



LINCOLN

APPLIED GEOLOGY, INC.  
ENVIRONMENTAL CONSULTANTS

Mr. Charles B. Schwer  
Petroleum Sites Coordinator  
Vermont Department of  
Environmental Conservation  
103 South Main Street  
Waterbury, Vermont 05676

June 3, 1994

HAZARDOUS MATERIALS  
MANAGEMENT DIVISION

JUN 6 11 08 AM '94

RE: Summary of Environmental Work Completed at the Achilles Property St.  
Johnsbury, Vermont (VDEC Site #931549)

Dear Mr. Schwer:

Lincoln Applied Geology, Inc. (LAG) recently completed the tasks recommended in our February 25, 1994 work plan and cost estimate that was subsequently approved in your March 18, 1994 work plan approval letter. The tasks that were completed include:

1. definition of the degree and extent of contamination to the soil and ground water,
2. perform an assessment of the site to determine the potential for sensitive receptors to be impacted by any contamination by the site, and
3. determine the need for a long term treatment and/or monitoring plan which addresses the contamination present at the site.

Results of the cumulative work, that has now been performed, indicate that while both the soil and ground water have been impacted by the contamination detected on the site, no other sensitive receptors were identified. The contaminated ground waters flow to the north and ultimately to the east towards the Passumpsic River which is under special management regulations as a Waste Management Zone. Contamination detected on-site is of minimal concentration to significantly impact the Passumpsic River. Additionally, there are other sites listed with the Sites Management Section (SMS) that are located between the Achilles property and the Passumpsic. The general location of the site within St. Johnsbury is depicted on **Figure 1**. **Figure 2** shows the location of this site in the general area of other known sources of contamination. As a result of these conditions and findings, LAG recommends that quarterly ground water quality sampling and monitoring be conducted to verify these current and low levels of contaminants. We recommend this sampling be performed in June and continue for one year. If

Mr. Charles B. Schwer  
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concentrations quantified in the ground water remain at these current levels and no free floating gasoline is detected, LAG will then be prepared to recommend site closure.

Four ground water monitor wells were installed by hollow stem auger techniques on April 7 and 8, 1994. The monitor wells were placed in locations to intercept any contamination migrating in the downgradient direction from the former underground storage tank (UST) area. Also, one well (MW-1) was located downgradient of an even older UST area to evaluate ground water quality in that area (**Figure 3**). Borings were made prior to monitor well installation utilizing hollow stem auger techniques with split spoon collection of soil samples. Detailed soil sample descriptions can be found on the attached Geologic Logs in **Appendix A**, along with the monitoring well construction details. Soil samples were screened for volatile organic compounds (VOC's) utilizing a photoionization detector (PID) equipped with a 10.2 eV lamp. PID assay results can be found on each attached geologic log. In general, PID levels from soil samples did not exceed 25 parts per million (ppm) in any of the samples. All of the more elevated assays were obtained from within the observed water table. Two-inch PVC ground water monitor wells were constructed and installed in each boring after sufficient depths of saturated sediments were encountered. Each well was then appropriately developed until the discharge water was clear and free of sediment.

In general, the split spoon soil samples showed the presence of very fine to very coarse tan to brown sands and silts to approximately 16 feet below the surface. At that depth, a very coarse to coarse light brown sand was encountered. Within the former UST excavation fine to medium brown sand, silts, and clays with alternating green and brown banding were noted throughout the drilling (MW-2) to 25 feet at that location. These soils are typical of the glaciofluvial deposits we have observed at other nearby spots within the Passumpsic River floodplain.

PID assay results of the soil samples obtained during drilling indicate that only low levels, less than 25 ppm, were detected. A sheen, however, was noted on several of the finer textured samples obtained from 0 - 7 feet within the former UST excavation. During drilling the water table was encountered in the northern part of the site (MW-1 and MW-2) at approximately 19 feet and was encountered at 14 feet at MW-3 and 7 feet at MW-4.

Water level data was used along with the survey information for each well to generate **Figure 3**, a Ground Water Contour Map. Ground water flow is to the north along a relatively steep gradient. While MW's 2, 3, and 4 are



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Environmental Consultants

RD # 1 Box 710 • Bristol, Vermont 05443 • (802) 453-4384 • FAX (802) 453-5399

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appropriately located to intercept any contamination migrating onto the site and from the former tank excavation, MW-1 is located in the topographically upgradient location.

The wells were appropriately sampled for BTEX and MTBE for analysis by accepted gas chromatographic techniques. The wells were purged using industry accepted methods and samples were collected and placed in 40 milliliter (ml) bottles. The collected samples were acidified, chilled, and brought to MicroAssays of Vermont in Montpelier, Vermont along with the proper chain-of-custody forms and a trip blank.

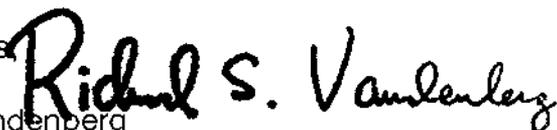
Water quality results indicate that MW-1 and MW-4 were the only monitor wells to show BTEX concentrations above Vermont Ground Water Enforcement Standards. MW-1 contained 13,280 parts per billion (ppb) BTEX and MW-4 contained 31,880 ppb BTEX. MW-3 contained 15 ppb BTEX, and MW-2 did not contain quantifiable concentrations of BTEX or MTBE. **Table 2** contains tabulated headspace PID data from each well and **Table 3** contains summarized ground water chemistry results. Copies of formal laboratory results can be found in **Appendix B**. **Figure 4** shows the spacial distribution of BTEX and MTBE constituents on the site.

Although concentrations of BTEX and MTBE are elevated, in two wells, the ultimate receptor of this contamination is the Passumpsic River and at least one additional SMS listed site is found between this property and the Passumpsic River. Based on these current results, LAG recommends that the site be monitored on a quarterly basis to verify these current levels and to verify if product accumulates in MW-4. Each quarterly monitoring and sampling will be summarized in a quarterly report.

A cost estimate for the continued work is attached as **Appendix C**. If you have any questions, comments, or concerns with regard to this matter please do not hesitate to call me or John Amadon, LAG Project Manager, at 453-4384.

Sincerely yours,

Richard S. Vandenberg  
Hydrogeologist



RSV/smd  
Enclosures  
cc: Ken Achilles



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Project: Achilles Property  
Location: St. Johnsbury, Vermont

**Ground Water Elevation/Product Level (feet)**

Data point	TOC	4-15-94						
MW-1	100.01	81.97						
MW-2	99.81	86.65						
MW-3	99.00	88.60						
MW-4	99.57	82.04						

Notes:  
1 - Elevation datum assumed  
2 - Reference elevation is elevation of top of PVC well casing  
Light Grey Cell = Dry  
Dark Grey Cell = Inaccessible

Project: Achilles Property  
Location: St. Johnsbury, Vermont

Table 2  
VDEC Site # 93-1549  
Sheet 1 of 1

**Photoionization Results (PID - ppm)**

Data Point	4-15-94						
MW-1	5.0						
MW-2	46						
MW-3	52						
MW-4	200						

Notes:  
BG - Background  
SL - Saturated Lamp

**Ground Water Quality Results (ppb)**

Data Point	4-15-94						
MW-1	13280	<100					
MW-2	<6	<1					
MW-3	15.0	<1					
MW-4	31880	<200					

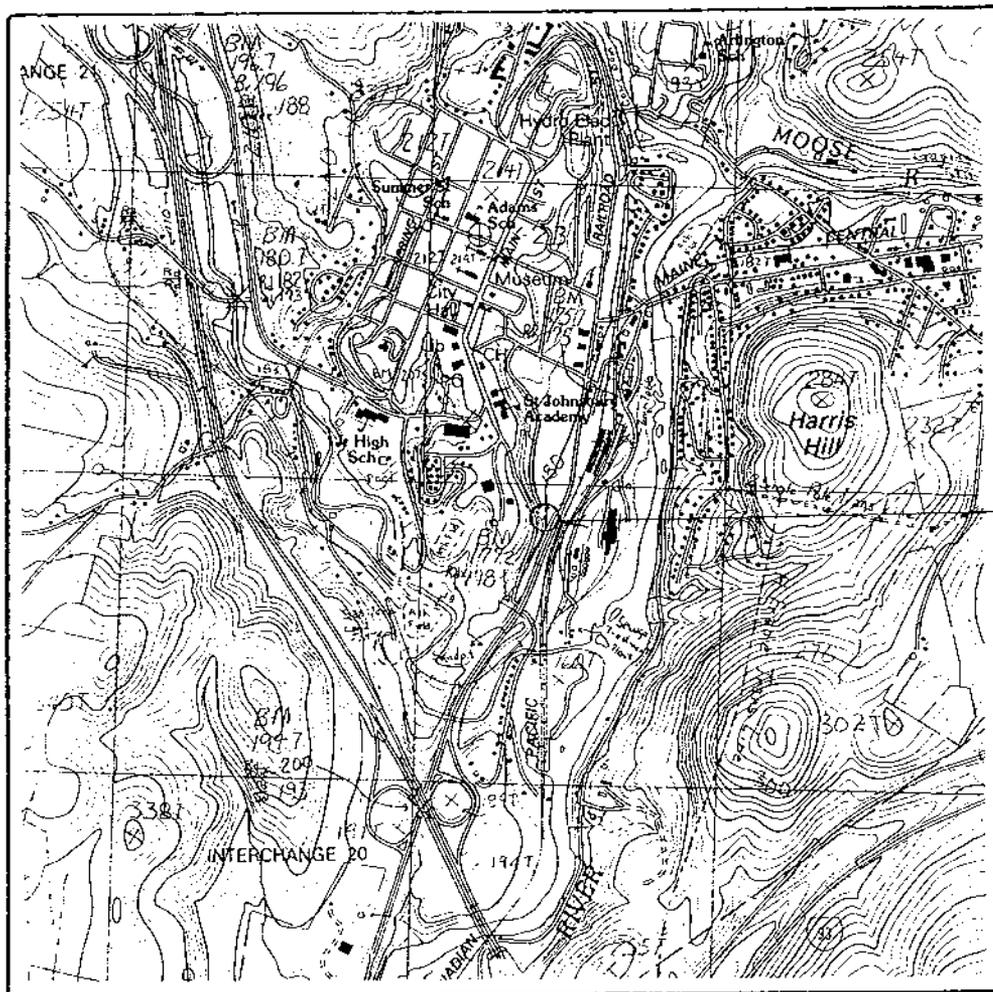
NOTES:

MTBE in upper right corner of cell

BTEX in lower left corner of cell

< - Contaminant not detected at specified detection limit

### Achilles Property GENERAL LOCATION MAP



Achilles Property

Source: U.S.G.S. 7.5 min.  
Topo Series  
St. Johnsbury, VT Quad.

Scale: 1" = 2000'

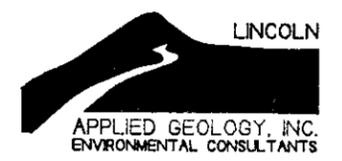
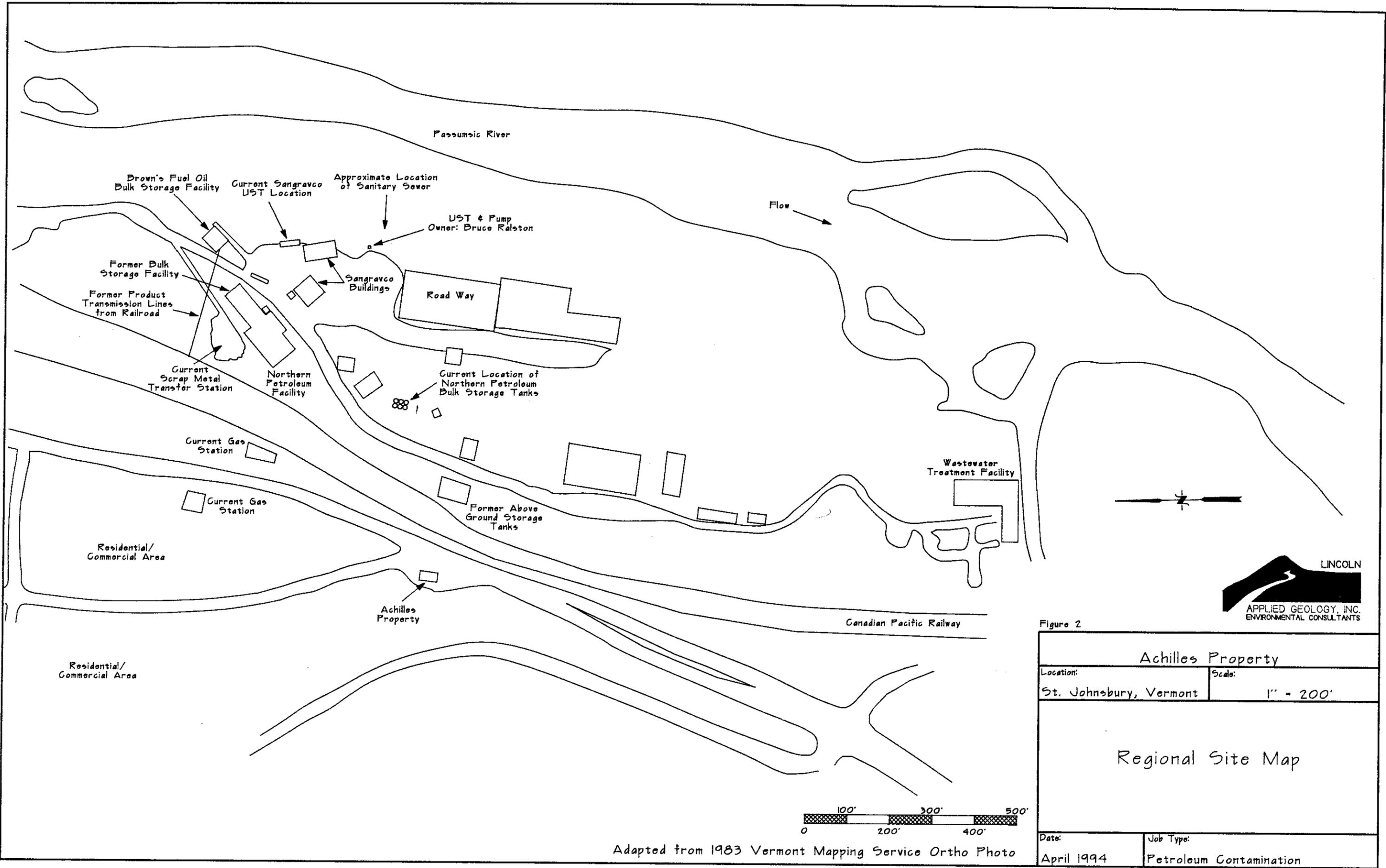
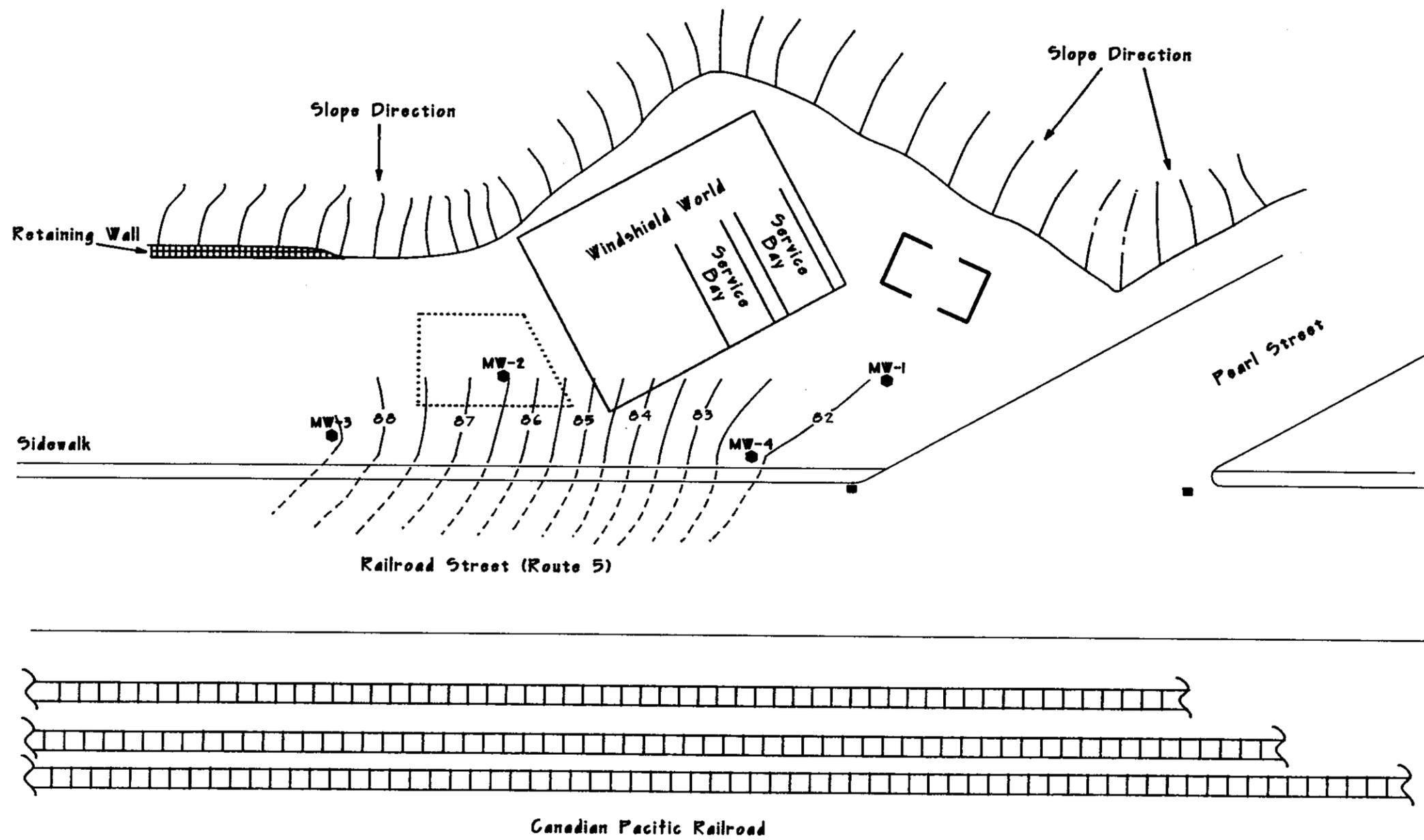


Figure 2

<b>Achilles Property</b>	
Location: St. Johnsbury, Vermont	Scale: 1" = 200'
<b>Regional Site Map</b>	
Date: April 1994	Job Type: Petroleum Contamination

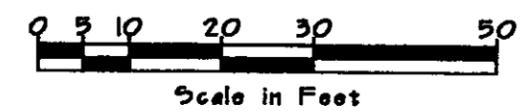
Adapted from 1983 Vermont Mapping Service Ortho Photo



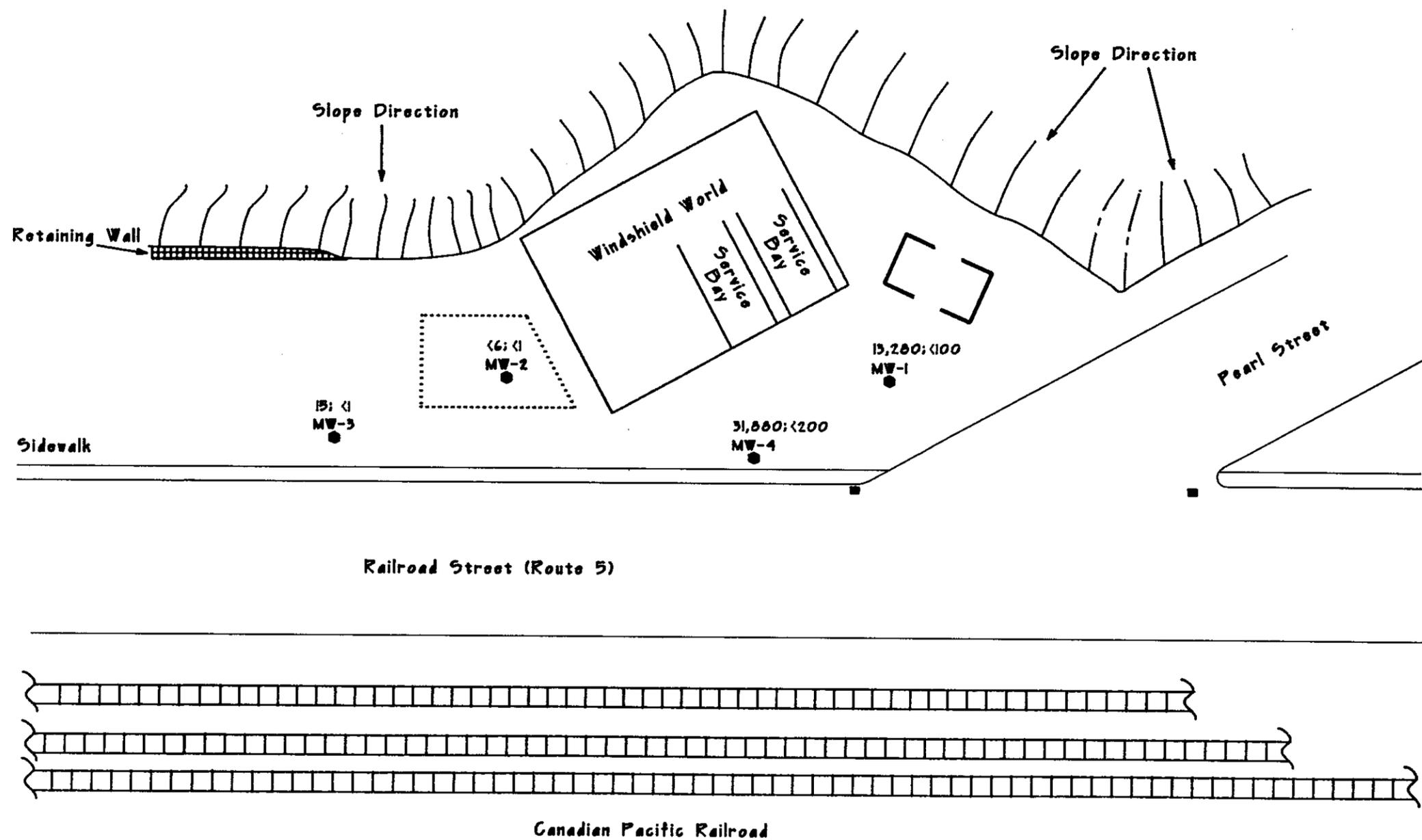
LEGEND	
	2" Monitoring Well
	Extent of former tank excavation
	Catch Basin
	Approximate location of UST's removed 15 years ago
	Contour Line



Figure 3



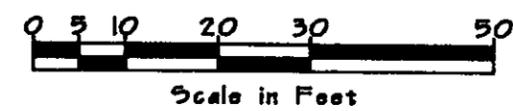
Achilles Property	
Location:	Scale:
St. Johnsbury, Vermont	1" = 20'
Ground Water Contour Map for April 15, 1994	
Date:	Job Type:
April 1994	Petroleum Contamination



LEGEND	
	2" Monitoring Well
	Extent of former tank excavation
	Catch Basin
	Approximate location of UST's removed 15 years ago
<6:1	BTEX/MTBE Contaminant Concentrations (ppb)



Figure 4



Achilles Property	
Location:	Scale:
St. Johnsbury, Vermont	1" = 20'
Water Quality Summary Map for April 15, 1994	
Date:	Job Type:
April 1994	Petroleum Contamination

Appendix A  
Geologic Logs

## GEOLOGIC LOG

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**WELL:** MW-1  
**LOCATION:** Achilles Property, 2 Railroad Street, St. Johnsbury, Vt.  
**DRILLER:** Tri-State Drilling and Boring, Inc.  
**HYDROGEOLOGIST:** Rick S. Vandenberg, Lincoln Applied Geology, Inc.  
**DATE:** April 7, 1994

**Soils Description:**

**BG** = **B**ackground [0.8]  
**SL** = **S**aturated **L**amp [>500]  
**ppm** = **P**arts **P**er **M**illion

<u>Depth</u>	<u>Description</u>	<u>PID (ppm)</u>
0 - 2'	Sand, very fine to very coarse, tan to brown; some silt; trace cobble	BG
2' - 16'	Sand, fine, tan; some silt; some orange mottling; some 0.1 - 0.3' medium to very coarse sand lenses.	BG (2-4') BG(4-6') BG (6-8') BG (8-10') BG (10-12') BG (12-14') BG (14-16')
16' - 24'	Sand, coarse to very coarse, light brown; some sand, fine to medium; trace silt, grey; ground water encountered at 19.6 feet.	BG (16-18') 1.0 (18-20') 25 (20-22') 7.0 (22-24') 0.2 (24-26')



**Well Construction:**

Bottom of Boring: 26 feet  
 Bottom of Well: 26 feet  
 Well Screen: 16' - 26', 2" sch 40 PVC, 10 slot (0.010") slotted pipe  
 Solid Riser: 0.5' - 16', 2" sch 40 PVC  
 Sand Pack: 14' - 26'  
 Bentointe Seal: 12' - 14'  
 Backfill: 0.5' - 12'  
 Well Box: Flush grade bolt down road box

## GEOLOGIC LOG

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WELL: MW-2  
LOCATION: Achilles Property, 2 Railroad Street, St. Johnsbury, VT.  
DRILLER: Tri-State Drilling and Boring, Inc.  
HYDROGEOLOGIST: Rick S. Vandenberg, Lincoln Applied Geology, Inc.  
DATE: April 7, 1994

### Soils Description:

**BG** = **Background** [0.8]  
**SL** = **Saturated Lamp** [>500]  
**ppm** = **Parts Per Million**

<u>Depth</u>	<u>Description</u>	<u>PID (ppm)</u>
0 - 5'	Sand, medium to coarse, brown; some silt, light green; hand sample	BG
5' - 25'	Silt, brown to light green; some gravel, fine to medium; hydrocarbon some sand, fine to coarse, sheen noted from 5 - 12 feet; some very fine sand.	BG (5-7') 0.4 (10-12') 0.2 (15-17') BG (20-22')
25' - 27'	Sand, medium to coarse, light green to light brown; some sand, fine; some silt; ground water encountered at 19 feet.	BG (25-27')



### Well Construction:

Bottom of Boring: 27 feet  
Bottom of Well: 26 feet  
Well Screen: 16' - 26', 2" sch 40 PVC, 10 slot (0.010") slotted pipe  
Solid Riser: 0.5' - 16', 2" sch 40 PVC, solid riser  
Sand Pack: 14' - 26'  
Bentointe Seal: 12' - 14'  
Backfill: 0.5' - 12'  
Well Box: Flush grade bolt down road box

## GEOLOGIC LOG

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WELL: MW-3  
LOCATION: Achilles Property, 2 Railroad Street, St. Johnsbury, VT.  
DRILLER: Tri-State Drilling and Boring, Inc.  
HYDROGEOLOGIST: Rick S. Vandenberg, Lincoln Applied Geology, Inc.  
DATE: April 8, 1994

### Soils Description:

BG = Background [0.6]  
SL = Saturated Lamp [>500]  
ppm = Parts Per Million

<u>Depth</u>	<u>Description</u>	<u>PID (ppm)</u>
0 - 7'	Sand, fine to medium, brown; some silt; moist; hard sample; some sand, coarse; hydrocarbon oder. Ground water encountered at 7 feet.	9 (0-4') 12.6 (4-6')
7' - 25'	Silt, light green to brown; some very fine sand; trace clay; alternating green and brown bands noted throughout.	BG (9-11') 0.6 (11-13') 0.8 (13-15') 0.2 (15-17') BG (17-19') BG (19-21') BG (21-23') BG (23-25')

### Well Contruccion:

Bottom of Boring: 25 feet  
Bottom of Well: 25 feet  
Well Screen: 5' - 25', 2" sch 40 PVC, 10 slot (0.010") slotted pipe  
Solid Riser: 0 - 5', 2" sch 40 PVC, solid riser  
Sand Pack: 3' - 25'  
Bentointe Seal: 1' - 3'  
Backfill: 0.5' - 1'  
Well Box: Flush grade bolt down road box

## GEOLOGIC LOG

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WELL: MW-4  
LOCATION: Achilles Property, 2 Railroad Street, St. Johnsbury, VT  
DRILLER: Tri-State Drilling and Boring, Inc.  
HYDROGEOLOGIST: Rick S. Vandenberg, Lincoln Applied Geology, Inc.  
DATE: April 8, 1994

### Soils Description:

BG = Background [0.6]  
SL = Saturated Lamp [>500]  
ppm = Parts Per Million

<u>Depth</u>	<u>Description</u>	<u>PID (ppm)</u>
0 - 6'	Sand, fine to coarse, brown; some silt; some gravel, medium to coarse; trace cobble	1.0 (0-4') 2.2 (4-6')
6' - 16'	Sand, fine, tan; some silt; trace gravel (9-11'); some orange staining	6.2 (9-11') 12.6 (14-16')
16' - 20'	Sand, fine to coarse, tan to brown; some gravel, fine; trace silt; highly transmissive	14.0 (19-21') 2.0 (24-26')



### Well Construction:

Bottom of Boring: 26 feet  
Bottom of Well: 26 feet  
Well Screen: 16' - 26', 2" sch 40 PVC, 10 slot (0.010") slotted pipe  
Solid Riser: 0.5' - 16', 2" sch 40 PVC, solid riser  
Sand Pack: 14' - 26'  
Bentointe Seal: 12' - 14'  
Backfill: 0.5' - 12'  
Well Box: Flush grade bolt down road box

Appendix B

April 15, 1994

Water Quality Results



## LABORATORY ANALYSIS

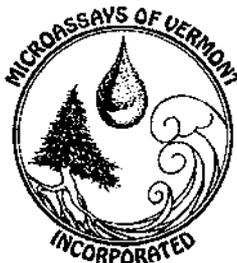
CLIENT NAME:	Lincoln Applied Geology	REF #:	8700
ADDRESS:	RD#1 Box 710 Bristol, VT 05443	PROJECT NO.:	not given
SAMPLE LOCATION:	Windshield World	DATE OF SAMPLE:	4/15/94
SAMPLER:	Jim Holman	DATE OF RECEIPT:	4/15/94
		DATE OF ANALYSIS:	4/23,4/29/94
ATTENTION:	Rick Vandenberg/John Amadon	DATE OF REPORT:	5/3/94

Pertaining to the analyses of specimens submitted under the accompanying chain of custody form, please note the following:

- Water samples submitted for VOC analysis were preserved with HCL.
- Specimens were processed and examined according to the procedures outlined in the specified method.
- Holding times were honored.
- Instruments were appropriately tuned and calibrations were checked with the frequencies required in the specified method.
- Blank contamination was not observed at levels interfering with the analytical results.
- Continuing calibration standards were monitored at intervals indicated in the specified method. The resulting analytical precision and accuracy were determined to be within method QA/QC acceptance limits.
- The inferred efficiency of analyte recovery for individual samples was monitored by the addition of surrogate analytes to all samples, standards, and blanks. Surrogate recoveries were found to be within laboratory QA/QC acceptance limits, unless noted otherwise.

Reviewed by:

Brendan McMahon, Ph.D.  
Director, Chemical Services



## LABORATORY REPORT

### GC/MS METHOD - BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES) + MTBE

CLIENT NAME:	Lincoln Applied Geology	PROJECT CODE:	not given
PROJECT NAME:	Windshield World	REF.#:	8,700
REPORT DATE:	May 3, 1994	STATION:	MW-1
DATE SAMPLED:	April 15, 1994	TIME SAMPLED:	10:45
DATE RECEIVED:	April 15, 1994	SAMPLER:	Jim Holman
ANALYSIS DATE:	April 23, 1994	SAMPLE TYPE:	Water

PARAMETER	PQL ( $\mu\text{g/L}$ )	Conc. ( $\mu\text{g/L}$ )
Benzene	100	1,250
Toluene	100	5,070
Ethylbenzene	100	1,100
Xylenes	300	5,860
MTBE	100	BPQL

Surrogate % Recovery: 95%

BPQL = Below Practical Quantitation Limit (PQL).

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## LABORATORY REPORT

### GC/MS METHOD - BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES) + MTBE

CLIENT NAME:	Lincoln Applied Geology	PROJECT CODE:	not given
PROJECT NAME:	Windshield World	REF.#:	8,700
REPORT DATE:	May 3, 1994	STATION:	MW-2
DATE SAMPLED:	April 15, 1994	TIME SAMPLED:	11:00
DATE RECEIVED:	April 15, 1994	SAMPLER:	Jim Holman
ANALYSIS DATE:	April 29, 1994	SAMPLE TYPE:	Water

PARAMETER	PQL ( $\mu\text{g/L}$ )	Conc. ( $\mu\text{g/L}$ )
Benzene	1	BPQL
Toluene	1	BPQL
Ethylbenzene	1	BPQL
Xylenes	3	BPQL
MTBE	1	BPQL

Surrogate % Recovery: 95%

BPQL = Below Practical Quantitation Limit (PQL).

01/15



## LABORATORY REPORT

GC/MS METHOD - BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES) + MTBE

CLIENT NAME:	Lincoln Applied Geology	PROJECT CODE:	not given
PROJECT NAME:	Windshield World	REF.#:	8,700
REPORT DATE:	May 3, 1994	STATION:	MW-3
DATE SAMPLED:	April 15, 1994	TIME SAMPLED:	11:17
DATE RECEIVED:	April 15, 1994	SAMPLER:	Jim Holman
ANALYSIS DATE:	April 29, 1994	SAMPLE TYPE:	Water

PARAMETER	PQL ( $\mu\text{g/L}$ )	Conc. ( $\mu\text{g/L}$ )
Benzene	1	2
Toluene	1	2
Ethylbenzene	1	BPQL
Xylenes	3	10
MTBE	1	BPQL

Surrogate % Recovery: 95%

BPQL = Below Practical Quantitation Limit (PQL).

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## LABORATORY REPORT

GC/MS METHOD - BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES) + MTBE

CLIENT NAME:	Lincoln Applied Geology	PROJECT CODE:	not given
PROJECT NAME:	Windshield World	REF.#:	8,700
REPORT DATE:	May 3, 1994	STATION:	MW-4
DATE SAMPLED:	April 15, 1994	TIME SAMPLED:	11:30
DATE RECEIVED:	April 15, 1994	SAMPLER:	Jim Holman
ANALYSIS DATE:	April 29, 1994	SAMPLE TYPE:	Water

PARAMETER	PQL ( $\mu\text{g/L}$ )	Conc. ( $\mu\text{g/L}$ )
Benzene	200	3,760
Toluene	200	16,600
Ethylbenzene	200	1,220
Xylenes	600	10,300
MTBE	200	BPQL

Surrogate % Recovery: 94%

BPQL = Below Practical Quantitation Limit (PQL).

10/1/94



## LABORATORY REPORT

### GC/MS METHOD - BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES) + MTBE

CLIENT NAME:	Lincoln Applied Geology	PROJECT CODE:	not given
PROJECT NAME:	Windshield World	REF.#:	8,700
REPORT DATE:	May 3, 1994	STATION:	Trip Blank
DATE SAMPLED:	April 15, 1994	TIME SAMPLED:	07:00
DATE RECEIVED:	April 15, 1994	SAMPLER:	Jim Holman
ANALYSIS DATE:	April 23, 1994	SAMPLE TYPE:	Water

PARAMETER	PQL ( $\mu\text{g/L}$ )	Conc. ( $\mu\text{g/L}$ )
Benzene	1	BPQL
Toluene	1	BPQL
Ethylbenzene	1	BPQL
Xylenes	3	BPQL
MTBE	1	BPQL

Surrogate % Recovery: 93%

BPQL = Below Practical Quantitation Limit (PQL).



Appendix C  
Cost Estimate

**Achilles Property  
St. Johnsbury, VT  
(VDEC Site #93-1549)**

**Cost Estimate for Quarterly Monitoring and Sampling**

**A. Quarterly Monitoring and Sampling**

Technician -	8.0	hr(s) @	\$45.00 per hour	\$	360.00
PID and Interface Probe -	1.0	day(s) @	\$100.00 per day	\$	100.00
BTEX and MTBE samples -	5.0	@	\$62.00 each	\$	310.00
<del>Borehole Sampling materials -</del>	4.0	@	\$6.73 each	\$	26.92
Mileage -	50.0	mile(s) @	\$0.30 per mile	\$	15.00
<i>Pump + Generator</i>	<i>1 day e</i>				<i>110.00</i>
<b>Subtotal A (Cost per sampling event)</b>				<b>\$</b>	<b>811.92</b>

**B. Quarterly Reporting**

Senior Hydrogeologist -	1.0	hr(s) @	\$75.00 per hour	\$	75.00
Project Manager -	1.0	hr(s) @	\$50.00 per hour	\$	50.00
Hydrogeologist -	4.0	hr(s) @	\$45.00 per hour	\$	180.00
Computer Technician -	4.0	hr(s) @	\$30.00 per hour	\$	120.00
Administrative Assistant -	3.0	hr(s) @	\$30.00 per hour	\$	90.00
<b>Subtotal B (per report)</b>				<b>\$</b>	<b>515.00</b>

**Grand Total >>> \$ 1,326.92**