) of volatile hydrocarbons from the subsurface since the vapor extraction and sparging system were activated in

December 1994. The groundwater recovery well has pumped a total of approximately 649,600 gal of water between December 2, 1994, and June 27, 1995. The average pumping rate was approximately 2 gpm. The groundwater recovery system removed approximately 8 lb of volatile hydrocarbons from the subsurface based on measured effluent concentrations. A total of 45.5 lb of volatile hydrocarbons were removed from the subsurface between December 2, 1994 and June 27, 1995. Table 2 presents the VES operating parameters and estimated total emissions from December 1994 to system deactivation. Copies of laboratory reports are included in Appendix B.

3 GROUNDWATER

3.1 Groundwater Sampling

EMCON collected groundwater samples from existing monitoring wells AGW-1, AGW-2, AGW-5, AGW-6, and AGW-7 on February 24 and June 28, 1995. The results of the groundwater sampling were presented in EMCON's June 13 and August 8, 1995 reports, each titled "Groundwater Sampling Report." EMCON also collected groundwater samples from the existing monitoring wells on September 11, 1995. The June and September groundwater sampling events occurred following deactivation of the remediation system. A summary of well survey and groundwater elevation data is presented in Table 3. A summary of laboratory results for groundwater sampling is presented in Table 4.

The February 1995 groundwater sampling laboratory results for monitoring wells AGW-2 and AGW-7 were below MTCA Method A Cleanup Levels. Groundwater sample laboratory results for monitoring well AGW-1 detected a benzene concentration of 4.8 ppb. A duplicate sample collected from well AGW-1 detected a benzene concentration of 5.3 ppb. One benzene concentration was detected below the MTCA Method A Cleanup Level and the other only slightly above. Groundwater sample laboratory results for AGW-5 detected a benzene concentration of 30.6 ppb. Historically, monitoring well AGW-5 has been below MTCA Method A Cleanup Levels since 1991. The laboratory results for AGW-5 are suspect due to historical groundwater quality data at this monitoring well. All other BTEX compounds, TPH-G, TPH-D and TPH-O laboratory results for AGW-5 were below MTCA Method A Cleanup Levels. Groundwater sample laboratory results for AGW-6 detected concentrations of benzene (8.3 ppb) slightly above the MTCA Method A Cleanup Level and total xylenes equal to the MTCA Method A Cleanup Level.

The June 1995 groundwater sampling laboratory results for monitoring wells AGW-2, AGW-5, AGW-6, and AGW-7 were below MTCA Method A Cleanup Levels. Groundwater sample laboratory results for two samples collected from monitoring well AGW-1 indicated benzene only slightly above MTCA Method A Cleanup Levels with both at concentrations of 5.3 ppb. Figure 4 presents the June 1995 sampling results and groundwater elevations.

The September 1995 groundwater sampling laboratory results for all monitoring wells were below MTCA Method A Cleanup Levels for BTEX, TPH-G, TPH-D and TPH-O. Figure 5 presents the September 1995 sampling results and groundwater elevations.

3.2 Groundwater Quality

Groundwater quality has improved substantially at this site due to the soil excavation activities conducted in January 1994, and the remediation efforts conducted between December 1994 and June 1995. Between November 1994 and June 1995 quarterly groundwater sampling laboratory results were only slightly above MTCA Method A Cleanup Levels for AGW-1, AGW-2, and AGW-6. Since deactivation of the remediation systems in June 1995, the September 1995 quarterly groundwater sampling event was the first event with all laboratory results below MTCA Method A Cleanup Levels for BTEX, TPH-G, TPH-D and TPH-O.

4 SUMMARY/CONCLUSIONS

EMCON operated and maintained a combined air sparging and vapor extraction system at the site between December 2, 1994, and June 27, 1995. The system was designed to address residual petroleum hydrocarbon concentrations in the soil and groundwater at the site. A groundwater recovery pump was installed in an existing dewatering well to lower the water table to below the VES lines for vapor extraction.

The remediation system recovered low levels of volatile hydrocarbons from the subsurface during the period of operation between December 2, 1994, and June 27, 1995. During this period, the VES extracted approximately 37.5 lb of volatile hydrocarbons from the site. Hydrocarbon removal rates ranged from 0.03 to 1.2 lb per day. The groundwater recovery system recovered approximately 649,600 gal of water during this period. The system recovered a total of 45.5 lb of volatile hydrocarbons from the subsurface over the period of operation and maintenance.

Groundwater quality at the site has improved due to the soil excavation activities and operation of the remediation systems. Groundwater quality during operation of the remediation systems was only slightly above MTCA Method A Cleanup Levels in monitoring well AGW-1 and AGW-5 and AGW-6 for benzene and total xylenes (only AGW-5 and AGW-6). In the June 1995 sampling event, following deactivation of the remediation system, only monitoring well AGW-1 detected benzene (5.3 ppb) slightly above the MTCA Method A Cleanup Level. The September 1995 groundwater sampling laboratory results were all below MTCA Method A Cleanup Levels. Groundwater quality appears to be improving and the overall trend of petroleum hydrocarbon concentrations in the groundwater appears to be declining.

LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

REFERENCES

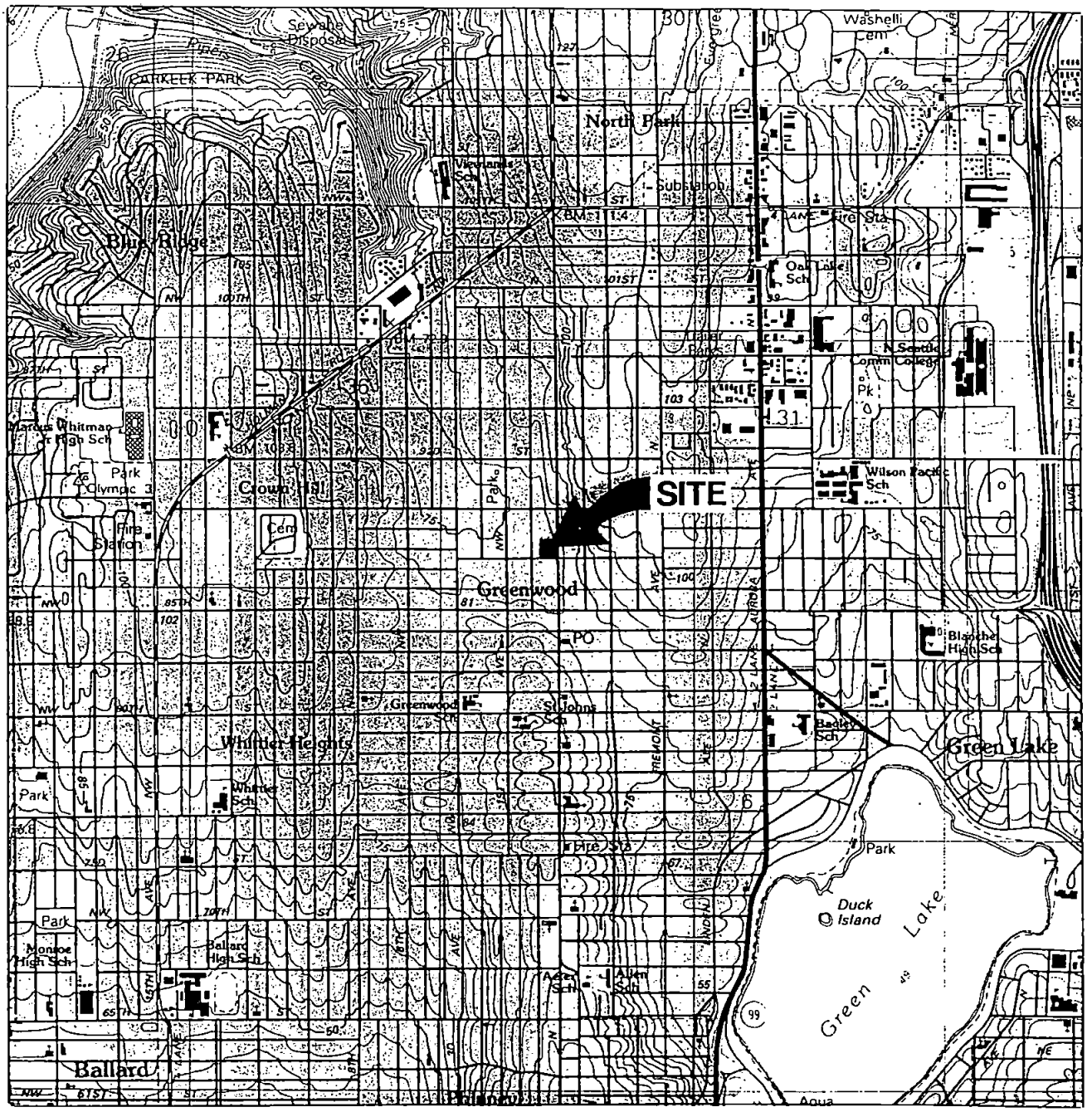
EMCON. 1991. Report on initial site assessment prepared for Texas Environmental Services. July.

EMCON. 1994. Underground storage tank decommissioning. Prepared for Texaco Environmental Services. September 9.

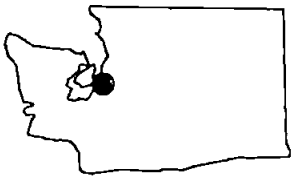
EMCON. 1995. Groundwater sampling report. Prepared for Texaco Environmental Services. August 8.

EMCON. 1995. Groundwater sampling report. Prepared for Texaco Environmental Services. June 13.

FIGURES



SOURCE: U.S.G.S. 7.5' x 15' Quadrangle, Seattle North, WA.



WASHINGTON

N

0 2000 4000

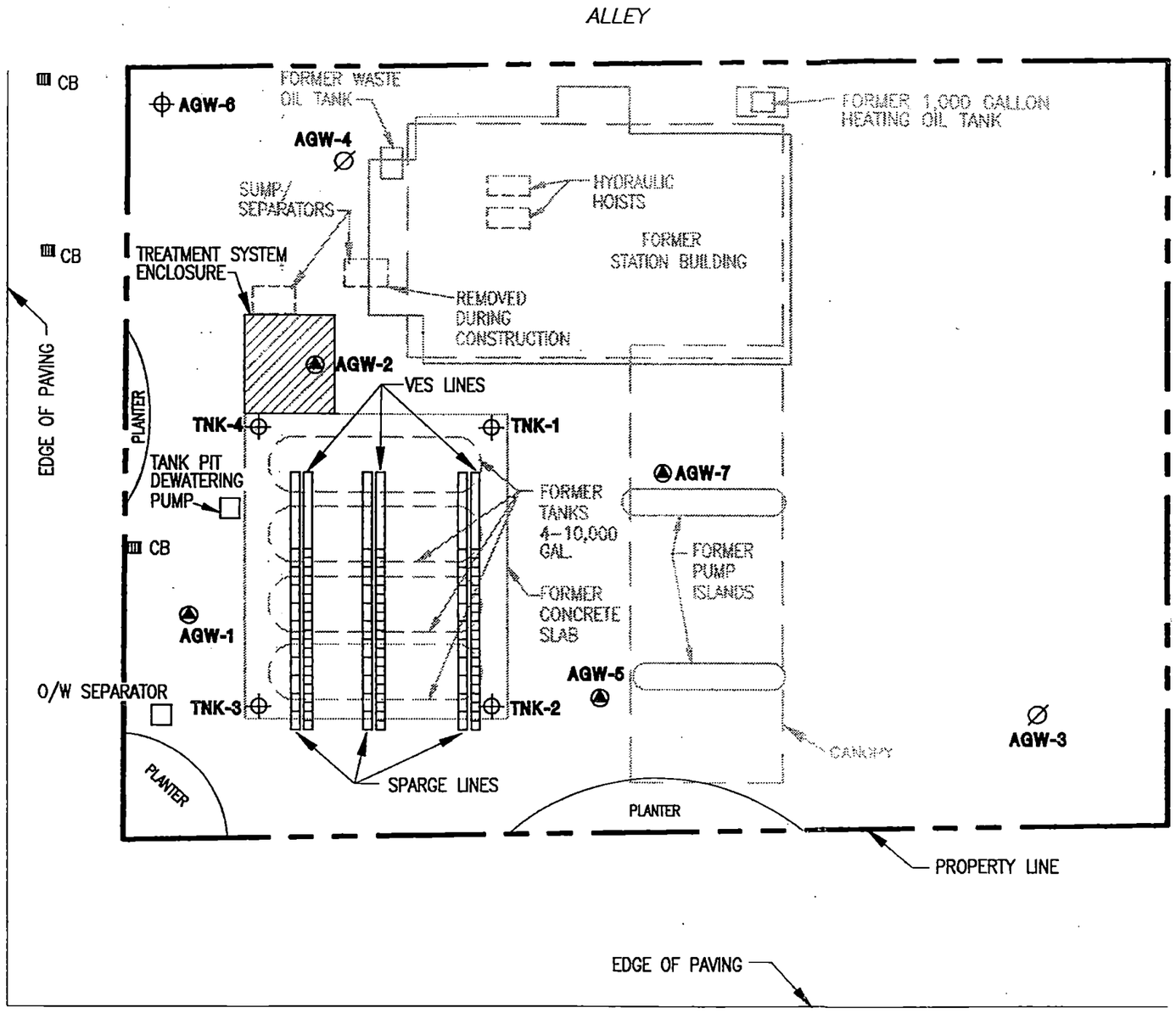
SCALE (Ft.)

EMCON

DATE 3-95
DWN. MLP
REV.
APPR.
PROJECT NO.
0368-013.11

Figure 1
TEXACO SERVICE STATION #63-232-0037
8701 GREENWOOD AVENUE NORTH
SEATTLE, WASHINGTON

SITE LOCATION MAP



LEGEND:

- AGW-1 ⊕ Monitoring Well Location and Well Number
- AGW-3 ∅ Decommissioned Monitoring Well
- TNK-1 ⊕ Tank Basin Observation Well
- CB Catch Basin
- Blank
- Screened

Sparge Lines set approximately 10' BGS

VES Lines set approximately 3' BGS

0 20 40

SCALE (ft)

EMCON

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DWN.	MLP
REV.	
APPR.	
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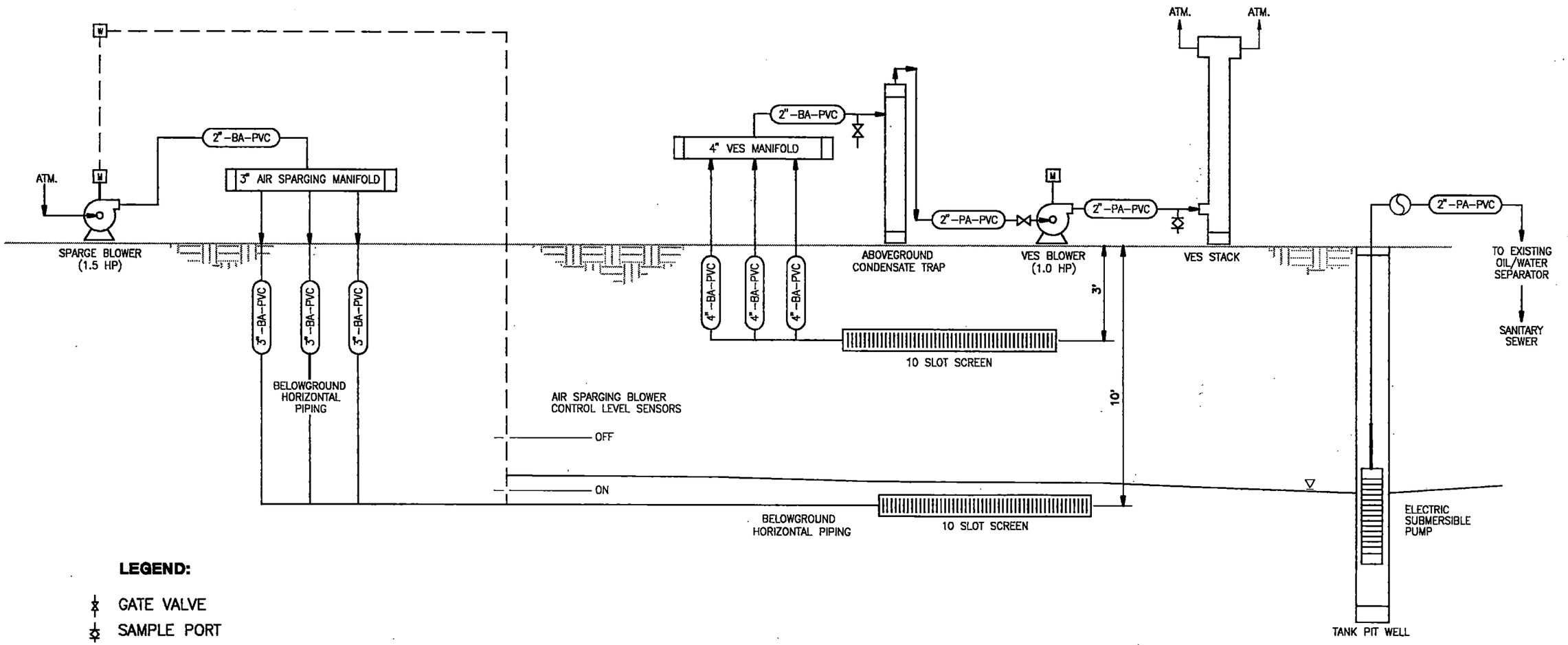
Figure 2
TEXACO SERVICE STATION NO. 63-232-0037
8701 GREENWOOD AVENUE NORTH
SEATTLE, WASHINGTON

SITE MAP - REMEDIATION SYSTEM LAYOUT

1=20 10-10-95 G:\DWG\0368\013\11BLC03C



LEGEND:

- GATE VALVE
- SAMPLE PORT
- [M] MOTOR STARTER
- [W] WARRICK LEVEL CONTROLLER
- FLOW METER (TOTALIZING)

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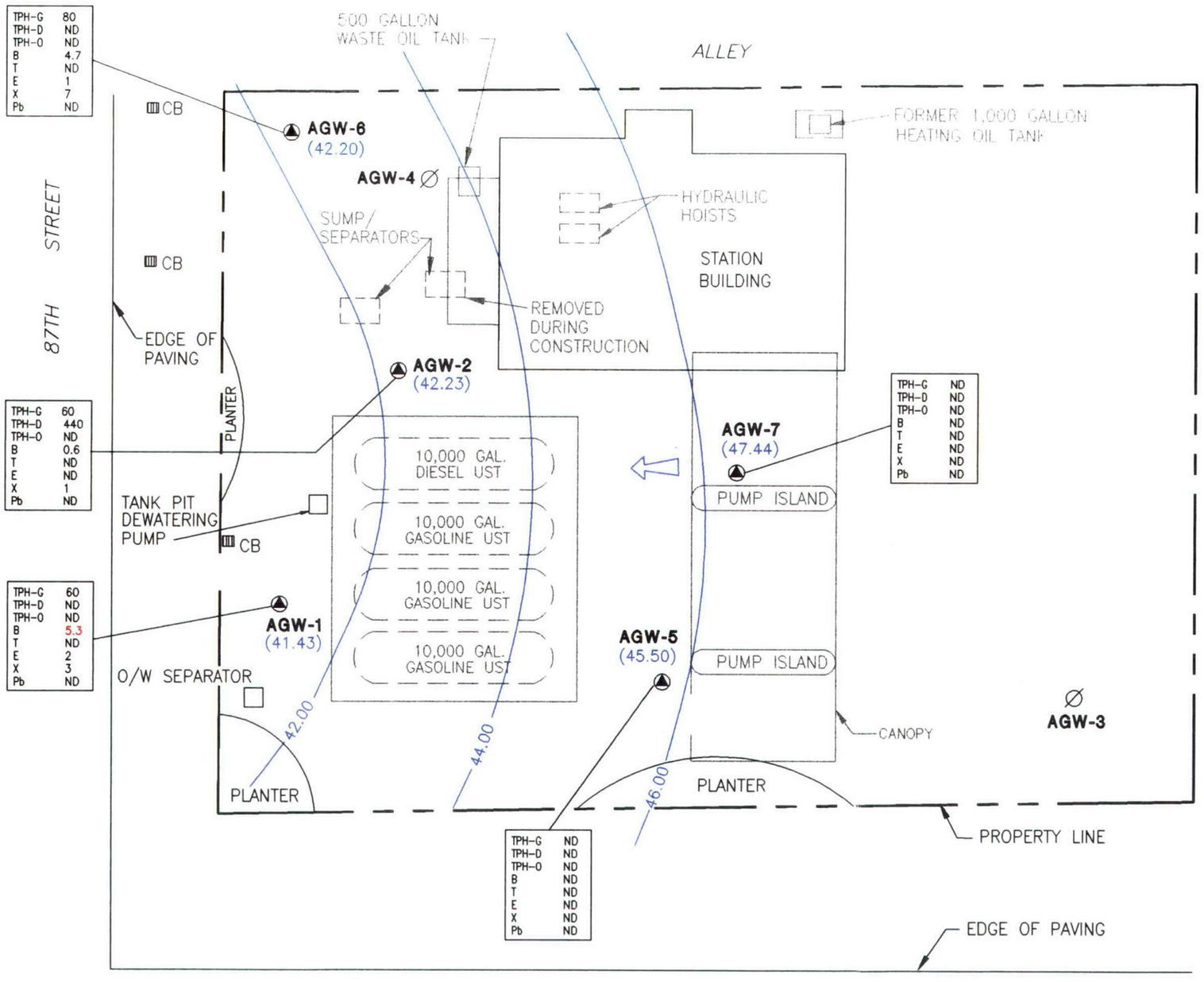
0368-013.11

Figure 3
TEXACO SERVICE STATION NO. 63-232-0037
8701 GREENWOOD AVENUE NORTH
SEATTLE, WASHINGTON
PROCESS FLOW DIAGRAM

SCALE: 1=1 3-28-95 G:\DWG\0368\013\11BLC02



LEGEND:

- **AGW-1** ▲ Monitoring Well Location and Well Number
- **AGW-3** ∅ Decommissioned Monitoring Well
- **TNK-1** ⊕ Tank Basin Observation Well
- CB ▥ Catch Basin
- —— 42.00 —— Groundwater Elevation Contour
- (41.43) Relative Groundwater Elevation
- ⇨ Inferred Groundwater Flow Direction

TPH-G	60
TPH-D	ND
TPH-O	ND
B	5.3
T	ND
E	2
X	3
Pb	ND

Laboratory Results in Parts per Billion

TPH-G = Total Petroleum Hydrocarbons as Gasoline
TPH-D = Total Petroleum Hydrocarbons as Diesel
TPH-O = Total Petroleum Hydrocarbons as Oil
B = Benzene
T = Toluene
E = Ethylbenzene
X = Total Xylenes
Pb = Total Lead
ND = Not Detected at or Above Method Reporting Limits
-- = Not Analyzed

Numbers in Red equal or exceed MTCA Method A Cleanup Levels

Contours may not reflect potential effects of the UST complex.

N

0 20 40

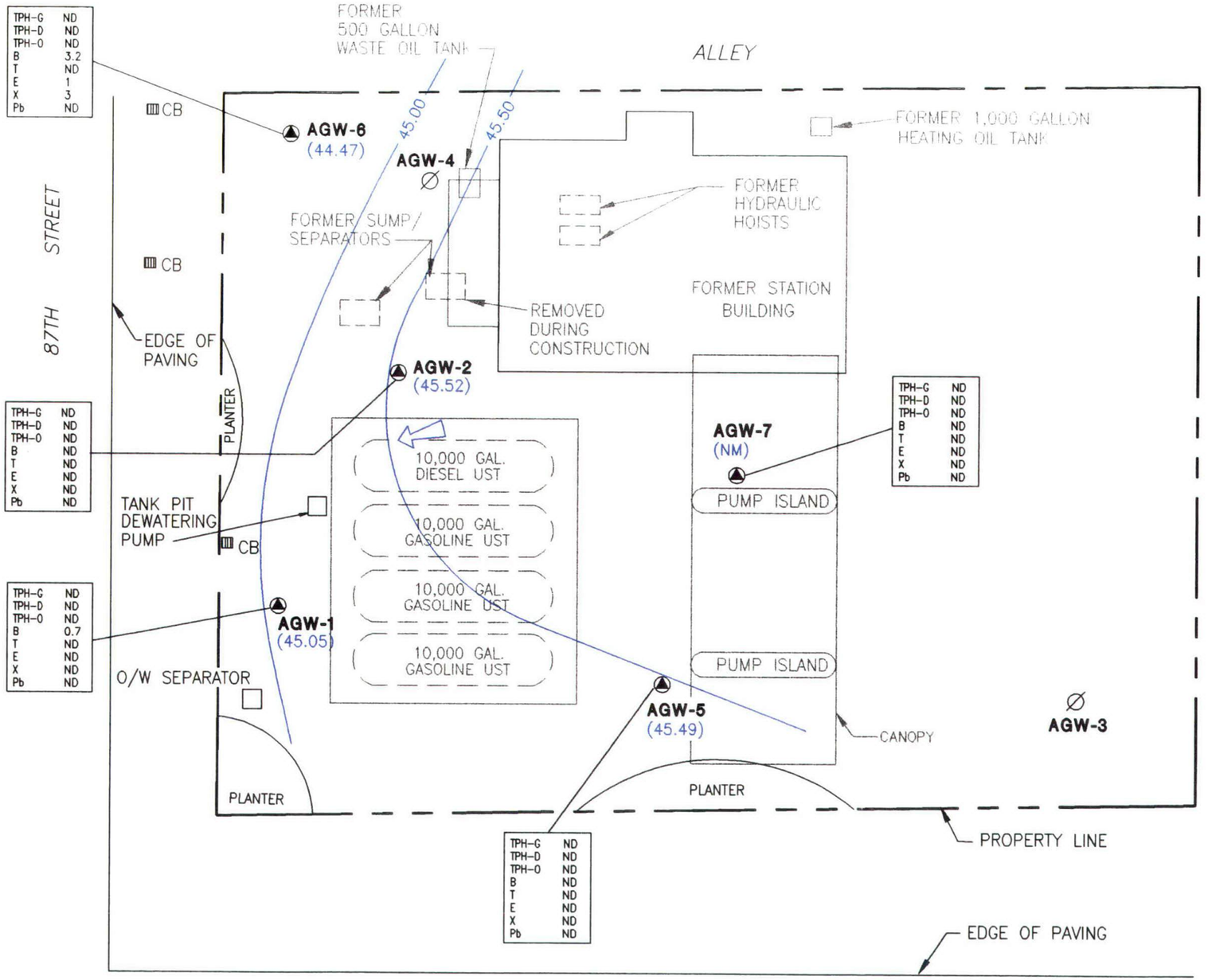
SCALE (ft)

EMCON

DATE	7-95
DWN.	MLP
REV.	
APPR.	
PROJECT NO.	40368-013.011

Figure 4
8701 GREENWOOD AVENUE NORTH
SEATTLE, WASHINGTON
GROUNDWATER DATA (JUNE 28, 1995)

I=20 10-10-95 G:\DWG\0368\013\11BLC09



LEGEND:

- **AGW-1** ▲ Monitoring Well Location and Well Number
- **AGW-3** ∅ Decommissioned Monitoring Well
- CB Catch Basin
- 45.00 Groundwater Elevation Contour
- (41.43) Relative Groundwater Elevation
- Inferred Groundwater Flow Direction
- (NM) Actual elevation could not be calculated because of flowing conditions at the well.

Contours may not reflect potential effects of the former UST basin.

TPH-G	60
TPH-D	ND
TPH-O	ND
B	5.3
T	ND
E	2
X	3
Pb	ND

Laboratory Results in Parts per Billion

TPH-G = Total Petroleum Hydrocarbons as Gasoline
TPH-D = Total Petroleum Hydrocarbons as Diesel
TPH-O = Total Petroleum Hydrocarbons as Oil
B = Benzene
T = Toluene
E = Ethylbenzene
X = Total Xylenes
Pb = Total Lead
ND = Not Detected at or Above Method Reporting Limits
-- = Not Analyzed

N

0 20 40

SCALE (ft)

EMCON

DATE 10-95
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40368-013.011

Figure 5
8701 GREENWOOD AVENUE NORTH
SEATTLE, WASHINGTON
GROUNDWATER DATA (SEPTEMBER 11, 1995)

I=20 11-10-95 G:\DWG\0368\013\11BLC10A

TABLES

Table 1

Groundwater Recovery Laboratory Results
Texaco Station 63-232-0037
8701 Greenwood Avenue North
Seattle, Washington

		Results of Analyses (µg/L)								
		SM 5520F	Ecology Method WTPH-G	Ecology Method WTPH-D (extended)		EPA Method 5030/602				EPA Method 7421
	Date	Fats, Oils, and Grease	TPH-G	TPH-D	TPH-O	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
Metro Discharge Limitations		100	—	—	—	130	1,500	1,400	—	—
Initial	12/02/94	ND	—	—	—	2.3	1	7	4	2
Effluent-0295	02/23/95	—	2,460	620	ND	4.8	1	10	22	—
Greenwood-0595	05/02/95	0.0034	1,680	—	—	3.6	2	6	8	—

NOTE: ND = not detected at or above method reporting limit.
µg/L = micrograms per liter; approximates parts per billion.
— = not analyzed.
* = results for duplicate sample, designated AGW-8-1194.
TPH-G = total petroleum hydrocarbons as gasoline.
TPH-D = total petroleum hydrocarbons as diesel.
TPH-O = total petroleum hydrocarbons as oil.

Table 2

Hydrocarbon Emissions/Mass Removal Results
Texaco Service Station 63-232-0037
Seattle, Washington

Date	Flow @ Stack[a] (fpm)	(cfm)	Vacuum[b] (" water)	FID[a] (ppmv)	Emissions (lbs/day)	Total[c] (pounds)
12/05/94	System activated					
12/07/94	1,200	105	1	30	1.2	—
01/03/95	System deactivated					16.5
01/11/95	System reactivated					16.5
01/11/95	1,000	87	1	5	0.2	16.5
01/30/95	1,100	96	1	10	0.4	22.2
02/15/95	1,200	105	1	5	0.2	27.0
02/23/95	0	0	1	3	0	27.8
02/23/95	System pulsed off					27.8
02/24/95	System pulsed on					27.8
03/10/95	1,000	87	4	1	0.03	28.0
04/12/95	900	78.5	--	4	0.1	30.1
05/02/95	900	78.5	-	4	0.1	31.9
06/27/95	System deactivated					37.5

NOTE: * = emissions calculated using PID reading.
NA = not analyzed.
Equation: ER (emission rate, lbs/day) = [cfm] x [FID (ppmv)] x [MW] x [1.581 ^-7] x [24 hours/day].
(Molecular weight [MW] for gasoline = 102.2 grams/mole).
Reference: United States Environmental Protection Agency, Office of Underground Storage Tanks, June 1989.
Estimating Air Emissions from Petroleum UST Cleanups.

[a] Measured at VES discharge stack.
[b] Vacuum was measured from north vapor extraction line.
[c] Total pounds were calculated assuming linear increase or decrease in stack emissions from monitoring date to monitoring date.

Table 3

Groundwater Monitoring Data
Texaco Service Station 63-232-0037
8701 Greenwood Avenue North
Seattle, Washington

Well Number	Screened Interval (ft bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft)	Depth to Product (ft)	Groundwater Elevation (ft)	Groundwater Elevation Change Since Last Measurement (ft)
AGW-1	4.5 - 19.5	47.36	04/03/91	3.18	None	44.18	—
			05/15/91	—	None	—	—
			08/15/91	0.62	None	46.74	+2.56
			11/21/91	0.70	None	46.88	+0.14
			03/06/92	0.47	None	46.89	+0.01
			11/06/92	0.46	None	46.90	+0.01
			03/26/93	0.49	None	46.87	-0.03
			06/09/93	0.42	None	46.94	+0.07
		47.36*	03/17/94	1.99	None	45.37	-1.57
			11/10/94	1.21	None	46.15	+0.78
			02/24/95	6.90	None	40.46	-5.69
			06/28/95	5.93	None	41.43	+0.97
			9/11/95	2.31	None	45.05	+3.62
AGW-2	4.5 - 19.0	47.59	04/03/91	3.43	None	44.16	—
			05/15/91	—	None	—	—
			08/15/91	1.65	None	45.94	+1.78
			11/21/91	1.30	None	46.29	+0.35
			03/06/92	1.14	None	46.45	+0.16
			11/06/92	1.18	None	46.41	-0.04
			03/26/93	1.18	None	46.41	0.00

Table 3

Groundwater Monitoring Data
Texaco Service Station 63-232-0037
8701 Greenwood Avenue North
Seattle, Washington

Well Number	Screened Interval (ft bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft)	Depth to Product (ft)	Groundwater Elevation (ft)	Groundwater Elevation Change Since Last Measurement (ft)
AGW-2			06/09/93	1.06	None	46.53	+0.12
(continued)		47.64*	03/17/94	2.18	None	45.46	-0.07
			11/10/94	1.57	None	46.07	+0.61
			02/24/95	5.84	None	41.80	-4.27
			06/28/95	5.41	None	42.23	+0.43
			09/11/95	2.12	None	45.52	+3.29
AGW-3	4.5 - 19.0	49.10	03/29/91	—	None	49.10	—
Well Decommissioned							
AGW-4	4.5 - 19.5	47.97	04/03/91	4.61	None	43.36	—
			05/15/91	—	None	—	—
			08/15/91	2.76	None	45.21	+1.85
			11/21/91	2.45	None	45.52	+0.31
			03/06/92	2.45	None	45.52	0.00
			11/06/92	3.21	None	44.79	-0.76
			03/26/93	3.03	None	44.94	+0.18
			06/09/93	2.66	None	45.31	+0.37
Well Decommissioned							
AGW-5	4.5 - 19.5	49.47	04/03/91	2.78	None	46.69	—
			05/15/91	—	None	—	—
			08/15/91	1.53	None	47.94	+1.25
			11/21/91	2.40	None	47.07	-0.87

Table 3

Groundwater Monitoring Data
Texaco Service Station 63-232-0037
8701 Greenwood Avenue North
Seattle, Washington

Well Number	Screened Interval (ft bgs)	Top of Casing Elevation (ft)	Date	Depth to Water (ft)	Depth to Product (ft)	Groundwater Elevation (ft)	Groundwater Elevation Change Since Last Measurement (ft)
AGW-5			03/06/92	1.45	None	48.02	+0.95
(continued)			11/06/92	2.27	None	47.20	-0.82
			03/26/93	2.05	None	47.42	+0.22
			06/09/93	1.95	None	47.52	+0.10
		49.11*	03/17/94	1.65*	None	47.46	-0.06
			11/10/94	3.52	None	45.59	-1.87
			02/24/95	3.79	None	45.32	-0.27
			06/28/95	3.61	None	45.50	+0.18
			09/11/95	3.62	None	45.49	-0.01
AGW-6	14.0 - 24.0	46.17*	03/17/94	.51	None	45.66	—
			11/10/94	1.58	None	44.59	-1.07
			02/24/95	2.62	None	43.55	-1.04
			06/28/95	3.97	None	42.20	-1.35
			09/11/95	1.70	None	44.47	+2.27
AGW-7	16.0 - 26.0	48.70	03/17/94	.05	None	48.65	—
			11/10/94	0.00	None	48.70	+0.05
			02/24/95	1.64	None	47.06	-1.64
			06/28/95	1.26	None	47.44	+0.38
			09/11/95	0.00	None	NM	NM

NOTE: * = resurveyed March 16, 1994.
NM = not measurable due to flowing conditions.

Table 1

Table 4

Groundwater Laboratory Results
Texaco Station 63-232-0037
8701 Greenwood Avenue North
Seattle, Washington

Monitoring Well		Results of Analyses (µg/L)							
		Ecology Method WTPH-G	Ecology Method WTPH-D (extended)		EPA Method 5030/602				EPA Method 7421
Well Number	Date	TPH-G	TPH-D	TPH-O	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
MTCA Method A Cleanup Levels[a]		1,000	1,000	1,000	5	40	30	20	5
AGW-1	04/03/91	ND	—	—	ND	ND	ND	ND	—
	05/15/91	—	—	—	440	1,000	92	670	—
	08/15/91	361,000	—	—	1,400	7,400	1,000	8,100	ND
	11/21/91	47,000	ND	ND	680	6,400	2,000	13,000	—
	03/06/92	48,000	ND	ND	710	3,200	1,400	8,700	ND
	11/06/92	37,000	—	—	95.1	260	1,400	8,200	ND
	03/26/93	18,400	—	—	42.8	27	397	1,450	ND
	06/09/93	15,000	—	—	35.2	23	415	1,530	ND
	03/17/94	1,960	730	ND	17.8	8	24	104	ND
	11/10/94	ND	840	ND	2.2	ND	ND	2	ND
	*11/10/94	ND	—	—	2.2	ND	ND	2	—
	02/24/95	180	ND	ND	4.8	ND	6	6	ND
	02/24/95	190	—	—	5.3	ND	6	7	—
	06/28/95	60	ND	ND	5.3	ND	2	3	ND
	06/28/95	60	ND	ND	5.3	ND	2	3	ND
	09/11/95	ND	ND	ND	0.7	ND	ND	ND	ND
	09/11/95	ND	—	—	0.8	ND	ND	ND	—

Table 4

Groundwater Laboratory Results
Texaco Station 63-232-0037
8701 Greenwood Avenue North
Seattle, Washington

Monitoring Well		Results of Analyses (µg/L)							
		Ecology Method WTPH-G	Ecology Method WTPH-D (extended)		EPA Method 5030/602				EPA Method 7421
Well Number	Date	TPH-G	TPH-D	TPH-O	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
MTCA Method A Cleanup Levels[a]		1,000	1,000	1,000	5	40	30	20	5
AGW-2	04/03/91	—	—	—	ND	ND	ND	ND	—
	05/15/91	—	—	—	ND	ND	ND	ND	—
	08/15/91	1,030	—	—	250	220	15	86	ND
	11/21/91	7,300	ND	1,200	910	1,300	260	1,200	—
	03/06/92	24,000	ND	1,100	870	3,700	760	4,900	ND
	11/06/92	3,230	—	—	152	98	175	804	ND
	03/26/93	3,390	340	ND	113	33	149	642	ND
	06/09/93	3,270	ND	ND	108	18	164	666	3
	03/17/94	470	270	ND	18.4	ND	17	68	ND
	11/10/94	470	ND	ND	11.5	ND	10	72	ND
	02/24/95	110	ND	ND	2.8	ND	2	14	ND
	06/28/95	60	440	ND	0.6	ND	ND	1	ND
	09/11/95	ND	ND	ND	ND	ND	ND	ND	ND
AGW-3 Well Decommissioned	03/29/91	—	—	—	ND	ND	ND	ND	—
AGW-4	04/03/91	—	—	—	2.6	20	2.7	31	—
	05/15/91	—	—	—	8.4	19	2.4	20	—
	08/15/91	1,200	3,260	—	11	4	1	7	4

Table 4

Groundwater Laboratory Results
Texaco Station 63-232-0037
8701 Greenwood Avenue North
Seattle, Washington

Monitoring Well		Results of Analyses (µg/L)							
		Ecology Method WTPH-G	Ecology Method WTPH-D (extended)		EPA Method 5030/602				EPA Method 7421
Well Number	Date	TPH-G	TPH-D	TPH-O	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
MTCA Method A Cleanup Levels[a]		1,000	1,000	1,000	5	40	30	20	5
AGW-4	11/21/91	3,500	ND	2,040	660	700	21	133	—
(continued)	03/06/92	ND	ND	800	139	182	3	18	ND
	11/06/92	90	—	—	20.9	13	4	17	ND
	03/26/93	999	480	ND	31.8	35	51	246	ND
	06/09/93	1,900	1,060	ND	61.1	64	108	533	ND
	03/17/94	—	—	—	—	—	—	—	—
Well Decommissioned									
AGW-5	04/03/91	—	—	—	30	10	5	7	—
	05/15/91	—	—	—	220	53	3.5	12	—
	08/15/91	—	—	—	9.4	ND	ND	ND	ND
	11/21/91	100	ND	ND	2.5	ND	ND	ND	—
	03/06/92	ND	ND	ND	0.9	ND	ND	ND	ND
	11/06/92	ND	—	—	ND	ND	ND	ND	ND
	03/26/93	ND	—	—	ND	ND	ND	ND	ND
	06/09/93	ND	—	—	ND	ND	ND	ND	ND
	03/17/94	ND	ND	ND	ND	ND	ND	ND	ND
	11/10/94	ND	ND	ND	ND	ND	ND	ND	ND

Table 4

Groundwater Laboratory Results
Texaco Station 63-232-0037
8701 Greenwood Avenue North
Seattle, Washington

Monitoring Well		Results of Analyses (µg/L)							
		Ecology Method WTPH-G	Ecology Method WTPH-D (extended)		EPA Method 5030/602				EPA Method 7421
Well Number	Date	TPH-G	TPH-D	TPH-O	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total Lead
MTCA Method A Cleanup Levels[a]		1,000	1,000	1,000	5	40	30	20	5
AGW-5	02/24/95	ND	ND	ND	30.6	1	2	ND	ND
(continued)	06/28/95	ND	ND	ND	ND	ND	ND	ND	ND
	09/11/95	ND	ND	ND	ND	ND	ND	ND	ND
AGW-6	03/17/94	300	ND	ND	10.6	1	14	56	4
	11/10/94	200	ND	ND	7.4	ND	6	29	ND
	02/24/95	460	ND	ND	8.3	2	8	20	ND
	06/28/95	80	ND	ND	4.7	ND	1	7	ND
	09/11/95	ND	ND	ND	3.2	ND	ND	3	ND
AGW-7	03/17/94	ND	ND	ND	ND	ND	ND	ND	ND
	11/10/94	ND	ND	ND	ND	ND	ND	ND	ND
	02/24/95	ND	ND	ND	ND	ND	ND	ND	ND
	06/28/95	ND	ND	ND	ND	ND	ND	ND	ND
	09/11/95	ND	ND	ND	ND	ND	ND	ND	ND

NOTE: Shaded values equal or exceed MTCA Method A Cleanup Levels.
ND = not detected at or above method reporting limit.
µg/L = micrograms per liter; approximates parts per billion.
— = not analyzed.
* = results for duplicate sample, designated AGW-8-1194.
TPH-G = total petroleum hydrocarbons as gasoline.
TPH-D = total petroleum hydrocarbons as diesel.
TPH-O = total petroleum hydrocarbons as oil.

[a] Chapter 173-340 WAC, "The Model Toxics Control Act Cleanup Regulation; Method A Cleanup Levels." Amended December 1993.

APPENDIX A

FIELD MEASUREMENTS OF SYSTEM PARAMETERS

SOIL VAPOR EXTRACTION SYSTEM-FIELD DATA SHE	TIME ON SITE 1155
GREENWOOD TEXACO	TIME OFF SITE 1230
PROJECT #40368-013.011 TASK 02	EQ: (2) DR404
DATE: 3-10-95	

INITIAL	Pressure	Flow	FID	PID	Status (I)	Status (F)	Pipe size
STACK	[redacted]	1000	1	✓			4"
MANIFOLD							

ISOLATION	Pressure	Flow	FID	PID	Status (I)	Status (F)	Pipe size
SV-3	1	1000	1				4"
SV-2	1	0	0				4"
SV-1	1	0	0				4"
SP-1	5.8	3000	NA				2"

FINAL	Pressure	Flow	FID	PID	Status (I)	Status (F)	Pipe size
STACK	[redacted]	1000	1	✓			4"
MANIFOLD							
GROUNDWATER PUMP STATUS active							
FLOW METER READING= 703518							

FIELD REPORT

Dtw = 9.95 Dtw 11.5 in sparge point to the north

Sensors set @ ≈ 10.3 feet Raised ½ foot

SOIL VAPOR EXTRACTION SYSTEM-FIELD DATA SHE	TIME ON SITE 1550
GREENWOOD TEXACO	TIME OFF SITE 1620
PROJECT #40368-013.011 TASK 02	EQ: (2) DR404
DATE: 4-12-95	

INITIAL	Pressure	Flow	FID	PID	Status (I)	Status (F)	
STACK	[redacted]	900	4	—	on	on	
MANIFOLD							

ISOLATION	Pressure	Flow	FID	PID	Status (I)	Status (F)	
SV-1	1	0	1-2		on	on	
SV-2	1	0	4				
SV-3	1,2	1000	4				
SP-1	8	3200			~~off~~	on	

FINAL	Pressure	Flow	FID	PID	Status (I)	Status (F)	
STACK	[redacted]	900	4	—	on	on	
MANIFOLD							
GROUNDWATER PUMP STATUS working							
FLOW METER READING= 163072.1							

FIELD REPORT

Sparge Blower off upon arrival Reactivated

Dtw in sparge point = 9.65

Russell T

EMCON
18912 Northcreek Parkway #100
Bothell, Washington 98011-8016

Job Number: 40368-013.011
Task Number: 02
Page: 1 of 1
Date: 2-23-95

FIELD REPORT

PROJECT: Remediation
ARRIVAL TIME: 1450
LOCATION: Seattle (Greenwood)
DEPARTURE TIME: 1530
CLIENT: Texaco
WEATHER: clear & cool
PURPOSE OF WORK/OBSERVATIONS: O&M

EMCON REPRESENTATIVE: Russell Thompson
EMCON PROJECT MANAGER:

Any conclusions and/or recommendations in this field report are subject to review by the EMCON Project Manager

COMMENTS: ① Sparge blower off upon arrival, Reactivated prior to taking SVE Readings. ② Pump flow meter Reads 31895.6
③ SVE Readings Stack OVA 3ppm flow NA
P-1 (South) 1ppm 1" + pressure flow - NA
P-2 (middle) 1ppm 1" + pressure flow - NA
P-3 (North) 4ppm 1" - Pressure flow - NA
Sparge Point = 1" ⊕ pressure flow - NA
Effluent sample to bold Effluent-0295 @ 1515 water was clear and contained a hydrocarbon-like odor.

Pulsed System off for water Sampling

By: Russell Thompson
EMCON Representative

Reviewed By:
EMCON Project Manager

Pink – Field Copy Yellow – Project Manager White – Project Files

EMCON
18912 Northcreek Parkway #100
Bothell, Washington 98011-8016

FIELD REPORT

Job Number: 0363-014.11
Task Number:
Page: 1 of
Date: 02-15-95

PROJECT: Greenwood
ARRIVAL TIME: 1710
LOCATION: Greenwood
DEPARTURE TIME: 1755
CLIENT: Texaco
WEATHER: 30's Overcast
PURPOSE OF WORK/OBSERVATIONS: O&M / Flow meter installation

EMCON REPRESENTATIVE: R. Scott Telford
EMCON PROJECT MANAGER: John Meyer

Any conclusions and/or recommendations in this field report are subject to review by the EMCON Project Manager

COMMENTS: A flow meter with peripheral fittings was purchased and installed in the [illegible] flexible pipe at the discharge [illegible] of the dewatering pump.
The totalizer was initialized at 0000.0 gal. Approximately [illegible] gallons pumped when [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] to [illegible] [illegible] for a period [illegible] [illegible] hours [illegible] water [illegible] [illegible] [illegible] [illegible] intake level.
[illegible] inspected the dewatering well and [illegible] that the water level [illegible] [illegible] the [illegible] [illegible] The flow [illegible] [illegible] VFS [illegible] [illegible] 1800hr [illegible]

By: R. Scott Telford

EMCON Representative

Reviewed By:

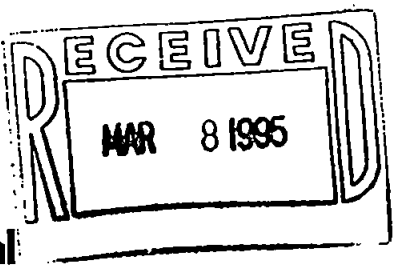
EMCON Project Manager

Pink – Field Copy Yellow – Project Manager White – Project Files

APPENDIX B

LABORATORY REPORTS AND CHAIN-OF-CUSTODY FORMS

PROJECT FILE



March 7, 1995

Service Request No.: B950141

John Meyer
EMCON Northwest
18912 N Creek Parkway
Suite 210
Bothell, WA 98011

Re: **Texaco - Greenwood/Project #0368-013.11(04)**

Dear John:

Attached are the results of the sample(s) submitted to our laboratory on February 23, 1995. For your reference, these analyses have been assigned our service request number B950141.

All analyses were performed consistent with our laboratory's quality assurance program. All results are intended to be considered in their entirety, and CAS is not responsible for use of less than the complete report. Results only apply to samples analyzed.

Please call if you have any questions.

Respectfully submitted,

Columbia Analytical Services, Inc.

Colin B. Elliott
Laboratory Manager

CBE/bdr

18912 North Creek Parkway, Suite 118 • Bothell, WA 98011 • 206/486-6983 • Fax 206/486-7695

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON	**Service Request:**	B950141
Project:	Texaco Greenwood	**Date Collected:**	2/23/95
Sample Matrix:	Water	**Date Received:**	2/23/95
		Date Extracted:	2/24/95
		Date Analyzed:	2/25/95

Total Petroleum Hydrocarbon as Diesel and Oil
Washington DOE Method WTPH-D
Units: µg/L (ppb)

Analyte:	Diesel	Oil*
Method Reporting Limit:	250	750

Sample Name	Lab Code		
Effluent-0295	B950141-01	620 (a)	ND
Method Blank	B950141-MB	ND	ND

* Quantified using 30 weight motor oil as a standard.

a Quantified as diesel. The sample contained components that eluted in the diesel range, but the chromatogram did not match the typical diesel fingerprint.

Approved By: Colin Elliott Date: 3/7/95

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON	**Service Request:**	B950141
Project:	Texaco Greenwood	**Date Collected:**	2/23/95
Sample Matrix:	Water	**Date Received:**	2/23/95
		Date Extracted:	NA
		Date Analyzed:	2/23/95

BTEX and Total Petroleum Hydrocarbons as Gasoline
EPA Methods 5030A/8020 and Washington DOE Method WTPH-G
Units: µg/L (ppb)

Analyte:	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH as Gasoline
Method Reporting Limit:	0.5	1	1	1	50
Sample Name	**Lab Code**				
Effluent-0295	B950141-01	4.8	1	10	22	2460
Method Blank	B950141-MB	ND	ND	ND	ND	ND

Approved By: Col. Elliott Date: 3/7/95

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EMCON	**Service Request:**	B950141
Project:	Texaco Greenwood	**Date Collected:**	2/23/95
Sample Matrix:	Water	**Date Received:**	2/23/95
		Date Extracted:	NA
		Date Analyzed:	2/23/95

Surrogate Recovery Summary
BTEX and Total Petroleum Hydrocarbons as Gasoline
EPA Methods 5030A/8020 and Washington DOE Method WTPH-G

Sample Name	Lab Code	Percent Recovery 4-BFB (PID - BTEX)	Percent Recovery 4-BFB (FID - GAS)
Effluent-0295	B950141-01	97	100
Method Blank	B950141-MB	101	94
CAS Acceptance Limits:		86-116	86-116

Approved By: G. Elliott Date: 3/7/95

SUR2/111594
0141PHC.DJ1 - BTXwSUR 3/2/95

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EMCON
Project: Texaco Greenwood
Sample Matrix: Water

Service Request: B950141
Date Collected: 2/23/95
Date Received: 2/23/95
Date Extracted: 2/24/95
Date Analyzed: 2/25/95

Surrogate Recovery Summary
Total Petroleum Hydrocarbons as Diesel and Oil
Washington DOE Method WTPH-D

Sample Name	Lab Code	Percent Recovery p-Terphenyl
Effluent-0295	B950141-01	92
Method Blank	B950141-MB	93

CAS Acceptance Limits: 59-124

Approved By: Ch. Elliott Date: 3/7/95

Columbia Analytical Services Inc.

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

18912 North Creek Pkwy, Suite 118 • Bothell, WA 98011 • (206) 486-6983 • FAX (206) 486-7695

DATE 2-23-95 PAGE 1 OF 1

PROJECT NAME Greenwood Texaco # ~~0328-013, 11 (02)~~ 0368-013,11(04)

PROJECT

COMPANY/ADDRESS Emcon (Bothell)

PHONE (206) 485-5000

SAMPLERS SIGNATURE [signature]

ANALYSIS REQUEST: PETROLEUM HCS | ORGANIC | ORGANIC METALS/INORGANICS

SAMPLE I.D.	DATE	TIME	LAB I.D.	SAMPLE MATRIX	NUMBER OF CONTAINERS	TPH - HCID State:	TPH - G State: WA BTEX X	TPH - D State: WA OIL X Extended	TPH - 418.1 State:	TPH - Other	Halogenated or Aromatic Volatiles 601/8010 ___ 602/8020	Volatile Organics GC/MS 624-8240	Base/Neu/Acid Organics GC/MS 625/8270	Pesticides/PCBS 8080 PCB ONLY	PAH 8310 8100 GC HPCL	TCLP Metals ___ Semi VOA VOA ___ Pest/Herb	Metals Total List Below DISS	Cyanide	pH, Cond Cl, SO4, PO4 F, Br NO2 NO3 (Circle)	NH_3 - N, COD, Total-P TKN, TOC, TOX (Circle)			REMARKS
Effluent-0295	2-23-95	1515		water			X	X															

RELINQUISHED BY:

Signature [signature]

Printed Name Russell Thompson

Firm Emcon

Date/Time 2-23-95 1638

RECEIVED BY:

Signature PJ Mosier

Printed Name DJ Mosier

Firm CAS

Date/Time 022395 ~~1430~~ 1640

TURNAROUND REQUIREMENTS

___ 24 hr ___ 48 hr. X 5 day

~~___~~ Standard (10-15 working days)

___ Provide Verbal Preliminary Results

___ Provide FAX preliminary Results

Requested Report Date ______

REPORT REQUIREMENTS

___ I. Routine Report

___ II. Report (includes DUP.MAS. MSD, as required, may be charged as samples)

___ III. Data Validation Report (includes All Raw Data)

___ IV. CLP Deliverable Report

INVOICE INFORMATION:

P.O.# ______

Bill To ______

SAMPLE RECEIPT:

Shipping VIA: ______

Shipping to: ______

Condition: ______

Lab No: B95-0141

RELINQUISHED BY:

Signature

Printed Name

Firm

Date/Time

RECEIVED BY:

Signature

Printed Name

Firm

Date/Time

SPECIAL INSTRUCTIONS/COMMENTS:

Columbia Analytical Services, Inc.

May 12, 1995

Service Request No.: B950352

John Meyer
EMCON Northwest
18912 N Creek Parkway
Suite 210
Bothell, WA 98011

Re: **Texaco - Greenwood/Project #40368-013.011(02)**

Dear John:

Attached are the results of the sample(s) submitted to our laboratory on May 3, 1995. Preliminary results were transmitted via facsimile on May 3, 1995. For your reference, these analyses have been assigned our service request number B950352.

All analyses were performed consistent with our laboratory's quality assurance program. All results are intended to be considered in their entirety, and CAS is not responsible for use of less than the complete report. Results only apply to samples analyzed.

Please call if you have any questions.

Respectfully submitted,

Columbia Analytical Services, Inc.

Colin B. Elliott
Laboratory Manager

CBE/bdr

18912 North Creek Parkway, Suite 118 • Bothell, WA 98011 • 206/486-6983 • Fax 206/486-7695

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON	**Service Request:**	B950352
Project:	Texaco - Greenwood	**Date Collected:**	5/2/95
Sample Matrix:	Water	**Date Received:**	5/3/95
		Date Extracted:	5/3/95
		Date Analyzed:	5/3/95

Non-Polar Fats, Oil, and Grease
Standard Method 5520F
Units: mg/L (ppm)

Sample Name	Lab Code	MRL	Result
Greenwood-0595	B950352-01	0.5	3.4
Method Blank	B950352-MB	0.5	ND

Approved By: Col. Elliott Date: 5/12/95

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON	**Service Request:**	B950352
Project:	Texaco - Greenwood	**Date Collected:**	5/2/95
Sample Matrix:	Water	**Date Received:**	5/3/95
		Date Extracted:	NA
		Date Analyzed:	5/3/95

BTEX and Total Petroleum Hydrocarbons as Gasoline
EPA Methods 5030A/8020 and Washington DOE Method WTPH-G
Units: µg/L (ppb)

Analyte:	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH as Gasoline
Method Reporting Limit:	0.5	1	1	1	50
Sample Name	**Lab Code**				
Greenwood-0595	B950352-01	3.6	2	6	8	1680
Method Blank	B950352-MB	ND	ND	ND	ND	ND

Approved By: C. Elliott Date: 5/12/95

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EMCON	**Service Request:**	B950352
Project:	Texaco - Greenwood	**Date Collected:**	5/2/95
Sample Matrix:	Water	**Date Received:**	5/3/95
		Date Extracted:	NA
		Date Analyzed:	5/3/95

Surrogate Recovery Summary
BTEX and Total Petroleum Hydrocarbons as Gasoline
EPA Methods 5030A/8020 and Washington DOE Method WTPH-G

Sample Name	Lab Code	Percent Recovery 4-BFB (PID - BTEX)	Percent Recovery 4-BFB (FID - GAS)
Greenwood-0595	B950352-01	99	106
Method Blank	B950352-MB	101	99
CAS Acceptance Limits:		86-116	86-116

Approved By: _____ Date: 5/12/95

EMCON Northwest, Inc.

DATE 5-3-95 PAGE 1 OF 1

PROJECT NAME Greenwood Texaco #40368-013,011 (02)

PROJECT Remediation

COMPANY/ADDRESS 18912 N creek Parkway suite 100 Bothell, WA 98011

PHONE (206) 485-5000

SAMPLERS SIGNATURE

SAMPLE I.D.	DATE	TIME	LAB I.D.	SAMPLE MATRIX	NUMBER OF CONTAINERS	ANALYSIS REQUEST: PETROLEUM HCS: TPH - HCID State:	TPH - G State: WA X	BTEX X	TPH - D State:	OIL	TPH - 418.1 State:	TPH - Other	ORGANIC: Halogenated or Aromatic Volatiles 601/8010	602/8020	Volatile Organics GC/MS 624-8240	Base/Neu/Acid Organics GC/MS 625/8270	Pesticides/PCBS 8080	PCB ONLY	PAH 8310	8100 GC	HPCL	TCLP Metals	Semi VOA	VOA	Pest/Herb	Metals Total	List Below	DISS	Cyanide	ORGANIC METALS/INORGANICS: pH, Cond Cl, SO_4, PO_4 F, Br	NO_2 NO_3 (Circle)	NH_3 - N, COD, Total-P TKN, TOC	TOX (Circle)	Non Polar Extr's Oils & Grease X	REMARKS
Greenwood-059S	5-2-95	1615		H_2O	3		X																								X		

RELINQUISHED BY:

Signature

Printed Name: Russell Thompson

Firm: Emcon Bothell

Date/Time: 5-3-95 0845

RECEIVED BY:

Signature: DJ Mosier

Printed Name: DJ Mosier

Firm: CAS

Date/Time: 5-3-95 0845

TURNAROUND REQUIREMENTS

X 24 hr ___ 48 hr. ___ 5 day

___ Standard (10-15 working days)

___ Provide Verbal Preliminary Results

___ Provide FAX preliminary Results

Requested Report Date ___

REPORT REQUIREMENTS

___ I. Routine Report

___ II. Report (includes DUP.MAS. MSD, as required, may be charged as samples)

___ III. Data Validation Report (includes All Raw Data)

___ IV. CLP Deliverable Report

INVOICE INFORMATION:

P.O.# ___

Bill To ___

SAMPLE RECEIPT:

Shipping VIA: ___

Shipping to: ___

Condition: ___

Lab No: B950352

RELINQUISHED BY:

Signature

Printed Name

Firm

Date/Time

RECEIVED BY:

Signature

Printed Name

Firm

Date/Time

SPECIAL INSTRUCTIONS/COMMENTS:

Columbia Analytical Services, Inc.

September 26, 1995

Service Request No.: B950697

John Meyer
EMCON Northwest
18912 N Creek Parkway
Suite 210
Bothell, WA 98011

ORIGINAL IS IN PROJECT FILING

Re: **Texaco - Greenwood/Project #0368-013.011**

Dear John:

Attached are the results of the sample(s) submitted to our laboratory on September 14, 1995. Preliminary results were transmitted via facsimile on September 25, 1995. For your reference, these analyses have been assigned our service request number B950697.

All analyses were performed consistent with our laboratory's quality assurance program. All results are intended to be considered in their entirety, and CAS is not responsible for use of less than the complete report. Results only apply to samples analyzed.

Please call if you have any questions.

Respectfully submitted,

Columbia Analytical Services, Inc.

Colin B. Elliott
Laboratory Manager

CBE/bdr

18912 North Creek Parkway, Suite 116 • Bothell, WA 98011 • 206/486-6983 • Fax 206/486-7695

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON	**Service Request:**	B950697
Project:	Texaco - Greenwood	**Date Collected:**	9/11/95
Sample Matrix:	Water	**Date Received:**	9/14/95
		Date Extracted:	NA
		Date Analyzed:	9/18,19/1995

BTEX and Total Petroleum Hydrocarbons as Gasoline
EPA Methods 5030A/8020 and Washington DOE Method WTPH-G
Units: µg/L (ppb)

Analyte:	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH as Gasoline
Method Reporting Limit:	0.5	1	1	1	50
Sample Name	**Lab Code**				
AGW-1-0995	B950697-01	0.7	ND	ND	ND	ND
AGW-2-0995	B950697-02	ND	ND	ND	ND	ND
AGW-5-0995	B950697-03	ND	ND	ND	ND	ND
AGW-6-0995	B950697-04	3.2	ND	ND	3	ND
AGW-7-0995	B950697-05	ND	ND	ND	ND	ND
AGW-8-0995	B950697-06	0.8	ND	ND	ND	ND
Method Blank	B950697-MB	ND	ND	ND	ND	ND

Approved By: Chr Elliott Date: 9/26/95

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EMCON	**Service Request:**	B950697
Project:	Texaco - Greenwood	**Date Collected:**	9/11/95
Sample Matrix:	Water	**Date Received:**	9/14/95
		Date Extracted:	9/18/95
		Date Analyzed:	9/18,19,20/95

Total Petroleum Hydrocarbon as Diesel and Oil
Washington DOE Method WTPH-D
Units: µg/L (ppb)

Analyte:	Diesel	Oil*
Method Reporting Limit:	250	750

Sample Name	Lab Code		
AGW-1-0995	B950697-01	ND	ND
AGW-2-0995	B950697-02	ND	ND
AGW-5-0995	B950697-03	ND	ND
AGW-6-0995	B950697-04	ND	ND
AGW-7-0995	B950697-05	ND	ND
Method Blank	B950697-MB	ND	ND

* Quantified using 30 weight motor oil as a standard.

Approved By: Col. Elliott Date: 9/26/95

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EMCON
Project: Texaco-Greenwood / #0368-013.011
Sample Matrix: Water

Service Request: K9505761
Date Collected: 9/11/95
Date Received: 9/15/95
Date Extracted: 9/19/95
Date Analyzed: 9/20/95

Total Lead
EPA Method 7421
Units: µg/L (ppb)

Sample Name	Lab Code	MRL	Result
AGW-1-0995	K9505761-001	2	ND
AGW-2-0995	K9505761-002	2	ND
AGW-5-0995	K9505761-003	2	ND
AGW-6-0995	K9505761-004	2	ND
AGW-7-0995	K9505761-005	2	ND
Method Blank	K9505761-MB	2	ND

Approved By: _____ Date: 9/25/95

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EMCON	**Service Request:**	B950697
Project:	Texaco - Greenwood	**Date Collected:**	9/11/95
Sample Matrix:	Water	**Date Received:**	9/14/95
		Date Extracted:	NA
		Date Analyzed:	9/18,19/1995

Surrogate Recovery Summary
BTEX and Total Petroleum Hydrocarbons as Gasoline
EPA Methods 5030A/8020 and Washington DOE Method WTPH-G

Sample Name	Lab Code	Percent Recovery 4-BFB (PID - BTEX)	Percent Recovery 4-BFB (FID - GAS)
AGW-1-0995	B950697-01	102	95
AGW-2-0995	B950697-02	104	97
AGW-5-0995	B950697-03	99	91
AGW-6-0995	B950697-04	105	96
AGW-7-0995	B950697-05	106	98
AGW-8-0995	B950697-06	104	96
Method Blank	B950697-MB	105	93
	CAS Acceptance Limits:	86-116	86-116

Approved By: A. Elliot Date: 9/26/95

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EMCON	**Service Request:**	B950697
Project:	Texaco - Greenwood	**Date Collected:**	9/11/95
Sample Matrix:	Water	**Date Received:**	9/14/95
		Date Extracted:	9/18/95
		Date Analyzed:	9/18,19,20/95

Surrogate Recovery Summary
Total Petroleum Hydrocarbons as Diesel and Oil
Washington DOE Method WTPH-D

Sample Name	Lab Code	Percent Recovery p-Terphenyl
AGW-1-0995	B950697-01	89
AGW-2-0995	B950697-02	88
AGW-5-0995	B950697-03	94
AGW-6-0995	B950697-04	94
AGW-7-0995	B950697-05	91
Method Blank	B950697-MB	79

CAS Acceptance Limits: 59-124

Approved By: C. Elliott Date: 9/26/95

CHAIN OF CUSTODY LABORATORY ANALYSIS REQUEST FORM

DATE 9-11-95 PAGE 1 OF 1

PROJECT NAME TEXACO-GREENWOOD #0368-013.011
PROJECT # 63-232-0037
COMPANY/ADDRESS 8701 GREENWOOD AVE. N. SEATTLE, WA
JOHN MEYER PHONE 485-5000
SAMPLERS SIGNATURE

SAMPLE I.D.	DATE	TIME	LAB I.D.	SAMPLE MATRIX	NUMBER OF CONTAINERS
AGW-1-0995	09/11/95	1500	B950697-1	WATER	*
-2-		1545	2		*
-5-		1405	3		*
-6-		1450	4		*
-7-		1420	5		*
-8-		1330	6		*

ANALYSIS REQUEST

PETROLEUM HCS					ORGANIC						ORGANIC METALS/INORGANICS						
TPH - HCID State:	TPH - G State: WA	BTEX	TPH - D State: WA	OIL	TPH - 418.1 State: WA	TPH - Other	Halogenated or Aromatic Volatiles 601/8010 / 602/8020	Volatile Organics GC/MS 624-8240	Base/Neu/Acid Organics GC/MS 625/8270	Pesticides/PCBS 8080 PCB ONLY	PAH 8310 HPCL / 8100 GC	TCLP Metals / Semi VOA / VOA	Metals Total / List Below / Cyanide	Pest/Herb DISS Pb	pH, Cond Cl, SO_4, PO_4 F, Br, NO_2 NO_3 (Circle)	NH_3 - N, COD, Total-P TKN, TOC, TOX (Circle)			REMARKS
X	X	X	X										X					
X	X	X	X										X					
X	X	X	X										X					
X	X	X	X										X					
X	X	X	X										X					
X	X	X	X															

RELINQUISHED BY:
Signature
MATTHEW MELTON
Printed Name
EMCON
Firm
9-12-95 / 0930
Date/Time

RECEIVED BY:
Signature
B. Regan
Printed Name
CAS Bothell
Firm
09/14/95
Date/Time

RELINQUISHED BY:
Signature
B. Regan
Printed Name
CAS Bothell
Firm
09/14/95 1630
Date/Time

RECEIVED BY:
Signature
Cindy Richardson
Printed Name
NET
Firm
9/13/95 10:30
Date/Time

TURNAROUND REQUIREMENTS
___ 24 hr ___ 48 hr. ___ 5 day
✓ Standard (10-15 working days)
___ Provide Verbal Preliminary Results
___ Provide FAX preliminary Results
Requested Report Date ___

REPORT REQUIREMENTS
✓ I. Routine Report
___ II. Report (includes DUP.MAS. MSD, as required, may be charged as samples)
___ III. Data Validation Report (includes All Raw Data)
___ IV. CLP Deliverable Report

INVOICE INFORMATION:
P.O.# ___
Bill To ___

SAMPLE RECEIPT:
Shipping VIA: ___
Shipping to: ___
Condition: 7°
Lab No: B950697

SPECIAL INSTRUCTIONS/COMMENTS:
METALS : TOTAL Pb.
Received by:
Lori K. Hawn
CAS-K
Date: 091595 Time: 1030

* Releasing sample containers for Pb only to Kelso CAS.
B. Regan