SUPPLEMENTAL SITE INVESTIGATION REPORT

BEDFORD VILLAGE WELLS
HUNTING RIDGE MALL
Site 360009

Prepared for:
SUPERFUND STANDBY PROGRAM
New York State Department of Environmental Conservation
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Table of Contents

List of Figures

List of Tables

Appendices

LIST OF ACRONYMS

AWQS	Ambient Water Quality Standards
cm/s	centimeters/second
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CVOCs	chlorinated volatile organic compounds
DCE	Dichloroethylene
DER	Division of Environmental Remediation
DI	dissolved iron
DM	dissolved manganese
DNAPL	dense non-aqueous phase liquid
ft-bgs	feet below ground surface
HSA	hollow stem auger
ISCO	in-situ chemical oxidation
MS	matrix spike
MSD	matrix spike duplicate
ft/day	feet/day
MTBE	methyl-tert butyl ether
NAP	natural attenuation parameters
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCE	Tetrachloroethylene
PID	photo ionization detector
ppb	parts per billion
PVC	polyvinyl chloride
QA/QC	quality assurance/ quality control
ROD	Record of Decision
SSI	Supplemental Site Investigation
TAL	target analyte list
TCE	Trichloroethylene
TCL	target compound list
TGSPs	temporary grab sample points
TICS	tentatively identified compounds
USEPA	United States Environmental Protection Agency
VOCs	volatile organic compounds

EXECUTIVE SUMMARY

AECOM Technical Services Northeast, Inc. (AECOM) conducted a Supplemental Site Investigation (SSI) to obtain additional data for the Bedford Village Wells – Hunting Ridge Mall Inactive Hazardous Waste Disposal Site #3-60-009 (the "Site") located in the Town of Bedford, Westchester County, New York. The project was performed at the request of the New York State Department of Environmental Conservation (NYSDEC) and conducted in general conformance with the approved Work Plan submitted by AECOM in March 2009. This SSI was initiated by NYSDEC to evaluate the distribution of contaminated soil and groundwater, and design a cost-effective mitigation program for the Site.

To fulfill the objectives for this investigation, AECOM performed the following activities:

- Assessed site geology in the vicinity of the former spill area;
- Assessed the potential for dense non-aqueous phase liquid (DNAPL) and/or impacted soils in or near the source area;
- Assessed the hydraulic properties of the shallow aquifer;
- Further evaluated the areal and vertical extent of contamination; and
- Collected additional data to support the design and implementation of a remedial action.

Based on the soil sampling activities performed during the SSI and the results presented in this document, residual soil contamination does not appear to be present at the Site.

The following conclusions are based on the groundwater sampling activities conducted during the SSI and subsequent results:

- No concentrated source of chlorinated volatile organic compounds (CVOCs) was encountered beneath the shopping mall during the SSI.
- As depicted in the sphere of contamination map developed during the SSI, historical CVOC impacts continue to migrate down gradient. CVOC concentrations observed in MW-3M remain within the residual plume.
- As measured in MW-3M dissolved phase contamination continues to show evidence of natural attenuation.

The following conclusions are based on the aquifer investigation activities conducted during the SSI and subsequent data evaluation:

- Review of the data logs from the transducers indicates no measurable response was observed between the municipal water supply wells and the Site wells.
- Since no hydraulic response was noted between the Site wells and the municipal wells, an infusion of chemical additives used for mitigation purposes should not affect the municipal water supply well chemistry.

- As a result of the slug tests conducted on MW-14 and MW-15, the hydraulic conductivity has been calculated to be:
  - Hydraulic conductivity as measured in MW-14 is 1.3×10^{-6} inches/second
  - Hydraulic conductivity as measured in MW-15 is 3.3×10^{-6} inches/second
- As depicted on the groundwater isoelevation map, groundwater flows southeast across the site and:
  - Groundwater velocity as measured from MW-14 is 2.86×10^{-9} inches/second
  - Groundwater velocity as measured from MW-15 is 7.26×10^{-8} inches/second.
  - Groundwater velocity as measured from MW-3M, 5.59×10^{-7} inches/second
  - Groundwater gradient as measured between MW-14, MW-15, and MW-3S is 2.2×10^{-3}.

Following the SSI, a limited in-situ chemical oxidation (ISCO) treatment is required at the Site to comply with the terms of the Record of Decision (ROD). A limited ISCO treatment is recommended upgradient of the area where the greatest contaminant concentrations were detected (MW-3M). AECOM recommends a three percent solution of sodium permanganate to be introduced into six injection points located approximately 10 and 35 feet upgradient of MW-3M. Approximately 50 gallons of three percent permanganate solution will be injected per injection point, though the exact amount will be decided in the field based on the rate of dissipation from the injection points. The permanganate will oxidize the CVOCs, degrading them into derivatives (i.e., carbon dioxide, manganese oxide, water, sodium, and chloride ions).

Monitoring well MW-3M will be sampled prior to injection to collect baseline data immediately prior to injection. This well will then be sampled one week, one month, three months, and six months after the injection for CVOCs and its derivatives to evaluate the success of the injection effort.

1.0 INTRODUCTION

At the request of the New York State Department of Environmental Conservation (NYSDEC), AECOM Technical Services, Northeast, Inc. (AECOM) prepared and implemented a Supplemental Site Investigation (SSI) to obtain additional data for the Bedford Village Wells – Hunting Ridge Mall Inactive Hazardous Waste Disposal Site #3-60-009 (the "Site") located in the Town of Bedford, Westchester County, New York. See **Figure 1** for site location. The Preliminary Design Report prepared by AECOM and submitted to NYSDEC in February 2009 concluded there was insufficient information to design a cost-effective mitigation program for the Site. In response, AECOM submitted a scope of work in March 2009 outlining a supplemental site investigation to evaluate the distribution of contaminated soil and groundwater, and design a cost-effective mitigation program for the Site.

This SSI report presents and summarizes all activities conducted by AECOM on site after the submittal of the Preliminary Design Report from February 2009. The SSI activities were conducted by AECOM, on behalf of NYSDEC under work assignment No. 00445-23. Activities were performed in general accordance with NYSDEC Draft DER-10, Technical Guidance for Site Investigation and Remediation (NYSDEC, 2002), the United States Environmental Protection Agency (USEPA) Guidance for Conducting Remedial Investigations and Feasibility Studies under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA [USEPA, 1980]).

1.1 SITE DESCRIPTION

For an introduction to the Site, refer to the Preliminary Design Report prepared by AECOM and submitted to the NYSDEC in February 2009. More specifically, refer to Sections 1 and 2 of Preliminary Design Report for details on the Site location, description, history, and environmental concerns.

2.0 PROJECT DESCRIPTION

2.1 PROJECT OBJECTIVES

The objectives of this SSI were to:

- Evaluate the distribution of contaminated groundwater and subsurface soil; and
- Evaluate the presence or absence of residual source materials beneath the mall.

2.2 PROJECT ACTIVITIES

To fulfill the objectives for this investigation, AECOM performed the following activities:

- Assessed site geology in the vicinity of the former spill area;
- Assessed the presence of dense non-aqueous phase liquid (DNAPL) and/or contaminated soils in or near the source area;
- Assessed the hydraulic properties of the shallow aquifer;
- Further evaluated areal and vertical extent of contamination; and
- Collected additional data to support the design and implementation of a remedial action.

2.3 METHODS AND PROCEDURES

2.3.1 Subsurface Soil Sampling Activities

AECOM and Aztech Technologies, Inc. (the subcontractor) mobilized to the Site on August 26, 2009 and installed six soil borings using a Geoprobe ® over a two-day period. **Figure 2** depicts the site layout and the location of the six soil borings. No additional borings were required, based on the absence of visual and olfactory evidence of contamination in the soil samples and the absence of detectable volatile organic compounds (VOCs) using a photo ionization detector (PID). Of the six soil boring locations, two were converted into monitoring wells using hollow stem augers (HSA). Soil boring logs and well construction diagrams are included as **Appendix A**.

A total of seven soil samples were collected for analytical testing. One soil sample was collected from each of the six soil boring locations, except for SB-5, where two samples were collected. An additional soil sample was collected from SB-5 at a depth of 25 to 30 ft-bgs due to slight odor. Four soil samples were collected from soil borings alone (i.e., borings not converted into monitoring wells) and analyzed for target compound list (TCL) VOCs plus 10 tentatively identified compounds (TICS). Three soil samples were collected from the soil borings converted into monitoring wells and analyzed for TCL VOC+10 TICS s as well as target analyte list (TAL) of regulated metals.

Along with the seven soil samples, additional soil was collected for quality assurance and quality control (QA/QC) purposes. Specifically, additional soil was collected for one duplicate sample, one matrix spike (MS) sample and one matrix spike duplicate (MSD) sample for TCL VOCs+10 TICS and TAL Metals. A total of two equipment blanks were taken from decontaminated, metal sampling equipment in association with the subsurface soil sampling activities. One equipment blank was collected by running distilled water along an auger flight and another by running distilled water through one of the drill rods.

All soil samples were collected in laboratory-supplied bottle-ware, labeled, and placed in a cooler on ice for overnight delivery or same day delivery to the NYSDEC-Department of Environmental Remediation (DER) Laboratory in Rensselaer, New York under standard chain-of-custody protocols. All samples were reported with full Category B data deliverables.

2.3.2 Groundwater Investigation

2.3.2.1 Direct Push Groundwater Sampling

Temporary grab sample points (TGSPs) were installed at two soil boring locations (SB-1 and SB-6). TGSPs were installed using a discrete interval water sampler driven to the desired depth with the Geoprobe®. Grab-samples were then collected using a peristaltic pump with dedicated polyethylene and silicone tubing. See **Figure 3** for locations of the two TGSPs. A TGSP was not installed at SB-3 because groundwater was not encountered during completion of the boring. Information collected during purging and sampling for these two TGSPs are included as **Appendix B**.

TGSP groundwater samples were analyzed for TCL VOCs. Additional water was collected for QA/QC purposes (i.e., additional water was collected for one duplicate sample, one MS and one MSD for TCL VOCs). In addition to the five groundwater samples submitted for analysis, one equipment blank and two trip blanks were included with this sample deliverable group. The equipment blank was collected by running distilled water through the discrete water sampler. Two trip blanks were submitted because these activities were conducted over a three-day period, which required the shipment of two separate coolers.

All water samples were collected in laboratory-supplied bottle-ware, labeled, and placed in a cooler on ice for overnight delivery or same day delivery to the NYSDEC-DER Laboratory in Rensselaer, New York under standard chain-of-custody protocols. All samples were reported with full Category B data deliverables.

2.3.2.2 Monitoring Well Installation and Development

As described above, two soil borings (SB-2 and SB-5) were converted into monitoring wells started on August 27, 2009 and completed on August 28, 2009. See **Figure 2** for locations of borings and monitoring wells. Two-inch diameter polyvinyl chloride (PVC) riser and screen were put into position after the enlargement of the boring with a 4.25 inch HSA. MW-14, which was converted from SB-2, was installed to a total depth of approximately 36 ft-bgs and MW-15, which was converted from SB-5, installed to a total depth of approximately 30 ft-bgs. Both wells are constructed with ten feet of screen open to the shallow aquifer.

Both wells were developed August 31, 2009. Water quality parameters were recorded during the development process and are included as **Appendix C.**

The wells were identified as MW-10 and MW-12, review of historical information shows that these well identifications had already been assigned to Site monitoring wells. The newly installed wells were subsequently renamed MW-14 (formerly MW-10) and MW-15 (formerly MW-12). These wells will be identified by their new names (MW-14 and MW-15) throughout this document.

2.3.2.3 Aquifer Testing

AECOM visited the municipal water supply department on September 11th and requested pumping records and well construction information. Historical records were to be examined for evidence of a demonstrable effect from pumping of the municipal water supply wells on the on-site wells without conducting an extensive bedrock evaluation and/or pumping tests.

After measuring water levels on all the existing wells, down-hole pressure transducers were placed in five wells (MW-14, MW-15, MW-6D, MW-3M and MW-3S) on September 11, 2009. The transducers were preset to begin recording simultaneously and to record water table elevation in each well once every 15 minutes until removed on September 17, 2009.

The depth of water data collected by the transducers was analyzed graphically for evidence of a response to groundwater withdrawal from the municipal supply wells for the same period. Time-lag and amplitude of the periodic wave observed in the on-site well data was then used to calculate a range of relative travel times, which was used to evaluate potential effects, if any, of the infusion of chemical additives used for mitigation on the municipal wells. Results and conclusions from this evaluation are presented in **Section 3 and Section 4** of this document, respectively.

A pneumatic slug test was performed on MW-14 and MW-15. A slug test involves inducing a rapid change in water level in a test well. By measuring and recording the rate of return to static conditions (recovery), the horizontal hydraulic conductivity of the material surrounding the well can be estimated. Slug test data is analyzed using established solutions to the equations which govern groundwater flow. Homogeneity and constant aquifer thickness are common assumptions for conditions within the area of influence of the test. In practice, these assumptions are usually met because the radius of influence of most slug tests is small.

2.3.2.4 Monitoring Well Sampling

On September 16, 2009, AECOM sampled three wells (MW-3M, MW-14, and MW-15) using a peristaltic pump and dedicated, polyethylene and silicone tubing. See **Figure 2** for locations of on- and off-site monitoring wells. Wells were purged and sampled using the low-flow or minimal draw-down technique, which monitors groundwater quality parameters until three consecutive rounds of readings stabilize to within an established range indicating no significant change. The information recorded during sampling for these three wells are included as **Appendix D**.

The groundwater samples were analyzed for TCL VOCs+10 TICS, TAL metals, dissolved iron (DI), dissolved manganese (DM), and natural attenuation parameters (NAP). Additional water was collected for QA/QC purposes. Specifically, additional water was collected for one duplicate sample on TCL VOCs+10 TICS and metals only and one MS/MSD to analyze for TCL VOCs+10 TICS only. In addition to the three groundwater samples submitted for analysis, one trip blank was included with this sample deliver group.

All groundwater samples were collected in laboratory-supplied bottle-ware, labeled, and placed in a cooler on ice for overnight delivery to Adirondack Environmental Services in Albany, New York under standard chain-of-custody protocols. All sample results were reported with full Category B data deliverables.

3.0 RESULTS

3.1 SOIL ANALYTICAL RESULTS

During soil screening and sampling activities, no DNAPL or staining was observed in any of the soil collected from the six borings. Since no visual, olfactory, or PID measurements indicating contamination was observed, no additional borings were completed.

As depicted in Table 3-1 below, the analytical results for the seven soil samples reported no detectable concentration of CVOCs and for all other VOCs except acetone. See **Figure 4** for a graphical summary of the soil results. Acetone was detected in all samples except for the samples collected from SB-1 and SB-3. The concentrations of acetone were detectable, but were well below the standard of 500,000 parts per billion (ppb) set by New York State Remedial Program Soil Cleanup Objectives (Subpart 375-6, December 2006) for protection of public health in a commercial setting.

Table 3-1: Summary of Subsurface Soil Results – VOCs

Sample ID			SB-1-(13-15')		SB-2-(13-15')		SB-3-(3-5')		SB-4-(2-4')		Dup-1S		SB-5-(10-12')		SB-5-(26-28')		SB-6-(13-15')	
Sample Date			8/25/09		8/25/09		8/25/09		8/25/09		8/25/09		8/25/09		8/25/09		8/26/09	
Matrix			Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
Volatile Organic Compounds (VOCs) µg/kg or ppb	NYS RPSCO Commercial	NYS RPSCO Groundwater																
Acetone	500,000	50	14.0	U	**8.0**	J	12.0	U	**20.0**		**11.0**		**15.0**		**7.0**	J	**24.0**	
Total Concentration			0.0		**8.0**	J	0.0		**20.0**		**11.0**		**15.0**		**7.0**	J	**24.0**	
Total Chlorinated VOCs			0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
Total TICs			0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	

NOTES:

1. **Samples analyzed for TCL VOCs + 10 TICs utilized USEPA SW-846 Method 8260.**
2. **NYRPSCO: NYS Remedial Program Soil Cleanup Objectives (Subpart 375-6, December 2006) for Protection of Public Health - Commercial and Protection of Groundwater.**
3. **U = Analyte not detected above the listed Reporting Limit.**
4. **J = estimated concentration**
5. **Bold font designates detected result. All sample results were either not detected or detected at concentrations less than associated Standard.**
6. **Duplicates are located to the right of the sample in which they replicate.**

The four soil samples that were tested for TAL metals exhibited detectable concentrations for several elements, but none of the concentrations exceeded the standards set by the soil cleanup objectives. A summary table for TAL metals is provided below.

Table 3-2: Summary of Subsurface Soil Results – TAL Metals

Sample ID			SB-2-(13-15')		SB-4-(2-4')		DUP-1S		SB-5-(10-12')		SB-5-(26-28')	
Sample Date			8/25/09		8/25/09		8/26/09		8/25/09		8/25/09	
Matrix			Soil		Soil		Soil		Soil		Soil	
Target Analyte List (TAL) of Regulated Metals mg/kg or ppm	NYS RPSCO Commercial	NYS RPSCO Groundwater										
Aluminum	NL	NL	**12600**		**14500**		**16000**		**8870**		**8040**	
Arsenic	16	16	**2.18**	**B**	**1.44**	**B**	**1.95**	**B**	**1.14**	**B**	0.56	U
Barium	400	820	**57.6**		**83.1**		**77.3**		**46.4**		**58.8**	
Calcium	NL	NL	**2700**		**3560**		**2400**		**2740**		**2610**	
Chromium	1,500	NS	**16.4**		**19.9**		**19.2**		**16.7**		**15.8**	
Cobalt	NL	NL	**7.1**		**9.17**		**7.76**		**7.3**		**5.81**	
Copper	270	1,720	**13.8**		**19.9**		**19.1**		**15.5**		**14.9**	
Iron	NL	NL	**19600**		**21000**		**25000**		**15700**		**16000**	
Lead	1,000	450	**6.24**		**5.07**		**5.46**		**2.18**	**B**	**2.34**	**B**
Magnesium	NL	NL	**5020**		**5290.0**		**5690**		**4000**		**3890.0**	
Manganese	10,000	2,000	**234**		**356**		**393**		**314**		**227**	
Molybdenum	NL	NL	**0.477**	**B**	**0.135**	**B**	**0.0142**	**B**	**0.0732**	**B**	**0.14**	**B**
Nickel	310	130	**10.9**		**14.0**		**14.6**		**12.1**		**11.1**	
Potassium	NL	NL	**2220**		**2750**		**2640**		**1630**		**2400**	
Sodium	NL	NL	**331**		**318**		**270**		**233**		**233**	
Titanium	NL	NL	**905**		**1260**		**1150**		**869**		**932**	
Vanadium	NL	NL	**26.3**		**32**		**28.0**		**21.8**		**22.8**	
Zinc	10,000	2,480	**37.9**		**35.4**		**38.6**		**27.9**		**24.9**	

NOTES:

1. **Samples analyzed for TAL regulated metals utilized USEAP SW-846 Method 6000 and 7000 series.**
2. **NYRPSCO: NYS Remedial Program Soil Cleanup Objectives (Subpart 375-6, December 2006) for Protection of Public Health - Commercial and Protection of Groundwater.**
3. **NL - designates no groundwater Standard or Guidance Value listed for this compound.**
4. **NA - Not Analyzed**
5. **U = Analyte not detected above the listed Reporting Limit.**
6. **B - if the reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).**
7. **Bold font designates detected result. All sample results were either not detected or detected at concentrations less than associated Standard.**
8. **Duplicates are located to the right of the sample in which they replicate.**

The QA/QC samples did not indicate any anomalies in the data that would suggest the sample results are not accurate.

3.2 GROUNDWATER ANALYTICAL RESULTS

3.2.1 Direct Push Groundwater Sampling

As depicted in Table 3-3 below, the results of the TGSP groundwater samples contained detectable concentrations of several VOCs. Some compounds were reported to exceed the NYS Ambient Water Quality Standards (AWQS) and Guidance values set by TOGS 1.1.1, June 1998 with April 2000 and June 2004 Addendums. See **Figure 5** for a summary of the groundwater analytical results from the TGSPs and the

monitoring wells. The total VOC concentrations for TGSP-SB-1-(28-32') and TGSP-SB-6-(36-40') were reported at 3.0 (J) ppb and 115 (J) ppb, respectively. The grab groundwater sample from SB-1 contained detectable concentrations of methyl-tert butyl ether (MTBE) and toluene, below the AWQS. The grab

sample from SB-6 exhibited concentrations exceeding the AWQS of three CVOCs, including cis 1,2-Dichloroethene (DCE) at 52.0 ppb, Trichloroethene (TCE) at 14 ppb, and Tetrachloroethene (PCE) at 47 ppb.

Table 3-3: Summary of TGSP Results – VOCs

Sample ID		**TGSP-SB-1-(28-32')**		**TGSP-SB-6-(36-40')**		**DUP-1W**	
Sample Date		**25-Aug-09**		**26-Aug-09**		**26-Aug-09**	
Matrix		Water		Water		Water	
Volatile Organic Compounds (VOCs) µg/l or ppb	**NYSAWQS GA**						
Methyl-tert butyl ether	10 GV	**2.0**	**J**	10.0	U	10.0	U
cis 1,2-Dichloroethene	5	10.0	U	**52.0**		**50.0**	
Chloroform	7	10.0	U	**2.0**	**J**	**2.0**	**J**
Trichloroethene	5	10.0	U	**14.0**		**13.0**	
Toluene	5	**1.0**	**J**	10.0	U	10.0	U
Tetrachloroethene	5	10.0	U	**47.0**		**47.0**	
Total Concentration.		**3.0**	**J**	**115.0**	**J**	**112.0**	**J**
Total Chlorinated VOCs		0.0		**115.0**	**J**	**112.0**	**J**
Total TICs		0.0		0.0		0.0	

NOTES:

1. Samples analyzed for TCL VOCs + 10 TICs utilized USEPA SW-846 Method 8260.
2. NYSAWQS: NYS Ambient Water Quality Standards and Guidance Values (TOGS 1.1.1, June 1998 with April 2000 and June 2004 Addendums) for groundwater (GA).
3. GV - designates a Guidance Value.
4. U - analyte not detected above the listed Reporting Limit.
5. J - estimated concentration.
6. Bold font designates detected result.
7. Shaded cells indicate detections above the standard or guidance value.
8. Duplicates are located to the right of the sample in which they replicate.

3.2.2 Aquifer Testing

Table 3-4 below is a groundwater elevation table generated from the depth to water measurements taken on September 11, 2009. **Figure 6** is a groundwater isoelevation map generated from this table.

Table 3-4: Groundwater Elevations

Well #	Reference Elevation	Feet Below Reference Elevation	Groundwater Elevation	Comments
MW-1S	370.29	NA	**NA**	**Decommissioned**
MW-3S	372.99	15.43	**357.56**	
MW-3M	374.13	16.52	**357.61**	
MW-6S	389.34	35.11	**354.23**	
MW-6M	388.73	32.03	**356.70**	
MW-6D	387.29	33.09	**354.20**	
MW-8B	368.12	NM	**NM**	
MW-8M	367.38	NM	**NM**	
MW-1	388.97	Dry	**NA**	
MW-2	390.21	33.49	**356.72**	
MW-3	390.03	33.27	**356.76**	
MW-4	389.53	32.75	**356.78**	
MW-5	389.09	32.57	**356.52**	
MW-6	388.47	34.16	**354.31**	
MW-8	391.23	36.93	**354.30**	
MW-9	388.61	38.84	**349.77**	
MW-14	371.77	13.95	**357.82**	
MW-15	371.70	13.62	**358.08**	
MW-?	379.34	24.24	**355.10**	
MW-??	Unknown	33.49	**NA**	

Notes:
1. Reference Elevation, from a survey completed by YEC Inc. January 12, 2009 (NAVD88)
2. NA - None applicable
3. NM - Not Measured
4. MW-? - unknown well identification

Based on review of the data logs from the five transducers, only one spike or alteration in the water level was observed. This spike was determined to be the result of the sampling event conducted on September 16, 2009. Therefore, AECOM concluded that there was no direct influence on the Site wells by groundwater withdrawal from the municipal supply wells. As a result, it was deemed unnecessary to review any historical or current documents from the municipal water supply pumping house.

The data collected from the Slug Tests conducted on MW-14 and MW-15 is included as **Figure 7** and **Figure 8** respectively.

3.2.3 Monitoring Well Sampling

Results from the samples collected at MW-3M, MW-14, and MW-15 indicate there are reported concentrations exceeding standards or guidance values in the groundwater at the Site. Three compounds were detected in MW-3M with a total CVOC concentration of 154.0 ppb. These compounds include DCE (19 ppb), TCE (15 ppb), and PCE (120 ppb). Total CVOCs for MW-14 and MW-15 are 7.1 ppb and 0.0 ppb, respectively. Small concentrations of acetone were detected in all three wells, which were flagged as potential laboratory contaminant. The following table summarizes the results of VOCs for the three monitoring wells.

Table 3-5: Summary of Monitoring Well Results – VOCs

Sample ID		MW-3M		MW-14		Dup-1-GW		MW-15	
Sample Date		16-Sep-09		16-Sep-09		16-Sep-09		16-Sep-09	
Matrix		Water		Water		Water		Water	
Volatile Organic Compounds (VOCs) µg/l or ppb	**NYSAWQS GA**								
Acetone	50 GV	**14.0**	**B**	**12.0**	**B**	10.0	U	**14.0**	**B**
cis-1,2-Dichloroethene	5	**19.0**		5.0	U	5.0	U	5.0	U
Trichloroethene	5	**15.0**		5.0	U	5.0	U	5.0	U
Tetrachloroethene	5	**120.0**		**7.1**		**5.8**		5.0	U
Total Concentration.		**168.0**	**B**	**19.1**	**B**	**5.8**		**14.0**	**B**
Total Chlorinated VOCs		**154.0**		**7.1**		**5.8**		0.0	
Total TICs		0.0		0.0		0.0		0.0	

NOTES:

1. **Samples analyzed for TCL VOCs + 10 TICs utilized USEPA SW-846 Method 8260.**
2. **NYSAWQS: NYS Ambient Water Quality Standards and Guidance Values (TOGS 1.1.1, June 1998 with April 2000 and June 2004 Addendums) for groundwater (GA).**
3. **GV - designates a Guidance Value.**
4. **U - analyte not detected above the listed Reporting Limit.**
5. **J - estimated concentration.**
6. **B - analyte detected in the associated Method Blank.**
7. **Bold font designates detected result.**
8. **Shaded cells indicate detections above the standard or guidance value.**
9. **Duplicates are located to the right of the sample in which they replicate.**

Figure 9 depicts total CVOC concentrations in Site monitoring wells as well as a sphere of contamination map. This sphere of contamination map shows the location of the contaminant plume. **Figure 9** shows a higher concentration of CVOCs in the vicinity of MW-3M and TGSP-SB-6 and no detection of CVOCs in TGSP-SB-1 and MW-15.

All QA/QC samples for groundwater duplicates were representative of the samples they replicated. However, acetone was detected in the trip blank shipped and analyzed with the samples collected from the monitoring wells. These results have been designated with a qualifier "B", which states that the analyte was detected in the method blank. Although acetone was detected in the SSI soil samples, no acetone was reported in the duplicate sample.

The groundwater samples were analyzed for TAL metals and NAP. Results from the groundwater samples indicate all three wells have detectable concentrations of several metals above the AWQS. As summarized in Table 3-6 below, concentrations of manganese and thallium were reported at levels above the associated AWQS at all three wells. MW-14 and MW-15 also exhibited elevated sodium levels and MW-15 exhibited elevated iron levels.

Table 3-6: Summary of Monitoring Well Results – TAL Metals

Sample ID		MW-3M		MW-14		Dup-1-GW		MW-15	
Sample Date		16-Sep-09		16-Sep-09		16-Sep-09		16-Sep-09	
Matrix		Water		Water		Water		Water	
Target Analyte List (TAL) Metals µg/l or ppb	**NYSAWQS GA**								
Aluminum	NL	100.0	U	**178**		**149**		**155**	
Barium	1000	**123**		**157**		**151**		**252**	
Calcium	NL	**56300**		**115000**		**113000**		**89500**	
Iron	300	**121**		**290**		**252**		**4620**	
Magnesium	35000 GV	**16000**		**23300**		**22700**		**20700**	
Manganese	300	**329**		**1050**		**1010**		**15800**	
Potassium	NL	**6210**		**10900**		**10700**		**20700**	
Sodium	20000	**16700**		**135000**		**120000**		**151000**	
Thallium	0.5 GV	**18**		**29**		**28**		**80**	
Zinc	2000 GV	**17**		10.0	U	10.0	U	10.0	U
Dissolved Metals µg/l or ppb									
Iron	300	50	U	50.0	U	50.0	U	**94**	
Manganese	35000	**240**		**968**		**1190**		**15500**	

NOTES:

1. NYSAWQS: NYS Ambient Water Quality Standards and Guidance Values (TOGS 1.1.1, June 1998 with April 2000 and June 2004 Addendums) for groundwater (GA).
2. GV - designates a Guidance Value.
3. NL - designates no groundwater Standard or Guidance Value listed for this compound.
4. U - analyte not detected above the listed Reporting Limit.
5. Bold font designates detected result.
6. Shaded cells indicate detections above the standard or guidance value.
7. Duplicates are located to the right of the sample in which they replicate.

Results of the NAP analysis are depicted in the following table. NAP were also recorded on the purge sheets, which are included as **Appendix D**. Since this was a baseline analysis of NAP, there is no available data to compare or analyze at this time.

Table 3-7: Monitoring Well Results – NAP

Sample ID		MW-3M		MW-14		Dup-1-GW		MW-15	
Sample Date		16-Sep-09		16-Sep-09		16-Sep-09		16-Sep-09	
Matrix		Water		Water		Water		Water	
Natural Attenuation Parameters (NAP) mg/l or ppm									
Total Hardness	NL	**206.0**		**383.0**		376.0		**309.0**	
Chloride	250	**47.0**		**280.0**		NA		**228.0**	
Sulfate	250	**28.0**		**102.0**		NA		**3.6**	
Total Alkalinity	NL	**150.0**		**170.0**		NA		**380.0**	
Biochemical Oxygen Demand	NL	2.0	U	2.0	U	NA		**20.0**	
Chemical Oxygen Demand	NL	5.0	U	**6.0**		NA		**19.0**	
Nitrogen, Nitrate	10	**0.35**		**0.86**		NA		**0.02**	
Nitrogen, Nitrite	1	**0.02**		**0.03**		NA		0.01	U
Total Organic Carbon	NL	**1.0**		**2.4**		NA		**6.5**	
Total Suspended Solids	NL	**2.5**		**9.5**		NA		**21.0**	

NOTES:

1. NYSAWQS: NYS Ambient Water Quality Standards and Guidance Values (TOGS 1.1.1, June 1998 with April 2000 and June 2004 Addendums) for groundwater (GA).
2. NL - designates no groundwater Standard or Guidance Value listed for this compound.
3. U - analyte not detected above the listed Reporting Limit.
4. NA - not analyzed.
5. Bold font designates detected result.
6. Shaded cells indicate detections above the standard or guidance value.
7. Duplicates are located to the right of the sample in which they replicate.

4.0 ANALYSIS AND CONCLUSIONS

4.1 SUBSURFACE SOIL SAMPLING ACTIVITIES

Two geologic cross-sections were generated after analyzing the soil logs collected during the SSI. The shallow aquifer material (i.e., above bedrock) was characterized into four separate intervals in the two cross-sections. Transect A-A' was generated using the soil logs from MW-3M, SB-1, SB-2, and SB-3 **(Figure 10)** and Transect B-B' was generated using soil logs from SB-2, SB-6, and SB-5 **(Figure 11)**. Starting from greatest depth and becoming shallower, the four geologic intervals are: sand, clayey sand, silty clay, and sand and silt. All four intervals are present in both cross-sections except for clayey sand, which was only evident in the cross-section generated along Transect B-B'.

While both transects generally trend in the north-south direction, Transect A-A' cuts across the building and Transect B-B' runs parallel to the front of the building. The soil logs used to create Transect B-B' produced a fairly uniform cross-section with sand and silt at the surface underlain by sand at depths ranging from 5-15 ft-bgs, underlain by bedrock encountered at depths ranging from 37-44 ft-bgs. A silty clay interval was also encountered in two of the three borings used to produce this cross-section. Transect A-A' was much more diverse, the surface deposits ranged from silty clay to sand and the depth to bedrock ranged from 5 feet at the north end of the transect to 95 feet at the south end of the transect.

Based on the soil sampling activities performed during the SSI and the results presented in this document, residual soil contamination does not appear to be present at the Site.

4.2 GROUNDWATER INVESTIGATION

4.2.1 Groundwater Analysis

The following conclusions are based on the groundwater sampling activities conducted during the SSI and subsequent results:

- No concentrated source of CVOCs was determined to be present beneath the shopping mall during the SSI.
- As depicted in the sphere of contamination map (**Figure 9**), historical CVOC contamination continues to migrate down gradient. CVOC concentrations observed in MW-3M remain within the residual plume.
- Dissolved phase contamination continues to show evidence of natural attenuation as measured in MW-3M.

Figure 3-2 from the Preliminary Design Report dated February 2009 has been modified and/or updated to reflect the result of the SSI and has been included as **Figure 12**.

4.2.2 Aquifer Analysis

The following conclusions are based on the aquifer investigation activities conducted during the SSI and subsequent data evaluation:

- Review of the data logs from the transducers indicates no measurable response was observed between the municipal water supply wells and the Site wells (see **Appendix F)**.

- Since no hydraulic response was noted between the Site wells and the municipal wells, an infusion of chemical additives used for mitigation purposes should not affect the municipal water supply well chemistry.
- As a result of the slug tests conducted on MW-14 and MW-15 (see **Appendix E**) the hydraulic conductivity has been calculated to be:
  - Hydraulic conductivity as measured in MW-14 is 1.3×10^{-6} inches/second
  - Hydraulic conductivity as measured in MW-15 is 3.3×10^{-6} inches/second
- As depicted on the groundwater isoelevation map, groundwater flows southeast across the site and:
  - Groundwater velocity as measured from MW-14 is 2.86×10^{-9} inches/second
  - Groundwater velocity as measured from MW-15 is 7.26×10^{-8} inches/second
  - Groundwater velocity as measured from MW-3M, 5.59×10^{-7} inches/second
  - Groundwater gradient as measured between MW-14, MW-15, and MW-3S is 2.2×10^{-3}

The slug test performed at MW-14 and MW-15 resulted in hydraulic conductivity values that indicate lower permeability conditions than what is believed the condition in the vicinity of MW-3M. For this reason, the hydraulic conductivity value calculated from particle grain size distribution tests of the shallow aquifer soil was used while recommending further remedial action at the Site.

5.0 RECOMMENDATIONS

Limited CVOCs were detected in Site groundwater at concentrations exceeding the NYS AWQS and Guidance Values. AECOM proposes an in-situ chemical oxidation (ISCO) program be conducted at the Site to comply with the terms of the Record of Decision (ROD). An ISCO program is recommended for the area between SB-6 and MW-3M where elevated contaminant concentrations were detected.

Sodium permanganate ($NaMnO_4$) is a stable oxidant that is proved to be effective on the target contaminants* (PCE, TCE, and DCE). Mass of the CVOCs was calculated per foot of overburden material based on the concentration recorded in MW-3M. The amount of sodium permanganate required to treat this mass of CVOCs was calculated based on stoichiometric equations.

A 5 percent solution of sodium permanganate will be injected in twenty injection points. The injections will be carried out by installing temporary Geoprobe ® points using a bottom-up injection technique. The injection points will be drilled into the shallow aquifer material until refusal is reached. The sodium permanganate will be injected at the injection point while the rod is being pulled out. Approximately 16 gallons of 5 percent solution will be injected per foot of overburden material, though the exact amount of sodium permanganate solution will be decided in the field based on the amount accepted by the injection points.

The sodium permanganate will travel in the groundwater through the soil pores as it is injected under pressure and will move downgradient with the groundwater following the injection. The permanganate will oxidize the CVOCs, degrading them into less harmful byproducts like carbon dioxide, water, sodium, and chloride ions.

The proposed injection point locations are depicted on **Figure 13**. The configuration for the injection points is based on an assumed initial radius of influence of 10 feet during the injection process as well as the distance the sodium permanganate will migrate through the overburden aquifer over a six month period. The sodium permanganate can be effective in the subsurface for up to 6 months. The final location of the injection points may be adjusted based on the location of underground utilities and to minimize interference with the patrons of the mall.

Groundwater samples will be collected from the selected monitoring wells prior to injection to establish baseline conditions. The following 11 monitoring wells will be sampled:

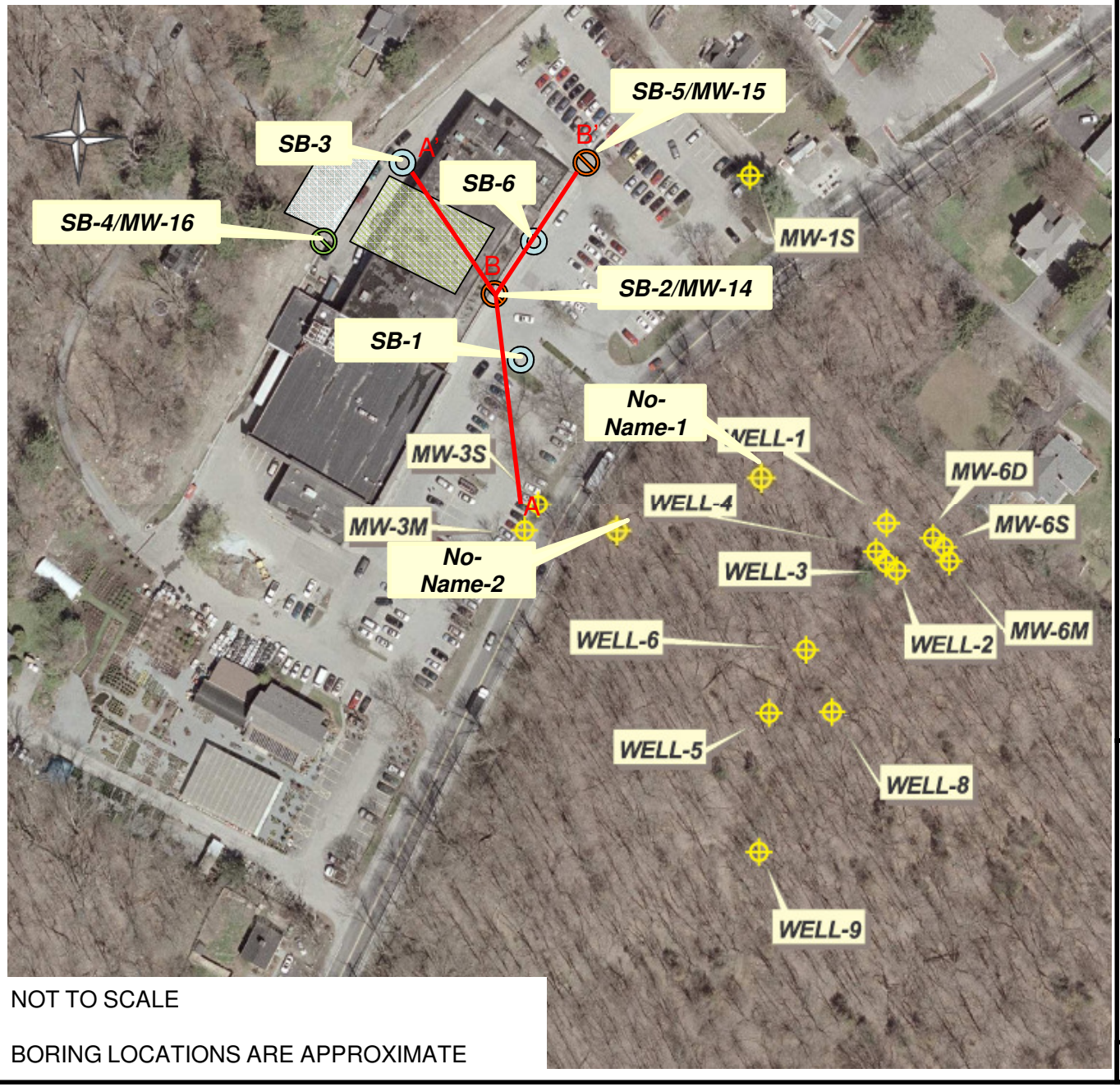
- MW-3S, MW-3M
- MW-5S, MW-5D
- MW-6S, MW-6M, MW-6D
- MW-12
- MW-14
- MW-15
- MW-16 (newly installed)

These wells will also be sampled one week, one month, three months and six months after the injection for CVOCs and its derivatives to evaluate the success of the injection effort.

Need for additional injection events will be evaluated following the six month sampling event. NYSDEC will be contacted at this time with recommendation of additional injection events or to request a determination that no further action is required at the Site.

Note: * ITRC Technical and Regulatory Guidance for In-Situ Chemical Oxidation of Contaminated Soil and Groundwater (Second Edition – January 2005)

FIGURES



NOT TO SCALE

BORING LOCATIONS ARE APPROXIMATE

LEGEND

- Preexisting Monitoring Well
- Drycleaner Location
- Former Septic Location
- Soil Borings Converted into Monitoring Wells
- Soil Boring Location
- Soil Boring to be Converted into Monitoring Well

Figure 2

Soil Boring and MW Locations

Bedford Village Wells – Hunting Ridge Mall
Bedford, NY

AECOM

November 2009 | PROJECT NO:105648

NOT TO SCALE

BORING LOCATIONS ARE APPROXIMATE

LEGEND

Monitoring Well

Temporary Grab Sample Points (TGSP)

Figure 3

TGSP and MW Locations

Bedford Village Wells – Hunting Ridge Mall
Bedford, NY

AECOM

November 2009	PROJECT NO:105648

84.10-1-30
N/F
WILTSE
L. 10447 P. 149

84.10-1-29
N/F
WILTSE
L.11018 P.275

84.10-1-28
N/F
37779 LLC
CN 443410522

N

CHAIN LINK FENCE

CONCRETE

MACADAM DRIVEWAY

RIGHT OF WAYS AS SHOWN ON TAX MAPS

WALK

MARY'S ROAD

MACADAM PARKING

MW-15/SB-5 — **Sample Date: 09/2009**
10-12 ft. BGS

Acetone	15 µg/kg
Total Chlorinated VOC Concentration	ND
Total VOC Concentration	15 µg/kg

MW-15/SB-5 — **Sample Date: 09/2009**
26-28 ft. BGS

Acetone	7 µg/kg
Total Chlorinated VOC Concentration	ND
Total VOC Concentration	7 µg/kg

MACADAM PARKING

MW-15

SB-3

SB-3 — **Sample Date: 09/2009**

Acetone	ND
Total Chlorinated VOC Concentration	ND
Total VOC Concentration	ND

84.14-1-1
N/F
B & B AUTO PARTS, INC.
L. 7126 P. 22

MW-1S

84.14-1-11
N/F
SUNNYFIELD FARM, INC.
L. 7331 P. 37

SB-4

SB-4 — **Sample Date: 09/2009**

Acetone	20 µg/kg
Total Chlorinated VOC Concentration	ND
Total VOC Concentration	20 µg/kg

SB-6

SB-6 — **Sample Date: 09/2009**

Acetone	24 µg/kg
Total Chlorinated VOC Concentration	ND
Total VOC Concentration	24 µg/kg

MACADAM PARKING

CONCRETE CURB

OLD POST ROAD

MW-14

MW-14/SB-2 — **Sample Date: 09/2009**

Acetone	8 µg/kg
Total Chlorinated VOC Concentration	ND
Total VOC Concentration	8 µg/kg

CONCRETE WALK

84.14-1-10

CONC PAD

2 STORY SHOPPING CENTER

SB-1

SB-1 — **Sample Date: 09/2009**

Acetone	ND
Total Chlorinated VOC Concentration	ND
Total VOC Concentration	ND

MW-3S

MW-3M

CONCRETE RETAINING WALL W/CHAIN LINK FENCE

MACADAM DRIVEWAY

MACADAM PARKING

RIGHT OF WAY FOR REAR PROPERTIES PER DEED
NO DIMENSIONS CITED

CONCRETE CURB

OLD POST ROAD

84.14-1-2
N/F
PERENNIAL GARDENS, INC.
L. 7179 P. 334
L. 7196 P. 279

LEGEND:

MW-14/SB-2 — SOIL BORING/MONITORING WELL LOCATION

ND — NON DETECT

SB-6 — Sample Date: 09/2009
Acetone 24 µg/kg
Total Chlorinated VOC Concentration ND
Total VOC Concentration 24 µg/kg
— SUMMARY OF VOCs

PROPERTY BOUNDARY

BUILDING

PAVED AREA

CONCRETE AREA

0 30 60 120
SCALE IN FEET

SOURCE:
SURVEY COMPLETED BY YEC, INC. DATE OF FIELD SURVEY JANUARY 12, 2009. PROPERTY LINES SHOWN ARE APPROXIMATE ONLY FROM TAX MAP INFORMATION AND ARE NOT CERTIFIED. PROPERTY OWNERS NAMES AND DEED REFERENCES FROM TOWN OF BEDFORD TAX ASSESSMENT ROLES.

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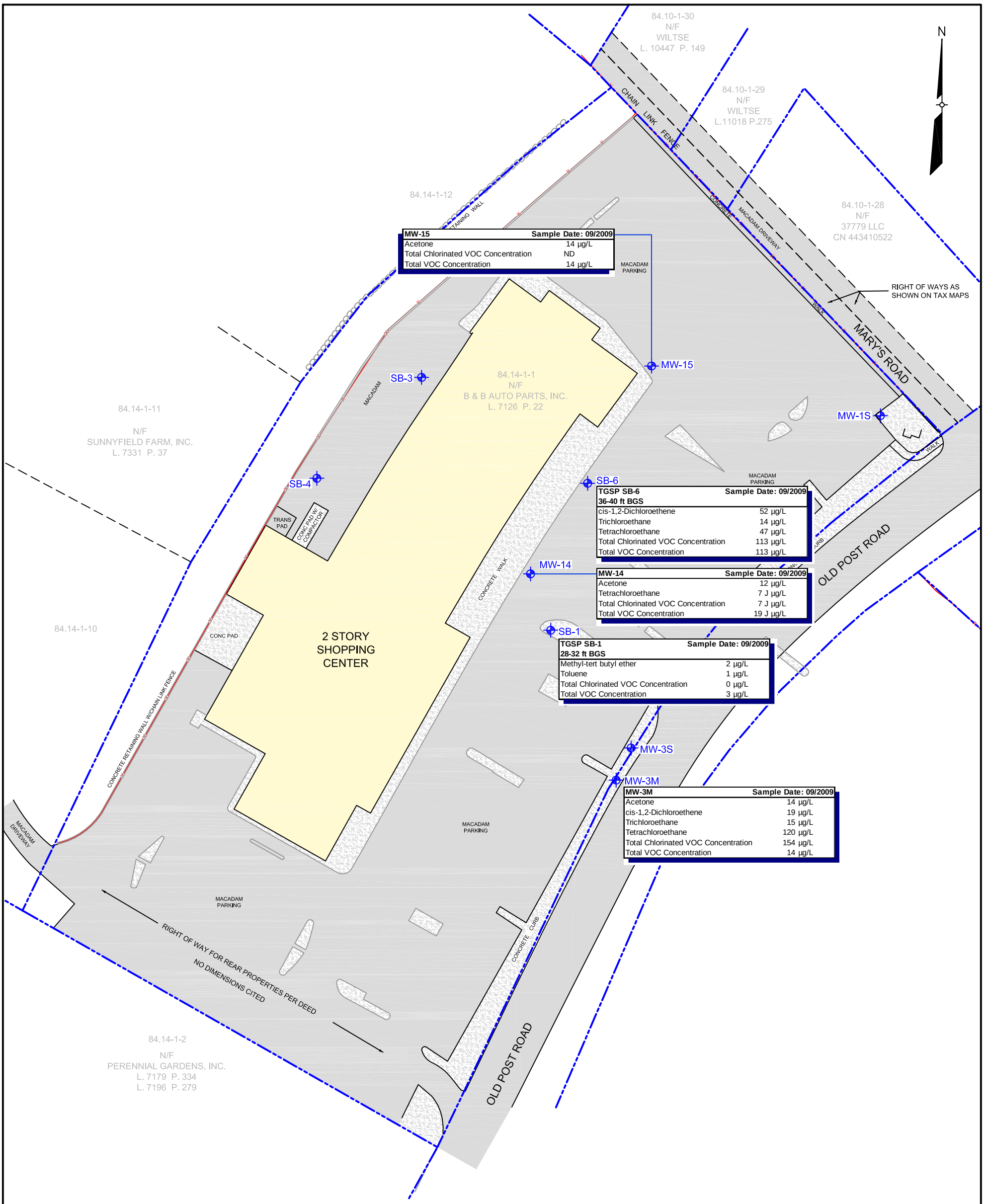
FIGURE 4
SUMMARY OF SOIL BORING RESULTS - VOCs

BEDFORD VILLAGE HUNTING RIDGE MALL
SITE NO. 360009

NOVEMBER 2009

60133923



LEGEND:

- MW-14/SB-2 — SOIL BORING/MONITORING WELL LOCATION
- ND — NON DETECT
- SUMMARY OF VOCs IN GROUNDWATER
- PROPERTY BOUNDARY
- BUILDING
- PAVED AREA
- CONCRETE AREA

0 30 60 120

SCALE IN FEET

SOURCE:
SURVEY COMPLETED BY YEC, INC. DATE OF FIELD SURVEY JANUARY 12, 2009. PROPERTY LINES SHOWN ARE APPROXIMATE ONLY FROM TAX MAP INFORMATION AND ARE NOT CERTIFIED. PROPERTY OWNERS NAMES AND DEED REFERENCES FROM TOWN OF BEDFORD TAX ASSESSMENT ROLES.

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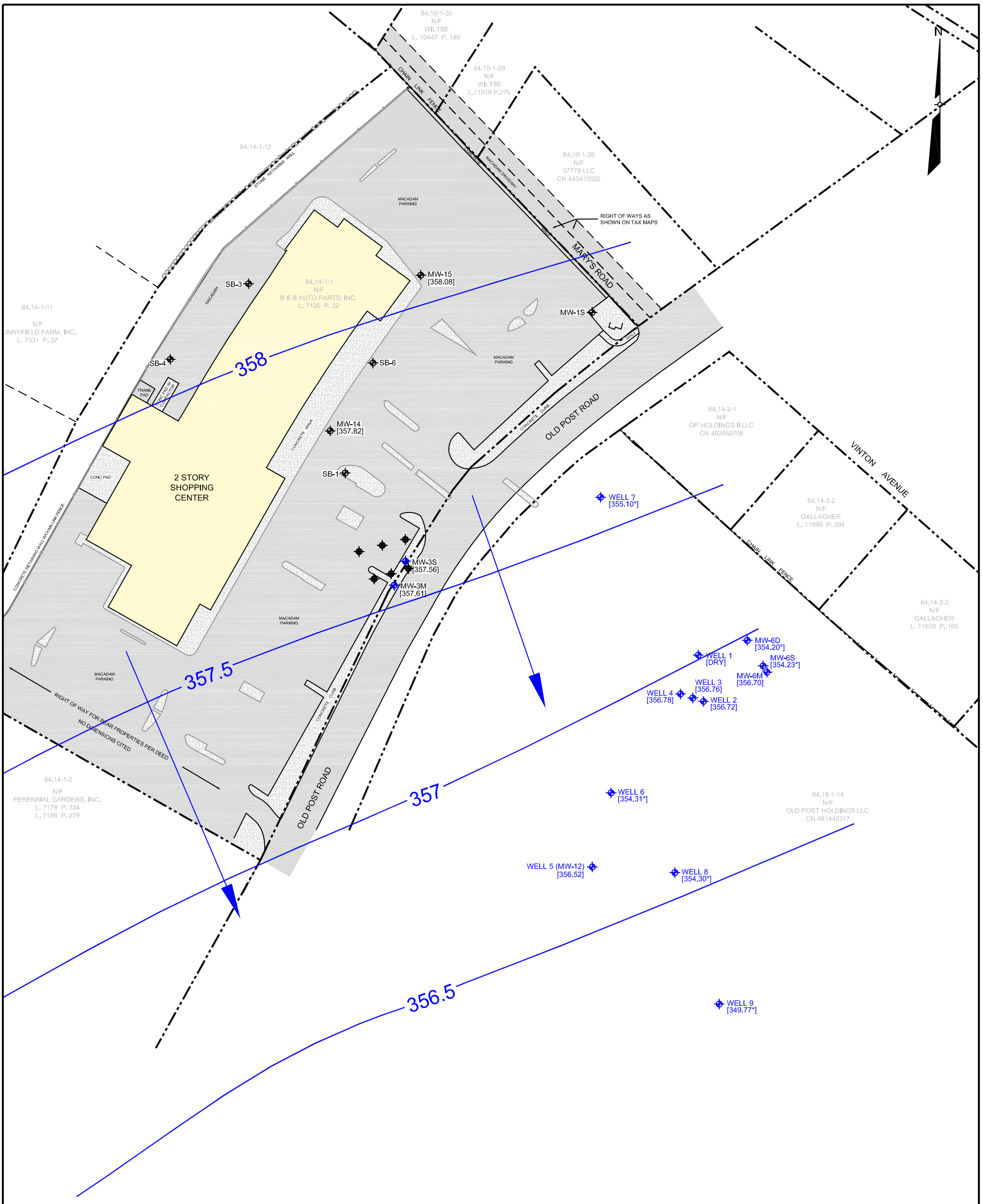
FIGURE 5
SUMMARY OF GROUNDWATER RESULTS - VOCs

BEDFORD VILLAGE HUNTING RIDGE MALL
SITE NO. 360009

NOVEMBER 2009

60133923



LEGEND:

- MW-14/SB-2 — SOIL BORING/MONITORING WELL LOCATION
- * — ANOMALOUS ELEVATION
- 356.5 — GROUNDWATER ELEVATION CONTOUR LINE
- PROPERTY BOUNDARY
- BUILDING
- PAVED AREA
- CONCRETE AREA

SOURCE:
SURVEY COMPLETED BY YEC, INC. DATE OF FIELD SURVEY JANUARY 12, 2009. PROPERTY LINES SHOWN ARE APPROXIMATE ONLY FROM TAX MAP INFORMATION AND ARE NOT CERTIFIED. PROPERTY OWNERS NAMES AND DEED REFERENCES FROM TOWN OF BEDFORD TAX ASSESSMENT ROLES.

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FIGURE 6
GROUNDWATER ISOELEVATION MAP

BEDFORD VILLAGE HUNTING RIDGE MALL
SITE NO. 360009

NOVEMBER 2009

60133923

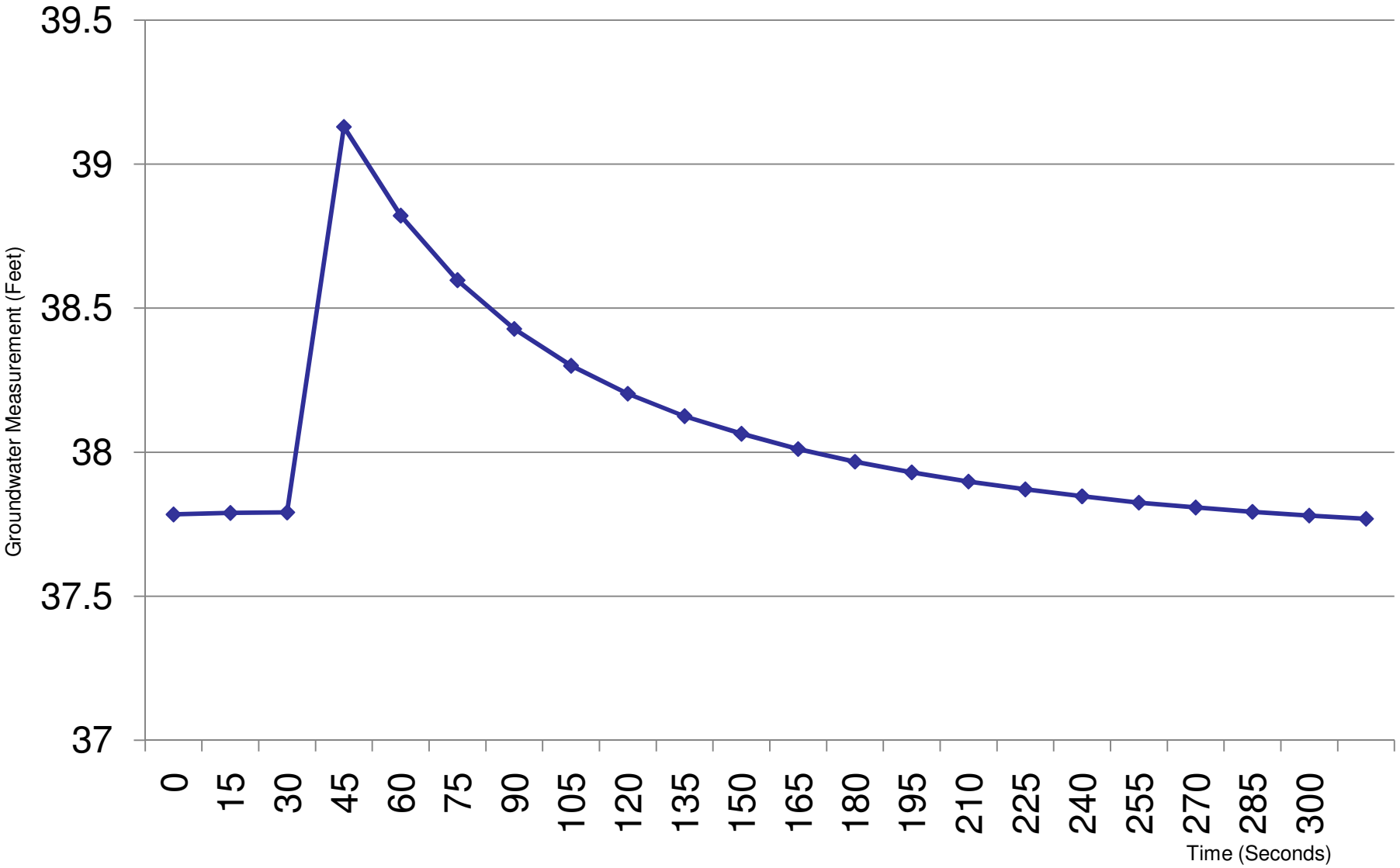


Figure 7

Slug Testing Data

Monitoring Well MW-14

AECOM

November 2009

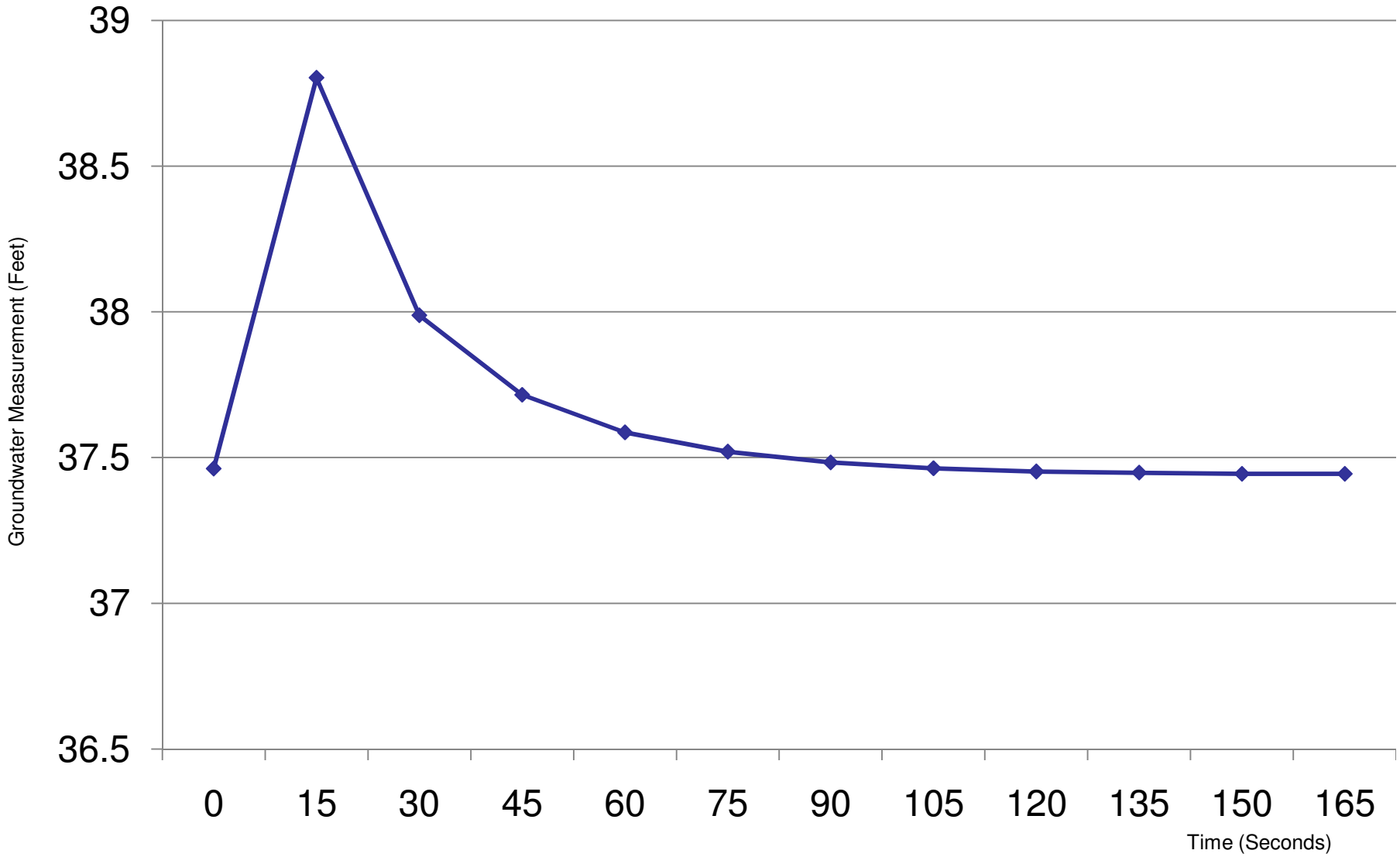


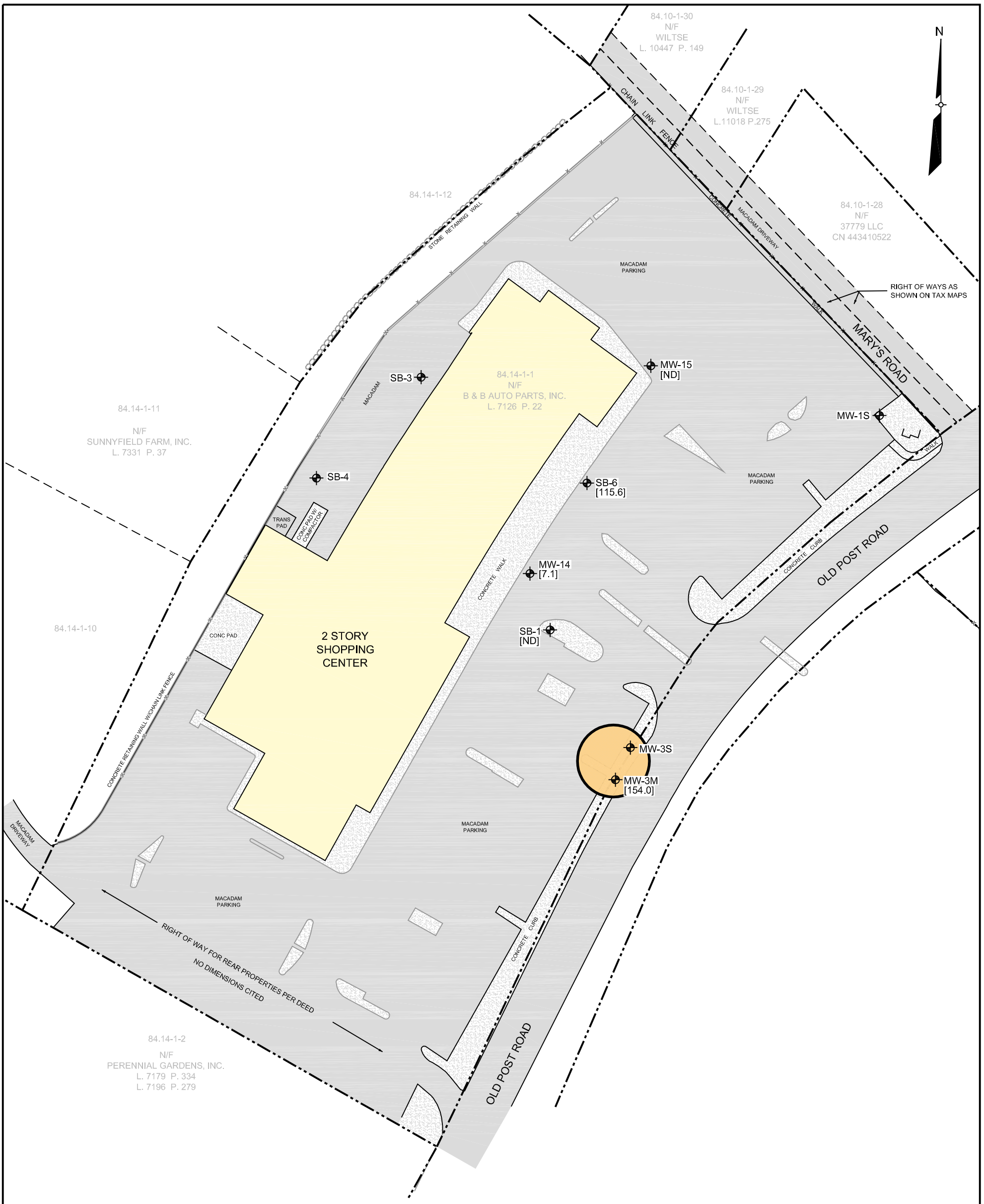
Figure 8

Slug Testing Data

Monitoring Well MW-15

AECOM

November 2009



LEGEND:

- MW-14/SB-2 — SOIL BORING/MONITORING WELL LOCATION
- SPHERE OF CHLORINATED VOC
- PROPERTY BOUNDARY
- BUILDING
- PAVED AREA
- CONCRETE AREA

0 30 60 120

SCALE IN FEET

SOURCE:
SURVEY COMPLETED BY YEC, INC. DATE OF FIELD SURVEY JANUARY 12, 2009. PROPERTY LINES SHOWN ARE APPROXIMATE ONLY FROM TAX MAP INFORMATION AND ARE NOT CERTIFIED. PROPERTY OWNERS NAMES AND DEED REFERENCES FROM TOWN OF BEDFORD TAX ASSESSMENT ROLES.

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FIGURE 9
SPHERE OF CONTAMINATION MAP - GROUNDWATER

BEDFORD VILLAGE HUNTING RIDGE MALL
SITE NO. 360009

NOVEMBER 2009

60133923

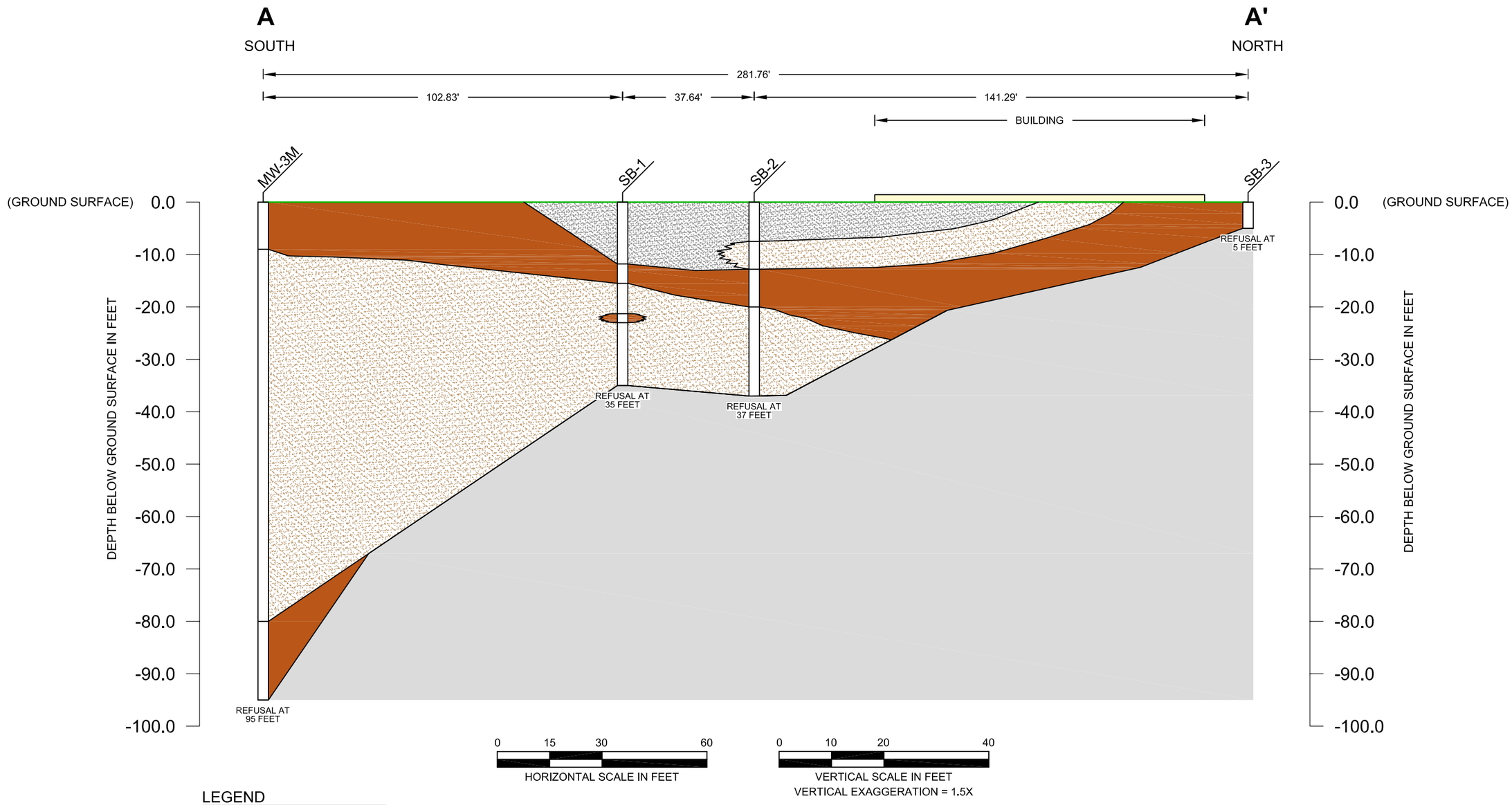

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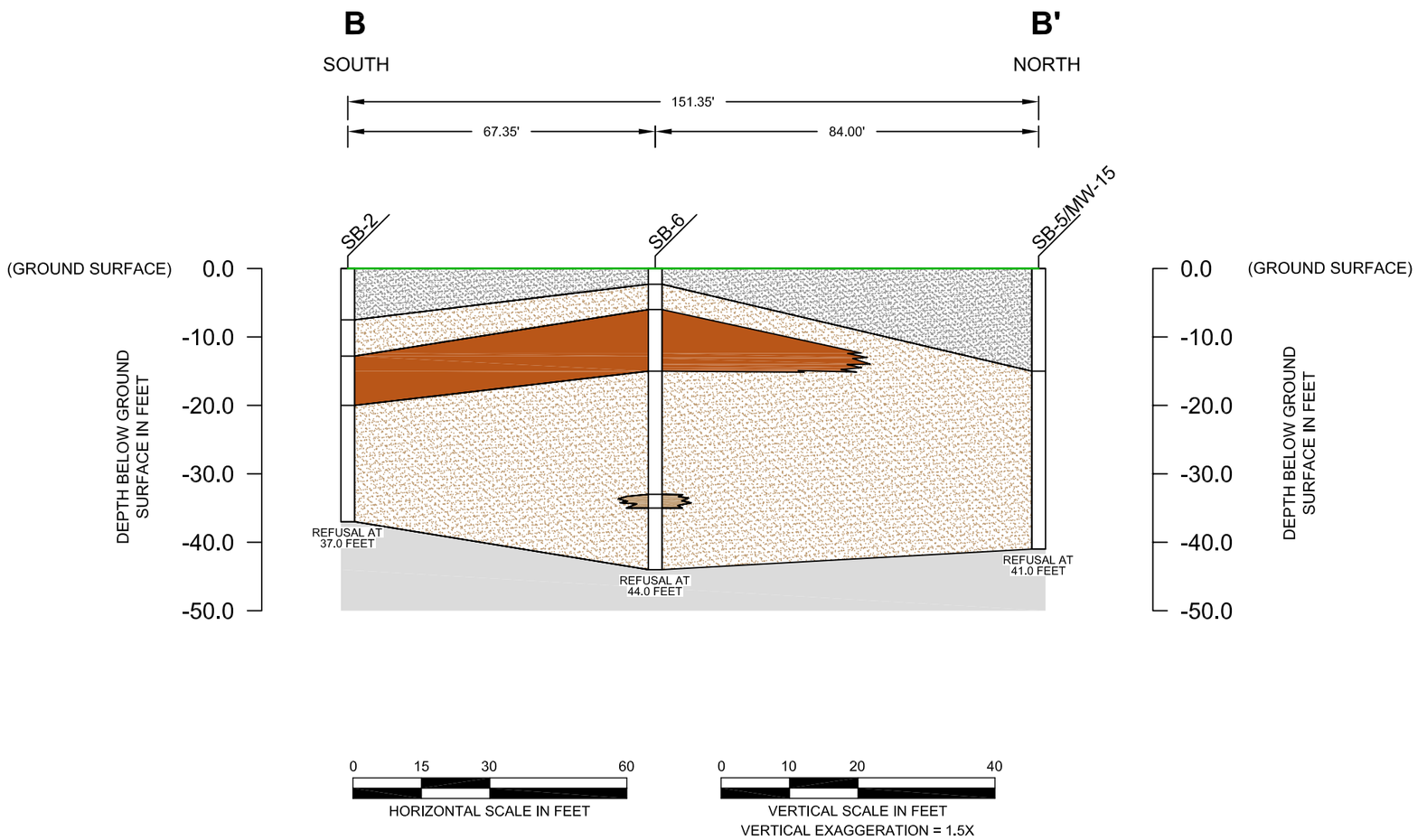
FIGURE 10
CROSS SECTION A-A'

BEDFORD VILLAGE HUNTING RIDGE MALL
SITE NO. 360009

NOVEMBER 2009 60133923



LEGEND

- SAND AND SILT
- SAND
- SILTY CLAY
- CLAYEY SAND
- BEDROCK
- SB-2 SAMPLE I.D.
- WELL / BORE HOLE

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FIGURE 11
CROSS SECTION B-B'

BEDFORD VILLAGE HUNTING RIDGE MALL
SITE NO. 360009

NOVEMBER 2009 60133923

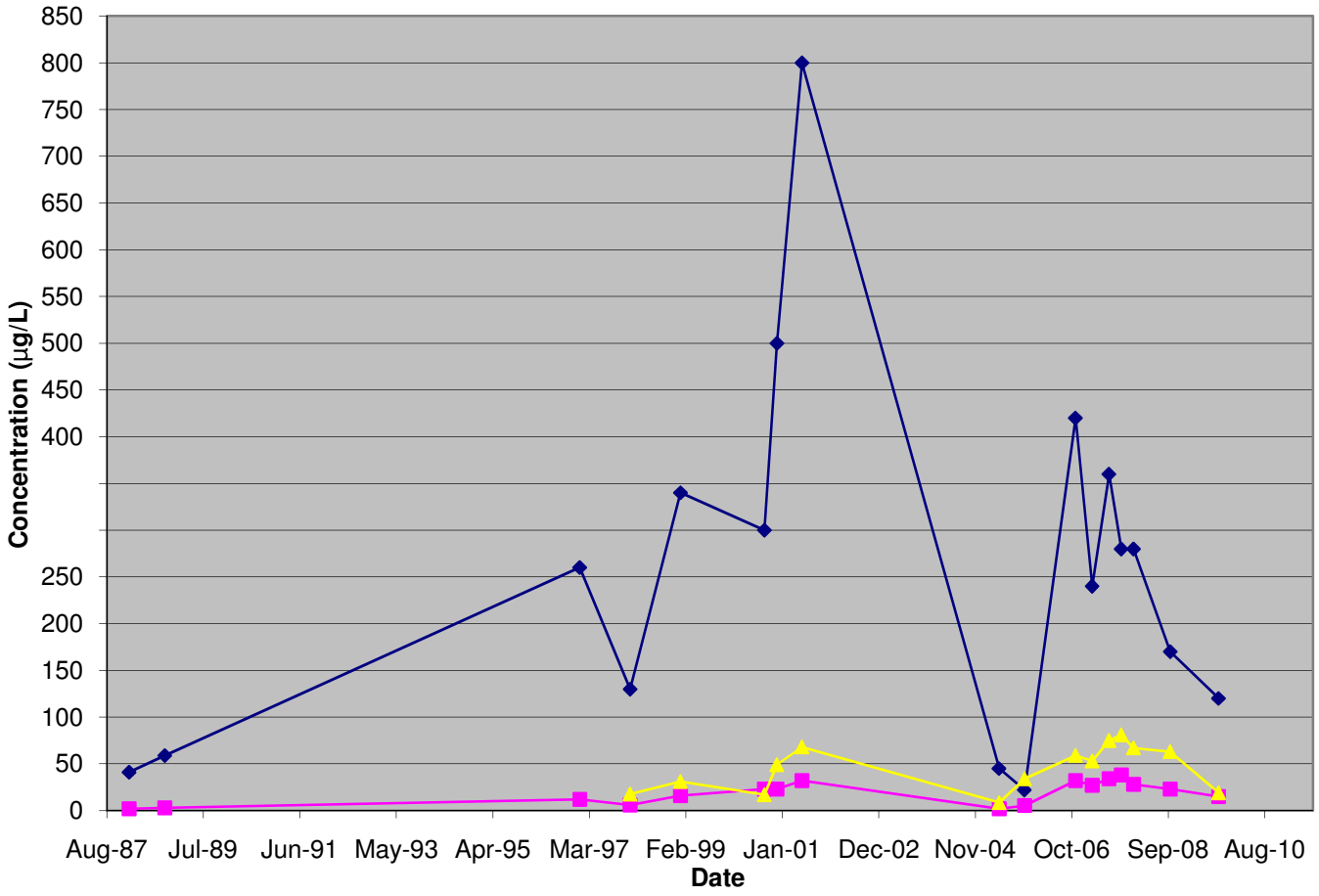

Figure 12

Concentration of CVOC Exceedences at MW-3M

Bedford Village Wells – Hunting Ridge Mall
Bedford, NY

AECOM

November 2009

PROJECT NO:105648

N

CHAIN LINK FENCE

STONE RETAINING WALL

CONCRETE

MACADAM DRIVEWAY

MACADAM PARKING

RIGHT OF WAYS AS SHOWN ON TAX MAPS

WALK

MARY'S ROAD

MW-15

SB-3

MACADAM

MW-1S

IP-20

IP-19

IP-18

SB-6

MACADAM PARKING

WALK

SB-4

TRANS PAD

CONC PAD W/ COMPACTOR

IP-17

IP-16

MW-16

IP-15

IP-14

IP-13

MW-14

CONCRETE CURB

OLD POST ROAD

CONCRETE WALK

IP-11

IP-12

SB-1

IP-9

IP-10

CONC PAD

2 STORY SHOPPING CENTER

IP-7

IP-8

IP-6

IP-4

IP-5

IP-2

MW-3S

IP-3

MW-3M

IP-1

CONCRETE RETAINING WALL W/CHAIN LINK FENCE

MACADAM DRIVEWAY

MACADAM PARKING

GROUNDWATER FLOW DIRECTION

MACADAM PARKING

RIGHT OF WAY FOR REAR PROPERTIES PER DEED
NO DIMENSIONS CITED

CONCRETE CURB

OLD POST ROAD

LEGEND:

IP-1	INJECTION POINT LOCATION
MW-16	PROPOSED MW-16
MW-14/SB-2	SOIL BORING/MONITORING WELL LOCATION
	15' RADIUS OF INFLUENCE
	PROPERTY BOUNDARY
	BUILDING
	PAVED AREA
	CONCRETE AREA

0 30 60 120

SCALE IN FEET

SOURCE:
SURVEY COMPLETED BY YEC, INC. DATE OF FIELD SURVEY JANUARY 12, 2009. PROPERTY LINES SHOWN ARE APPROXIMATE ONLY FROM TAX MAP INFORMATION AND ARE NOT CERTIFIED. PROPERTY OWNERS NAMES AND DEED REFERENCES FROM TOWN OF BEDFORD TAX ASSESSMENT ROLES.

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FIGURE 13
PROPOSED INJECTION POINT LAYOUT

BEDFORD VILLAGE HUNTING RIDGE MALL
SITE NO. 360009

NOVEMBER 2009

60133923

APPENDIX A

Boring Logs and Well Construction Diagrams

AECOM
40 British American Boulevard
Latham, New York 12110

Boring ID: SB-1

Project Name: Bedford Village Wells - Hunting Ridge Mall
Client/Project Number: NYSDEC/60133923
Date Started: 8/25/09 **Date Completed:** 8/25/09
Boring Location: Parking lot in front fo grocery store
Drilling Company: Aztech Technologies, Inc.

Drilling Method: Direct Push
Rig Type: Geoprobe®
Sampling Method: 5 ft Macro-Core® w/ 2" OD Acetate Liner
Total Depth: ~35 feet
Logged By: Mark Howard

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Impacts	Geologic Description	Remarks
0	1.5	0.0				ML		brown Silt and Sand, trace Clay, wood fragments (roots) at 1'-1.5'	Moist to Dry/Soft
-2		0.0 HS							
-4									
	4.2	0.0				SM		brown Sand and Silt, trace fine Gravel, trace Clay, glass fragments	Moist/Soft
-6						ML		dark brown Silt, some fine to coarse Sand, little Clay, little fine to medium Gravel, glass fragments	Moist/Soft
-8		0.0 HS				ML		light brown to light gray Silt and fine to medium Sand, wood fragments, drier than the described layer above	Moist/Very Soft
-10	5	0.0				SM		brown Sand and Silt, trace Clay, trace fine Gravel, glass fragments	Moist/Soft
						SP		gray Sand	Moist/Loose to Medium Compact
-12		0.0 HS	SB-1			ML		brown to light brown Clayey Silt with intermittent Sand lenses, (orange brown to brown), exhibits layering and oxidation	Moist to Wet/Soft
-14	5	0.0				CL		brown Silty Clay, trace fine to medium Gravel	Saturated to Wet/Soft to Very Soft, Water Table Saturated/ Loose
-16						SM		brown fine to coarse Sand, some Silt, little Clay	
		0.0							

Odor Observed

Staining or visual impacts observed

Comments: SB-1 sampled for TCL VOCs+10 TICS
TGSP-SB-1 sampled for TCL VOCs
Bedrock at approximately 35 feet below ground surface (rod refusal)

AECOM
40 British American Boulevard
Latham, New York 12110

Boring ID: SB-1

Project Name: Bedford Village Wells - Hunting Ridge Mall
Client/Project Number: NYSDEC/60133923
Date Started: 8/25/09 **Date Completed:** 8/25/09
Boring Location: Parking lot in front fo grocery store
Drilling Company: Aztech Technologies, Inc.

Drilling Method: Direct Push
Rig Type: Geoprobe®
Sampling Method: 5 ft Macro-Core® w/ 2" OD Acetate Liner
Total Depth: ~35 feet
Logged By: Mark Howard

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Impacts	Geologic Description	Remarks
-18		HS				SC		brown fine to medium Sand, exhibits layering, some Clay, some Silt	Wet/Loose
-20	5	0.0				SP		brown fine to medium Sand	Saturated/ Loose
						CL		brown Silty Clay, some fine to medium Sand (22.6-23' increase in Clay, decrease in Sand)	Wet/Soft
-22		0.0 HS				SW		brown medium to coarse Sand, trace Silt, exhibited layering	Saturated/ Loose
-24									
	5	0.0				SP		brown fine to medium Sand, trace Silt	Saturated/ Loose
-26									
						SP		brown fine to coarse Sand, no trace Silt	Saturated/ Loose
-28		0.0 HS	TGSP-SB-1			SP		brown fine to medium Sand, trace Silt	Saturated/ Loose
						SP		brown fine to coarse Sand, no trace Silt	Saturated/ Loose
-30	5	0.0				SP		brown Sand, some Silt, trace Clay	Saturated/ Loose
						SP		brown fine to coarse Sand, trace Silt	Saturated/ Loose
-32		0.0 HS							
-34									

Odor Observed

Staining or visual impacts observed

Comments: SB-1 sampled for TCL VOCs+10 TICS
TGSP-SB-1 sampled for TCL VOCs
Bedrock at approximately 35 feet below ground surface (rod refusal)

AECOM
40 British American Boulevard
Latham, New York 12110

Well ID: SB-2/MW-14

Project Name: Bedford Village Wells - Hunting Ridge Mall

Client/Project Number: NYSDEC/60133923

Date Started/Date Completed: 8/25/09 and 8/28/09

Boring Location: In the parking lot in front of the coffee shop

Drilling Company: Aztech Technologies, Inc.

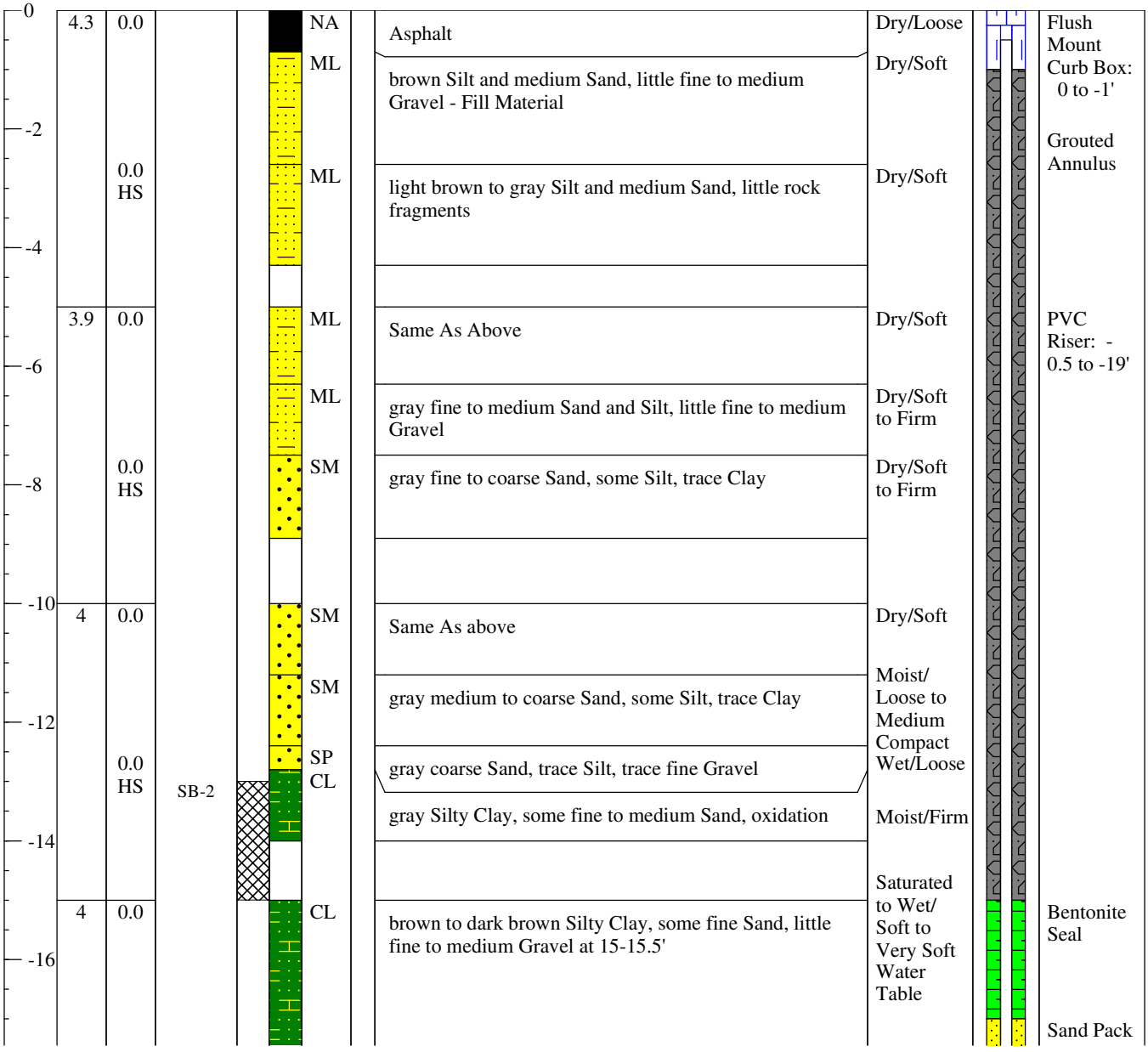
Sampling Method: Direct Push with HSA

PVC Elevation (ft/msl, NAVD 88): 371.77

Ground Elevation (ft/msl, NAVD 88): 371.95

Total Depth: ~37 feet

Logged By: Mark Howard



Odor Observed

Staining or visual impacts observed

Comments: SB-2 sampled for TCL VOCs+10 TICS and TAL Metals

No TGSP sample collected

Bedrock at approximately 37 feet below ground surface

AECOM
40 British American Boulevard
Latham, New York 12110

Well ID: SB-2/MW-14

Project Name: Bedford Village Wells - Hunting Ridge Mall
Client/Project Number: NYSDEC/60133923
Date Started/Date Completed: 8/25/09 and 8/28/09
Boring Location: In the parking lot in front of the coffee shop
Drilling Company: Aztech Technologies, Inc.

Sampling Method: Direct Push with HSA
PVC Elevation (ft/msl, NAVD 88): 371.77
Ground Elevation (ft/msl, NAVD 88): 371.95
Total Depth: ~37 feet
Logged By: Mark Howard

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Impacts	Geologic Description	Remarks	Well Construction	Well Remarks
-18		0.0 HS									PVC Screen: -19 to 29'
-20	5	0.0				SM		gray to dark brown Sand and Silt, some fine to medium Gravel, rock fragments	Saturated/ Loose		
						SC		dark brown to reddish brown fine to medium Sand, some Clay, some Silt, trace fine Gravel	Saturated to Wet/ Soft to Firm		
-22		0.0 HS				SW		brown to reddish brown fine to coarse Sand, graded Sand - increased grain size with depth	Wet/Loose to Medium Compact		
-24	5	0.0				SW		brown to reddish brown fine to coarse Sand, trace Silt increases in grain size with depth, very fine Sand @ 29.8-30'	Wet to Saturated/ Loose		
-26											
-28		0.0 HS									Well Cap: -29 to -29.2'
-30	5	0.0				GM		brown fine to medium Gravel and fine to coarse Sand	Saturated/ Very Loose		Sand
-32		0.0 HS				SW		brown fine to medium Sand, trace Silt becomes very fine @ 34.8-35'	Wet to Saturated/ Loose to Medium Compact		
-34											

Odor Observed

Staining or visual impacts observed

Comments: SB-2 sampled for TCL VOCs+10 TICS and TAL Metals
No TGSP sample collected
Bedrock at approximately 37 feet below ground surface

AECOM
40 British American Boulevard
Latham, New York 12110

Well ID: SB-2/MW-14

Project Name: Bedford Village Wells - Hunting Ridge Mall

Client/Project Number: NYSDEC/60133923

Date Started/Date Completed: 8/25/09 and 8/28/09

Boring Location: In the parking lot in front of the coffee shop

Drilling Company: Aztech Technologies, Inc.

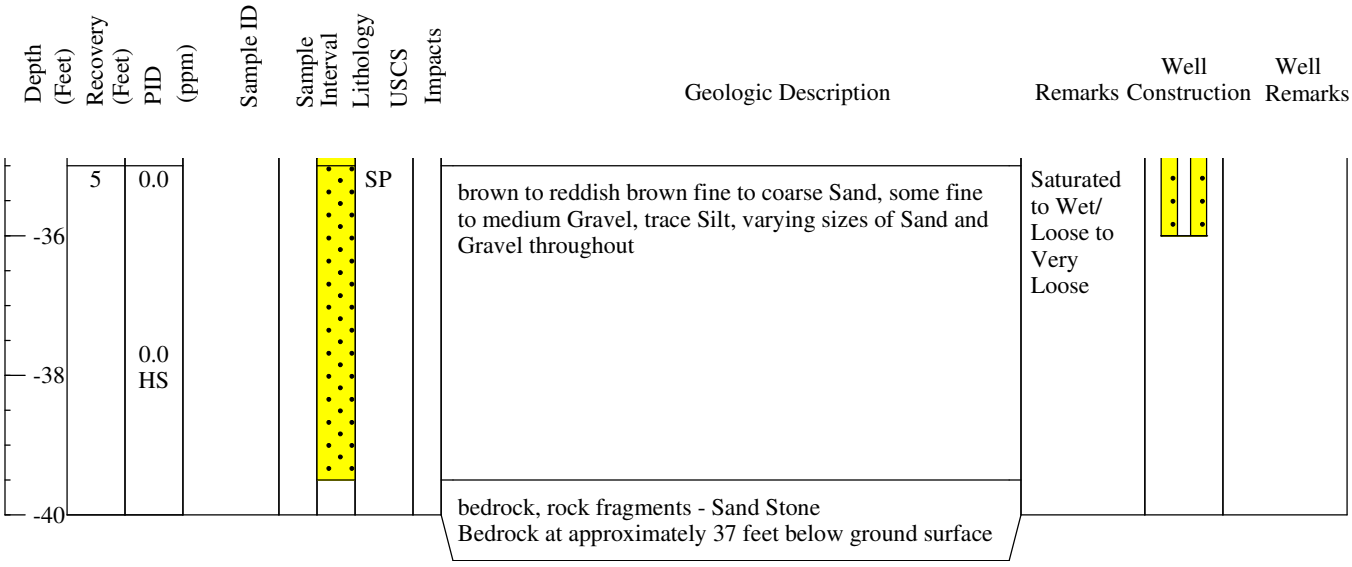
Sampling Method: Direct Push with HSA

PVC Elevation (ft/msl, NAVD 88): 371.77

Ground Elevation (ft/msl, NAVD 88): 371.95

Total Depth: ~37 feet

Logged By: Mark Howard



Odor Observed

Staining or visual impacts observed

Comments: SB-2 sampled for TCL VOCs+10 TICS and TAL Metals

No TGSP sample collected

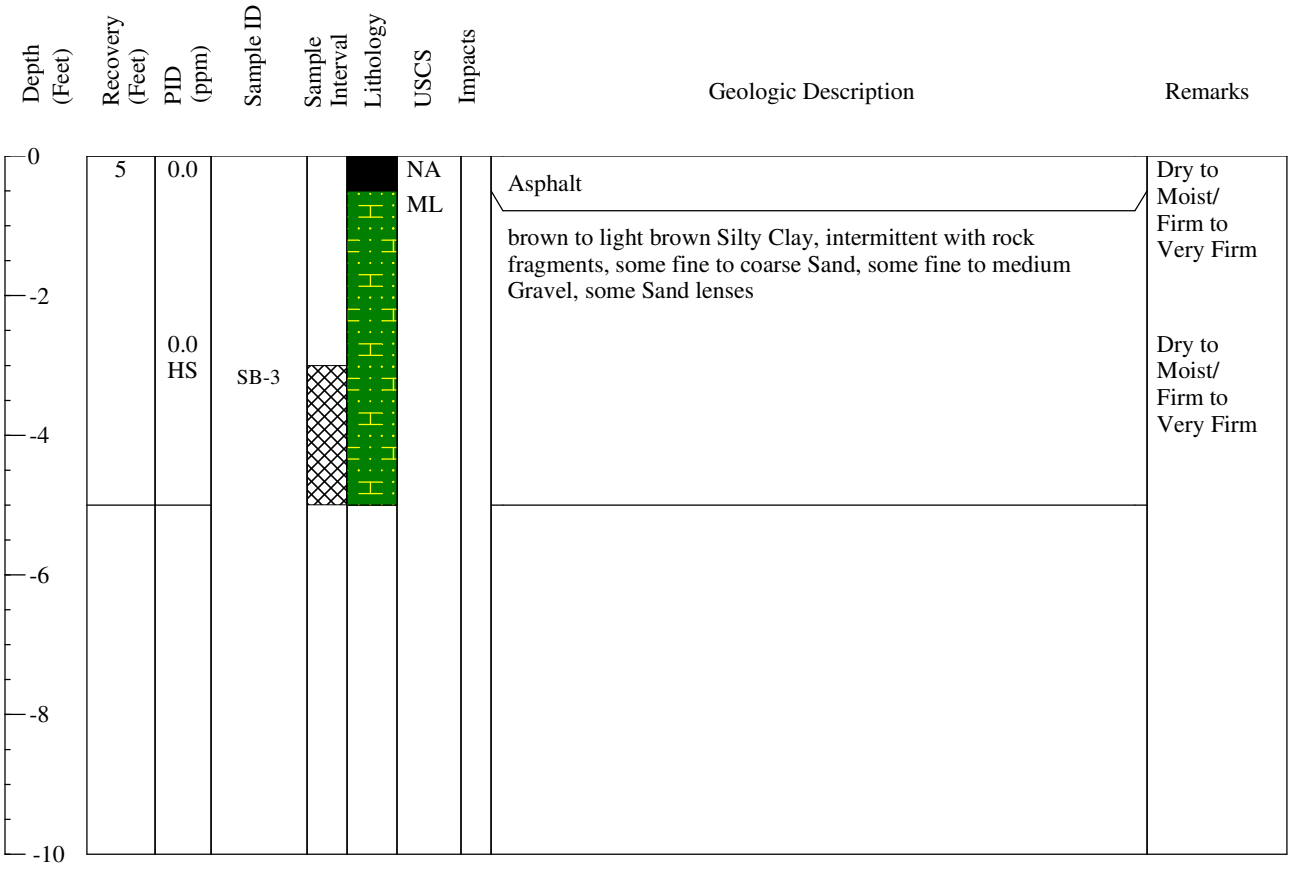
Bedrock at approximately 37 feet below ground surface

AECOM
40 British American Boulevard
Latham, New York 12110

Boring ID: SB-3

Project Name: Bedford Village Wells - Hunting Ridge Mall
Client/Project Number: NYSDEC/60133923
Date Started: 8/25/09 **Date Completed:** 8/25/09
Boring Location: Behind the laundromat
Drilling Company: Aztech Technologies, Inc.

Drilling Method: Direct Push
Rig Type: Geoprobe®
Sampling Method: 5 ft Macro-Core® w/ 2" OD Acetate Liner
Total Depth: ~5 feet
Logged By: Mark Howard



Odor Observed

Staining or visual impacts observed

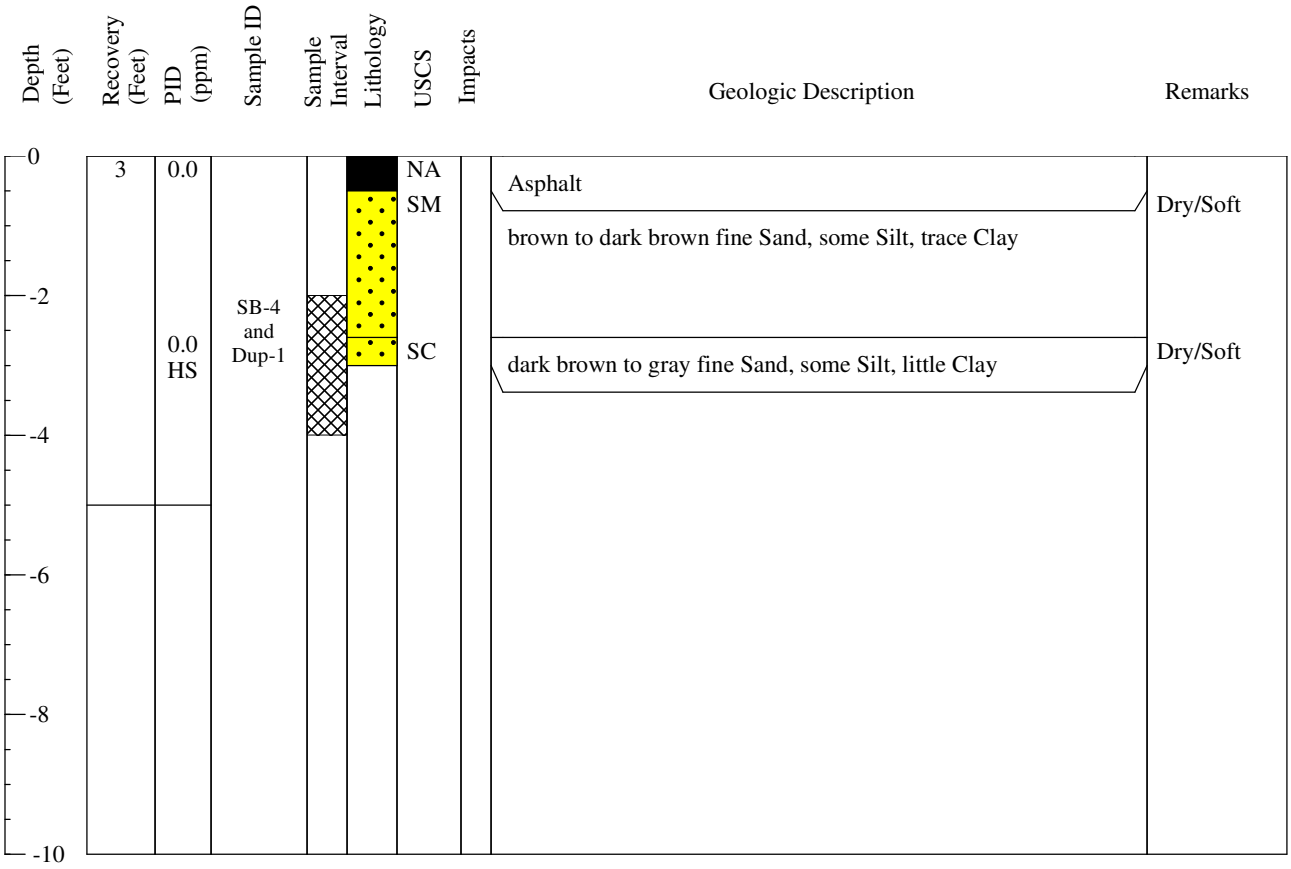
Comments: SB-3 sampled for TCL VOCs+10 TICS
No TGSP sample collected, groundwater not encountered
Bedrock at approximately 2 to 5 feet below ground surface (five attempts made)

AECOM
40 British American Boulevard
Latham, New York 12110

Boring ID: SB-4

Project Name: Bedford Village Wells - Hunting Ridge Mall
Client/Project Number: NYSDEC/60133923
Date Started: 8/25/09 **Date Completed:** 8/25/09
Boring Location: Behind the mall, in the parking lot
Drilling Company: Aztech Technologies, Inc.

Drilling Method: Direct Push
Rig Type: Geoprobe®
Sampling Method: 5 ft Macro-Core® w/ 2" OD Acetate Liner
Total Depth: ~ 4.5 feet
Logged By: Mark Howard



Odor Observed

Staining or visual impacts observed

Comments: SB-4 sampled for TCL VOCs+10 TICS and TAL Metals
No TGSP sampled collected, no groundwater encountered
Bedrock at approximately 4.5 feet below ground surface

AECOM
40 British American Boulevard
Latham, New York 12110

Well ID: SB-5/MW-15

Project Name: Bedford Village Wells - Hunting Ridge Mall

Client/Project Number: NYSDEC/60133923

Date Started/Date Completed: 8/25/09 and 8/28/09

Boring Location: Northeast corner of the mall, in the parking lot

Drilling Company: Aztech Technologies, Inc.

Sampling Method: Direct Push with HSA

PVC Elevation (ft/msl, NAVD 88): 371.70

Ground Elevation (ft/msl, NAVD 88): 371.79

Total Depth: ~ 41 feet

Logged By: Mark Howard

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Impacts	Geologic Description	Remarks	Well Construction	Well Remarks
0	4.4	0.0				NA		Asphalt			Flush Mount Curb Box: 0 to -1'
						ML		light brown Silt and Sand, little Clay, trace fine Gravel	Dry/Firm		
-2		0.0 HS				ML		gray Silt and Sand, little Clay, trace fine Gravel	Dry/Firm		Grouted Annulus
-4						ML		gray to dark gray Silt and Sand, some Clay, trace fine Gravel	Dry/Soft		
	5	0.0				ML		dark brown Sandy Silt, little Clay, trace fine Gravel	Dry/Firm		PVC Riser: -0.5 to -20'
-6						ML		light brown to brown Silt, some fine Sand, trace fine Gravel, little to trace Clay, Clay increases with depth	Dry/Soft		
-8		0.0 HS									
						ML		light brown Silt, some fine Sand, little Clay	Dry/Firm		
-10	5	0.0	SB-5			ML		dark gray to green Silt and fine Sand, little Clay, trace fine Gravel	Dry/Firm		
						SC		fine Sand and Silt, little Clay, trace fine Gravel lenses of Sand throughout	Moist/ Loose to Medium Compact		Bentonite Seal
-12		0.0 HS									
-14											
	5	0.0				SP		brown to gray fine to coarse Sand	Saturated to Wet/ Soft to Very Soft		Sand Pack
-16											
		0.0									

Odor Observed

Staining or visual impacts observed

Comments: SB-5 sampled for TCL VOCs+10 TICS and TAL Metals

No TGSP sample collected

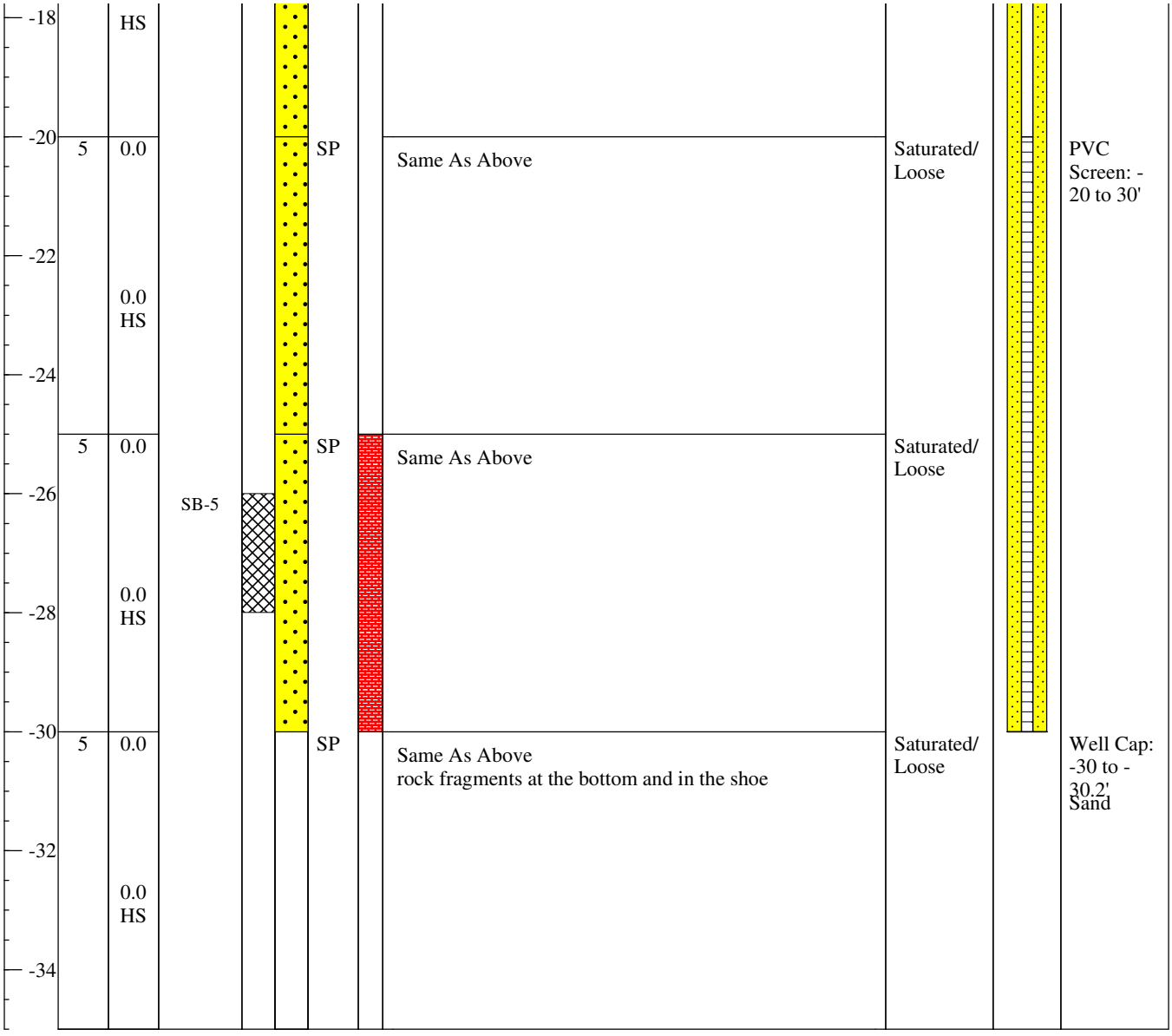
Bedrock approximately 41 feet below ground surface

AECOM
40 British American Boulevard
Latham, New York 12110

Well ID: SB-5/MW-15

Project Name: Bedford Village Wells - Hunting Ridge Mall
Client/Project Number: NYSDEC/60133923
Date Started/Date Completed: 8/25/09 and 8/28/09
Boring Location: Northeast corner of the mall, in the parking lot
Drilling Company: Aztech Technologies, Inc.

Sampling Method: Direct Push with HSA
PVC Elevation (ft/msl, NAVD 88): 371.70
Ground Elevation (ft/msl, NAVD 88): 371.79
Total Depth: ~ 41 feet
Logged By: Mark Howard



Odor Observed

Staining or visual impacts observed

Comments: SB-5 sampled for TCL VOCs+10 TICS and TAL Metals
No TGSP sample collected
Bedrock approximately 41 feet below ground surface

AECOM

40 British American Boulevard
Latham, New York 12110

Boring ID: SB-6

Project Name: Bedford Village Wells - Hunting Ridge Mall
Client/Project Number: NYSDEC/60133923
Date Started: 8/26/09 **Date Completed:** 8/26/09
Boring Location: In front of the dry cleaners, in the parking lot
Drilling Company: Aztech Technologies, Inc.

Drilling Method: Direct Push
Rig Type: Geoprobe®
Sampling Method: 5 ft Macro-Core® w/ 2" OD Acetate Liner
Total Depth: ~ 44 feet
Logged By: Mark Howard

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Impacts	Geologic Description	Remarks
0	3.6	0.0				NA		Asphalt	
						ML		brown Sand and Silt, little fine to medium Gravel	Dry/Firm
-2		0.0 HS				SM		dark brown to gray fine to medium Sand, some Silt, trace Clay, little fine Gravel	Dry/Firm
-4									
	5	0.0				SM		Same As Above	Dry/Firm
-6						ML		brown to light brown Clayey Silt, some fine Sand, trace fine Gravel oxidized Sand lenses @ 8.8', Clay increases with depth	Dry/Firm
-8		0.0 HS							
			SB-6			SP		red to reddish brown fine to medium Sand	Dry to Moist/ Loose
-10	5	0.0				ML		dark brown to gray Clayey Silt, some fine to medium Sand, trace fine Gravel, rock fragments	Moist/Soft to Firm
						SP CL		brown to reddish brown Sand lenses	Water Table Moist/Loose to Medium Compact
-12		0.0 HS						brown Silty Clay, some fine Sand, some intermittent Sand lenses 14.8-15' reddish brown Sand exhibiting layering	Wet/Firm Saturated Loose
-14									
	5	0.0				SP		brown to reddish brown medium to coarse Sand, trace Silt	Saturated to Wet/ Soft to Very Soft
-16						SM		brown fine to medium Sand, little Silt, trace Clay	Saturated/ Loose
		0.0 HS				SP		brown fine to medium Sand, trace Silt	Saturated/ Loose
-18									

Odor Observed

Staining or visual impacts observed

Comments: SB-6 sampled for TCL VOCs+10 TICS
TGSP-SB-6 sampled for TCL VOCs
Drove 1" rod to refusal; Did not collect sample; Bedrock at ~44 feet below ground surface

AECOM
40 British American Boulevard
Latham, New York 12110

Boring ID: SB-6

Project Name: Bedford Village Wells - Hunting Ridge Mall
Client/Project Number: NYSDEC/60133923
Date Started: 8/26/09 **Date Completed:** 8/26/09
Boring Location: In front of the dry cleaners, in the parking lot
Drilling Company: Aztech Technologies, Inc.

Drilling Method: Direct Push
Rig Type: Geoprobe®
Sampling Method: 5 ft Macro-Core® w/ 2" OD Acetate Liner
Total Depth: ~ 44 feet
Logged By: Mark Howard

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Impacts	Geologic Description	Remarks
-18									
						SM		brown finer Sand, little to trace Silt	Saturated/ Loose
-20	5	0.0				SP		brown fine to medium Sand, trace Silt, finely sorted Sand	Saturated/ Loose
-22		0.0 HS							
						SP		brown medium to coarse Sand, poorly sorted Sand, sub angular	Saturated/ Loose
-24	5	0.0				SW		brown Sand, sub angular two series of fine to coarse gradation in the Sand	Saturated/ Loose
-26									
-28		0.0 HS							
-30	5	0.0				SP		brown to light brown fine to coarse Sand	Saturated/ Loose
-32		0.0 HS							Saturated/ Loose to Soft
-34						SC		light brown Clayey Sand, some Silt	Saturated/ Loose to Soft
						CL		light brown to light gray very fine Sand, some Clay some Silt	Saturated/ Very Soft
	5	0.0	TGSP-			SP		light gray Sandy Clay, some Silt	
-36									

Odor Observed

Staining or visual impacts observed

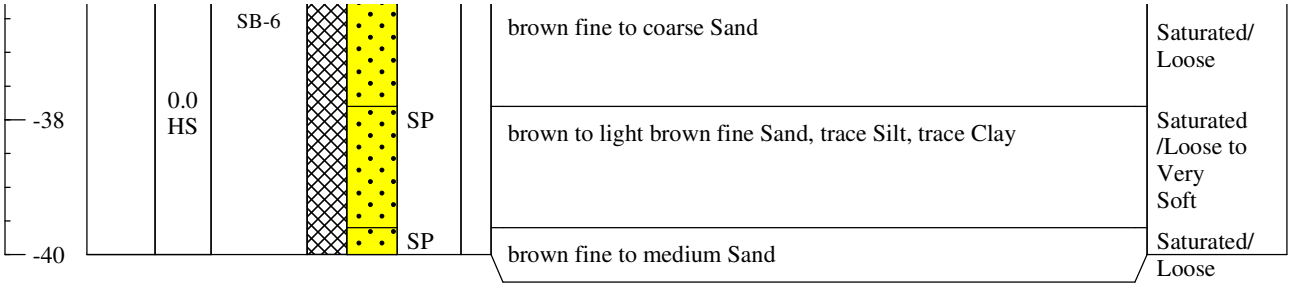
Comments: SB-6 sampled for TCL VOCs+10 TICS
TGSP-SB-6 sampled for TCL VOCs
Drove 1" rod to refusal; Did not collect sample; Bedrock at ~44 feet below ground surface

AECOM
40 British American Boulevard
Latham, New York 12110

Boring ID: SB-6

Project Name: Bedford Village Wells - Hunting Ridge Mall
Client/Project Number: NYSDEC/60133923
Date Started: 8/26/09 **Date Completed:** 8/26/09
Boring Location: In front of the dry cleaners, in the parking lot
Drilling Company: Aztech Technologies, Inc.

Drilling Method: Direct Push
Rig Type: Geoprobe®
Sampling Method: 5 ft Macro-Core® w/ 2" OD Acetate Liner
Total Depth: ~ 44 feet
Logged By: Mark Howard



Odor Observed

Staining or visual impacts observed

Comments: SB-6 sampled for TCL VOCs+10 TICS
TGSP-SB-6 sampled for TCL VOCs
Drove 1" rod to refusal; Did not collect sample; Bedrock at ~44 feet below ground surface

APPENDIX B

Temporary Grab Sample Points Purge Form

Temporary Grap Sampling Point (TGSP) Purge Form

Project Name and Number: Bedford Village Wells - Hunting Ridge Mall 105648.03.02

TGSP: SB-1 Date: August 25, 2009

Samplers: Mark Howard

Sample Number: TGSP-SB-1-(28'-32') QA/QC Collected? None

Purging / Sampling Method: Dedicated Poly Tubing with Deconned Stainless Steel Check Valve

1. L = Well Depth:		feet
2. D = Riser Diameter (I.D.):		feet
3. W = Depth to Water:	~16	feet
4. C = Column of Water in Well:		feet
5. V = Volume of Water in Well = C(3.14159)(0.5D)^2(7.48)		gal
6. 10(V) = Target Purge Volume		gal

D (inches)	D (feet)
1-inch	0.08
2-inch	0.17
3-inch	0.25
4-inch	0.33
6-inch	0.50

Conversion factors to determine V given C

D (inches)	1-inch	2-inch	3-inch	4-inch	6-inch
V (gal / ft)	0.041	0.163	0.37	0.65	1.5

Water Quality Readings Collected Using YSI-650 MSD (without turbidity)

Parameter	**Units**	**Readings**						
Time	24 hr	1046						
Water Level (0.33)	feet	-						
Volume Purged	gal	2.00						
Flow Rate	mL / min	-						
Turbidity (+/- 10%)	NTU	-						
Dissolved Oxygen (+/- 10%)	%	57.9						
Dissolved Oxygen (+/- 10%)	mg/L	4.89						
Eh / ORP (+/- 10)	MeV	83.3						
Specific Conductivity	mS/cm^c	1.140						
Conductivity (+/- 3%)	µmho / cm	1.093						
pH (+/- 0.1)	pH unit	6.31						
Temp (+/- 0.5)	C	22.87						
Color	Visual	Cloudy						
Odor	Olfactory	None						
Ferrous Iron	mg/L	Collect only at sample time						

Comments: Sampled @ 1047

Temporary Grap Sampling Point (TGSP) Purge Form

Project Name and Number: Bedford Village Wells - Hunting Ridge Mall 105648.03.02

TGSP: SB-6 Date: August 26, 2009

Samplers: Mark Howard

Sample Number: TGSP-SB-6-(36'-40') QA/QC Collected? DUP-1/MS/MSD

Purging / Sampling Method: Dedicated Poly Tubing with Deconned Stainless Steel Check Valve

1. L = Well Depth:		feet
2. D = Riser Diameter (I.D.):		feet
3. W = Depth to Water:	~11	feet
4. C = Column of Water in Well:		feet
5. V = Volume of Water in Well = C(3.14159)(0.5D)^2(7.48)		gal
6. 10(V) = Target Purge Volume		gal

D (inches)	D (feet)
1-inch	0.08
2-inch	0.17
3-inch	0.25
4-inch	0.33
6-inch	0.50

Conversion factors to determine V given C

D (inches)	1-inch	2-inch	3-inch	4-inch	6-inch
V (gal / ft)	0.041	0.163	0.37	0.65	1.5

Water Quality Readings Collected Using YSI-650 MSD (without turbidity)

Parameter	Units	Readings						
Time	24 hr	1017	1019	1022	1025			
Water Level (0.33)	feet	~11	~11	~11	~11			
Volume Purged	gal	0.00	0.25	>0.25	0.50			
Flow Rate	mL / min	-	-	-	-			
Turbidity (+/- 10%)	NTU	-	-	-	-			
Dissolved Oxygen (+/- 10%)	%	79.9	76.4	84.0	86.5			
Dissolved Oxygen (+/- 10%)	mg/L	5.91	6.15	6.85	7.28			
Eh / ORP (+/- 10)	MeV	117.3	-10.5	-14.6	-23.6			
Specific Conductivity	mS/cm^c	1.216	1.190	1.194	1.362			
Conductivity (+/- 3%)	µmho / cm	1.110	1.038	1.020	1.153			
pH (+/- 0.1)	pH unit	6.52	6.59	6.33	6.49			
Temp (+/- 0.5)	C	21.16	18.42	17.43	17.04			
Color	Visual	Brown	Brown	Lt. Brown	Cloudy			
Odor	Olfactory	None	None	None	None			
Ferrous Iron	mg/L	Collect only at sample time						

Comments: Sampled @ 1025

APPENDIX C

Monitoring Well Development Forms

Monitoring Well Development

Project Name and Number: Bedford Village Wells - Hunting Ridge Mall 105648.03.02

Monitoring Well Number: MW-14 Date: August 31, 2009

Samplers: Aztech and Mark Howard

Sample Number: QA/QC Collected? None

Purging / Sampling Method: Mega Purger - Whale Pump

1. L = Well Depth:	30	feet
2. D = Riser Diameter (I.D.):	0.17	feet
3. W = Depth to Water:	12	feet
4. C = Column of Water in Well:	18	feet
5. V = Volume of Water in Well = $C(3.14159)(0.5D)^2(7.48)$	2.93	gal
6. 10(V) = Target Purge Volume	29.34	gal

D (inches)	D (feet)
1-inch	0.08
2-inch	0.17
3-inch	0.25
4-inch	0.33
6-inch	0.50

Conversion factors to determine V given C

D (inches)	1-inch	2-inch	3-inch	4-inch	6-inch
V (gal / ft)	0.041	0.163	0.37	0.65	1.5

Water Quality Readings Collected Using YSI-650 MSD (without turbidity)

Parameter	Units	Readings						
Time	24 hr	1108	1115	1123	1128	1130	1132	1137
Water Level (0.33)	feet	12.00	-	-	-	-	-	-
Volume Purged	gal	0	3	6	9	14	20	25
Flow Rate	mL / min	-	-	-	-	-	-	-
Turbidity (+/- 10%)	NTU	-	-	-	-	-	-	-
Dissolved Oxygen (+/- 10%)	%	42.0	46.6	77.7	78.1	65.0	71.2	57.1
Dissolved Oxygen (+/- 10%)	mg/L	3.79	4.07	7.62	6.88	6.05	6.60	5.44
Eh / ORP (+/- 10)	MeV	92.0	75.9	91.2	93.3	95.4	97.1	99.2
Specific Conductivity	mS/cm^c	2.285	1.578	1.511	1.507	1.489	1.488	1.495
Conductivity (+/- 3%)	µmho / cm	1.984	1.336	1.256	1.250	1.239	1.234	1.240
pH (+/- 0.1)	pH unit	6.51	6.60	6.47	6.39	6.38	6.41	6.37
Temp (+/- 0.5)	C	18.20	16.94	16.21	16.10	16.26	16.06	16.08
Color	Visual	Brown	Brown	Brown	Lt. Brown	Lt. Brown	Lt. Brown	Lt. Brown
Odor	Olfactory	None	None	None	None	None	None	None
Ferrous Iron	mg/L	Collect only at sample time						

Comments: Started Purge @ 1108
Flow issues between 1108 and 1115, water very silt, pump silted up

Monitoring Well Development

Project Name and Number: Bedford Village Wells - Hunting Ridge Mall 105648.03.02

Monitoring Well Number: MW-14 Date: August 31, 2009

Samplers: Aztech and Mark Howard

Sample Number: QA/QC Collected? None

Purging / Sampling Method: Mega Purger - Whale Pump

1. L = Well Depth:	30	feet
2. D = Riser Diameter (I.D.):	0.17	feet
3. W = Depth to Water:	12	feet
4. C = Column of Water in Well:	18	feet
5. V = Volume of Water in Well = $C(3.14159)(0.5D)^2(7.48)$	2.93	gal
6. 10(V) = Target Purge Volume	29.34	gal

D (inches)	D (feet)
1-inch	0.08
2-inch	0.17
3-inch	0.25
4-inch	0.33
6-inch	0.50

Conversion factors to determine V given C

D (inches)	1-inch	2-inch	3-inch	4-inch	6-inch
V (gal / ft)	0.041	0.163	0.37	0.65	1.5

Water Quality Readings Collected Using YSI-650 MSD (without turbidity)

Parameter	Units	Readings						
Time	24 hr	1142	1146					
Water Level (0.33)	feet	-	-					
Volume Purged	gal	30	35					
Flow Rate	mL / min	-	-					
Turbidity (+/- 10%)	NTU	-	-					
Dissolved Oxygen (+/- 10%)	%	61.5	61.4					
Dissolved Oxygen (+/- 10%)	mg/L	5.55	5.83					
Eh / ORP (+/- 10)	MeV	100.9	100.0					
Specific Conductivity	mS/cm^c	1.493	1.500					
Conductivity (+/- 3%)	µmho / cm	1.240	1.244					
pH (+/- 0.1)	pH unit	6.35	6.36					
Temp (+/- 0.5)	C	16.17	16.09					
Color	Visual	Lt. Brown	Lt. Brown					
Odor	Olfactory	None	None					
Ferrous Iron	mg/L	Collect only at sample time						

Comments: Finished Purge @ 1146
Purged a total of ~35 gallons

Monitoring Well Development

Project Name and Number: Bedford Village Wells - Hunting Ridge Mall 105648.03.02

Monitoring Well Number: MW-15 Date: August 31, 2009

Samplers: Aztech and Mark Howard

Sample Number: QA/QC Collected? None

Purging / Sampling Method: Mega Purger - Whale Pump

1. L = Well Depth:	30	feet
2. D = Riser Diameter (I.D.):	0.17	feet
3. W = Depth to Water:	12	feet
4. C = Column of Water in Well:	18	feet
5. V = Volume of Water in Well = $C(3.14159)(0.5D)^2(7.48)$	2.93	gal
6. 10(V) = Target Purge Volume	29.34	gal

D (inches)	D (feet)
1-inch	0.08
2-inch	0.17
3-inch	0.25
4-inch	0.33
6-inch	0.50

Conversion factors to determine V given C

D (inches)	1-inch	2-inch	3-inch	4-inch	6-inch
V (gal / ft)	0.041	0.163	0.37	0.65	1.5

Water Quality Readings Collected Using YSI-650 MSD (without turbidity)

Parameter	Units	Readings						
Time	24 hr	1214	1221	1224	1226	1235	1237	1240
Water Level (0.33)	feet	12.00	-	-	-	-	-	-
Volume Purged	gal	0	5	10	15	20	25	30
Flow Rate	mL / min	-	-	-	-	-	-	-
Turbidity (+/- 10%)	NTU	-	-	-	-	-	-	-
Dissolved Oxygen (+/- 10%)	%	85.6	61.4	47.2	39.5	87.3	87.7	106.3
Dissolved Oxygen (+/- 10%)	mg/L	7.45	6.28	4.53	4.10	8.79	8.71	10.86
Eh / ORP (+/- 10)	MeV	83.9	63.6	16.5	3.8	-5.7	-10.2	-6.1
Specific Conductivity	mS/cm^c	1.239	1.408	1.308	1.344	1.391	1.383	1.434
Conductivity (+/- 3%)	µmho / cm	1.006	1.118	1.026	1.054	1.098	1.083	1.126
pH (+/- 0.1)	pH unit	6.69	6.59	6.69	6.51	6.53	6.52	6.48
Temp (+/- 0.5)	C	15.34	14.30	13.66	13.72	14.11	13.65	13.79
Color	Visual	Brown	Brown	Brown	Lt. Brown	Lt. Brown	Lt. Brown	Lt. Brown
Odor	Olfactory	None	None	None	None	None	None	None
Ferrous Iron	mg/L	Collect only at sample time						

Comments:

Started Purge @ 1214
Flow Issues between 1214 and 1221, water is very silty, silted up the pump
Finished Purge @ 1240
Purged a total of ~ 30 gallons

APPENDIX D

Monitoring Purge/Sampling Forms

Monitoring Well Purging/Sampling Form

Project Name and Number: Bedford Village Wells - Hunting Ridge Mall 105648.03.02

Monitoring Well Number: MW-3M Date: September 16, 2009

Samplers: Mark Howard

Sample Number: MW-3M QA/QC Collected? None

Purging / Sampling Method: Peristaltic Pump with Dedicated Tubing

1. L = Total Well Depth:	74.94	feet
2. D = Riser Diameter (I.D.):	0.17	feet
3. W = Static Depth to Water (TOC):	17.02	feet
4. C = Column of Water in Casing:	57.92	feet
5. V = Volume of Water in Well = $C(3.14159)(0.5D)^2(7.48)$	9.44	gal
6. D2 = Tube Setting Depth (ft):	29.85	feet
7. C2 = Column of water in Pump/Tubing (ft):	12.83	feet
8. Tubing Volume = C2(0.005737088)	0.07	gal

D (inches)	D (feet)
1-inch	0.08
2-inch	0.17
3-inch	0.25
4-inch	0.33
6-inch	0.50

Conversion factors to determine V given C

D (inches)	1-inch	2-inch	3-inch	4-inch	6-inch
V (gal / ft)	0.041	0.163	0.37	0.65	1.5

Water Quality Readings Collected Using YSI-650/6920

Parameter	**Units**	**Readings**						
Time	24 hr	1044	1049	1054	1059	1104	1109	1114
Water Level (0.33)	feet	17.02	17.02	17.02	17.03	17.03	17.02	16.91
Volume Purged	gal	0.00	0.25	>0.25	0.50	<0.75	0.75	>0.75
Flow Rate	mL / min	150	150	150	150	150	150	150
Turbidity (+/- 10%)	NTU	0.9	-1.6	-3.2	-4.4	-3.3	-3.2	-3.5
Dissolved Oxygen (+/- 10%)	%	10.7	7.6	7.6	6.8	7.9	6.8	7.9
Dissolved Oxygen (+/- 10%)	mg/L	1.07	0.74	0.76	0.68	0.65	0.68	0.70
Eh / ORP (+/- 10)	MeV	71.9	67.5	62.6	57.5	55.0	52.4	48.5
Specific Conductivity	mS/cm^c	0.503	0.502	0.503	0.505	0.505	0.505	0.504
Conductivity (+/- 3%)	µmho / cm	0.404	0.409	0.411	0.413	0.414	0.414	0.417
pH (+/- 0.1)	pH unit	7.27	7.26	7.29	7.31	7.33	7.31	7.34
Temp (+/- 0.5)	C	14.67	15.28	15.44	15.50	15.50	15.59	15.97
Color	Visual	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Odor	Olfactory	None	None	None	None	None	None	None

Comments: Started Purge @ 1043
Flow stopped @ 1113, recently charged battery dying already, will connect to car battery

* Three consecutive readings within range indicates stabilization of that parameter.

Monitoring Well Purging/Sampling Form

Project Name and Number: Bedford Village Wells - Hunting Ridge Mall 105648.03.02

Monitoring Well Number: MW-3M Date: September 16, 2009

Samplers: Mark Howard

Sample Number: MW-3M QA/QC Collected? None

Purging / Sampling Method: Peristaltic Pump with Dedicated Tubing

1. L = Total Well Depth:	74.94	feet
2. D = Riser Diameter (I.D.):	0.17	feet
3. W = Static Depth to Water (TOC):	17.02	feet
4. C = Column of Water in Casing:	57.92	feet
5. V = Volume of Water in Well = $C(3.14159)(0.5D)^2(7.48)$	9.44	gal
6. D2 = Tube Setting Depth (ft):	29.85	feet
7. C2 = Column of water in Pump/Tubing (ft):	12.83	feet
8. Tubing Volume = C2(0.005737088)	0.07	gal

D (inches)	D (feet)
1-inch	0.08
2-inch	0.17
3-inch	0.25
4-inch	0.33
6-inch	0.50

Conversion factors to determine V given C

D (inches)	1-inch	2-inch	3-inch	4-inch	6-inch
V (gal / ft)	0.041	0.163	0.37	0.65	1.5

Water Quality Readings Collected Using YSI-650/6920

Parameter	**Units**	**Readings**						
Time	24 hr	1119	1124	1129	1134	1139	1144	1149
Water Level (0.33)	feet	-	17.01	17.01	17.01	17.01	17.01	17.01
Volume Purged	gal	-	>1.00	<1.25	1.25	<1.50	1.50	1.75
Flow Rate	mL / min	-	150	150	150	150	150	150
Turbidity (+/- 10%)	NTU	-	-4.7	-4.4	-4.5	-4.2	-3.6	-4.5
Dissolved Oxygen (+/- 10%)	%	-	7.4	7.0	6.1	6.2	6.0	5.8
Dissolved Oxygen (+/- 10%)	mg/L	-	0.72	0.69	0.61	0.61	0.60	0.59
Eh / ORP (+/- 10)	MeV	-	43.5	42.1	41.4	40.1	38.2	35.3
Specific Conductivity	mS/cm^c	-	0.504	0.506	0.504	0.504	0.503	0.504
Conductivity (+/- 3%)	µmho / cm	-	0.420	0.420	0.415	0.413	0.413	0.413
pH (+/- 0.1)	pH unit	-	7.34	7.34	7.33	7.32	7.32	7.32
Temp (+/- 0.5)	C	-	16.24	16.02	15.67	15.60	15.56	15.55
Color	Visual	-	Clear	Clear	Clear	Clear	Clear	Clear
Odor	Olfactory	-	None	None	None	None	None	None

Comments: 1119 - Hooked the pumpe up to car battery

Sampled @ 1149
Purged a total of ~2 gallons

* Three consecutive readings within range indicates stabilization of that parameter.

Monitoring Well Purging/Sampling Form

Project Name and Number: Bedford Village Wells - Hunting Ridge Mall 105648.03.02

Monitoring Well Number: MW-14 Date: September 16, 2009

Samplers: Mark Howard

Sample Number: MW-14 QA/QC Collected? DUP-1-GW (VOCs + Metals Only)

Purging / Sampling Method: Peristaltic Pump with Dedicated Tubing

1. L = Total Well Depth:	27.4	feet
2. D = Riser Diameter (I.D.):	0.17	feet
3. W = Static Depth to Water (TOC):	14.04	feet
4. C = Column of Water in Casing:	13.36	feet
5. V = Volume of Water in Well = $C(3.14159)(0.5D)^2(7.48)$	2.18	gal
6. D2 = Tube Setting Depth (ft):	22.65	feet
7. C2 = Column of water in Pump/Tubing (ft):	8.61	feet
8. Tubing Volume = C2(0.005737088)	0.05	gal

D (inches)	D (feet)
1-inch	0.08
2-inch	0.17
3-inch	0.25
4-inch	0.33
6-inch	0.50

Conversion factors to determine V given C

D (inches)	1-inch	2-inch	3-inch	4-inch	6-inch
V (gal / ft)	0.041	0.163	0.37	0.65	1.5

Water Quality Readings Collected Using YSI-650/6920

Parameter	**Units**	**Readings**						
Time	24 hr	1319	1324	1329	1334	1339	1344	1349
Water Level (0.33)	feet	14.04	14.24	14.26	14.21	14.22	14.24	14.24
Volume Purged	gal	0.00	<0.25	>0.25	0.50	>0.50	0.75	>0.75
Flow Rate	mL / min	150	150	150	150	150	150	150
Turbidity (+/- 10%)	NTU	42.3	31.9	23.3	17.0	17.8	15.6	12.7
Dissolved Oxygen (+/- 10%)	%	24.9	27.9	26.2	26.9	28.2	28.0	27.1
Dissolved Oxygen (+/- 10%)	mg/L	2.48	2.42	2.52	2.52	2.57	2.61	2.57
Eh / ORP (+/- 10)	MeV	76.6	92.3	96.2	97.5	98.4	98.9	99.9
Specific Conductivity	mS/cm^c	1.328	1.332	1.336	1.338	1.338	1.341	1.345
Conductivity (+/- 3%)	µmho / cm	1.127	1.147	1.157	1.160	1.170	1.175	1.177
pH (+/- 0.1)	pH unit	6.16	6.00	5.99	5.99	5.99	5.99	5.98
Temp (+/- 0.5)	C	17.08	17.75	17.98	18.04	18.43	18.53	18.45
Color	Visual	Sl Cl	Sl Cl	Clear	Clear	Clear	Clear	Clear
Odor	Olfactory	None	None	None	None	None	None	None

Comments: Started Purge @ 1318

Sl Cl - Slightly Cloudy

* Three consecutive readings within range indicates stabilization of that parameter.

Monitoring Well Purging/Sampling Form

Project Name and Number: Bedford Village Wells - Hunting Ridge Mall 105648.03.02

Monitoring Well Number: MW-14 Date: September 16, 2009

Samplers: Mark Howard

Sample Number: MW-14 QA/QC Collected? DUP-1-GW (VOCs + Metals Only)

Purging / Sampling Method: Peristaltic Pump with Dedicated Tubing

1. L = Total Well Depth:	27.4	feet
2. D = Riser Diameter (I.D.):	0.17	feet
3. W = Static Depth to Water (TOC):	14.04	feet
4. C = Column of Water in Casing:	13.36	feet
5. V = Volume of Water in Well = $C(3.14159)(0.5D)^2(7.48)$	2.18	gal
6. D2 = Tube Setting Depth (ft):	22.65	feet
7. C2 = Column of water in Pump/Tubing (ft):	8.61	feet
8. Tubing Volume = C2(0.005737088)	0.05	gal

D (inches)	D (feet)
1-inch	0.08
2-inch	0.17
3-inch	0.25
4-inch	0.33
6-inch	0.50

Conversion factors to determine V given C

D (inches)	1-inch	2-inch	3-inch	4-inch	6-inch
V (gal / ft)	0.041	0.163	0.37	0.65	1.5

Water Quality Readings Collected Using YSI-650/6920

Parameter	**Units**	**Readings**						
Time	24 hr	1354	1359	1404	1409	1414	1419	1424
Water Level (0.33)	feet	14.24	14.23	14.23	14.23	14.23	14.26	14.25
Volume Purged	gal	1.00	<1.25	1.25	<1.50	1.50	1.75	>1.75
Flow Rate	mL / min	150	150	150	150	150	150	150
Turbidity (+/- 10%)	NTU	13.4	13.9	9.4	9.4	8.5	4.4	3.7
Dissolved Oxygen (+/- 10%)	%	27.8	27.1	25.1	26.0	26.9	27.2	26.2
Dissolved Oxygen (+/- 10%)	mg/L	2.56	2.57	2.60	2.42	2.51	2.50	2.69
Eh / ORP (+/- 10)	MeV	100.8	101.4	101.7	101.7	102.2	102.7	103.8
Specific Conductivity	mS/cm^c	1.351	1.363	1.371	1.376	1.380	1.387	1.384
Conductivity (+/- 3%)	µmho / cm	1.183	1.190	1.196	1.204	1.207	1.205	1.199
pH (+/- 0.1)	pH unit	5.98	5.98	5.99	5.99	5.99	5.99	5.98
Temp (+/- 0.5)	C	18.47	18.35	18.34	18.44	18.43	18.03	18.02
Color	Visual	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Odor	Olfactory	None	None	None	None	None	None	None

Comments:

* Three consecutive readings within range indicates stabilization of that parameter.

Monitoring Well Purging/Sampling Form

Project Name and Number: Bedford Village Wells - Hunting Ridge Mall 105648.03.02

Monitoring Well Number: MW-14 Date: September 16, 2009

Samplers: Mark Howard

Sample Number: MW-14 QA/QC Collected? DUP-1-GW (VOCs + Metals Only)

Purging / Sampling Method: Peristaltic Pump with Dedicated Tubing

1. L = Total Well Depth:	27.4	feet
2. D = Riser Diameter (I.D.):	0.17	feet
3. W = Static Depth to Water (TOC):	14.04	feet
4. C = Column of Water in Casing:	13.36	feet
5. V = Volume of Water in Well = $C(3.14159)(0.5D)^2(7.48)$	2.18	gal
6. D2 = Tube Setting Depth (ft):	22.65	feet
7. C2 = Column of water in Pump/Tubing (ft):	8.61	feet
8. Tubing Volume = C2(0.005737088)	0.05	gal

D (inches)	D (feet)
1-inch	0.08
2-inch	0.17
3-inch	0.25
4-inch	0.33
6-inch	0.50

Conversion factors to determine V given C

D (inches)	1-inch	2-inch	3-inch	4-inch	6-inch
V (gal / ft)	0.041	0.163	0.37	0.65	1.5

Water Quality Readings Collected Using YSI-650/6920

Parameter	**Units**	**Readings**						
Time	24 hr	1429	1434	1439				
Water Level (0.33)	feet	14.25	14.25	14.25				
Volume Purged	gal	2.00	<2.25	2.50				
Flow Rate	mL / min	150	150	150				
Turbidity (+/- 10%)	NTU	4.1	4.1	2.0				
Dissolved Oxygen (+/- 10%)	%	26.8	27.1	27.7				
Dissolved Oxygen (+/- 10%)	mg/L	2.48	2.63	2.58				
Eh / ORP (+/- 10)	MeV	104.9	105.8	106.0				
Specific Conductivity	mS/cm^c	1.385	1.385	1.388				
Conductivity (+/- 3%)	µmho / cm	1.200	1.200	1.200				
pH (+/- 0.1)	pH unit	5.98	5.97	5.98				
Temp (+/- 0.5)	C	18.03	18.00	17.91				
Color	Visual	Clear	Clear	Clear				
Odor	Olfactory	None	None	None				

Comments: Sampled @ 1439
Purged a total of ~2.5 gallons
Sheen on purge water

* Three consecutive readings within range indicates stabilization of that parameter.

Monitoring Well Purging/Sampling Form

Project Name and Number: Bedford Village Wells - Hunting Ridge Mall 105648.03.02

Monitoring Well Number: MW-15 Date: September 16, 2009

Samplers: Mark Howard

Sample Number: MW-15 QA/QC Collected? MS/MSD (VOCs Only)

Purging / Sampling Method: Peristaltic Pump with Dedicated Tubing

1. L = Total Well Depth:	27.93	feet
2. D = Riser Diameter (I.D.):	0.17	feet
3. W = Static Depth to Water (TOC):	13.76	feet
4. C = Column of Water in Casing:	14.17	feet
5. V = Volume of Water in Well = $C(3.14159)(0.5D)^2(7.48)$	2.31	gal
6. D2 = Tube Setting Depth (ft):	25.00	feet
7. C2 = Column of water in Pump/Tubing (ft):	11.24	feet
8. Tubing Volume = C2(0.005737088)	0.06	gal

D (inches)	D (feet)
1-inch	0.08
2-inch	0.17
3-inch	0.25
4-inch	0.33
6-inch	0.50

Conversion factors to determine V given C

D (inches)	1-inch	2-inch	3-inch	4-inch	6-inch
V (gal / ft)	0.041	0.163	0.37	0.65	1.5

Water Quality Readings Collected Using YSI-650/6920

Parameter	**Units**	**Readings**						
Time	24 hr	1556	1601	1606	1611	1616	1621	1626
Water Level (0.33)	feet	13.76	13.80	13.81	13.81	13.81	13.81	13.81
Volume Purged	gal	0.00	0.25	<0.50	0.50	>0.50	0.75	>0.75
Flow Rate	mL / min	150	150	150	150	150	150	150
Turbidity (+/- 10%)	NTU	33.3	25.2	21.8	24.8	14.9	15.3	12.6
Dissolved Oxygen (+/- 10%)	%	24.4	18.7	17.5	10.8	12.2	11.6	11.2
Dissolved Oxygen (+/- 10%)	mg/L	3.00	1.80	1.59	1.11	1.19	1.13	1.14
Eh / ORP (+/- 10)	MeV	-35.3	-44.1	-45.7	-44.0	-44.3	-43.2	-40.5
Specific Conductivity	mS/cm^c	1.432	1.431	1.447	1.462	1.480	1.484	1.495
Conductivity (+/- 3%)	µmho / cm	1.148	1.173	1.196	1.215	1.231	1.235	1.244
pH (+/- 0.1)	pH unit	6.57	6.48	6.47	6.47	6.47	6.46	6.45
Temp (+/- 0.5)	C	14.72	15.59	15.92	16.13	16.18	16.23	16.22
Color	Visual	Sl Cl	Clear	Clear	Clear	Clear	Clear	Clear
Odor	Olfactory	Slight	None	None	None	None	None	None

Comments: Started Purge @ 1555

Sl Cl - Slightly Cloudy

* Three consecutive readings within range indicates stabilization of that parameter.

Monitoring Well Purging/Sampling Form

Project Name and Number: Bedford Village Wells - Hunting Ridge Mall 105648.03.02

Monitoring Well Number: MW-15 Date: September 16, 2009

Samplers: Mark Howard

Sample Number: MW-15 QA/QC Collected? MS/MSD (VOCs Only)

Purging / Sampling Method: Peristaltic Pump with Dedicated Tubing

1. L = Total Well Depth:	27.93	feet
2. D = Riser Diameter (I.D.):	0.17	feet
3. W = Static Depth to Water (TOC):	13.76	feet
4. C = Column of Water in Casing:	14.17	feet
5. V = Volume of Water in Well = $C(3.14159)(0.5D)^2(7.48)$	2.31	gal
6. D2 = Tube Setting Depth (ft):	25.00	feet
7. C2 = Column of water in Pump/Tubing (ft):	11.24	feet
8. Tubing Volume = C2(0.005737088)	0.06	gal

D (inches)	D (feet)
1-inch	0.08
2-inch	0.17
3-inch	0.25
4-inch	0.33
6-inch	0.50

Conversion factors to determine V given C

D (inches)	1-inch	2-inch	3-inch	4-inch	6-inch
V (gal / ft)	0.041	0.163	0.37	0.65	1.5

Water Quality Readings Collected Using YSI-650/6920

Parameter	**Units**	**Readings**						
Time	24 hr	1631	1636	1641				
Water Level (0.33)	feet	13.81	13.81	13.81				
Volume Purged	gal	1.00	>1.00	1.25				
Flow Rate	mL / min	150	150	150				
Turbidity (+/- 10%)	NTU	11.1	7.0	4.4				
Dissolved Oxygen (+/- 10%)	%	13.5	13.8	13.1				
Dissolved Oxygen (+/- 10%)	mg/L	1.32	1.24	1.28				
Eh / ORP (+/- 10)	MeV	-40.4	-40.1	-40.7				
Specific Conductivity	mS/cm^c	1.496	1.492	1.488				
Conductivity (+/- 3%)	µmho / cm	1.241	1.230	1.266				
pH (+/- 0.1)	pH unit	6.45	6.44	6.44				
Temp (+/- 0.5)	C	16.09	15.82	15.78				
Color	Visual	Clear	Clear	Clear				
Odor	Olfactory	None	None	None				

Comments: Sampled @ 1641

Purged a total of ~1.5 gallons

Water is sudzy or has a soapy appearance

* Three consecutive readings within range indicates stabilization of that parameter.

APPENDIX E

Slug Test Calculation Work Sheet

CLIENT: NYSDEC **SUBJECT:** Soil Conductivity Calculation from Slug Test Data
PROJECT: Bedford Village Hunting Ridge Mall

Prepared By BB **Date** 11/30/09
Reviewed By KM **Date** 11/30/09
Approved By KM **Date** 11/30/09

TASK

Estimate the soil conductivity using slug test data..

REFERENCES

1. Bouwer, H. and R. C. Rice, 1976. A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. Water Resources Research. V. 12, pp. 423-428.
2. Bouwer, H. and R. C. Rice, 1989. The Bouwer and Rice slug test – an update. Ground Water. V. 27, No. 3 pp. 304-309.

ASSUMPTIONS

Re - Radius of the testing influence: 10 inches

CALCULATIONS

$$K = \frac{rc^2 \ln(Re/Rw)\ln(yo/yt)}{2Le\Delta t}$$

K - Soil conductivity
Re - Radius of the testing influence
Rw - Radius of the soil boring
Le - Length of the open interval of the well
Δt - length of time required for recovery
rc - radius of the well screen and riser
yo - groundwater elevation when testing is initiated
yt - groundwater elevation during testing

MW-15

K - Soil conductivity
Re - Assume 10 inches
Rw - 4.25 inches
Le - 60 inches
Δt - 75 seconds
rc - 1 inch
yo - 38.803
yt - 37.483

$$K = \frac{12 \ln(10/4.25)\ln(38.803/37.483)}{2(60)(75)}$$

$$K = \frac{0.030}{9000}$$

K= 3.3 x 10-6 inches/second

MW-14

K - Soil conductivity
Re - Assume 10 inches
Rw - 4.25 inches
Le - 60 inches
Δt - 195 seconds
rc - 1 inch
yo - 39.129
yt - 37.793

$$K = \frac{12 \ln(10/4.25)\ln(39.129/37.793)}{2(60)(195)}$$

$$K = \frac{0.030}{23400}$$

K= 1.3 x 10-6 inches/second

Groundwater surface gradient as measured between wells MW-14, MW-15 and MW-3S

$$\text{Gradient} = \frac{\Delta h}{\Delta l}$$

Δl - distance between well and isoelevation line
Δh - change in groundwater elevation between points

$$\text{Gradient} = \frac{0.44}{196.58}$$

Gradient = 2.2 x 10-3

Groundwater velocity as measured moving from the source area, MW-14 and MW-15 toward the greatest contamination, MW-3S and MW-3M.

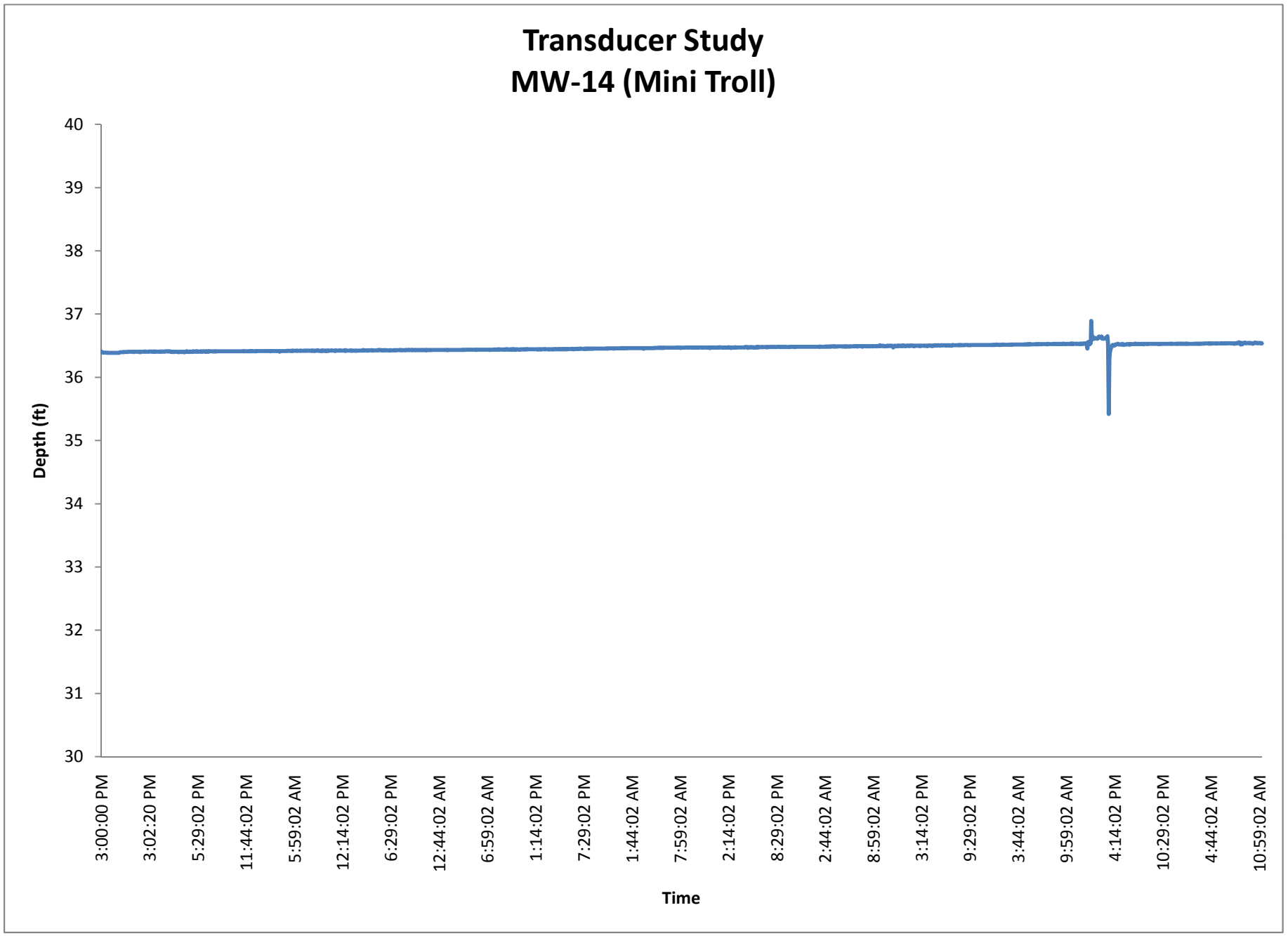
Velocity = K Gradient

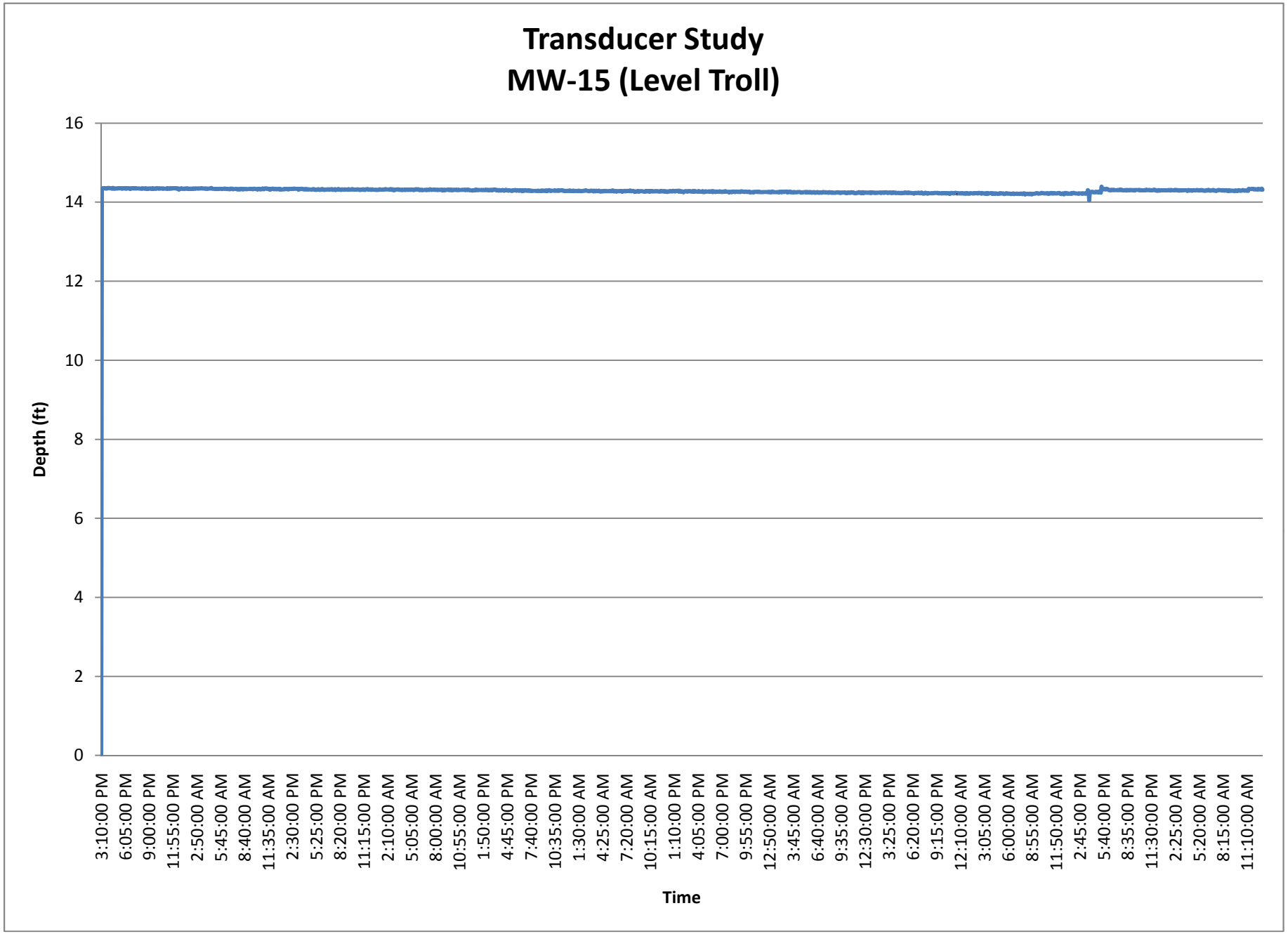
MW-15
Velocity = 3.3 x 10-6 inches/second (2.2 x 10-3)
Velocity = 7.26 x 10-8 inches/second

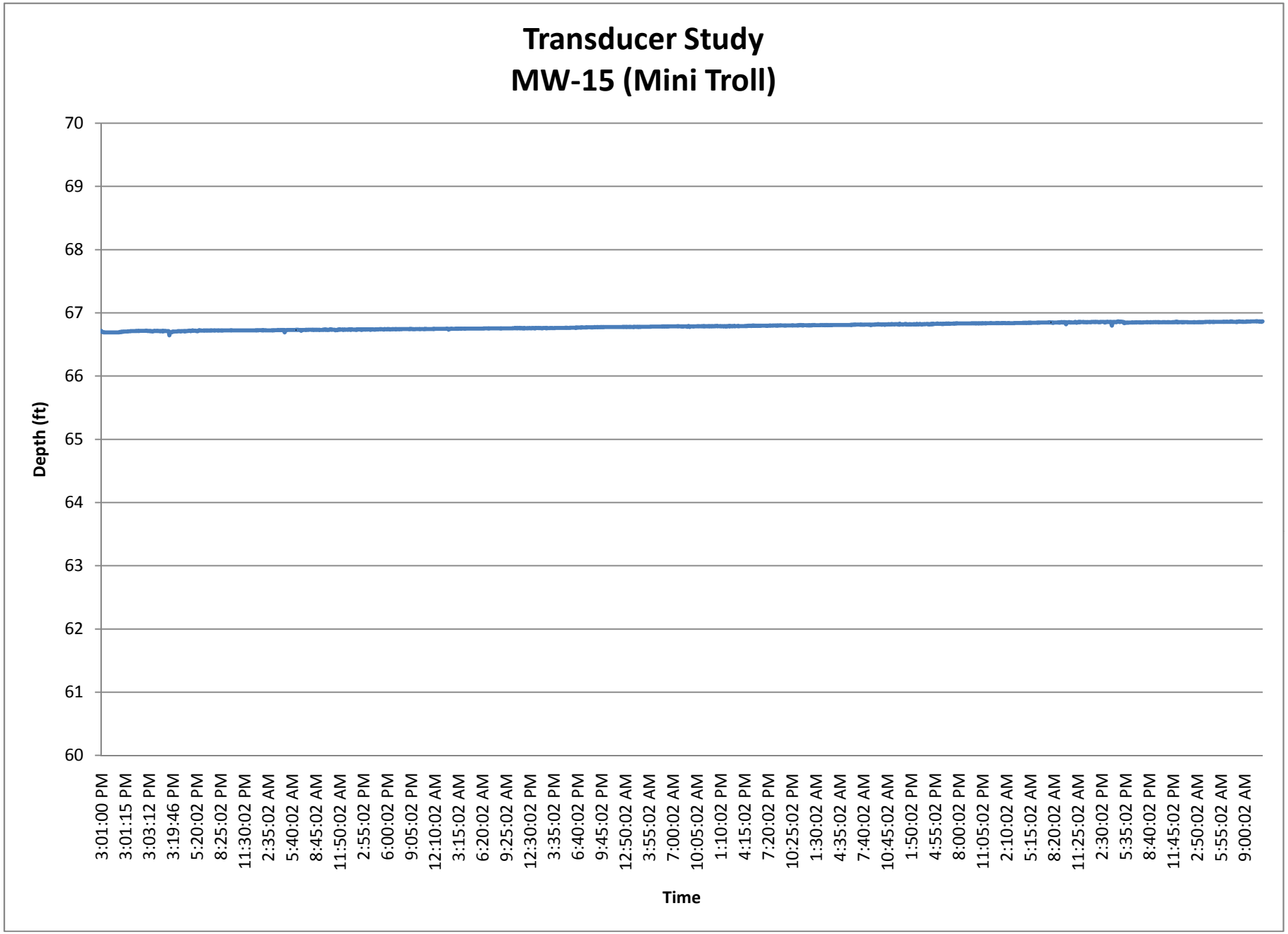
MW-14
Velocity = 1.3 x 10-6 inches/second (2.2 x 10-3)
Velocity = 2.86 x 10-9 inches/second

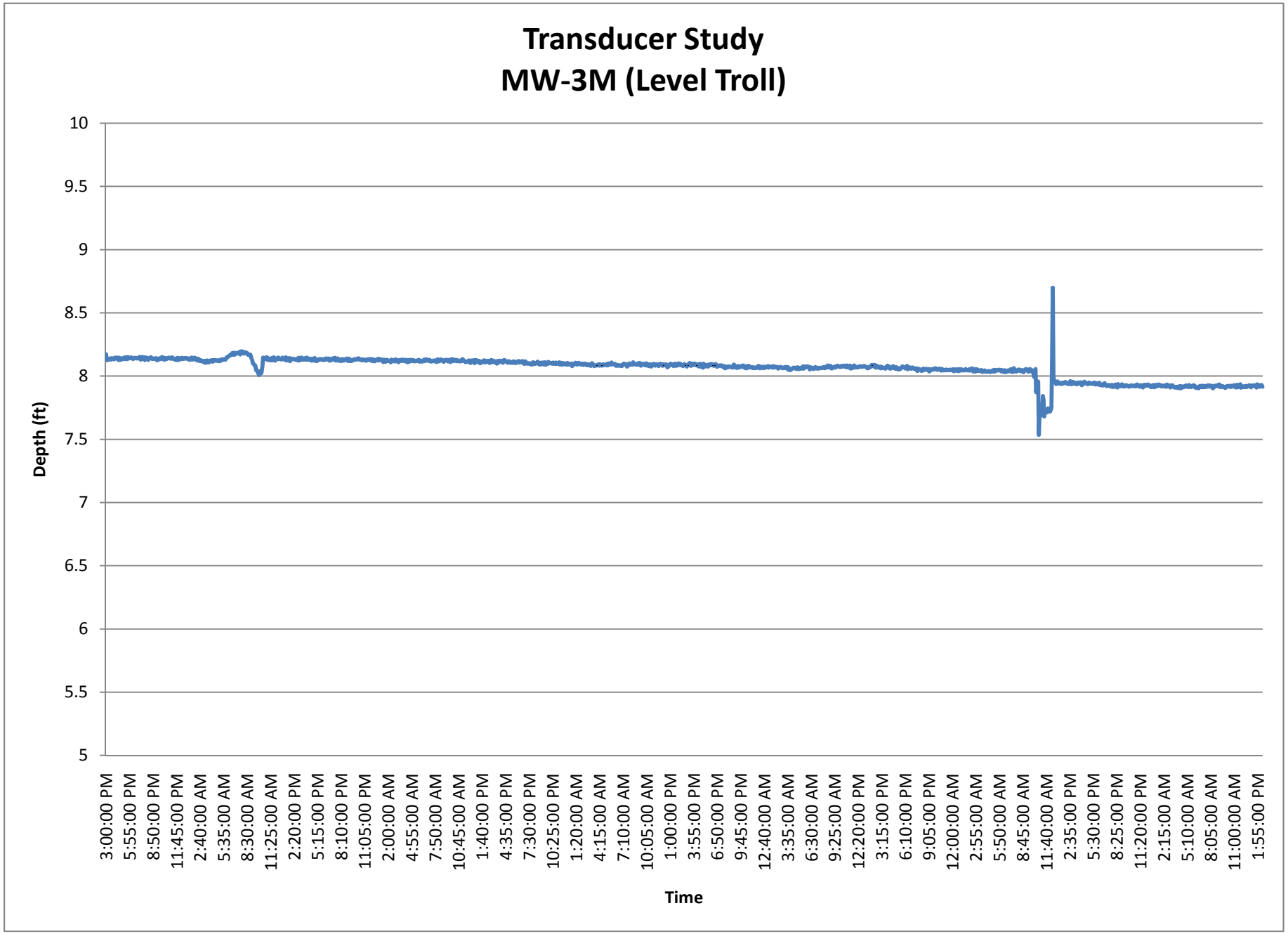
APPENDIX F

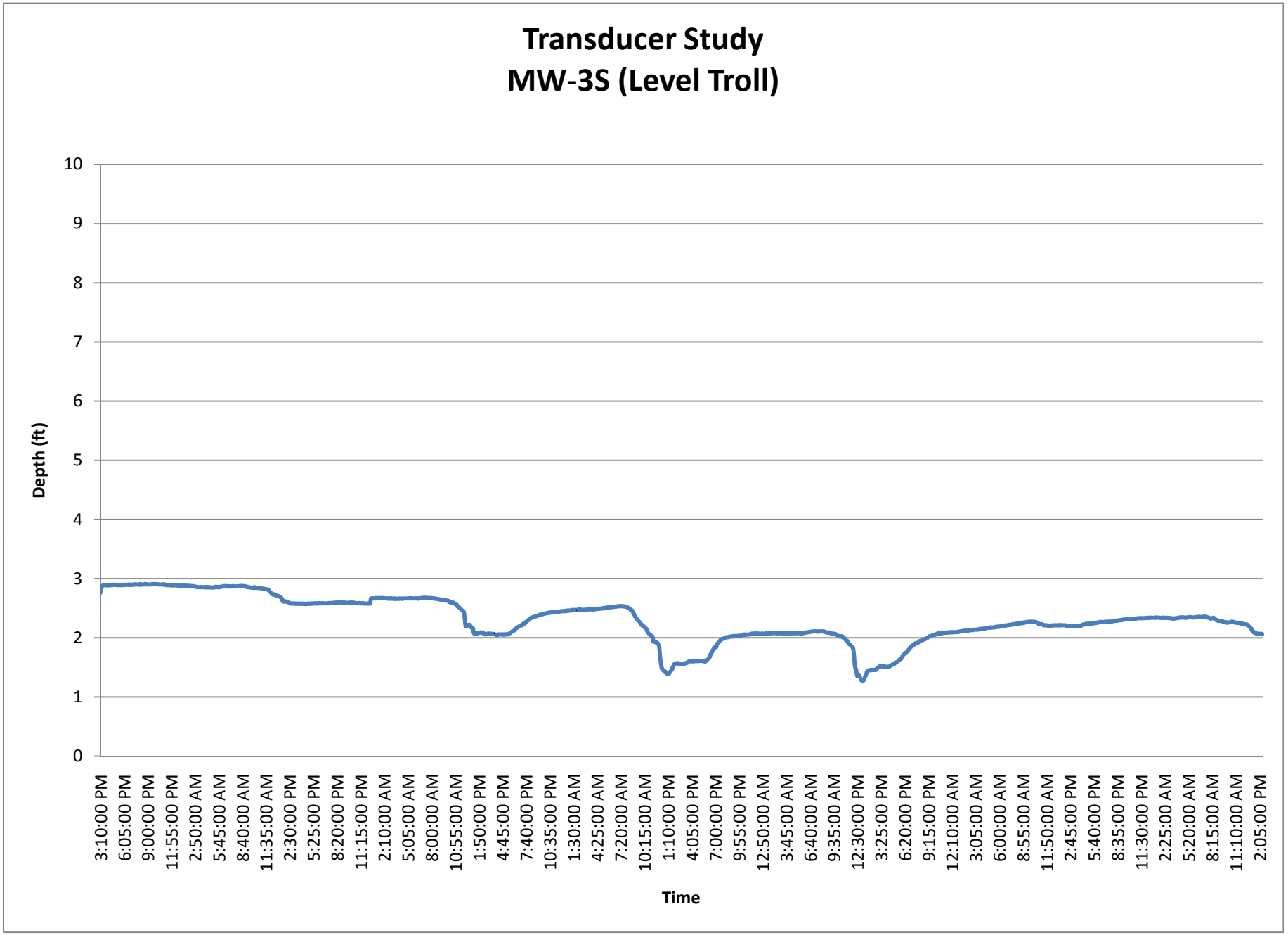
Raw Transducer Data


Transducer Study
MW-14 (Mini Troll)
Depth (ft)
40
39
38
37
36
35
34
33
32
31
30
3:00:00 PM
3:02:20 PM
5:29:02 PM
11:44:02 PM
5:59:02 AM
12:14:02 PM
6:29:02 PM
12:44:02 AM
6:59:02 AM
1:14:02 PM
7:29:02 PM
1:44:02 AM
7:59:02 AM
2:14:02 PM
8:29:02 PM
2:44:02 AM
8:59:02 AM
3:14:02 PM
9:29:02 PM
3:44:02 AM
9:59:02 AM
4:14:02 PM
10:29:02 PM
4:44:02 AM
10:59:02 AM
Time


Transducer Study
MW-15 (Level Troll)
Depth (ft)
16
14
12
10
8
6
4
2
0
3:10:00 PM
6:05:00 PM
9:00:00 PM
11:55:00 PM
2:50:00 AM
5:45:00 AM
8:40:00 AM
11:35:00 AM
2:30:00 PM
5:25:00 PM
8:20:00 PM
11:15:00 PM
2:10:00 AM
5:05:00 AM
8:00:00 AM
10:55:00 AM
1:50:00 PM
4:45:00 PM
7:40:00 PM
10:35:00 PM
1:30:00 AM
4:25:00 AM
7:20:00 AM
10:15:00 AM
1:10:00 PM
4:05:00 PM
7:00:00 PM
9:55:00 PM
12:50:00 AM
3:45:00 AM
6:40:00 AM
9:35:00 AM
12:30:00 PM
3:25:00 PM
6:20:00 PM
9:15:00 PM
12:10:00 AM
3:05:00 AM
6:00:00 AM
8:55:00 AM
11:50:00 AM
2:45:00 PM
5:40:00 PM
8:35:00 PM
11:30:00 PM
2:25:00 AM
5:20:00 AM
8:15:00 AM
11:10:00 AM
Time


Transducer Study
MW-15 (Mini Troll)
Depth (ft)
70
69
68
67
66
65
64
63
62
61
60
3:01:00 PM
3:01:15 PM
3:03:12 PM
3:19:46 PM
5:20:02 PM
8:25:02 PM
11:30:02 PM
2:35:02 AM
5:40:02 AM
8:45:02 AM
11:50:02 AM
2:55:02 PM
6:00:02 PM
9:05:02 PM
12:10:02 AM
3:15:02 AM
6:20:02 AM
9:25:02 AM
12:30:02 PM
3:35:02 PM
6:40:02 PM
9:45:02 PM
12:50:02 AM
3:55:02 AM
7:00:02 AM
10:05:02 AM
1:10:02 PM
4:15:02 PM
7:20:02 PM
10:25:02 PM
1:30:02 AM
4:35:02 AM
7:40:02 AM
10:45:02 AM
1:50:02 PM
4:55:02 PM
8:00:02 PM
11:05:02 PM
2:10:02 AM
5:15:02 AM
8:20:02 AM
11:25:02 AM
2:30:02 PM
5:35:02 PM
8:40:02 PM
11:45:02 PM
2:50:02 AM
5:55:02 AM
9:00:02 AM
Time


Transducer Study
MW-3M (Level Troll)
Depth (ft)
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
3:00:00 PM
5:55:00 PM
8:50:00 PM
11:45:00 PM
2:40:00 AM
5:35:00 AM
8:30:00 AM
11:25:00 AM
2:20:00 PM
5:15:00 PM
8:10:00 PM
11:05:00 PM
2:00:00 AM
4:55:00 AM
7:50:00 AM
10:45:00 AM
1:40:00 PM
4:35:00 PM
7:30:00 PM
10:25:00 PM
1:20:00 AM
4:15:00 AM
7:10:00 AM
10:05:00 AM
1:00:00 PM
3:55:00 PM
6:50:00 PM
9:45:00 PM
12:40:00 AM
3:35:00 AM
6:30:00 AM
9:25:00 AM
12:20:00 PM
3:15:00 PM
6:10:00 PM
9:05:00 PM
12:00:00 AM
2:55:00 AM
5:50:00 AM
8:45:00 AM
11:40:00 AM
2:35:00 PM
5:30:00 PM
8:25:00 PM
11:20:00 PM
2:15:00 AM
5:10:00 AM
8:05:00 AM
11:00:00 AM
1:55:00 PM
Time


Transducer Study
MW-3S (Level Troll)
Depth (ft)
10
9
8
7
6
5
4
3
2
1
0
3:10:00 PM
6:05:00 PM
9:00:00 PM
11:55:00 PM
2:50:00 AM
5:45:00 AM
8:40:00 AM
11:35:00 AM
2:30:00 PM
5:25:00 PM
8:20:00 PM
11:15:00 PM
2:10:00 AM
5:05:00 AM
8:00:00 AM
10:55:00 AM
1:50:00 PM
4:45:00 PM
7:40:00 PM
10:35:00 PM
1:30:00 AM
4:25:00 AM
7:20:00 AM
10:15:00 AM
1:10:00 PM
4:05:00 PM
7:00:00 PM
9:55:00 PM
12:50:00 AM
3:45:00 AM
6:40:00 AM
9:35:00 AM
12:30:00 PM
3:25:00 PM
6:20:00 PM
9:15:00 PM
12:10:00 AM
3:05:00 AM
6:00:00 AM
8:55:00 AM
11:50:00 AM
2:45:00 PM
5:40:00 PM
8:35:00 PM
11:30:00 PM
2:25:00 AM
5:20:00 AM
8:15:00 AM
11:10:00 AM
2:05:00 PM
Time

Transducer Study
MW-6D (Level Troll)