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October 7, 2015

Mr. Steve Leroux
Berlin Lubricants
492 Bay Street
St. Johnsbury, Vermont 05819

RE: August 2015 Annual Summary Report
Northern Petroleum Company
St. Johnsbury, Vermont
VTDEC SMS #91-1169
LAG Project #00470

Dear Mr. Leroux:

Lincoln Applied Geology, Inc. is pleased to present the results of the recent groundwater monitoring and sampling event performed on August 25, 2015 at the above referenced site. Groundwater sampling is performed on an annual basis.

If you have any questions or comments, please feel free to contact me directly at 1-800-477-4384.

Respectfully,
Lincoln Applied Geology, Inc.

Devon Neary
Staff Geologist

DN/BE:ih
Enclosures

Cc: James Donaldson, VTDEC
George Pratt, Bradford Oil Co.

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August 2015
Annual Summary Report

Northern Petroleum
492 Bay Street
St. Johnsbury, Vermont

VTDEC SMS Site #91-1169
LAG Project #00470

October 7, 2015

Prepared for:

Mr. Steve Leroux
Berlin Lubricants
492 Bay Street
St. Johnsbury, Vermont 05819

Prepared by:

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APPLIED GEOLOGY, INC.
Environmental Consultants

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1.0 INTRODUCTION

The Northern Petroleum Site located 492 Bay Street in St. Johnsbury, Vermont operates as a bulk storage facility for petroleum fuels. In the early 1990s, Lincoln Applied Geology, Inc. (LAG) was contacted by Bradford Oil Company, the former land owner, to oversee the removal of three underground storage tanks (UST). Upon removing the USTs, free product was observed; therefore, a subsurface investigation was conducted to determine the degree and extent of subsurface contamination. The results of the investigation indicated that the former on-site USTs were the source of the subsurface petroleum contaminant plume. Due to the lack of nearby sensitive receptors and the stable condition of the contaminant plume, the Vermont Department of Environmental Conservation (VTDEC) determined that Monitored Natural Attenuation (MNA) was the most suitable approach for addressing residual subsurface contamination.

Monitoring and sampling is current performed on an annual basis. LAG performed an additional Site evaluation during the August 2013 monitoring and sampling event to gain an understanding of current aquifer conditions and assess the viability of MNA. Based on the results of the additional Site evaluation work the VTDEC determined MNA was an effective remedial approach given the limited threat to sensitive receptors. This report outlines the annual groundwater monitoring and sampling event performed on August 15, 2014.

2.0 SITE MONITORING ACTIVITIES

Monitoring activities include free phase petroleum product checks, groundwater level measurements, photoionization detector (PID) well headspace assays, and groundwater quality sampling.

2.1 Groundwater Elevation Data and Site Hydrogeology

During the August 2015 monitoring event, groundwater level measurements were obtained from all accessible monitoring wells using a Solinst® interface probe. Monitoring well MW-13 was destroyed in 2010. During the Site visit, monitoring well MW-4 was discovered to be intact but damaged. According to past reports the well had been destroyed, but was not properly abandoned. Depth to water (DTW) ranged from 3.45 (MW-14) to 9.93 (AH-1) feet below top of casing (TOC). Free product was encountered with a thickness of 0.05 feet in MW-9. Free product was last reported in MW-11 at 0.01 feet during the August 2014 monitoring event. Calculated groundwater elevations are presented in Table 1. Historical groundwater elevation data since November 2007 is summarized in Table 2. The August 2015 groundwater elevation data were used to generate a Groundwater Contour Map presented as Figure 1.

The groundwater flow direction during the August 2015 event was south-southeast at a relatively flat hydraulic gradient of 2.1% (0.021 ft/ft) calculated between monitoring wells MW-11 and MW-9. The Passumpsic River is the ultimate discharge point for groundwater in the area. Groundwater elevations, flow direction, and gradient are consistent with historical measurements recorded at the Site.

2.3 Photoionization Detector Results

A properly calibrated PID was utilized to screen the headspace of each monitoring well to assess VOC vapor phase contamination in the vadose zone at the Site. PID assay results are presented in Table 3. VOC concentrations were reported in MW-3, MW-9, MW-11, and MW-14 at 107, 229, 325, and 245 parts per million (ppm), respectively. Low to moderate vapor phase contamination was reported in MW-1 and AH-1 at 43 and 68.7 ppm, respectively. The remaining monitoring wells did not report VOCs (0.0 ppm). The PID readings obtained during the most recent monitoring event indicate that residual vapor phase contamination persists in the vadose zone at moderate levels.

2.4 Groundwater Quality Results

Groundwater quality samples were collected from all accessible monitoring wells on August 25, 2015. Groundwater samples were analyzed at Green Mountain Laboratories, Inc. in Montpelier, Vermont for the VTDEC Targeted Petroleum Compound List per EPA Method 8260M. Water quality results are summarized in Table 4, and the Laboratory Analytical Reports are included in Appendix A. The August 2015 data were used to generate the Total Targeted VOC Map presented as Figure 2.

Monitoring wells MW-1, MW-3, MW-10, MW-11, MW-14, and AH-1 reported several VOCs above their respective Vermont Groundwater Enforcement Standards (VGES). The highest total VOC concentration was reported in MW-14 at 11,880 parts per billion (ppb). This is an increase when compared to water quality for recent years, and the highest VOC concentration reported in MW-14 since 2005. However, free product was detected in this in 2011. Monitoring wells MW-2, MW-7, MW-8, MW-12, and MW-15 did not report VOCs above laboratory detection limits.

Charts 1 through 6 display historic groundwater elevations and total VOC concentrations for monitoring wells MW-1, MW-3, MW-9, MW-10, MW-11, and MW-14 since 2002. All six charts indicate VOC concentrations fluctuate with the rise and fall of groundwater elevations. MW-1, MW-3, MW-9, MW-10, and MW-11 display a direct relationship between groundwater elevations and contaminant concentrations. MW-14 displays a general direct relationship between these same two parameters, which is a common trend in downgradient and cross-gradient monitoring wells.

The dissolved phase contaminant plume is centered on source area monitoring well MW-3. The observed fluctuations in contaminant concentrations appear to be influenced by seasonal fluctuations in groundwater elevations. The contaminant plume is relatively stable in terms of its shape and orientation given it has remained relatively unchanged for the last ten years. However, contaminant degradation appears to be slow to non-existent across the Site. Furthermore, the significant dissolve phase VOC concentration increase reported in monitoring well MW-14 indicates possible lateral migration away from of the source area.

2.5 Vapor Intrusion Assessment

Based on guidance in the VTDEC Investigation and Remediation of Contaminated Properties Procedure (IRCPP), a vapor intrusion assessment of the onsite building and the offsite building to the north is required. This is due to free product within 30 feet of the structures.

3.0 CONCLUSIONS

Based on the results of these findings, the following conclusions are provided:

- Groundwater was calculated to flow in a south-southeast direction at an average hydraulic gradient of 2.1% (0.018 ft/ft).
- Free product was reported in monitoring well MW-9. In recent years, it has also been detected in MW-11 and MW-14.
- Moderate to high vapor phase VOCs were reported in several monitoring wells
- Monitoring wells MW-1, MW-3, MW-10, MW-11, MW-14, and AH-1 reported several VOCs above their respective VGES. MW-14 reported the highest total VOC concentration at 11,880 ppb, which may indicate lateral contaminant migration away from the source zone.
- The contaminant plume fluctuates with groundwater elevation and has been minimally impacted by monitored natural attenuation.
- Based on IRCPP guidance, building vapor intrusion assessments are required due to the presence of free product. No other threatened sensitive receptors have been identified.
- MW-4 and MW-14 road boxes were noted to be in need of repair.

4.0 RECOMMENDATIONS

Based on the above conclusions, LAG presents the following recommendations:

1. LAG recommends continuing with the annual monitoring and sampling schedule to evaluate contaminant concentrations, degradation, and migration. The next Site visit will be scheduled for August 2016.

2. Based on guidance in the IRCPP, a vapor intrusion assessment of the onsite building and offsite building to the north is required. This is due to free product within 30 feet of the structures.

3. LAG believes the poor condition of MW-4 presents a possible liability to the site and recommends properly abandoning the monitoring well. In addition, LAG recommends replacing the damaged road box in monitoring well MW-14. The proposed well maintenance work should be performed in conjunction with the 2016 annual monitoring and sampling event.

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Tables

Project: Northern Petroleum
Location: St. Johnsbury, Vermont
LAG Project # 00470

Table 1
VTDEC Site #91-1169

Liquid Level Data

August 25, 2015

Well ID	TOC Elevation	Total Well Depth	Depth to Product	Depth to Water	Product Thickness	Water Table Elevation
MW-1	100.00	10.70	-	5.58	-	**94.42**
MW-2	99.19	16.65	-	5.07	-	**94.12**
MW-3	98.66	8.60	-	5.22	-	**93.44**
MW-7	98.26	-	-	5.05	-	**93.21**
MW-8	97.73	-		4.95		**92.78**
MW-9	98.49	10.70	5.85	5.90	0.05	**92.59**
MW-10	98.58	11.80	-	4.52	-	**94.06**
MW-11	100.64	8.70	-	6.08	-	**94.56**
MW-12	103.36	12.55	-	7.95	-	**95.41**
MW-13	105.08	14.17	**DESTROYED**			
MW-14	99.40	11.10	-	3.45	-	**95.95**
MW-15	98.46	14.85		6.20		**92.26**
Sanitary Sewer	NA	NA				
Manway	NA	NA				
AH-1	104.55	11.95	-	9.93	-	**94.62**

NOTES:
TOC - Reference elevation is elevation of top of PVC well casing relative to an arbitrary datum on-site
All data measured in feet.
Dark Grey - Inaccessible

Project: Northern Petroleum
Location: St. Johnsbury, Vermont
LAG Project #00470

Table 2
VTDEC Site # 91-1169

Historic Groundwater Elevations

Data Point	TOC	11-21-07	1-17-08	2-11-08	4-1-08	9-3-08	3-5-09	8-14-09	2-10-10	8-6-10	8-4-11	4-4-12	8-16-12	8-30-13	8-15-14	8-25-15
MW-1	100.00	94.65	95.00	94.70	95.32	93.88	94.90	94.46	94.79	94.26	94.26	94.56	93.83	93.77	94.08	94.42
MW-2	99.18			94.47		94.44	94.84	94.14	94.61	94.04	93.83	94.27	93.52	93.43	93.76	94.12
MW-3	98.66	93.51	93.87			93.25	94.26	93.86	94.20	93.73	93.61	93.96	93.26	93.75	93.59	93.44
MW-7	98.26			93.46		93.43	93.63	93.29	93.56	93.26	92.98	93.29	92.75	92.76	93.01	93.21
MW-8	97.73			93.15		92.96	93.25	92.88	93.32	92.88	92.51	92.93	92.31	92.35		92.78
MW-9	98.49	92.84	93.29	93.19		94.15	93.64	92.87	93.45	92.87	92.56	92.96	92.22	92.22	92.51	FP = 0.05' 92.59
MW-10	98.58	93.62	94.18	93.93	94.43	94.08	93.98	93.89	93.98	93.78	93.65	93.86	93.33	93.31	93.58	94.06
MW-11	100.64	94.47	94.79	94.62		94.99	95.02	94.60		94.36	94.39	94.61	93.94	93.91	FP = 0.01' 94.18	94.56
MW-12	103.36			95.55		95.93	95.72	95.33	95.68	95.06	95.33	95.51	94.83	94.77	95.05	95.41
MW-13	105.08			95.18		95.53	95.40	95.03								
MW-14	99.40	93.41	92.86	92.73	94.30	93.77	94.28	93.90	94.20	93.70	FP = 0.05' 93.50	93.93	93.55	93.45	93.64	95.95
MW-15	98.46			93.03		92.56	93.14	92.53	93.18	92.64	92.01	92.65	91.89	91.94		92.26
AH-1	104.55			94.95		95.70	95.55	95.25	95.55	94.85	93.61	95.53	94.57	94.51	94.85	94.62

NOTES:
TOC - Reference elevation is elevation of top of PVC well casing compared to an arbritrary datum at the Site
Dark Gray - Inaccessible/Destroyed
FP = Free Product

Project:Northern Petroleum
Location:St. Johnsbury, Vermont
LAG# 00470

Table 3
VTDEC Site #91-1169

Photoionization Detector Readings (PID - ppm)

Data Point	1-17-08	2-11-08	4-1-08	9-3-08	3-5-09	8-14-09	2-10-10	8-6-10	8-4-11	4-4-12	8-16-12	8-30-13	8-15-14	8-25-15
MW-1	53.9	74.9	11.8	56.8	32.4	346	216	426	423	141	479	246	316	43
MW-2		0.0		0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MW-3	31.3			171	2.7	447	596	672	440	416	0.0	0.0	1.7	107.0
MW-7		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MW-8		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
MW-9	6.0	10	12	0.0	0.0	0.0	261	0.0	333	411	416	24.5	186	229
MW-10	0.0	0.0	0.2	0.0	0.0	0.0	0.0	41.6	0.0	0.0	0.0	9.8	0.0	0.0
MW-11	23.4	15.8	15.8	147	0.0	215		165	208	123	235	283	213	325
MW-12		0.0		296	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0
MW-13		0.0		0.0	0.0	0.0								
MW-14	115	150.1	117	427	89.5	238	241	326	225	183	346	93.3	261	245
MW-15		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Sanitary Sewer		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manway		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AH-1		0.0		102	0.0	123	124	77.9	90.5	101	117	69.5	37.5	68.7

NOTES:
Shadded Gray - Wells Not Assayed
BG - Background
SL - Saturated Lamp
* - PID measurements taken with system off
Dark Gray - Inaccessible

Project: Northern Petroleum
Location: St. Johnsbury, VT
LAG Project #00470

Table 4
VTDEC Site # 91-1169

Groundwater Quality Results (ppb)

Data Point	Compound	*VGES	2-12-08	9-3-08	3-5-09	8-14-09	2-10-10	8-6-10	8-4-11	4-4-12	8-16-12	8-30-13	8-15-14	8-25-15
MW-1	Benzene	5	300	220	260	320	330	400	310	530	450	210	750	380
	Toluene	1,000	23	36	27	30	24	24	43	36	26	31	25	20
	Ethylbenzene	700	150	59	100	67	120	61	150	250	96	260	230	110
	Xylenes	10,000	1,900	810	1,100	730	1,600	1,200	1,600	2,400	1,200	1,800	1,800	780
	Total BTEX		2,373	1,125	1,487	1,147	2,074	1,685	2,103	3,216	1,772	2,301	2,805	1,290
	1,3,5-Trimethylbenzene	350	220	<10	<4	<10	11	<10	370	650	450	210	270	94
	1,2,4-Trimethylbenzene		510	<10	210	230	730	390	180	310	230	490	610	190
	Naphthalene	20	120	<5	55	150	250	200	<125	150	160	<125	140	<50
	MTBE	40	<25	<5	<10	<25	<10	<25	<125	<125	<125	<125	<125	<50
	Total Targeted VOCs		3,223	1,125	1,752	1,527	3,065	2,275	2,653	4,326	2,612	3,001	3,825	1,574
MW-2	Benzene	5	<1	<1	<1	<1	<1	<1	<1	2.3	<1	<1	<1	<1
	Toluene	1,000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Ethylbenzene	700	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Xylenes	10,000	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
	Total BTEX		BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	2.3	BQL/ND	BQL/ND	BQL/ND	BQL/ND
	1,3,5-Trimethylbenzene	350	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	1,2,4-Trimethylbenzene		<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	Naphthalene	20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	MTBE	40	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	Total Targeted VOCs		BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	2.3	BQL/ND	BQL/ND	BQL/ND	BQL/ND
MW-3	Benzene	5		450	12,000	680	9,100	4,000	84	4,700	250	5,000	22,000	480
	Toluene	1,000		92	8,300	530	3,800	1,500	<100	1,300	<5	620	8,200	26
	Ethylbenzene	700		6.9	1,000	11	350	150	<100	170	14	430	1500	21
	Xylenes	10,000		74	8,200	3,000	4,200	3,200	112	4,300	21	1,900	7,700	110
	Total BTEX			623	29,500	4,221	17,450	8,850	196	10,470	285	7,950	39,400	637
	1,3,5-Trimethylbenzene	350		<10	<100	<10	20	<100	40	620	23	22	<200	<20
	1,2,4-Trimethylbenzene			<10	300	470	530	420	<200	210	<10	140	820	27
	Naphthalene	20		<5	<250	47	390	380	<500	50	<25	53	<500	<50
	MTBE	40		67	580	85	400	310	<500	46	<25	260	2000	<50
	Total Targeted VOCs			690	30,380	4,823	18,790	9,960	236	11,396	308	8,425	42,220	664
MW-7	Benzene	5		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Toluene	1,000		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Ethylbenzene	700		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Xylenes	10,000		<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
	Total BTEX			BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND
	1,3,5-Trimethylbenzene	350		<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	1,2,4-Trimethylbenzene			<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	Naphthalene	20		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	MTBE	40		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	Total Targeted VOCs			BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND
MW-8	Benzene	5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1
	Toluene	1,000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1
	Ethylbenzene	700	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1
	Xylenes	10,000	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3		<3
	Total BTEX		BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	NS	BQL/ND
	1,3,5-Trimethylbenzene	350	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2		<2
	1,2,4-Trimethylbenzene		<2	<2	<2	<2	<2	<2	<2	<2	<2	<2		<2
	Naphthalene	20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5
	MTBE	40	83	51	52	5.8	59	6.6	19	30	14	<5		<5
	Total Targeted VOCs		83	51	52	5.8	59	6.6	19	30	14	BQL/ND	NS	BQL/ND

NOTES:
BQL/ND - Below Quantitation LimitNon-Detect
Dark grey cell - Inaccessible
Light grey cell - Constituent exceeds VT Groundwater Enforcement Standard (VGES)

Project: Northern Petroleum
Location: St. Johnsbury, VT
LAG Project #00470

Table 4
VTDEC Site # 91-1169

Groundwater Quality Results (ppb)

Data Point	Compound	*VGES	2-12-08	9-3-08	3-5-09	8-14-09	2-10-10	8-6-10	8-4-11	4-4-12	8-16-12	8-30-13	8-15-14	8-25-15
MW-9	Benzene	5	680	1,900	1,900	2,200	2,600	140	4,000	4,800	3,500	990	550	Free Product
	Toluene	1,000	<20	48	52	29	110	4	97	99	71	43	34	
	Ethylbenzene	700	48	270	310	130	570	68	1,100	1,300	890	210	1,300	
	Xylenes	10,000	150	770	1,500	86	2,200	180	3,000	3,100	1,800	630	4,800	
	Total BTEX		878	2,988	3,762	2,445	5,480	392	8,197	9,299	6,261	1,873	6,684	
	1,3,5-Trimethylbenzene	350	<40	17	<40	<40	53	3.7	1400	1600	1400	130	660	
	1,2,4-Trimethylbenzene		67	100	180	97	970	77	350	350	310	530	3000	
	Naphthalene	20	<100	<5	200	<100	370	11	390	300	370	<125	690	
	MTBE	40	140	170	<100	<100	190	7.5	150	170	200	<125	<125	
	Total Targeted VOCs		1,085	3,275	4,142	2,542	7,063	491	10,487	11,719	8,541	2,533	11,034	NS
MW-10	Benzene	5	78	280	21	310	38	31	79	96	68	15	<25	<10
	Toluene	1,000	780	9,300	280	5,900	240	580	4,500	730	2,200	150	330	100
	Ethylbenzene	700	130	1,500	46	1,300	210	400	1,600	1,300	1,200	360	1,100	790
	Xylenes	10,000	1,800	6,900	1,100	5,700	2,400	1,600	6,900	4,100	4,600	1,200	3,600	3,100
	Total BTEX		2,788	17,980	1,447	13,210	2,888	2,611	13,079	6,226	8,068	1,725	5,030	3,990
	1,3,5-Trimethylbenzene	350	79	46	<10	49	<20	21	1,400	1,200	1,300	32	140	230
	1,2,4-Trimethylbenzene		290	260	79	970	580	470	330	<100	210	360	1,200	900
	Naphthalene	20	370	<5	<25	300	330	180	340	<250	340	84	260	230
	MTBE	40	<125	<5	<25	<25	<50	<25	<250	<250	<125	<25	<125	<50
	Total Targeted VOCs		3,527	18,286	1,526	14,529	3,798	3,282	15,149	7,426	9,918	2,201	6,630	5,350
MW-11	Benzene	5	13	23	11	9.3		3.4	<5	10	<5	5.1	7.6	7
	Toluene	1,000	<2	<16	<2	6.6		4.8	<5	<5	<5	<5	<5	<5
	Ethylbenzene	700	42	97	56	48		140	6.1	85	270	310	78	42
	Xylenes	10,000	440	860	440	430		590	140	710	1,300	1,400	540	400
	Total BTEX		495	996	507	494	0	738	146	805	1,570	1,715	626	449
	1,3,5-Trimethylbenzene	350	85	<4	<4	<4		9.8	79	430	640	190	130	110
	1,2,4-Trimethylbenzene		180	110	85	180		320	77	180	230	590	350	260
	Naphthalene	20	110	<5	77	270		220	26	210	430	340	120	83
	MTBE	40	<10	<5	<10	<10		<5	<25	<25	<25	<25	<25	<25
	Total Targeted VOCs		870	1,106	669	944	0	1,288	328	1,625	2,870	2,835	1,226	902
MW-12	Benzene	5	<1	<1	<1	<1	<1	<1	<1	<1	<1	5.6	<1	<1
	Toluene	1,000	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.5	<1	<1
	Ethylbenzene	700	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.0	<1	<1
	Xylenes	10,000	<3	<3	<3	<3	<3	<3	<3	<3	<3	4.0	<3	<3
	Total BTEX		BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	12.1	BQL/ND	BQL/ND
	1,3,5-Trimethylbenzene	350	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	1,2,4-Trimethylbenzene		<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	Naphthalene	20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	MTBE	40	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	Total Targeted VOCs		BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	BQL/ND	12.1	BQL/ND	BQL/ND
MW-13	Benzene	5	<1	<1	<1	<1								
	Toluene	1,000	<1	<1	<1	<1								
	Ethylbenzene	700	<1	<1	<1	<1								
	Xylenes	10,000	<3	<3	<3	<3								
	Total BTEX		BQL/ND	BQL/ND	BQL/ND	BQL/ND								
	1,3,5-Trimethylbenzene	350	<2	<2	<2	<2								
	1,2,4-Trimethylbenzene		<2	<2	<2	<2								
	Naphthalene	20	<5	<5	<5	<5								
	MTBE	40	<5	<5	<5	<5								
	Total Targeted VOCs		BQL/ND	BQL/ND	BQL/ND	BQL/ND								

NOTES:
BQL/ND - Below Quantitation LimitNon-Detect
Dark grey cell - Inaccessible
Light grey cell - Constituent exceeds VT Groundwater Enforcement Standard (VGES)

Groundwater Quality Results (ppb)

Data Point	Compound	*VGES	2-12-08	9-3-08	3-5-09	8-14-09	2-10-10	8-6-10	8-4-11	4-4-12	8-16-12	8-30-13	8-15-14	8-25-15
MW-14	Benzene	**5**	1,200	1,400	2,100	2,200	1,500	1,200	Free Product	1,800	760	2,800	1,900	170
	Toluene	**1,000**	340	470	400	150	120	87		76	21	100	65	<100
	Ethylbenzene	**700**	150	200	330	98	310	150		240	37	430	110	160
	Xylenes	**10,000**	3,000	3,900	3,600	3,100	3,400	2,800		3,600	830	2,500	2,800	4,700
	Total BTEX		4,690	5,970	6,430	5,548	5,330	4,237		5,716	1,648	5,830	4,875	5,030
	1,3,5-Trimethylbenzene	**350**	160	<20	22	<20	44	<20		1300	630	160	220	1600
	1,2,4-Trimethylbenzene		680	<20	300	830	1,300	980		300	87	600	1,000	4,600
	Naphthalene	**20**	76	<5	120	250	120	130		240	63	140	120	650
	MTBE	**40**	120	190	210	280	150	220		170	280	250	260	<500
	Total Targeted VOCs		5,726	6,160	7,082	6,908	6,944	5,567	NS	7,726	2,708	6,980	6,475	11,880
MW-15	Benzene	**5**	<1	<1	6.4	<1	<1	<1	<1	190	<1	72		<1
	Toluene	**1,000**	<1	<1	<1	<1	<1	<1	<1	<1	<1	1		<1
	Ethylbenzene	**700**	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1
	Xylenes	**10,000**	<3	<3	<3	<3	<3	<3	<3	<3	<3	13		<3
	Total BTEX		BQL/ND	BQL/ND	6.4	BQL/ND	BQL/ND	BQL/ND	BQL/ND	190	BQL/ND	86	NS	BQL/ND
	1,3,5-Trimethylbenzene	**350**	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2		<2
	1,2,4-Trimethylbenzene		<2	<2	<2	<2	<2	<2	<2	<2	<2	6.8		<2
	Naphthalene	**20**	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5
	MTBE	**40**	20	31	10	17	6.1	6.3	20	40	6.3	16		<5
	Total Targeted VOCs		20	31	16.4	17	6.1	6.3	20	230	6.3	108.8	NS	BQL/ND
AH-1	Benzene	**5**	62	49	49	45	34	28	19	12	5.9	<5	<5	<5
	Toluene	**1,000**	8.4	19	<10	8.3	13	14	14	6.7	<5	<5	<5	<5
	Ethylbenzene	**700**	260	430	420	310	420	290	600	350	140	140	350	390
	Xylenes	**10,000**	2,000	2,000	2,100	870	1,800	840	1,900	2,100	730	580	1,200	1,600
	Total BTEX		2,330	2,498	2,569	1,233	2,267	1,172	2,533	2,469	876	720	1,550	1,990
	1,3,5-Trimethylbenzene	**350**	250	18	22	16	27	20	1,200	1,100	910	180	230	280
	1,2,4-Trimethylbenzene		960	280	340	720	940	800	350	260	300	490	860	880
	Naphthalene	**20**	370	<5	450	<25	490	670	520	400	440	320	230	280
	MTBE	**40**	<25	<5	<50	<25	<258	<25	<50	<5	<25	<25	<25	<25
	Total Targeted VOCs		3,910	2,796	3,381	1,969	3,724	2,662	4,603	4,229	2,526	1,710	2,870	3,430

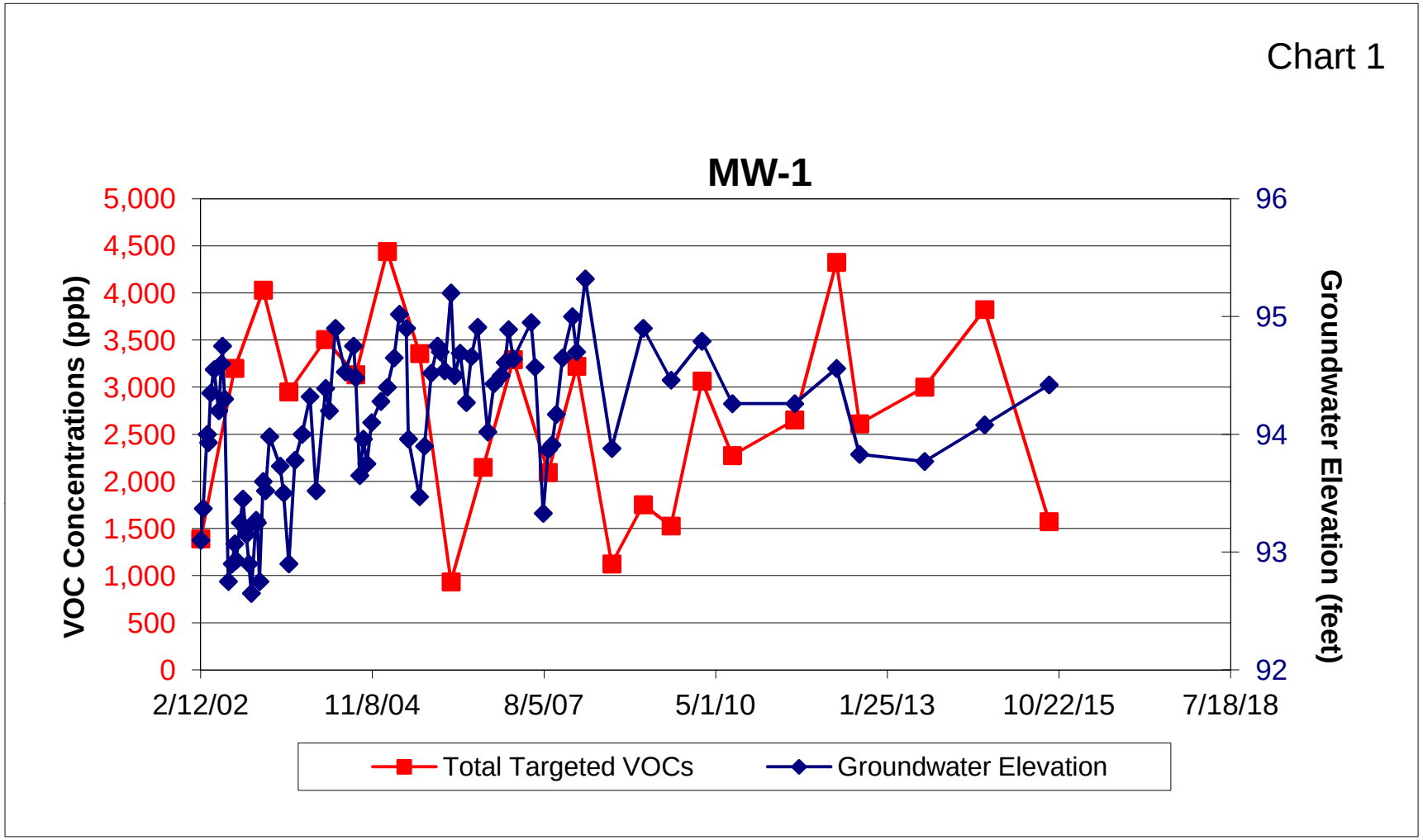
NOTES:
BQL/ND - Below Quantitation LimitNon-Detect
Dark grey cell - Inaccessible
Light grey cell - Constituent exceeds VT Groundwater Enforcement Standard (VGES)

Charts

Project: Northern Petroleum
Location: St. Johnsbury, VT

VTDEC Site # 91-1169
LAG Project # 00470

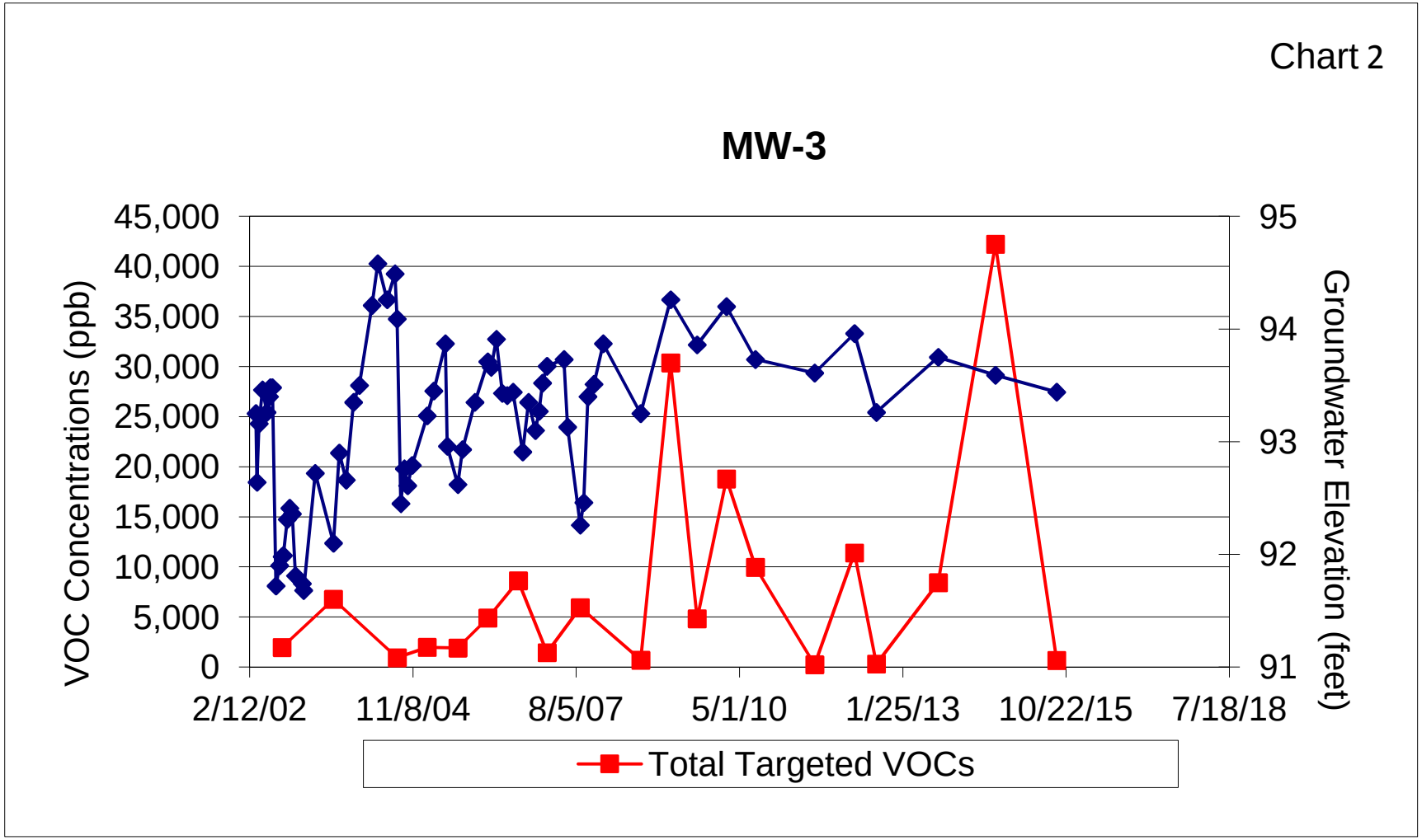
Groundwater Elevations vs. Total VOCs from 2002-Present



Project: Northern Petroleum
Location: St. Johnsbury, VT

VTDEC Site # 91-1169
LAG Project # 00470

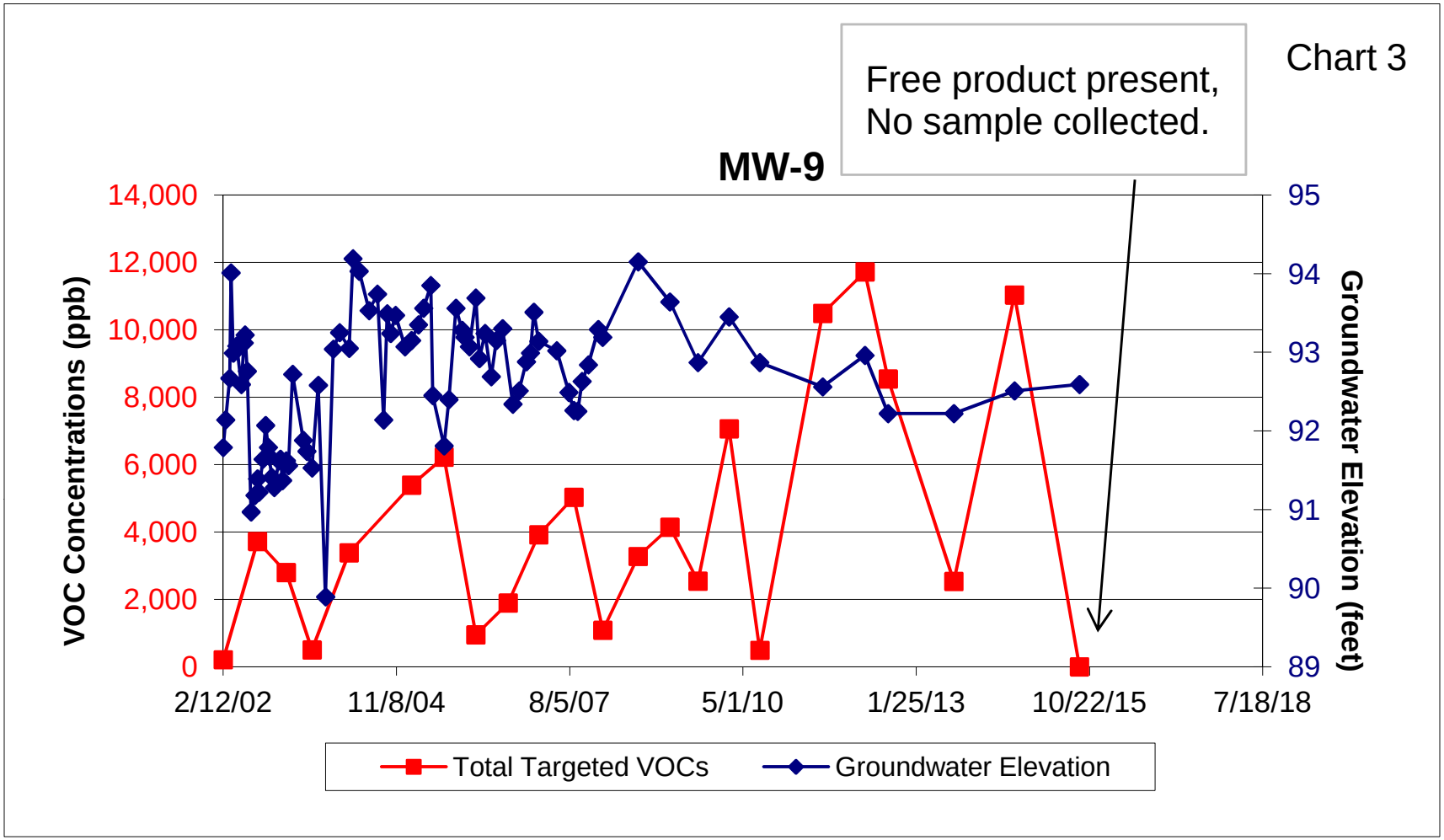
Groundwater Elevations vs. Total VOCs from 2002-Present



Project: Northern Petroleum
Location: St. Johnsbury, VT

VTDEC Site # 91-1169
LAG Project # 00470

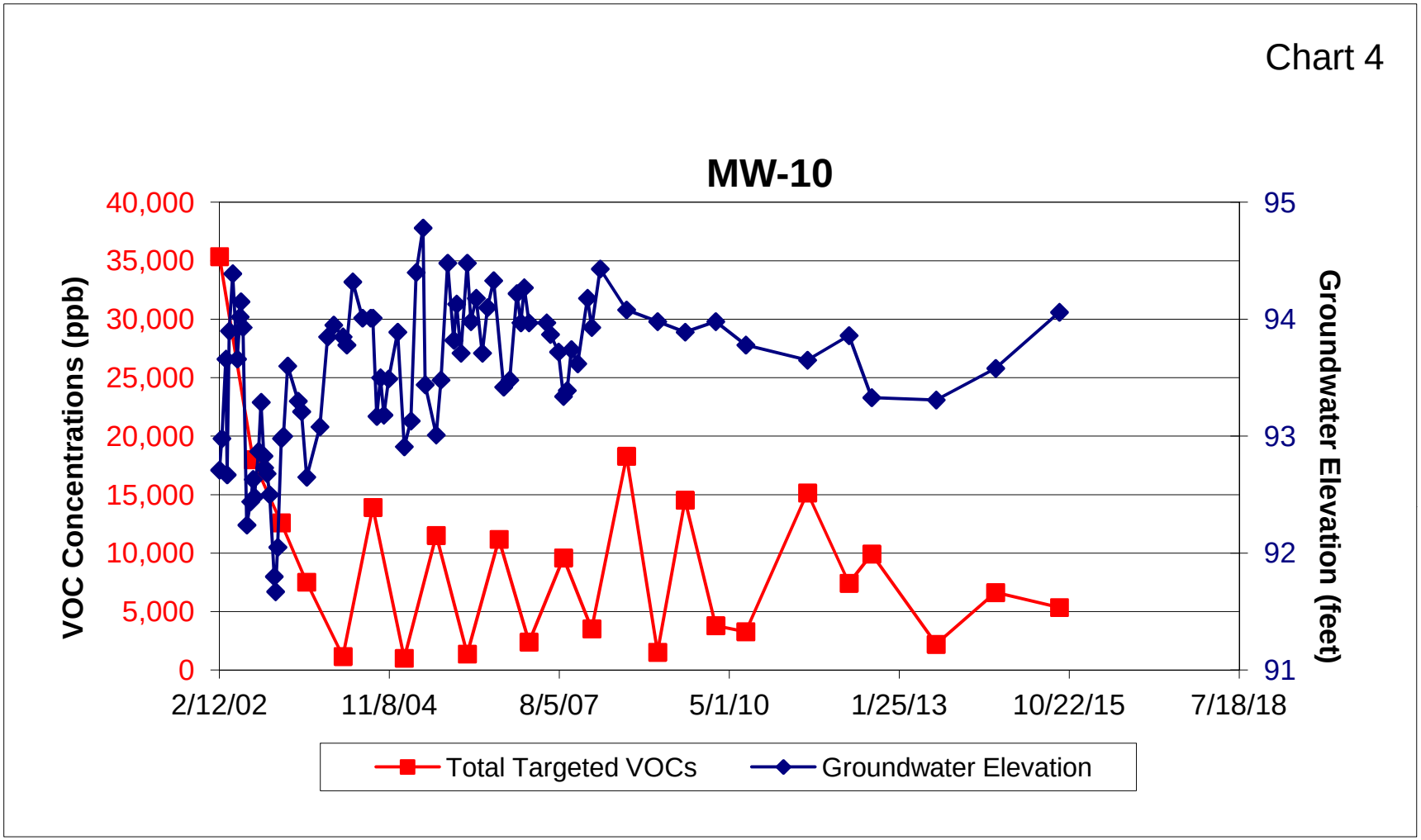
Groundwater Elevations vs. Total VOCs from 2002-Present



Project: Northern Petroleum
Location: St. Johnsbury, VT

VTDEC Site # 91-1169
LAG Project # 00470

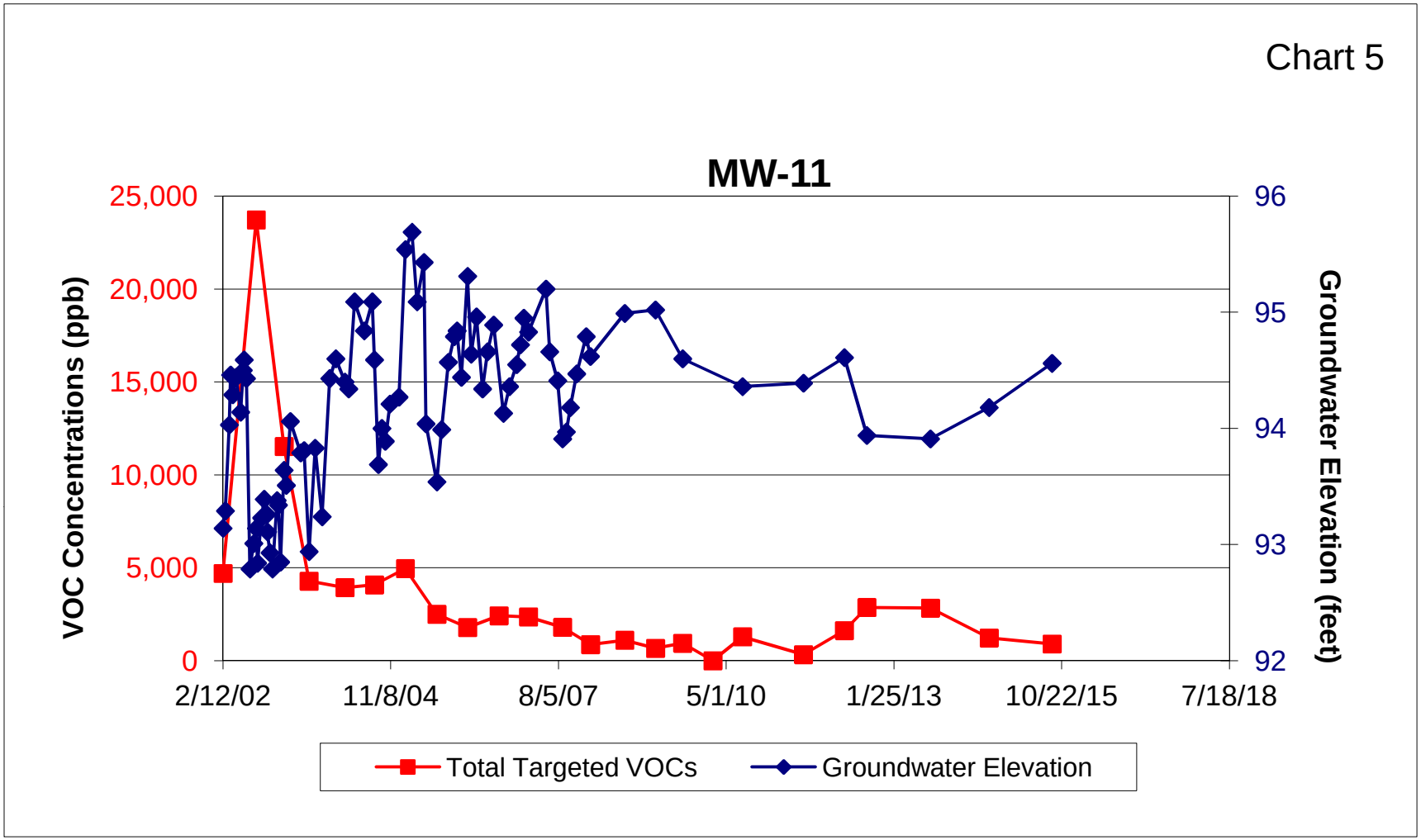
Groundwater Elevations vs. Total VOCs from 2002-Present



Project: Northern Petroleum
Location: St. Johnsbury, VT

VTDEC Site # 91-1169
LAG Project # 00470

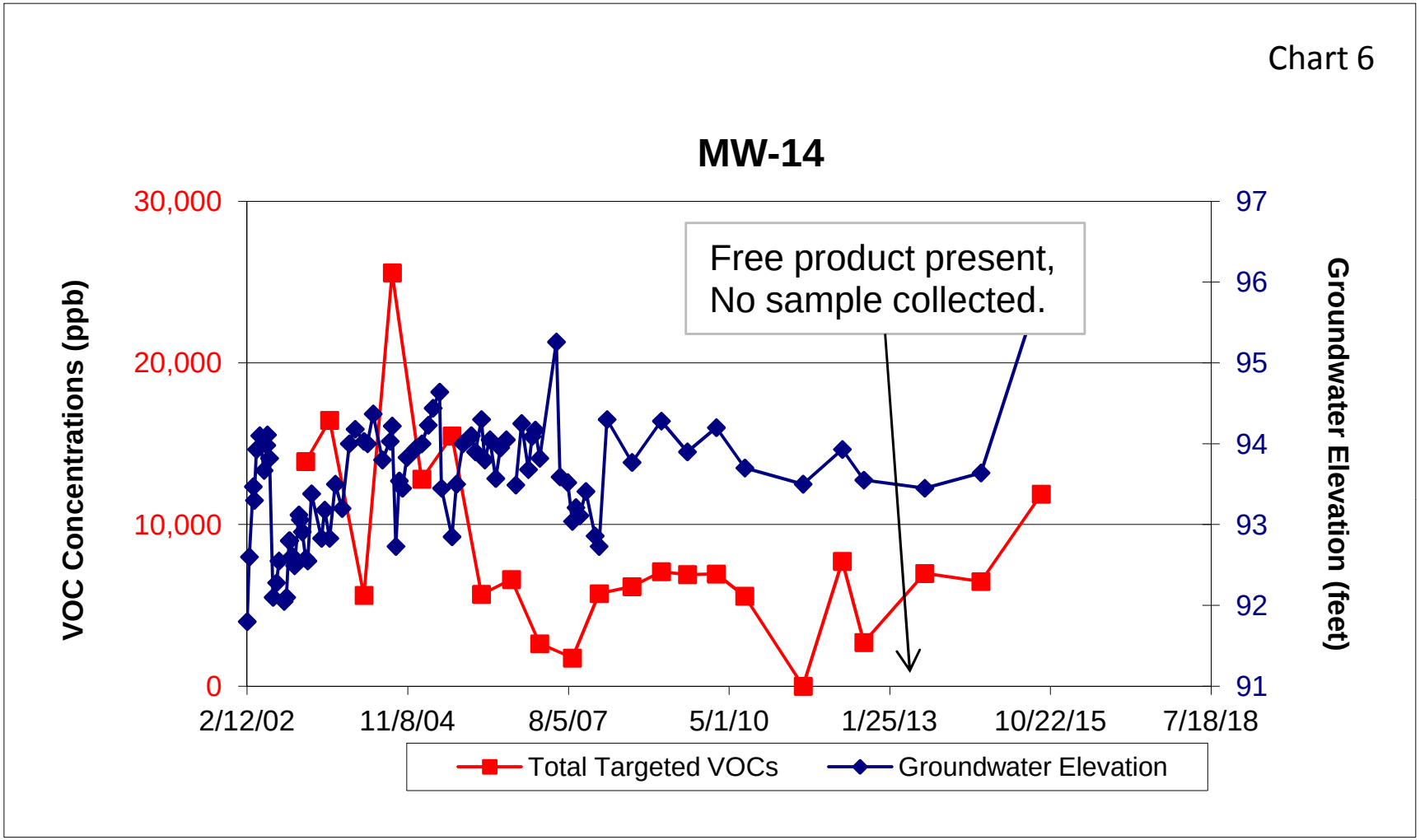
Groundwater Elevations vs. Total VOCs from 2002-Present



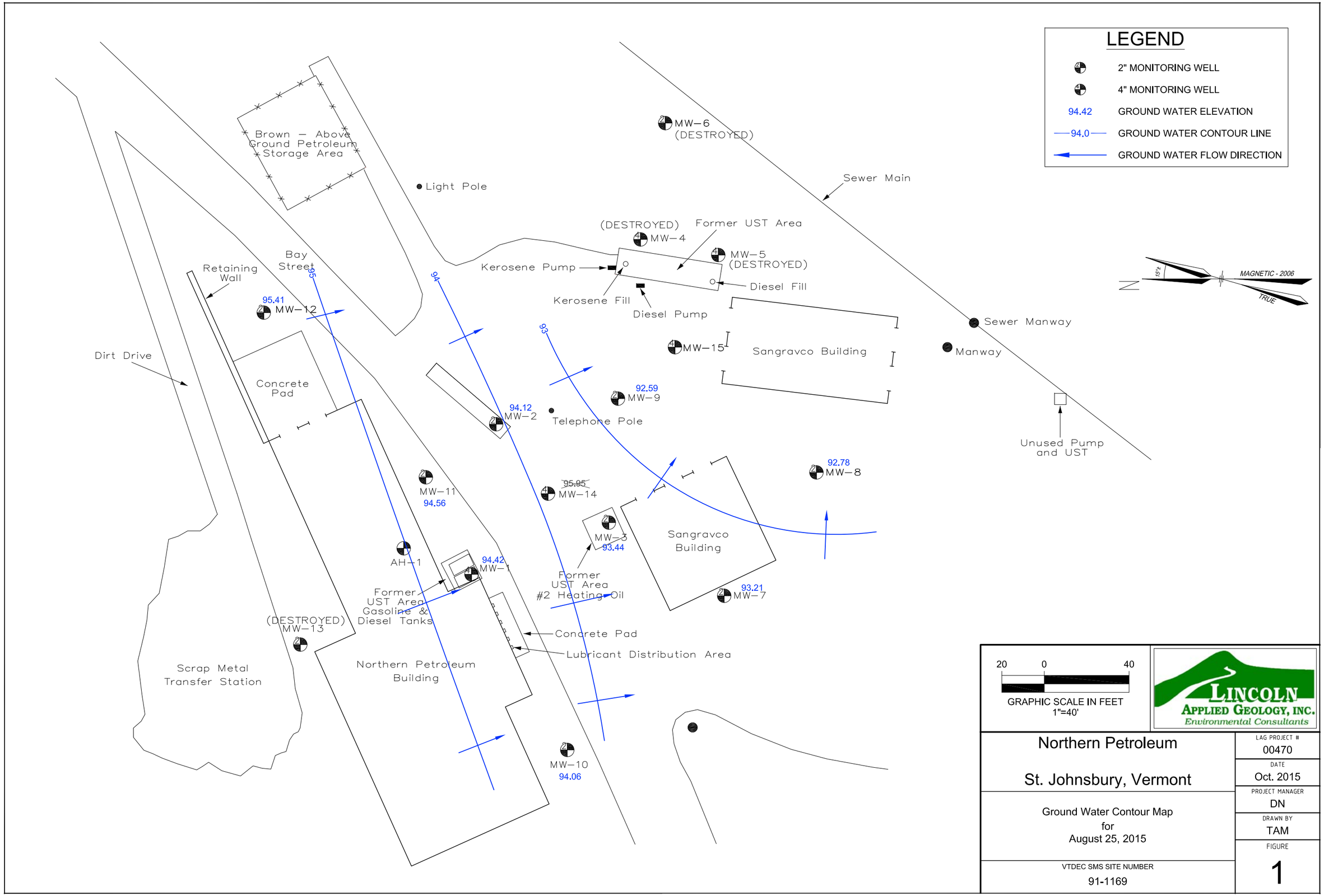
Project: Northern Petroleum
Location: St. Johnsbury, VT

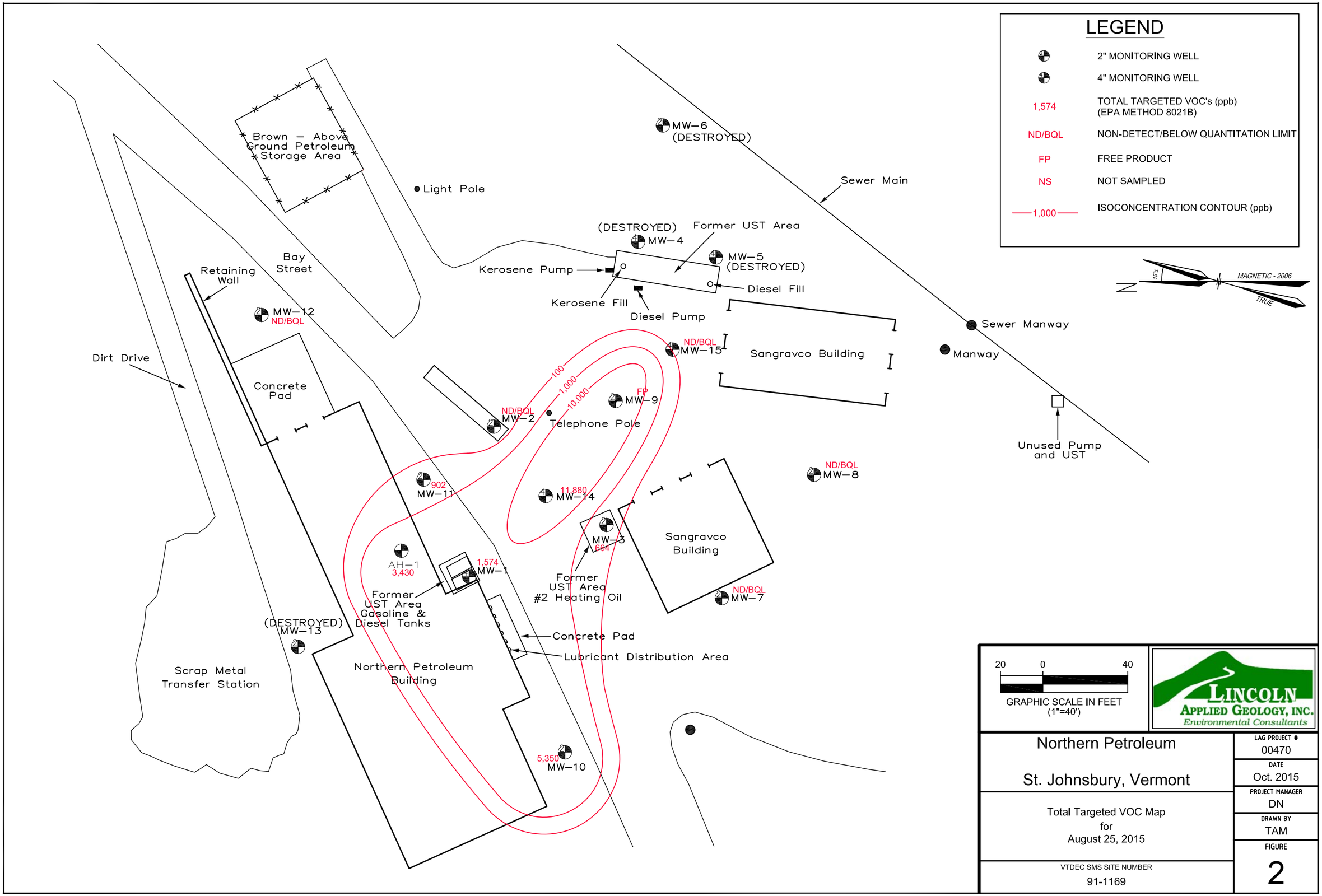
VTDEC Site # 91-1169
LAG Project # 00470

Groundwater Elevations vs. Total VOCs from 2002-Present



Figures


LEGEND
2" MONITORING WELL
4" MONITORING WELL
94.42 GROUND WATER ELEVATION
94.0 GROUND WATER CONTOUR LINE
GROUND WATER FLOW DIRECTION
Brown – Above Ground Petroleum Storage Area
Light Pole
MW-6 (DESTROYED)
Sewer Main
(DESTROYED) MW-4
Former UST Area
MW-5 (DESTROYED)
Kerosene Pump
Kerosene Fill
Diesel Pump
Diesel Fill
Bay Street
Retaining Wall
95.41 MW-12
Dirt Drive
Concrete Pad
MW-15
Sangravco Building
Sewer Manway
Manway
92.59 MW-9
94.12 MW-2
Telephone Pole
Unused Pump and UST
92.78 MW-8
MW-11 94.56
95.95 MW-14
MW-3 93.44
Sangravco Building
AH-1
94.42 MW-1
Former UST Area #2 Heating Oil
93.21 MW-7
Former UST Area Gasoline & Diesel Tanks
(DESTROYED) MW-13
Concrete Pad
Lubricant Distribution Area
Scrap Metal Transfer Station
Northern Petroleum Building
MW-10 94.06
95
94
93
MAGNETIC - 2006
TRUE
15°±
20 0 40
GRAPHIC SCALE IN FEET
1"=40'
LINCOLN APPLIED GEOLOGY, INC.
Environmental Consultants
Northern Petroleum
St. Johnsbury, Vermont
Ground Water Contour Map
for
August 25, 2015
VTDEC SMS SITE NUMBER
91-1169
LAG PROJECT #
00470
DATE
Oct. 2015
PROJECT MANAGER
DN
DRAWN BY
TAM
FIGURE
1


LEGEND
2" MONITORING WELL
4" MONITORING WELL
1,574 TOTAL TARGETED VOC's (ppb) (EPA METHOD 8021B)
ND/BQL NON-DETECT/BELOW QUANTITATION LIMIT
FP FREE PRODUCT
NS NOT SAMPLED
1,000 ISOCONCENTRATION CONTOUR (ppb)
MAGNETIC - 2006
TRUE
15.5°
Brown – Above Ground Petroleum Storage Area
Light Pole
MW–6 (DESTROYED)
Sewer Main
(DESTROYED) MW–4
Former UST Area
MW–5 (DESTROYED)
Kerosene Pump
Kerosene Fill
Diesel Pump
Diesel Fill
Bay Street
Retaining Wall
MW–12 ND/BQL
Dirt Drive
Concrete Pad
ND/BQL MW–15
Sangravco Building
Sewer Manway
Manway
FP MW–9
ND/BQL MW–2
Telephone Pole
100
1,000
10,000
Unused Pump and UST
ND/BQL MW–8
902 MW–11
11,880 MW–14
MW–3 564
Sangravco Building
AH–1 3,430
1,574 MW–1
Former UST Area #2 Heating Oil
ND/BQL MW–7
Former UST Area Gasoline & Diesel Tanks
(DESTROYED) MW–13
Concrete Pad
Lubricant Distribution Area
Scrap Metal Transfer Station
Northern Petroleum Building
5,350 MW–10
20 0 40
GRAPHIC SCALE IN FEET (1"=40')
LINCOLN APPLIED GEOLOGY, INC.
Environmental Consultants
Northern Petroleum
St. Johnsbury, Vermont
Total Targeted VOC Map for August 25, 2015
VTDEC SMS SITE NUMBER
91-1169
LAG PROJECT #
00470
DATE
Oct. 2015
PROJECT MANAGER
DN
DRAWN BY
TAM
FIGURE
2

Appendix A

Laboratory Analytical Reports
August 25, 2015

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

CLIENT NAME:	Lincoln Applied Geology	GML REFERENCE N0.:	965E
ADDRESS:	163 Revell Drive	PROJECT NO.:	0 0470
	Lincoln, VT 05443	DATE OF SAMPLE:	8/25/2015
SAMPLE LOCATION:	Northern Petroleum St. J	DATE OF RECEIPT:	8/25/2015
SAMPLER:	Conrad Zeller	DATE OF ANALYSIS:	9/10/2015
ATTENTION:	Devon Neary	DATE OF REPORT:	9/21/2015

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. The trip blank was prepared by the client with reagent water supplied by the laboratory.
- 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 efficiency of analyte recovery for individual samples was monitored by the addition of surrogate analyte to all samples, standards, and blanks. Surrogate recoveries were found to be within laboratory QA/QC acceptance limits, unless noted otherwise.

Reviewed by:

Raul Sanchez
Chemical Services

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	957E
SAMPLE ID:	TRIP BLANK
ANALYSIS DATE:	9/9/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	5	ND
Benzene	1	ND
Toluene	1	ND
Ethylbenzene	1	ND
Xylenes	3	ND
1,3,5-trimethylbenzene	2	ND
1,2,4-Trimethylbenzene	2	ND
Naphthalene	5	ND

Surrogate % Recovery: 104%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	957E
SAMPLE ID:	MW-7
ANALYSIS DATE:	9/9/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	5	ND
Benzene	1	ND
Toluene	1	ND
Ethylbenzene	1	ND
Xylenes	3	ND
1,3,5-trimethylbenzene	2	ND
1,2,4-Trimethylbenzene	2	ND
Naphthalene	5	ND

Surrogate % Recovery: 102%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	957E
SAMPLE ID:	MW-8
ANALYSIS DATE:	9/9/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	5	ND
Benzene	1	ND
Toluene	1	ND
Ethylbenzene	1	ND
Xylenes	3	ND
1,3,5-trimethylbenzene	2	ND
1,2,4-Trimethylbenzene	2	ND
Naphthalene	5	ND

Surrogate % Recovery: 101%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	957E
SAMPLE ID:	MW-15
ANALYSIS DATE:	9/9/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	5	ND
Benzene	1	BPQL
Toluene	1	ND
Ethylbenzene	1	ND
Xylenes	3	ND
1,3,5-trimethylbenzene	2	ND
1,2,4-Trimethylbenzene	2	ND
Naphthalene	5	ND

Surrogate % Recovery: 101%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	957E
SAMPLE ID:	MW-2
ANALYSIS DATE:	9/9/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	5	ND
Benzene	1	ND
Toluene	1	ND
Ethylbenzene	1	ND
Xylenes	3	ND
1,3,5-trimethylbenzene	2	ND
1,2,4-Trimethylbenzene	2	ND
Naphthalene	5	ND

Surrogate % Recovery: 100%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	957E
SAMPLE ID:	MW-12
ANALYSIS DATE:	9/9/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	5	ND
Benzene	1	ND
Toluene	1	ND
Ethylbenzene	1	ND
Xylenes	3	ND
1,3,5-trimethylbenzene	2	ND
1,2,4-Trimethylbenzene	2	ND
Naphthalene	5	ND

Surrogate % Recovery: 100%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	957E
SAMPLE ID:	MW-11
ANALYSIS DATE:	9/9/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	25	ND
Benzene	5	7
Toluene	5	ND
Ethylbenzene	5	42
Xylenes	15	400
1,3,5-trimethylbenzene	10	110
1,2,4-Trimethylbenzene	10	260
Naphthalene	25	83

Surrogate % Recovery: 103%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	957E
SAMPLE ID:	MW-1
ANALYSIS DATE:	9/9/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	50	ND
Benzene	10	380
Toluene	10	20
Ethylbenzene	10	110
Xylenes	30	780
1,3,5-trimethylbenzene	20	94
1,2,4-Trimethylbenzene	20	190
Naphthalene	50	BPQL

Surrogate % Recovery: 102%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	957E
SAMPLE ID:	AH-1
ANALYSIS DATE:	9/9/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	25	ND
Benzene	5	ND
Toluene	5	BPQL
Ethylbenzene	5	390
Xylenes	15	1600
1,3,5-trimethylbenzene	10	280
1,2,4-Trimethylbenzene	10	880
Naphthalene	25	280

Surrogate % Recovery: 103%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	967E
SAMPLE ID:	MW-10
ANALYSIS DATE:	9/10/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	500	ND
Benzene	100	170
Toluene	100	ND
Ethylbenzene	100	160
Xylenes	300	4700
1,3,5-trimethylbenzene	200	1600
1,2,4-Trimethylbenzene	200	4600
Naphthalene	500	650

Surrogate % Recovery: 102%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	967E
SAMPLE ID:	MW-10
ANALYSIS DATE:	9/9/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	50	ND
Benzene	10	ND
Toluene	10	100
Ethylbenzene	10	790
Xylenes	30	3100
1,3,5-trimethylbenzene	20	230
1,2,4-Trimethylbenzene	20	900
Naphthalene	50	230

Surrogate % Recovery: 103%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

GREEN MOUNTAIN LABORATORIES, INC.

2 Moonlight Terrace
Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	957E
SAMPLE ID:	MW-3
ANALYSIS DATE:	9/10/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	50	BPQL
Benzene	10	480
Toluene	10	26
Ethylbenzene	10	21
Xylenes	30	110
1,3,5-trimethylbenzene	20	ND
1,2,4-Trimethylbenzene	20	27
Naphthalene	50	ND

Surrogate % Recovery: 103%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

GREEN MOUNTAIN LABORATORIES, INC.

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Montpelier, VT 05602
Phone (802) 262-2004

LABORATORY RESULTS

GC/MS METHOD - 8260M

GML REF. #	957E
SAMPLE ID:	MW-14
ANALYSIS DATE:	9/9/2015
SAMPLE TYPE:	WATER

PARAMETER	PQL (µg/L)	RESULT (µg/L)
Methl t-butyl Ether (MTBE)	50	ND
Benzene	10	ND
Toluene	10	100
Ethylbenzene	10	790
Xylenes	30	3100
1,3,5-trimethylbenzene	20	230
1,2,4-Trimethylbenzene	20	900
Naphthalene	50	230

Surrogate % Recovery: 103%

ND = Not Detected
BPQL = Below Practical Quantitation Limit

Green Mountain Laboratories, Inc.

2 Moonlight Terrace
Montpelier, Vermont 05602
Phone (802) 262-2004 Fax (802) 262-2005
www.greenmtlabs.com

GML SAMPLE #

Client Name: Lincoln Applied Geology
Address: 163 Revell Dr., Lincoln Vt. 05443
Phone / Fax (802) 453-4384 (802) 453-5399
Project Name Northern Petroleum St. 5
Project Number 00470
Project Manager Devon Neary
Sampler Conrad Zeller

Analysis Requested: 8260B

Page 1 of 1

GML # #957E

#	Sample Location	Date	Time	# of Cont.	Pres.	Sample Type	Remarks
1	Trip Blank	8/25/15	0600	2	HCl	H2O	
2	MW-7		1100				
3	MW-8		1105				
4	MW-15		1110				
5	MW-2		1115				
6	MW-12		1120				
7	MW-11		1125				
8	MW-1		1130				
9	AH-1		1135				
10	MW-14		1140				
11	MW-10		1145				
~~12~~	~~MW-9~~		~~1150~~				
13	MW-3		1155				
~~14~~	~~MW-4~~		~~1200~~				

DMS

☒ Digital Copy Requested

Chain of Custody

Relinquished By:	Date/Time: 8/25/15	Received By: L Shutlee	Date/Time: 8-25-15
Relinquished By:	Date/Time: 1411	Received By:	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Temperature Blank:	Vial Lot ID #:		Date/Time: 200