Applied GeoSolutions, LLC

Remediation Hydrogeology Geophysics

INITIAL SITE INVESTIGATION REPORT

Former Cafori's Market
VT Route 100
Waterbury, Vermont
(SMS #98-2502)

Latitude: 044° 20′ 59.32″ N
Longitude: 072° 44′ 33.49″ W

July 23, 2009

Prepared for:

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EXECUTIVE SUMMARY

Applied GeoSolutions, LLC (AGS) was retained by Mr. Wai Cha Wan to complete an Initial Site Investigation (ISI) at Former Caforia's Market, located on Vermont Route 100 in Waterbury, Vermont (Site or Property). The purpose of the ISI was to further characterize the impact of apparent gasoline contamination identified during the removal of two (2) 3,000-gallon, gasoline underground storage tanks (USTs) at the Site in 1998.

The Property is located in a mixed commercial and residential setting on the east side of VT Route 100, in Waterbury, Vermont (about ¾ miles north of the Interstate 89). The Site is bound by VT Route 100 to the west, Laurel Road to the north, Thatcher Brook to the east, and a residential property to the south. One two-story building, with a footprint of about 3,900 square feet (ft^2), is located on the Property. The northern portion of the building formerly functioned as a market (on the first floor), and is currently being renovated for future use as a restaurant; a residential apartment is located on the second story.

The ISI concluded that gasoline was released to the subsurface at the Site in the vicinity of former UST #1. The release(s) likely occurred via surface spills and/or leakage associated with the former fuel dispensing appurtenances. The volume of the release(s) is unknown. The petroleum release has impacted soil, ground water, and surface water. Gasoline constituents are known to be present in the vapor, sorbed, and dissolved phases. No measureable free-phase non aqueous phase liquid (NAPL) was detected in any of the Site monitoring wells; however, heavy sheening was observed in several soil borings, suggesting residual NAPL may also be present.

The magnitude and extent of gasoline-related impact to soil and ground water appears to be reasonably defined. The area of soil with photoionization (PID) readings greater than 1,000 parts per million volume (ppmv) is estimated at about 3,500 ft^2, and extends from the former UST #1 area to Thatcher Brook. Within the source area (UST #1), gross soil contamination appears present from about two (2) to 11 feet below ground surface (bgs); downgradient of the former UST, gross soil contamination is generally present within the saturated zone between about eight (8) to 15 feet bgs, extending down to the bedrock surface.

The dissolved-phase VOC plume has migrated from the former UST #1 area and is discharging to Thatcher Brook, located about 120 feet downgradient from the former pump island. Benzene, toluene, total trimethylbenzenes, and naphthalene were detected within one or more ground water sample at concentrations above the respective Vermont Groundwater Enforcement Standards (VGESs); benzene exceeded the Vermont Water Quality Standard (VWQS) in a water sample collected from Thatcher Brook. Plume migration within the overburden aquifer appears to be dominated by the

more conductive sand and gravel layers/lenses within the glaciofluvial deposits. The 5 micrograms per Kilograms (µg/L) dissolved benzene isopleth covers an estimated 3,700 ft^2, extending into Thatcher Brook. The contaminant plume infiltrates the northern basement of the on-Site building during high water table conditions.

There are insufficient data to determine whether the dissolved-phase plume is receding or stabilized, since there is only one round of analytical data. Thatcher Brook, which has been impacted, is the ultimate discharge area for the contaminant plume.

Sensitive receptors /media impacted include soil, ground water, surface water, and possibly indoor air. Elevated PID readings were detected within the ambient air of the first floor and basement of the former market; however, compound-specific analysis of soil gas and/or indoor air would be required to further evaluate whether the vapor intrusion exposure pathway is complete. Drinking water supplies do not appear to currently be impacted or at risk of future impact.

Due to the impact to Thatcher Brook, and risk or possible impact to indoor air quality, a Corrective Action Feasibility Investigation (CAFI) should be completed to evaluate the most appropriate remedial alternatives to mitigate impact to these sensitive receptors. Since the new restaurant is expected to open in the near future, likely before a formal CAFI could be completed, and the associated ventilation system could potentially facilitate vapor intrusion, a contingency plan to mitigate such an impact should be considered at this time. It is advisable to complete an SVE pilot study in the near future (using MW-1 as an extraction well) to obtain appropriate design data should this technology need to be implemented on short notice to mitigate vapor intrusion.

1.0 INTRODUCTION

Applied GeoSolutions, LLC (AGS) was retained by Mr. Wai Cha Wan to complete an Initial Site Investigation (ISI) at Former Caforia's Market, located on Vermont Route 100 in Waterbury, Vermont (Site or Property). The purpose of the ISI was to further characterize the impact of apparent gasoline contamination identified during the removal of two (2) 3,000-gallon, gasoline underground storage tanks (USTs) at the Site in 1998.

The ISI was completed in general accordance with the work plan and cost estimate prepared by AGS, dated May 11, 2009, which was approved by Mr. Gerold Noyes of the Vermont Department of Environmental Conservation (VT DEC) in a letter dated April 30, 2009.

This ISI complies with the requirements set forth in the VT DEC's Site Investigation Procedure document, effective June 2005.

2.0 BACKGROUND

2.1 Site Description and Physical Setting

The Property is located in a mixed commercial and residential setting on the east side of VT Route 100, in Waterbury, Vermont (about ¾ miles north of the Interstate 89), at an approximate latitude and longitude of 044° 20′ 59.32″ N and 072° 44′ 33.49″ W, respectively (**Figure 1**, Attached). The Site is bound by VT Route 100 to the west, Laurel Road to the north, Thatcher Brook to the east, and a residential property to the south.

The Property is owned by Wai Cha Wan. One two-story building, with a footprint of about 3,900 square feet (ft^2), is located on the Property. The northern portion of the building formerly functioned as a market (on the first floor), and is currently being renovated for future use as a restaurant; a residential apartment is located on the second story. The southern portion of the building is a residence that is currently unoccupied. A full basement (with poured concrete walls) is present beneath the southern portion of the former market area; crawl spaces underlie the balance of the structure of the former market. A full basement is also believed to be present beneath the unoccupied residence (**Figure 2**).

The building, and neighboring properties, is served by municipal water and sewer. The approximate location of the underground water line servicing the Site is

shown on **Figure 2**. There are multiple sewer lines that exit the rear (east side) of the building; it is currently unclear where these lines connect to the sanitary sewer main line.

Former gasoline UST #1 and the pump dispenser were located in front of the building (west side); former gasoline UST #2 was located on the north side of the building.

The topography of the Property slopes downward to the southeast, towards Thatcher Brook, which is located about 120 feet from the former USTs at its closest point. Thatcher Brook is damned a few hundred feet downstream of the bridge for Laurel Road.

2.2 UST Removals

On August 28, 1998, Griffin International, Inc. (Griffin) completed a UST closure site assessment during the removal of two (2), 3,000-gallon, single-walled steel gasoline USTs (UST #1 and UST #2) at the above-referenced Site. Gravel Construction provided excavation services, and Ostrout Petroleum, purged and cleaned the USTs.

Upon removal, the USTs appeared to be in excellent condition, with minimal rust, no pitting or scaling, and no holes. The associated piping was found to be in good condition. Both USTs were 14 years old prior to removal.

The following Site conditions were noted in Griffin's site assessment report dated August 31, 1998:

- Seventeen (17) soil samples were collected from the UST excavations. PID readings from soil samples collected in Excavation A (for UST #1) ranged from 180 parts per million volume (ppmv) to 300 ppmv, with elevated PID readings observed from one (1) to ten (10) feet below ground surface (bgs). In Excavation B (for UST #2), PID readings ranged from 0.0 ppmv to 12.4 ppmv, with the highest reading obtained near the water table at about seven (7) feet bgs. All soils were backfilled into the respective excavations after the USTs were removed.

- Soils in the UST excavations consisted primarily of sand and gravel. Ground water was encountered at about seven (7) feet bgs in Excavation A, and nine (9) feet bgs in Excavation B.

The degree and extent of petroleum contamination were not determined during the UST closures. Several sensitive receptors were impacted or at risk, including soil, ground water, indoor air quality, and surface water. Based on the findings of the UST site assessment, additional investigation was required to define the degree and extent of the contamination, and assess the risk to sensitive receptors.

3.0 WORK COMPLETED

Copies of field notes for the project are provided in **Appendix A**.

3.1 Soil Borings / Sampling

On June 4, 2009, AGS conducted a soil boring / soil sampling program at the Site to help determine the degree and extent of potential petroleum impact to the subsurface. A total of five soil borings were completed (SB-1 through SB-5). Soil boring locations are provided on **Figure 2**. Soil boring logs are provided in **Appendix B**.

Soil borings were advanced by Stone Environmental, Inc. (SEI) using a track-mounted Geoprobe® unit (model 6610 DT), under the supervision of AGS. Soil samples were collected in five-foot intervals, using macrocore sampling liners and dual tube sampling technology. Soil samples were logged by AGS for texture and screened for the possible presence of VOCs using a portable PID (Ion Science Model 1000 plus), with a 10.6 eV lamp. The PID was calibrated on-Site using ambient air and 100 ppmv isobutylene.

Soil boring SB-1 was installed near the southern end of former UST #1, in the vicinity of the former pump island. Soil borings SB-2, SB-3, SB-4, and SB-5 were installed at areas presumed to be hydraulically downgradient of the former USTs, based on topography and proximity to Thatcher Brook. All soil boring were advanced to about 15 feet bgs, except at SB-5, where refusal was encountered at about 13.5 feet bgs.

3.2 Monitoring Well Installations

In order to further assess contaminant and hydrogeologic conditions at the Site, monitoring wells were constructed within the five soil borings: monitoring well MW-1 was installed in soil boring SB-1; MW-2 was installed in SB-2; MW-3 was installed in SB-3; MW-4 was installed in SB-4; and MW-5 was installed in SB-5. The locations of the monitoring wells, relative to Site features, are presented on **Figure 2**.

Monitoring wells MW-1 through MW-4 were installed to a depth of about 15 feet bgs; monitoring well MW-5 was installed to a depth of about 13.5 feet bgs. Monitoring well MW-1 was constructed using two-inch diameter schedule 40 poly-vinyl chloride (PVC) with flush-threaded joints; all other wells were one inch in diameter. Wells consisted of 10 feet of factory-slotted 0.010″ (0.020″ at MW-1) screen with sections of PVC riser added to extend the top of the casings to approximately 0.3 feet bgs (except at MW-2, which was completed as a stick up). Each borehole annulus was backfilled with #1 sand pack (#2 at MW-1) to above the screened interval, and a bentonite-chip seal was set within each annulus immediately above the sand pack. Well casings were topped with expansion caps, and protected at the surface with flush-mounted road boxes, except at MW-2, which was finished with a steel stick-up protector.

3.3 Monitoring Well Survey

On June 4, 2009, AGS surveyed the newly installed monitoring wells relative to existing Site features using an automatic level, with an azimuth accuracy of ± 1.0 feet, and an elevation accuracy of ± 0.01 feet. In addition, the second post on the south side of the bridge across Thatcher Brook (heading east) was surveyed to facilitate collection of surface-water elevation data. Elevations were surveyed relative to an arbitrary Site datum of 100.00 feet (MW-1).

3.4 Hydraulic Monitoring

On June 11, 2009, AGS collected a synoptic round of liquid levels in on-Site monitoring wells using an electronic interface probe. No free-phase petroleum product was observed in the monitoring wells. Ground water elevations were subsequently calculated for each monitoring well by subtracting the measured depth-to-water readings from the respective surveyed top-of-casing elevations, which are relative to an arbitrary Site datum of 100.00 feet. AGS also collected a depth-to-water measurement from the surveyed elevation on the bridge over Thatcher Brook, and subsequently calculated a surface water elevation at this location.

3.5 Water Quality Sampling

On June 11, 2009, AGS collected ground water samples from monitoring wells MW-1, MW-2, MW-3, MW-4, and MW-5, and a ground water seep discharging along the bank of Thatcher Brook (“Seep-1”). In addition, a surface water sample

("SW-1") was collected from Thatcher Brook, immediately adjacent to "Seep-1" (**Figure 5**).

Prior to purging, AGS measured and recorded the depth-to-water in the monitoring wells using an electronic interface probe; the depth to the bottom of each well was also recorded. Approximately 3-5 well volumes were removed from each well prior to sampling. At monitoring well MW-1, purging and sampling was completed using a dedicated disposable polyethylene bailer and dropline. At monitoring wells MW-2, MW-3, MW-4, and MW-4, a peristaltic pump, with dedicated FEP and silicone tubing, was used to purge and sample.

The ground water seep "Seep-1" and surface water "SW-1" samples were collected by submerging unpreserved vials directly into the flowing water, and then transferring the samples into preserved vials.

AGS acquired a duplicate sample from MW-4 for quality assurance / quality control (QA/QC) purposes.

Following collection, all samples were properly preserved and placed in an ice-filled cooler for transport under a chain-of-custody to Endyne, Inc. of Williston, Vermont. All samples were analyzed for VOCs by EPA Method 8021B.

3.6 Indoor Air Screening

On June 4, 2009, AGS used a PID (Ion Science model 1000+) to screen the air within the northern portion of the on-Site building (the former market area). Screening locations included the ambient air throughout the first floor and basement, and cracks within the foundation walls in the vicinity of former UST#1.

4.0 INVESTIGATION RESULTS

4.1 Geology/Hydrogeology

Overburden materials within the investigated portion of the Site generally consist of fill within the upper 2 to 5 feet bgs, overlying native glaciofluvial deposits and/or glacial till. Based on data from MW-1, MW-2, MW-4, and MW-5), glaciofluvial deposits overlie a thin veneer of glacial till within the northern portion of the Site, between the former UST area and Thatcher Brook (near the bridge for Laurel Road); glaciofluvial deposits are not present at SB-3 (MW-3), the southernmost soil boring, where glacial till immediately underlies the

shallow fill materials. Bedrock (schist) was encountered at depths of about 13.5 to 15 feet bgs in soil borings SB-5 (MW-5) and SB-2 (MW-2), respectively, and outcrops were observed along the stream bed of Thatcher Brook, and its western bank.

The texture of the fill materials generally consist of poorly sorted fine to coarse sand and gravel. The native fluvial deposits generally consist of interbedded fine to coarse sand, silt, and gravel layers/lenses. The glacial till is generally comprised of poorly sorted fine to coarse sand and gravel within a silty-clay matrix.

On June 11, 2009, depth-to-water measurements in the overburden monitoring wells ranged from about seven (7) feet bgs in monitoring wells MW-1 and MW-2 to about eight (8) feet bgs in monitoring wells MW-3, MW-4, and MW-5. Calculated relative ground water elevations ranged from 83.87 feet at monitoring well MW-2 to 92.69 feet at monitoring well MW-1; the elevation of surface water in Thatcher Brook at the Laurel Road bridge was 74.62 feet (**Table 4-1**).

Table 4-1. Liquid-Level Monitoring Data: June 11, 2009

Well I.D.	Top-of-Casing Elevation (feet)	Depth-to-Product (feet BTOC)	Depth-to-Water (feet BTOC)	Apparent Product Thickness (feet)	Corrected Depth-to-water (feet BTOC)	Ground Water Elevation (feet)
MW-1	100.00	--	7.31	0.00	7.31	92.69
MW-2	92.75	--	8.88	0.00	8.88	83.87
MW-3	92.27	--	8.26	0.00	8.26	84.01
MW-4	94.03	--	8.37	0.00	8.37	85.66
MW-5	95.62	--	8.39	0.00	8.39	87.23

The average water-table gradient across the investigated area of the Site was about 0.13 feet/foot (between MW-1 and MW-4), decreasing to about 0.03 feet/foot (between MW-4 and MW-2). Beyond MW-2, the water table gradient increases significantly prior to discharging at ground water seeps evident along the western bank of Thatcher Brook. Assuming ground water flow is perpendicular to equipotential hydraulic-head contours (**Figure 3**), apparent shallow ground water flow in the overburden aquifer was generally to the southeast, towards Thatcher Brook.

Vertical ground water flow components within the overburden aquifer were not quantified during the ISI. Ground water seeps were observed along the western bank of the Thatcher Brook; it appears that these seeps occur at the overburden/bedrock interface.

Underground utilities are located in the vicinity of the Site, including water and sanitary sewer. The invert elevations of these utility corridors are likely about 5 to 6 feet bgs, which is above the water-table depth observed during the ISI; as such, these utility corridors would not have been influencing shallow ground water flow in the investigation area. However, under high water table conditions, these underground utilities may influence shallow ground water flow, either acting as preferential pathways or hydraulic barriers, depending the hydraulic properties of the bedding materials used for installing the utilities (if any), and the actual elevation relationship between the utility itself and the water table.

Of note, during the ISI field visits on June 4th and 11th 2009, the sump pump in the basement beneath the former market area was not discharging. However, during AGS' Site visit on May 7, 2009, AGS observed that the sump pump was frequently cycling in order to reduce the influx of ground water into the basement. When the sump pump is operational under high water-table conditions, local shallow ground water flow patterns would be altered as ground water is drawn towards the sump.

4.2 *Contaminant Distribution*

4.2.1 Field PID Screening

4.2.1.1 Indoor Air

On June 4, 2009, ambient PID readings within the first floor of the former market area ranged from 0.1 ppmv to 0.2 ppmv. A sustained PID reading of 0.5 ppmv was recorded throughout the ambient air of the basement beneath the former market. No elevated PID readings were recorded within cracks present in the northern and western foundation walls within the former market's basement (near former UST #1). Of note, a 275-gallon heating oil UST is located in the northwest corner of the basement; however, no elevated PID readings were detected in this area above the ambient concentration.

4.2.1.2 Soil

Peak PID headspace readings (per soil boring) obtained during the soil boring program are displayed on **Figure 4**, and in **Table 4-2**.

Table 4-2. Peak PID Readings: June 4, 2009

Boring Location	Approximate Depth (ft bgs)	Peak Headspace PID Reading (ppmv)
MW-1	8-9	2,700
MW-2	9-10	1,300
MW-4	12-13	1,920
MW-5	0.5	3.4

No elevated PID readings were recorded at soil boring SB-3 (MW-3).

At soil boring SB-1 (MW-1), in the vicinity of the former pump island, PID readings ranged from 222 ppmv to 2,700 ppmv between about two (2) to 11 feet bgs; black staining (in gravel layers) and strong gasoline odors were observed within soils in this zone. A PID reading of 85 ppmv was recorded at about 12 feet bgs, and a reading of 2.1 ppmv was obtained at the bottom of the boring (about 15 feet bgs).

At soil boring SB-2 (MW-2), located near the top of the western bank of Thatcher Brook (about 110 feet downgradient of former UST #1), PID readings ranged from non-detect to one (1) ppmv from ground surface to about eight (8) feet bgs. Between about eight (8) to 15 feet bgs, PID readings ranged from 33 ppmv to 1,300 ppmv, with a reading of 900 ppmv (with sheening and black staining) observed directly on top of bedrock.

At soil boring SB-4 (MW-4), located about 50 feet downgradient of former UST #1, PID readings ranged from non-detect to 2.4 ppmv from ground surface to about 10 feet bgs. Between about 10 to 15 feet bgs, PID readings ranged from 333 ppmv to 1,920 ppmv, with strong gasoline odors and black staining observed between about 12 to 13 feet bgs.

At soil boring SB-5 (MW-5), located about eight (8) feet downgradient of former UST #2, a peak PID reading of 3.4 ppmv was recorded at about 0.5 feet bgs. No elevated PID readings were observed throughout the balance of the soil boring to 13.5 feet bgs; however, soil recovery was minimal.

PID readings are also provided on the boring logs (**Appendix B**).

4.2.2 Ground Water and Surface Water

Dissolved-phase analytical results are included in **Table 4-3**, and on **Figure 5**. Laboratory report forms are included in **Appendix C**.

Table 4-3. Water Quality Analytical Results: June 11, 2009

Sample Location	MTBE	Benzene	Toluene	Ethyl-benzene	Total Xylenes	Total TMBs	Naph-thalene	Total Target VOCs
Ground Water								
MW-1	**ND<100**	**ND<50.0**	**2,270**	**337**	**2,880**	**1,395**	**126**	**7,008**
MW-2	ND<40.0	**42.9**	ND<20.0	**115**	**107**	**331**	**ND<40.0**	**596**
MW-3	ND<2.0	**2.3**	ND<1.0	ND<1.0	**10.6**	**15.9**	**19.9**	**48.7**
MW-4	ND<40.0	**189**	**58.7**	**387**	**1,430**	**2,070**	**138**	**4,273**
MW-5	ND<2.0	ND<1.0	ND<1.0	ND<1.0	ND<2.0	ND<1.0	ND<2.0	ND
Seep-1	ND<20.0	**37.9**	ND<10.0	**106**	**95.9**	**1,077**	**45.6**	**1,362**
VGES	***40.0***	***5.0***	***1,000.0***	***700.0***	***10,000.0***	***350.0***	***20.0***	***--***
Surface Water								
SW-1	ND<4.0	**7.6**	ND<2.0	**40.8**	**33.2**	**282**	**18.4**	**382**
VWQS[1]	***--***	***1.2***	***6,800***	***3,100***	***--***	***--***	***--***	***--***
VWQS[2]	***--***	***71***	***200,000***	***29,000***	***--***	***--***	***--***	***--***
QA / QC								
MW-4	ND<40.0	**189**	**58.7**	**387**	**1,430**	**2,070**	**138**	**4,273**
Dup	ND<40.0	**226**	**84.3**	**405**	**1,480**	**2,352**	**156**	**4,703**
RPD	**--**	**17.8**	**35.8**	**4.5**	**3.4**	**12.8**	**12.2**	**9.6**

Notes:

All concentrations reported in micrograms per Liter (µg/L).

Shaded values exceed the VGES and/or VWQS.

ND values in bold font indicate detection limit was above the VGES for the respective compound.

ND = None Detected above quantitation limit

RPD = Relative Percent Difference

VWQS [1] = VT Water Quality Standard for the Protection of Human Heath – Consumption of Water and Organisms

VWQS [2] = VT Water Quality Standard for the Protection of Human Heath – Consumption of Organisms Only

Total target VOC concentrations in ground water samples ranged from none detected in cross-gradient monitoring well MW-5 to 7,008 micrograms per Liter (µg/L) in monitoring well MW-1, located near UST #1 and the former pump island. Target VOCs include methyl tert-butyl ether (MTBE), benzene, toluene, ethylbenzene, total xylenes, total trimethylbenzenes, and naphthalene.

Benzene was detected at concentrations above the Vermont Ground Water Enforcement Standard (VGES) of 5.0 µg/L in monitoring wells MW-2 and MW-4, and the ground water seep (Seep-1). Of note, the detection limit was elevated above the VGES for the sample collected from MW-1.

Toluene was detected above the VGES of 1,000.0 µg/L in MW-1.

Total trimethylbenzenes were detected above the VGES of 350.0 µg/L in MW-1, MW-4, and Seep-1.

Naphthalene was detected above the VGES of 20.0 µg/L in MW-1, MW-4, and Seep-1.

The surface water sample SW-1 contained benzene at a concentration of 7.6 µg/L, which exceeds the Vermont Water Quality Standard (VWQS) for the Protection of Human Heath (Consumption of Water and Organisms).

The relative percent difference (RPD) of the blind field duplicate sample collected from MW-4 ranged from 3.4 percent to 35.8 percent of the original sample results for individual compounds.

5.0 CONCEPTUAL SITE MODEL

Two (2) 3,000-gallon gasoline USTs were removed from the Site in 1988. Given the relatively good condition of the USTs upon removal, and the contaminant distribution observed during the UST closures and the ISI, gasoline was likely released to the subsurface in the vicinity of former UST #1 via surface spills and/or leakage associated with the former fuel dispensing appurtenances. The volume of the release(s) is unknown.

In general, once released to the subsurface, petroleum hydrocarbons (e.g. gasoline) can partition into four phases: 1) vapor (i.e. soil gas), 2) aqueous (dissolved in pore water or ground water), 3) sorbed (to soil minerals and organic matter), and 4) remain as NAPL, either residual or mobile. The phase partitioning and migration of petroleum hydrocarbons, once released to the subsurface, depends on several factors, including:

the volume of the release, the physical and chemical properties of the individual hydrocarbon compounds, and the physical and chemical properties of the media that the hydrocarbons were released into. At the former Caforia' Market Site, the gasoline release is known to have impacted soil, ground water, and surface water, and hydrocarbons are present in the vapor, sorbed, and dissolved phases. No measureable free-phase NAPL was detected in any of the Site monitoring wells; however, heavy sheening was observed in several soil borings, suggesting residual NAPL may be present.

The magnitude and extent of gasoline-related impact to soil and ground water appears to be reasonably defined. The area of soil with PID readings greater than 1,000 ppmv is estimated at about 3,500 ft^2, and extends from the former UST #1 area to Thatcher Brook (**Figure 4**). Within the source area (UST #1), gross soil contamination appears present from about two (2) to 11 feet bgs; downgradient of the former UST, gross soil contamination is generally present within the saturated zone between about eight (8) to 15 feet bgs, extending down to the bedrock surface.

The dissolved-phase VOC plume has migrated from the former UST #1 area, beneath the northernmost portion of the on-Site building, and is discharging to Thatcher Brook, located about 120 feet downgradient from the former pump island. Plume migration within the overburden aquifer appears to be dominated by the more conductive sand and gravel layers/lenses within the glaciofluvial deposits. The 5 µg/L dissolved benzene isopleth covers an estimated 3,700 ft^2, extending into Thatcher Brook (**Figure 5**).

Under high water table conditions, flooding occurs within the basement beneath the former market, and a sump pump is used to reduce the influx of ground water. Iron staining is present across the basement floor and towards the bottom of the basement walls, suggesting that the contaminant plume may periodically infiltrate the basement. When the sump pump is operational, a portion of the contaminant plume is likely drawn towards the sump and discharged out of the structure. Mr. Wai Cha Wan indicated that he believed the pump discharged to the sanitary sewer; however, AGS could not identify a location where the discharge hose connected to the sewer. In fact, it appeared that the discharge hose may simply terminate on the ground surface within the crawl space beneath the rear portion of the building.

There are insufficient data to determine whether the dissolved-phase plume is receding or stabilized, since there is only one round of analytical data. Thatcher Brook, which has been impacted, is the ultimate discharge area for the contaminant plume.

Gasoline is comprised of hundreds of individual compounds. These compounds are typically readily sorbed to soil and organic matter, have a relatively low aqueous solubility, and are biodegradable (under both aerobic and anaerobic conditions).

Sensitive Receptor Evaluation

Media either impacted or at potential risk include soil, shallow ground water, surface water (Thatcher Brook), and indoor air. Potential exposure pathways to human and/or ecological receptors are evaluated below.

- **Indoor Air –** Given the proximity of gasoline-related contamination (in soil and ground water) relative to the on-Site structure, vapor intrusion of petroleum VOCs to indoor air appears to present a potential exposure pathway to human receptors.

  On June 4, 2009, a sustained PID reading of 0.5 ppmv was detected within the basement beneath the former market, and PID readings on the first floor of the former market fluctuated between 0.1 ppmv and 0.2 ppmv. However, no elevated PID readings were recorded within cracks present in the northern and western foundation walls within the former market's basement (near former UST #1), suggesting that the elevated readings within the structure were not attributed to vapor migration from the grossly contaminated soils immediately adjacent to the building's foundation. Rather, the elevated readings on this date may have been attributed to phase partitioning from the dissolved VOCs likely present directly beneath the basement and within the sump. Since the PID does not differentiate between petroleum and non-petroleum VOCs, it is also possible that the PID was measuring VOCs that were not related to the gasoline release at the Site. Compound-specific analysis of soil gas and/or indoor air would be required to further evaluate whether the vapor intrusion exposure pathway is complete.

  The risk to indoor air may be greater during the heating season, when negative pressures could be generated within the building which may facilitate soil vapor transport into the structure. The risk may also increase once the ventilation systems for the new restaurant are operational.

- **Soil –** Shallow soils in the vicinity of former gasoline UST #1 are grossly impacted by gasoline constituents. Exposure pathways for humans through impacted soils include dermal absorption (via direct contact), ingestion, and inhalation. The soils are currently covered with asphalt pavement, and as such, do not present a significant risk to human health or the environment. However,

any future Site redevelopment or intrusive activities could possibly result in exposure.

- **Surface Water –** The contaminant plume is discharging to Thatcher Brook, and benzene was detected at a concentration above the VWQS in the surface water sample collected immediately adjacent to the stream bank (**Figure 5**). An estimated 40-foot reach along the western edge of Thatcher Brook exhibits iron staining, suggesting the contaminant plume is discharging to the stream in this area (see photographs in **Appendix D**).

- **Ground Water –** The shallow, unconfined aquifer at the Site is impacted by benzene, toluene, total trimethylbenzenes, and naphthalene at concentrations above the respective VGESs. However, drinking water supplies in the area do not appear to be at significant risk.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Given the results of the ISI, AGS has drawn the following conclusions:

- Gasoline was released to the subsurface at the Site in the vicinity of former UST #1. The release(s) likely occurred via surface spills and/or leakage associated with the former fuel dispensing appurtenances. The volume of the release(s) is unknown.

- The petroleum release has impacted soil, ground water, and surface water. Gasoline constituents are known to be present in the vapor, sorbed, and dissolved phases. No measureable free-phase NAPL was detected in any of the Site monitoring wells; however, heavy sheening was observed in several soil borings, suggesting residual NAPL may also be present.

- The magnitude and extent of gasoline-related impact to soil and ground water appears to be reasonably defined. The area of soil with PID readings greater than 1,000 ppmv is estimated at about 3,500 ft^2, and extends from the former UST #1 area to Thatcher Brook. Within the source area (UST #1), gross soil contamination appears present from about two (2) to 11 feet bgs; downgradient of the former UST, gross soil contamination is generally present within the saturated zone between about eight (8) to 15 feet bgs, extending down to the bedrock surface.

- The dissolved-phase VOC plume has migrated from the former UST #1 area and is discharging to Thatcher Brook, located about 120 feet downgradient from the former pump island. Plume migration within the overburden aquifer appears to be dominated by the more conductive sand and gravel layers/lenses within the glaciofluvial deposits. The 5 µg/L dissolved benzene isopleth covers an estimated 3,700 ft^2, extending into Thatcher Brook. The contaminant plume infiltrates the northern basement of the on-Site building during high water table conditions.

- On June 11, 2009, total target VOC concentrations in ground water samples ranged from none detected in cross-gradient monitoring well MW-5 to 7,008 µg/L in monitoring well MW-1, located near the former pump island. Benzene, toluene, total trimethylbenzenes, and naphthalene were detected within one or more ground water sample at concentrations above the respective VGESs.

- The surface water sample collected from Thatcher Brook contained benzene at a concentration of 7.6 µg/L, which exceeds the VWQS for the Protection of Human Heath (Consumption of Water and Organisms). The extent of surface water impact above the VWQSs has not been determined.

- There are insufficient data to determine whether the dissolved-phase plume is receding or stabilized, since there is only one round of analytical data. Thatcher Brook, which has been impacted, is the ultimate discharge area for the contaminant plume.

- Sensitive receptors /media impacted include soil, ground water, surface water, and possibly indoor air. Although elevated PID readings were detected within the ambient air of the first floor and basement of the former market, compound-specific analysis of soil gas and/or indoor air would be required to further evaluate whether the vapor intrusion exposure pathway is complete. Drinking water supplies do not appear to currently be impacted or at risk of future impact.

Based on the above conclusions, AGS makes the following recommendations:

- Due to the impact to Thatcher Brook, and risk of possible impact to indoor air quality, a Corrective Action Feasibility Investigation (CAFI) should be completed to evaluate the most appropriate remedial alternatives to mitigate impact to these sensitive receptors. Since the new restaurant is expected to open in the near future, likely before a formal CAFI could be completed, and the associated ventilation system could potentially facilitate vapor intrusion, a contingency plan

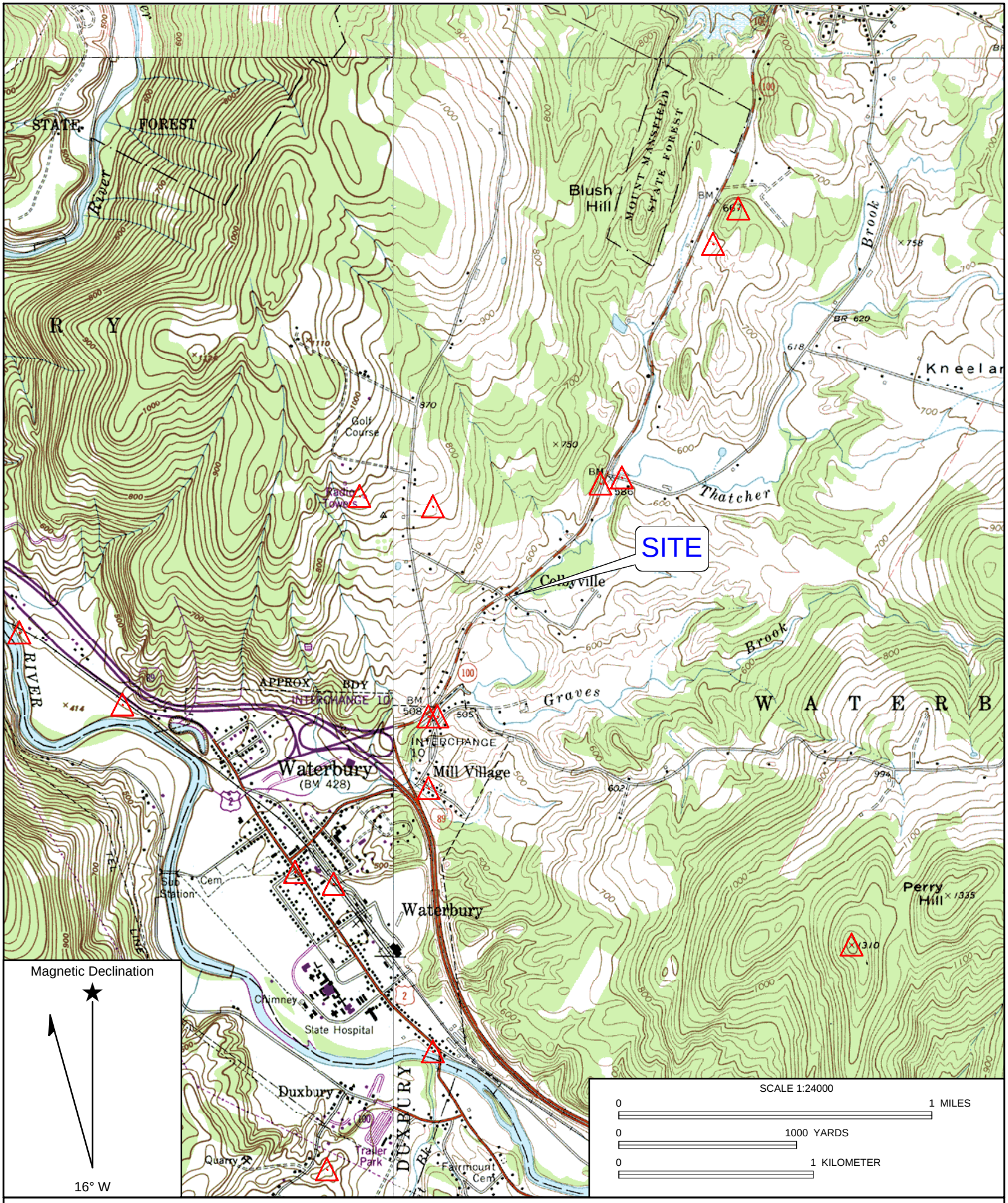
to mitigate such an impact should be considered at this time. A preliminary screening of potentially applicable technologies, based on Site conditions, suggests that soil vapor extraction (SVE) would likely be appropriate for: A) mitigating vapor intrusion of the building, and B) removing gross contaminant mass in the vadose/"smear zone" zone adjacent to the northern basement that could act as a long-term source for ground water contamination. It is advisable to complete an SVE pilot study in the near future (using MW-1 as an extraction well) to obtain appropriate design data should this technology need to be implemented on short notice to mitigate vapor intrusion.

- Additional investigation should be implemented to determine whether vapor intrusion pathways are complete at the on-Site building. The next phase of investigation should include soil gas and/or indoor air sampling and compound-specific laboratory analysis. This phase of work should be implemented prior to the SVE pilot study.

- The terminus of the sump-pump discharge hose should be located. If the hose is connected to the sanitary sewer, the Town of Waterbury waste water treatment facility should be notified. If the discharge hose terminates to the ground surface or a dry well on-Site, the discharge area should be further investigated for petroleum VOC impact.

- A bi-annual water-quality monitoring program should be implemented to evaluate temporal changes in water quality and the state of the dissolved-phase plume (e.g. whether it is receding or stabilized). The monitoring program should be expanded to incorporate additional surface water sampling locations to delineate surface water impact. All samples should be analyzed for target VOCs by EPA Method 8021B.

- A work plan and cost estimate should be prepared for VT DEC review and approval prior to initiating field activities.



Name: MIDDLESEX
Date: 5/11/2009
Scale: 1 inch equals 2000 feet

Location: 044° 20' 59.33" N 072° 44' 34.22" W NAD 27
Caption: Figure 1. Site Location Map

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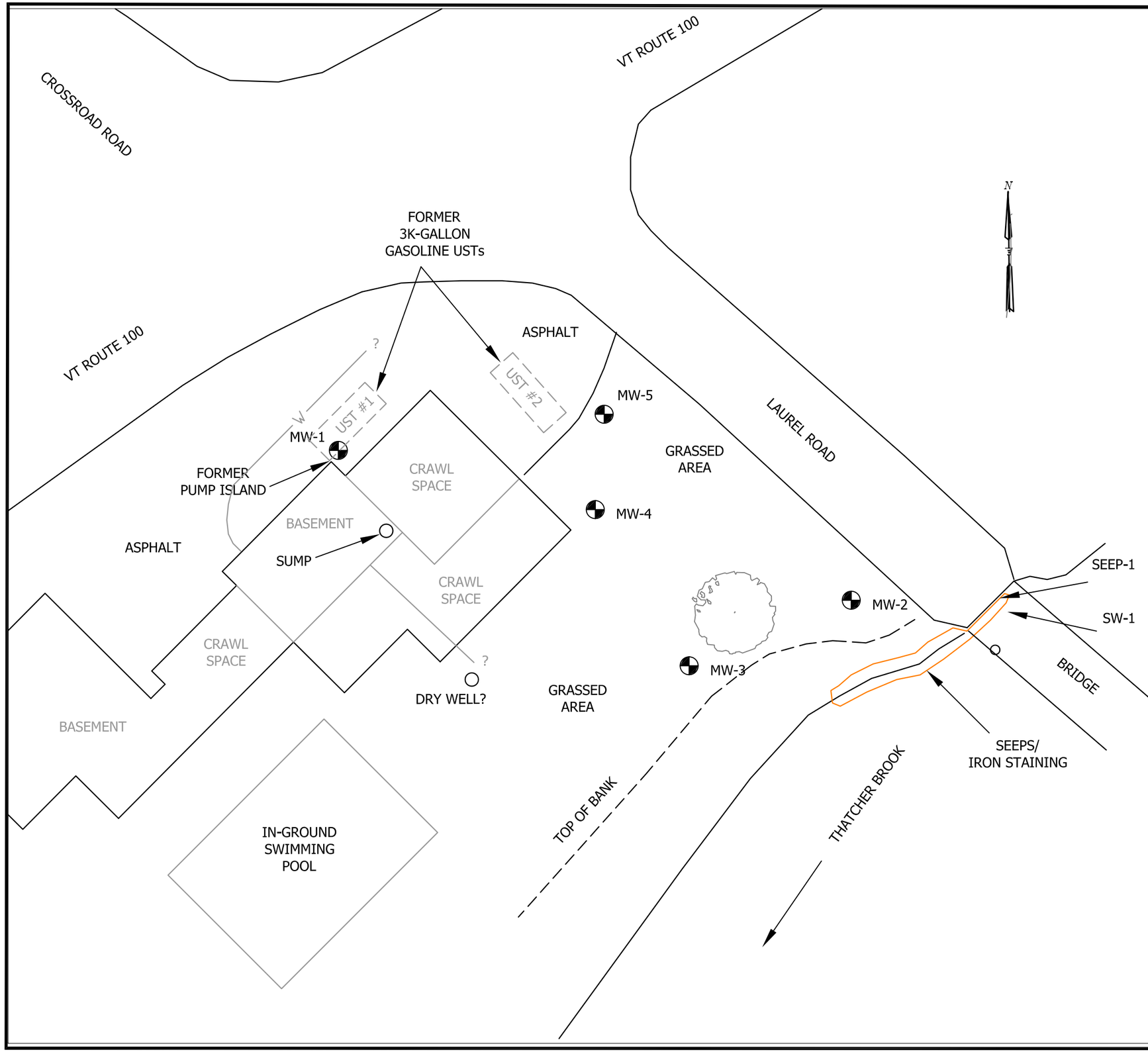


LEGEND

MW-1 MONITORING WELL

NOTES:

BASE MAP GENERATED FROM SURVEY OF SELECT FEATURES BY AGS ON 6/4/09, AND A REVIEW OF AERIAL PHOTOGRAPHS.

ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. NO CLAIM IS MADE TO ACCURACY. THIS PLAN SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES, PROPERTY LINE DETERMINATION, EXACT LOCATION OF SITE FEATURES ETC.

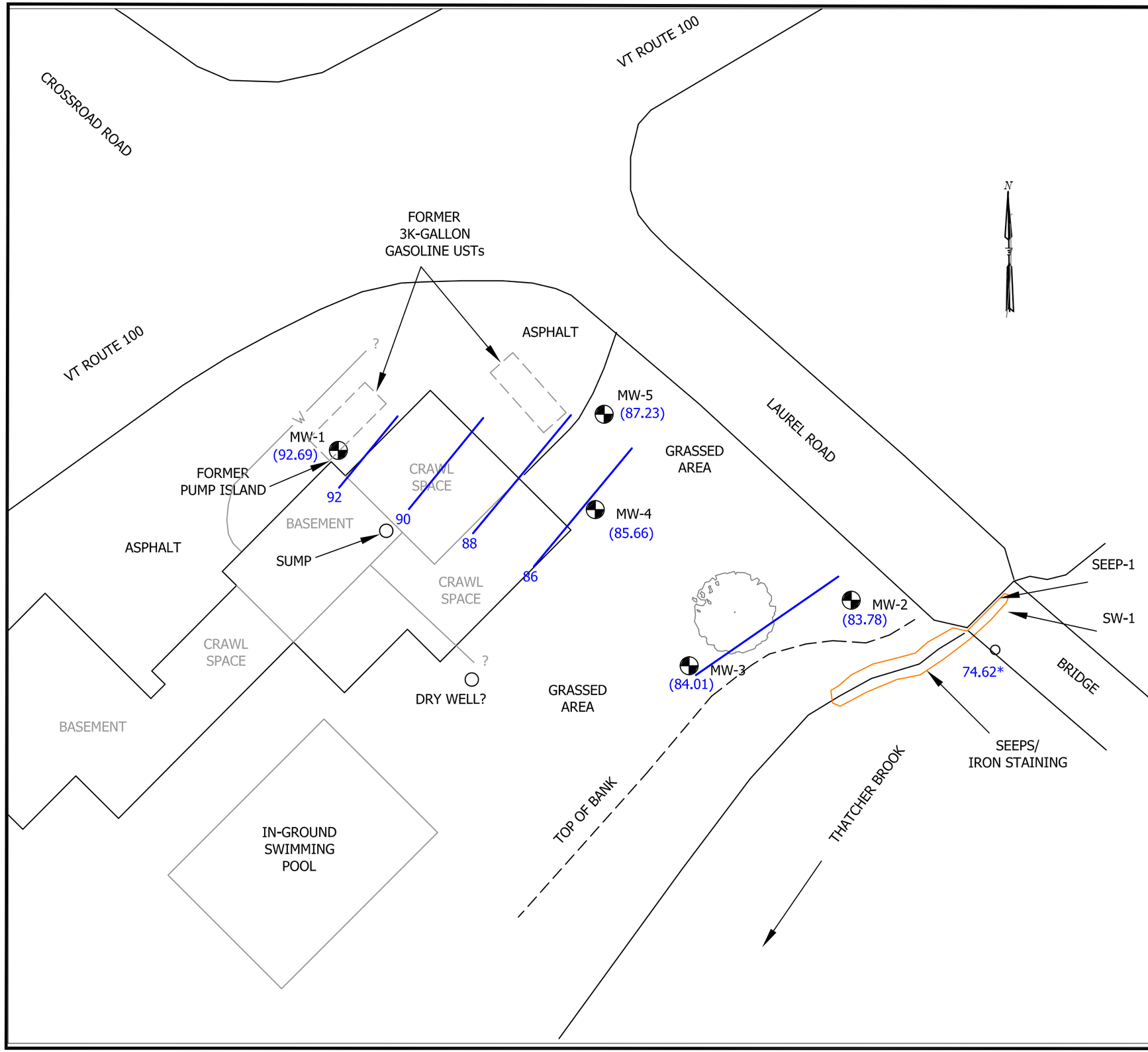
0 20 40

APPROX. SCALE IN FEET

Applied GeoSolutions, LLC

Remediation Hydrogeology Geophysics

TITLE: SITE PLAN		
PROJECT: FORMER CAFORIA'S MARKET		FIGURE NO.: 2
DATE: 7/1/09	DRAWN BY: EJS	CHECKED BY: MP



LEGEND

MW-1	MONITORING WELL
(87.23)	WATER TABLE ELEVATION (FEET)
92	WATER TABLE CONTOUR (FEET)
72.62*	SURFACE WATER ELEVATION (FEET)

NOTES:

BASE MAP GENERATED FROM SURVEY OF SELECT FEATURES BY AGS ON 6/4/09, AND A REVIEW OF AERIAL PHOTOGRAPHS.

ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. NO CLAIM IS MADE TO ACCURACY. THIS PLAN SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES, PROPERTY LINE DETERMINATION, EXACT LOCATION OF SITE FEATURES ETC.

ELEVATION VALUES REPORTED IN FEET RELATIVE TO AN ARBITRARY SITE DATUM OF 100.00 FEET.

0 20 40

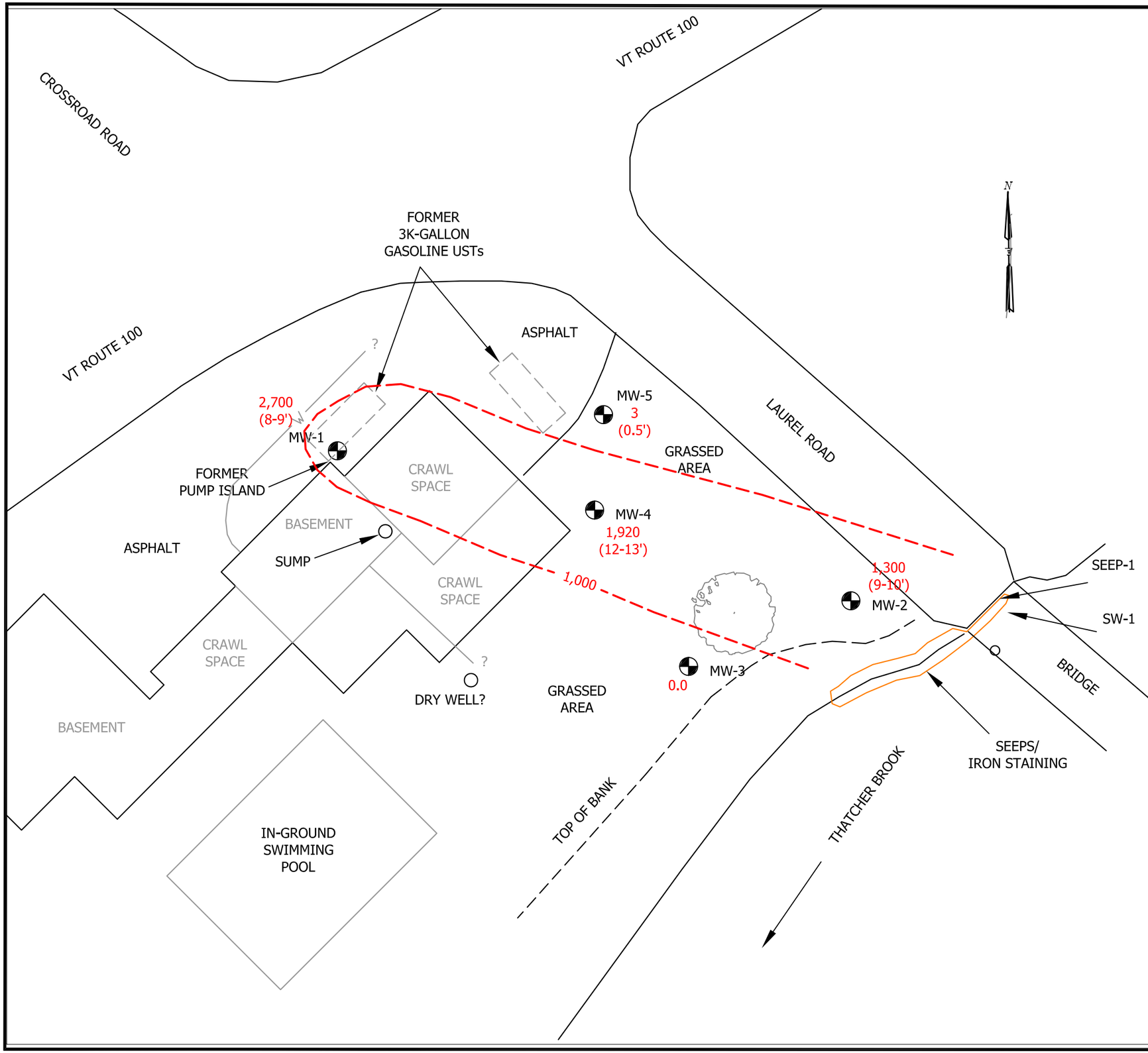
APPROX. SCALE IN FEET

Applied GeoSolutions, LLC

Remediation Hydrogeology Geophysics

AGS

TITLE:	POTENTIOMETRIC SURFACE MAP: 06/11/09
PROJECT:	FORMER CAFORIA'S MARKET
FIGURE NO.:	3
DATE: 7/1/09	DRAWN BY: EJS / CHECKED BY: MP



LEGEND

MW-1 — MONITORING WELL

1,920 — MAXIMUM FIELD PID READING (PPMV)

(9') — APPROXIMATE DEPTH (FEET BGS)

1,000 — MAXIMUM PID READING ISOPLETH (PPMV)

NOTES:

BASE MAP GENERATED FROM SURVEY OF SELECT FEATURES BY AGS ON 6/4/09, AND A REVIEW OF AERIAL PHOTOGRAPHS.

ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. NO CLAIM IS MADE TO ACCURACY. THIS PLAN SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES, PROPERTY LINE DETERMINATION, EXACT LOCATION OF SITE FEATURES ETC.

PID READINGS OBTAINED USING AN IONSCIENCE MODEL 1000+ PID WITH A 10.6 eV UV LAMP.

0 20 40

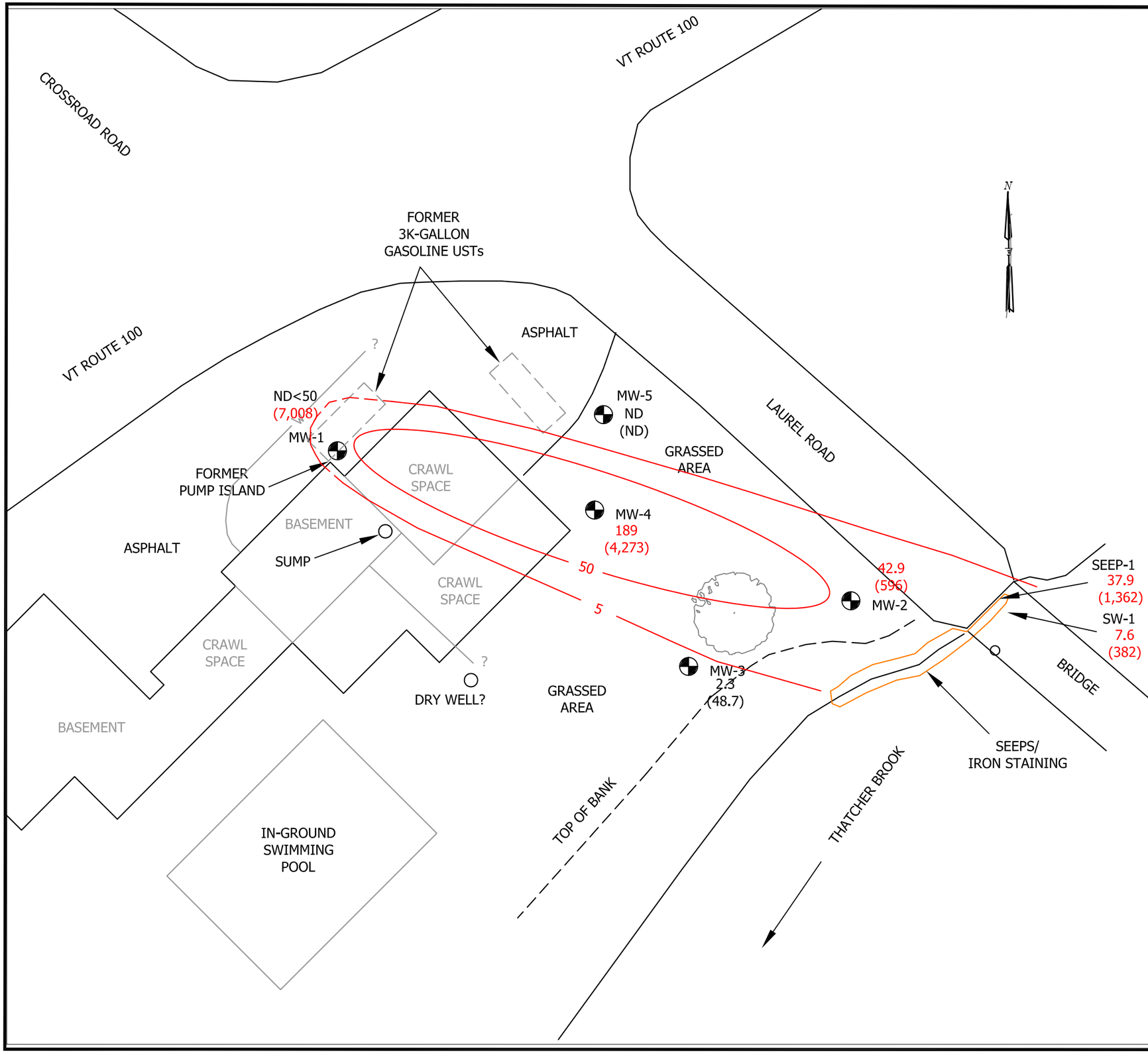
APPROX. SCALE IN FEET

Applied GeoSolutions, LLC

Remediation Hydrogeology Geophysics

AGS

TITLE:	PID FIELD SCREENING RESULTS: 06/04/09
PROJECT:	FORMER CAFORIA'S MARKET
FIGURE NO.:	4
DATE: 7/1/09	DRAWN BY: EJS / CHECKED BY: MP



LEGEND

MW-1 — MONITORING WELL

189 (4,273) — DISSOLVED BENZENE (ug/L) / TOTAL DISSOLVED TARGET VOCs (ug/L)

50 — DISSOLVED BENZENE ISOPLETH (ug/L)

NOTES:

BASE MAP GENERATED FROM SURVEY OF SELECT FEATURES BY AGS ON 6/4/09, AND A REVIEW OF AERIAL PHOTOGRAPHS.

ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. NO CLAIM IS MADE TO ACCURACY. THIS PLAN SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES, PROPERTY LINE DETERMINATION, EXACT LOCATION OF SITE FEATURES ETC.

RED VALUES INDICATE AN EXCEEDANCE OF ONE OR MORE VERMONT GROUND WATER ENFORCEMENT STANDARD.

0 20 40

APPROX. SCALE IN FEET

Applied GeoSolutions, LLC

Remediation Hydrogeology Geophysics

AGS

TITLE: GROUND WATER ANALYTICAL RESULTS: 06/11/09

PROJECT: FORMER CAFORIA'S MARKET

FIGURE NO.: 5

DATE: 7/1/09

DRAWN BY: EJS

CHECKED BY: MP

APPENDIX A

6-4-09

0840 ES ON SITE @ CAFORIA'S MARKET (FORMER), RT 100, WATERBURY, VT.

OBJECTIVE: INSTALL MONITORING WELLS

MET w/ MIKE JORDAN OF STATE ENV. (OPERATING GEOPROBE 6610 DT)

0925 HAD HEALTH & SAFETY BRIEFING.

SET ON SB-1 / MW-1 (w/IN FORMER UST #1 GRAVE- NEAR PUMP ISLAND)

0-5' RUN

RECOV = 3'

PID: 1' = 0 PPMV

1'7" = 462

2'7" = 1670

TEXT = 0-1'3" = BRN F.C SAND LITTLE F. GRAVE (SILT FROM 6"-10"). FILL. DRY.

1'3"-3'2 GREY SILT, MOIST - WET. STRONG GASOLINE ODORS

GRAVEL @ ~ 7' BGS

5-10' RUN

RECOV = 2'5"

PID = 8" = 1620

1'2" = 2500

1'8" = 2700

2' = 222

TEXT = 0-4" = AS ABOVE (WET)

4"-10" = DRK BRN - ~~ORANGE BRN~~

F-C SAND, + F-C GRAVEL (WELL ROUNDED)

DRY

10"-1'2" = ORANGE BRN F SAND, MOIST-DRY.

1'2"-2'5" = GREY F-C GRAVEL

(POORLY SORTED) WITHIN FINE GRAINED (SILT + LITTLE SAND) MATRIX, WET. BLK. STAINING @ 1'10"

10-12' RUN

RECOV = 1'4"

PID = ~400 @ 5"

85 @ 1'

TEXT = 0-10" = AS ABOVE

10"-1'4" = GREY SILT w/ SOME F SAND LENSES.

12-15' RUN

RECOV = 5'

PID = 30 @ 4'4"

2.1 @ 4'9"

1015 TEXT = AS ABOVE (SOUPY)

4'-4'6" = OLIVE GRAY - BLK M. SAND, WET.

4'6" = 5' = SANDY TILL (F-C SAND + GRAVEL, LITTLE SILT.) ANGULAR WET.

SETTING MW-1

15-5' = 2" ϕ PVC 20 SLOT

5-0.5' = 2" ϕ RIVER

7 15-3' = #1 SAND

1200 SET MW MW-2 (NEAR BRIDGE)

0-5' RUN

RECOV = 2'7"

PID = 0.2 - 0.4

TEXT = BRN F-C SAND, SOME SILT + F-C GRAVEL. DRY - MOIST.

5-10' RUN

RECOV = 2'

PID = 0 @ 6"

1.0 @ 1'4"

1300 @ 1'8" (BLACK STAINING)

TEXT = 0-9" = AS ABOVE — MOIST - WET.

9" - 1'8" = BRN CHANGING TO GREY CLAYEY ORGANIC SILT, LITTLE F-C GRAVEL.

1'8" - 2' = BLACK F-C SAND, SOME GRAVEL. STRONG GASOLINE ODORS. WET

10/15' RUN

RECOV = 4'

PID = 1010 @ 6"

33 @ 1'

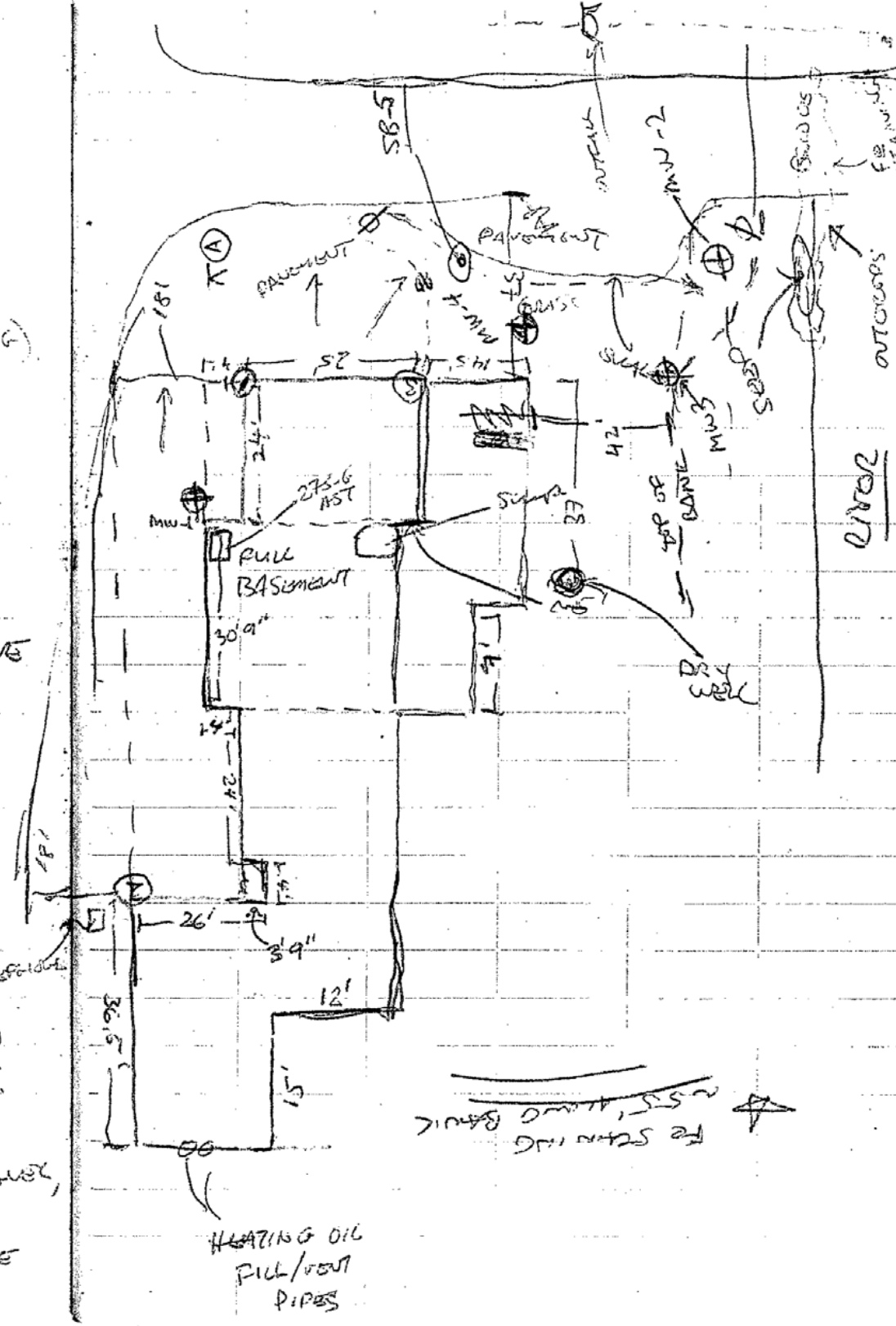
900 @ 2' (SHEENING)

TEXT = 0-9" AS ABOVE (BLACK)

9-2' = GREY F. SAND + SILT. WET (SOMPY)

2' - 2'7" = F-C SAND, + F-C GRAVEL, SOME SILT. SHEENING.

2'7-3'7 = BLACK F-C SAND SOME SILT + ORGANIC ~~DEBRIS~~ MATERIAL



3'7" – 4' = WEATHERED ROCK (SCHIST FRAGMENTS)

1240 SETTING WELL MW-2
15 – 5' = 1"Ø PVC 10 SLOT
5 – = 1"Ø PVC RISER
15 – 3' = #1 SAND

☆ 1ST FLOOR PID = 0.1 – 0.2 PPM
AMBIENT
BASEMENT = 0.5 PPM SUSTAINED
FOUNDATION CRACKS NEAR OLD PUMPS = 0.0 PPM

☆ WATER LEVEL OF RIVER IS ~16' BELOW BOTTOM OF BRIDGE
– SEEP ~12' BELOW BRIDGE BOTTOM

1250 SETTING ON SB-3/MW-3
0-5' RUN
RECOV = 3'
PID = 0.0
TEXT = BRN F-C SAND, SOME F-C GRAVEL, LITTLE SILT. DRY – MOIST

5-10' RUN
RECOV = 3'
PID = 0.0
TEXT = 0-1' = GREY SILTY CLAY W/ SOME F-C SUB-ROUNDED GRAVEL. MOIST. PLASTIC
1-2.5' = GREY F-C SAND, SOME SILT & SUB ROUNDED GRAVEL. MOIST – WET
2.5-3' = GREY SILTY CLAY W/ SOME F-C SAND & F-C GRAVEL. MOIST – WET

10-15' RUN
RECOV = 3.5'
PID = 0.0
TEXT = AS ABOVE, W/ SOME SILTY CLAY LENSES/LAYERS. WET

1320 SETTING MW-3
15-5' = 1"Ø PVC 10 SLOT
5-0.5' = 1"Ø PVC RISER
15-3' =

SETON MW-4

0-5' RUN

RECOV = 2.5'

PID = 0.0

TEXT = BRN F-C SAND, SOME F-C GRAVEL, LITTLE SILT. ~~DE~~ MOIST

5-10' RUN

RECOV = 2'

PID = 2.4 @ ~6"

0.4 @ 18"

TEXT = GREY SILT, SOME F-C SAND & F-C GRAVEL. WET. SLIGHT PETRO ODORS

10-15' RUN

RECOV = 3'

PID: 3330 @ 7"

1920 @ 18"

235 @ 2'4"

TEXT = GREY (w/ BLK STAINING)

0-1'3" = F-C SAND + GRAVEL, SOME SILT + ORGANIC DEBRIS

1'3"-1'8" = BLK F-C SAND + GRAVEL. STRONG ODOR / SHEENING

1'8"-3' = OLIVE GREY TILL

SETTING MW-4

15-5' = 1" Ø 10 SLOT PVC

5-0.3' = 1" Ø PVC RISER

15-3' = #1 SAND

1445 SETTING ON SB-5

0-5' RUN

RECOV = 2'3"

PID = 3.4 @ 7"

0.0 @ 2'

TEXT: SIMILAR MW-4 (0-5')

1510 REFUSED @ ~7.5' BGS

MOVED OVER ~COUPLE FT.

5-10' RUN

RECOVERY = ~~0'~~ ~2" (ROCK IN SAMPLE)

PID = 0.0

10-~13.5' (REFUSAL)

RECOV = NO RECOVERY

PID =

SETTING MW-5
~13.5 - 3.5 = 1" Ø .10 SLOT

TOC (A) 104.32

	BOTTOM	MID	TOP	Σ	
(1)	4.02	4.10	4.18	0	
(2)	3.86	4.36	4.87	10.25	
(3)	4.85	5.01	5.16	297.25	
MW-1 RIM		4.15			
PVC	4.14	4.32	4.51	1.75	100.00
MW-5 RIM		8.51			
PVC	8.55	8.70	8.86	257	95.62
MW-4 RIM		10.05			
PVC	10.08	10.29	10.51	279.25	
MW-3 RIM		11.82			
PVC	11.66	12.05	12.46	279.75	
MW-2 (GS) RIM		14.45			
PVC	13.12	13.56	14.04	257.25	
★ NEED TO GET (ADDED) 24 3/8")					
(4) 2nd BRIDGE RAIL/POST					
	10.70	11.30	11.92	254	
MW-1 PVC		4.32			

1730 ES OFFSITE

PARTLY SUNNY, ~70°F

6-11-09
1853 ES ONSITE @ CAFORIA'S
OBJECTIVE: SAMPLE MONITORING WELLS.

		DTP	DTW	PURGE VOL	
1605	MW-1	—	7.31	~3.5	SHEEN ★ 18' FEP SILICONE
1445	MW-2	—	8.88		
1600	MW-3	—	8.26	DRY	
1510	MW-4	—	8.37	~1.5	SLIGHT SHEEN
1540	MW-5	—	8.39	~1	
	RIVER @ BRIDGE		18.40		

MW-2: FEP INTAKE @ ~12' BTOC FOR SAMPLING
MW-3: " @ ~13' BTOC

★ DAP FROM MW-4
MW-1 SAMPLED VIA BAILER;
92.27 OTHER WELLS w/ PERI + FEP/SILICONE
→ 90.72 TUBING.
1620 COLLECT SURFACE WATER "SW-1" (BENEATH BRIDGE)
1625 COLLECT "SEEP-1"
1630 ES OFFSITE
93.02 END.

APPENDIX B

Drilling Log

MW-1

Site Name:	Cafori'a	**Client:**	Wai Cha Wan	**Permit No.:**	NA
Location:	Rt 100 N, Waterbury, VT			**Drilling Dates:**	6/4/2009
Project:				**Field Log By:**	Eric Swiech
Driller:	Mike Jordan	**Company:**	SEI	**Drilling Method:**	Geoprobe (6610 DT)
					5-foot dual-tube sampler
Latitude:		**Longitude:**		**Borehole Diam. (in.):**	3.25"
State Plane Coordinate Feet (North):				**Outer Casing:**	NA
State Plane Coordinate Feet (East):				**Well Diameter (inches)**	2
Outer Casing (OC) Elevation (feet):			NA	**Casing Length (feet):**	See Below
Inner Casing (IC) Elevation (feet):			NA	**Screen Length (feet):**	See Below
Ground Elevation (feet):			NA	**Screen Slot Size:**	20
Datum:			MSL	**Sand Pack:**	#2
Notes:	Flush-mounted roadbox				

Depth (feet)	Description	PID Response (ppm)	Recovery	Sample IDs
	0-5' RUN			
1		0		
2	0-1'3": Brn f-c SAND, little f Gravel, w/ SILT layer from 6"-10" (Fill). Dry.			
	1'3"-3': Grey SILT, moist-wet. Strong gasoline odors.	462	3'	
3				
4		1670		
5				
	5-10' RUN			
6		1620		
	0-4": As above.			
7		2500		
	4-10": drk brn f-c Sand, and f-c Gravel (well rounded). Dry.		2'5"	
8	10"-1'2": orange-brn f SAND, moist-dry.			
	1'2"-2'5": Grey f-c GRAVEL within silt and f sand matrix. Wet. Blk	2700		
9	staining @ 1'10".			
		222		
10				
	10-12' RUN			
11	0-10": As above.	400		
			1'4"	
12	10"-1'4": Grey SILT w/ f Sand lenses. Wet.	85		
	12-15' RUN			
13	0-4': as above (soupy)			
	4'-4'6": Olive grey-blk m SAND. Wet.		5'	
14	4'6"-5': Sandy glacial till (f-c Sand and Gravel, little silt). Wet.			
15				
	E.O.B. @ 15'.			
	Set MW-1 @ 15' bgs, w/ 10' of 20-slot screen. #2 sand to 3' bgs, bentonite chips to 1' bgs.			
	PID readings obtained w/ Ion Science Model 1000+ (10.6 eV lamp)			

Drilling Log

MW-2

Site Name:	Cafori'a	**Client:**	Wai Cha Wan	**Permit No.:**	NA
Location:	Rt 100 N, Waterbury, VT			**Drilling Dates:**	6/4/2009
Project:				**Field Log By:**	Eric Swiech
Driller:	Mike Jordan	**Company:**	SEI	**Drilling Method:**	Geoprobe (6610 DT)
					5-foot dual-tube sampler
Latitude:		**Longitude:**		**Borehole Diam. (in.):**	3.25"
State Plane Coordinate Feet (North):				**Outer Casing:**	NA
State Plane Coordinate Feet (East):				**Well Diameter (inches)**	1
Outer Casing (OC) Elevation (feet):			NA	**Casing Length (feet):**	See Below
Inner Casing (IC) Elevation (feet):			NA	**Screen Length (feet):**	See Below
Ground Elevation (feet):			NA	**Screen Slot Size:**	10
Datum:			MSL	**Sand Pack:**	#1
Notes:	Flush-mounted roadbox				

Depth (feet)	Description	PID Response (ppm)	Recovery	Sample IDs
1 2 3 4 5	**0-5' RUN** Brn f-c SAND, some Silt and f-c Gravel. Dry-moist.	0.2-0.4	2'7"	
6 7 8 9 10	**5-10' RUN** 0-9": As above. Moist-wet. 9"-1'8": Brn changing to grey clayey organic SILT, little f-c Gravel. 1'8"-2': Black f-c SAND, some Gravel. Strong gasoline odors. Wet.	0 1 1300	2'	
11 12 13 14 15	**10-15' RUN** 0-9": As above. 9"-2': Grey f Sand and Silt. Wet. Soupy. 2'-2'7": f-c Sand, abd f-c Grave, some Silt. Sheening. 2'7"-3'7": Black f-c Sand, some Silt and organic material. 3'7"-4': Weathered Schist.	1010 33 900	4'	
	E.O.B. @ 15'. Set MW-2 @ 15' bgs, w/ 10' of 20-slot screen. #1 sand to 3' bgs, bentonite chips to 1' bgs. PID readings obtained w/ Ion Science Model 1000+ (10.6 eV lamp)			

Drilling Log

MW-3

Site Name:	Cafori'a	**Client:**	Wai Cha Wan	**Permit No.:**	NA
Location:	Rt 100 N, Waterbury, VT			**Drilling Dates:**	6/4/2009
Project:				**Field Log By:**	Eric Swiech
Driller:	Mike Jordan	**Company:**	SEI	**Drilling Method:**	Geoprobe (6610 DT)
					5-foot dual-tube sampler
Latitude:		**Longitude:**		**Borehole Diam. (in.):**	3.25"
State Plane Coordinate Feet (North):				**Outer Casing:**	NA
State Plane Coordinate Feet (East):				**Well Diameter (inches)**	1
Outer Casing (OC) Elevation (feet):			NA	**Casing Length (feet):**	See Below
Inner Casing (IC) Elevation (feet):			NA	**Screen Length (feet):**	See Below
Ground Elevation (feet):			NA	**Screen Slot Size:**	10
Datum:			MSL	**Sand Pack:**	#1
Notes:	Flush-mounted roadbox				

Depth (feet)	Description	PID Response (ppm)	Recovery	Sample IDs
1 2 3 4 5	**0-5' RUN** Brn f-c SAND, some f-c Gravel, little Silt. Dry-moist.	0	3'	
6 7 8 9 10	**5-10' RUN** 0-1': Grey Silty Clay w/ some f-c Gravel. Moist. High plasticity. 1'-2'6": Grey f-c Sand, some Silt and subrounded Gravel. Moist-wet. 2'6"-3': Grey Silty Clay w/ some f-c Sand and Gravel. Moist-Wet.	0	3'	
11 12 13 14 15	**10-15' RUN** As above, w/ some Silty Clay lenses/layers. Wet.	0	3.5'	
	E.O.B. @ 15'. Set MW-3 @ 15' bgs, w/ 10' of 20-slot screen. #1 sand to 3' bgs, bentonite chips to 1' bgs. PID readings obtained w/ Ion Science Model 1000+ (10.6 eV lamp)			

Drilling Log

MW-4

Site Name:	Cafori'a	**Client:**	Wai Cha Wan	**Permit No.:**	NA
Location:	Rt 100 N, Waterbury, VT			**Drilling Dates:**	6/4/2009
Project:				**Field Log By:**	Eric Swiech
Driller:	Mike Jordan	**Company:**	SEI	**Drilling Method:**	Geoprobe (6610 DT)
					5-foot dual-tube sampler
Latitude:		**Longitude:**		**Borehole Diam. (in.):**	3.25"
State Plane Coordinate Feet (North):				**Outer Casing:**	NA
State Plane Coordinate Feet (East):				**Well Diameter (inches)**	1
Outer Casing (OC) Elevation (feet):			NA	**Casing Length (feet):**	See Below
Inner Casing (IC) Elevation (feet):			NA	**Screen Length (feet):**	See Below
Ground Elevation (feet):			NA	**Screen Slot Size:**	10
Datum:			MSL	**Sand Pack:**	#1
Notes:	Flush-mounted roadbox				

Depth (feet)	Description	PID Response (ppm)	Recovery	Sample IDs
1 2 3 4 5	**0-5' RUN** Brn f-c SAND, some f-c Gravel, little Silt. Dry-moist.	0	2.5'	
6 7 8 9 10	**5-10' RUN** Grey SILT, some f-c Sand and Gravel. Wet. Slight petro odors.	2.4 0.4	2'	
11 12 13 14 15	**10-15' RUN** 0-1'3": Grey (w/ black staining) f-c Sand and Gravel, some Silt and organic debris. 1'3"-1'8": Blk f-c SAND and Gravel. Strong petro odors and sheening. 1'8"-3': Olive-grey glacial till.	333 1920 235	3'	
	E.O.B. @ 15'. Set MW-4 @ 15' bgs, w/ 10' of 20-slot screen. #1 sand to 3' bgs, bentonite chips to 1' bgs. PID readings obtained w/ Ion Science Model 1000+ (10.6 eV lamp)			

Drilling Log

MW-5

Site Name:	Cafori'a	**Client:**	Wai Cha Wan	**Permit No.:**	NA
Location:	Rt 100 N, Waterbury, VT			**Drilling Dates:**	6/4/2009
Project:				**Field Log By:**	Eric Swiech
Driller:	Mike Jordan	**Company:**	SEI	**Drilling Method:**	Geoprobe (6610 DT)
					5-foot dual-tube sampler
Latitude:		**Longitude:**		**Borehole Diam. (in.):**	3.25"
State Plane Coordinate Feet (North):				**Outer Casing:**	NA
State Plane Coordinate Feet (East):				**Well Diameter (inches)**	1
Outer Casing (OC) Elevation (feet):			NA	**Casing Length (feet):**	See Below
Inner Casing (IC) Elevation (feet):			NA	**Screen Length (feet):**	See Below
Ground Elevation (feet):			NA	**Screen Slot Size:**	10
Datum:			MSL	**Sand Pack:**	#1
Notes:	Flush-mounted roadbox				

Depth (feet)	Description	PID Response (ppm)	Recovery	Sample IDs
1 2 3 4 5	**0-5' RUN** Brn f-c SAND, some f-c Gravel, little Silt. Dry-moist.	0	2'3"	
6 7 8 9 10	**5-10' RUN** no recovery		0	
11 12 13 14 15	**10-15' RUN** no recovery Refused at 13.5'		0	
	E.O.B. @ 13.5'. Set MW-5 @ 13.5' bgs, w/ 10' of 20-slot screen. #1 sand to 3' bgs, bentonite chips to 1' bgs. PID readings obtained w/ Ion Science Model 1000+ (10.6 eV lamp)			

APPENDIX C

ENDYNE Inc.
Environmental Laboratories

Applied Geosolutions, LLC	
2113 Stony Brook Rd.	090420
Northfield, VT 05663	
Atten: Eric Swiech	

PROJECT: Caforia
WORK ORDER: **0906-08099**
DATE RECEIVED: June 12, 2009
DATE REPORTED: June 24, 2009
SAMPLER: Eric Swiech

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Randolph, VT facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report

DATE REPORTED: 06/24/2009

CLIENT: Applied Geosolutions, LLC
PROJECT: Caforia

WORK ORDER: **0906-08099**
DATE RECEIVED 06/12/2009

001 Site: MW-1 Date Sampled: 6/11/09 Time: 16:05

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Vt Petroleum List 8021B							
Methyl-t-butyl ether (MTBE)	< 100	ug/L	EPA 8021B	6/19/09	W MMW	N	
Benzene	< 50.0	ug/L	EPA 8021B	6/19/09	W MMW	N	
Toluene	2,270	ug/L	EPA 8021B	6/19/09	W MMW	N	
Ethylbenzene	337	ug/L	EPA 8021B	6/19/09	W MMW	N	
Xylenes, Total	2,880	ug/L	EPA 8021B	6/19/09	W MMW	N	
1,3,5-Trimethylbenzene	335	ug/L	EPA 8021B	6/19/09	W MMW	N	
1,2,4-Trimethylbenzene	1,060	ug/L	EPA 8021B	6/19/09	W MMW	N	
Naphthalene	123	ug/L	EPA 8021B	6/19/09	W MMW	N	
Surr. 1 (Bromobenzene)	101	%	EPA 8021B	6/19/09	W MMW	N	
Unidentified Peaks	> 10		EPA 8021B	6/19/09	W MMW	N	

002 Site: MW-2 Date Sampled: 6/11/09 Time: 14:45

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Vt Petroleum List 8021B							
Methyl-t-butyl ether (MTBE)	< 40.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Benzene	42.9	ug/L	EPA 8021B	6/18/09	W MMW	N	
Toluene	< 20.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Ethylbenzene	115	ug/L	EPA 8021B	6/18/09	W MMW	N	
Xylenes, Total	107	ug/L	EPA 8021B	6/18/09	W MMW	N	
1,3,5-Trimethylbenzene	39.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
1,2,4-Trimethylbenzene	292	ug/L	EPA 8021B	6/18/09	W MMW	N	
Naphthalene	< 40.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Surr. 1 (Bromobenzene)	102	%	EPA 8021B	6/18/09	W MMW	N	
Unidentified Peaks	> 10		EPA 8021B	6/18/09	W MMW	N	

003 Site: MW-3 Date Sampled: 6/11/09 Time: 16:00

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Vt Petroleum List 8021B							
Methyl-t-butyl ether (MTBE)	< 2.0	ug/L	EPA 8021B	6/19/09	W MMW	N	
Benzene	2.3	ug/L	EPA 8021B	6/19/09	W MMW	N	
Toluene	< 1.0	ug/L	EPA 8021B	6/19/09	W MMW	N	
Ethylbenzene	< 1.0	ug/L	EPA 8021B	6/19/09	W MMW	N	
Xylenes, Total	10.6	ug/L	EPA 8021B	6/19/09	W MMW	N	
1,3,5-Trimethylbenzene	1.3	ug/L	EPA 8021B	6/19/09	W MMW	N	
1,2,4-Trimethylbenzene	14.6	ug/L	EPA 8021B	6/19/09	W MMW	N	
Naphthalene	19.9	ug/L	EPA 8021B	6/19/09	W MMW	N	
Surr. 1 (Bromobenzene)	106	%	EPA 8021B	6/19/09	W MMW	N	
Unidentified Peaks	> 10		EPA 8021B	6/19/09	W MMW	N	

Laboratory Report

DATE REPORTED: 06/24/2009

CLIENT: Applied Geosolutions, LLC
PROJECT: Caforia

WORK ORDER: **0906-08099**
DATE RECEIVED 06/12/2009

004 Site: MW-4 Date Sampled: 6/11/09 Time: 15:10

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Vt Petroleum List 8021B							
Methyl-t-butyl ether (MTBE)	< 40.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Benzene	189	ug/L	EPA 8021B	6/18/09	W MMW	N	
Toluene	58.7	ug/L	EPA 8021B	6/18/09	W MMW	N	
Ethylbenzene	387	ug/L	EPA 8021B	6/18/09	W MMW	N	
Xylenes, Total	1,430	ug/L	EPA 8021B	6/18/09	W MMW	N	
1,3,5-Trimethylbenzene	550	ug/L	EPA 8021B	6/18/09	W MMW	N	
1,2,4-Trimethylbenzene	1,520	ug/L	EPA 8021B	6/18/09	W MMW	N	
Naphthalene	138	ug/L	EPA 8021B	6/18/09	W MMW	N	
Surr. 1 (Bromobenzene)	105	%	EPA 8021B	6/18/09	W MMW	N	
Unidentified Peaks	> 10		EPA 8021B	6/18/09	W MMW	N	

005 Site: MW-5 Date Sampled: 6/11/09 Time: 15:40

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Vt Petroleum List 8021B							
Methyl-t-butyl ether (MTBE)	< 2.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Benzene	< 1.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Toluene	< 1.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Ethylbenzene	< 1.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Xylenes, Total	< 2.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
1,3,5-Trimethylbenzene	< 1.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
1,2,4-Trimethylbenzene	< 1.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Naphthalene	< 2.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Surr. 1 (Bromobenzene)	116	%	EPA 8021B	6/18/09	W MMW	N	
Unidentified Peaks	1		EPA 8021B	6/18/09	W MMW	N	

006 Site: SW-1 Date Sampled: 6/11/09 Time: 16:20

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Vt Petroleum List 8021B							
Methyl-t-butyl ether (MTBE)	< 4.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Benzene	7.6	ug/L	EPA 8021B	6/18/09	W MMW	N	
Toluene	< 2.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Ethylbenzene	40.8	ug/L	EPA 8021B	6/18/09	W MMW	N	
Xylenes, Total	33.2	ug/L	EPA 8021B	6/18/09	W MMW	N	
1,3,5-Trimethylbenzene	43.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
1,2,4-Trimethylbenzene	239	ug/L	EPA 8021B	6/18/09	W MMW	N	
Naphthalene	18.4	ug/L	EPA 8021B	6/18/09	W MMW	N	
Surr. 1 (Bromobenzene)	104	%	EPA 8021B	6/18/09	W MMW	N	

Laboratory Report

DATE REPORTED: 06/24/2009

CLIENT: Applied Geosolutions, LLC
PROJECT: Caforia

WORK ORDER: **0906-08099**
DATE RECEIVED 06/12/2009

006 Site: SW-1 Date Sampled: 6/11/09 Time: 16:20

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Unidentified Peaks	> 10		EPA 8021B	6/18/09	W MMW	N	

007 Site: Seep-1 Date Sampled: 6/11/09 Time: 16:25

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Vt Petroleum List 8021B							
Methyl-t-butyl ether (MTBE)	< 20.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Benzene	37.9	ug/L	EPA 8021B	6/18/09	W MMW	N	
Toluene	< 10.0	ug/L	EPA 8021B	6/18/09	W MMW	N	
Ethylbenzene	106	ug/L	EPA 8021B	6/18/09	W MMW	N	
Xylenes, Total	95.9	ug/L	EPA 8021B	6/18/09	W MMW	N	
1,3,5-Trimethylbenzene	234	ug/L	EPA 8021B	6/18/09	W MMW	N	
1,2,4-Trimethylbenzene	843	ug/L	EPA 8021B	6/18/09	W MMW	N	
Naphthalene	45.6	ug/L	EPA 8021B	6/18/09	W MMW	N	
Surr. 1 (Bromobenzene)	104	%	EPA 8021B	6/18/09	W MMW	N	
Unidentified Peaks	> 10		EPA 8021B	6/18/09	W MMW	N	

008 Site: Duplicate Date Sampled: 6/11/09 Time: 16:05

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Vt Petroleum List 8021B							
Methyl-t-butyl ether (MTBE)	< 40.0	ug/L	EPA 8021B	6/19/09	W MMW	N	
Benzene	226	ug/L	EPA 8021B	6/19/09	W MMW	N	
Toluene	84.3	ug/L	EPA 8021B	6/19/09	W MMW	N	
Ethylbenzene	405	ug/L	EPA 8021B	6/19/09	W MMW	N	
Xylenes, Total	1,480	ug/L	EPA 8021B	6/19/09	W MMW	N	
1,3,5-Trimethylbenzene	622	ug/L	EPA 8021B	6/19/09	W MMW	N	
1,2,4-Trimethylbenzene	1,730	ug/L	EPA 8021B	6/19/09	W MMW	N	
Naphthalene	156	ug/L	EPA 8021B	6/19/09	W MMW	N	
Surr. 1 (Bromobenzene)	100	%	EPA 8021B	6/19/09	W MMW	N	
Unidentified Peaks	> 10		EPA 8021B	6/19/09	W MMW	N	

ENDYNE, INC.
160 James Brown Drive
Williston, Vermont 05495
(802) 879-4333

CHAIN-OF-CUSTODY-RECORD

37928

Special Reporting Instructions:

Project Name: CAFORIA	Reporting Address: AGS 213 STONY BROOK RD NORTHFIELD, VT 05663	Billing Address: SAME
Endyne Order ID: (Lab Use Only) -O -I -S	Company: AGS Contact Name/Phone #: ERIC SWIERK / 485-9466	Sampler Name: SAME Phone #:

Ref # (Lab Use Only)	Sample Identification	Matrix	GRAB	COMP	Date/Time 6-11-09	Sample Containers No.	Sample Containers Type/Size	Field Results/Remarks	Analysis Required	Sample Preservation	Rush
	MW-1	WATER	X		1605	2	40ml		19	HCL	
	MW-2				1445						
	MW-3				1600						
	MW-4				1510						
	MW-5				1540						
	SW-1				1620						
	SEEP-1				1625						
	DUP				—						

Relinquished by:	Date/Time	Received by:	Date/Time	Received by:	Date/Time
Eric J. S	6-12-09 1303			[illegible]	6/12/09 1305

New York State Project: Yes _____ No _____

Requested Analyses

1	pH	6	TKN	11	Total Solids	16	Sulfate	21	1664 TPH/FOG	26	8270 PAH
2	Chloride	7	Total P	12	TSS	17	Coliform (Specify)	22	8015 GRO	27	PP13 Metals
3	Ammonia N	8	Total Diss. P	13	TDS	18	COD	23	8015 DRO	28	RCRA8 Metals
4	Nitrite N	9	BOD	14	Turbidity	19	8021B	24	8260/8260B	29	
5	Nitrate N	10	Alkalinity	15	Conductivity	20	8010/8020	25	8270 B/N or Acid	30	

31 Metals (As Is, Total, Diss.) Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, Sb, Se, Tl, V, Zn

32 TCLP (Specify: volatiles, semi-volatiles, metals, pesticides, herbicides) 33

34 Other

LAB USE ONLY
Delivery:
Temp: ice, <2
Comment:
0906-08099

(White – Laboratory / Yellow – Client)

APPENDIX D

Photo #1. Ground water seeps and iron staining along west bank of Thatcher Brook (6/11/09).

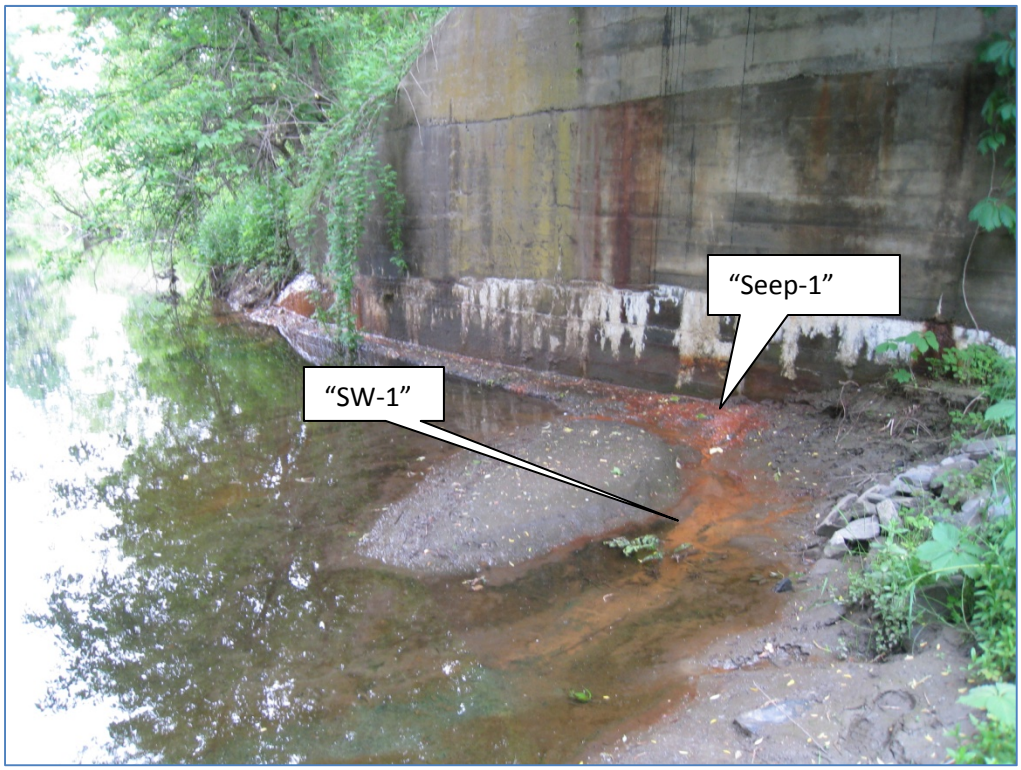


Photo #2. Ground water seep and surface water sampling locations (6/11/09).