



April 30, 1998

Ms. Kathy Bahnick
Port of Seattle, Environmental Engineering
PO Box 1209
Seattle, WA

Re: Results of Additional Monitoring and Extraction Well Installation, Wellhead Repair,
High-vacuum Extraction Pilot Testing, and Hydrogen Peroxide Treatments
Port of Seattle Terminal 115, Seattle, Washington

Dear Ms. Bahnick,

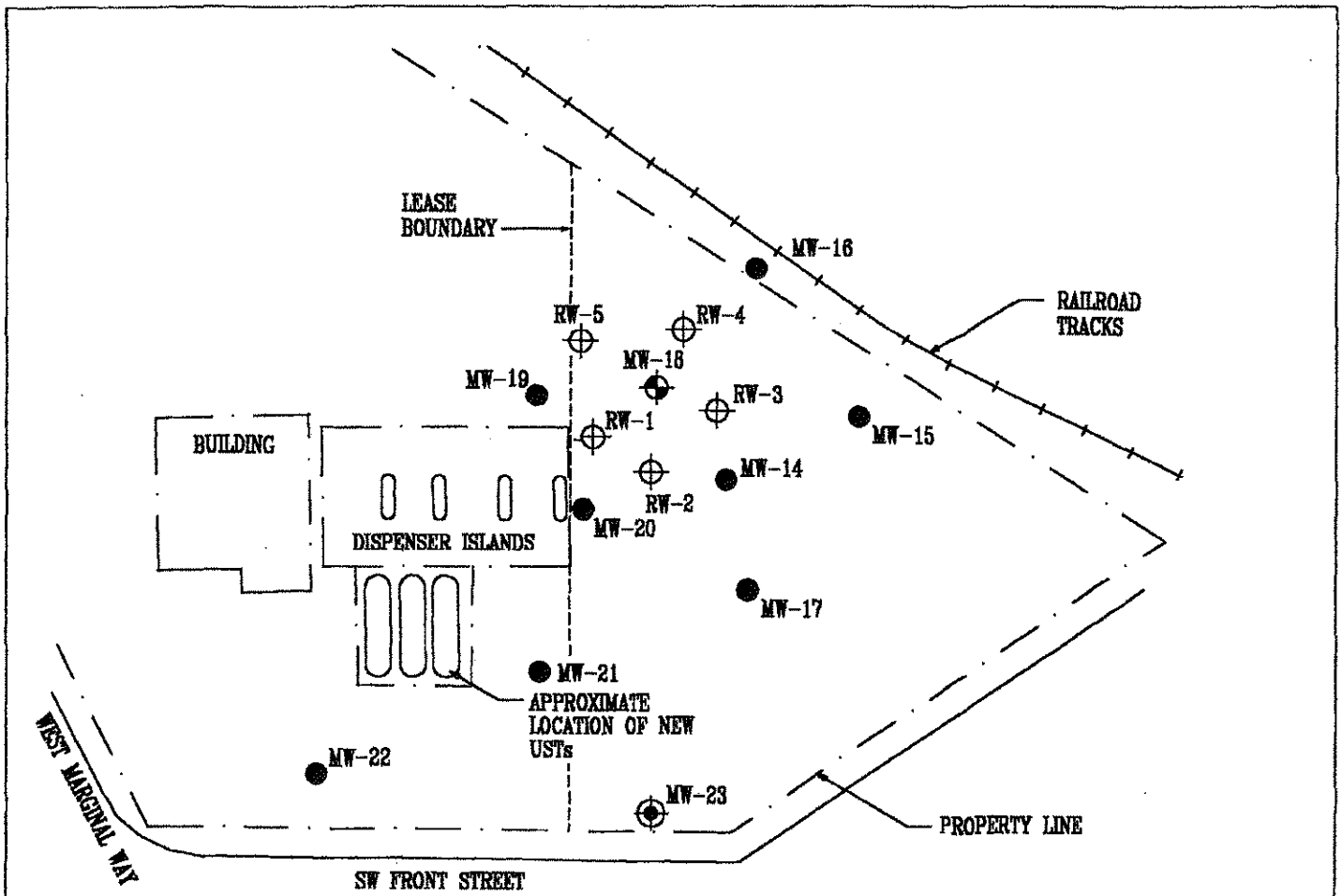
This report documents the results of pilot-scale vacuum extraction testing, the installation of new groundwater monitoring and extraction wells, and the repair of existing wellheads by GeoScience Management, Inc. (GSM). The work was performed at the Port of Seattle's (Port) Terminal 115 site located at 6730 West Marginal Way, Seattle, Washington. The work was performed in general accordance with our proposal to you dated April 10, 1997, under Professional Services Agreement Number P-950137 and subsequent amendments.

Project Background

The project site is located at the northeast corner of West Marginal Way SW, and SW Front Street in Seattle Washington, and is part of the Port of Seattle's (Port) Terminal 115 property (Figure 1). The site was purchased by the Port in the early 1990's and contained one empty warehouse structure with attached office space and shed. According to information supplied by the Port of Seattle, the original structure was apparently built by Materials Reclamation Company, Inc. (d.b.a. Maralco Aluminum) about 1952. A later addition was built on the north side of the structure in approximately the early 1970's. Architectural drawings obtained by the Port indicate that an 8,000-gallon fuel oil underground storage tank was installed immediately adjacent to the original building on the east side.

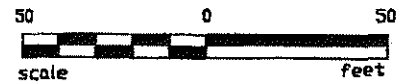
In November 1994, AGRA Earth and Environmental Technologies, Inc. (AGRA) conducted a geotechnical evaluation of the site for a prospective tenant who planned to install a card-lock fueling facility on the property. Approximately two feet (apparent thickness) of free petroleum product was discovered floating on the groundwater surface in a monitoring well completed by AGRA. Subsequent work at the site by GSM has identified a free product plume consisting of weathered diesel fuel in the vicinity of existing monitoring well MW-18 (Figure 2). The product release is suspected to have come from the former 8,000-gallon UST, which was removed by the Port in 1996. However, no detectable free product has been observed the area where the former UST was located (near existing monitoring well MW-17).

The purpose of the work described below was to complete definition of the aerial extent of the free product plume, to evaluate whether effective recovery of free product from the subsurface could be accomplished using high-vacuum extraction, and to determine whether additions of hydrogen peroxide subsurface could be used to enhance natural biodegradation of petroleum hydrocarbons in-situ.



LEGEND


- RW-1 ⊕ New 4-inch Diameter Monitoring/Extraction Well Location
- MW-23 ⊕ New 2-inch Diameter Monitoring Well Location
- MW-16 ● Existing 2-inch Diameter Monitoring Well Location
- MW-18 ⊕ Existing 4-inch Diameter Monitoring Well Location



GeoScience Management, Inc.
Environmental Consulting Services
 18808 89th Avenue NE
 Bothell, Washington 98011

DESIGNED BY: HWS
 DRAWN BY: JB/HWS
 DATE: April 1998
 JOB No.: 1002.01

FIGURE 2
 PORT OF SEATTLE - TERMINAL 115
 6730 WEST MARGINAL WAY, SEATTLE, WA
 NEW AND EXISTING WELL LOCATIONS


 GeoScience Management, Inc. 18608 89th Avenue NE Bothell, WA 98011	Project Name: <u>Port of Seattle, Terminal 115</u>	Boring No: <u>MW-23</u>
	Location: <u>6730 West Marginal Way, Seattle, WA</u>	Date Began: <u>5/10/97</u>
	Geologist/Engineer: <u>Howard W. Small</u>	Date Completed: <u>5/10/97</u>
	Drilling Contractor: <u>Cascade Drilling, Inc.</u>	Total Depth: <u>14.0 feet bgs</u>
	Drilling Method: <u>Mod. B-50, 6-inch inside dia. HSA</u>	Sheet: <u>1 of 1</u>

Construction Details		Sampling Data				Lithologic Description		
Other: PID		Sampling Method	Sample Number	Blows per 6 inches	Depth Sampled		Depth In Feet	Graphic Log and Soil Group Symbol (USCS)
	Ground Surface							(USCS Designation, density, moisture, color, soil type and comments)
	Flush-mount steel well monument							Approximately 6 inches of crushed rock and gravel over:
	Hydrated bentonite chips							0.5 to 15.0 feet: SILT (ML) - Medium stiff, moist, gray to dark gray, clayey SILT, with scattered organic matter, roots.
<1		SB S-1	1			5	ML	
			2					
			5					
	Monterey #8-12 sand pack		(7)					
	2-inch dia. flush-threaded SCH 40 PVC 0.020-slot screen	SB S-2	2			10		
<1			4					
			6					
			(10)					
<1		SB S-3	3			15		
	Threaded bottom cap		5					
			5					

Bottom of Boring at 15.0 feet. Installed 2-inch diameter groundwater monitoring well.

REMARKS:

Descriptive Modifiers: Trace - < 5%; Slightly - 5 to 12 %; Silty, Gravely, etc. - 12 to 30 %; Very - 30 to 50 %.
 SB means 2-inch I.D. split-barrel sampler driven using 140-lb. free-falling hammer. Blow counts DO NOT represent SPT values.

 GeoScience Management, Inc. 18608 89th Avenue NE Bothell, WA 98011	Project Name: <u>Port of Seattle, Terminal 115</u>	Boring No: <u>RW-3</u>
	Location: <u>6730 West Marginal Way, Seattle, WA</u>	Date Began: <u>5/10/97</u>
	Geologist/Engineer: <u>Howard W. Small</u>	Date Completed: <u>5/10/97</u>
	Drilling Contractor: <u>Cascade Drilling, Inc.</u>	Total Depth: <u>14.0 feet bgs</u>
	Drilling Method: <u>Mod. B-50, 6-inch inside dia. HSA</u>	Sheet: <u>1 of 1</u>

Construction Details		Sampling Data				Lithologic Description		
Other: PID		Sampling Method	Sample Number	Blows per 6 inches	Depth Sampled		Depth in Feet	Graphic Log and Soil Group Symbol (USCS)
	Ground Surface							(USCS Designation, density, moisture, color, soil type and comments)
	Flush-mount steel well monument							Approximately 6 inches of concrete over:
	Hydrated bentonite chips							0.5 to 5.0 feet: SANDY SILT (ML) - (Medium stiff), moist, gray to dark gray, black, sandy silt, with scattered organic matter and debris, including wire, wood and metal scraps. (FILL).
<1		SB	S-1	2		5		
				2				
				2				
				4				
	Monterey #8-12 sand pack							5.0 to 15.0 feet: SILT (ML) - Medium stiff, moist, gray to dark gray, clayey SILT, with scattered organic matter, roots.
	4-inch dia. flush-threaded SCH 40 PVC							
<1		SB	S-2	2		10		
	0.020-slot screen			4				
				5				
				9				
	Threaded bottom cap							
<1		SB	S-3	3		15		
				3				
				6				

(9)

Bottom of boring at 15.0 feet below ground surface. Installed 4-inch diameter monitoring/extraction well.

REMARKS:

Descriptive Modifiers: Trace - < 5%; Slightly - 5 to 12 %; Silty, Gravelly, etc. - 12 to 30 %; Very - 30 to 50 %.

SB means 2-inch I.D. split-barrel sampler driven using 140-lb. free-falling hammer. Blow counts DO NOT represent SPT values.

 GeoScience Management, Inc. 18608 89th Avenue NE Bothell, WA 98011	Project Name: <u>Port of Seattle, Terminal 115</u>	Boring No: <u>RW-4</u>
	Location: <u>6730 West Marginal Way, Seattle, WA</u>	Date Began: <u>5/10/97</u>
	Geologist/Engineer: <u>Howard W. Small</u>	Date Completed: <u>5/10/97</u>
	Drilling Contractor: <u>Cascade Drilling, Inc.</u>	Total Depth: <u>14.0 feet bgs</u>
	Drilling Method: <u>Mod. B-50, 6-inch inside dia. HSA</u>	Sheet: <u>1 of 1</u>

Construction Details		Sampling Data				Lithologic Description		
Other: PID		Sampling Method	Sample Number	Blows per 6 inches	Depth Sampled		Depth In Feet	Graphic Log and Soil Group Symbol (USCS)
	Ground Surface							(USCS Designation, density, moisture, color, soil type and comments)
	Flush-mount steel well monument							Approximately 6 inches of concrete over:
	Hydrated bentonite chips							0.5 to 6.0 feet: SANDY SILT (ML) - (Medium stiff), moist, gray to dark gray, black, sandy silt, with scattered organic matter and debris, including wire, wood and metal scraps. (FILL).
<1		SB S-1	1			5		
			2					
			5					
			7					
	Monterey #8-12 sand pack							6.0 to 15.0 feet: SILT (ML) - Medium stiff, moist, gray to dark gray, clayey SILT, with scattered organic matter, roots.
	4-inch dia. flush-threaded SCH 40 PVC	SB S-2	2			10		Petroleum-like odor.
30			2					
			6					
			8					
<1								
<1		SB S-3	5			15		
	Threaded bottom cap		5					
			4					


(9)

Bottom of boring at 15.0 feet below ground surface. Installed 4-inch diameter monitoring/extraction well.

REMARKS:

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 GeoScience Management, Inc. 18608 89th Avenue NE Bothell, WA 98011	Project Name: <u>Port of Seattle, Terminal 115</u>	Boring No: <u>RW-5</u>
	Location: <u>6730 West Marginal Way, Seattle, WA</u>	Date Began: <u>5/10/97</u>
	Geologist/Engineer: <u>Howard W. Small</u>	Date Completed: <u>5/10/97</u>
	Drilling Contractor: <u>Cascade Drilling, Inc.</u>	Total Depth: <u>14.0 feet bgs</u>
	Drilling Method: <u>Mod. B-50, 6-inch inside dia. HSA</u>	Sheet: <u>1 of 1</u>

Construction Details		Sampling Data				Lithologic Description		
Other: PID		Sampling Method	Sample Number	Blows per 6 inches	Depth Sampled		Depth in Feet	Graphic Log and Soil Group Symbol (USCS)
	Ground Surface							(USCS Designation, density, moisture, color, soil type and comments)
	Flush-mount steel well monument							Approximately 6 inches concrete over:
	Hydrated bentonite chips							0.5 to 6.0 feet: SANDY SILT (ML) - (Medium stiff), moist, gray to dark gray, black, sandy silt, with scattered organic matter and debris, including wire, wood and metal scraps. (FILL).
△		SB S-1	1			5		
			2					
			5					
			7					
	Monterey #8-12 sand pack							6.0 to 15.0 feet: SILT (ML) - Medium stiff, moist, gray to dark gray, clayey SILT, with scattered organic matter, roots.
	2-inch dia. flush-threaded SCH 40 PVC	SB S-2	2			10		Petroleum-like odor.
10	0.020-slot screen		4					
			6					
			10					
<1	Threaded bottom cap	SB S-3	6			15		
			3					
			4					

(7)

Bottom of boring at 15.0 feet below ground surface. Installed 4-inch diameter monitoring/extraction well.

REMARKS:

Descriptive Modifiers: Trace - < 5%; Slightly - 5 to 12 %; Silty, Gravely, etc. - 12 to 30 %; Very - 30 to 50 %.

SB means 2-inch I.D. split-barrel sampler driven using 140-lb. free-falling hammer. Blow counts DO NOT represent SPT values.