

Geophex, Ltd

605 Mercury Street
Raleigh, North Carolina 27603
(919) 839-8515

January 13, 1992

Mr. W.L. Moore, III
State Engineering Geologist
N.C. Dept. of Transportation
P.O. Box 25201
Raleigh, NC 27611-5201

Subject: Final Report for Preliminary Site Assessments of Two UST Sites Located in Lake
Junaluska, Haywood County, North Carolina. Geophex Job No. 255B.

Ref: NC DOT Project: 6.941013 Tip R-2117

Dear Mr. Moore:

Enclosed are results of the preliminary site assessment (PSA) of the two subject sites. If you have questions or comments concerning these results, please feel free to contact us.

Sincerely,

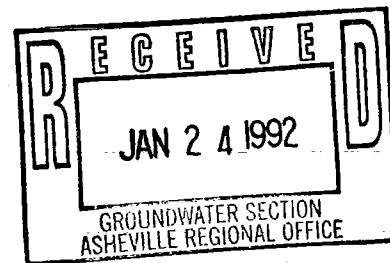

George R.A. Fields, P.G.
Project Manager



I.J. Won, Ph.D., P.G.
Technical Director

Enclosures
GRAF/ah

**Preliminary Site Assessment of the
Howard Liner Property/UST Site, Lake Junaluska,
Haywood County, North Carolina**



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1. Introduction

This report summarizes activities conducted during a preliminary site assessment (PSA) of the Howard Liner property. The UST site is located on the northwest side of NC 209, at its intersection with SR 1375, Lake Junaluska, North Carolina (Figure 1). The investigation has been conducted as part of a proposed road improvement of NC 209 in Lake Junaluska. The purpose of the investigation is to locate USTs on the site and to determine whether any petroleum hydrocarbon contamination is associated with the UST systems.

2. Site Inspection and Geophysical Survey

Following a visual site inspection, geophysical surveys were conducted to locate USTs. Surveys consisted of: 1) total field magnetic survey, and 2) a ground-penetrating radar survey. Field survey instruments used included:

Total Field Magnetometer: Model 846, Manufactured by EG&G Geometrics, with a 1 gamma accuracy.

Ground-Penetrating Radar (GPR): SIR System-3, manufactured by GSSI, Inc.; Model PR-8304 Profiling Recorder; Model 3102 transducer with a center frequency of 500 MHz and a 2 ns pulse width; CC-30/11 Control Cable with a 30 m length; and Model 10 Remote Marker.

A magnetometer responds mainly to ferromagnetic objects, such as steel containers and drums buried in the earth. It is a simple and unambiguous method for detecting ferromagnetic targets. For total-field magnetic data, the spatial variations of the field (rather than their absolute values or signs) are indicative of buried targets. The main guideline on interpreting the magnetic data is isolating magnetic highs or lows (with sufficient magnitude) whose lateral extent is comparable to, or slightly larger than, the size of the suspected tank. It should be noted that large, often erratic, magnetic anomalies associated with buildings and other man-made structures often override the anomalies caused by subsurface objects.

GPR anomalies result when there is a contrast in bulk dielectric property between the buried materials and the host geologic formation. Metals having high electrical conductivities also produce strong radar reflections; however high water content of soils may limit GPR capabilities. For GPR, certain targets (tanks or drums) exhibit identifiable reflection signatures.

Contoured magnetic data for the site are shown on Figure 2. Based on these magnetic data, interviews with the site owner, and subsequent GPR surveys, we conclude that five USTs are at the site. Two additional fuel tanks are located in the building basement. Mr. Howard Liner

revealed that the seven tanks were installed by his father in the late 1930s to early 1940s, and have not been used since the mid 1970s. Table 1 lists information gathered on the tanks.

Table 1. Inventory of five USTs and two fuel tanks inside building basement located at the Howard Liner property/UST site. UST locations (T1 through T5) are shown in Figure 2.

UST Number	Product Type	Approximate Size			Construction Material	Estimated Contents (gallons)
		Length (feet)	Diameter (inches)	Volume (gallons)		
T1	Gasoline	24	64	4,000	Steel	Empty
T2	Gasoline	18	64	3,000	Steel	15*
T3	Gasoline	14	64	3,000	Steel	Empty
T4	Gasoline	12	64	2,000	Steel	Empty
T5	Gasoline	24	64	4,000	Steel	Empty
T6	Heating Oil	Estimated 275 gallons. Tank is inside basement.				
T7	Heating Oil/Kerosene	Estimated 275 gallons. Tank is inside basement				

* The present contents of the UST is probably a mixture of fuel, water, and sludge.

Visual inspection of the site identified a vehicle "grease pit" located northwest of the building that has been filled with soil.

3. Soils Investigation

Seven borings (see Figure 2; labeled B1 through B7) were advanced, surrounding the USTs to determine if there is any petroleum contamination of soils. Lithologic descriptions of the borings are included in Table 2. Five borings (B1 through B4, and B7) were advanced to depths of approximately 9-10 feet and contained reddish-brown to dark-gray clayey silt/silty clay. Two borings (B5 and B6) hit auger refusal at shallow depths (3 to 5 feet).

Soil samples were collected at 3-foot intervals and field-screened for organic vapor content by means of a head-space technique modified from a method described by Robbins and others (A field screening method for gasoline contamination using a polyethylene bag sampling system; Ground Water Monitoring Review, v. 9, no. 4, pp. 87-97; 1989.) The method involves placing a measured amount of a representative soil sample in a valved zip-lock plastic bag, then inflating the bag with air. After a 5-minute waiting period, at a constant temperature, to allow organic compounds to vaporize into the bag, a photoionization detector (PID) is used to detect the organic vapor level in the bag.

The results of the soil-gas survey are presented in Table 2. All of the borings analyzed with the PID revealed soils having hydrocarbon levels generally below 100 ppm. PID senses a wide range of hydrocarbon gases including methane and other naturally occurring gases. Elevated PID levels

may also indicate the presence of non-fuel related hydrocarbons.

Three soil samples were submitted to a laboratory (IEA, Inc. in Cary, NC) for total petroleum hydrocarbon (TPH) analysis under EPA Methods 5030 (gasoline fraction) and/or 3550 (diesel fraction). Results of the laboratory analysis are shown in Table 2. Original laboratory data and the Chain-of-Custody Record are included in Appendix A.

Table 2. Soil boring descriptions, PID data, and laboratory results collected from the Howard Liner property.

Boring	Depth Interval (feet)	Soil Description	Sample Interval (feet)	Petroleum Odor	PID (ppm)	TPH 3550 (mg/kg)	TPH 5030 (mg/kg)
B-1	0.0 - 0.5	ASPHALT and GRAVEL	3	L-M	52	-	-
	0.5 - 8.5	Red-Brown Clayey SILT w/some mica	6	L-M	56	-	-
	8.5 - 9.5	Dark Gray Clayey SILT w/some mica	9	L	39	-	<2.0
	9.5 - 10.0	Dark Gray-Black Silty CLAY Auger Refusal @ 10.0 ft					
B-2	0.0 - 0.5	ASPHALT and GRAVEL	3	L-M	49	-	-
	0.5 - 6.5	Red-Brown Clayey SILT w/some mica	6	L-M	44	-	-
	6.5 - 9.5	Dark Gray Clayey SILT w/wood fibers Boring Terminated @ 9.5 ft	9	L	39	-	<2.0
B-3	0.0 - 0.5	ASPHALT and GRAVEL					
	0.5 - 4.0	Red-Brown Clayey SILT w/some mica	3	L-M	35	-	-
	4.0 - 7.5	Dark Gray Clayey SILT w/brick	6	L-M	34	-	-
	7.5 - 9.0	Lt Tan-Brown Silty CLAY Boring Terminated @ 9.0 ft	9	L	29	<2.0	<2.0
B-4	0.0 - 0.5	ASPHALT and GRAVEL	3	L-M	31	-	-
	0.5 - 5.5	Red-Brown Clayey SILT	6	L-M	36	-	-
	5.5 - 9.0	Dark Gray Clayey SILT w/pebbles Boring Terminated @ 9.0	9	L	31	-	-
B-5	0.0 - 0.5	ASPHALT and GRAVEL					
	0.5 - 2.0	Red-Brown Clayey SAND					
	2.0 - 3.5	Red-Brown to Gray Clayey SILT	3	L-M	35	-	-
	3.5 - 5.0	Dark Brown decomposed WOOD Auger Refusal @ 5.0 ft					
B-6	0.0 - 0.5	ASPHALT and GRAVEL					
	0.5 - 3.0	Brown Clayey SILT Auger Refusal @ 3.0 ft	3	L	26	-	-
B-7	0.0 - 0.5	CONCRETE and ROAD PACK					
	0.5 - 2.5	Brown Clayey SILT					
	2.5 - 5.5	Dark Gray Clayey SILT	3	M	29	-	-
	5.5 - 6.5	Brown Clayey SILT w/wood fragments	6	M	28	-	-
	6.5 - 9.0	Greenish-Gray to Gray Clayey SILT Boring Terminated @ 9.0 ft	9	M	20	-	-

Petroleum Odor: N = None, L = Low, M = Moderate, H = High
Symbol '-' denotes that no analysis is done for the sample.

4. Discussion

The North Carolina Department of Environmental Management (DEM) document entitled "Guidelines for Remediation of Soil Contaminated by Petroleum" specify an action level of 10 parts per million (ppm) for TPH content using laboratory methods. Laboratory analyses of soil samples collected during this investigation indicates no petroleum contamination above this level. We note that the PID data (all below 100 ppm) show consistently higher levels of vapor contamination than the laboratory TPH data; the cause has not been ascertained. The DEM guideline is, however, based solely on TPH data.

5. Conclusions and Recommendations

Petroleum contamination of the soil, determined by laboratory TPH analyses, within the vicinity of the five UST systems does not exceed the DEM's specified action levels. We, therefore, do not recommend any further action. The owner of the USTs do, however, need to take an appropriate closure action for all unused USTs.

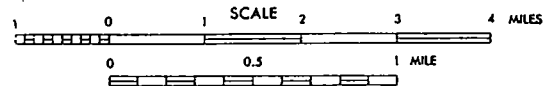
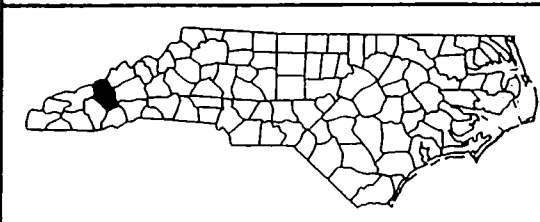
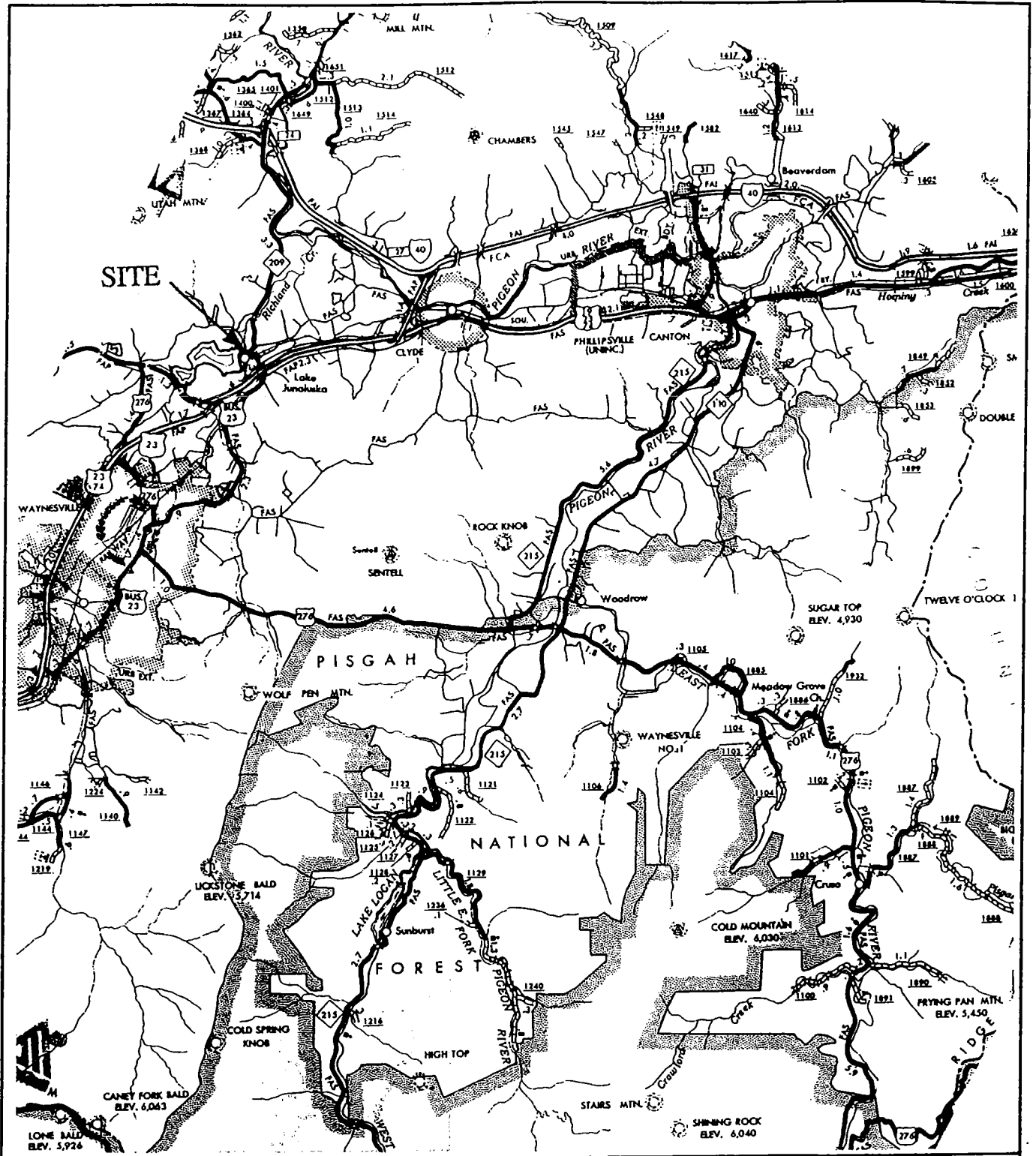
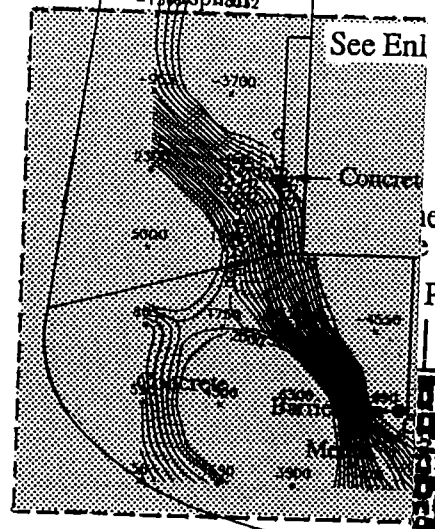


Figure 1. Location of the Howard Liner Property/UST site on the NC DOT Haywood County Map.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100



SR 1376 County Road



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Backg.
Cont

See Enl

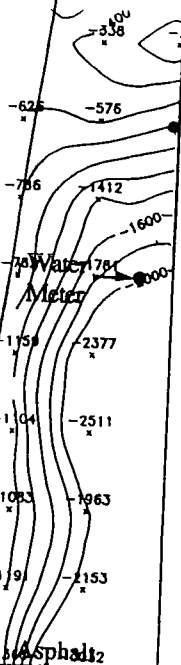
Concrete

Line D
(feet)

Pipe 20

Fill Pipe

30



Soil-fill
Grease
Concr

Garage/Building

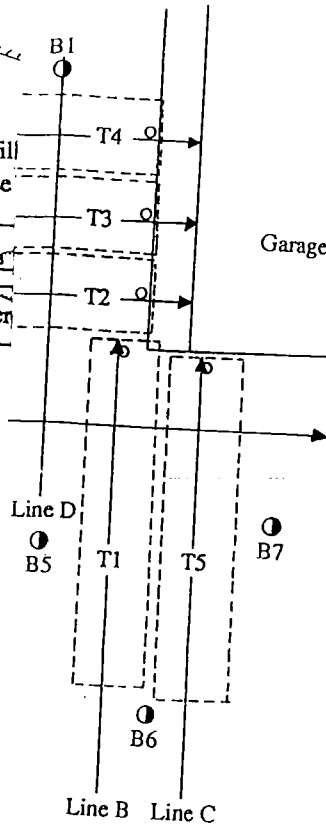
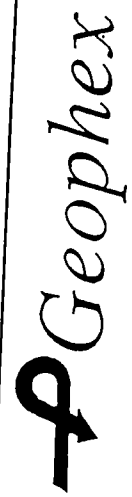


Figure 2. Site details of the Howard Liner Property/UST site showing magnetic data, magnetic contours, representative GPR line, and enlarged map of US T locations.



Appendix A.

Laboratory Analytical Results and Chain-of-Custody Records

Total petroleum hydrocarbon (TPH) using SW-846 Methods 3550 and/or 5030.

<u>Description</u>	<u>Page</u>
QC Blank for Methods 3550 and 5030	A-1
QC Blank for Method 5030	A-2
Site 1 B-1 9'	A-3
Site 1 B-2 9'	A-4
Site 1 B-3 9'	A-5
Site 2 B-2 9'	A-6
Site 2 B-2 15'	A-7
Site 2 B-4 15'	A-8
Site 2 B-6 9-12'	A-9
Site 2 B-8 12'	A-10
Chain-of-Custody Record	A-11



Total Petroleum Hydrocarbon Analysis

IEA Sample No:	646-048	Date Sampled:	N/A
Client Sample No:	QC Blank	Date Received:	N/A
Client Project No:	255B	Date Extracted:	11-20-91

Extraction (SW 846 - 3550) / GC-FID analysis (for #2 fuel oil, kerosene, varsol)
 Date Analyzed: 11-21-91 Analyzed by: Correa

The sample does not contain a petroleum hydrocarbon blend in the distillation range referenced above. The quantitation limit is 2.0 mg/kg.

Comment:
 N/A = Not Applicable
 Corresponding Samples: 646-048-3
 646-048-7
 646-048-8

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Purge and Trap (SW 846 - 5030) / GC-FID analysis (for gasoline only)
 Date Analyzed: 11-23-91 Analyzed by: Joaquin

The sample does not contain a petroleum hydrocarbon blend with a distillation range similar to gasoline. The quantitation limit is 2.0 mg/kg.

Comment:
 N/A = Not Applicable
 Corresponding Samples: 646-048-1 646-048-3 646-048-7
 646-048-2 646-048-4



Total Petroleum Hydrocarbon Analysis

IEA Sample No: 646-048 Date Sampled: N/A
Client Sample No: QC Blank Date Received: N/A
Client Project No: 255B

Purge and Trap (SW 846 - 5030) / GC-FID analysis (for gasoline only)
Date Analyzed: 11-24-91 Analyzed by: Joaquin

The sample does not contain a petroleum hydrocarbon blend with a distillation range similar to gasoline. The quantitation limit is 2.0 mg/kg.

Comment:
N/A = Not Applicable
Corresponding Samples: 646-048-5
646-048-6
646-048-8



Total Petroleum Hydrocarbon Analysis

IEA Sample No: 646-048-1 Date Sampled: 11-15-91
Client Sample No: 255B Site 1 B-1 9' Date Received: 11-18-91
Client Project No: 255B

Purge and Trap (SW 846 - 5030) / GC-FID analysis (for gasoline only)
Date Analyzed: 11-23-91 Analyzed by: Joaquin

The sample does not contain a petroleum hydrocarbon blend with a distillation range similar to gasoline. The quantitation limit is 2.0 mg/kg.

Comment:



Total Petroleum Hydrocarbon Analysis

IEA Sample No: 646-048-2 Date Sampled: 11-15-91
Client Sample No: 255B Site 1 B-2 9' Date Received: 11-18-91
Client Project No: 255B

Purge and Trap (SW 846 - 5030) / GC-FID analysis (for gasoline only)
Date Analyzed: 11-23-91 Analyzed by: Joaquin

The sample does not contain a petroleum hydrocarbon blend with a distillation range similar to gasoline. The quantitation limit is 2.0 mg/kg.

Comment:



Total Petroleum Hydrocarbon Analysis

IEA Sample No: 646-048-3 Date Sampled: 11-15-91
Client Sample No: 255B Site 1 B-3 9' Date Received: 11-18-91
Client Project No: 255B Date Extracted: 11-20-91

Extraction (SW 846 - 3550) / GC-FID analysis (for #2 fuel oil, kerosene, varsol)
Date Analyzed: 11-22-91 Analyzed by: Correa

The sample does not contain a petroleum hydrocarbon blend in the distillation range referenced above. The quantitation limit is 2.0 mg/kg.

Comment:

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Purge and Trap (SW 846 - 5030) / GC-FID analysis (for gasoline only)
Date Analyzed: 11-23-91 Analyzed by: Joaquin

The sample does not contain a petroleum hydrocarbon blend with a distillation range similar to gasoline. The quantitation limit is 2.0 mg/kg.

Comment:



Total Petroleum Hydrocarbon Analysis

IEA Sample No: 646-048-4 Date Sampled: 11-13-91
Client Sample No: 255B Site 2 B-2 9' Date Received: 11-18-91
Client Project No: 255B

Purge and Trap (SW 846 - 5030) / GC-FID analysis (for gasoline only)
Date Analyzed: 11-23-91 Analyzed by: Joaquin

The sample does not contain a petroleum hydrocarbon blend with a distillation range similar to gasoline. The quantitation limit is 2.0 mg/kg.

Comment:



Total Petroleum Hydrocarbon Analysis

IEA Sample No: 646-048-5 Date Sampled: 11-13-91
Client Sample No: 255B Site 2 B-2 15' Date Received: 11-18-91
Client Project No: 255B

Purge and Trap (SW 846 - 5030) / GC-FID analysis (for gasoline only)
Date Analyzed: 11-24-91 Analyzed by: Joaquin

The sample contains a petroleum hydrocarbon blend with a distillation range similar to gasoline. Total concentration is 200 mg/kg. The quantitation limit is 10 mg/kg.

Comment:

Quantitation limit elevated due to sample dilution prior to analysis. Sample diluted due to the presence of target compounds.



Total Petroleum Hydrocarbon Analysis

IEA Sample No: 646-048-6 Date Sampled: 11-14-91
Client Sample No: 255B Site 2 B-4 15' Date Received: 11-18-91
Client Project No: 255B

Purge and Trap (SW 846 - 5030) / GC-FID analysis (for gasoline only)
Date Analyzed: 11-24-91 Analyzed by: Joaquin

The sample contains a petroleum hydrocarbon blend with a distillation range similar to gasoline. Total concentration is 100 mg/kg. The quantitation limit is 5 mg/kg.

Comment:

Quantitation limit elevated due to sample dilution prior to analysis. Sample diluted due to the presence of target compounds.



Total Petroleum Hydrocarbon Analysis

IEA Sample No:	646-048-7	Date Sampled:	11-14-91
Client Sample No:	255B Site 2 B-6 9-12'	Date Received:	11-18-91
Client Project No:	255B	Date Extracted:	11-20-91

Extraction (SW 846 - 3550) / GC-FID analysis (for #2 fuel oil, kerosene, varsol)
Date Analyzed: 11-22-91 Analyzed by: Correa

The sample does not contain a petroleum hydrocarbon blend in the distillation range referenced above. The quantitation limit is 2.0 mg/kg.

Comment:

=====
Purge and Trap (SW 846 - 5030) / GC-FID analysis (for gasoline only)
Date Analyzed: 11-23-91 Analyzed by: Joaquin

The sample contains a petroleum hydrocarbon blend with a distillation range similar to gasoline. Total concentration is 57 mg/kg. The quantitation limit is 2.0 mg/kg.

Comment:



Total Petroleum Hydrocarbon Analysis

IEA Sample No: 646-048-8 Date Sampled: 11-15-91
Client Sample No: 255B Site 2 B-8 12' Date Received: 11-18-91
Client Project No: 255B Date Extracted: 11-20-91

Extraction (SW 846 - 3550) / GC-FID analysis (for #2 fuel oil, kerosene, varsol)
Date Analyzed: 11-22-91 Analyzed by: Correa

The sample does not contain a petroleum hydrocarbon blend in the distillation range referenced above. The quantitation limit is 2.0 mg/kg.

Comment:

=====
Purge and Trap (SW 846 - 5030) / GC-FID analysis (for gasoline only)
Date Analyzed: 11-24-91 Analyzed by: Joaquin

The sample does not contain a petroleum hydrocarbon blend with a distillation range similar to gasoline. The quantitation limit is 2.0 mg/kg.

Comment:

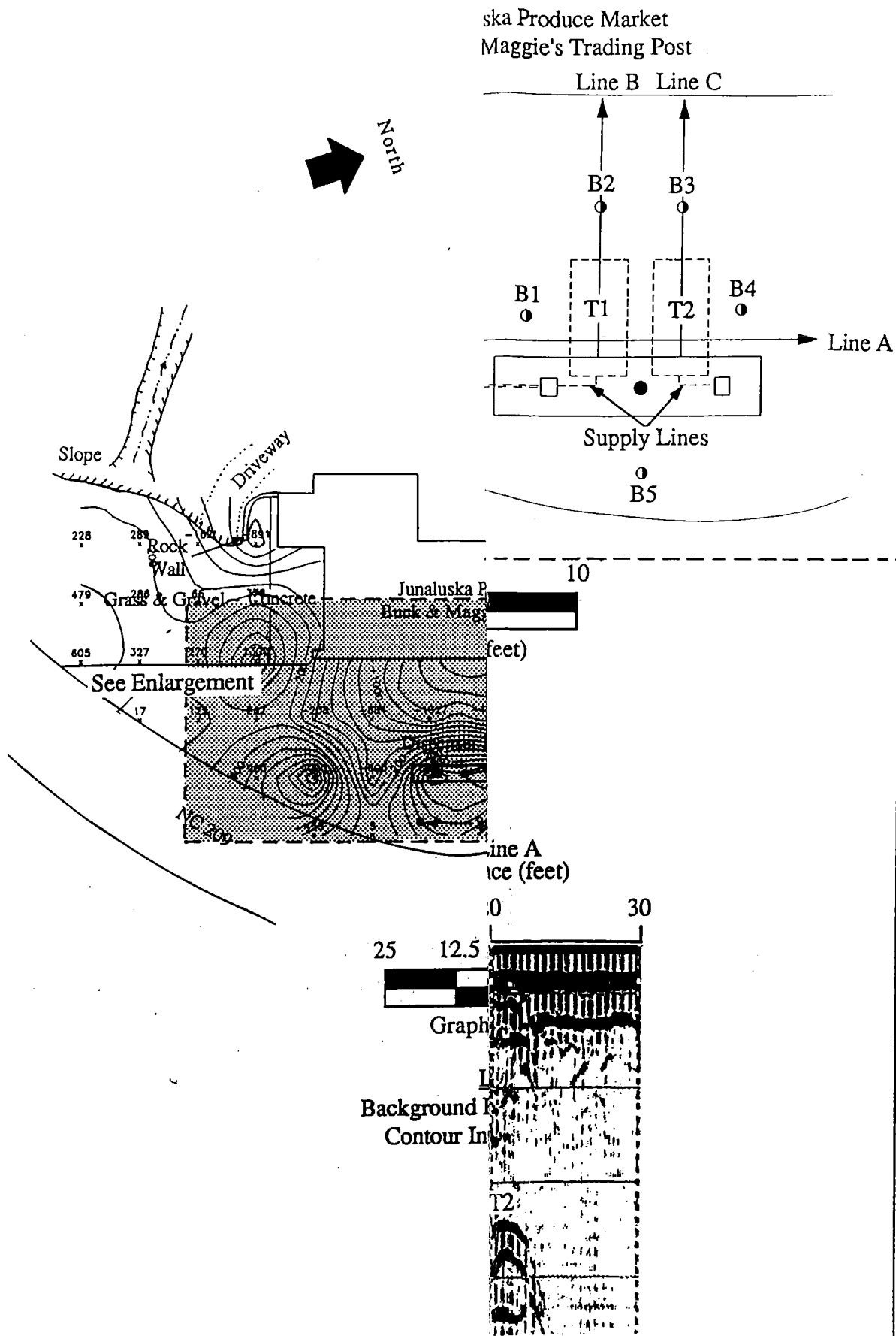


Figure 2. Site details of the Roy Goodwin Property/UST site showing magnetic data, magnetic contours, representative GPR line, and enlarged map of UST locations.