TERRA ASSOCIATES, Inc.
Geotechnical Consultants

May 1, 1987
Project No. T-291-1

Mr. Charles R. Blumenfeld
Bogle and Gates
The Bank of California Center
Seattle, WA 98104

Subject: Soil and Groundwater Sampling and Testing
Sternoff Metals Site
East Marginal Way South
Seattle, Washington

Dear Mr. Blumenfeld:

As requested and in accordance with our proposal dated November 4, 1986 we have conducted subsurface soil and groundwater sampling at the Sternoff Metals site on East Marginal Way in Seattle, Washington. The scope of our work included installation of two monitoring wells for sampling of groundwater and the excavation of several test holes by hand to collect soil samples for chemical analyses for PCB's, and heavy metals by the EP Toxicity procedure. In addition, we also collected a sample from a trash pile for chemical analysis to determine its possible designation as hazardous waste material. We had previously conducted a subsurface exploration on the property in the spring of 1986, at which time PCB's were identified at the site. Our present subsurface soil and groundwater sampling and chemical analyses was undertaken to further identify the levels and extent of potentially contaminated soils on the site and to develop additional information with which to assess the possible migration of contaminants off the site through surface or groundwater movement. This report presents the results of our sampling and analyses along with our interpretation of these test data.

SUMMARY

During the 45 years that the site was operated as a scrap metal salvage yard, a variety of materials were accepted and handled on the site including electrical transformers and capacitors which were sometimes filled with oils which may have contained PCB's.

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Our studies indicate that PCB's are present in the near surface soils at levels up to 75 ug/g (micrograms per gram) or parts per million (ppm), on the site. The higher concentration of PCB's appears to be limited to an isolated area in the southwest corner of the property. We also measured PCB's in groundwater samples collected from two monitoring wells installed on the site at levels on the order of 2 ug/l (micrograms per liter) or parts per billion (ppb). Priority metals in the soils as determined by the EP toxicity procedure are present in the near surface soils at concentrations below the criteria for designation as dangerous waste. Metals in the groundwater samples were also measured at levels below federal clean water standards.

Plans for future development of the site will need to address the presence of the PCB's in the near surface soils.

It is our opinion that the site can be adequately sealed to minimize the movement of contaminants off the site by placing an impermeable fill cap over the existing surface and installing a redesigned storm drainage system. Some cleanup of the existing storm drains and surface soils may be required prior to further development on the site. The soils with relatively higher concentrations of PCB's in the southwest corner of the site should be removed and disposed off-site.

The following sections of this report describe our study in greater detail and present the results.

SITE EXPLORATION AND SAMPLING

Our field sampling for this phase of the work was conducted on December 8, 1986. Four shallow test holes were excavated by hand to depths of 24 inches for collection of near surface soil samples for chemical analyses. Two monitoring wells were also installed in test borings drilled to a depth of 17.5 feet. Soil samples were placed in clean jars and kept refrigerated until delivery to the testing laboratory the next morning. Water samples were collected from the monitoring wells on December 24 for chemical analyses.

Our previous sampling at the site was conducted on April 17, 1986 when a back-hoe was used to excavate test pits for collection of soil samples. Sample collection locations are shown on the attached Site Plan, Figure 1.

The sample locations for our initial study were selected based on our understanding of the history of the operation of the property as a metal salvage yard. Sample locations were selected to provide coverage across the site and also include areas where we understood transformers may have been handled on the site since the possibility of PCB contamination is a major environmental concern. Sample locations for the second series of tests were selected to delineate areas where initial tests indicated elevated levels of various chemicals, and also to verify that chemicals were not present in certain areas. The groundwater samples were located along the most likely path of underground flow, along the old rail tracks.

Results of the chemical analyses are listed on Tables A-1 through A-5. Logs of test pits are included as Figures 3 through 7. These logs show details of soil conditions encountered in the test pits.

RESULTS AND DISCUSSION

Site Conditions

Surface

Until recently, the property has been operated as a scrap metal recycling facility. At present the site is idle and the equipment and scrap metal has been removed from the site. The site is presently paved over most of the area with asphalt or concrete except for an area along the south property line and a smaller area in the southwest corner.

A visit was made to the site on January 24, 1987, after an overnight rain to observe the movement of surface storm water on the site. Presently, surface water ponds on the site and slowly infiltrates or evaporates. When the facility was operating, there were pumps operating in sumps which served to remove surface water from the site. These pumps are not functioning at the present time. One of these sumps is located near the entrance gate on 8th Avenue and when operating handled most of the storm water on the site. A second pump handled water in the depression for the loading dock in front of the shop building. There may also be sumps located for the basement of the office building and truck scale. At the time of our visit on January 24, it was noted that surface water flows onto the site from 8th Avenue South at the location of the west gate and some of this water enters the open sump. Some surface water leaves the site from the southeast corner following the pathway of abandoned railroad tracks. The area drained through this pathway appears relatively small. Water also ponds against the plate metal fence along the south property line. Soil has been piled up against the plate metal on the outside and there does not appear to be any movement of water off the site at this location. Except as noted there is very little surface water which leaves the site in its present configuration. DOE in association with METRO has sampled and tested water and sediment samples from catch basins on the site and directly off the site.

Soils

In general, the native soils encountered in our test pits consist of a layer of silt or sandy silt about three feet in thickness over clean sand which extended below the depths explored by our test pits. The silt strata appears to be relatively impermeable. Above the native soils there are varying depths of soils with the accumulation of debris from the operation of the salvage yard. Generally, this depth is less than two feet.

Our previous screening tests which measured total concentrations of Lead, Cadmium and Copper showed relatively high concentrations. In Test Pits TP-1 and TP-10 where samples from an upper and lower elevation were tested, the concentration measured in the lower sample was significantly lower the upper sample. This pattern is also true of the total hydrocarbons data for TP-10 indicating that there is relatively little downward migration of materials into the native soils.

Comparison of the total metal concentrations with the EP Toxicity values indicates that the metals present are not readily soluble and as such are not available for transport via groundwater.

PCB's were measured in the soil in an unpaved area near the southwest corner of the property (TP-5) at a level of 75 ug/g (ppm). Subsequent testing (TH-3, TH-4 and B-2) indicate that the area of soils with PCB's at a concentration greater than 50 ug/g is limited. Other tests showed lower levels of PCB's; 23 ug/g in TP-1, 12 ug/g in TP-2 and 3.3 ug/g in TP-10. We understand that the southwest corner of the site is underlain by a concrete slab at a depth of approximately 18 to 24 inchese below the existing grade. This concrete slab, where present, should prevent downward migration of the higher levels of PCB's noted in this area.

We also collected a sample of material from the trash pile located in the southwest corner of the site for analysis. The trash pile is located above an asphalt surface. PCB levels in this sample were 540 ug/g. At this level, this pile should be treated as dangerous waste and should be disposed of accordingly.

Groundwater

Groundwater was measured at a depth of 11 feet in the two monitoring wells. It is presumed that the direction of groundwater flow is toward the west to the Duwamish Waterway although the movement may be complicated by discontinuities caused by ancient river channels. Prior to the straightening and dredging of the Duwamish River, the river meandered and flowed through a channel to the east of the site. The site is located close enough to the Duwamish Waterway that groundwater movement may be subject to tidal influences, in addition to presumed seasonal differences in volume and velocity of groundwater movement.

Chemical analysis of the groundwater samples show that the levels of metals are below applicable standards.

PCB's were also detected at levels of 2.57 ug/l (ppb) and 1.52 ug/l (ppb) in the groundwater samples collected from the two monitoring wells. These levels are very close to the detection limit of 2.0 ug/l for the test procedure, and are below the Marine Acute L.O.E.L. (Lowest Observed Effect Level) criteria of 10 ug/l. There are no publicly available tests of groundwater in the vicinity for background levels against which to compare these values. In our opinion, the levels measured are sufficiently low so that they are not of concern.

CONCLUSIONS

It is our opinion that the migration of potentially contaminated materials off the site and the environmental hazard can be minimized by placing an impermeable fill cap over the existing grades to seal the site. The trash pile in the southwest corner should be cleaned up and treated as hazardous waste. In addition, the soils in the vicinity of our Test Pit TP-5 should also be cleaned up to levels below 50 ug/g. We estimate that this involves removal of soil to a depth of two feet in an area approximately 20 feet by 20 feet. Existing storm drains should be abandoned and plugged and a new storm drainage system installed after fills have been placed to seal the site. The sediment should be removed from the storm drains. The native silt layer across the site is presumed to be relatively impermeable and excavations for buildings, and utility trenches should not penetrate this layer in order to maintain this natural impermeable layer. It may be possible to seal spoils from site excavations under the clean fill cover. Excavations into the existing soils and through the existing pavement should be minimized.

The measured levels of PCB's in the groundwater monitoring wells will be expected to decrease over time after the site is sealed and surface water is collected in a redesigned storm drainage system.

While we believe that the site can be adequately sealed to insure environmental safety, it will be necessary to maintain the integrity of the cover. Once the site has been developed future excavations should be carefully monitored to insure that the integrity of the cover is maintained.

The following tables and figures are included and complete this report:

Figure	1	Site Plan
Figure	2	Soil Classification Chart
Figures	3 through 7	Test Pit Logs
Table	A-1	EP Toxicity Metals in Soil Samples
Table	A-2	Metals in Groundwater Samples
Table	A-3	PCB's in Soil
Table	A-4	PCB's in Groundwater
Table	A-5	Total Metals & Total Hydrocarbons in Soil Samples

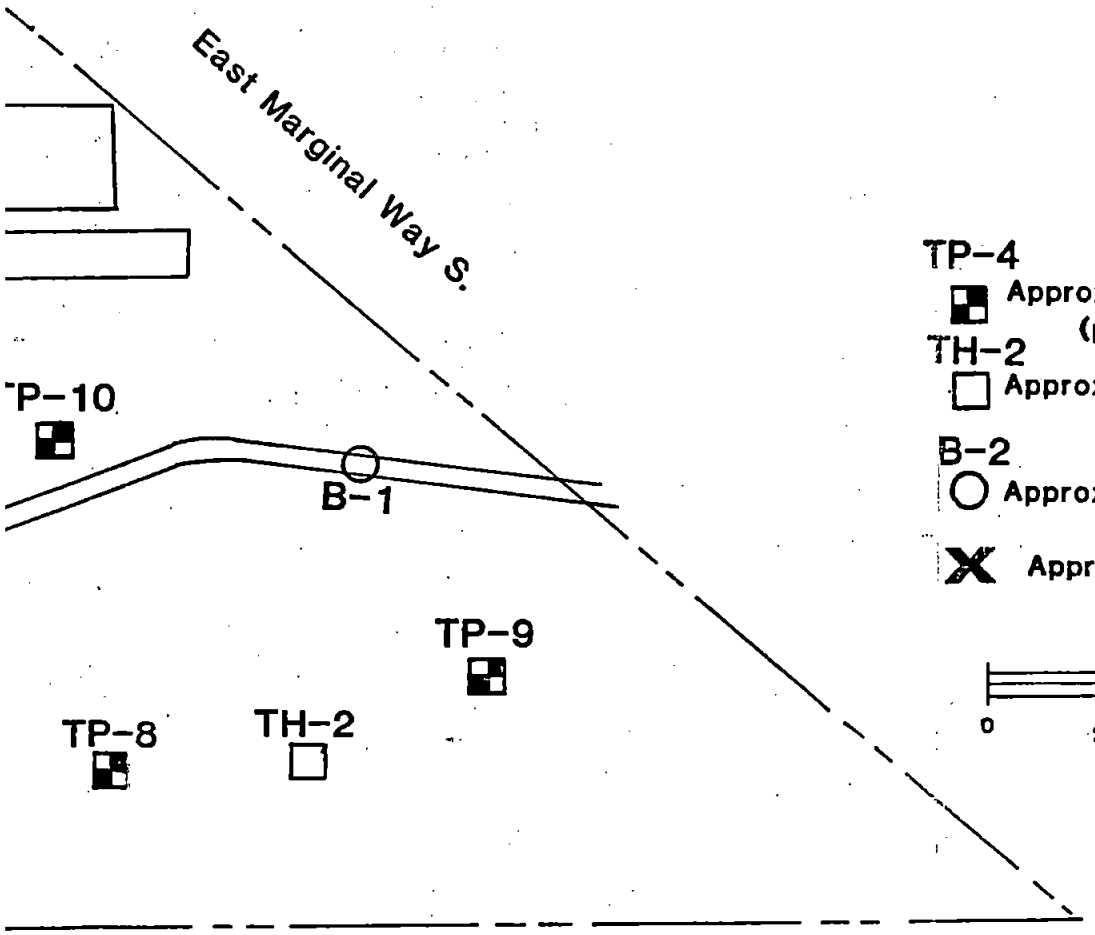
We trust that this report is sufficient for you to proceed with preliminary plans for development of the property. We will be available to provide additional testing and consultation services as your plans for the site progress. If you need any additional information, please call.

Sincerely,

TERRA ASSOCIATES, INC.

Anil Butail, P.E.
President

GPM/AB:mf
Enclosures



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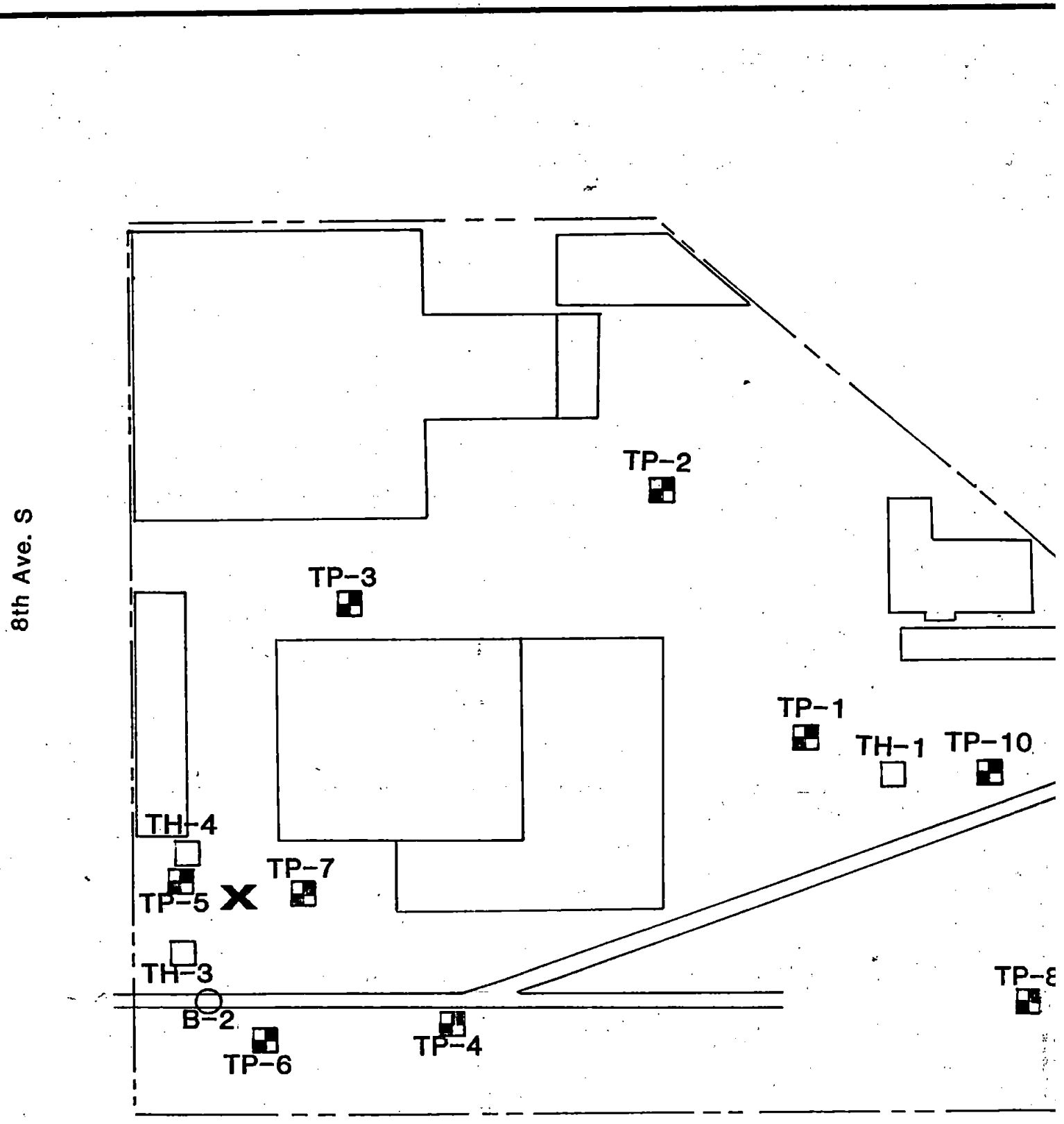
SITE PLAN
East Marginal Way Site
Seattle, Wa

Proj. No291-1 | Date Feb. 87 | Figure 1


8th Ave. S
TP-2
TP-3
TP-1
TH-1
TP-10
TH-4
TP-5
TP-7
TH-3
B-2
TP-6
TP-4
TP-8

PRIMARY DIVISIONS			Group Symbol	SECONDARY DIVISIONS
COARSE GRAINED SOILS more than half of material is larger than No. 200 sieve size	GRAVELS more than half of coarse fraction is larger than No. 4 sieve	Clean Gravels (less than 5% fines)	GW	well graded gravels, gravel-sand mixtures, little or no fines.
			GP	poorly graded gravels or gravel-sand mixtures, little or no fines.
		Gravel with fines	GM	silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS more than half of coarse fraction is smaller than No. 4 sieve	Clean Sands (less than 5% fines)	SW	well graded sands, gravelly sands, little or no fines.
			SP	poorly graded sands or gravelly sands, little or no fines.
		Sands with fines	SM	silty sands, sand-silt mixtures, non-plastic fines.
			SC	clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS more than half of material is smaller than No. 200 sieve size	SILTS AND CLAYS liquid limit is less than 50%		ML	inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	inorganic clays of low to medium plasticity gravelly clays, sandy clays, silty clays, lean clays.
			OL	organic silts and organic clays of low plasticity.
	SILTS AND CLAYS liquid limits is greater than 50%		MH	inorganic silts, micaceous or diatomceous fine sandy or silty soils, elastic.
			CH	inorganic clays of high plasticity, fat clays.
HIGHLY ORGANIC SOILS			PT	peat and other highly organic soils.

DEFINITION OF TERMS

U.S. Standard Series Sieve: 200 | 40 | 10 | 4 — Clear Square Sieve Openings: 3/4" | 3" | 12"

SILTS & CLAYS	SAND			GRAVEL		COBBLE	BOULDER
	fine	medium	coarse	fine	coarse		

GRAIN SIZES

SANDS, GRAVELS, AND NON-PLASTIC SILTS	STANDARD PENETRATION Blows/Ft.
very loose	0- 4
loose	4-10
medium dense	10-30
dense	30-50
very dense	over 50

RELATIVE DENSITY

PLASTIC SILTS AND CLAYS	Unconfined Compressive Strength tons/sq. ft.	STANDARD PENETRATION Blows/ft.
very soft	0 - 1/4	0 - 2
soft	1/4 - 1/2	2 - 4
firm	1/2 - 1	4 - 8
stiff	1 - 2	8-16
very stiff	2 - 4	16-32
hard	over 4	over 32

CONSISTENCY

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UNIFIED SOIL CLASSIFICATION SYSTEM

East Marginal Way Site
Seattle, Washington

Proj. No. 291 | Date May '86 | Figure 2

TEST PIT NO. 1

Logged By GPM
Date 4-17-86
Elev. ____

Depth (ft.)	USCS	Soil Description	W (%)
0		2" Asphalt surface over 6" crushed rock	
		Black "dirt" with wire, metal pieces, tire, insulator pieces, glass, etc.	
	ML	Grey/brown mottled black, sandy SILT, damp, dense.	
5			
	SM	Grey, medium coarse, clean SAND, damp, dense.	
		No groundater seepage observed.	
		Test Pit terminated at 8.0 feet.	
10			
15			

TEST PIT NO. 2

Logged By GPM
Date 4-17-86
Elev. ____

0		Black "dirt" with metal fragments, trash, etc.	
	ML	Grey/brown SILT, moist, dense.	
	ML	Orange/brown mottled SILT, wet, soft.	
5			
	SM	Grey, medium coarse, clean SAND, damp, medium dense	
		2" asphalt surface.	
		No groundwater seepage observed.	
10		Test Pit terminated at 6.0 feet.	
15			

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TEST PIT LOGS
East Marginal Way Site
Seattle, Washington

Proj. No. 291 | Date May '86 | Figure 3

TEST PIT NO. 3

Logged By GPM
Date 4-17-86
Elev. ____

Depth (ft.)	USCS	Soil Description	W (%)	
0	ML	Grey, black SILT, moist, medium dense.		
	SM	Tan, silty SAND, moist, medium dense.		
5	SM	Grey, medium coarse, clean SAND, moist, medium dense.		
		2" asphalt surface No groundwater seepage observed. Test Pit terminated at 7.0 feet.		
10				
15				

Logged By GPM
Date 4-17-86

TEST PIT NO. 4

Elev. ____

0		Crushed rock		
		Black "dirt" with metal fragments, glass, etc.		
	ML	Grey SILT, moist, medium dense.		
5		2" asphalt surface Slight seepage below crushed rock Test Pit terminated at 5.5 feet.		
10				
15				

TEST PIT NO. 5

Logged By GPM
Date 4-17-86
Elev. ____

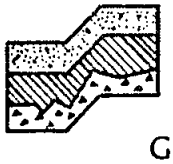
Depth (ft.)	USCS	Soil Description	W (%)	
0		Black "dirt" with metal fragments, glass, wire, insulator pieces, etc.		
		Test Pit terminated at 2.0 feet on concrete slab.		
5				
10				
15				

Logged By GPM
Date 4-17-86

TEST PIT NO. 6

Elev. ____

0		Crushed rock		
		Black "dirt" with gravel, metal fragments, wire, etc.		
5	SM	Black topsoil layer at 3.0 feet. Light brown, medium fine, silty SAND, damp, dense.		
		No groundwater seepage observed. Test Pit terminated at 7.0 feet.		
10				
15				



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TEST PIT LOGS

East Marginal Way Site
Seattle, Washington

Proj. No. 291	Date May '86	Figure 5

TEST PIT NO. 7

Logged By GPM

Date 4-17-86

Elev. _____

Depth (ft.)	USCS	Soil Description	W (%)
0		Black "dirt" with metal fragments, etc.	
		2" asphalt surface. Test Pit terminated at 1.5' on concrete slab and foundation.	
5			
10			
15			

Logged By GPM

Date 4-17-86

TEST PIT NO. 8

Elev. _____

0		Dirty crushed rock.	
		Orange/black "dirt" with trash.	
5	SM	Grey/brown, medium coarse, clean SAND, moist, medium dense.	
		Heavy perched water seepage below crushed rock. No seepage below 2.0 feet. Test Pit terminated at 7.0 feet.	
10			
15			

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TEST PIT LOGS

East Marginal Way Site
Seattle, Washington

Proj. No. 291	Date May '86	Figure 6

TEST PIT NO. 9

Logged By GPM
Date 4-17-86
Elev. _____

Depth (ft.)	USCS	Soil Description	W (%)
0		Crushed rock	
		Black "dirt" with metal fragments, trash, etc.	
	ML	Grey/brown SILT, moist, dense.	
5		2" asphalt surface	
		Test Pit terminated at 5.0 feet.	
10			
15			

TEST PIT NO. 10

Logged By GPM
Date 4-17-86
Elev. _____

Depth (ft.)	USCS	Soil Description
0		2" asphalt over 6" crushed rock
		Black "dirt" with insulator pieces, trash, etc.
	ML	Grey/black SILT, moist, medium dense.
5	SM	Grey, medium coarse SAND, moist, dense.
		Extensive caving below 5 feet.
10		Becoming wet to saturated below 13.0 feet.
		Test Pit terminated at 16.0 feet.
15		

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TEST PIT LOGS
East Marginal Way Site
Seattle, Washington

Proj. No. 291 | Date May '86 | Figure 7

TABLE A-1

Results of Chemical Analysis
EP Toxicity Metals in Soil Samples

Sternoff Property
Seattle, Washington

	TH-1 @ 2'	TH-2 @ 1'	EP Toxicity Dangerous Waste Standard
Arsenic	<0.02	0.02	5.0
Selenium	<0.05	<0.05	1.0
Lead	<0.1	<0.1	5.0
Barium	1.5	<1.0	100.0
Cadmium	0.05	<0.05	1.0
Silver	<0.05	<0.05	5.0
Chromium	<0.1	<0.1	5.0
Nickel	0.20	0.25	-
Copper	0.15	0.10	-
Zinc	13.	24.	-
Mercury	<0.001	0.001	0.2

Values reported are milligrams per liter.

TABLE A-2

Results of Chemical Analysis
Metals in Groundwater Samples

Sternoff Property
Seattle, Washington

	B-1	B-2	Marine Acute Criteria L.O.E.L. *
Arsenic	0.003	0.003	-
Selenium	0.18	<0.05	-
Lead	0.02	<0.01	.043
Barium	<0.05	<0.05	103.
Cadmium	<0.05	<0.05	.0029
Silver	<0.25	<0.25	.140
Chromium	0.001	<0.001	.0021
Nickel	0.05	<0.05	.140
Copper	<0.002	<0.002	.410
Zinc	<0.01	<0.01	.0023
Mercury	0.09	0.07	.170

Values reported are in milligrams per liter.

* L.O.E.L. = Lowest observed effect level

TABLE A-3

Results of Chemical Analysis
PCB's in Soil

Sternoff Property
Seattle, Washington

	Trash Pile	TH-2 @ 1.0'	TH-3 @ 1.0'	TH-4 @ 1.0'
Arochlor 1202	50.	N.D.	N.D.	N.D.
Arochlor 1254	N.D.	N.D.	N.D.	N.D.
Arochlor 1260	490.	0.81	3.11	42.

	TP-1 @ 2.0'	TP-2 @ 0.8'	TP-5 @ 1.0'	TP-10 @ 1'
Arochlor 1202	N.D.	N.D.	N.D.	N.D.
Arochlor 1254	23.	12.	N.D.	N.D.
Arochlor 1260	N.D.	N.D.	75.	3.3

Values reported are in micrograms per gram.

N.D. = Not Detected.

TABLE A-4

Results of Chemical Analysis
PCB's in Groundwater

Sternoff Property
Seattle, Washington

	B-1	B-2	Marine Acute Criteria L.O.E.L. *
Arochlor 1260	N.D.	1.52	-
Arochlor 1242	2.57	N.D.	-
TOTAL	2.57	1.52	10

Values reported are in milligrams per liter.

* L.O.E.L. = Lowest Observed Effect Level

N.D. = Not Detected

TABLE A-5

Results of Chemical Analysis
Total Metals & Total Hydrocarbons in Soil Samples*

Sternoff Property
Seattle, Washington

	TP-1@2.0'	TP-1@4.0'	TP-2@0.8'	TP-3@0.8'	TP-4@1'	TP-4@2'
Cadmium	35	<0.30	8.2	310	39	-
Copper	5,500	19	1,600	6.6	1,100	-
Lead	7,100	8.1	6,500	9,800	8,800	-
Total Hydrocarbons	25,000 (1)	-	-	-	-	1,000 (2)

	TP-6@ 1.0'	TP-7@1.0'	TP-8@1.3'	TP-10@1.0'	TP-10@2'	TP-10@3'
Cadmium	74	53	42	45	-	0.38
Copper	5,500	8,300	870	5,800	-	16
Lead	19,800	5,800	1,600	6,700	-	<0.10
Total Hydrocarbons	-	-	-	610 (3)	9	-

Values reported are in micrograms per gram.