



FEB 2 9 53 AM '98

January 30, 1998

Mr. Matt Moran  
Sites Management Section  
VTDEC WMD  
103 South Main St./ West Bldg.  
Waterbury, VT 05671-0404

RE: Initial Investigation of Subsurface Petroleum Contamination at Twin City Plaza, Berlin,  
Vermont (VTDEC Site #96-2114)

Dear Mr. Moran:

Enclosed please find the January 1998 report titled *Initial Investigation of Subsurface Petroleum Contamination at Twin City Plaza*. Mr. Alan Lendway of Goodhart Associates requested that a copy be forwarded to you for review. Please do not hesitate to call, if you have any questions or comments.

Sincerely,

Robert Higgins  
Engineer

Enc.

cc: Mr. Alan Lendway, Goodhart Associates (w/out Enc.)  
GI #109741131

**INITIAL INVESTIGATION OF  
SUBSURFACE PETROLEUM CONTAMINATION AT  
TWIN CITY PLAZA**

**JANUARY 22, 1998**

**Site Location:**

**Twin City Plaza  
Barre-Montpelier Road  
Berlin, VT  
(VTDEC SITE #96-2114)  
GI Project # 109741131**

**Prepared For:**

**Mr. Alan Lendway  
Goodhart Associates  
18 Bailey Avenue  
Montpelier, VT 05602  
(802) 229-6669**

**Prepared By:**



**P.O. Box 943 / 19 Commerce Street Williston, VT 05495 (802) 865-4288**

**FEB 2 9 53 AM '98**

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## **I. INTRODUCTION**

This report summarizes the initial investigation of suspected subsurface petroleum contamination at the Twin City Plaza located on the Barre-Montpelier Road in Berlin, VT (see location map in Appendix A). This investigation was conducted by Griffin International, Inc. (Griffin) for Mr. Alan Lendway of Goodhart Associates to address petroleum contamination detected during the closure of gasoline underground storage tanks (USTs) at the site in October of 1996. The Vermont Department of Environmental Conservation (VTDEC) requested that this work be completed in a letter to Mr. Lendway, from Mr. Chuck Schwer of the VTDEC, dated February 11, 1997. All work at the site was conducted in accordance with the February 24, 1997 Work Plan and Cost Estimate prepared by Griffin. Approval to proceed with this plan was given in a letter dated October 29, 1997 from Mr. Matt Moran of the VTDEC to Griffin. The site (VTDEC Site #96-2114) is owned by Goodhart Associates of Montpelier, VT.

Work conducted at the site included the installation of four groundwater monitoring wells and the collection and laboratory analysis of groundwater samples from these wells. Additional tasks included the development of groundwater contour and contaminant concentration maps for the site. Also, a sensitive receptor risk assessment was conducted to assess the risk that subsurface petroleum contamination at the site may pose to potentially sensitive receptors identified in the site vicinity.

## **II. SITE BACKGROUND**

### **A. Site History**

On October 30 and 31, 1996 three USTs (one 3,000-gallon gasoline; one 4,000-gallon gasoline; and one 20,000-gallon gasoline) were permanently closed and removed from the ground at the Twin City Plaza. The USTs had been abandoned for approximately 20 years. During the closure inspection, petroleum-contaminated soils and groundwater were detected in the vicinity of the USTs. The apparent cause of this contamination was a release through a hole in the bottom of the 4,000-gallon UST. Because groundwater had been impacted, the extent and degree of petroleum contamination to the subsurface could not be adequately defined at the time of the closure inspection conducted in October of 1996.

The VTDEC requested that additional work be conducted at the site in order to determine the extent and degree of petroleum contamination relative to the former gasoline USTs. Mr. Alan Lendway retained the services of Griffin to conduct this investigation.

At the time of the monitoring well installation Griffin observed the removal of eight (8) No. 2 fuel oil USTs. These USTs were located on the east side of the property; the USTs were used to store fuel for the purpose of heating the individual businesses within the Twin City Plaza. The removal of the eight fuel oil USTs was conducted by North Country Environmental Services of Barre, VT.

## **B. Site Description**

The Twin City Plaza is located on the Barre-Montpelier Road in Berlin, VT. The site consists of one building situated on a paved lot. There are eight businesses occupying the building. Property uses in the area are solely commercial. All buildings in the vicinity are serviced by municipal water and sewer systems (see the Site Map included in Appendix A).

## **C. Site Geologic Setting**

According to the Surficial Geologic Map of Vermont (Ref. 1), the site is underlain by fluvial sands and gravel. Bedrock at the site is of the Waits River formation, which consists predominately of siliceous limestone and sericite quartz (Ref. 2).

# **III. INVESTIGATIVE PROCEDURES**

## **A. Monitoring Well Installation**

On December 8, 1997, four monitoring wells were installed by Green Mountain Boring (GMB) using a hollow-stem auger drill rig. The monitoring wells, designated MW-1 through MW-4, were installed to help define the degree and extent of petroleum contamination in the vicinity of the former on-site gasoline USTs. MW-1 was installed in the expected upgradient direction from the former tank pit. MW-2 was installed along the eastern edge of the former common tank pit. MW-3 and MW-4 were installed in a presumed downgradient location. The locations of the monitoring wells are shown on the Site Map in Appendix A.

Soil samples were collected at approximately five-foot intervals in each boring. Each soil sample was screened for volatile organic compounds (VOCs) using an HNu™ systems Model PI 101 photoionization detector (PID). Soils were screened using the Griffin Jar/Polyethylene Bag Headspace Screening Protocol, which conforms to state and industry standards. Contaminant concentrations and soil characteristics were recorded in detailed boring logs by the supervising Griffin engineer (see the Well Logs in Appendix B). The water table was observed to be approximately 14.5 feet below grade in each of the four borings.

Approximately 1 cubic yard of drill cuttings with elevated contaminant concentrations was polyencapsulated and stockpiled at the east side of the on-site building. It is expected that over time, contaminant levels in these soils will degrade due to the natural mitigative processes of biodegradation, diffusion, and volatilization.

### *MW-1*

The boring for MW-1 was advanced to 20 feet below grade, approximately 5.5 feet below the water table. Soils from the boring for MW-1 consisted of fine gravel with coarse to fine sand and some silt from grade to a depth of 4 feet. Clay and silt with some fine gravel and little fine

sand were observed from 4 feet below grade to a depth of 17 feet. Gray clay was observed from 17 feet to 20 feet below grade. Petroleum odors were not observed in the soils from this boring, however, low PID readings were recorded in all of the soil samples, ranging from 0.2 to 26 parts per million (ppm).

#### *MW-2*

The boring for MW-2 was also advanced to 20 feet below grade. Soils from this boring were similar to those observed in the MW-1 boring. Petroleum odors were observed in this boring. Low to moderate PID readings were recorded in these soils, ranging from 28 to 182 ppm.

#### *MW-3*

The boring for MW-3 was also advanced to 20 feet below grade. Soils from this boring were similar to those observed in the MW-1 boring. Petroleum odors were observed in this boring from 10 to 20 feet below grade. Low to moderate PID readings were recorded in these soils, ranging from 0 to 182 ppm.

#### *MW-4*

The boring for MW-4 was again advanced to 20 feet below grade. Soils from this boring were similar to those observed in the MW-1 boring. Petroleum odors were observed in this boring from 10 to 20 feet below grade. Low to moderate PID readings were recorded in these soils, ranging from 20 to 124 ppm.

#### *Well Construction Details*

All four monitoring wells were constructed with two-inch diameter, Schedule 40 PVC riser and 0.010-inch slotted screen. The screened portion of the monitoring wells is from 10 to 20 feet below grade. A silica sand pack was placed around the screened portion of each well and a bentonite seal was placed at the ground surface. To complete the construction of each well, a road box was set in concrete at grade level. In addition, locking well caps were placed on the monitoring wells.

#### **B. Determination of Groundwater Flow Direction and Gradient**

On December 17, 1997, depth to water measurements were taken with the use of a Keck<sup>TM</sup> interface probe in the four site wells. These measurements were subtracted from the top of casing elevations, which were determined relative to an arbitrary datum of 100 feet at the top of the casing for MW-1, to determine the water table elevation at each of the wells. From the monitoring well water table elevation data, the groundwater contours were interpolated onto the site map, and the groundwater direction and gradient were determined.

As displayed on the groundwater contour map included in Appendix A, the regional groundwater flow direction for December 17, 1997, was estimated to be southeast at a gradient of approximately 3.5%. All groundwater level data are recorded in Appendix C.

### **C. Groundwater Sample Collection and Analysis**

Immediately following well gauging, samples of the groundwater were collected from the four monitoring wells. Samples were analyzed per EPA Method 602 for benzene, toluene, ethylbenzene, and xylenes (BTEX), and methyl tertiary butyl ether (MTBE). Results of the laboratory analyses for wells sampled December 17, 1997 are summarized in Appendix D. Laboratory report forms are presented in Appendix E.

With the exception of MW-1, all of the monitoring wells contained concentrations of benzene exceeding the Vermont Groundwater Enforcement Standard (VGES) of 5 parts per billion (ppb). MW-3 contained concentrations of MTBE and ethylbenzene in excess of their respective VGESs. Due to the contaminant concentrations present in MW-2 and MW-4 the detection limit for MTBE was raised to levels above the VGES. Several additional compounds were detected in each well at concentrations below their respective VGES. None of the targeted compounds were present above method detection limits in the sample collected from MW-1.

All samples were collected according to Griffin's groundwater sampling protocol which complies with industry and state standards. Results from the analyses of the duplicate and trip blank samples indicate that adequate quality assurance and control (QA/QC) were maintained during sample collection and analysis.

### **D. Sensitive Receptor Risk Assessment**

A receptor risk assessment was conducted to identify known and potential receptors of the contamination detected at the Twin City Plaza. A visual survey was conducted at the time of monitoring well installation and during the UST closure inspection. Based on these observations, an estimation of the potential risk to identified receptors was made based on proximity to the source area, groundwater flow direction, and contaminant concentration levels in groundwater.

#### *Water Supplies*

The Village of Berlin receives its water from the Berlin Pond Reservoir which is located approximately 4 to 5 miles to the west of the site. It is not likely that the town water supply is at risk of petroleum contamination from the Twin City Plaza given its sufficient distance from the site. Properties immediately surrounding the Twin City Plaza are reportedly all served by this municipal water source.

### *Buildings in the Vicinity*

Twin City Plaza is the only building located on the subject property. The building is constructed on a slab and is therefore at minimal risk of impact from petroleum vapors from the gasoline USTs. The area surrounding the site is comprised of commercial properties. Based on visual inspection, all of the buildings surrounding the property appear to be constructed on concrete slabs. No complaints have been reported of petroleum odors within any building immediately surrounding the Twin City Plaza site.

### *Surface Water*

The Stevens Branch River flows along the eastern border of the property. At the time of the UST closure in October of 1996 no signs of petroleum impact to the Stevens Branch River were observed. At the time of the monitoring well installation and sampling, the banks and the surface of the river were frozen and could not be evaluated. Based on the proximity of the Stevens Branch, it is possible that low levels of dissolved contamination will reach the river.

## **IV. CONCLUSIONS**

Based on the initial site investigation of petroleum contamination resulting from three former gasoline USTs at the Twin City Plaza site, the following conclusions are offered:

1. Based on the water table elevation data collected on December 17, 1997, groundwater beneath the site appears to be flowing southeast toward the adjacent Stevens Branch at a gradient of approximately 3.5%.
2. Three of the monitoring wells located downgradient of the former gasoline UST pit contained concentrations of select petroleum related compounds exceeding the VGES. The downgradient extent of dissolved petroleum contamination has not been defined.
3. None of the targeted compounds were present above method detection limits in the sample collected from MW-1, located upgradient of the former gasoline UST pit.
4. Only one sensitive receptor in the area, the Stevens Branch River, appears to be at risk from the on-site contamination. At the time of the gasoline UST closures in October of 1996 no signs of petroleum impact to the Stevens Branch River were observed. Based on the proximity of the Stevens Branch, it is possible that low levels of dissolved contamination will reach the river.
5. Over time, the natural processes of dilution, dispersion, and biodegradation will continue to reduce dissolved contaminant concentrations present in shallow groundwater beneath the Twin City Plaza.

6. The former apparent source of contamination at the site (gasoline USTs) has been removed. The eight former fuel oil USTs may present an additional contaminant source.
7. Approximately one cubic yard of drill cuttings with elevated contaminant concentrations resulting from installation of the monitoring wells was polyencapsulated and stockpiled near the rear of the building.
8. No free product was present in the on-site wells on December 17, 1997.

## V. RECOMMENDATIONS

In order to monitor and track the expected decrease in contaminant concentrations the on-site monitoring wells should be sampled on an annual basis. These samples will be analyzed by EPA Method 602 for the presence of petroleum related compounds. Pending VTDEC approval the next sampling event will take place in April of 1998 to confirm current findings and continue annually until such time that contaminant concentrations drop below VGESs. At that time, Griffin can recommend site closure. ✓

The water surface of the nearby Stevens Branch River as well as the soils along the west bank will be visually inspected for potential evidence of petroleum contamination. This inspection will be conducted in conjunction with the annual groundwater monitoring visits. ✓

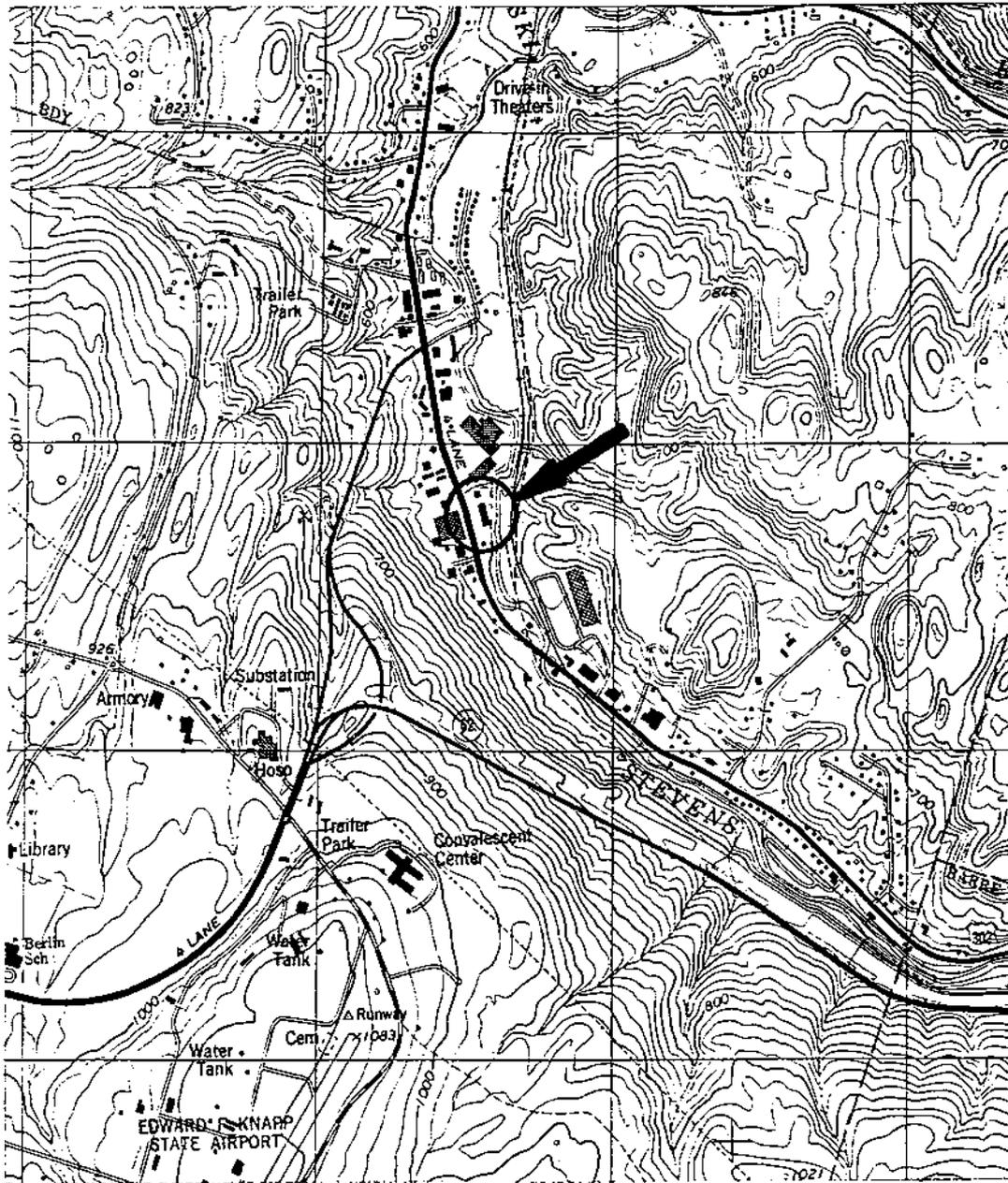
The approximately one cubic yard of petroleum-contaminated soils stockpiled behind the Twin City Plaza will be screened annually beginning in April of 1998. Soil screening efforts will be conducted in conjunction with groundwater monitoring events. Annual stockpiled soil screening will continue until contaminant levels decrease to levels below 1 ppm and there is no remaining evidence (olfactory or visual) of petroleum contamination. At that time, in accordance with VTDEC guidelines the soils can then be thin-spread on their site of origin, with VTDEC approval. The integrity of the plastic liner covering the soil stockpile will be checked periodically by representatives of the Twin City Plaza, and repairs or replacements will be made accordingly. ✓

## References

1. Doll, Charles G., ed., 1970, Surficial Geologic Map of Vermont, State of Vermont.
2. Doll, Charles G., ed., 1961, Centennial Geologic Map of Vermont, State of Vermont.

**APPENDIX A**

**Maps**



JOB #: 109741131  
 SOURCE: USGS- BARRE WEST, VERMONT QUADRANGLE



TWIN CITY PLAZA

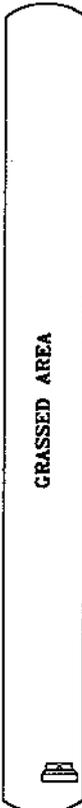
BERLIN, VERMONT

SITE LOCATION MAP

DATE: 12/23/97	DWG.#:1	SCALE: 1:24000	DRN.:SB	APP.:RH
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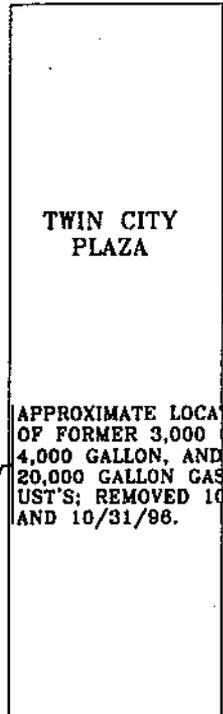


ROUTE 302



GRASSED AREA

PAVED  
PARKING LOT

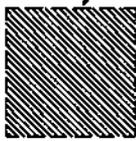


TWIN CITY  
PLAZA

APPROXIMATE LOCATION  
OF FORMER 3,000 GALLON,  
4,000 GALLON, AND  
20,000 GALLON GASOLINE  
UST'S; REMOVED 10/30/98  
AND 10/31/96.



MW1



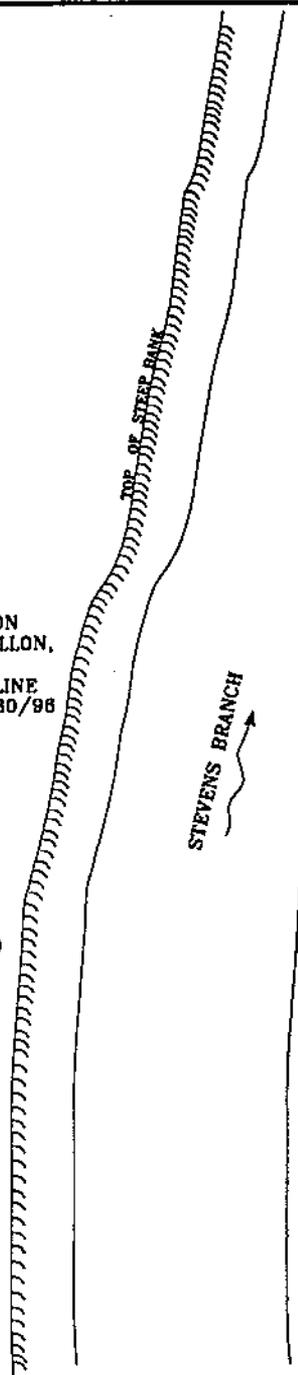
MW2



MW3



MW4



TOP OF STEEP BANK

STEVENS BRANCH



WINDSHIELD  
WORLD

**LEGEND**

-  MONITORING WELL
-  BUSINESS SIGN

JOB #: 109741131



**TWIN CITY PLAZA**

BERLIN, VERMONT

SITE MAP

DATE: 12/23/97

DWG.#:2

SCALE: 1"=60'

DRN.:SB

APP.:RH



ROUTE 302

GRASSED AREA

PAVED  
PARKING LOT

TWIN CITY  
PLAZA

APPROXIMATE LOCATION  
OF FORMER 3,000 GALLON,  
4,000 GALLON, AND  
20,000 GALLON GASOLINE  
UST'S; REMOVED 10/30/98  
AND 10/31/98.

TOP OF STEEP BANK

STEVENS BRANCH

MW1  
89.05'

MW2  
87.28'

MW3  
88.08'

MW4  
85.60'

88.0'

87.0'

88.0'

WINDSHIELD  
WORLD

APPROX. DIRECTION OF  
GROUNDWATER FLOW

**LEGEND**

-  MW2 MONITORING WELL AND WATER TABLE ELEVATION IN FEET
-  87.0' GROUNDWATER CONTOUR IN FEET (DASHED WHERE INFERRED)
-  BUSINESS SIGN

JOB #: 109741131  
MEASUREMENT DATE: 12/17/97



**TWIN CITY PLAZA**

BERLIN, VERMONT

**GROUNDWATER CONTOUR MAP**

DATE: 12/29/97	DWG.#:2	SCALE: 1"=60'	DRN.:SB	APP.:RH
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ROUTE 302

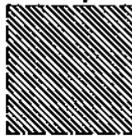
GRASSED AREA

PAVED PARKING LOT

TWIN CITY PLAZA

APPROXIMATE LOCATION OF FORMER 3,000 GALLON, 4,000 GALLON, AND 20,000 GALLON GASOLINE UST'S; REMOVED 10/30/96 AND 10/31/98.

MW1  
ND



MW2  
1,527.5

MW3  
7,319

MW4  
5,693

TOP OF STEEP BANK  
STEVENS BRANCH

WINDSHIELD  
WORLD

**LEGEND**

MW2 1,734.4 MONITORING WELL AND TOTAL BTEX AND MTBE CONCENTRATION (ppb)

ND NONE DETECTED

BUSINESS SIGN

JOB #: 109741131  
SAMPLE DATE: 12/17/97



**TWIN CITY PLAZA**  
BERLIN, VERMONT

**CONTAMINANT CONCENTRATION MAP**

DATE: 1/6/98 DWG.#:4 SCALE: 1"=60' DRN.:SB APP.:RH

**APPENDIX B**

**Well Logs**

PROJECT TWIN CITY PLAZA

LOCATION BERLIN, VERMONT

DATE DRILLED 12/8/97 TOTAL DEPTH OF HOLE 20.0'

DIAMETER \_\_\_\_\_

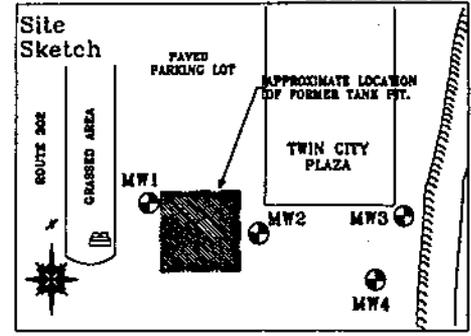
SCREEN DIA. 2" LENGTH 10.0' SLOT SIZE 0.010"

CASING DIA. 2" LENGTH 9.5' TYPE sch 40 pvc

DRILLING CO. GMB DRILLING METHOD HSA

DRILLER RON LOG BY R. HIGGINS

WELL NUMBER MW1



GRIFFIN INTERNATIONAL, INC

DEPTH IN FEET	WELL CONSTRUCTION	NOTES	BLOWS PER 6" OF SPOON & PID READINGS	DESCRIPTION/SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	DEPTH IN FEET
0	ROAD BOX	LOCKING WELL CAP			0
1	CONCRETE				1
2	BENTONITE			Dry, brown, coarse to fine SAND and fine GRAVEL, some silt, no odor.	2
3					3
4					4
5	NATIVE BACKFILL			Dry, brownish gray CLAY and SILT, some fine gravel, no odor.	5
6			5'-7'- 3/4/5/5 0.4 ppm		6
7	WELL RISER				7
8					8
9					9
10					10
11	SAND PACK		10'-12'- 9/2/3/4 26 ppm	Dry, gray, CLAY, SILT and a little fine sand. Slight petroleum odor.	11
12					12
13					13
14				14.5' WATER TABLE	14
15					15
16	WELL SCREEN		15'-17'- 5/4/5/5 0.2 ppm		16
17					17
18				Wet, gray CLAY, no odor.	18
19	BOTTOM CAP				19
20	UNDISTURBED NATIVE SOIL			BASE OF WELL AT 20' END OF EXPLORATION AT 20'	20
21					21
22					22
23					23
24					24
25					25

PROJECT TWIN CITY PLAZA

LOCATION BERLIN, VERMONT

DATE DRILLED 12/8/97 TOTAL DEPTH OF HOLE 20.0'

DIAMETER \_\_\_\_\_

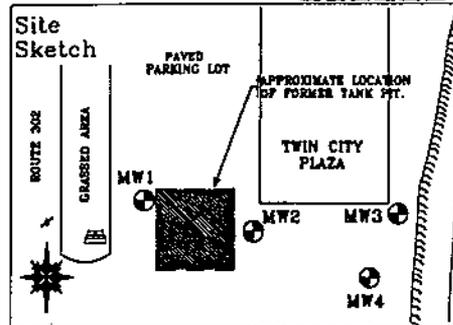
SCREEN DIA. 2" LENGTH 10.0' SLOT SIZE 0.010"

CASING DIA. 2" LENGTH 9.5' TYPE sch 40 pvc

DRILLING CO. GMB DRILLING METHOD HSA

DRILLER RON LOG BY R. HIGGINS

WELL NUMBER MW2



GRIFFIN INTERNATIONAL, INC

DEPTH IN FEET	WELL CONSTRUCTION	NOTES	BLOWS PER 6" OF SPOON & PID READINGS	DESCRIPTION/SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	DEPTH IN FEET
0	ROAD BOX				0
0	LOCKING WELL CAP				0
1	CONCRETE				1
2	BENTONITE			Dry, brown, coarse to fine SAND and fine GRAVEL, some silt, no odor.	2
3					3
4					4
5	NATIVE BACKFILL				5
6			5'-7'- 30/14/3/3 28 ppm		6
7	WELL RISER				7
8				Dry, grayish CLAY and SILT, some fine gravel, little fine sand, petroleum odor.	8
9					9
10			10'-12'- 16/16/17/3 no recovery		10
11	SAND PACK				11
12					12
13					13
14				14.5' WATER TABLE	14
15					15
16	WELL SCREEN		15'-17'- 3/7/9/12 182 ppm	Wet, grayish CLAY and SILT, trace fine sand, petroleum odor.	16
17					17
18					18
19	BOTTOM CAP		18'-20' 112 ppm	Wet, gray CLAY, petroleum odor.	19
20	UNDISTURBED NATIVE SOIL			BASE OF WELL AT 20' END OF EXPLORATION AT 20'	20
21					21
22					22
23					23
24					24
25					25

PROJECT TWIN CITY PLAZA

LOCATION BERLIN, VERMONT

DATE DRILLED 12/8/97 TOTAL DEPTH OF HOLE 20.0'

DIAMETER \_\_\_\_\_

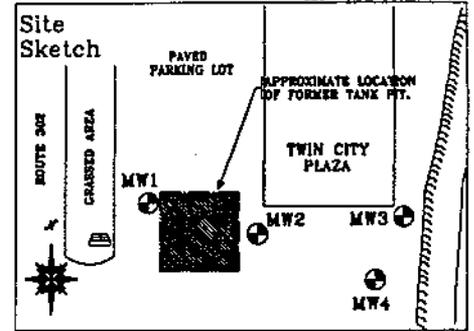
SCREEN DIA. 2" LENGTH 10.0' SLOT SIZE 0.010"

CASING DIA. 2" LENGTH 9.0' TYPE sch 40 pvc

DRILLING CO. GMB DRILLING METHOD HSA

DRILLER RON LOG BY R. HIGGINS

WELL NUMBER MW3



GRIFFIN INTERNATIONAL, INC

DEPTH IN FEET	WELL CONSTRUCTION	NOTES	BLOWS PER 6" OF SPOON & PID READINGS	DESCRIPTION/SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	DEPTH IN FEET
0	ROAD BOX	LOCKING WELL CAP			0
1	CONCRETE	NATIVE BACKFILL			1
2	BENTONITE		0'-4.5' 0 ppm	Dry, brown, coarse to fine SAND and fine GRAVEL, some silt, no odor.	2
3					3
4					4
5	NATIVE BACKFILL				5
6			5'-7'- 6/3/3/3 no recovery		6
7	WELL RISER				7
8					8
9					9
10			10'-12'- 6/7/7/7 180 ppm		10
11	SAND PACK			Dry, grayish CLAY and SILT, some medium gravel and coarse sand, petroleum odor.	11
12			13' 182 ppm		12
13					13
14				14.5' WATER TABLE	14
15	WELL SCREEN		15'-17'- 5/4/3/3 102 ppm	Wet, grayish CLAY and SILT, some medium gravel, wet, petroleum odor.	15
16					16
17					17
18				Wet, gray CLAY, petroleum odor.	18
19	BOTTOM CAP				19
20	UNDISTURBED NATIVE SOIL			BASE OF WELL AT 20.0' END OF EXPLORATION AT 20'	20
21					21
22					22
23					23
24					24
25					25

PROJECT TWIN CITY PLAZA

LOCATION BERLIN, VERMONT

DATE DRILLED 12/8/97 TOTAL DEPTH OF HOLE 20.0'

DIAMETER \_\_\_\_\_

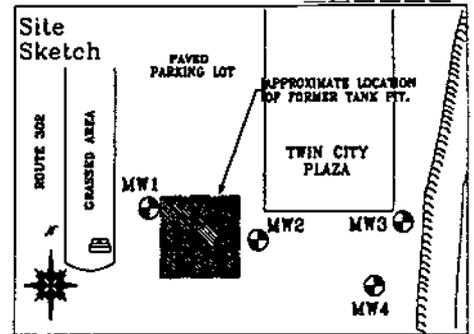
SCREEN DIA. 2" LENGTH 10.0' SLOT SIZE 0.010"

CASING DIA. 2" LENGTH 9.5' TYPE sch 40 pvc

DRILLING CO. GMB DRILLING METHOD HSA

DRILLER RON LOG BY R. HIGGINS

WELL NUMBER MW4



GRIFFIN INTERNATIONAL, INC

DEPTH IN FEET	WELL CONSTRUCTION	NOTES	BLOWS PER 6" OF SPOON & PID READINGS	DESCRIPTION/SOIL CLASSIFICATION (COLOR, TEXTURE, STRUCTURES)	DEPTH IN FEET
0	ROAD BOX	LOCKING WELL CAP			0
1	CONCRETE				1
2	BENTONITE			Dry, brown, coarse to fine SAND and fine GRAVEL, silt, no odor.	2
3					3
4					4
5	NATIVE BACKFILL				5
6			5'-7'- 12/8/6/5 0 ppm		6
7	WELL RISER			Dry, grayish CLAY and SILT, some fine sand, no odor.	7
8					8
9					9
10					10
11	SAND PACK		10'-12'- 22/8/8/7 20 ppm	Damp, grayish CLAY and SILT, some fine gravel, petroleum odor at approximately 11.0'.	11
12					12
13					13
14				14.50' WATER TABLE	14
15					15
16	WELL SCREEN		15'-17'- 4/5/6/8 124 ppm	Wet, CLAY and SILT, petroleum odor.	16
17					17
18			18' 64 ppm		18
19	BOTTOM CAP			Wet, gray CLAY, petroleum odor.	19
20	UNDISTURBED NATIVE SOIL			BASE OF WELL AT 20' END OF EXPLORATION AT 20'	20
21					21
22					22
23					23
24					24
25					25

**APPENDIX C**

**Groundwater Liquid Level Data**

Liquid Level Monitoring Data  
Twin City Plaza  
Berlin, VT

Monitoring Date: 12/17/97

Well I.D.	Top of Casing Elevation	Depth To Product	Depth To Water	Product Thickness	Specific Gravity Of Product	Hydro Equivalent	Corrected Depth To Water	Corrected Water Table Elevation
MW-1	100.00	-	10.95	-	-	-	10.95	89.05
MW-2	99.07	-	11.79	-	-	-	11.79	87.28
MW-3	98.42	-	12.34	-	-	-	12.34	86.08
MW-4	98.36	-	12.76	-	-	-	12.76	85.60

**APPENDIX D**

**Groundwater Quality Summary Data**

**Groundwater Quality Summary  
Twin City Plaza  
Berlin, VT**

PARAMETER	MW1			Enforcement Standard
	12/17/97			
Benzene	<1			5
Chlorobenzene	<1			100
1,2-DCB	<1			600
1,3-DCB	<1			600
1,4-DCB	<1			75
Ethylbenzene	<1			700
Toluene	<1			1,000
Xylenes	<1			10,000
Total BTEX				-
MTBE	<10			40
BTEX+MTBE				-

PARAMETER	MW2			Enforcement Standard
	12/17/97			
Benzene	508.			5
Chlorobenzene	<10			100
1,2-DCB	<10			600
1,3-DCB	<10			600
1,4-DCB	<10			75
Ethylbenzene	218.			700
Toluene	51.5			1,000
Xylenes	750.			10,000
Total BTEX	1,527.5			-
MTBE	<100			40
BTEX+MTBE	1,527.5			-

All Values Reported in ug/L (ppb)

ANALYSIS BY EPA METHOD 602

**Groundwater Quality Summary  
Twin City Plaza  
Berlin, VT**

PARAMETER	MW3			Enforcement Standard
	12/17/97			
Benzene	1,870.			5
Chlorobenzene	<20			100
1,2-DCB	<20			600
1,3-DCB	<20			600
1,4-DCB	<20			75
Ethylbenzene	985.			700
Toluene	177.			1,000
Xylenes	3,960.			10,000
Total BTEX	6,992.			
MTBE	327.			40
BTEX + MTBE	7,319.			

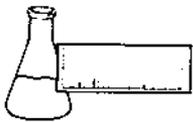
PARAMETER	MW4			Enforcement Standard
	12/17/97			
Benzene	2,260.			5
Chlorobenzene	<50			100
1,2-DCB	<50			600
1,3-DCB	<50			600
1,4-DCB	<50			75
Ethylbenzene	669.			700
Toluene	154.			1,000
Xylenes	2,610.			10,000
Total BTEX	5,693.			
MTBE	<500			40
BTEX + MTBE	5,693.			

All Values Reported in ug/L (ppb)

ANALYSIS BY EPA METHOD 602

**APPENDIX E**

**Laboratory Analysis Reports**



**ENDYNE, INC.**

Laboratory Services

32 James Brown Drive  
Williston, Vermont 05495  
(802) 879-4333  
FAX 879-7103

REPORT OF LABORATORY ANALYSIS

CLIENT: Griffin International  
PROJECT NAME: Twin City Plaza  
REPORT DATE: December 29, 1997  
DATE SAMPLED: December 17, 1997

PROJECT CODE: GITC1739  
REF.#: 114,756 - 114,761

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. Chain of custody indicated sample preservation with HCl.

All samples were prepared and analyzed by requirements outlined in the referenced method and within the specified holding times. All instrumentation was calibrated with the appropriate frequency and verified by the requirements outlined in the referenced method. Blank contamination was not observed at levels affecting the analytical results.

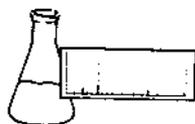
Analytical method precision and accuracy was monitored by laboratory control standards which included matrix spike, duplicate and quality control analyses. These standards were determined to be within established laboratory method acceptance limits.

Individual sample performance was monitored by the addition of surrogate analytes to each sample. All surrogate recovery data was determined to be within laboratory QA/QC guidelines unless otherwise noted.

Reviewed by,

Harry B. Locker, Ph.D.  
Laboratory Director

enclosures



### EPA METHOD 602--PURGEABLE AROMATICS

CLIENT: Griffin International

DATE RECEIVED: December 18, 1997

PROJECT NAME: Twin City Plaza

REPORT DATE: December 29, 1997

CLIENT PROJ. #: 109741131

PROJECT CODE: GITC1739

Ref. #:	114,756	114,757	114,758	114,759	114,760
Site:	Trip Blank	MW1	MW2	Duplicate MW2	MW3
Date Sampled:	12/17/97	12/17/97	12/17/97	12/17/97	12/17/97
Time Sampled:	7:48	9:20	9:30	9:36	9:49
Sampler:	R. Higgins	R. Higgins	R. Higgins	R. Higgins	R. Higgins
Date Analyzed:	12/23/97	12/23/97	12/23/97	12/26/97	12/26/97
UIP Count:	0	0	>10	>10	>10
Dil. Factor (%):	100	100	10	10	5
Surr % Rec. (%):	89	90	90	86	82
Parameter	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)
Benzene	<1	<1	508.	612.	1,870.
Chlorobenzene	<1	<1	<10	<10	<20
1,2-Dichlorobenzene	<1	<1	<10	<10	<20
1,3-Dichlorobenzene	<1	<1	<10	<10	<20
1,4-Dichlorobenzene	<1	<1	<10	<10	<20
Ethylbenzene	<1	<1	218.	267.	985.
Toluene	<1	<1	51.5	59.4	177.
Xylenes	<1	<1	750.	900.	3,960.
MTBE	<10	<10	<100	<100	327.

Ref. #:	114,761				
Site:	MW4				
Date Sampled:	12/17/97				
Time Sampled:	9:53				
Sampler:	R. Higgins				
Date Analyzed:	12/26/97				
UIP Count:	>10				
Dil. Factor (%):	2				
Surr % Rec. (%):	87				
Parameter	Conc. (ug/L)				
Benzene	2,260.				
Chlorobenzene	<50				
1,2-Dichlorobenzene	<50				
1,3-Dichlorobenzene	<50				
1,4-Dichlorobenzene	<50				
Ethylbenzene	669.				
Toluene	154.				
Xylenes	2,610.				
MTBE	<500				

Note: UIP = Unidentified Peaks TBQ = Trace Below Quantitation NI = Not Indicated

**CHAIN-OF-CUSTODY RECORD**

24953

109741131

Project Name: <u>TWIN CITY PLAZA</u>	Reporting Address: <u>GRIFFIN</u>	Billing Address:
Site Location: <u>BRAIN VT</u>		
Endyne Project Number: <u>GITC 1739</u>	Company: Contact Name/Phone #: <u>R. Higgins</u>	Sampler Name: Phone #: <u>R. Higgins</u>

Lab #	Sample Location	Matrix	G R A B	C O M P	Date/Time	Sample Containers		Field Results/Remarks	Analysis Required	Sample Preservation	Rush
						No.	Type/Size				
114,756	TRIP BANK	H <sub>2</sub> O	✓		12/17/97 7:48	2	40ML G		602	H4	
114,757	MW1				9:20						
114,758	MW2				9:36						
114,759	Duplicate MW2				9:36						
114,760	MW3				9:44						
114,761	MW4				9:53						

Relinquished by: Signature <u>[Signature]</u>	Received by: Signature <u>John Suer</u>	Date/Time <u>12/18/97 9:55 AM</u>
Relinquished by: Signature	Received by: Signature	Date/Time

 New York State Project: Yes  No  Requested Analyses

1	pH	6	TKN	11	Total Solids	16	Metals (Specify)	21	EPA 624	26	EPA 8270 B/N or Acid
2	Chloride	7	Total P	12	TSS	17	Coliform (Specify)	22	EPA 625 B/N or A	27	EPA 8010/8020
3	Ammonia N	8	Total Diss. P	13	TDS	18	COD	23	EPA 418.1	28	EPA 8080 Pest/PCB
4	Nitrite N	9	BOD <sub>5</sub>	14	Turbidity	19	BTEX	24	EPA 608 Pest/PCB		
5	Nitrate N	10	Alkalinity	15	Conductivity	20	EPA 601/602	25	EPA 8240		
29	TCLP (Specify: volatiles, semi-volatiles, metals, pesticides, herbicides)										
30	Other (Specify):										

**CHAIN-OF-CUSTODY RECORD**
**24953**

1097-1131

Project Name: <u>TUNNELLY PLAZA</u>	Reporting Address: <u>GRIFFIN</u>	Billing Address:
Site Location: <u>RELIANT VT</u>		
Endyne Project Number:	Company: Contact Name/Phone #: <u>R. Higgins</u>	Sampler Name: Phone #: <u>R. Higgins</u>

Lab #	Sample Location	Matrix	G R A B	C O M P	Date/Time	Sample Containers		Field Results/Remarks	Analysis Required	Sample Preservation	Rush
						No.	Type/Size				
	<u>TRP BANK</u>	<u>1170</u>	<input checked="" type="checkbox"/>		<u>12/17/97</u> <u>7:48</u>	<u>2</u>	<u>400ml</u>		<u>6000</u>	<u>11/4</u>	
	<u>MW1</u>				<u>9:20</u>						
	<u>MW2</u>				<u>9:30</u>						
	<u>D. ALICE MW2</u>				<u>9:36</u>						
	<u>MW3</u>				<u>9:44</u>						
	<u>MW4</u>				<u>9:53</u>						

Relinquished by: Signature <u>R. Higgins</u>	Received by: Signature <u>John Sweeney</u>	Date/Time <u>12/17/97 9:55 AM</u>
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Relinquished by: Signature	Received by: Signature	Date/Time
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 New York State Project: Yes  No 
**Requested Analyses**

1	pH	6	TKN	11	Total Solids	16	Metals (Specify)	21	EPA 624	26	EPA 8270 B/N or Acid
2	Chloride	7	Total P	12	TSS	17	Coliform (Specify)	22	EPA 625 B/N or A	27	EPA 8010/8020
3	Ammonia N	8	Total Diss. P	13	TDS	18	COD	23	EPA 418.1	28	EPA 8080 Pest/PCB
4	Nitrite N	9	BOD <sub>5</sub>	14	Turbidity	19	BTEX	24	EPA 608 Pest/PCB		
5	Nitrate N	10	Alkalinity	15	Conductivity	20	EPA 601/602	25	EPA 8240		
29	TCLP (Specify: volatiles, semi-volatiles, metals, pesticides, herbicides)										
30	Other (Specify):										