LUST INC. #5622
Metro South Base
Facility Annex
King Co. / Seattle

RECEIVED
MAR - 1 1995
DEPT. OF ECOLOGY

[redacted] PRE-CONSTRUCTION SITE ASSESSMENT REPORT

South Operating Base Facility Annex

Prepared for:
King County
Department of Metropolitan Services
South Operating Base Facility Annex
11911 East Marginal Way South
Seattle, Washington
January 1995

1/30/95

Woodward-Clyde

Woodward-Clyde
1501 Fourth Avenue, Suite 1500
Seattle, Washington 98101-1662

METRO
King County / Department of Metropolitan Services
Exchange Building • 821 Second Avenue • Seattle, WA 98104-1598 • (206) 684 - 2100

January 18, 1995

91785
E20

Joe Hickey
Washington State Department of Ecology
Northwest Regional Office
3190 160th Avenue S.E.
Bellevue, Washington 98008-5452

Pre-Construction Site Assessment Report
South Facilities UST Replacement Project
ARMS No. C76053; Task No. E20

Dear Mr. Hickey:

The King County Department of Metropolitan Services completed a pre-construction site assessment in preparation to replace several underground storage tanks at the Transit Department South Facilities Maintenance yard during the next two years. As we notified you in November 1994, some soil contamination above MTCA cleanup levels was discovered near one of the tanks.

Attached is a copy of the site assessment report for your records. The soil contamination will be removed and remediated during replacement of the underground storage tanks.

We will send all the proper documentation to Ecology upon completion of the remediation.

Very truly yours,

Christy Sanders-Meena

Christy Sanders-Meena, P.E.
Project Manager

CSM:sc

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0
INTRODUCTION

This report describes the results of a pre-construction site assessment study conducted by Woodward-Clyde Consultants (Woodward-Clyde) at the Metro South Operating Base Facility Annex at 11911 East Marginal Way South in Seattle, Washington. The work was conducted to assist Metro's Engineering Services Division (ESD) with environmental issues related to the upgrade of existing underground storage tank (UST) installations to meet the new tank standards that will become effective on December 22, 1998. The focus of Woodward-Clyde's services is assistance to Metro during the predesign activities.

1.1 PURPOSE

The purpose of the study was to identify and evaluate possible releases of petroleum hydrocarbons from the existing tanks in advance of site construction activities.

1.2 SCOPE OF WORK

The scope of work for this work effort consists of four tasks (described below).

Task 1 - Research on Facility Background

Research into the history of the facility UST's was conducted to determine if there was evidence of past leaks or releases. The data reviewed included tank tightness testing records, and UST registration records.

Task 2 - Phase 1 Site Assessment

Soil samples were taken from each of four borings advanced in Area 1. One sample from each boring was submitted for laboratory analysis for petroleum hydrocarbons and lead. For each boring, the sample submitted was the sample from the water table zone, or the one exhibiting the greatest indication of hydrocarbon contamination

during field screening. Laboratory analysis was conducted by Metro's own Environmental Laboratory Division.

Water samples were taken from each of four dewatering wells. These wells are constructed in a way that will facilitate removal of large volumes of water during excavation activities associated with installation of the underground storage tanks. This construction may not make them appropriate wells for obtaining representative groundwater samples. Additionally, some or all of these wells may be in the area of the original excavation surrounding the present tanks. According to Washington Department of Ecology guidance documents this makes them unacceptable for obtaining valid groundwater samples. Therefore, water samples may not be representative of groundwater in the area.

After initiating the work covered by the original scope, it was decided by Metro and Woodward-Clyde that no sampling would be conducted in the area of the Emergency Spill Containment Tank (Area 2), and that no groundwater monitoring wells would be installed (personal correspondence with D. Dittmar). The scope of work described above reflects these changes from the original scope of work.

Task 3 - Pre-Construction Site Assessment Report

The Pre-Construction Site Assessment Report (this Report) summarizes the activities and results of all site work and analytical information. This will include interpretation of analytical results, estimates of volumes of contaminated soils, and a recommended course of action during project construction.

Task 4 - Phase 2 Sampling

During Phase 1 Site Assessment sampling (Task 2) one sample (out of four total samples) tested positive for petroleum hydrocarbons. To further characterize the site and to allow for preliminary estimation of contaminated soil volumes, a second round of soil sampling and groundwater sampling was scheduled.

The scope of work for this task (letter dated November 28, 1994 Woodward-Clyde to Metro/Christine Sanders-Meena) called for four additional soil borings to be performed at the site, with three of the borings completed as groundwater monitoring wells. The approximate location of these borings/wells is shown in Figure 1 (Soil borings SB-5, 6, 7, and 8). Boring SB-6 was to be completed as a fourth groundwater monitoring well only if field screening of samples indicated hydrocarbon impacts.

Analytical support was to be provided by Metro's Environmental Laboratory Division.

1.3 SITE AND TANK LOCATIONS

The subject site is currently used to maintain transit support equipment such as bus stop shelters and signs. The parking areas which cover most of the site property are paved with approximately 12 inches of concrete in the parking areas which cover most of the site. Vehicle fueling tanks are also located on the property. Two discrete tank installations on the site include the following USTs:

- **Area 1:** one 500-gallon engine oil tank (SOBMX-1), one 10,000-gallon unleaded gasoline tank (SOBMX-2), and one 10,000-gallon diesel tank (SOBMX-3);

- **Area 2:** one 500-gallon emergency spill containment tank (SOBMX-4).

The 500 gallon emergency spill containment tank oil UST (SOBMX-4) in Area 2 has been determined to be non-regulated and was therefore not included in this investigation.

1.4 TANK HISTORY

The three tanks in Area 1 were installed in 1986. All of the tanks in Area 1 are unlined, single walled, fiberglass reinforced plastic tanks. No leak detection equipment is in place, and no cathodic protection devices are present.

Tanks SOBMX-2 and SOBMX-3 and their respective pipelines were tightness tested on January 25, 1993, May 21, 1993, and March 25, 1994. Both tanks passed all three tests.

Documentation indicates that SOBMX-1 was placed temporarily out of service on May 17, 1994.

2.0
DESCRIPTION OF FIELD ACTIVITIES

2.1 PHASE 1 SITE ASSESSMENT

On Tuesday, October 11, 1994, Woodward-Clyde conducted a site investigation to: (1) evaluate the presence of petroleum hydrocarbon and lead contamination in soils and (2) to evaluate potential hydrocarbon and lead impacts to groundwater. Woodward-Clyde drilled four soil borings on the site in Area 1. Boring SB-1 was drilled adjacent to the 500-gallon engine oil tank (SOBMX-1) and the 10,000-gallon unleaded gasoline tank (SOBMX-2). Boring SB-2 was installed about 10 feet west of the engine oil tank (SOBMX-1). Boring SB-3 was drilled adjacent and to the south of the 10,000-gallon diesel tank (SOBMX-3), and SB-4 was installed near DW-4 (De-watering well #4) to the east of the diesel tank (SOBMX-3). The locations of these borings are shown on Figure 1.

Soil borings were advanced using a hollow stem auger drill rig (See Appendix B, Field Investigation Procedures). Borings SB-1 through SB-4 were drilled to approximately 18 feet below ground surface (bgs). Soil samples were collected at 5, 7.5, 10 and 15 feet bgs. One sample from each boring that exhibited the most evidence of hydrocarbon contamination (by field screening) was submitted to the Metro Environmental Laboratory for analysis. If field screening indicated no contamination, the sample at approximately 7.5 feet was submitted for analysis. This sample interval was selected because it was at the approximate elevation of the water table, based on water level measurements from existing onsite wells.

Following completion of drilling, the boreholes were backfilled with sodium bentonite chips. Holes made in the parking lot concrete were patched with concrete to match the surrounding surface.

Four dewatering wells, which were installed within the original UST excavation during the installation of the tanks, were sampled in order to assess the presence of hydrocarbon contamination. These wells are approximately 11 feet in depth. Water levels were approximately 6 feet below the ground surface. Following purging, a sample of water from each well was sent to the laboratory for analysis. Well construction details were not

available; therefore, the screened interval for each well is unknown. Since it was not known if the wells are screened across the water table, the possible presence or absence of free product could not be reliably determined. The locations of these wells are shown on Figure 1.

2.2 PHASE 2 SAMPLING

Well Installation and Soil Sampling

One boring and three groundwater monitoring wells were installed at the property under the supervision of a Woodward-Clyde geologist on December 12, 1994. The wells are located to south, northwest, and northeast of the tank excavation area and are noted as SB-5, SB-7, and SB-8 on Figure 1. The boring is located to the west of the tank excavation and is noted as SB-6. Tacoma Pump and Drill drilled the borings and installed the wells using a Mobile B-61 trailer mounted drill rig equipped with an 8-inch diameter hollow stem auger. Total depths of the borings ranged from 7 to 17.0 feet below ground surface (BGS) and groundwater levels during drilling were between 7 and 11.0 feet. As the borings were advanced, drill cuttings were observed for soil type, moisture, and the presence of petroleum hydrocarbons. Drill cuttings were placed in drums pending laboratory analyses.

Soil samples were collected at five-foot intervals using a 1.5-foot, 2-inch diameter, spilt drive tube. Each soil sample collected from the drive tube was described and logged for soil type and screened for petroleum hydrocarbons using a Photovac photoionization detector. No evidence of gasoline was noted in any of the samples. Groundwater was encountered between seven and eleven feet below ground surface (bgs) during drilling. All the borings encountered approximately four feet of sandy gravel (fill) underlying the concrete at the surface. Native soils in these borings included sand, sandy silt, and sandy, clayey silt with an apparent decrease in grain size with increasing depth below ground surface.

One soil sample from each boring was sent to the laboratory for analysis. These samples were collected at about 5 feet BGS, just above groundwater. These samples were analyzed for total petroleum hydrocarbons (TPH) by Ecology method WTPH-G.

The wells are completed using 2-inch diameter, PVC casing and 10-foot long PVC screens with 0.020-inch perforations. The screens extend from 5 to 15 feet bgs and the sand pack around the screens consists of 10/20 silica sand. The wells are completed with ground surface steel covers and locking caps. Well construction details are shown on the boring logs/well construction diagrams (Appendix A).

Well Development

The wells were developed on December 15 and 16, 1994, using teflon bailers. Water quality measurements were collected (pH, conductivity, temperature and clarity) as the wells were developed. Approximately 50 to 75 gallons of water was removed from each well. Each well was bailed for approximately 1.0 hours until water quality parameters stabilized. Development water was placed in 55-gallon drums pending groundwater analytical results.

Surveying

After the wells were installed and developed, they were surveyed to determine groundwater elevations and positions relative to existing site structures. The survey was completed using a tape and Leitz Level. An assumed elevation of 0 feet was given to control point PT-2, located at the northwest corner of the building (See Figure 1). Well casing and groundwater elevations were calculated and are shown in Table 4.

Groundwater Sampling

The wells were purged and sampled on December 19, 1994. Prior to sampling, the water level in each well was measured, and a minimum of three casing volumes of water was removed from each well using a teflon bailer. Water level measurements and elevations are given on Table 1. As water was removed from the well, groundwater quality parameters were monitored until readings stabilized. One sample was collected from each well and analyzed for Total Petroleum Hydrocarbons (WTPH-D). These parameters are required by Ecology to confirm a suspected release from a UST. The unfiltered samples were slightly turbid.

All samples collected from the site were cooled to 4 degrees C and kept in an insulated box until they reached the laboratory. Samples were analyzed by Metro's Environmental Laboratory.

3.0
LABORATORY RESULTS

3.1 PHASE 1 SITE ASSESSMENT WORK

Four soil and four groundwater samples were analyzed by Metro's Environmental Laboratory in Seattle, Washington for petroleum hydrocarbons and lead. The following table summarizes the hydrocarbon analytical results obtained from the laboratory:

TABLE 1.
HYDROCARBON ANALYTICAL RESULTS:
METRO SOUTH FACILITIES ANNEX
OCTOBER 1994

Sample Number*	Matrix	Hydrocarbon Concentration	Analytical Method
SB-1 (10.0-11.5)	Soil	< 5 mg/kg	WTPH-G/BTEX
SB-2 (7.5-9.0)	Soil	8710 mg/kg	WTPH-418.1
SB-3 (7.5-9.0)	Soil	< 5 mg/kg	WTPH-G/BTEX
SB-4 (7.5-9.0)	Soil	< 5 mg/kg	WTPH-G/BTEX
SB-5 (Dup. of SB-4)	Soil	< 5 mg/kg	WTPH-G/BTEX
DW-1	Groundwater	< 0.2 mg/l	WTPH-D(extended)
DW-2	Groundwater	< 0.2 mg/l	WTPH-D(extended)
DW-3	Groundwater	< 0.2 mg/l	WTPH-D(extended)
DW-4	Groundwater	< 0.2 mg/l	WTPH-D(extended)
DW-5 (Dup of DW-2)	Groundwater	< 0.2 mg/l	WTPH-D(extended)

* Numbers in parentheses indicate sample depth in feet below ground surface.

Method WTPH-418.1 was run on sample SB-2 due to its relative proximity to SOBMX-1, the engine oil tank. Due to the possible varying nature of lubricating oils, any release from this tank could contain a broad range of hydrocarbon types. The other soil samples were analyzed by WTPH-G/BTEX because they were collected from locations near to the gasoline

tanks. Groundwater samples were analyzed using WTPH-D(extended) to measure a wide range of hydrocarbons.

The Model Toxics Control Act (MTCA) cleanup level for TPH (gasoline) is 100 mg/kg in soil. For hydrocarbons heavier than gasoline (diesel and other oils) the soil cleanup level is 200 mg/kg. The groundwater TPH regulatory criteria for drinking water aquifers is 1 mg/L.

The following table summarizes the lead analytical results.

TABLE 2.
HYDROCARBON ANALYTICAL RESULTS
METRO SOUTH FACILITIES ANNEX

Sample Number	Matrix	Total Lead
SB-1 (10.0 - 11.5)	Soil	<1.2 j mg/kg
DW-1	Groundwater	<.003 mg/L
DW-2	Groundwater	<.003 mg/L
DW-3	Groundwater	<.003 mg/L
DW-4	Groundwater	<.003 mg/L
DW-5	Groundwater	<.003 mg/L

j = estimated value

Lead was analyzed using the graphite furnace method. No concentrations of lead were detected. The MTCA action level for lead is .005 mg/L in groundwater and 250 mg/kg in soil.

3.2 PHASE 2 SITE ASSESSMENT WORK

Five soil and four groundwater samples were analyzed by Metro's Environmental Laboratory in Seattle, Washington for petroleum hydrocarbons by method WTPH-D. Integrations were run over the diesel range (C13 to C24) and the heavy oil range (greater than C24). The following table summarizes the results of this analysis.

TABLE 3.
LEAD ANALYTICAL RESULTS
METRO SOUTH FACILITIES ANNEX

Sample Number	Matrix	Total Petroleum Hydrocarbons	Analytical Methods
SB-5	Soil	<MDL	WTPH-D Diesel
		54.7 mg/kg	WTPH-D Oil
SB-6	Soil	<MDL	WTPH-D Diesel
		<MDL	WTPH-D Oil
SB-7	Soil	<MDL	WTPH-D Diesel
		<MDL	WTPH-D Oil
SB-8	Soil	<MDL	WTPH-D Diesel
		25.5 mg/kg	WTPH-D Oil
SB-9	Soil	<MDL	WTPH-D Diesel
		<MDL	WTPH-D Oil
SB-5	Groundwater	<MDL	WTPH-D Diesel
		<MDL	WPTH-D Oil
SB-6	Groundwater	<MDL	WTPH-D Diesel
		.236 mg/kg	WTPH-D Oil
SB-7	Groundwater	.55 mg/kg	WTPH-D Diesel
		.723 mg/kg	WTPH-D Oil
SB-8	Groundwater	.495 mg/kg	WTPH-D Diesel
		.326 mg/kg	WTPH-D Oil

Analysis of soil samples are below detection limits for SB-6, SB-7, and SB-9 (SB-9 is a duplicate of SB-8). SB-5 and SB-8 show very low concentrations of hydrocarbons when integrated over the heavy oil range. No concentrations above detection limits were noted for integrations over the diesel range. Detectable concentrations of hydrocarbons in soil are all below MTCA limits.

Analysis of groundwater samples is below detection limits for SB-5 only. All other samples indicated small but detectable concentrations of hydrocarbons. As with the soil samples, the analysis of samples in the area of the tanks indicates a tendency for concentrations to be slightly higher when integrated over the oil range. SB-8, which is approximately 350 feet from the location of the tanks indicates a tendency to analyze slightly higher when integrated over the diesel range. All detectable concentrations in groundwater are below MTCA limits.

3.3 GROUNDWATER SURVEY

Results of survey and groundwater measurement data taken at the site indicate that the groundwater gradient is in a west-northwest direction as shown on Figure 1.

3.4 QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

The quality assurance/quality control (QA/QC) program for the project included use of strict chain-of-custody procedures for sample handing and shipping, maintenance of written records of all field activities, collection and analysis of a field duplicate sample, and analysis of laboratory method blank samples and matrix spike/matrix spike duplicates (MS/MSD).

All analytical data is acceptable for project uses. All samples were analyzed within holding times. Surrogate recoveries for all analyses were within laboratory control limits, with the exception of one sample, L5119-3, which is qualified (J). Recoveries and RPD of matrix (blank) spike and laboratory duplicates were within laboratory control limits. One field duplicate each was collected for soil and water samples. Field duplicate precision or representativeness is acceptable. Agreement between laboratory duplicate results was acceptable. The laboratory reported both Method Detection Limits and Method Reporting Limits.

4.0
SUMMARY AND CONCLUSIONS

4.1 PHASE 1 SITE ASSESSMENT

Hydrocarbon impacted soils appear to be limited to the area of SB-2, and the detected hydrocarbons may be associated with the motor oil tank nearby. The high concentration of hydrocarbons in this sample suggest that hydrocarbon may extend some distance around the engine oil tank. The extent of that migration is unknown at this time. The absence of hydrocarbons at the other sample points indicate that there has been no leakage from the tanks in that area. However, the presence of high concentrations of hydrocarbons at SB-2 indicates possible migration in an approximately southwestern direction.

In addition, the presence of elevated levels of hydrocarbons at or below the level of the groundwater table suggests the potential for groundwater impacts. The dewatering wells that were sampled produced groundwater from within the excavation backfill. These samples may not be representative of groundwater in native soils in the vicinity of the engine oil tank.

4.2 PHASE 2 SITE ASSESSMENT

All soil sample analysis with detectable quantities of hydrocarbons indicated that the hydrocarbons were heavy oil types. This indicates that the source of these hydrocarbons is the engine oil tank near by (SOBMX-1), rather than the gasoline tanks.

The low concentrations detected in the soils suggests that the borings intersected the periphery of the hydrocarbon impacted soils and that a calculation of the volume of impacted soils can be made from the location of these borings.

The analysis of the groundwater samples in the area of the tanks (SB-5, SB-6, and SB-7) supports the interpretation that the hydrocarbons are tending to be heavy oil and probably came from the engine oil tank.

This match between soil analysis and groundwater analysis suggests that the source of these detected materials in the groundwater may be the overlying soils. If this is the case, then excavation of the impacted soils during tank replacement will improve the groundwater conditions; however the groundwater is not currently imparted at concentrations of regulatory concern.

4.3 IMPACTED SOIL VOLUME ESTIMATE

The area of soils impacted by oil-type petroleum hydrocarbons is bounded on the east by SB-1 and SB-3, on the south by SB-7 and on the west by SB-6. Boring SB-5 appears to be on the fringe of the impacted soils, based on the 54.7 mg/kg analysis using the heavy oil integration. This describes an impacted area in the shape of an oval with the long axis extending from SB-5 to near SB-7, and a short axis from near SB-6 to near SB-1. The "nearness" to each of these borings can only be estimated due to the spacing of the borings.

Using a worst case scenario, impacted soils would extend to, but not touch, SB-1, SB-6, and SB-7, the area would be approximately 300 square yards (defined by an oval 80 feet long approximately north to south, and 40 feet wide). A best case scenario would have the impacted soils ending short of SB-1, SB-6, and SB-7 by a larger distance, giving a volume estimate of approximately 140 square yards (defined by an oval 60 feet long, and 20 feet wide). A best estimate would be approximately 220 square yards (see Figure 2).

Analysis of the soil boring for SB-2 indicates that the petroleum impacted zone may be thin, and lay at or just above the water table, and may be as much as 1 to 2 feet in thickness. For purposes of estimation of the amount of soils that will require excavation and disposal it may be necessary to assume that the impacted zone is one yard thick. While it does not appear that the zone is that thick, for practical purposes it is difficult to excavate any zone thinner than one yard due to the nature of the excavation activity. In the process of removing the thin layer of contaminated soils a certain amount of adjacent clean soils inevitably become mixed in.

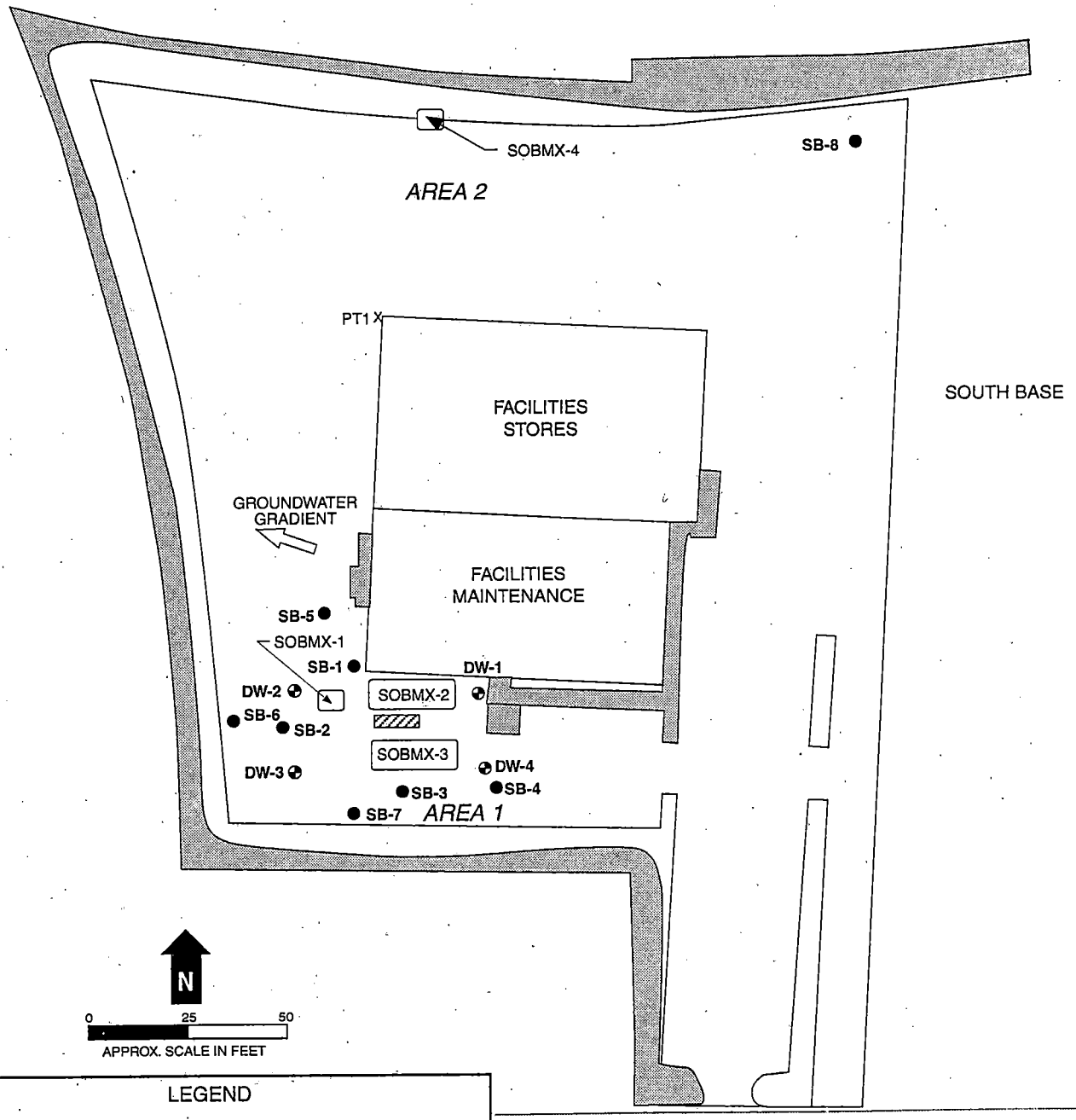
Therefore, the volume of petroleum impacted soil appears to be fall between 140 cubic yards (best case scenario) and 300 cubic yards (worst case scenario), with a most likely volume of 220 cubic yards.

5.0
LIMITATIONS

Our soil and groundwater investigation was limited to the property described herein and our opinions regarding soil and groundwater conditions are valid for that property only. They do not apply to adjacent properties or to other properties in the vicinity.

The records search was limited to information available from public sources; this information is changing continually and is frequently incomplete. Unless we have actual knowledge to the contrary, information obtained from interviews or provided to us has been assumed to be correct and complete. We do not assume liability for misrepresentation of information or for items not visible, accessible, or present on the Property at the time of the site visit.

Services for this project are performed in accordance with the agreement between King County Department of Metropolitan Service (Metro) and Woodward-Clyde Consultants and current professional standards for environmental site assessment and subsurface contamination investigations. No warranty or guarantee of site conditions is intended.



LEGEND

SOBMX-1	500 Gallon Engine Oil Tank
SOBMX-2	10,000 Gallon Unleaded Gasoline Tank
SOBMX-3	10,000 Gallon Diesel/Gasoline Tank
SOBMX-4	500 Gallon Emergency Spill Containment Tank
◒	De-watering Well Location
●	Soil Boring Location

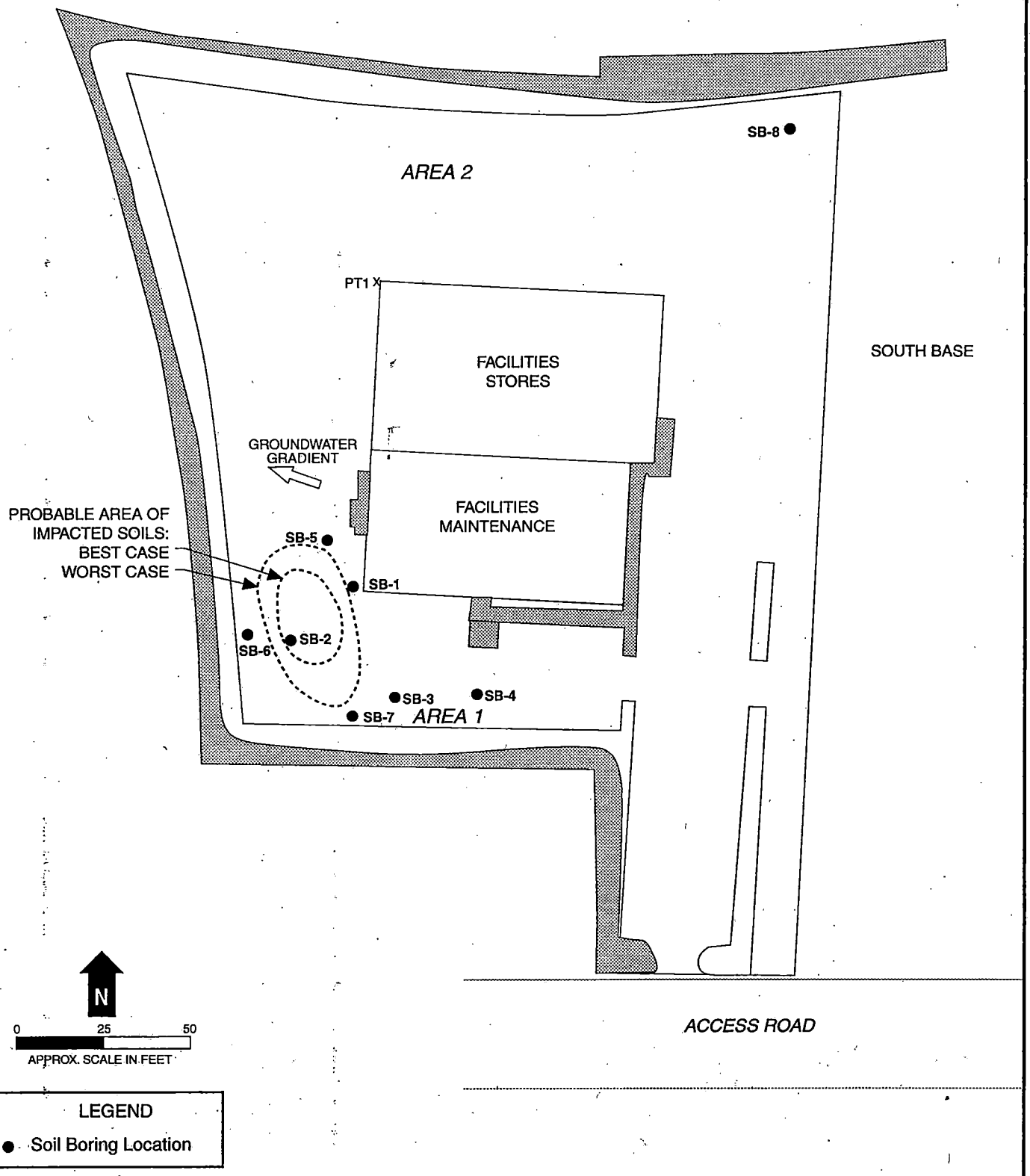
METRO SOUTH BASE ANNEX

Woodward-Clyde Consultants

SITE PLAN & SAMPLING LOCATIONS

FIGURE 1

GR044/METRO/01



METRO SOUTH BASE ANNEX	IMPACTED SOIL VOLUME ESTIMATE	FIGURE 2
Woodward-Clyde Consultants		

GR044/METRO/02

TABLE 4

SOUTH BASE FACILTY ANNEX

LOCATION		ROD HEIGHT [feet]	ELEVATION (relative to NW corner of bldg.) [feet]	DISTANCE (from PT1) [meters]	ANGLE (from SB-8) [degrees]	MEASURED DEPTH TO GROUNDWATER [feet]	ELEVATION OF GROUNDWATER [feet]
NW Corner of Building	Reference Elevation Pt.	3.60	0	20.6	25.0		0
SB-5		4.18	-0.58	52.54	94.5	6.60	-7.18
SB-7		4.33	-0.73	82.15	94.8	4.80	-5.53
SB-8		4.11	-0.51	90.6	0.0	4.28	-4.79

DISTANCE		
in meters	SB-8 TO SB-5	108.24 m
	SB-8 TO SB-7	127.29 m
	SB-5 TO SB-7	29.61 m

APPENDIX A
BORING LOGS AND GROUNDWATER SAMPLING DATA SHEETS

Project: METRO SOUTH BASE ANNEX Project Location: TUKWILA, WA Project Number: 944039NA	Log of Boring SB-1 Sheet 1 of 1

Date(s) Drilled	10/11/94	Logged By	S. Dunnigan	Checked By	D. Walker
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	8" O.D. HSA	Total Depth Drilled (feet)	18.0
Drill Rig Type	450 Canterra	Drilled By	Ramlo Well Drilling	Hammer Weight/ Drop (lbs/in.)	140#/30"
Apparent Groundwater Depth	7 ft			Surface Elevation (feet)	
Comments		Borehole Backfill	Bentonite Chips	Elevation Datum	Not Surveyed

Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per 1/2 foot	SAMPLES Recovery(%)	Moisture Content (%)	Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
0							Concrete (12"), Pea Gravel (6")	
							Loose, organic clayey SILT (OL), with root material, brown	No evidence of TPH contamination
5		1	3 5 7					
							Medium dense silty SAND (SM), with some organic matter, saturated	
10		2	4 5 10					Sample sent to lab
							Medium dense SAND (SP), dark with red and white grains, saturated	No evidence of TPH contamination
15		3	3 6 4					
							Boring terminated at 18 ft bgs.	
20								
25								

Project: METRO SOUTH BASE ANNEX Project Location: TUKWILA, WA Project Number: 944039NA	**Log of Boring SB-2** Sheet 1 of 1

Date(s) Drilled	10/11/94	Logged By	S. Dunnigan	Checked By	D. Walker
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	8" O.D. HSA	Total Depth Drilled (feet)	16.5
Drill Rig Type	450 Canterra	Drilled By	Ramlo Well Drilling	Hammer Weight/ Drop (lbs/in.)	140#/30"
Apparent Groundwater Depth	7 ft			Surface Elevation (feet)	
Comments		Borehole Backfill	Bentonite Chips	Elevation Datum	Not Surveyed

Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per 1/2 foot	SAMPLES Recovery(%)	Moisture Content (%)	Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
0							Concrete (12"), Pea gravel (6")	
							Dense clayey SILT (ML), grey, dry	No evidence of TPH contamination
5		1	3 4 3					
							▽ Silty SAND (SM), gray, saturated below 7'	Possible TPH odor
		2	1 1 2					Sample submitted to lab
10		3	3 2 3				SAND (SP), with red and white grains, very dark, saturated	
15		4	2 4 4					
							Boring terminated at 16.5 ft bgs.	
20								
25								

Woodward-Clyde Consultants

Project: METRO SOUTH BASE ANNEX
Project Location: TUKWILA, WA
Project Number: 944039NA

Log of Boring SB-3

Sheet 1 of 1

Date(s) Drilled	10/11/94	Logged By	S. Dunnigan	Checked By	D. Walker
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	8" O.D. HSA	Total Depth Drilled (feet)	16.5
Drill Rig Type	450 Canterra	Drilled By	Ramlo Well Drilling	Hammer Weight/ Drop (lbs/in.)	140#/30"
Apparent Groundwater Depth	7 ft			Surface Elevation (feet)	
Comments		Borehole Backfill	Bentonite Chips	Elevation Datum	Not Surveyed

Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per 1/2 foot	SAMPLES Recovery(%)	Moisture Content (%)	Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
0							Concrete (12"), Pea Gravel (6")	
							Sandy GRAVEL (GP), backfill material	
5		1	4 5 7					No evidence of impact
		2						Sample sent to lab
10		3	3 3 4				SAND (SP), with white and red grains, dark, saturated	
15		4	2 2 2					
							Boring terminated at 16.5 ft bgs	
20								
25								

Woodward-Clyde Consultants

Project: METRO SOUTH BASE ANNEX Project Location: TUKWILA, WA Project Number: 944039NA	Log of Boring SB-4 Sheet 1 of 1

Date(s) Drilled	10/11/94	Logged By	S. Dunnigan	Checked By	D. Walker
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	8" O.D. HSA	Total Depth Drilled (feet)	16.5
Drill Rig Type	450 Canterra	Drilled By	Ramlo Well Drilling	Hammer Weight/ Drop (lbs/in.)	140#/30"
Apparent Groundwater Depth	7 ft			Surface Elevation (feet)	
Comments		Borehole Backfill	Bentonite Chips	Elevation Datum	Not Surveyed

Depth, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows per 1/2 foot	SAMPLES Recovery(%)	Moisture Content (%)	Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
0							Concrete (12"), Pea Gravel (6")	
							Sandy Gravel (GP), backfill material	No evidence of TPH contamination
5		1	1 3 2				▽	
		2	1 2 1					Sample sent to lab
10		3						
15		4						
							Boring terminated at 16.5 ft bgs.	
20								
25								

Project: METRO, SOUTH BASE
Project Location: TUKWILA, WA
Project Number: 944032NA

Log of Boring SB-5

Sheet 1 of 1

Date(s) Drilled	12/12/94	Logged By	BH	Checked By	JB
Drilling Method	HOLLOW STEM AUGER	Top of PVC Elevation (feet)	FLUSH MOUNT	Total Depth Drilled (feet)	16.5
Drill Rig Type	MOBILE-B61	Drilled By	TACOMA PUMP AND DRILL	Hammer Weight/ Drop (lbs/in.)	140/30
Groundwater Level (ft bgs)	7.75	Sampler Type	SPLIT SPOON	Approx. Surface Elevation (feet)	98
Diameter of Hole (inches)	8	Diameter of Well (inches)	2	Type of Well Casing	SCH 40 PVC	Screen Perforation	0.020"
Type of Sand Pack	10/20 SILICA	Type/Thickness of Seal(s)	BENTONITE CHIPS 1-3 FEET		
Comments					

Depth, feet	Elevation, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows/6in	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	OVA (ppm) Headspace	OVA (ppm) Background	OVA (ppm) Drilling Rate (time)	REMARKS
0	98					Ground Surface - Concrete				1335	
				40 30		1 - 2.0' SANDY GRAVEL (GP) - Brown to gray, angular gravel, medium grained sand.		1	0		
	95					2-4' Gravels become rounded (FILL)					
5			SB-5	1 2 4		5.0 - 6.5 CLAYEY SILT (ML), brown to gray, moist, abundnant organics.		6	0		Sample sent to lab
	90					6.5 - 16.5 SAND (SM), Brown to black, fine grained, minor organics. Wet at 7.5-8.0 ▽					
10				8 3 6				4	0		
	85										
15				6 9 10		Same as above; sand becomes finer grained		5	0	1400	
	80					Boring terminated at 16.5'BGS.					
20											

Project: METRO, SOUTH BASE Project Location: TUKWILA, WA Project Number: 944032NA	Log of Boring SB-6 Sheet 1 of 1

Date(s) Drilled	12/12/94	Logged By	BH	Checked By	JB
Drilling Method	HOLLOW STEM AUGER	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	16.0
Drill Rig Type	MOBILE-B61	Drilled By	TACOMA PUMP AND DRILL	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Groundwater Depth	7.5 ft			Surface Elevation (feet)	100
Comments		Borehole Backfill	BENTONITE CHIPS	Elevation Datum	RELATIVE

Depth, feet	SAMPLES Type	SAMPLES Number	Blows per 1/2 foot	Recovery(%)	Moisture Content (%)	Graphic Log	MATERIAL DESCRIPTION	FIELD NOTES
0							Ground Surface - Concrete	
							1 - 9.0' SANDY GRAVEL (GP) - Brown to gray, fine to medium grained sand	Cobble encountered at 2 ft. Sample spoon refusal
5	SB6-1		17 22 14		0			
			2 4 8		0		▽ Groundwater level approximately 7.5 feet.	Collect lab sample from 7-9 ft, poor recovery, abandon boring
10							Boring Terminated at 9.0'BGS.	
15								
20								

Project: METRO, SOUTH BASE Project Location: TUKWILA, WA Project Number: 944032NA	Log of Boring SB-7 Sheet 1 of 1

Date(s) Drilled	12/12/94 12/13/94	Logged By	BH	Checked By	JB
Drilling Method	HOLLOW STEM AUGER	Top of PVC Elevation (feet)	FLUSH MOUNT	Total Depth Drilled (feet)	16.5
Drill Rig Type	MOBILE-B61	Drilled By	TACOMA PUMP AND DRILL	Hammer Weight/ Drop (lbs/in.)	140/30
Groundwater Level (ft bgs)	7.0	Sampler Type	SPLIT SPOON	Approx. Surface Elevation (feet)	98
Diameter of Hole (inches)	8	Diameter of Well (inches)	2	Type of Well Casing	SCH 40 PVC	Screen Perforation	0.020"
Type of Sand Pack	10/20 SILICA	Type/Thickness of Seal(s)	BENTONITE CHIPS 1-3 FEET		
Comments					

Depth, feet	Elevation, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows/6in	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	OVA (ppm) Headspace	OVA (ppm) Background	Drilling Rate (time)	REMARKS
0						Ground Surface - Concrete				1530	
				50 60		0 - 4' GRAVEL (GP) - Brown to gray, angular gravel.		1	0		
	95					(FILL)					
5			SB-7	11 12 8		4-14' SANDY GRAVEL (GW), Brown, with fine to coarse grained sand, sand becomes finer grained towards bottom of interval.		3	0		Sample sent to lab
						Wet at 7.0					
	90										
10				12 19 5				3	0		
	85										
15				5 5 12		SAND (SM) - Light to dark gray, fine to medium grained, wet, dark colored due to organics.		4	0		
						Boring terminated at 16.5'BGS.				0730	
	80										
20											

Project: METRO, SOUTH BASE Project Location: TUKWILA, WA Project Number: 944032NA	Log of Boring SB-8 Sheet 1 of 1

Date(s) Drilled	12/12/94	Logged By	BH	Checked By	JB
Drilling Method	HOLLOW STEM AUGER	Top of PVC Elevation (feet)	FLUSH MOUNT	Total Depth Drilled (feet)	17.0
Drill Rig Type	MOBILE-B61	Drilled By	TACOMA PUMP AND DRILL	Hammer Weight/ Drop (lbs/in.)	140/30
Groundwater Level (ft bgs)	11.00	Sampler Type	SPLIT SPOON	Approx. Surface Elevation (feet)	98
Diameter of Hole (inches)	8 / Diameter of Well (inches) 2	Type of Well Casing	SCH 40 PVC	Screen Perforation	0.020"
Type of Sand Pack	10/20 SILICA	Type/Thickness of Seal(s)	BENTONITE CHIPS 1-3 FEET		
Comments					

Depth, feet	Elevation, feet	SAMPLES Type	SAMPLES Number	SAMPLES Blows/6in	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	OVA (ppm) Headspace	OVA (ppm) Background	Drilling Rate (time)	REMARKS
0						Ground Surface - Concrete				1100	
				29 60		1 - 4' GRAVEL (GP), Angular gravel to .5" in diameter.		0	0		
	95					(FILL) 4 - 5' SILTY SAND (SM), Brown to black, fine grained, abundant organics.					
5				1 2 4		5-11' SILTY SAND, Brown to gray, fine to medium grained sand, moist, natural organic odor.		1	0		
	90										
10			SB-8	4 8 6		Wet at 11' ▽		0	0		Sample sent to lab
						11-17' SAND (SW) - Grey to dark grey, medium grained, water at contact with sand.					
	85										
15				6 9 10					0	1200	
	80					Boring terminated at 17.0'BGS.					
20											

GROUNDWATER SAMPLING DATA SHEET

Well Number: MW-1 Sample Number: MW-1 Date: 10/4/94

Project: South Base Annex Project Number: 944039NA Task: 200

Well Depth: 11.50'

Water Depth: 6.72'

Feet of Water: 4.78'

Gallons per Foot: 2.61 gal/ft

Well Volume: 12.5 gal

Purge Volume: 40 gal

Measuring Point (MP): —

Elevation of MP: —

Elevation of Water: —

Well Diameter: 8"

Well Diameter	Gallons per casing foot
2 inches	0.16
4 inches	0.65

Purge Method: Bailer (Disposable)

Sample Method: Bailer

Water Disposal: On Site O:I/Water Separator

Weather: Partly Cloudy

Sampler(s): S. Dunnigan / C. Garrison

pH meter: —

Eh meter: —

Conductivity meter: —

Calibration Date: —

QA/QC samples: —

Field Parameters	Before Purging	Volume 1	Volume 2	Volume 3	Volume 4	Volume 5	Sample
Time		9:45	10:00	10:20			10:30
pH		6.82	6.82	6.81			6.81
Conductivity		405 µmhos	432 µmhos	488 µmhos			484 µmhos
Eh		—	—	—			—
Temperature		18.5°C	18.5°C	18.6°C			18.6°C

GROUNDWATER SAMPLING DATA SHEET

Well Number: MW-2 Sample Number: MW-2 Date: 10/4/94

Project: South Base Annex Project Number: 944039NA Task: 200

Well Depth: 11.30' Measuring Point (MP): —

Water Depth: 6.56' Elevation of MP: —

Feet of Water: 4.74 Elevation of Water: —

Gallons per Foot: 2.61 gal/ft Well Diameter: —

Well Volume: 12.4 gal

Purge Volume: 40 gallons

Well Diameter	Gallons per casing foot
2 inches	0.16
4 inches	0.65

Purge Method: Bailer (Disposable) pH meter: —

Sample Method: Bailer Eh meter: —

Water Disposal: On Site O/W Water Separator Conductivity meter: —

Weather: Partly Cloudy Calibration Date: —

Sampler(s): S. Dunnigan / C. Garrison QA/QC samples: —

Field Parameters	Before Purging	Volume 1	Volume 2	Volume 3	Volume 4	Volume 5	Sample
Time		1:40	1:50	2:10			2:20
pH		6.55	6.55	6.46			6.46
Conductivity		414 µmhos	424 µmhos	447 µmhos			449 µmhos
Eh		—	—	—			—
Temperature		19.9°C	19.9°C	18.9°C			18.9°C

GROUNDWATER SAMPLING DATA SHEET

Well Number: MW-3 Sample Number: MW-3 Date: 10/14/94

Project: South Base Annex Project Number: 944039NA Task: 200

Well Depth: 11.30' Measuring Point (MP): —

Water Depth: 5.98' Elevation of MP: —

Feet of Water: 5.32' Elevation of Water: —

Gallons per Foot: 2.61 gal/ft Well Diameter: —

Well Volume: 13.8 gal

Purge Volume: 40 gallons

Well Diameter	Gallons per casing foot
2 inches	0.16
4 inches	0.65

Purge Method: Bailer (Disposable) pH meter: —

Sample Method: Bailer Eh meter: —

Water Disposal: On Site Oil/Water Separator Conductivity meter: —

Weather: Partly Cloudy Calibration Date: —

Sampler(s): S. Dunnigan / C. Garrison QA/QC samples: —

Field Parameters	Before Purging	Volume 1	Volume 2	Volume 3	Volume 4	Volume 5	Sample
Time		10:20	10:30	10:40			10:55
pH		6.80	6.65	6.65			6.60
Conductivity		475 µmhos	487 µmhos	475 µmhos			474 µmhos
Eh		—	—	—			—
Temperature		18.9°C	19.0°C	19.0°C			19.2°C

GROUNDWATER SAMPLING DATA SHEET

Well Number: MW-4 Sample Number: MW-4 Date: 10/11/94

Project: South Base Annex Project Number: 944039WA Task: 200

Well Depth: 11.16'

Water Depth: 6.36'

Feet of Water: 4.80'

Gallons per Foot: 2.61 gal/ft

Well Volume: 12.5 gal

Purge Volume: 40 gallons

Measuring Point (MP): –

Elevation of MP: –

Elevation of Water: –

Well Diameter: 8"

Well Diameter	Gallons per casing foot
2 inches	0.16
4 inches	0.65

Purge Method: Bailer (Disposable)

Sample Method: Bailer

Water Disposal: On site Oil/Water Separator

Weather: Cloudy / Partly Sunny

Sampler(s): S. Dunnigan / C. Garrison

pH meter: –

Eh meter: –

Conductivity meter: –

Calibration Date: –

QA/QC samples: –

Field Parameters	Before Purging	Volume 1	Volume 2	Volume 3	Volume 4	Volume 5	Sample
Time		12:10	12:15	12:20			12:45
pH		6.78	6.78	6.78			6.61
Conductivity		518 μmhos	522 μmhos	524 μmhos			501 μmhos
Eh		–	–	–			–
Temperature		19.3°C	19.3°C	19.3°C			19.6°C

GROUNDWATER SAMPLING DATA SHEET

Well Number:	SB-5	Sample Number:	SB-5
Project Name:	METRO S. BASIC	Project/Task:	9440 39NA/1000
		Date:	12-17-94
Well Depth:	14.10	Measuring Point (MP):	TOC
Water Depth:	~~7.50~~ 6.66	Elevation of MP:	NA
Feet of Water:	7.50	Elevation of Water:	NA
Gallons per Foot:	0.16		
		Well Diameter:	2 INCHES
Well Volume:	1.20		
Purge Volume:	6.0		

Well Diameter	Gallons per casing foot
2 inches	0.16
4 inches	0.65

Purge Method:	POLYETHYLENE BAILER	pH meter:	BECKMAN
Sample Method:	POLYETHYLENE BAILER	Eh meter:	NA
Water Disposal:	OIL SEPERATOR	Conductivity meter:	HANNAH
Weather:	RAINING MID 40'S	D.O. Meter:	NA
Sampler(s):	RICHARD GOGGINS	Calibration Date:	12-19-94

QA/QC Samples

Blind Duplicate	NA
MS/MSD	NA
Replicate	NA
Blank	NA

Field Parameters	0 Volumes	1 Volume	2 Volumes	3 Volumes	4 Volumes	5 Volumes	Sample
Temperature	14.0	14.0	14.0	14.0			
pH	6.45	6.46	6.45	6.45			
Conductivity	540	536	541	541			
Eh	NA	NA	NA	NA	NA	NA	
Dissolved Oxygen	NA	NA	NA	NA	NA	NA	
Turbidity	HIGH	HIGH	HIGH	HIGH			
Time	1235	1237	1239	1241			

BOTTLE REQUIREMENTS

Analysis	Bottle Type	Number	Number MS/MSD	Bottle Type	Bottle Number	Number MS/MSD

GROUNDWATER SAMPLING DATA SHEET

Well Number:	SB-7	Sample Number:	SB-7
Project Name:	METRO S. BASE	Project/Task:	944039NA/1000
		Date:	12-19-94
Well Depth:	12.00	Measuring Point (MP):	TOC
Water Depth:	4.80	Elevation of MP:	NA
Feet of Water:	7.20	Elevation of Water:	NA
Gallons per Foot:	0.16		
		Well Diameter:	2 INCHES
Well Volume:	1.15		
Purge Volume:	5.75		

Well Diameter	Gallons per casing foot
2 inches	0.16
4 inches	0.65

Purge Method:	POLYETHYLENE BAILER	pH meter:	BECKMAN
Sample Method:	POLYETHYLENE BAILER	Eh meter:	NA
Water Disposal:	OIL SEPERATOR	Conductivity meter:	HANNAH
Weather:	RAINING MID 40'S	D.O. Meter:	NA
Sampler(s):	RICHARD GOGGINS	Calibration Date:	12-19-94

QA/QC Samples

Blind Duplicate	SB-6
MS/MSD	NA
Replicate	NA
Blank	NA

Field Parameters	0 Volumes	1 Volume	2 Volumes	3 Volumes	4 Volumes	5 Volumes	Sample
Temperature	11.6	11.0	10.9	10.8	11.3	10.8	
pH	6.49	6.40	6.35	6.32	6.27	6.29	
Conductivity	639	621	582	537	567	498	
Eh	NA	NA	NA	NA	NA	NA	
Dissolved Oxygen	NA	NA	NA	NA	NA	NA	
Turbidity	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	
Time	1145	1150	1155	1200	1205	1210	

BOTTLE REQUIREMENTS

Analysis	Bottle Type	Number	Number MS/MSD	Bottle Type	Bottle Number	Number MS/MSD

GROUNDWATER SAMPLING DATA SHEET

Well Number:	SB-8	Sample Number:	SB-8
Project Name:	METRO S. BASE	Project/Task:	944039NA/1000
		Date:	12-19-94
Well Depth:	11.10	Measuring Point (MP):	TOC
Water Depth:	4.28	Elevation of MP:	NA
Feet of Water:	6.82	Elevation of Water:	NA
Gallons per Foot:	0.16		
		Well Diameter:	2 INCHES
Well Volume:	1.09		
Purge Volume:	5.45		

Well Diameter	Gallons per casing foot
2 inches	0.16
4 inches	0.65

Purge Method:	POLYETHYLENE BAILER	pH meter:	BECKMAN
Sample Method:	POLYETHYLENE BAILER	Eh meter:	NA
Water Disposal:	OIL SEPARATOR	Conductivity meter:	HANNAH
Weather:	RAINING MID 40'S	D.O. Meter:	NA
Sampler(s):	RICHARD GOGGINS	Calibration Date:	12-19-94

QA/QC Samples

Blind Duplicate	NA
MS/MSD	NA
Replicate	NA
Blank	NA

Field Parameters	0 Volumes	1 Volume	2 Volumes	3 Volumes	4 Volumes	5 Volumes	Sample
Temperature	14.2	14.3					
pH	6.13	6.15					
Conductivity	705	700					
Eh	NA	NA					
Dissolved Oxygen	NA	NA					
Turbidity	HIGH	HIGH					
Time	1025	1050					

BOTTLE REQUIREMENTS

Analysis	Bottle Type	Number	Number MS/MSD	Bottle Type	Bottle Number	Number MS/MSD

APPENDIX B
FIELD INVESTIGATION PROCEDURES

B.1 DRILLING METHODS

Soil borings were advanced using a truck mounted Canterra 450 drilling rig equipped with 8-5/8-inch outside diameter (OD) hollow stem augers. Samples were collected by driving a 2-1/2-inch outside diameter split-spoon sampler into the soil using a 140-pound drop hammer with a 30-inch fall. Drill cuttings were contained in 55-gallon, DOT-approved steel drums that were left on site for disposal at Metro's remediation facility based on laboratory results.

B.2 WELL SAMPLING

The wells were purged and sampled using disposable polyethylene bailers. More than three well volumes of groundwater were purged prior to sample collection. Measurements of temperature, pH, and specific conductance were made periodically during purging. Sampled groundwater was poured directly into the appropriate sample container. The samples were labelled and placed into a chilled ice chest for transport to the laboratory.

B.3 DECONTAMINATION

All appropriate drilling and sampling equipment was decontaminated before entering and leaving the site. Equipment (i.e., augers, bits, samplers, etc.) in direct contact with soil was also cleaned between boring locations with a steam cleaner and/or phosphate-free detergent to remove oil, grease, and any other potential contaminants.

B.4 SAMPLE HANDLING PROTOCOLS

All samples were placed into laboratory-cleaned glass jars with teflon-lined lids. The jars were labelled with the project name and number, sample number, location, depth, sample date and, time and analyses required.

All samples were kept cool (4°C) in an ice chest for storage and transport to the laboratory. Sufficient ice-substitute was enclosed in the chest to keep the samples cool until arrival at the laboratory.

All sample handling was conducted under strict chain-of-custody procedures. Samples were accompanied by a chain-of-custody record. When transferring possession of the samples the individuals relinquishing and receiving signed dated and noted the time on the record. This record documents transfer of sample custody from the sampler to the laboratory. The chain-of-custody record includes a sample analysis request section. This section identifies the parameters that are to be analyzed and which sample containers have been designated for each requested parameter. One copy of the form was passed on to the laboratory, while a copy was retained by the sampler.

One QA/QC duplicate soil sample and one QA/QC duplicate groundwater sample were collected by field personnel. The duplicate samples were labelled with a fictitious sample number and sampling time. This information was recorded by field personnel.

A record of all field activities was kept in a field notebook on waterproof paper. All entries were made in waterproof ink. Pertinent data collected includes, but is not limited to: time of day started/finished, sample numbers, time collected and analytical requirements. A sketch map was also made of the sampling locations, however, this was made on paper separate from the notebook.

APPENDIX C
LABORATORY RESULTS

Memo

COPY

6895
E20

October 20, 1994

RECEIVED
OCT 21 1994
ENGINEERING SERVICES

To: Dave Dittmar

From: Jim Endres

Subject: S. Facilities UST Samples (C76053)

Attached are the analytical reports and quality control for the following samples that were received by the Laboratory on October 12, 1994.

			Reported Analyses				
Lab ID	Sample Description	Matrix	WTPH-D heavy oil	WTPH-D gasoline screen	WTPH-G	Lead	WTPH-418.1
L4734-1	MW-1	water	x	x		x	
L4734-2	MW-2	water	x	x		x	
L4734-3	MW-3	water	x	x		x	
L4734-4	MW-4	water	x	x		x	
L4734-5	MW-5	water	x	x		x	
L4734-6	SB-1	soil			x	x	
L4734-7	SB-2	soil					x
L4734-8	SB-3	soil			x		
L4734-9	SB-4	soil			x		
L4734-10	SB-5	soil			x		

At the request of Sean Dunnagin of Woodward-Clyde, the samples were analyzed using the guidelines below:

Waters - If gasoline range components are observed in the WTPH-D analyses, the lab would follow-up with a WTPH-G, BTEX and lead analyses.
Soils - For L4734-6, -8, -9 and -10, if gasoline range components are observed in the WTPH-G analyses, analyze for BTEX. For L4734-6 only, if gasoline range components are observed in the WTPH-G analyses, analyze for lead.

Neither heavy oil nor gasoline range components were observed in any of the samples. The Metals Section proceeded with the lead analyses in both waters and soil prior to the gasoline analyses to meet the requested due date. Only L4734-6 had a trace level. The only sample requiring WTPH 418.1 was L4734-7 and 8710 mg/Kg was found. All results were determined on a wet-weight basis.

If you have any questions or would like additional information concerning these analyses, please feel free to call me at ext. 2305.

DESCRIPTION OF COMPREHENSIVE REPORT CONTENTS

Locator

Each sampling site is assigned a unique locator code which defines a unique, specific, geographic reference for that sampling point.

Sample Date

The sample date is labeled Sampled. It is the record of the month, day, and year the sample was collected.

Lab ID

Each sample receives a unique Lab sample number, so that all samples can be referenced by their sample numbers.

Matrix

Matrix is the Lab's designation of the type of environment from which the sample was taken. There are four groups of matrices: liquids, solids, tissues, and air. The matrices and their codes are as follows.

Liquid		
	OTHER WTR	LA
	INFLUENT	LB
	EFFLUENT	LC
	DIG SLUDGE	LD
	IW WTR	LE
	SEWER WTR	LF
	STORM WTR	LG
	DRINK WTR	LH
	GRND WTR	LJ
	FRESH WTR	LK
	SALT WTR	LL
	FILTER WTR	LM
	BLANK WTR	LN
	SEPTAGE	LP
	TCLP LEACH	LQ
	RECON WTR	LR
SOLIDS		
	OTHR SOLID	SA
	SOIL	SB
	COMPOST	SC
	SLUDGE	SD
	FRSHWTRSED	SE
	SALTWTRSED	SF
	IW SLUDGE	SG
	IN-LINE SED	SH

Matrices Cont.

	SOLIDBLANK	SJ
TISSUES		
	OTHR TISS	TA
	ALGAE	TB
	PLANT	TC
	SHELLFISH	TD
	FISH	TE
	CRAYFISH W	TF
	CRAYFISH E	TG
	ORGANS	TH
AIR		
	AIR	AB

%Solids

The percent of the non-liquid (by weight) portion of the sample. % Solids is used for calculating dry weight conversions. All samples are analyzed on a wet weight basis and when requested the measurements are converted to a dry weight basis. Your sample will each be flagged
- Wet Weight Basis
unless you requested dry weight. In that case they would be flagged
- Dry Weight Basis.

Parameters

Parameters (analytes tested for) are reported in sub-groups corresponding to the laboratory that tested for them. The sub-groups are: organics, metals, conventionals, and micro (microbiology) field analysis, and Aquatic Toxicology.

Qualifiers

Qualifiers give additional information about data points.

<MDL	Less than method detection limit
<RDL	Less than reporting detection limit (practical quantitation limit, PQL)

Some other qualifiers you may find:

Qualifiers Cont.

AD	Adult
B	Blank
C	Confluent growth
CS	Composite sample
D	Dominant
DIL	Diluted
E	Estimated
G	Matrix spike or SRM recovery below acceptance range
IP	Incorrect preservation
j#	Chemist's confidence of a Tentatively Identified Compound as indicated by the value of #. The value can vary from 1 to 4, the most confident being 1.
L	Matrix spike or SRM above acceptance range
LV	Larvae
NF	Not found
P	Present
PU	Pupae
R	Data rejected
S	Sub-dominant
SL	Sample lost
TIA	Text information available
X	Matrix spike or surrogate recovery <10 %
XCM	Exceeds capacity to measure (Instrument X limitation)
XHT	Exceeds holding time
RDL	Equal to the Reporting Detection Limit
>MR.###	exceeds the measurable range ###

Value

The value is the measurement of the parameter expressed in the appropriate units of measure. The units of measure are stated directly beneath the label *Value*.

Significant Figures

As standard practice the Environmental Laboratory reports values above the RDL to 3 significant figures. Values below the RDL, or practical quantitation limit, are reported to 2 significant figures. There are exceptions to the standard convention for microbiological, aquatic toxicology, field, and some conventional data. In addition, the Laboratory retains

see reverse side

WOODWARD-CLYDE
CHAIN OF CUSTODY RECORD

1501 Fourth Avenue Suite 1500
Seattle, Washington 98101
(206) 343-7933 fax (206) 343-0513

Project Name: Metro South Base Annex
Project Number: Dave Walker Project Manager: 94403.NA
Sampler (signature):
Shipping Form Tracking Number:
Page 1 of 1 Number of Coolers: 1

Date	Time	Sample Identification	Matrix	Lab ID	Analyses: WTPH-D (ext)	WTPH-G	Pb by GFAA	BTEX 418.1								Preservative y/n	Number of Containers
10/11	10:15a	MW-1	W		X	X	X	X								N	3
10/11	2:15p	MW-2	W		X	X	X	X								N	3
10/11	10:35a	MW-3	W		X	X	X	X								N	3
10/11	1:00p	MW-4	W		X	X	X	X								N	3
10/11	3:30p	MW-5	W		X	X	X	X								N	3
			Rinsate														
10/11	10:45a	SB1 (10-11.5)	Soil			X	X	X								N	2
10/11	11:00a	SB2 (7.5-9)	Soil						X							N	2
10/11	-	SB3 (7.5-9)	Soil			X		X								N	2
10/11	2:30p	SB4 (7.5-9)	Soil			X		X								N	2
10/11	3:15p	SB5 (7.5-9)	Soil			X		X								N	2

Comments: Hold all Water WTPH-G, BTEX and Pb analyses until WTPH-D (ext) results ind. cide gasoline.

Total Number of Containers: 25

Relinquished By (signature):	Date/Time	Relinquished By (signature):	Date/Time
	10-12-94 9:06		
Received By (Signature):	Date/Time	Received for Lab By (signature):	Date/Time
	10/12/94 9:07		

(COCSEA.xls)

METRO Environmental Lab Analytical Report

PROJECT: C76053																			
	Locator:	NONE				Locator:	NONE				Locator:	NONE				Locator:	NONE		
	Client Loc:	MW-1				Client Loc:	MW-2				Client Loc:	MW-3				Client Loc:	MW-4		
	Sampled:	Oct 11, 94				Sampled:	Oct 11, 94				Sampled:	Oct 11, 94				Sampled:	Oct 11, 94		
	Lab ID:	L4734-1				Lab ID:	L4734-2				Lab ID:	L4734-3				Lab ID:	L4734-4		
	Matrix:	GRND WTR				Matrix:	GRND WTR				Matrix:	GRND WTR				Matrix:	GRND WTR		
	% Solids:					% Solids:					% Solids:					% Solids:			
Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
	- Wet Weight Basis					- Wet Weight Basis					- Wet Weight Basis					- Wet Weight Basis				
COMBINED LABS																				
M.Code=DOE WTPH-D																				
Heavy Oil Range (>C24)		<MDL		0.2	0.2 mg/L		<MDL		0.2	0.2 mg/L		<MDL		0.2	0.2 mg/L		<MDL		0.2	0.2 mg/L
	No evidence of gasoline components					No evidence of gasoline components					No evidence of gasoline components					No evidence of gasoline components				
M.Code=DOE WTPH-G																				
Gasoline Range (C7-C12)																				
M.Code=METRO 16-03-001																				
Lead, Total, GFAA		<MDL		0.003	0.009 mg/L		<MDL		0.003	0.009 mg/L		<MDL		0.003	0.009 mg/L		<MDL		0.003	0.009 mg/L
M.Code=METRO 16-03-004																				
Lead, Total, GFAA																				
M.Code=SM5520-F																				
Total Petroleum Hydrocarbon																				

METRO Environmental Lab Analytical Report

PROJECT: C76053																	
	Locator:	NONE				Locator:	NONE				Locator:	NONE				Locator:	TRC			
	Client Loc:	MW-5				Client Loc:	SB1				Client Loc:	SB2				Client Loc:	SB3			
	Sampled:	Oct 11, 94				Sampled:	Oct 11, 94				Sampled:	Oct 11, 94				Sampled:	Oct 11, 94			
	Lab ID:	L4734-5				Lab ID:	L4734-6				Lab ID:	L4734-7				Lab ID:	L4734-8			
	Matrix:	GRND WTR				Matrix:	SOIL				Matrix:	SOIL				Matrix:	SOIL			
	% Solids:					% Solids:					% Solids:					% Solids:				
Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
	- Wet Weight Basis					- Wet Weight Basis					- Wet Weight Basis					- Wet Weight Basis				
COMBINED LABS																				
M.Code=DOE WTPH-D																				
Heavy Oil Range (>C24)		<MDL	0.2	0.2	mg/L															
	No evidence of gasoline components																			
M.Code=DOE WTPH-G																				
Gasoline Range (C7-C12)							<MDL	5	5	mg/Kg							<MDL	5	5	mg/Kg
M.Code=METRO 16-03-001																				
Lead, Total, GFAA		<MDL	0.003	0.009	mg/L															
M.Code=METRO 16-03-004																				
Lead, Total, GFAA						1.2	<RDL	0.43	1.29	mg/Kg										
M.Code=SM5520-F																				
Total Petroleum Hydrocarbon											8710		15	100	mg/Kg					

METRO Environmental Lab Analytical Report

PROJECT: C76053										
	Locator:	TRC				Locator:	TRC			
	Client Loc:	SB4				Client Loc:	SB5			
	Sampled:	Oct 11, 94				Sampled:	Oct 11, 94			
	Lab ID:	L4734-9				Lab ID:	L4734-10			
	Matrix:	SOIL				Matrix:	SOIL			
	% Solids:					% Solids:				
Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
	- Wet Weight Basis					- Wet Weight Basis				
COMBINED LABS										
M.Code=DOE WTPH-D										
Heavy Oil Range (>C24)										
M.Code=DOE WTPH-G										
Gasoline Range (C7-C12)	<MDL		5	5	mg/Kg	<MDL		5	5	mg/Kg
M.Code=METRO 16-03-001										
Lead, Total, GFAA										
M.Code=METRO 16-03-004										
Lead, Total, GFAA										
M.Code=SM5520-F										
Total Petroleum Hydrocarbon										

WTPH-D / WTPH-HCID QAQC SUMMARY

Extraction Date: Oct 11 -94
Instrument: HP5890 FID
Analyst: gm
QA/QC Ref. # : DL22
Wkgp # : WG14419
Comments:

Matrix: water
MB filename: W14419-1
Duplicate filenames: W14419-3 (L4734-1)

SB Diesel filename: W14419-2

Surrogate Recoveries

Sample #	TFT		BFB		2-FB		p-Terp	
WG14419-1 MB					61		113	
WG14419-2 SB					56		118	
WG14419-3 LD					75		125	
L4734-1					60		133	
L4734-2					79		116	
L4734-3					68		111	
L4734-4					62		110	
L4734-5					60		122	
QC Limits	50 - 150		50 - 150		50 - 150		50 - 150	

*Indicates values outside QC Limits

Spike Blank Recoveries

Spiked Compound	Spike Conc.	Found Conc.	% Rec.
motor oil	500.0	480.0	96

Sample/Sample Duplicate Comparison

Compound	Samp	Dupl	RPD
motor oil	<mdl	<mdl	

Method Blank Contamination

Compound	Method Blank	Instr. Conc.
none found	WG14419-1	<mdl

WTPH-G/SW846 8020 QA/QC SUMMARY

Extraction Date: 10/13/94 and 10/14/94
Instrument: Tremetrics 9000
Analyst: JDE
QA/QC Ref. # : GS9
Wkgp # : WG14430
Comments: na = not applicable

Matrix: soil
MB filename: wg14430-1, -5
Duplicate filenames: wg14430-4
L4734-6
SB Gasoline filename: wg14430-3
SB BTEX filename: wg14430-2

Surrogate Recoveries

	PID				FID			
Sample #	TFT		BFB		TFT		BFB	
10/13/94							-	
w14430-1 mb 100	93		89		85		95	
L4734-10 100ul	na		na		63		83	
L4734-8 100ul	na		na		51		71	
L4734-6 100ul	na		na		65		77	
w14430-4 LD 100	na		na		66		81	
w14430-2 sb btex	95		92		na		na	
w14430-3 sb gas	na		na		91		91	
10/14/94 reextract								
w14430-5 md 100ul					83		95	
L4734-9 100ul					54		70	
QC Limits	50 - 150		50 - 150		50 - 150		50 - 150	

*Indicates values outside QC Limits

Spike Blank Recoveries

Spiked Compounds	Spike Conc.	Found Conc.	% Rec.	
Gasoline	97	83	86	
Benzene	40	42	105	
Toluene	40	41	103	
Ethylbenzene	40	41	103	
mp Xylene	120	130	108	
o Xylene	40	37	92	

*Indicates values outside QC Limits

Sample/Sample Duplicate Comparison

	PID			FID		
Compound	Sample	Duplicate	RPD	Sample	Duplicate	RPD
gasoline				<mdl	<mdl	

*Indicates values outside QC Limits

Method Blank Contamination

Compound	Method Blank	Instr. Conc.
gasoline	wg14430-1	<mdl
btex	wg14430-1	<mdl
gasoline	wg14430-5	<mdl
btex	wg14430-5	<mdl

South Facilities VST Project
METALS QC SUMMARY FOR LIQUID SAMPLES

Parameter	Method	MDL (mg/L)	Method Blank 1	Sample Value (mg/L)	Duplicate Value (mg/L)	RPD	Matrix Spike Percent Recovery	Lab Control Sample True Value (mg/L)	Lab Control Sample Measured Value (mg/L)	Lab Control Sample Percent Recovery	Spike Blank Percent Recovery
				L4734-2	WG14502-4						
Pb	GFAA	0.003	<MDL	<MDL	<MDL	---	92	0.0312	0.0298	96	92

MDL=Method Detection Limit.
RPD=Relative Percent Difference.
More numbers than are significant may have been included for calculation purposes.
*Spike recovery out of 80-120% limits.

South Facilities VST Project
METALS QC SUMMARY FOR SOIL SAMPLES

Parameter	Method	MDL (mg/Kg)	Method Blank 1	Sample Value (mg/Kg) L4734-6	Duplicate Value (mg/Kg) WG14432-4	RPD	Matrix Spike Percent Recovery	Montana Soil, NIST 2711 True Value (mg/Kg)	Measured Value (mg/Kg)	Percent Recovery	Spike Blank Percent Recovery
Pb	GFAA	0.4	<MDL	1.2	1.0	18	81	1162	1014	87	88

All results are in wet weight.
MDL=Method Detection Limit.
RPD=Relative Percent Difference.
*RPD exceeds 20%
**Percent recovery out of 80-120% limits.
More numbers than are significant may have been included for calculation purposes.

TO: Jim Endres

FROM: Doris Meade, Conventionals Chemist

SUBJECT: South Facilities VST Project (October 12, 1994) Data Summary Report

DATE: October 20, 1994

The attached comprehensive report shows results for the soil sample collected on October 11, 1994. The lab sample number assigned to the sample was L4734-7. A QA/QC Data Summary is also included for your information.

All products are analyzed in batches. For appropriate products, each analytical batch includes a calibration curve and one or more check standards. All the analytical results are reported from batches where the calibration curve and check standards were within control windows. Calibration curve and check standard control windows are r = 0.995 or greater, and +/- 20% of the true value respectively. Sample duplicate reproducibility is expected to be within 25%, recovery of spiked samples is expected to be within 70-130%, and method blanks are expected to be less than method detection limits.

The method blank resulted in a concentration slightly above but within twice the concentration of the Reporting Detection Limit for the parameter. The contamination is most likely due to the use of recycled freon during the extraction process. Freon has become increasingly difficult to obtain in the past year and will eventually be replaced by hexane, a non-chlorofluorohydrocarbon that is thought to have less of an impact on the ozone layer. Although the method blank was above the detection limit, the concentration detected in the sample is significantly greater than the detection limit and is high enough that the slight contamination detected in the blank has a minimal effect on the data. The matrix spike recovery was also above the control window; however, this is not uncommon for a soil matrix and is most likely due to an inhomogeneous sub-sample taken for the matrix spike analysis.

Please note that the sample on which laboratory duplicate and matrix spike analyses were performed is not included in this project but was run simultaneously with the sample for this project.

The data has passed all other internal QA/QC checks for accuracy and completeness and may be used without qualification.

If you have any questions or concerns, please contact me at 684-2383. Thank you.

South Facilities VST Project (L4734-7 10/12/94) QA/QC Data Summary

Laboratory Duplicate Samples (25%RPD)

Parameter	Total Petroleum Hydrocarbons, mg/kg
Sample	L4718-1
Result 1	7831
Result 2	8430
Rel. % Diff.	-7.37%

Laboratory Spiked Samples (70 - 130%)

Parameter	Total Petroleum Hydrocarbons, mg/kg
Sample	L4718-1
Result 1	7831
Spike Amount	2172
Result 2	11190
% Recovery	155%

Laboratory Method Blanks (<MDL)

Parameter	Total Petroleum Hydrocarbons, mg/kg
Blank	174

<MDL = less than the Method Detection Limit

Laboratory Check Standards (80 - 120%)

Parameter	Total Petroleum Hydrocarbons, mg/kg
True Value	2029
Det'd Value	2302
% Recovery	113%

Memo

RECEIVED

DEC 21 1994

Capital Projects Division

December 20, 1994

To: Christy Sanders-Meena

From: Jim Endres

Subject: S. Facilities UST Samples (C76053)

Attached are the analytical reports and quality control for the following samples that were received by the Laboratory on December 13, 1994.

Lab ID	Sample Description	Matrix	WTPH-D heavy oil	WTPH-D diesel
L5103-1	SB-6	soil	x	x
L5103-2	SB-5	soil	x	x
L5103-3	SB-7	soil	x	x
L5103-4	SB-8	soil	x	x
L5103-5	SB-9	soil	x	x

Only two sample had heavy oil range components at low concentrations; all other samples were clean with no reportable results. All results were determined on a wet-weight basis.

If you have any questions or would like additional information concerning these analyses, please feel free to call me at 684-2305.

DESCRIPTION OF COMPREHENSIVE REPORT CONTENTS

Locator

Each sampling site is assigned a unique locator code which defines a unique, specific, geographic reference for that sampling point.

Sample Date

The sample date is labeled Sampled. It is the record of the month, day, and year the sample was collected.

Lab ID

Each sample receives a unique Lab sample number, so that all samples can be referenced by their sample numbers.

Matrix.

Matrix is the Lab's designation of the type of environment from which the sample was taken. There are four groups of matrices: liquids, solids, tissues, and air. The matrices and their codes are as follows.

Liquid

OTHER WTR	LA
INFLUENT	LB
EFFLUENT	LC
DIG SLUDGE	LD
IW WTR	LE
SEWER WTR	LF
STORM WTR	LG
DRINK WTR	LH
GRND WTR	LJ
FRESH WTR	LK
SALT WTR	LL
FILTER WTR	LM
BLANK WTR	LN
SEPTAGE	LP
TCLP LEACH	LQ
RECON WTR	LR

SOLIDS

OTHR SOLID	SA
SOIL	SB
COMPOST	SC
SLUDGE	SD
FRSHWTRSED	SE
SALTWTRSED	SF
IW SLUDGE	SG
IN-LINE SED	SH

Matrices Cont.

SOLIDBLANK	SJ

TISSUES

OTHR TISS	TA
ALGAE	TB
PLANT	TC
SHELLFISH	TD
FISH	TE
CRAYFISH W	TF
CRAYFISH E	TG
ORGANS	TH

AIR

AIR	AB

%Solids

The percent of the non-liquid (by weight) portion of the sample. All data are calculated and stored on a wet weight basis. The % Solid value is used, if requested, to normalize and report data on a dry weight basis. Each sample will be flagged either **Wet Weight Basis** or **Dry Weight Basis** in the report. Note that the conversion to a dry weight basis is not applicable to all parameters, for example pH. Also, Particle Size Distribution is not based on moisure content.

Parameters

Parameters (analytes tested for) are reported in sub-groups corresponding to the laboratory that tested for them. The sub-groups are: **organics, metals, conventionals, and micro** (microbiology) **field analysis, and Aquatic Toxicology.**

Qualifiers

Qualifiers give additional information about data points.

<MDL	Less than method detection limit
<RDL	Less than reporting detection limit (practical quantitation limit, PQL)

Some other qualifiers you may find:

Qualifiers Cont.

AD	Adult
B	Blank
C	Confluent growth
CS	Composite sample
D	Dominant
DIL	Diluted
E	Estimated
G	Matrix spike or SRM recovery below acceptance range
IP	Incorrect preservation
j#	Chemist's confidence of a Tentatively Identified Compound as indicated by the value of #. The value can vary from 1 to 4, the most confident being 1.
L	Recovery of matrix spike or SRM above acceptance range
LV	Larvae
NF	Not found
P	Present
PU	Pupae
R	Data rejected
S	Sub-dominant
SL	Sample lost
TIA	Text information available
X	Matrix spike or surrogate recovery <10 %
XCM	Exceeds capacity to measure (Instrument X limitation)
XHT	Exceeds holding time
RDL	Equal to the Reporting Detection Limit
>MR,###	exceeds the measurable range ###

Value

The value is the measurement of the parameter expressed in the appropriate units of measure. The units of measure are stated directly beneath the label *Units*.

Significant Figures

As standard practice the Environmental Laboratory reports values above the RDL to 3 figures. Values below the RDL, or practical quantitation limit, are reported to 2 figures. There are exceptions to the standard convention for micro-biological, aquatic toxicology, field, and some

see reverse side

WTPH-D / WTPH-HCID QAQC SUMMARY

Extraction Date: Dec 14, 1994
Instrument: HP5890
Analyst: GM and JE
QA/QC Ref. # : DS21
Wkgp # : WG15738 and WG15684
Comments:

Matrix: soil
MB filename: WG15684-1, WG15738-1
Duplicate filenames: WG15684-4
L5103-1
SB Diesel filename: WG15684-2
SB Motor Oil filename: WG15684-3

**High recovery due to presence of fuel

Surrogate Recoveries

Sample #	TFT		BFB		2-FB		p-Terp	
WG15738-1 MB					86		76	
L5116-1					85		77	
L5116-3					84		77	
L5116-5					90		89	
L5116-6					97		116	
L5116-2					146		**	
L5116-4					128		**	
WG15684-1 MB					85		77	
WG15684-2 SB DSL					101		88	
WG15684-3 SB MO					85		90	
WG15684-4 LD					87		81	
L5103-1					87		82	
L5103-2					86		81	
L5103-3					91		87	
L5103-4					86		81	
L5103-5					84		77	
QC Limits	50 - 150		50 - 150		50 - 150		50 - 150	

*Indicates values outside QC Limits

Spike Blank Recoveries

Spiked Compound	Spike Conc.	Found Conc.	% Rec.	
diesel	300.0	272.7	91	
motor oil	300.0	273.1	91	

Sample/Sample Duplicate Comparison

Compound	Samp	Dupl	RPD
diesel	<MDL	<MDL	
motor oil	<MDL	<MDL	

Method Blank Contamination

Compound	Method Blank	Instr. Conc.
nothing found	WG15738-1	<mdl
nothing found	WG15684-1	<mdl

METRO Environmental Lab Analytical Report

PROJECT: C76053	Locator:	TEMP				Locator:	TEMP				Locator:	TEMP				Locator:	TEMP			
	Client Loc:	SB-6				Client Loc:	SB-5				Client Loc:	SB-7				Client Loc:	SB-8			
	Sampled:	Dec 12, 94				Sampled:	Dec 12, 94				Sampled:	Dec 12, 94				Sampled:	Dec 13, 94			
	Lab ID:	L5103-1				Lab ID:	L5103-2				Lab ID:	L5103-3				Lab ID:	L5103-4			
	Matrix:	SOIL				Matrix:	SOIL				Matrix:	SOIL				Matrix:	SOIL			
	% Solids:					% Solids:					% Solids:					% Solids:				
Parameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
		- Wet Weight Basis					- Wet Weight Basis					- Wet Weight Basis					- Wet Weight Basis			
ORGANICS																				
M.Code=DOE WTPH-D																				
Diesel Range (C13-C24)		<MDL	25	25	mg/Kg		<MDL	25	25	mg/Kg		<MDL	25	25	mg/Kg		<MDL	25	25	mg/Kg
Heavy Oil Range (>C24)		<MDL	25	25	mg/Kg	54.7		25	25	mg/Kg		<MDL	25	25	mg/Kg	25.5		25	25	mg/Kg

METRO Environmental Lab Analytical Report

PROJECT: C76053	Locator:	TEMP
	Client Loc:	SB-9
	Sampled:	Dec 13, 94
	Lab ID:	L5103-5
	Matrix:	SOIL
	% Solids:	

Parameters	Value	Qual	MDL	RDL	Units
		- Wet Weight Basis			
ORGANICS					
M.Code=DOE WTPH-D					
Diesel Range (C13-C24)		<MDL	25	25	mg/Kg
Heavy Oil Range (>C24)		<MDL	25	25	mg/Kg

WOODWARD-CLYDE
CHAIN OF CUSTODY RECORD

501 Fourth Avenue Suite 1500
Seattle, Washington 98101
(206) 343-7933 fax (206) 343-0513

Project Name: Metro S.B

Project Number: Project Manager: J. Boutwell

Sampler (signature): Bill Hellman

Shipping Form Tracking Number:

Page 1 of 1 Number of Coolers: 1

Date	Time	Sample Identification	Matrix	Lab ID	Analyses: WTPH-D EXT	Preservative y/n	Number of Containers
12/12	1100	SB-6 1/2, 2/2	Soil	5103-1	X		2
12/12	1400	SB-5	Soil	5103-2	X		1
12/12	1300	SB-7	Soil	5103-3	X		1
12/13	1130	SB-8	Soil	5103-4	X		1
12/13	1130	SB-9	Soil	5103-5	X		1

Total Number of Containers: 6

Comments: SB-6 2/2 @ extra sample; do not need to composite per JMM Earthman. (BLL 12/12/94)

Relinquished By (signature):	Date/Time	Relinquished By (signature):	Date/Time
Bill Hellman	12/13/94		
Received By (Signature):	**Date/Time**	**Received for Lab By (signature):**	**Date/Time**
Alan Laird	12/13/94 1610		

(COCSEA.xls)

METRO

Municipality of Metropolitan Seattle
Exchange Bldg. 821 Second Avenue M.S. 117
Seattle, Washington 98104

LETTER OF TRANSMITTAL

DATE	FILE/CONTRACT NO.
12/22/94	CS/M112-92 WO#35

TO ATTENTION OF
Mr. James Borthen

REGARDING
South Facilities Site Assessment
Work Order No. 35

TO:

Woodward-Clyde
1500 Century Square, 1501 4th Avenue
Seattle, Washington 98101-1662

WE ARE SENDING YOU THE FOLLOWING:

[X] ATTACHED [ ] UNDER SEPARATE COVER

COPIES	DATE	DWG NO	DESCRIPTION
1	12/20/94		Sample Results from the Water Quality Lab for Soil Samples - Memo from Jim Endres

THESE ARE TRANSMITTED:

[ ] FOR APPROVAL
[X] FOR YOUR USE AND INFORMATION
[ ] AS REQUESTED
[ ] FOR REVIEW AND COMMENT
[ ] OTHER:

REMARKS
Hard copy of results previously faxed to you.

SIGNATURE	TITLE	DIVISION
Christy Sanders-Meena CSM	Project Manager	Capital Programs Phone: (206) 684-1358 Fax: (206) 684-1710

Memo

December 23, 1994

To: Christy Sanders-Meena

From: Jim Endres

Subject: S. Facilities UST Samples (C76053)

Attached are the results for the following samples that were received by the Laboratory on December 19, 1994.

Lab ID	Sample Description	Matrix	WTPH-D heavy oil	WTPH-D diesel
L5119-1	SB-8	water	x	x
L5119-2	SB-7	water	x	x
L5119-3	SB-6	water	x	x
L5119-4	SB-5	water	x	x

Three of the samples (L5119-1 and -2) had hydrocarbon components that calculated above the reporting limit for diesel and heavy oil range components based the petroleum products identifying criteria found in Appendix L of DOE's "Guidance for Remediation of Releases from Underground Storage Tanks." One sample (L5119-3) had hydrocarbon components for heavy oil. In all samples, the hydrocarbon pattern more closely resembled heavy oil than diesel. There were no hydrocarbons above the reporting limits for sample L5119-4.

There was an extraction problem with sample L5119-3 that resulted in low surrogate recoveries. The recovery of the surrogates reflect the efficiency of the extraction process and should fall within 50 to 150%. The recoveries in this case were quite a bit lower. Unfortunately, we did not have enough to re analyze it. If a result is needed to comply with the QC requirements, we will re analyze it if you can provide more sample.

If you have any questions or would like additional information concerning these analyses, please feel free to call me at 684-2305.

cc: Jim Borthen, Woodward-Clyde

METRO Environmental Lab Analytical Report

ROJECT: C76053																				
	Locator:	NONE				Locator:	NONE				Locator:	NONE				Locator:	NONE			
	Client Loc:	SB-8				Client Loc:	SB-7				Client Loc:	SB-6				Client Loc:	SB-5			
	Sampled:	Dec 19, 94				Sampled:	Sep 19, 94				Sampled:	Sep 19, 94				Sampled:	Sep 19, 94			
	Lab ID:	L5119-1				Lab ID:	L5119-2				Lab ID:	L5119-3				Lab ID:	L5119-4			
	Matrix:	OTHR WTR				Matrix:	OTHR WTR				Matrix:	OTHR WTR				Matrix:	OTHR WTR			
	% Solids:					% Solids:					% Solids:					% Solids:				
arameters	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units	Value	Qual	MDL	RDL	Units
		- Wet Weight Basis					- Wet Weight Basis					- Wet Weight Basis					- Wet Weight Basis			
RGANICS																				
M.Code=DOE WTPH-D																				
iesel Range (C13-C24)	0.495		0.2	0.2	mg/L	0.55		0.2	0.2	mg/L		<MDL	0.2	0.2	mg/L		<MDL	0.2	0.2	mg/L
leavy Oil Range (>C24)	0.326		0.2	0.2	mg/L	0.723		0.2	0.2	mg/L	0.236		0.2	0.2	mg/L		<MDL	0.2	0.2	mg/L

DESCRIPTION OF COMPREHENSIVE REPORT CONTENTS

Locator

Each sampling site is assigned a unique locator code which defines a unique, specific, geographic reference for that sampling point.

Sample Date

The sample date is labeled Sampled. It is the record of the month, day, and year the sample was collected.

Lab ID

Each sample receives a unique Lab sample number, so that all samples can be referenced by their sample numbers.

Matrix.

Matrix is the Lab's designation of the type of environment from which the sample was taken. There are four groups of matrices: liquids, solids, tissues, and air. The matrices and their codes are as follows.

Liquid		
	OTHER WTR	LA
	INFLUENT	LB
	EFFLUENT	LC
	DIG SLUDGE	LD
	IW WTR	LE
	SEWER WTR	LF
	STORM WTR	LG
	DRINK WTR	LH
	GRND WTR	LJ
	FRESH WTR	LK
	SALT WTR	LL
	FILTER WTR	LM
	BLANK WTR	LN
	SEPTAGE	LP
	TCLP LEACH	LQ
	RECON WTR	LR
SOLIDS		
	OTHR SOLID	SA
	SOIL	SB
	COMPOST	SC
	SLUDGE	SD
	FRSHWTRSED	SE
	SALTWTRSED	SF
	IW SLUDGE	SG
	IN-LINE SED	SH

Matrices Cont.

	SOLIDBLANK	SJ
TISSUES		
	OTHR TISS	TA
	ALGAE	TB
	PLANT	TC
	SHELLFISH	TD
	FISH	TE
	CRAYFISH W	TF
	CRAYFISH E	TG
	ORGANS	TH
AIR		
	AIR	AB

%Solids

The percent of the non-liquid (by weight) portion of the sample. All data are calculated and stored on a wet weight basis. The % Solid value is used, if requested, to normalize and report data on a dry weight basis. Each sample will be flagged either **Wet Weight Basis** or **Dry Weight Basis** in the report. Note that the conversion to a dry weight basis is not applicable to all parameters, for example pH. Also, Particle Size Distribution is not based on moisure content.

Parameters

Parameters (analytes tested for) are reported in sub-groups corresponding to the laboratory that tested for them. The sub-groups are: **organics, metals, conventionals, and micro** (microbiology) **field analysis, and Aquatic Toxicology.**

Qualifiers

Qualifiers give additional information about data points.

<MDL	Less than method detection limit
<RDL	Less than reporting detection limit (practical quantitation limit, PQL)

Some other qualifiers you may find:

Qualifiers Cont.

AD	Adult
B	Blank
C	Confluent growth
CS	Composite sample
D	Dominant
DIL	Diluted
E	Estimated
G	Matrix spike or SRM recovery below acceptance range
IP	Incorrect preservation
j#	Chemist's confidence of a Tentatively Identified Compound as indicated by the value of #. The value can vary from 1 to 4, the most confident being 1.
L	Recovery of matrix spike or SRM above acceptance range
LV	Larvae
NF	Not found
P	Present
PU	Pupae
R	Data rejected
S	Sub-dominant
SL	Sample lost
TIA	Text information available
X	Matrix spike or surrogate recovery <10 %
XCM	Exceeds capacity to measure (Instrument X limitation)
XHT	Exceeds holding time
RDL	Equal to the Reporting Detection Limit
>MR,###	exceeds the measurable range ###

Value

The value is the measurement of the parameter expressed in the appropriate units of measure. The units of measure are stated directly beneath the label *Units*.

Significant Figures

As standard practice the Environmental Laboratory reports values above the RDL to 3 figures. Values below the RDL, or practical quantitation limit, are reported to 2 figures. There are exceptions to the standard convention for micro-biological, aquatic toxicology, field, and some

see reverse side

WTPH-D / WTPH-HCID QAQC SUMMARY

Extraction Date: Dec 20 -94
Instrument: HP5890 FID
Analyst: gm
QA/QC Ref. # : DL24
Wkgp # : WG15787
Comments: *low surrogate recovery

Matrix: water
MB filename: W15787-1
Duplicate filenames: W15787-4 (L5119-1)

SB Diesel filename: W15787-2
SB Mo filename: W15787-3

Surrogate Recoveries

Sample #	TFT		BFB		2-FB		p-Terp	
WG15787-1 MB					67		98	
WG15787-2 SB DSL					77		109	
WG15787-3 SB MO					67		103	
WG15787-4 SB MO					54		99	
L5119-1					59		101	
L5119-2					51		101	
L5119-3					13	*	28	*
L5119-4					51		98	
L5133-2					135		144	
QC Limits	50 - 150		50 - 150		50 - 150		50 - 150	

*Indicates values outside QC Limits

Spike Blank Recoveries

Spiked Compound	Spike Conc.	Found Conc.	% Rec.
motor oil	500.0	468.9	94
diesel	500.0	457.1	91

Sample/Sample Duplicate Comparison

Compound	Samp	Dupl	RPD
motor oil	81.6	70.4	7
diesel	123.8	101.0	10

Method Blank Contamination

Compound	Method Blank	Instr. Conc.
none found	WG15787-1	<mdl