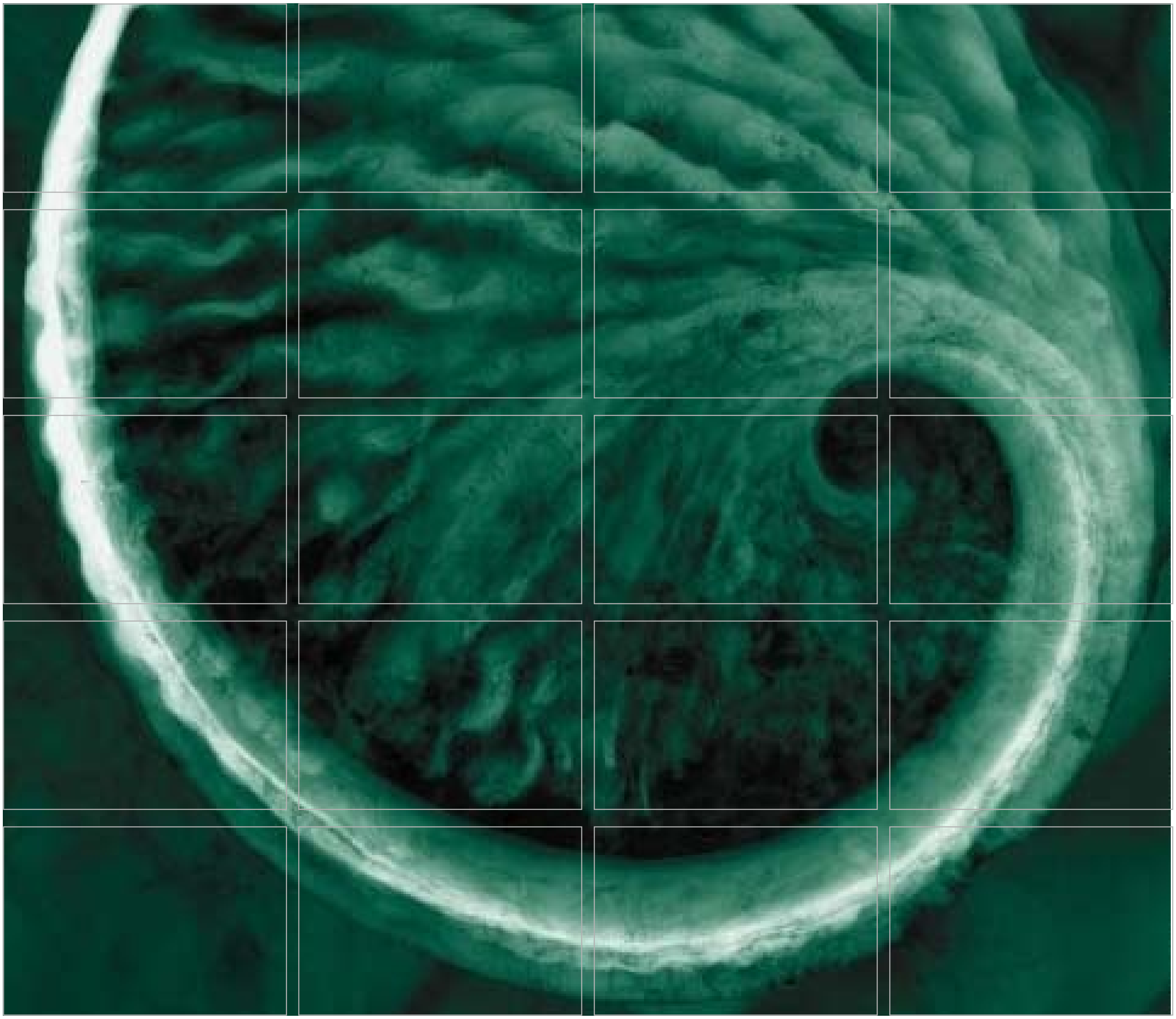

# Corrective Action Plan

**SMS #2006-3509**
**401 Gage Street**
**Bennington, Vermont**

**Prepared for:**
**Energizer Battery Manufacturing, Inc.**
**401 Gage Street**
**Bennington, Vermont 05201**
**(802) 442-6301**

ERM Reference 0066698
1 October 2007

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**FINAL REPORT**

Energizer Battery Manufacturing, Inc.

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Environmental Resources Management
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Energizer Battery Manufacturing, Inc.

# Corrective Action Plan

SMS# 2006-3509

401 Gage Street

Bennington, Vermont

1 October 2007

ERM Reference 0066698


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## *EXECUTIVE SUMMARY*

Environmental Resources Management (ERM) has prepared a Corrective Action Plan (CAP) on behalf of Energizer Battery Manufacturing, Inc. (Energizer) for the Energizer facility at 401 Gage Street, Bennington, Vermont (the "Site"). The Vermont Department of Environmental Conservation (VTDEC), Sites Management Section has assigned the Site Number 2006-3509.

The Site Investigation Report (SIR; ERM, 2007c) concluded that concentrations of tetrachloroethene (PCE) and trichloroethene (TCE) in Site soil and groundwater exceed VTDEC regulatory cleanup criteria. The SIR concluded that remediation and/or management of Site soil, groundwater and soil gas will be necessary. ERM has identified six potential Areas of Concern (AOCs), which correspond to current or former solvent use at the facility, which may require remediation.

The Corrective Action Feasibility Investigation (CAFI; ERM, 2007c) recommended implementation of the following remedial alternatives:

- A containment remedy consisting of focused shallow soil excavation and air sparge/soil vapor extraction (AS/SVE) along the northern Site boundary; and
- A source abatement remedy consisting of a combination of AS/SVE, steam-enhanced SVE, and possibly in-situ chemical oxidation (ISCO).

The containment remedy design is documented in the CAFI (ERM, 2007c) as an Interim Remedial Measure (IRM).

The CAP remediation is designed to abate PCE and TCE impacts within the vadose and saturated zones within the most significant AOCs using an integrated steam, AS, and SVE system, with an option for application of ISCO as a polishing step. The IRM AS/SVE containment system will operate during CAP remediation activities. The remedial objective is to achieve applicable groundwater standards at the facility property line. The remediation systems will operate until either these groundwater standards have been achieved or until asymptotic levels of mass removal have occurred. If it is determined that SVE, AS, and steam alone cannot achieve the groundwater standards at the facility property boundary, then ISCO may be implemented after receiving VTDEC approval (note: since application of ISCO is optional, a detailed design has not been included in the CAP, a work plan will be submitted to the VTDEC if ISCO is necessary).

This CAP includes an active remediation plan for AOC-1 through AOC-4. The need for active remediation within AOC-1 through AOC-4 will be further evaluated based on data collected during remedial well installation. Based on field measurements made during the IRM well installation, ERM does not believe that active remediation of AOC-5 and AOC-6 is necessary due to limited contaminant mass in the saturated zone and the close proximity of these AOCs to the IRM containment system. The need for active remediation of these AOCs will be determined following treatment of AOC-1 through AOC-4, based on groundwater monitoring results at the compliance points. If necessary, a CAP addendum will be submitted to the VTDEC to actively address these AOCs.

# 1.0 INTRODUCTION

## 1.1 OVERVIEW

Environmental Resources Management (ERM) has prepared this Corrective Action Plan (CAP) on behalf of Energizer Battery Manufacturing, Inc. (Energizer) for the Energizer facility located at 401 Gage Street, Bennington, Vermont (the "Site"). The Vermont Department of Environmental Conservation (VTDEC), Sites Management Section has assigned the Site Number 2006-3509. A Site Locus Map and Site Plan are provided as Figures 1 and 2, respectively.

## 1.2 BACKGROUND

In February 2006, ERM conducted a limited soil and shallow groundwater investigation to determine if chlorinated solvents were present in the subsurface in the vicinity of an active vapor degreaser located in the northeast corner of Plant I. The results of this initial investigation indicated that both tetrachloroethene (PCE) and trichloroethene (TCE) were present in soil and groundwater in the vicinity of the active degreaser (ERM, 2006). Mr. Greg Bird of Energizer verbally notified VTDEC of the findings of the initial investigation on 6 March 2006. Subsequently, written notification was provided to the VTDEC on 16 March 2006.

Site investigation activities conducted to date have focused on the delineation of the extent of PCE and TCE impacts in soil, groundwater and soil gas. ERM has identified six potential Areas of Concern (AOCs), which correspond to current or former solvent use at the facility:

- AOC-1: Current active degreaser area;
- AOC-2: Former machine shop;
- AOC-3: Current production area;
- AOC-4: Former loading dock area;
- AOC-5: Former drain line; and
- AOC-6: Former process area sump.

This CAP includes an active remediation plan for AOC-1 through AOC-4. The need for active remediation within AOC-1 through AOC-4 will be further evaluated based on data collected during remedial well installation. Based on field measurements made during the IRM well installation, ERM does not believe that active remediation of AOC-5 and AOC-6 is necessary due to limited contaminant mass in the saturated zone and the close proximity of these AOCs to the IRM containment system. The need for active remediation of these AOCs will be determined following treatment of AOC-1 through AOC-4, based on groundwater monitoring results at the compliance points. If necessary, a CAP addendum will be submitted to the VTDEC to actively address these AOCs.

During 2006 and early 2007, ERM conducted a dynamic Triad site investigation in accordance with the VTDEC Site Investigation Procedure (VTDEC, 2005). In June 2007, ERM submitted a Site Investigation Report (SIR) to the VTDEC documenting the methods, results, and conclusions of the site investigation. The SIR concluded that remediation and/or management of Site soil, groundwater and soil gas will be necessary. The SIR Executive Summary is provided as Appendix A.

In June 2007, ERM submitted a Corrective Action Feasibility Investigation (CAFI) to the VTDEC documenting a formal evaluation of potential Site remedial alternatives. Based on the results of the CAFI, ERM recommended implementation of the following remedial alternatives:

- A containment remedy consisting of focused shallow soil excavation and air sparge/soil vapor extraction (AS/SVE) along the northern Site boundary; and
- A source abatement remedy consisting of a combination of AS/SVE, steam-enhanced SVE, and possibly in-situ chemical oxidation (ISCO).

The containment remedy design is documented in the CAFI (ERM, 2007c) as an Interim Remedial Measure (IRM). This CAP documents the source abatement remedy design in accordance with the VTDEC Corrective Action Guidance (VTDEC, 1997).

## *1.3 PURPOSE AND SCOPE*

The purpose of the CAP is to clearly communicate the basis and details of the proposed remediation strategy to the VTDEC. To achieve this objective, ERM has prepared a detailed description of the proposed remedy, including a series of figures depicting the source, nature and extent of subsurface impacts, and the system design and layout.

## 1.4 *REPORT ORGANIZATION*

The remainder of this report is divided into the following sections:

- Section 2.0 – Site Description
- Section 3.0 – Results of Corrective Action Feasibility Investigation
- Section 4.0 – Corrective Action Plan
- Section 5.0 – Operation, Monitoring, and Maintenance

## 2.0 SITE INFORMATION

### 2.1 SITE LOCATION

The Energizer Facility located at 401 Gage Street, Bennington, Vermont is a 9-acre property located in an area of residential and light industrial/commercial use. The Energizer facility currently consists of two buildings, Plants I and II, which have a combined footprint of 148,754 square feet, and four asphalt-paved parking areas located on Gage and Scott Streets. The property is abutted by residential properties to the north, east and west and the Walloomsac River to the south. The portion of the Site that is the subject of this report is the Plant I building, including associated land parcels, and two parking areas located to the west of the building. The Site does not include Plant II, Energizer property south of Scott Street or the eastern parking area. A Site Plan showing the Site boundary is provided as Figure 2.

### 2.2 SENSITIVE RECEPTORS

According to the VTDEC Site Investigation Procedure (June 2005), sensitive receptors may include public and private water supplies, surface water bodies, wetlands, sensitive ecological areas, outdoor and indoor air, or enclosed spaces such as basements, sewers or utility easements. Sensitive receptors located within one mile of the Site were identified and evaluated as part of the Site Investigation (ERM, 2007c). To date, the only potential impacts to sensitive receptors that have been identified are associated with the potential for vapor intrusion. The occurrence of and potential for vapor intrusion into nearby off-Site residential structures is currently being monitored and evaluated. Both indoor air and soil vapor samples have been collected on adjacent off-Site properties as part of ongoing Site investigation activities. An Evaluation of Vapor Intrusion report will be provided to the VTDEC in December 2007.

The following table presents property ownership information for potentially affected properties.

*Potentially Affected Properties*

| Address | Property Owner/Mailing Address | Phone Number |
|---|---|---|
| 403 Gage St. | Christopher Kennedy<br>403 Gage St., Bennington, VT 05201 | (802) 447-2420 |
| 405 Gage St. | Arlene H. Danville<br>405 Gage St., Bennington, VT 05201 | (802) 442-3735 |
| 407 Gage St. | Andrea J. Crawford<br>41 Earls Dr., Bennington, VT 05201 | (802) 447-0087 |
| 409 Gage St. | Colleen B. Macksey<br>P.O. Box 29, Bennington, VT | (802) 447-0300 |

## 2.3 RELEVANT SITE CONDITIONS

### 2.3.1 Site Geology

The investigation locations are shown on Figure 3. The Site surficial geology consists of the following geologic units, from shallowest to deepest:

- Coarse sand and gravel deposit (approximately 20-feet thick).
- Silt deposit (ranging from approximately 25- to 50-feet thick).
- Till deposit (ranging from approximately 10- to 20-feet thick).

The vertical sequence of these geologic units is consistent across the Site. The thickness of the upper, coarser units are consistent across the Site, while the depths to the lodgment till and bedrock vary from east (70 feet to till, 80 feet to bedrock) to west (45 feet to till, 60 feet to bedrock). Geologic cross sections are presented in Figures 4A and 4B.

### 2.3.2 Site Hydrogeology

Figure 5 depicts the shallow groundwater potentiometric surface across the Site and on downgradient off-Site properties based on groundwater elevation data collected in February 2007. This map also incorporates groundwater elevation data collected as part of the July 2006 modified Waterloo Profiler investigation. Data from the July 2006 modified

Waterloo Profiler borings were adjusted based on their relationship to wells that were gauged during both the July 2006 and February 2007 monitoring events. In general, overburden groundwater appears to be flowing toward the west-northwest. A summary of groundwater gauging data collected to date from on and off-Site monitoring wells is provided in Table 1A. A summary of groundwater elevation data collected as part of the July 2006 modified Waterloo Profiler investigation is provided in Table 1B.

Hydraulic conductivity at the Site ranges from 1.5 X $10^{-5}$ centimeters per second in the till unit to 2.6 X $10^{-1}$ cm/s in the overlying sand and gravel unit (ERM, 2007c). Using Darcy's Law, ERM calculated groundwater flow velocities within the shallow sand and gravel and underlying silt and till layers ranging from 1 to 60 feet per day and 0.004 to 0.16 feet per day, respectively (ERM, 2007c).

### 2.3.3 *Site Soil Quality*

Site soil analytical results indicate that only PCE and TCE have been detected at concentrations exceeding the EPA Region IX Preliminary Remediation Goals (PRGs) Industrial Standards (ERM, 2007c). Concentrations of PCE and TCE in soil are presented in Table 2. Subsequent to submittal of the Site Investigation Report (ERM, 2007c), additional soil samples were collected during implementation of Interim Remedial Measures (IRM) at the Site. Results of the soil sampling conducted during implementation of the IRM are included in Table 2. Geologic cross sections depicting headspace readings of total VOCs in soil are presented as Figures 4A and 4B. The analytical laboratory report for soil data collected during the implementation of the IRM and prior to preparation of this CAP report is included as Appendix B.

### 2.3.4 *Site Groundwater Quality*

Groundwater analytical results obtained during this investigation indicate that only PCE and TCE have been detected at concentrations exceeding the Vermont Primary Groundwater Quality Standards (VTPGQS, VTDEC, 2004). PCE and TCE impacts in groundwater are limited to the shallow sand and gravel aquifer. Groundwater analytical data for deep overburden wells (>45 feet bgs) indicates that PCE and TCE are not present in deep groundwater at the Site. Concentrations of PCE and TCE in groundwater are presented in Table 3. Figures 6A and 6B illustrate PCE concentrations in Site groundwater in cross-section based on the modified Waterloo Profiler boring investigation. Figures 7A and 7B illustrate TCE concentrations in Site groundwater in cross-section. Concentration isopleth maps illustrating the lateral distribution of PCE and TCE in groundwater at the Site are provided as Figures 8 and 9, respectively.

### *2.3.5 Site Soil Gas*

Based on the results of a passive soil gas investigation conducted at the Site, concentrations of PCE and TCE are present in soil gas. Figures 10 and 11 depict cumulative mass flux values for PCE and TCE, respectively, in soil gas at the Site.

# 3.0 SUMMARY OF CORRECTIVE ACTION FEASIBILITY INVESTIGATION

In June 2007, ERM submitted a CAFI to the VTDEC documenting a formal evaluation of potential remedial alternatives for the Site. The CAFI focused on selection of remedies to abate PCE and TCE impacts to soil and groundwater at the Site. Both PCE and TCE are amenable to remediation by a wide range of chemical, physical, and biological technologies.

Based on AOC characterization activities conducted to date, PCE and TCE are primarily present within the vadose zone and within the upper 5 to 10 feet of the silt aquitard. Off-Site mass flux occurs via advective groundwater transport within the sand and gravel aquifer at a flow rate ranging from 1 to 60 feet per day. This sand and gravel aquifer is difficult to penetrate using standard drilling techniques, due to the presence of numerous quartzite boulders. Successful well installation requires use of roto-sonic drilling techniques. Drill rig accessibility in and around the active manufacturing facility is limited. A successful remediation strategy must consider:

- treatment of both high and low permeability zones;
- the effects of the extremely high groundwater velocity on the technology selected; and
- the ability to implement the technology given the challenging logistics associated with Site geology and facility operations.

To incorporate these challenges into the technology screening process, the CAFI was conducted in two steps. The first step focused on evaluation of a remedial technology's applicability in treating PCE and TCE, and the likelihood that it could be successfully implemented in at least one AOC. The second step involved development of potential remedial alternatives using one or more technologies that were retained during the initial screening step. The scenarios were then evaluated against a series of criteria to select the most appropriate remediation scenario for the Site (ERM, 2007c).

Based on the results of the CAFI, ERM recommended implementation of the following remedial alternatives:

- a containment remedy consisting of focused shallow soil excavation and AS/SVE along the northern Site boundary; and
- a source abatement remedy consisting of a combination of AS/SVE, steam-enhanced SVE, and possibly ISCO.

The containment remedy design is documented in the CAFI (ERM, 2007c) as an IRM. A Final Construction Report will be prepared for the IRM and CAP installation activities. As-Built drawings of the IRM and CAP systems will be provided as part of the Final Construction Report, as well as a discussion of the analytical results of soil samplings collected during installation of the IRM and CAP systems. The Final Construction Report will be submitted to the VTDEC approximately two months following startup of the CAP system, which is currently scheduled to occur in December 2007.

Section 4.0 of this CAP documents the source abatement remedy design in accordance with the VTDEC Corrective Action Guidance (VTDEC, 1997).

## 4.0 CORRECTIVE ACTION PLAN

The CAP remediation is designed to abate PCE and TCE impacts within the vadose and saturated zones beneath Plant I (Figure 2) using an integrated steam, AS, and SVE system, with an option for application of ISCO as a polishing step. The IRM AS/SVE containment system (ERM, 2007c) will operate during CAP remediation activities. Copies of the well construction logs for air sparge and soil vapor extraction (AS/SVE) installed to date as part of the IRM, as well as construction logs for performance monitoring wells installed since the submittal of the SIR/CAFI, are included as Appendix C.

In accordance with the Correction Action Guidance (VTDEC, 1997), James D. Fitzgerald, P.E. has reviewed this CAP. His signature and stamp can be found on the signature page at the front of this report.

A health and safety plan for installing the IRM system is provided as Appendix D. The CAP installation activities will be very similar to the IRM, and any required modifications to the health and safety plan for the CAP will be completed prior to the start of system installation.

### 4.1 REMEDIAL OBJECTIVE

There are PCE and TCE impacts to soil and groundwater in the vadose zone and the high-permeability and low-permeability saturated zones. An aggressive treatment train will be implemented to remediate each of these zones.

The remedial objective is to achieve applicable groundwater standards at the facility property line. The remediation systems will operate until either these groundwater standards have been achieved or until asymptotic levels of mass removal have occurred. If necessary, ISCO will be implemented, after receiving VTDEC approval, if it is determined that SVE, AS, and steam alone cannot achieve the groundwater standards at the facility property boundary.

### 4.2 *REMEDIATION SYSTEM DESCRIPTION*

To address the vadose and saturated zone impacts, the following remediation approach will be implemented:

- Vadose zone – SVE;
- High-permeability coarse sand and gravel deposit – AS; and
- Low-permeability silt deposit – steam injection.

Descriptions of the steam, AS and SVE remediation systems are presented in the following sections. A detailed design has not been completed for the ISCO program, given that it is an optional polishing technology that may not be applied. If ISCO is necessary, ERM will prepare and submit a CAP amendment to the VTDEC for review and approval.

The steam, AS and SVE remediation system wells are being installed as part of a dynamic investigation program. The exact footprint of each AOC has not been fully delineated. Therefore, additional data will be collected during installation of the CAP AS wells to further delineate the horizontal and vertical extent of AOCs 1 through 4. Based on the data collected during system installation, the exact number and location of AS, SVE and steam injection wells may be modified to more effectively address each AOC.

The CAP source remediation system was designed to complement the IRM perimeter containment system and is focused on removal of contaminant mass from four AOCs. Based on the results of ongoing source characterization activities, steam remediation will be conducted only in AOCs-1, 3 and 4 , whereas AS/SVE will likely be conducted in each of the four AOCs.

It should also be noted that, while no contaminant migration is expected as a result of operation of the CAP remediation system, in the event that the CAP remediation system does result in small-scale contaminant migration in either the saturated or vadose zones, the IRM perimeter containment system was designed to capture contaminants leaving the Site. Figure 12 shows that the IRM system is capable of capturing groundwater and soil gas impacts present at the Site. Therefore, the IRM system will act as a secondary capture system in the event that any contaminant migration occurs out of the CAP treatment zones.

### 4.2.1 *Soil Vapor Extraction (SVE)*

SVE removes volatile organic compounds (VOCs) from unsaturated soils by inducing air flow through impacted areas. SVE is typically performed by applying a vacuum to vertical extraction wells screened within the impacted soil. The pressure gradients induced by the applied vacuum within the radius of influence cause the soil gas to migrate through the soil pores toward the vapor extraction wells.

An AS/SVE pilot study was conducted at the Site between 6 and 8 March 2007 (ERM, 2007a). The pilot study report is provided as Appendix E. It was determined from the pilot study that an SVE radius of influence of 25 feet (50-foot well spacing) will provide adequate capture of vapors within the high permeability sand and gravel layer.

The IRM SVE barrier system is currently being installed and will consist of 18 SVE wells (Figure 12). The CAP SVE source abatement system will consist of 12 SVE wells (Figure 13). A single SVE system has been designed to operate the IRM and CAP SVE wells. The estimated IRM and CAP SVE locations are shown on Figure 14. A process flow diagram for the SVE system is provided as part of Figure 15. A process and instrumentation diagram (P&ID) for the SVE system is provided as Figure 16. The calculations related to the SVE system design are provided in Appendix F, and the equipment specifications are provided in Appendix G.

The SVE system will consist of the following equipment:

- two rotary lobe SVE blowers (Sutorbilt 6L, 25 horsepower (hp), 800 standard cubic feet per minute (scfm) each) with silencer, variable frequency drive, and associated valving;
- one air to water heat exchanger (American Industrial Heat Transfer, shell and tube, 1,600 scfm) with associated temperature, pressure, and flow meters;
- two moisture separators (VLW-480, 1,800 scfm) with associated holding tank, level alarms, manual drain, and centrifugal transfer pump;
- off-gas treatment (three sacrificial carbon beds); and
- associated pumps, valves, and instruments.

The SVE system is rated for 1,600 standard cubic feet per minute (scfm) at 6 inches of mercury ("Hg). Based on the AS/SVE pilot study, it is estimated that the flow rate from each well will be approximately 40 scfm.

Schedule 80 PVC piping will be used in areas that are outside the effect of the steam treatment and either chlorinated polyvinyl chloride (CPVC) or high temperature hot air blower piping will be used in areas where steam injection will be used.

High temperature vapor extracted from SVE wells within the steam treatment areas will pass through a heat exchanger to remove condensable fluids and moisture separator to remove large entrained water droplets to prevent damage to the SVE blowers from water impingement on the blower internals. This is necessary to prevent clogging of the downstream off-gas treatment. Condensate from the moisture separators will be collected in a holding tank until it is discharged to the sanitary sewer in accordance with Energizer's existing water discharge permit. Condensate will be analyzed for VOCs prior to discharge to the sanitary sewer.

The subsurface vapors collected from the SVE system will be treated on-Site using sacrificial granular activated carbon. After carbon treatment, the air will be discharged to the atmosphere via the existing stack for the facility's carbon regeneration system. Samples of the carbon influent and effluent will be regularly collected to verify the carbon's effectiveness in removing VOCs prior to discharge to the atmosphere.

### *4.2.2 Air Sparging (AS)*

AS will be implemented as an in-situ approach for enhancing desorption and volatilization of sorbed-phase VOCs and aqueous-phase constituents in saturated sand and gravel layer, as well as a means of collecting the VOC vapors that are volatilized from the steam injection in the underlying silt layer. AS involves the forcing of air under pressure through a well screened below the vertical extent of contamination. VOCs are carried by the sparge air into the vadose zone. SVE is used to capture vapors in the unsaturated zone.

The AS wells will also capture vapors generated during steam injection. Since the steam injection wells are screened within the silt layer, heating and steam generation will occur initially within the silt, and over time will migrate upward into the overlying sand and gravel layer. Steam will migrate upward along with entrained PCE and TCE vapors into the overlying sand and gravel layer. During the early period of the steam treatment, PCE and TCE vapors may re-condense within the cooler sand and gravel layer. However, this is not thought to result in a significant increase in contaminant migration because the PCE and TCE will be stripped from groundwater by the AS system, which is designed to remove PCE and TCE from the sand and gravel layer. Based on the AS/SVE pilot study (Appendix E), the AS radius of influence is estimated to be 10 feet (20-foot well spacing). (Please refer to Section 4.2.3 for additional details regarding the steam injection system.)

The IRM AS barrier system consists of 45 AS points (Figure 12). The CAP will consist of an additional 17 AS points (Figure 13). A single AS system will be used to operate the IRM and CAP AS wells. Estimated locations for the IRM and CAP AS wells are shown on Figure 14. A process flow diagram for the AS system is provided as part of Figure 15. P&IDs for the SVE system and AS system are provided as Figure 16 and Figure 17, respectively. The calculations related to the AS system design are provided in Appendix F, and the equipment specifications are provided in Appendix G.

The AS system consists of the following equipment:

- two rotary lobe AS blowers (Sutorbilt 5M, 40 hp, 400 scfm each) with silencer, variable frequency drive, and associated valving;
- one air to water heat exchanger (American Industrial Heat Transfer, shell and tube, 800 scfm) with associated temperature, pressure, and flow meters; and
- associated pumps, valves, and instruments.

The AS system will provide 12 pounds per square inch gauge (psig) of air to a total of 62 wells (45 for the IRM and 17 for the CAP). Prior to entering the AS wells, the sparge air will be cooled by a heat exchanger.

Based on the steam model (see Section 4.2.3), it was determined that temperatures within the radius of influence of each steam well could be up to 150 degrees Farenheit (°F) at the depth where the trenches and piping associated with the AS system will be located. As a result, piping in trenches away from the zones heated by the steam injection will be Schedule 80 PVC piping. Piping in trenches within the steam treatment areas will be CPVC. Figure 14 depicts the estimated radius of influence of each steam injection well.

### 4.2.3 *Steam Injection*

Steam injection is a thermal enhancement to air sparging and SVE and will be used to remove contaminant mass in the silt layer. Steam generation is available on-Site and will be used to inject into the low permeability silt layer that underlies the high permeability sand and gravel layer. The increased soil temperature resulting from the injected steam causes desorption and volatilization of the VOCs, which are then captured and removed by the SVE system. Groundwater extraction will be conducted within the silt layer to keep the silt from fracturing and creating preferential flow pathways. Subsurface temperature monitoring will be conducted to determine the rate of heating by the steam.

The CAP system will use steam to transfer thermal energy to soil and groundwater within the silt layer, which will ultimately result in achievement of elevated temperature (i.e., approximately 100 °C) within the silt layer. Once the target temperature has been achieved within the treatment volume, the pore space will consist of a mixture of steam, air and contaminant (i.e., PCE and TCE) vapors. Since steam is warmer and less dense than ambient groundwater, it will migrate upward along with entrained PCE and TCE vapors into the overlying sand and gravel layer where they will be captured by the overlying AS system. Thermal modeling of the subsurface was conducted to evaluate the impact of steam injection in the silt layer. The results of the modeling are presented in Appendix H.

There are a total of 14 steam injection wells (CAP only). Based on the modeling results, steam injection wells will be spaced approximately 30 feet apart. A process flow diagram for the steam injection system is provided as part of Figure 15. The steam piping header locations are provided in Figure 18, and the calculations related to the steam system design are provided in Appendix I.

The system will be designed in accordance with ASME Code B31.3-2002, Process Piping. Components will be rated for Class 150, Category D steam service. Steam piping materials will be carbon steel (schedule 40, A106 Grade B, seamless). Buried piping will be insulated with Pittsburgh Corning Foamglas® insulation and Pittwrap® jacket. Aboveground piping will be insulated with fiberglass insulation and Kraft® paper all-service jacket.

*Steam Generation*

The steam injection system will use steam generated by up to three of the existing boilers located in Plant II. Table 4 provides information on the existing three boilers. Currently, each boiler is fitted with a 4-inch stop valve that delivers steam into 6-inch branch lines that combine into an 8-inch main header. The main header supplies 60 psig steam to Plant I loads and 22 psig steam to Plant II loads. At 60 psig, the maximum flow rate through the 4-inch stop valve is 6,270 lb/hr (at a 2 psi pressure drop). Since the boilers are rated for 10,350 lb/hr, the boiler output pressures will be increased to 90 psig to provide the necessary injection flow rates for this project without installing larger stop valves. At this higher pressure, the allowable pressure drop can be increased to 5 psi and still meet facility needs.

Currently, Energizer's air discharge permit caps fuel usage to the following limits:

- 600,000 gallons maximum fuel consumption per rolling 12 months; and
- 3,300 gallons maximum fuel consumption per 24 hour day.

Currently, the average facility demands are estimated to be:

- 750 gallons of fuel per day or 3,700 pounds per hour (lb/hr) of steam in summer; and
- 1,500 gallons of fuel per day or 7,400 lb/hr of steam in winter.

Therefore, based on current facility fuel usage and the air permit's daily fuel consumption limit, the estimated total maximum steam injection flow rates are:

- 2,550 gallons of fuel per day or 12,520 lb/hr in summer; and
- 1,800 gallons of fuel per day or 8,820 lb/hr in winter.

System operation will be adjusted throughout the project to prevent exceeding the air discharge permit's 12-month rolling limit. Table 5 summarizes the facility's current fuel usage and the excess fuel available for steam generation for CAP remediation. It is estimated that, given the fuel usage limit, approximately three to five steam injection points can operate simultaneously. A planned reduction in the number of active steam injection wells will take place during months of higher fuel consumption by the facility (i.e., periods of cold weather). The amount of steam injected per well will not change seasonally; however, the number of steam injection wells that operate simultaneously will be adjusted. The amount of fuel consumption will be closely monitored, and the number of steam wells that can operate concurrently will be adjusted based on the amount of fuel being consumed. This approach will not change the effectiveness of the steam remediation system; however, the number of wells that can be operated simultaneously may affect the length of the remediation program.

Given the existing fuel limits, 6-inch steam conveyance piping is required. To the fullest extent possible, existing steam piping will be used to route steam to each AOC. If the use of existing piping is not feasible, then a new 6-inch steam header will be installed. The header will begin where the existing 8-inch steam header enters the southern portion of Plant I and extend to each of the AOCs requiring steam remediation (Figure 18). Spring-actuated pilot-operated pressure regulators will reduce steam pressure from approximately 90 psig at the boiler to 45 psig at each steam injection well. Branch lines will be manifolded and instrumented aboveground to monitor and control steam injection flow rates and pressures to each well.

*Steam Injection*

The target temperature in the silt is 90°C. A steam model was completed (Appendix H) to show heat distribution as the steam is injected. After 120 days of steam injection, the target temperature is reached, and at some depths, even exceeded. Therefore, it is likely that less than 120 days of heating will be necessary to reach the target temperature. Once the target temperature is reached, the amount of steam injected will be reduced to roughly 20 percent of the maximum to overcome heat loss to the surrounding colder regions and maintain the target temperature. The remaining 80 percent of the steam capacity will be used at new steam injection wells to bring new areas up to the target temperature. The steam implementation in each new area will start slowly until it is understood how the subsurface reacts to the application of heat in that particular area.

Each well will be designed for a maximum flow rate of 2,500 lb/hr at 45 psig. The well spacing will be as such to provide adequate horizontal coverage of the contaminant plume and minimize downgradient condensation. For vertical coverage, the steam wells will be screened within the silt layer to a depth that establishes a heat zone around and beneath the contaminants.

It is estimated that, given the fuel usage limit, approximately three to five steam injection points can operate simultaneously. Therefore, the steam remediation will be conducted in a phased approach. There is no limitation on AS and SVE system operation, and those systems will be operated continuously during steam system sequencing.

*Temperature Monitoring*

To determine the subsurface temperatures during steam injection, subsurface thermal monitoring will be conducted using dedicated digital temperature sensors. Temperature sensors will be installed at 12 locations (TMP locations, Figure 13). Each sensor location will have a string of sensors that will be able to measure heat from shallow groundwater down into the silt layer where the steam is being injected.

*Groundwater Extraction*

Steam modeling calculations indicate that each steam injection well will produce a maximum of approximately four gallons per minute (gpm) of condensate that will go into the subsurface. It is anticipated that the subsurface will be able to accept much of this flow. However, to maintain hydraulic and pressure control within the silt layer, groundwater will be extracted from the silt layer via groundwater extraction wells. These extraction wells will act as "pressure relief" wells to provide hydraulic capture of excess condensate and minimize the likelihood of fracturing in the silt.

There are a total of 8 extraction wells (EW). Groundwater will be extracted from the extraction wells using bottom loading pneumatic pumps (QED Model AP-4/BL or similar). Each pump is rated for up to 9 gallons per minute (gpm) at 70 pounds per square inch (psi) air with a minimum of 2 feet submergence. Extracted and condensed liquids will be collected with the condensation from the moisture separators, treated on-site, and discharged to the sanitary sewer. Please refer to Section 4.5 for additional details regarding on-Site treatment of condensate and extracted groundwater.

### 4.2.4 In-Situ Chemical Oxidation

ISCO may be used as a polishing step to further reduce PCE and TCE within the saturated zone. ISCO would involve injection of an oxidizing agent into vertical injection points to chemically degrade chlorinated solvents such as PCE and TCE into non-toxic by-products (carbon dioxide and inorganic chloride). The oxidation process is a contact reaction, whereby the oxidant must come in direct contact with the chlorinated ethenes. Sufficient oxidant must be injected to satisfy both the stoichiometric oxidant demand of the constituents of concern (COCs) and the soil oxidant demand (SOD). Based on soil analytical results for the Site, there is no measurable SOD (ERM, 2007c).

ISCO injection points (IWs) will be installed inside the facility in AOC-1 and AOC-2 in case polishing in the shallow groundwater is necessary. These injection wells will be coupled with the AS points. IW points outside of the facility will be installed for the other AOCs only if it is determined that they are necessary. ISCO may also be applied to the AS and steam injection points, if needed.

Two chemical oxidants are being considered for application at this Site: potassium permanganate and sodium persulfate. Both oxidants are capable of treating the COCs at the Site. Permanganate is more persistent, which will enable it to diffuse into the low permeability silt layer to enhance remediation of this low permeability unit. However, given the extremely fast groundwater flow velocity at the Site, permanganate could migrate over significant distances and, therefore, any permanganate application would need to consider potential impacts to off-Site receptors (e.g., discharge to wet basements, sump pumps or surface water bodies).

Persulfate may also be considered in areas where ISCO is co-located with thermal remediation, whereby the heat from thermal remediation can be used to activate the oxidant. Persulfate has a much shorter half-life than permanganate and therefore, would not likely pose a concern to off-Site receptors. However, the shorter half-life would minimize the degree to which persulfate could diffuse into the low permeability silt unit. Persulfate would not likely be used in portions of the Site where thermal remediation is not being conducted. As noted above, if ISCO polishing is required, ERM will prepare a detailed ISCO application design that will be submitted to the VTDEC for review and approval.

#### *4.2.5 Programmable Logic Controller*

A Programmable Logic Controller (PLC) microprocessor will monitor system performance and control equipment operation. The ladder logic will be designed to protect the equipment and prevent inadvertent releases above permit limits.

The PLC will help monitor, in real time, the following system operating parameters:

- Subsurface temperature from the digital temperature sensors;
- Level of extracted groundwater and condensation in the moisture separators and holding tank;
- Air and steam flow rates, temperatures, and pressures; and
- Revolutions per minute (rpm) of each variable frequency drive.

The remediation system will have telemetry to allow for remote monitoring of the systems. Additionally, the system will "dial-out" to select Energizer and ERM personnel if the system requires immediate attention.

### *4.3 REMEDIATION WELL CONSTRUCTION DETAILS*

To date, the AOCs have been primarily characterized using passive soil gas survey and downgradient Waterloo Profiler groundwater quality data (ERM, 2007c). Soil quality data have been used to delineate the horizontal and vertical extent of VOC impacts for the exterior portions of AOC-1 and AOC-3. However, due to facility access issues, delineation of the interior portions of the six AOCs has not yet been conducted. Energizer is in the process of modifying access to portions of the facility to enable drill rig access. It will not be possible to directly access each area of the interior AOCs (i.e., primary production areas are located within AOCs-1 and -3).

ERM will conduct a dynamic source area characterization program in AOCs-1, 2, 3, and 4, which will involve delineation of the horizontal and vertical extent of VOC impacts to vadose and saturated zone soil during installation of the AS remediation wells (Figure 14). Drilling will begin in the center of each AOC, and the AS points will be overdrilled into the silt to a depth that is great enough to delineate the vertical extent of VOC impacts. The AS drilling program will continue outward until each AOC is horizontally delineated, to the extent possible given access constraints discussed above. Some AOCs may extend into areas where interior drilling is not possible. However, the CAP remediation program is robust and designed to aggressively target portions of AOCs where vertical drilling is not possible. At this time, no AS points are proposed for AOC-5 or AOC-6. Following the implementation of the CAP, performance monitoring will be conducted at several compliance points (Section 5.4). Based on the results of groundwater samples collected from the compliance points, additional AS, SVE and/or steam points may be proposed for AOC-5 or AOC-6, if necessary. These points will only be installed after prior approval from the VTDEC.

The current well layout and count (Figure 14) was developed based on the current understanding of the AOC dimensions to support system design. However, the final layout and number of remediation wells may change based on results of the dynamic AOC characterization activities. In each AOC, the AS drilling program will begin adjacent to the historical passive soil gas location (Figure 10) with the highest concentrations and continue outwards until the AOC is horizontally delineated. Some wells depicted on Figure 13 may not be installed based on the findings of the AS drilling program.

Given that the AOCs have not been fully characterized, it is currently not possible to assess the mass within the subsurface in these areas. The drilling program and remediation equipment have been designed to address a wide range of subsurface impacts that may be encountered.

### 4.3.1 *Well Layout*

The remedy selected for the CAP is comprised of steam injection wells (denoted as "SIW"), groundwater extraction wells (EW), temperature monitoring points (TMP), ISCO injection wells (IW), AS wells (AS), and SVE wells (SVE). The locations of these wells are shown on Figure 14. This figure shows both the IRM and CAP wells.

### 4.3.2 *Soil Vapor Extraction Wells*

The SVE well construction detail is provided on Figure 19. The SVE wells will be 4 inches in diameter and have 3-foot long screens set within the vadose zone. The SVE wells located within the estimated radius of influence of a steam injection well will be constructed of stainless-steel screens and carbon steel risers to withstand the expected high temperatures in the vadose zone created by the steam. SVE wells located outside the radius of influence of the steam injection locations will be constructed of PVC. Figure 14 depicts the estimated radius of influence for the steam injection wells.

### 4.3.3 *Air Sparge Points*

The AS well construction detail is also provided on Figure 19. The AS wells will be 1.25 inches in diameter and have a 2-foot screen placed at the interface between the silt layer and the overlying high-permeability sand

and gravel layer. Like the SVE points, any AS wells located within the estimated radius of influence of a steam injection well will be constructed of stainless-steel screens and carbon steel risers. Otherwise, they will be constructed of PVC. Figure 14 depicts the estimated radius of influence for the steam injection wells.

### 4.3.4 *Steam Injection Wells*

The steam injection well detail is provided on Figure 20. These wells will be 4 inches in diameter and constructed with 5-foot long stainless-steel screen and carbon steel riser. The top of the screen will be at least 3 feet into the silt layer to minimize the potential for short-circuiting of the steam into the overlying sand and gravel layer. The bottom depth of the steam injection wells will be based on the results of the dynamic AOC characterization program (i.e., the steam wells will be installed at or near the bottom of significant VOC impacts identified within the silt).

### 4.3.5 *Groundwater Extraction Wells*

Groundwater extraction will be necessary to keep steam condensate from fracturing the silt and creating preferential heating pathways into the high-permeability sand and gravel layer. The groundwater extraction well detail is provided on Figure 20. These wells will be 4 inches in diameter and constructed with 5-foot long stainless-steel screen and carbon steel riser. The top of the screen will be set approximately three feet into the silt to minimize the potential for extracting groundwater from within the overlying high-permeability sand and gravel layer.

### 4.3.6 *Temperature Monitoring Points*

Subsurface thermal monitoring will be conducted at TMP locations using thermocouple strings. Thermocouples will be placed every three to five feet from approximately 5 to 30 feet below ground surface. The deepest temperature sensor will be placed approximately five feet deeper than the closest steam injection well. The thermocouple strings will be placed either in 1-inch diameter water-tight galvanized steel pipe or attached to a fiberglass rod. To the fullest extent possible, TMP locations will be nested with an AS or groundwater extraction well within a single borehole.

### 4.3.7 *In Situ Chemical Oxidation Injection Wells*

ISCO injection wells will be 1.0 to 1.5 inches in diameter with at least a 5-foot screen. At this time, each ISCO well is located within the estimated radius of influence of the steam injection locations; therefore, they will be constructed of stainless steel screen and carbon steel riser. Any ISCO wells installed outside the radius of influence of the steam injection locations will be constructed of PVC. The ISCO injection wells will be screened within the shallow groundwater table, with the screen depth determined in the field based on headspace samples of the soil. Figure 14 depicts the estimated radius of influence for the steam injection wells.

It should be noted that the exact depths and locations where ISCO may be applied will depend on the results of the dynamic drilling program and the effectiveness of the AS and steam injection remediation program. ISCO is intended to be a polishing mechanism. Shallow ISCO points are currently being installed in the event that polishing is the shallow aquifer is necessary. In addition, select AS points will be converted to ISCO points if polishing is necessary deeper within the aquifer. Steam injection points could also be converted to ISCO injection points if polishing is necessary in the silt layer. However, as described in Section 4.2.4, if ISCO polishing is required, ERM will prepare a detailed ISCO application design that will be submitted to the VTDEC for review and approval.

## *4.4 USE OF FACILITY INFRASTRUCTURE*

System operation will require the following facility services: steam, water treatment, electrical, compressed air, and cooling water. The first two services were previously discussed in Sections 4.1.3 and 4.1.1, respectively.

### *4.4.1 Electrical*

To operate the electrical equipment, a new 480-volt, 3-phase, 400-amp panel will be installed and fed from an existing Energizer electrical panel. The location of the electrical panel will be approved by the State electrical inspector. Installation will be in accordance with the latest edition of the National Electric Code.

The electrical distribution system will consist of branch circuits to motor starters, disconnects, 480V/120V transformer, and associated conductors and conduits.

### 4.4.2 *Compressed Air*

The groundwater extraction pumps will each require up to 5 scfm of compressed air at 70 psig. It is expected that up to 20 scfm of air will be needed at any given time (two pumps near active steam injection locations and two pumps outside of active steam injection locations). Compressed air from the facility will be plumbed to the groundwater extraction pumps.

### 4.4.3 *Cooling Water*

Non-contact cooling water for the shell-and-tube heat exchangers will be provided from Morgan Brook. One heat exchanger is necessary to cool the compressed air from the AS blowers before it enters the subsurface. The second heat exchanger is needed to cool the SVE blower effluent and remove condensation before it enters the off-gas treatment system.

## 4.5 *REQUIRED PERMITS*

The SVE system off-gas will be treated using the facility's existing carbon absorption system. The effluent will be discharged through the existing stack to the atmosphere. Although remediation off-gas is not subject to permit, the off-gas will meet the facility's air discharge permit requirements. Additionally, the daily and annual fuel usage will be monitored such that exceedences of the air permit limitations will be avoided. Finally, steam for the CAP remediation program will be generated using low-sulfur diesel, which will help ensure the sulfur omitted to the atmosphere does not exceed the air permit requirements.

Condensed liquids and extracted groundwater will contain dissolved-phase contaminants that must be treated prior to final discharge. An air stripper will be used to treat the water on-Site. Following treatment, discharge to the sanitary sewer will occur under the existing permit. According to a conversation with Mr. Michael Smith of the VTDEC on 13 June 2007, the condensate and extracted groundwater can be treated and discharged, rather than be disposed of off-Site. A request to modify the existing facility discharge permit will be submitted to the VTDEC for review and approval prior to starting the treatment system. As part of the permit modification, a written overview of the water treatment system will be provided to the VTDEC.

### 4.6 REMEDIATION WASTE

Purge water generated while installing, developing or sampling the CAP remediation wells will be treated on Site and discharged in accordance with the modified facility discharge permit. If necessary, some water may be drummed and decanted prior to treatment on Site. In the event that any drummed purge water is not treated on Site and discharged, the water will be characterized and disposed of in accordance with all applicable state and federal regulations.

Some trenching will be installed inside of the facility to connect the vertical remediation wells to common manifolds. These soils and any drill cuttings will be managed in accordance with the Soil Management Plan (SMP) for the IRM installation (ERM, 2007b). The SMP was approved by the VTDEC on 9 June 2007 and is provided as Appendix J. At this time, no on-Site treatment of soil is anticipated. Excavated soil will be disposed of off-Site at an appropriate disposal facility(ies).

### 4.7 IMPLEMENTATION SCHEDULE

An estimated CAP implementation schedule is provided in Appendix K.

## 4.8 SUBCONTRACTORS

At this time, the following subcontractors have been identified:

***Subcontractor List***

| Subcontractor Name | Work Description | Contact Person | Address | Telephone |
|---|---|---|---|---|
| ERM-RCM | Oversight of CAP system installation | Mike Ravella | 399 Boylston, 6th floor, Boston, Massachusetts | (617) 646-7800 |
| AES Remedial Contracting | AS/SVE system installation | Ken Sweetman | 62 Reservoir, Kensington, Connecticut | (860) 620-1791 |
| Boart Longyear – DL Maher | Drilling | David Maher | 71 Concord Street, North Reading, Massachusetts | (781) 933-3210 |
| E-W-C | Steam system design and installation | Charlie Eischen | P.O. Box 15823, Seattle, Washington | (206) 522-6584 |
| McMillan-McGee | Steam system modeling | Dr. Bruce McGee | 4895 35 Street, S.E., Alberta, Calgary | (403) 569-5101 |
| Monument Electric | Electrical wiring | Ed Flynn | Bennington, Vermont | (802) 447-0784 |
| Pittsfield Piping | Steam pipe welding | Mike Passardi | 73 Fourth Street, Pittsfield, Massachusetts | (413) 443-4402 |

## 5.0 OPERATION, MONITORING, AND MAINTENANCE

Operation, monitoring, and maintenance (OM&M) will be conducted for the CAP remediation systems to ensure that the systems are operating effectively and efficiently. The systems will be adjusted as required to achieve optimal mass removal rates. OM&M will be performed by trained facility personnel and by ERM personnel on regularly-scheduled Site visits. Additionally, the telemetry system will remotely monitor system performance. It is expected that OM&M activities will occur weekly during the first month of system operation and when a new steam treatment area is started. The OM&M will then decrease but will occur at least monthly. The following sections summarize the OM&M activities for each remediation system.

### 5.1 SVE SYSTEM

The following OM&M activities will be performed during start-up of the SVE system:

- measure total VOCs from SVE wells and SVE blower exhaust (carbon influent) with a photoionization detector (PID);
- read and record vacuum, flow, and temperature data;
- review air discharge permit compliance (measure VOCs in carbon effluent);
- review heat exchanger cooling water and condensate discharge permit compliance;
- calculate actual treatment system loading and expected off-gas treatment system regeneration cycle durations; and
- calculate total VOC mass removal rates and trends.

System start-up monitoring will include collection of off-gas treatment system influent and effluent vapor samples on days 1 and 7 of system operation using Summa® canisters. These vapor samples will be analyzed for VOCs using USEPA Method TO-15. The initial sample will be analyzed with a 2-day turnaround time to enable evaluation of SVE system air discharge relative to the facility's air discharge permit requirements. The information collected during this startup will serve as the baseline sampling data.

Supplemental air discharge and condensate discharge will be performed as necessary to meet the facility's permit requirements.

After start-up, the following OM&M activities will be completed:

- performed the tasks previously described for system start-up;
- completing maintenance activities for the air and water separator and extraction blower, as required by the manufacturer's specifications;
- making or arranging for any repairs needed to the system; and
- collecting influent and effluent vapor samples at the end of each month.

## *5.2 AS SYSTEM*

The following OM&M activities will be performed for the AS system start-up:

- read and record pressure, flow, and temperature data.

After start-up, the following OM&M activities will be completed:

- performing the tasks previously described for system start-up;
- completing maintenance activities for the air compressor and blower, as required by the manufacturer's specifications; and
- making or arranging for any repairs needed to the system.

## *5.3 STEAM INJECTION SYSTEM*

The following OM&M activities will be performed for the steam injection system:

- read and record temperature data from the digital sensors;
- record flow from the groundwater extraction wells and perform required sampling for discharge to the sanitary sewer;
- record fuel consumption associated with the steam remediation; and
- record steam pressures and flows within the steam lines.

After start-up, the following OM&M activities will be completed:

- performing the tasks previously described for system start-up;
- assessing overall performance of the facility boilers and opportunities for fuel usage efficiencies; and
- making or arranging for any repairs.

## 5.4 GROUNDWATER MONITORING

Periodic groundwater sampling will be performed during system operation as well as following shutdown to assess the effectiveness of the CAP remediation systems.

Soil gas and monitoring well locations are provided on Figure 3. As part of the CAP and IRM effectiveness monitoring, the following soil gas and groundwater samples will be collected per the following schedule:

***Proposed Monitoring Schedule***

| Sampling Event | Soil Gas Locations | Monitoring Well Locations |
|---|---|---|
| Baseline (before IRM System Start-Up) | - northwest parking lot location ASG-14<br><br>- residential locations ASG-32 and ASG-33 | - on- and off-Site monitoring wells ERM-12, ERM-13, ERM-14, ERM-15, ERM-16 and ERM-17<br><br>- residential locations ERM-19 and ERM-20 |
| Three monthly sampling events (after IRM system is activated) | - residential locations ASG-32 and ASG-33 | - residential locations ERM-19 and ERM-20 |
| Quarterly sampling events during IRM and CAP system operation | - northwest parking lot location ASG-14<br><br>- residential locations ASG-32 and ASG-33 | - on- and off-Site monitoring wells ERM-12, ERM-13, ERM-14, ERM-15, ERM-16 and ERM-17<br><br>- residential locations ERM-19 and ERM-20 |
| Quarterly sampling events following CAP system deactivation[1] | - on- and off-site locations ASG-10, ASG-12 and ASG-14<br><br>- residential locations ASG-32, ASG-33, ASG-16, ASG-17, ASG-18, ASG-20, and ASG-28 | - on- and off-Site monitoring wells ERM-11S, ERM-12, ERM-13, ERM-14, ERM-15, ERM-16, ERM-17<br><br>- residential locations ERM-19, ERM-20 |

[1] The sampling frequency will be re-evaluated based on the results of quarterly sampling.

### *5.5 REPORTING*

During CAP implementation, ERM will prepare quarterly OM&M reports that will be submitted to the VTDEC. The quarterly OM&M reports for the CAP system will present the system monitoring results, including system balancing information. The first quarterly OM&M report will be issued following startup of the CAP system. No OM&M reports will be issued during operation of the IRM system. IRM system OM&M information will be included in the CAP OM&M reports once they are initiated.

## 6.0 REFERENCES


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ERM, 2007a. Summary of Air Sparge/Soil Vapor Extraction (AS/SVE) Pilot Study. Environmental Resources Management. 1 May 2007.

ERM, 2007b. Interim Remedial Measure Soil Management Plan. Environmental Resources Management. 12 June 2007.

ERM, 2007c. Site Investigation Report/Corrective Action Investigation. Environmental Resources Management. 14 June 2007.

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# *Tables*

**Table 1A**
**Summary of Groundwater Gauging Data - Monitoring Wells**
**Energizer Facility**
**401 Gage Street, Bennington, Vermont**

| Well Designation | Measuring Point Elevation* | Depth to Water (feet from top of PVC casing) | | | | | Groundwater Elevation (feet ASL) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 25-May-06 | 2-Jun-06 | 28-Feb-07 | 15-Mar-07 | 22-May-07 | 25-May-06 | 2-Jun-06 | 28-Feb-07 | 15-Mar-07 |
| ERM-1 | 709.40 | 5.39 | 5.06 | 5.81 | 4.42 | - | 704.01 | 704.34 | 703.59 | 704.98 |
| ERM-2S | 713.64 | 5.44 | 5.23 | 5.95 | 4.73 | - | 708.20 | 708.41 | 707.69 | 708.91 |
| ERM-2Ma | 713.61 | 9.06 | 8.76 | 7.47 | 4.79 | - | 704.55 | 704.85 | 706.14 | 708.82 |
| ERM-2Mb | 713.61 | 16.34 | 16.16 | 17.92 | 16.89 | - | 697.27 | 697.45 | 695.69 | 696.72 |
| ERM-2D | 713.64 | 17.23 | 17.04 | 19.06 | 17.06 | - | 696.41 | 696.60 | 694.58 | 696.58 |
| ERM-3S | 709.70 | 5.58 | 5.22 | 5.96 | 4.52 | - | 704.12 | 704.48 | 703.74 | 705.18 |
| ERM-3M | 709.70 | 5.61 | 5.26 | 6.02 | 4.57 | - | 704.09 | 704.44 | 703.68 | 705.13 |
| ERM-4 | 709.26 | 5.13 | 4.80 | 5.52 | 4.27 | - | 704.13 | 704.46 | 703.74 | 704.99 |
| ERM-5S | 700.81 | 5.00 | 6.04 | 6.34 | 5.91 | - | 695.81 | 694.77 | 694.47 | 694.90 |
| ERM-5Ma | 700.83 | 5.13 | 6.07 | 6.33 | 5.91 | - | 695.70 | 694.76 | 694.50 | 694.92 |
| ERM-5Mb | 700.83 | 12.00 | 11.95 | 12.91 | 11.96 | - | 688.83 | 688.88 | 687.92 | 688.87 |
| ERM-5D | 700.83 | 12.51 | 12.14 | 13.15 | 12.98 | - | 688.32 | 688.69 | 687.68 | 687.85 |
| ERM-6 | 705.76 | - | - | 5.31 | 4.47 | - | - | - | 700.45 | 701.29 |
| ERM-7 | 713.07 | - | - | 7.15 | 6.48 | - | - | - | 705.92 | 706.59 |
| ERM-8 | 705.17 | - | - | 7.51 | 6.40 | - | - | - | 697.66 | 698.77 |
| ERM-9S | 704.57 | - | - | 7.13 | 6.12 | - | - | - | 697.44 | 698.45 |
| ERM-9M | 704.25 | - | - | 6.81 | 5.80 | - | - | - | 697.44 | 698.45 |
| ERM-10 | 704.78 | - | - | 7.37 | 6.37 | - | - | - | 697.41 | 698.41 |
| ERM-11S | 702.94 | - | - | 10.54 | 9.73 | - | - | - | 692.40 | 693.21 |
| ERM-11D | 702.81 | - | - | 16.10 | 15.55 | - | - | - | 686.71 | 687.26 |
| ERM-12 | 701.48 | - | - | 11.61 | 10.50 | - | - | - | 689.87 | 690.98 |
| ERM-13 | 701.28 | - | - | 10.13 | 9.59 | - | - | - | 691.15 | 691.69 |
| ERM-14 | - | - | - | - | - | 11.40 | - | - | - | - |
| ERM-15 | - | - | - | - | - | 12.42 | - | - | - | - |
| ERM-16 | - | - | - | - | - | 12.17 | - | - | - | - |
| ERM-17 | - | - | - | - | - | 14.3 | - | - | - | - |

Notes:
All elevations are relative to mean sea level.
ASL = Above Sea Level
- = Not measured
*= Measured from top of PVC

**Table 1B**
**Summary of Groundwater Gauging Data - Temporary Locations**
**Energizer Facility**
**401 Gage Street, Bennington, Vermont**

| Well Designation | Gauging Date | Ground Surface Elevation (feet ASL) | Depth to Water (feet bgs) | Groundwater Elevation July 2006 (feet ASL) | Groundwater Elevation February 2007 (feet ASL) |
|---|---|---|---|---|---|
| **Modified Waterloo Profiler Boring** | | | | | |
| WP-1 | 7/17/2006 | 705.36 | 7.10 | 698.26 | 698.44* |
| WP-2 | 7/17/2006 | 702.86 | 5.99 | 696.87 | 697.05* |
| WP-3 | 7/17/2006 | 704.27 | 6.13 | 698.14 | 698.32* |
| WP-4 | 7/18/2006 | 699.16 | 6.67 | 692.49 | 692.67* |
| WP-6 | 7/18/2006 | 700.66 | 10.68 | 689.98 | 689.79* |
| WP-9 | 7/19/2006 | 700.94 | 9.36 | 691.58 | 691.86* |
| WP-12 | 7/20/2006 | 702.39 | 10.00 | 692.39 | 692.01* |
| WP-13 | 7/20/2006 | 700.64 | 8.15 | 692.49 | 692.77* |
| WP-15 | 7/20/2006 | 705.42 | 8.34 | 697.08 | 697.49* |
| WP-16 | 7/20/2006 | 704.99 | 7.23 | 697.76 | 697.58* |
| WP-17 | 7/21/2006 | 709.23 | 6.47 | 702.76 | 702.96* |
| WP-19 | 7/21/2006 | 709.98 | 6.10 | 703.88 | 704.10* |
| WP-20 | 7/24/2006 | 707.08 | 5.73 | 701.35 | 701.57* |
| WP-21 | 7/24/2006 | 709.60 | 5.5 | 704.1 | 704.32* |
| WP-22 | 7/24/2006 | 707.87 | 4.84 | 703.03 | 703.25* |
| WP-23 | 7/24/2006 | 706.48 | 5.96 | 700.52 | 700.79* |
| WP-24 | 7/24/2006 | 707.38 | 6.77 | 700.61 | 700.83* |
| WP-25 | 7/24/2006 | 708.81 | 6.28 | 702.53 | 702.75* |
| WP-27 | 7/24/2006 | 710.32 | 6.05 | 704.27 | 704.49* |
| WP-28 | 2/12/2007 | 697.70 | 9.86 | - | 687.84 |
| WP-29 | 2/9/2007 | 695.94 | 12.03 | - | 683.91 |
| WP-30 | 2/19/2007 | 700.17 | 14.41 | - | 685.76 |
| WP-31 | 2/13/2007 | 703.46 | 10.20 | - | 693.26 |
| WP-32 | 2/13/2007 | 704.70 | 8.10 | - | 696.60 |
| WP-33 | 2/15/2007 | 706.40 | 6.04 | - | 700.36 |
| WP-34 | 2/15/2007 | 707.90 | 6.37 | - | 701.53 |
| WP-35 | 2/16/2007 | 701.07 | 11.81 | - | 689.26 |
| WP-36 | 2/19/2007 | 699.58 | 13.61 | - | 685.97 |
| WP-37 | 2/19/2007 | 690.81 | 14.33 | - | 676.48 |
| WP-38 | 2/20/2007 | 689.48 | 13.45 | - | 676.03 |
| WP-39 | 2/20/2007 | 689.61 | 12.56 | - | 677.05 |
| **Shallow Groundwater Points** | | | | | |
| SGW-1 | 2/13/2007 | - | 11.50 | - | 697.91** |
| SGW-2 | 2/13/2007 | 710.71 | 7.55 | - | 704.36 |
| SGW-3 | 2/13/2007 | 708.77 | 7.48 | - | 703.48 |
| SGW-4 | 2/13/2007 | 709.39 | 8.76 | - | 702.80 |
| SGW-5 | 2/14/2007 | 706.51 | 8.39 | - | 700.07 |
| SGW-6 | 2/19/2007 | 693.80 | 11.31 | - | 682.49 |
| SGW-7 | 2/27/2007 | - | 7.15 | - | 700.8** |

Notes:
All elevations are relative to mean sea level.
ASL = Above Sea Level
bgs = Below Ground Surface
- = Not measured
* Groundwater elevation shown represents July 2006 data that were adjusted to February 2007 elevations by comparing groundwater elevations from monitoring wells measured during both July 2006 and February 2007.
**Groundwater elevation calculated based on estimated ground surface elevation.

**Table 2**
**Summary of Soil Analytical Results**
**Energizer Facility**
**401 Gage Street, Bennington, Vermont**

| Sample I.D. | EPA Region IX Preliminary Remediation Goals-Industrial | ERM-2 | ERM-2 | ERM-2 | ERM-3 | ERM-3 | ERM-5 | ERM-5 | ERM-6 | ERM-6 | ERM-6 | ERM-6 | GP-1 | GP-3 | GP-5 | GP-6 | SB-1 | SB-1 | SB-1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth | | 0-2' | 15-18' | 80-82.5' | 1-2' | 19-20' | 2-3' | 64-65' | 0-1' | 1-2' | 2-3' | 3-4' | 0.5-1' | 0.5-1' | 0.5-2.5' | 0.5-2.5' | 0-1' | 2-3' | 4-5' |
| Date Sampled | | 23-May-06 | 23-May-06 | 23-May-06 | 24-May-06 | 24-May-06 | 24-May-06 | 24-May-06 | 12-Feb-07 | 12-Feb-07 | 12-Feb-07 | 13-Feb-07 | 18-Feb-06 | 18-Feb-06 | 19-Feb-06 | 19-Feb-06 | 13-Feb-07 | 13-Feb-07 | 13-Feb-07 |
| Laboratory | | Alpha | Alpha | Alpha | Alpha | Alpha | Alpha | Alpha | Stone | Stone | Stone | Stone | Alpha | Alpha | Alpha | Alpha | Stone | Alpha | Stone |
| **Parameter** | | | | | | | | | | | | | | | | | | | |
| **Volatile Organics (VOCs) (ug/kg)** | | | | | | | | | | | | | | | | | | | |
| ***(EPA Method 8260)*** | | | | | | | | | | | | | | | | | | | |
| Tetrachloroethene | 1,300 | <0.93 | <1.1 | <0.98 | **1,900** | **4,400** | **3.4** | <0.75 | **19** | **31** | <23 | <18 | **180,000** | **2,200** | **15,000** | **86,000** | <0.119 | NA | <95 |
| Trichloroethene | 110 | <0.93 | <1.1 | <0.98 | **380** | <71 | **1.4** | <0.75 | **149** | **289** | **365** | <18 | **270,000** | **1,000** | **54,000** | **170,000** | **8,481** | NA | **540** |
| Cis 1,2-Dichloroethene | 150,000 | <0.93 | <1.1 | <0.98 | <65 | <71 | <89 | <75 | <19 | <21 | <23 | <18 | <2,800 | <850 | <490 | <1,600 | <119 | NA | <95 |
| Acetone | 54,000,000 | <9.3 | <11 | **19** | <650 | <710 | <8.9 | **23** | NA | NA | NA | NA | <28,000 | <8,500 | <4,900 | <16,000 | NA | NA | NA |
| Ethylbenzene | 400,000 | < 0.93 | < 1.1 | < 0.98 | < 65 | < 71 | < 0.89 | < 0.75 | NA | NA | NA | NA | < 2,800 | < 850 | < 490 | < 1,600 | NA | NA | NA |
| Isopropylbenzene | 2,000,000 | <0.93 | <1.1 | **3** | <65 | <71 | <0.89 | <0.75 | NA | NA | NA | NA | <2,800 | <850 | <490 | <1,600 | NA | NA | NA |
| Naphthalene | NS | < 4.6 | < 5.5 | < 4.9 | < 320 | < 350 | < 4.4 | < 3.7 | NA | NA | NA | NA | < 14,000 | < 4,200 | < 2,500 | < 8,100 | NA | NA | NA |
| Toluene | 520,000 | <1.4 | <1.6 | **2.1** | <97 | <110 | <1.3 | <1.1 | NA | NA | NA | NA | <4,200 | <1,300 | <740 | <2,400 | NA | NA | NA |
| o-Xylene | 420,000 | < 1.9 | < 2.2 | < 2 | < 130 | < 140 | < 1.8 | < 1.5 | NA | NA | NA | NA | < 5,600 | < 1,700 | < 980 | < 3,200 | NA | NA | NA |
| p,m-Xylene | 420,000 | < 1.9 | < 2.2 | < 2 | < 130 | < 140 | < 1.8 | < 1.5 | NA | NA | NA | NA | < 5,600 | < 1,700 | < 980 | < 3,200 | NA | NA | NA |
| **Petroleum Hydrocarbons (mg/kg)** | | | | | | | | | | | | | | | | | | | |
| TPH | NS | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | **372** [1] | NA |

| Sample I.D. | EPA Region IX Preliminary Remediation Goals-Industrial | SB-2 | SB-2 | SB-2 | SB-2 | SB-2 | SB-3 | SB-3 | SB-3 | SB-4 | SB-4 | SB-4 | SB-4 | AS-1 | AS-1 | AS-2 | AS-3 | AS-5 | AS-6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth | | 0-1' | 2-3' | 4-5' | 15-16' | 19-20' | 0-1' | 4-5' | 15-16' | 0-1' | 2-3' | 3-4' | 4-5' | 0-1' | 19-20' | 0-1' | 3-6' | 19-20' | 0-1' |
| Date Sampled | | 13-Feb-07 | 13-Feb-07 | 13-Feb-07 | 13-Feb-07 | 13-Feb-07 | 13-Feb-07 | 13-Feb-07 | 13-Feb-07 | 13-Feb-07 | 13-Feb-07 | 13-Feb-07 | 13-Feb-07 | 17-May-07 | 17-May-07 | 14-May-07 | 14-May-07 | 17-May-07 | 17-May-07 |
| Laboratory | | Stone | Alpha | Stone | Stone | Stone | Stone | Alpha/Stone | Stone | Stone | Alpha | Stone | Stone | Alpha | Alpha | Alpha | Alpha | Alpha | Alpha |
| **Parameter** | | | | | | | | | | | | | | | | | | | |
| **Volatile Organics (VOCs) (ug/kg)** | | | | | | | | | | | | | | | | | | | |
| ***(EPA Method 8260)*** | | | | | | | | | | | | | | | | | | | |
| Tetrachloroethene | 1,300 | **7,121** | NA | **132** | **241** | **1,912** | **297** | <149 | **117** | **24,139** | NA | **224** | **751** | **72,000** | **3,900** | < 49 | < 54 | **67,000** | **60,000** |
| Trichloroethene | 110 | **8,186** | NA | <113 | <99 | **400** | **12,809** | **16,721** | <79 | **15,433** | NA | **144** | **455** | **120,000** | **100** | < 49 | < 54 | < 77 | **140,000** |
| Cis 1,2-Dichloroethene | 150,000 | <95 | NA | <113 | <99 | <110 | **2,664** | **1,541** | <79 | **394** | NA | <115 | <187 | **520** | < 83 | < 49 | < 54 | < 77 | **450** |
| Acetone | 54,000,000 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | < 970 | < 830 | < 490 | < 540 | < 770 | < 550 |
| Ethylbenzene | 400,000 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | < 97 | < 83 | **71** | < 54 | < 77 | < 55 |
| Isopropylbenzene | 2,000,000 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | < 97 | < 83 | < 49 | < 54 | < 77 | < 55 |
| Naphthalene | NS | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | < 480 | < 420 | **530** | < 270 | < 380 | < 270 |
| Toluene | 520,000 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | <140 | <120 | <74 | <82 | <120 | <82 |
| o-Xylene | 420,000 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | < 190 | < 170 | **170** | < 110 | < 150 | < 110 |
| p,m-Xylene | 420,000 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | **190** | < 170 | **330** | < 110 | < 150 | **130** |
| **Petroleum Hydrocarbons (mg/kg)** | | | | | | | | | | | | | | | | | | | |
| TPH | NS | NA | **133** [1] | NA | NA | NA | NA | <86.6 | NA | NA | <85.5 | NA | NA | **182** [1] | NA | **421** | < 72.5 | NA | < 75.8 |

| Sample I.D. | EPA Region IX Preliminary Remediation Goals-Industrial | AS-7 | AS-8 | AS-9 | AS-10 | AS-11 | AS-13 |
|---|---|---|---|---|---|---|---|
| Depth | | 4-5' | 10-11' | 0-1' | 17-18' | 19-20' | 19-20' |
| Date Sampled | | 16-May-07 | 15-May-07 | 15-May-07 | 14-May-07 | 11-May-07 | 10-May-07 |
| Laboratory | | Alpha | Alpha | Alpha | Alpha | Alpha | Alpha |
| **Parameter** | | | | | | | |
| **Volatile Organics (VOCs) (ug/kg)** | | | | | | | |
| ***(EPA Method 8260)*** | | | | | | | |
| Tetrachloroethene | 1,300 | < 57 | < 63 | **19,000** | **17,000** | **8,000** | **10,000** |
| Trichloroethene | 110 | < 57 | < 63 | **8,900** | **3,000** | **800** | **3,000** |
| Cis 1,2-Dichloroethene | 150,000 | < 57 | < 63 | < 56 | < 90 | < 82 | **220** |
| Acetone | 54,000,000 | < 570 | < 630 | < 560 | < 900 | < 820 | < 820 |
| Ethylbenzene | 400,000 | < 57 | < 63 | **83** | < 90 | < 82 | < 82 |
| Isopropylbenzene | 2,000,000 | < 57 | < 63 | < 56 | < 90 | < 82 | < 82 |
| Naphthalene | NS | < 280 | < 310 | **1,300** | < 450 | < 410 | < 410 |
| Toluene | 520,000 | <85 | <94 | <84 | <130 | <120 | <120 |
| o-Xylene | 420,000 | < 110 | < 120 | **160** | < 180 | < 160 | < 160 |
| p,m-Xylene | 420,000 | < 110 | < 120 | **360** | < 180 | < 160 | < 160 |
| **Petroleum Hydrocarbons (mg/kg)** | | | | | | | |
| TPH | NS | < 69.4 | NA | **407** | NA | NA | NA |

Notes:
Units are in µg/kg and mg/kg.
µg/kg = micrograms per kilogram (ppb)
mg/kg = milligrams per kilogram (ppm)
< = Compound not detected. Method detection limit shown.
NA: Not analyzed.
NS: No standard available.
Standards provided are EPA Region IX Preliminary Remediation Goals (PRGs), Industrial Standard, Version 9, October 2004.
Bold cells indicate concentrations greater than the laboratory detection limits
Shaded cells indicate exceedances of EPA Region IX Preliminary Remediation Goals (PRGs), Industrial Standard.
Tabulated results include only those analytes detected at least once above method detection limits.
Alpha is the Lab designation for Alpha Woods Hole Laboratory Westboro, MA
Stone is the Lab designation for Stone Environmental, Inc. Montpelier, VT
Analyses for VOCs performed by Alpha (EPA Method SW8260) and Stone (EPA Method SW8260B). See Table for distinction
Analyses for TPH performed by Alpha (EPA Method 8015)

Footnotes:
1. Sample also analyzed for TPH Petroleum Hydrocarbon Identification (PHI). Analysis indicated hydrocarbons present in the $C_8$ -$C_{36}$ or $C_{10}$ - $C_{36}$ range.

**Table 3**

**Summary of Groundwater Analytical Results**

**Energizer Facility**

**401 Gage Street, Bennington, Vermont**

| **Sample Designation** | **VT Primary GW Stds Enforcement Standard** | **ERM-1 (GP-7)** | **ERM-1** | **ERM-1** | **ERM-1** | **ERM-1** | **ERM-2S** | **ERM-2S** | **ERM-2Ma** | **ERM-2Mb** | **ERM-2D** | **ERM-2D** | **ERM-3S** | **ERM-3S** | **ERM-3S** | **ERM-3M** | **ERM-3M** | **ERM-3M** | **ERM-3M** | **ERM-4** | **ERM-4** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date Sampled** | | **19-Feb-06** | **18-Jul-06** | **18-Jul-06** | **19-Jul-06** | **14-Feb-07** | **19-Jul-06** | **13-Feb-07** | **19-Jul-06** | **17-Jul-06** | **19-Jul-06** | **13-Feb-07** | **18-Jul-06** | **18-Jul-06** | **15-Feb-07** | **18-Jul-06** | **18-Jul-06** | **19-Jul-06** | **15-Feb-07** | **18-Jul-06** | **14-Feb-07** |
| **Laboratory - VOCs** | | **Alpha** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** |
| **Parameter** | | **N** | **N** | **FD** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **FD** | **N** | **N** | **FD** | **N** | **N** | **N** | **N** |
| **Volatile Organic Compounds (VOCs, ug/L)** | | | | | | | | | | | | | | | | | | | | | |
| Tetrachloroethene | 5 | **130,000** | **2,600** | **1,600** | **1,400** | **470** | **1** | < 2 | < 2 | < 2 | **1** | < 2 | 2 | 2 | < 2 | **3** | **3** | **3** | < 2 | **1** | < 2 |
| Trichloroethene | 5 | < 1,200 | 1 | < 2 | 1 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 |
| Cis-1,2-dichloroethene | 70 | < 1,200 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 |
| Chloroform | 0.17 [1] | <1,900 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **Inorganic compounds (mg/l)** | | | | | | | | | | | | | | | | | | | | | |
| Nitrogen, Nitrate | 10 [2] | NA | NA | NA | NA | **1.4** | NA | 1.2 | NA | NA | NA | NA | NA | NA | **0.51** | NA | NA | NA | **0.64** | **1.3** | NA |
| Sulfate | 250 [2] | NA | NA | NA | NA | <10 | NA | <10 | NA | NA | NA | NA | NA | NA | <10 | NA | NA | NA | <10 | <10 | NA |
| Iron, Total | 0.3 [2,3] | NA | NA | NA | NA | **0.13** | NA | 0.51 | NA | NA | NA | NA | NA | NA | **0.10** | NA | NA | NA | **0.11** | **0.10** | NA |
| Iron Dissolved | 0.3 [2,3] | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

| **Sample Designation** | **VT Primary GW Stds Enforcement Standard** | **ERM-5S** | **ERM-5S** | **ERM-5Ma** | **ERM-5Ma** | **ERM-5Mb** | **ERM-5D** | **ERM-6** | **ERM-6** | **ERM-6** | **ERM-7** | **ERM-8** | **ERM-9S** | **ERM-9M** | **ERM-10** | **ERM-11S** | **ERM-11D** | **ERM-12** | **ERM-13** | **ERM-14** | **ERM-15** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date Sampled** | | **18-Jul-06** | **13-Feb-07** | **17-Jul-06** | **13-Feb-07** | **17-Jul-05** | **18-Jul-06** | **16-Feb-07** | **16-Feb-07** | **16-Feb-07** | **19-Feb-07** | **21-Feb-07** | **23-Feb-07** | **23-Feb-07** | **23-Feb-07** | **23-Feb-07** | **23-Feb-07** | **27-Feb-07** | **27-Feb-07** | **22-May-07** | **22-May-07** |
| **Laboratory - VOCs** | | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Alpha** | **Stone** | **Alpha** | **Alpha** | **Alpha** | **Alpha** | **Alpha** | **Alpha** | **Alpha** | **Alpha** | **Alpha** | **Alpha** |
| **Parameter** | | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **FD** | **FR** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** |
| **Volatile Organic Compounds (VOCs, ug/L)** | | | | | | | | | | | | | | | | | | | | | |
| Tetrachloroethene | 5 | **24** | **12** | **4** | < 2 | < 2 | < 2 | **240** | **280** | **360** | < 2 | **62** | **250** | **240** | **1.3** | **180** | **1.7** | **120** | **16** | **3.6** | **3.3** |
| Trichloroethene | 5 | **3** | **2.3** | < 2 | < 2 | < 2 | < 2 | **15** | **15** | **14** | < 2 | **3.9** | < 2.5 | < 2.5 | < 0.5 | < 2.5 | < 0.5 | < 2 | 1.2 | < 0.5 | **0.63** |
| Cis-1,2-dichloroethene | 70 | < 2 | < 2 | < 2 | < 2 | < 2 | < 2 | **4** | NA | < 5 | < 2 | **0.83** | < 2.5 | < 2.5 | < 0.5 | < 2.5 | < 0.5 | < 2 | < 0.5 | < 0.5 | < 0.5 |
| Chloroform | 0.17 [1] | NA | NA | NA | NA | NA | NA | NA | NA | <7.5 | NA | <0.75 | <3.8 | <3.8 | <0.75 | <3.8 | **5.5** | <3 | **1.7** | **23** | **2.7** |
| **Inorganic compounds (mg/l)** | | | | | | | | | | | | | | | | | | | | | |
| Nitrogen, Nitrate | 10 [2] | NA | NA | NA | NA | NA | NA | NA | NA | 0.62 | NA | **0.31** | NA | NA | NA | 0.69 | NA | NA | NA | NA | NA |
| Sulfate | 250 [2] | NA | NA | NA | NA | NA | NA | NA | NA | <10 | NA | <10 | NA | NA | NA | <10 | NA | NA | NA | NA | NA |
| Iron, Total | 0.3 [2,3] | NA | NA | NA | NA | NA | NA | NA | NA | **3.5** | NA | **1.1** | NA | NA | NA | <0.05 | NA | NA | NA | NA | NA |
| Iron Dissolved | 0.3 [2,3] | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | <0.05 | NA | NA | NA | <0.05 | NA | NA | NA | NA | NA |

| **Sample Designation** | **VT Primary GW Stds Enforcement Standard** | **ERM-16** | **ERM-17** | **GP-2** | **GP-5** | **GP-6** | **SGW-1** | **SGW-1** | **SGW-1** | **SGW-2** | **SGW-3** | **SGW-4** | **SGW-4** | **SGW-5** | **SGW-6** | **SGW-7** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date Sampled** | | **22-May-07** | **22-May-07** | **18-Feb-06** | **19-Feb-06** | **19-Feb-06** | **13-Feb-07** | **13-Feb-07** | **13-Feb-07** | **13-Feb-07** | **13-Feb-07** | **13-Feb-07** | **16-Feb-07** | **16-Feb-07** | **19-Feb-07** | **27-Feb-07** |
| **Laboratory - VOCs** | | **Alpha** | **Alpha** | **Alpha** | **Alpha** | **Alpha** | **Stone** | **Stone** | **Alpha** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Stone** | **Alpha** |
| **Parameter** | | **N** | **N** | **N** | **N** | **N** | **N** | **FD** | **FR** | **N** | **N** | **N** | **N** | **N** | **N** | **N** |
| **Volatile Organic Compounds (VOCs, ug/L)** | | | | | | | | | | | | | | | | |
| Tetrachloroethene | 5 | **54** | **100** | **120** | **120** | **21** | **250** | **240** | **350** | **6.6** | <2 | **680** | **200** | **330** | <2 | **680** |
| Trichloroethene | 5 | **1.5** | < 1.2 | **230** | **1,100** | **140** | <2 | <2 | <5 | <2 | <2 | <2 | <2 | <2 | <2 | <10 |
| Cis-1,2-dichloroethene | 70 | < 0.5 | < 1.2 | **7.6** | <12 | <2.5 | <2 | NA | <5 | <2 | <2 | <2 | <2 | <2 | <2 | <10 |
| Chloroform | 0.17 [1] | **1.3** | < 1.9 | <3.8 | <19 | <3.8 | NA | NA | <7.5 | NA | NA | NA | NA | NA | NA | <15 |
| **Inorganic compounds (mg/l)** | | | | | | | | | | | | | | | | |
| Nitrogen, Nitrate | 10 [2] | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Sulfate | 250 [2] | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron, Total | 0.3 [2,3] | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| Iron Dissolved | 0.3 [2,3] | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

**Notes:**

Units are in ug/L & mg/L.

ug/L = micrograms per liter, approximately equal to parts per billion (ppb).

mg/L = milligrams per liter, approximately equal to parts per billion (ppm).

FD = Field Duplicate sample; FR = Field Replicate sample; N = Normal Environmental Sample

NA = Not Analyzed

< = Compound not detected. Method detection limit shown.

* = Standard calculated from value available for NO3

Standards provided are the Vermont Primary Groundwater Quality Standards, September 29, 2004 for VOCs.

Bold cells indicate concentrations greater than the laboratory detection limits

Shaded cells indicate exceedances of Vermont Primary Groundwater Quality Standards (PGQS) Enforcement Standard

Tabulated results include only those analytes reported above method detection limits.

Alpha is the Lab designation for Alpha Analytical Laboratory Westboro, MA

Stone is the Lab designation for Stone Environmental, Inc. Montpelier, VT

Analyses for VOCs performed by Alpha (EPA Method SW8260) and Stone (EPA Method SW8260B). See Table for distinction

Analyses for inorganic compounds performed by Alpha (EPA Methods 450 NO3-F for Nitrogen as Nitrate, 9038 for Sulfates, 6010B for Iron Total, and 6010 for Iron Dissolved)

**Footnotes:**

1. Standard provided is from the EPA Region III Risk Based Concentrations.
2. Standard provided is from Vermont Secondary Groundwater Standards, September 29, 2004.
3. Standard provided is for total iron.

**Table 4**
**Steam Supply System Parameters**
**Energizer Facility**
**401 Gage Street, Bennington, Vermont**

| Boiler Number | Manufacturer | Model Number | Serial Number | Horsepower | Installation Date | Flow rate (lb/hr) | 4" Stop Valve Capacity (lb/hr)* | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 60 psig | 90 psig |
| 2 | Cleaver Brooks | CB-657-300 | L-40495 | 300 | 19-Oct-66 | 10,350 | 6,270 | 14,143 |
| 3 | Cleaver Brooks | CB-657-300 | L-40494 | 300 | 19-Oct-66 | 10,350 | 6,270 | 14,143 |
| 4 | Cleaver Brooks | CB-100X-300 | L-57274 | 300 | 7-Nov-73 | 10,350 | 6,270 | 14,143 |
| **TOTAL** | | | | | | **31,050** | **18,810** | **42,429** |

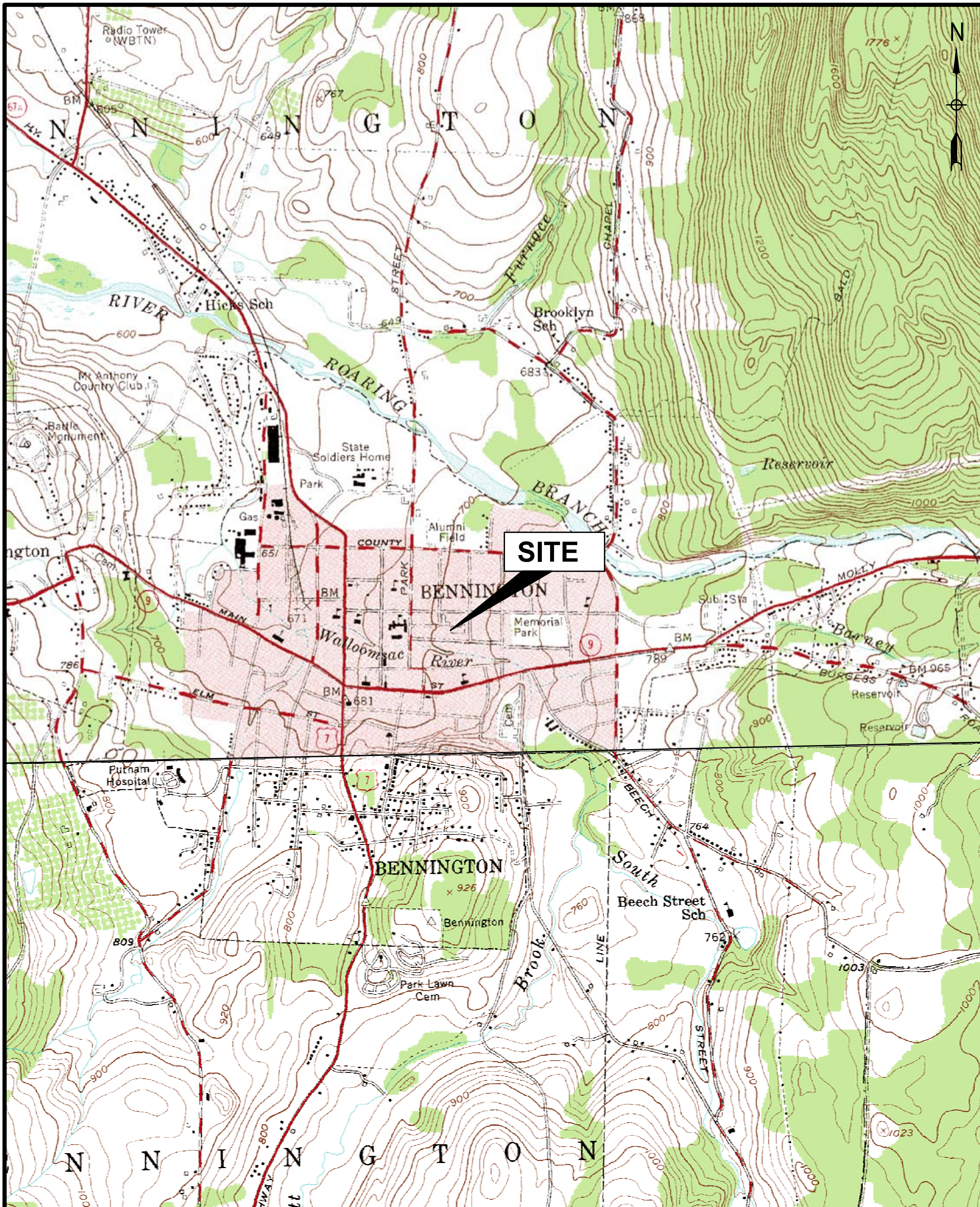
**Notes:**
* Based on 2 psi drop for 60 psig and 5 psi drop for 90 psig.
lb/hr = pounds per hour
psig = pounds per square inch gauge

**Table 5**
**Summary of Steam Supply Availability**
**Energizer Facility**
**401 Gage Street, Bennington, Vermont**

| | SUMMER | | | WINTER | | |
|---|---|---|---|---|---|---|
| | Facility | Steam Injection | Total | Facility | Steam Injection | Total |
| Steam flow rate (lb/hr) | 3,700 | 12,520 | 16,220 | 7,400 | 8,820 | 16,220 |
| Fuel use (gal/day) | 750 | 2,550 | 3,300 | 1,500 | 1,800 | 3,300 |

**Notes:**
lb/hr = pounds per hour
gal/day = gallons per day

*Figures*

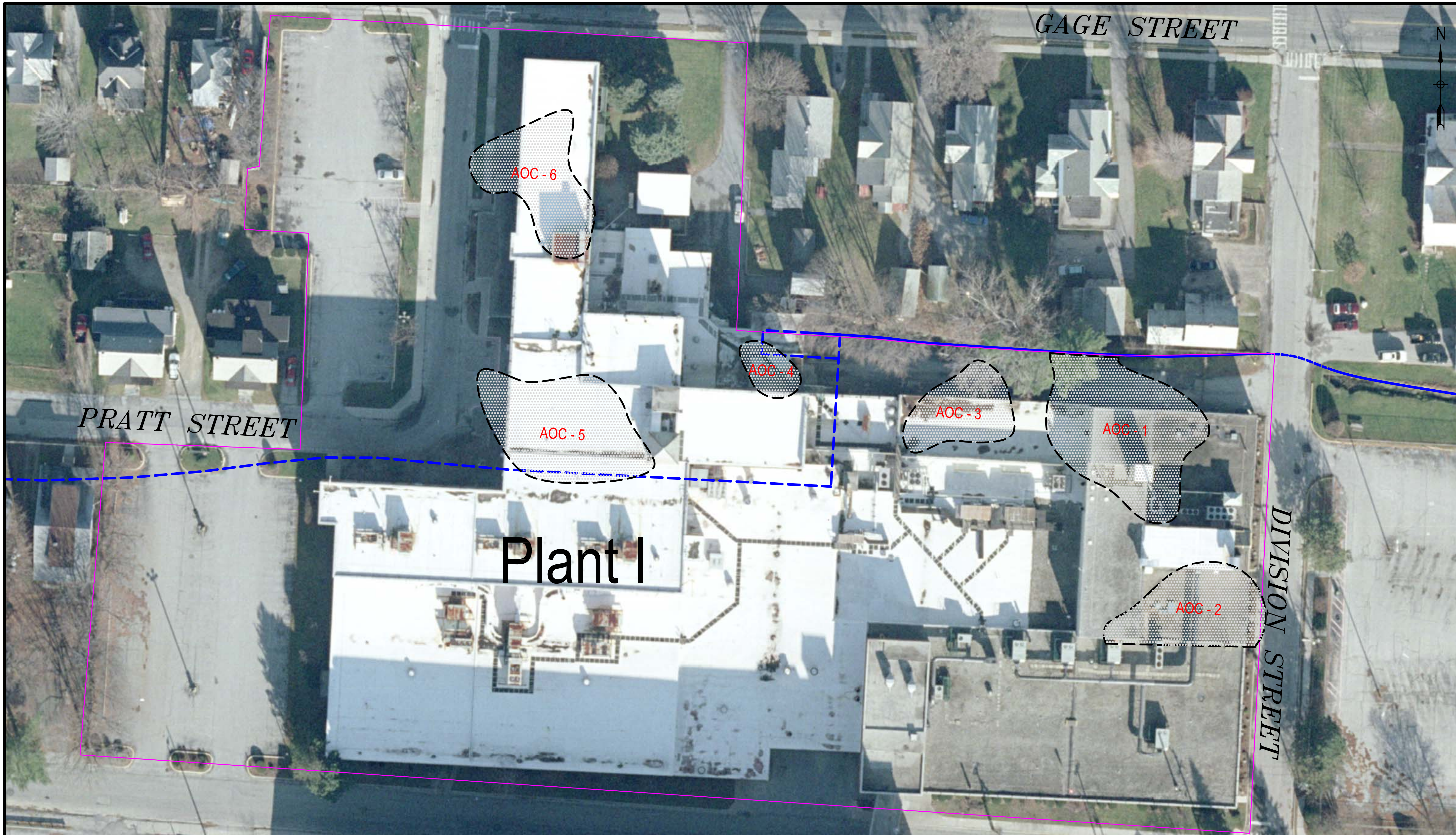



Source: Libremap.org, (1954)
Quadrangle Cell Name : Bennington & Pownel

**Figure 1** - Site Locus Map
Energizer Facility
401 Gage Street, Bennington, VT

ERM

R:\energizer\REPORT - CAP\Evergizer Locus Map.dwg (07/27/2007 - 12:28pm Boston)




Legend
- Site Boundary
- Morgan Brook ( Dashed Where Culverted )
- AOC - 1 Areas of Concern (AOC)
- Potential Source Area

Scale (1"=100')
50' 0 50' 100' 200'

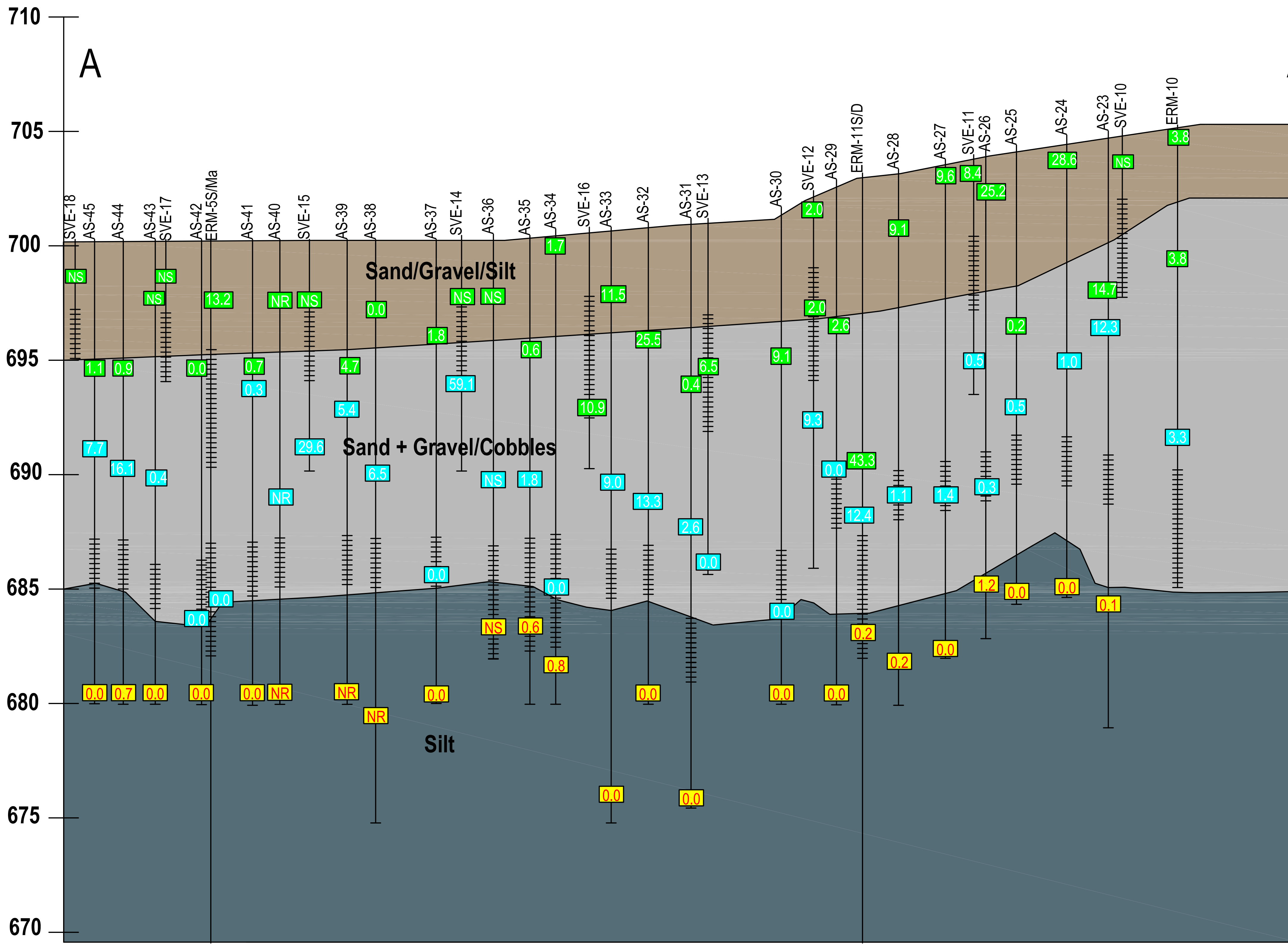
**Figure 2** - Site Plan
Energizer Facility
401 Gage Street, Bennington, VT

ERM

R:\energizer\REPORT - CAP\Figure 2 Site Plan(Aerial).dwg (07/27/2007 - 12:27pm Boston)


**Figure 3 -** Detailed Site Plan
Energizer Facility
401 Gage Street, Bennington, VT


Scale (1"=275')




Note:
1. AS/SVE wells have not been surveyed. Topography based on elevation data from ERM-5,ERM-11 & ERM-10.
2. Highest headspace reading in each of the Vadose Zone, Sand/Gravel Saturated Zone and Silt Saturated Zone shown for each boring.
3. ppm = parts per million
4. Wells depicted are only those installed to date.
5. Total depth of boring is shown at each location.

Legend:

- 0.0 Maximum Vadose Zone Headspace Reading (ppm)
- 0.0 Maximum Saturated Zone Headspace Reading (ppm)
- 0.0 Maximum Silt Headspace Reading (ppm)
- NS Not Sampled
- NR No Recovery
- Site Boundary
- No Data Evaluated
- Screened Interval (if installed)
- Boring

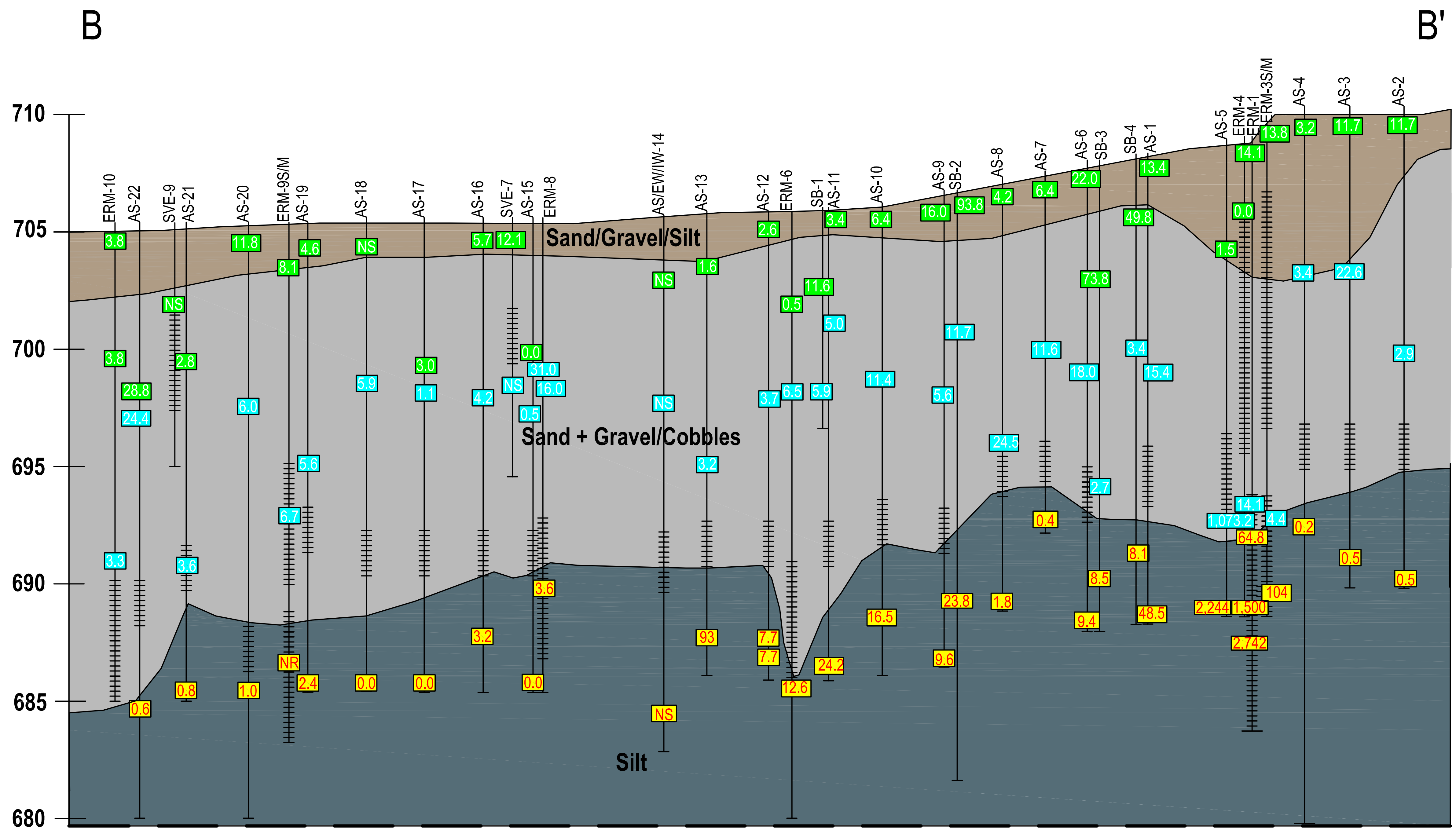
Vertical Scale (1"=5')
Horizontal Scale (1"=40')

**Figure 4A** - Geologic Cross-Section A-A'
Energizer Facility
401 Gage Street, Bennington, VT

ERM

R:\energizer\REPORT - CAP\FIGURE 4A PID X SECTION.dwg (07/27/2007 - 3:42pm Boston)


Scale (1"=275')




Note:
1. AS/SVE wells have not been surveyed. Topography based on elevation data from ERM-5,ERM-11 & ERM-10.
2. Highest headspace reading in each of the Vadose Zone, Sand/Gravel Saturated Zone and Silt Saturated Zone shown for each boring.
3. ppm = parts per million
4. Wells depicted are only those installed to date.
5. Total depth of boring is shown at each location.

Legend:

- 0.0 Maximum Vadose Zone Headspace Reading (ppm)
- 0.0 Maximum Saturated Zone Headspace Reading (ppm)
- 0.0 Maximum Silt Headspace Reading (ppm)
- NS Not Sampled
- NR No Recovery
- Site Boundary
- No Data Evaluated
- Screened Interval (if installed)
- Boring

Vertical Scale (1"=5')
Horizontal Scale (1"=40')

**Figure 4B**- Geologic Cross-Section B-B'
Energizer Facility
401 Gage Street, Bennington, VT

ERM

R:\Energizer\REPORT - CAP\Figure 4B PID X-Sec.dwg (07/27/2007 - 2:10pm Boston)


Legend

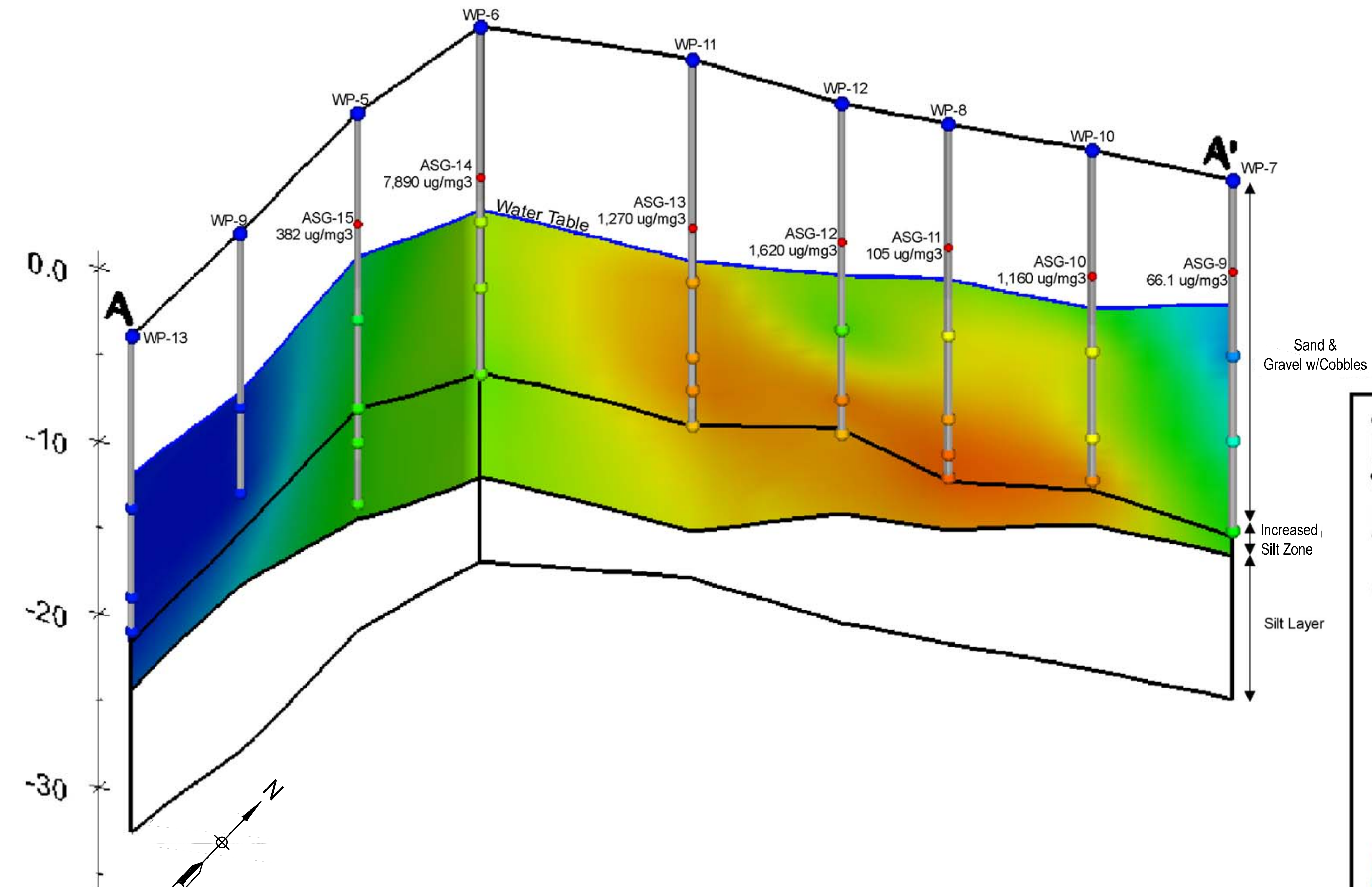
- Modified Waterloo Profiler Boring Location ( 2/16/07 - 2/20/2007 Plus Adjusted Data From July 2006 )
- Monitoring Well Location ( 2/28/07 )
- Shallow Groundwater Point Location ( 2/16/07 - 2/20/07 )
- Interpolated July 2006 Hydraulic Head Data to Fit Feb 2007 Data Set
- Morgan Brook ( Dashed Where Culverted )
- Groundwater Contours ( Feet Above Sea Level )
- 700 Groundwater Elevations ( Feet Above Sea Level )
- Direction of Shallow Groundwater Flow

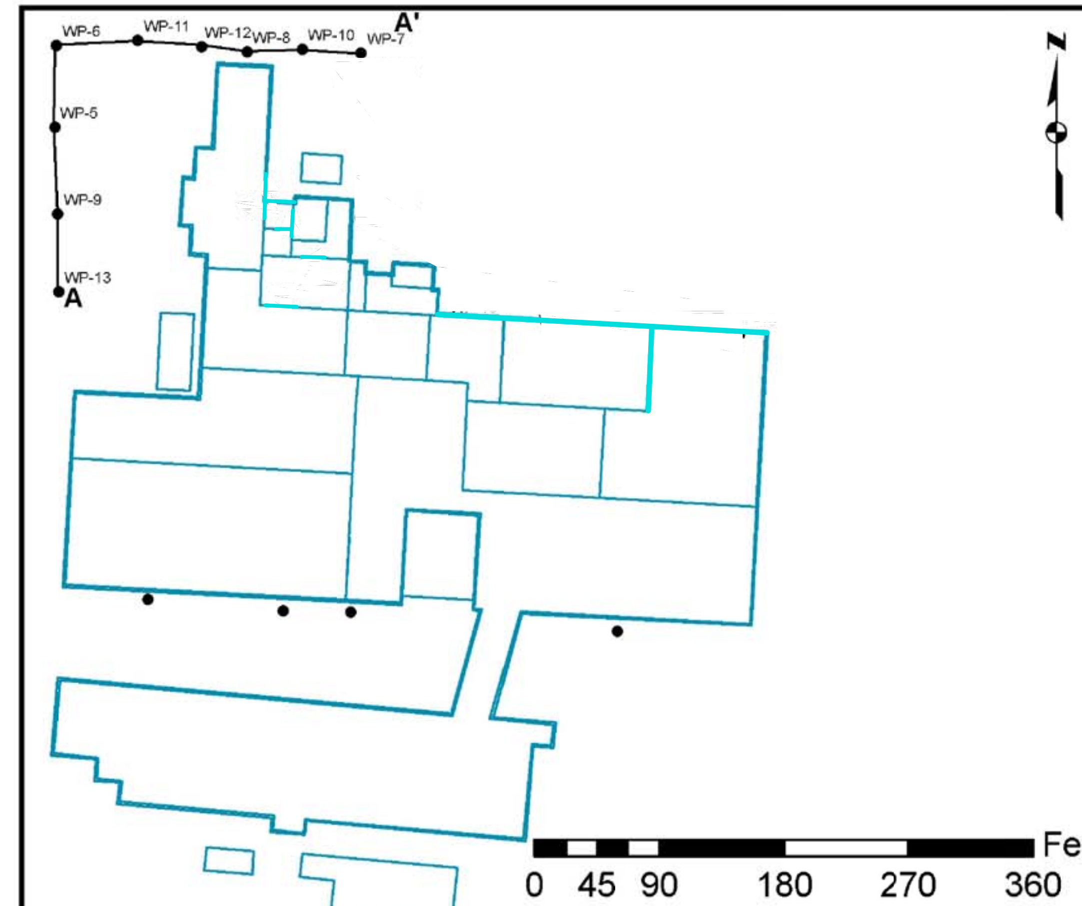
Scale (1"=50')

25' 0 25' 50' 100'

**Figure 5 -** Shallow Groundwater Potentiometric Surface
February 2007
Energizer Facility
401 Gage Street, Bennington, VT

ERM




**Legend**
**PCE Concentrations**

1µg/l 2µg/l 5µg/l 10µg/l 20µg/l 50µg/l 100µg/l 200µg/l 500µg/l 1000µg/l

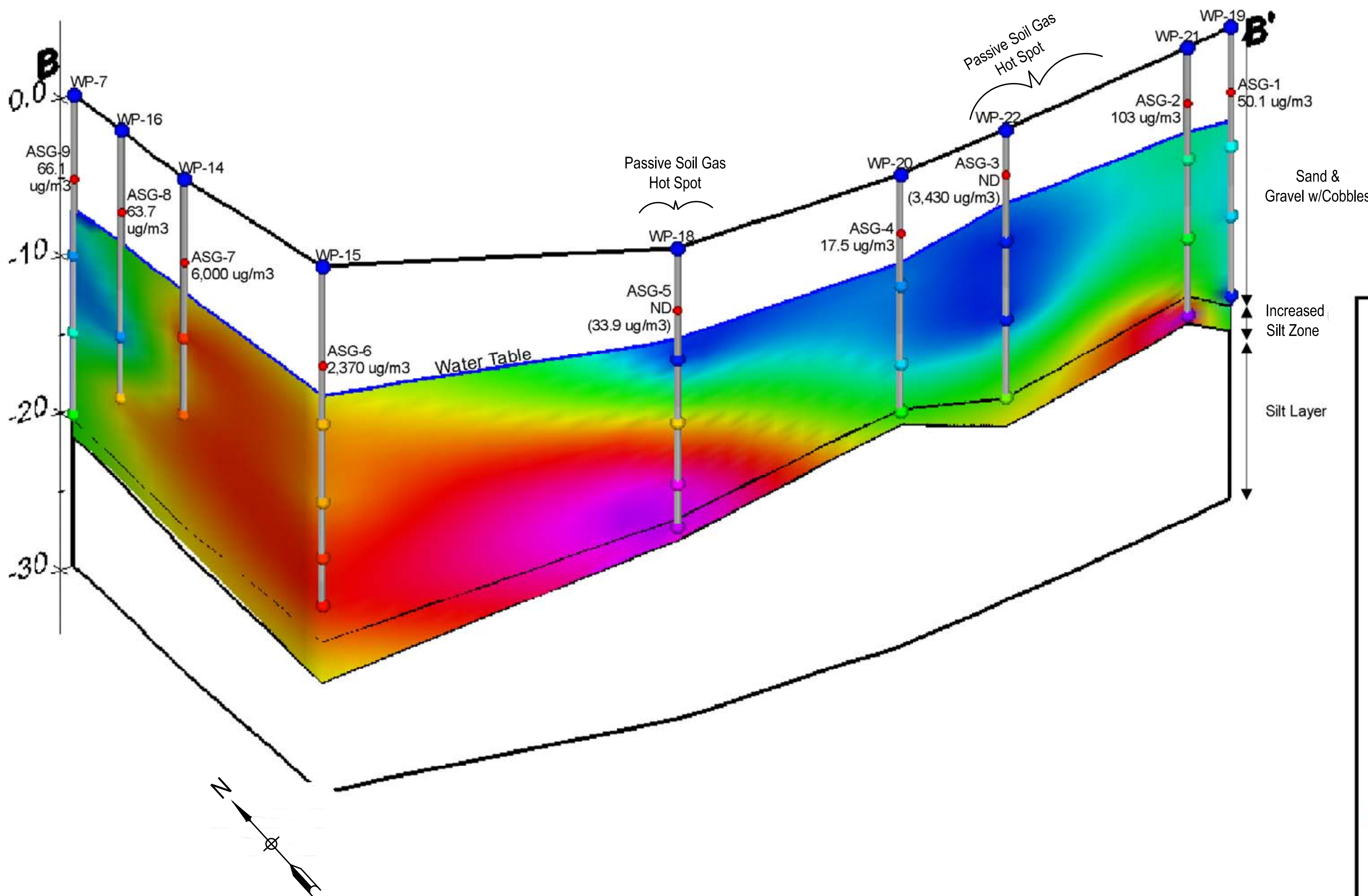
Active Soil Gas Sample Depth & Concentration (Reporting Limit)

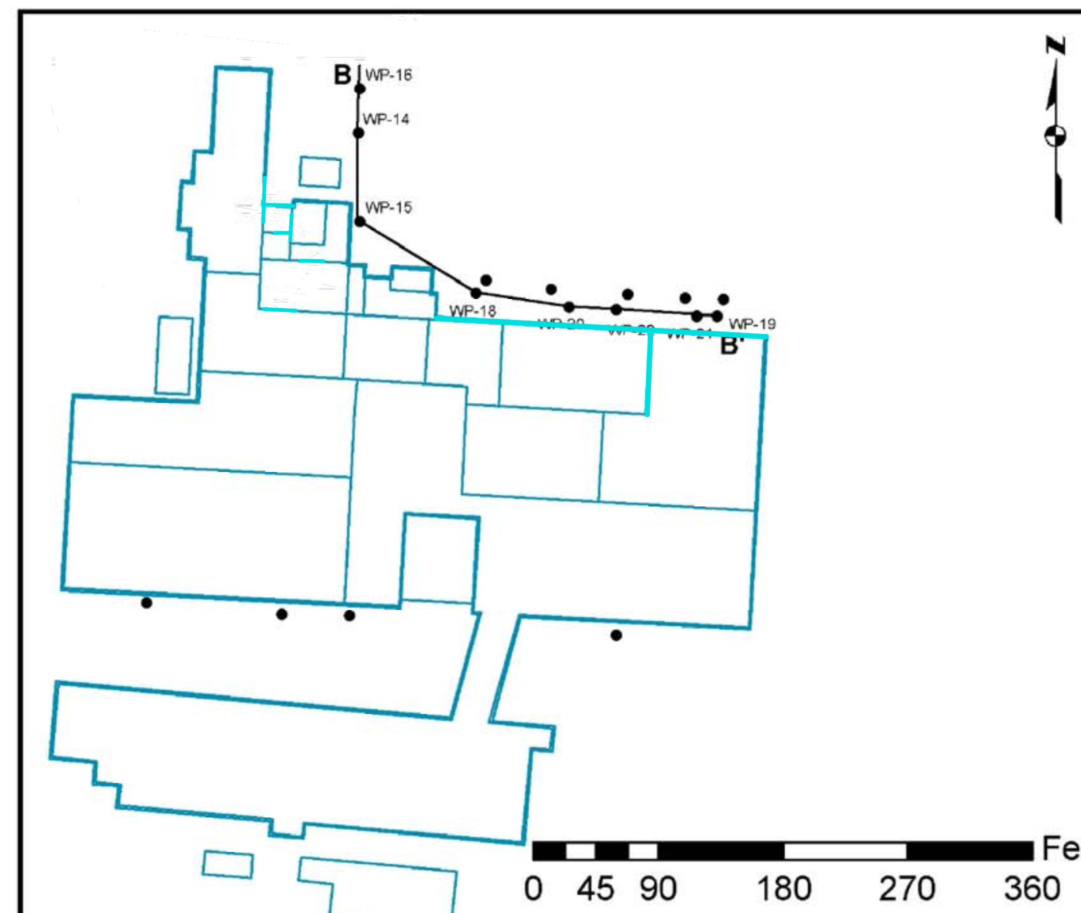
Modified Waterloo Profiler Discrete Interval Groundwater Sample Concentration (See Color-Coded Concentration Legend)

**Figure 6A -** PCE Concentrations in Groundwater
A-A'
Energizer Facility
401 Gage Street, Bennington, VT

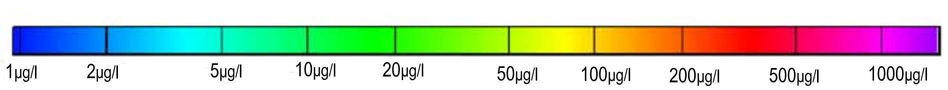
ERM

R:\energizer\REPORT - CAP\FIGURE-6A PCE Concentrations in Groundwater.dwg (07/27/2007 - 12:32pm Boston)




**Legend**
**PCE Concentrations**



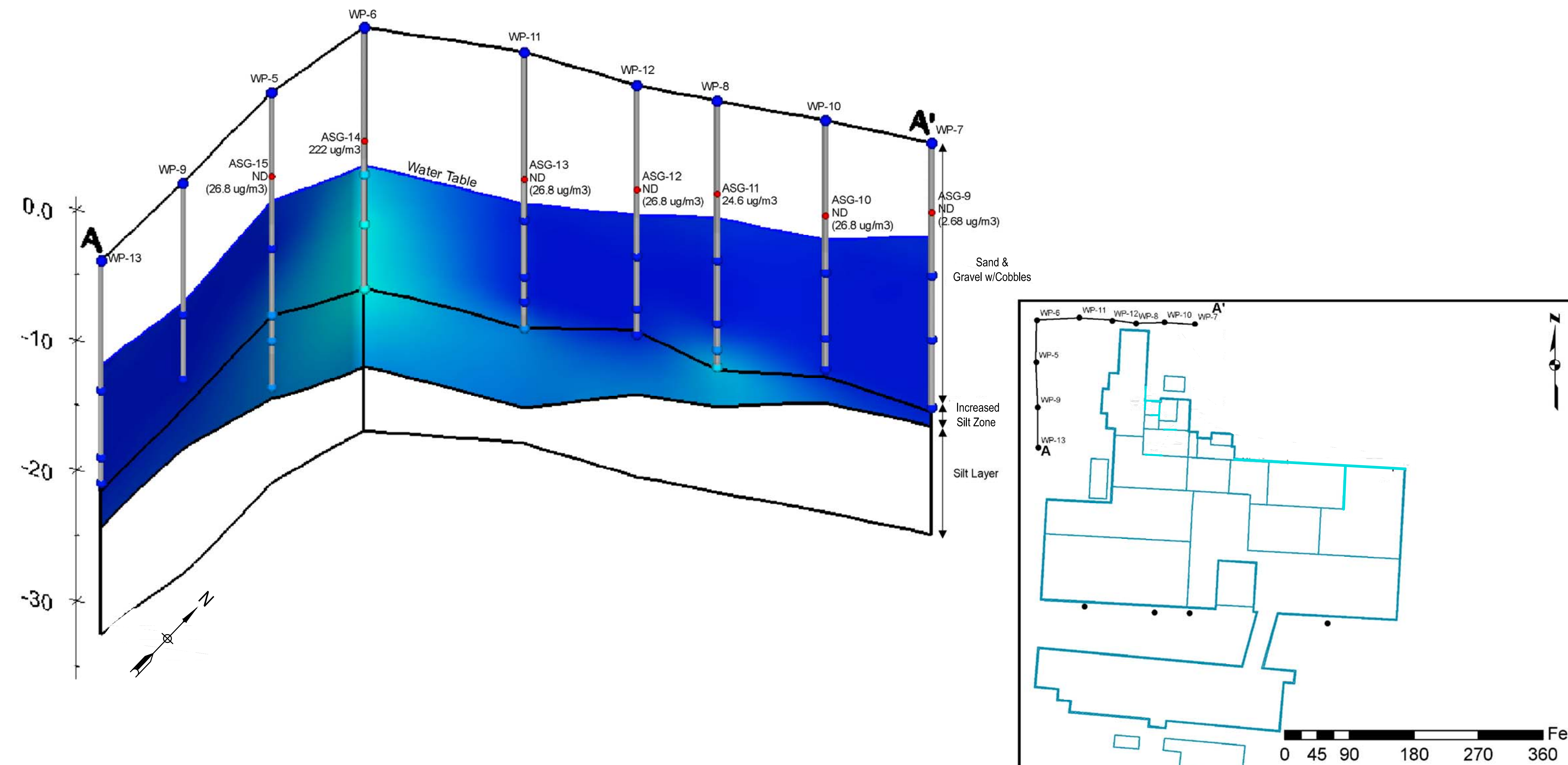

Active Soil Gas Sample Depth
& Concentration (Reporting Limit)

Modified Waterloo Profiler Discrete Interval Groundwater
Sample Concentration (See Color-Coded Concentration Legend)

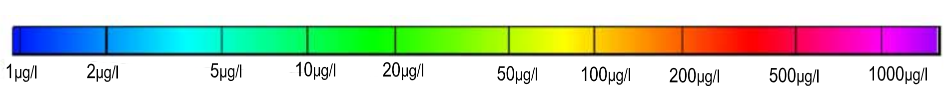
**Figure 6B -** PCE Concentrations in Groundwater
B-B'
Energizer Facility
401 Gage Street, Bennington, VT

ERM

R:\energizer\REPORT - CAP\FIGURE-6B PCE Concentrations in Groundwater.dwg (07/27/2007 - 12:32pm Boston)




**Legend**
**TCE Concentrations**



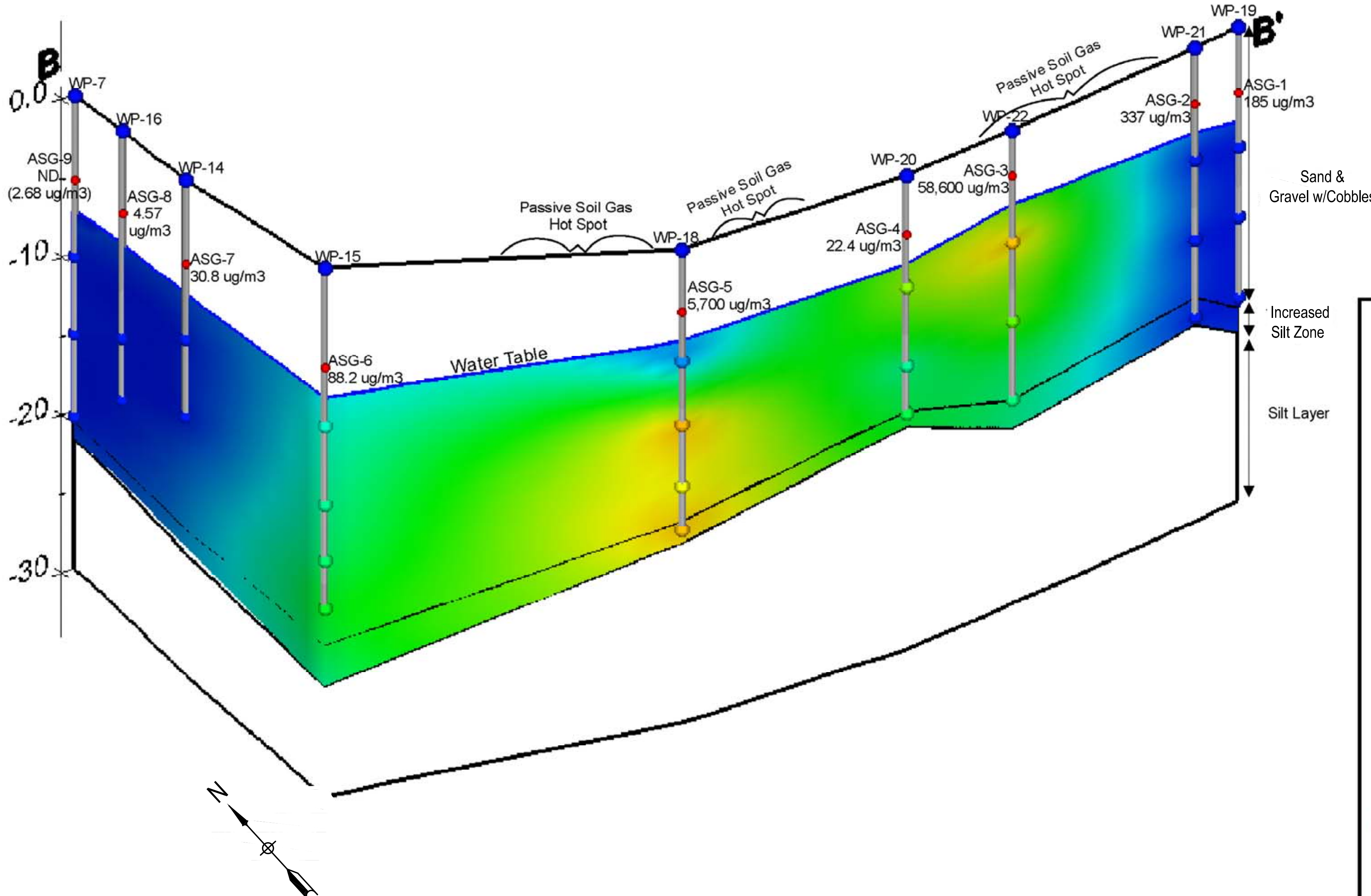

Active Soil Gas Sample Depth & Concentration (Reporting Limit)

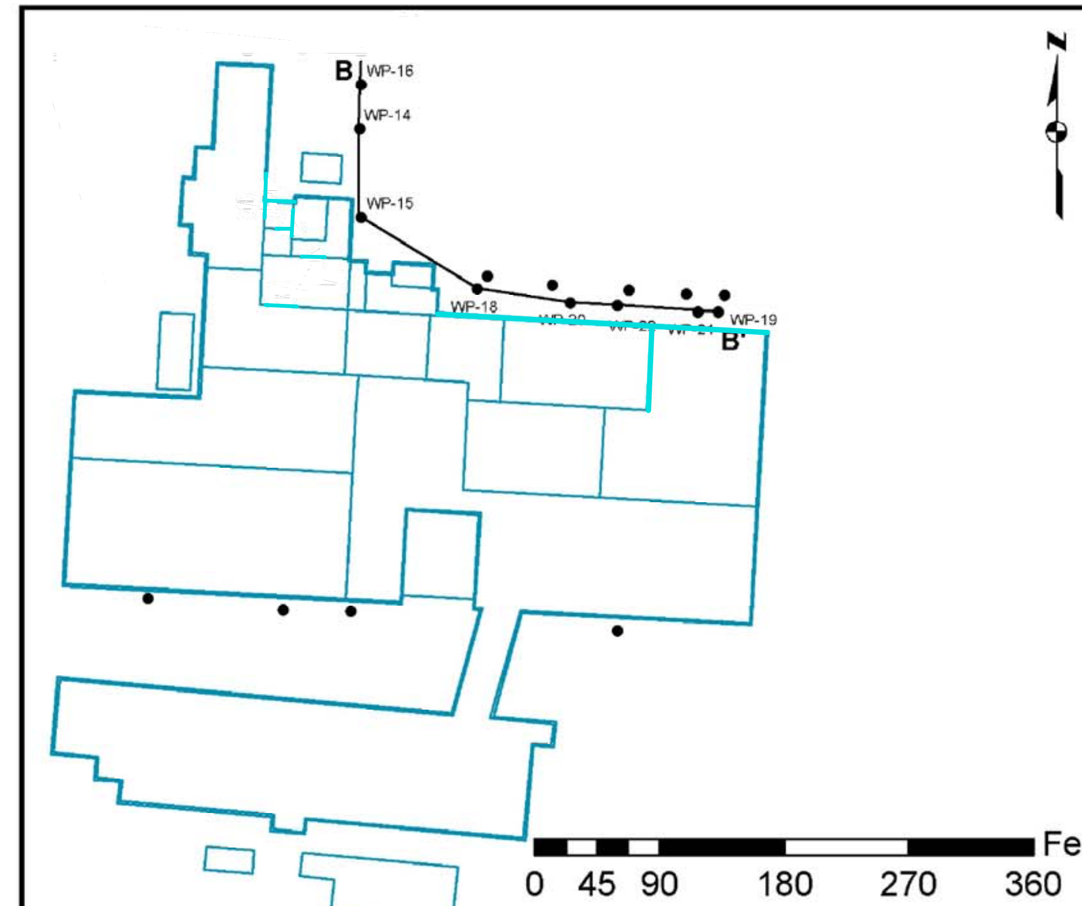
Modified Waterloo Profiler Discrete Interval Groundwater Sample Concentration (See Color-Coded Concentration Legend)

**Figure 7A -** TCE Concentrations in Groundwater
A-A'
Energizer Facility
401 Gage Street, Bennington, VT

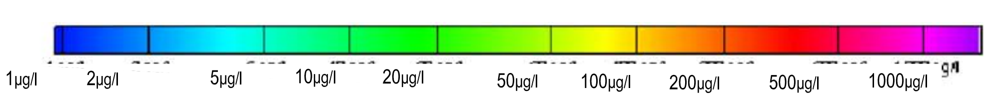
ERM

R:\energizer\REPORT - CAP\FIGURE-7A TCE Concentrations in Groundwater.dwg (07/27/2007 - 12:33pm Boston)




**Legend**
**TCE Concentrations**




Active Soil Gas Sample Depth
& Concentration (Reporting Limit)

Modified Waterloo Profiler Discrete Interval Groundwater
Sample Concentration (See Color-Coded Concentration Legend)

**Figure 7B -** TCE Concentrations in Groundwater
B-B'
Energizer Facility
401 Gage Street, Bennington, VT

ERM

R:\energizer\REPORT - CAP\FIGURE-7B TCE Concentrations in Groundwater.dwg (07/27/2007 - 12:34pm Boston)


Legend

PCE Concentration (µg/L) in Groundwater

- NS ( Not Sampled )
- ND ( Not Detected )
- ND- < 5
- 5- < 50
- 50- < 500
- 500- < 5,000
- \> 5,000
- Morgan Brook ( Dashed Where Culverted )
- Water Table Groundwater Samples only
- PCE Concentration Contours (µg/L)
  ( Groundwater Contours Beneath Plant I Building Footprint Inferred Based on Passive Soil Gas Survey Results.)

Note:
1. For Modified Waterloo Profiler Boring Locations, Value Shown is the Highest Concentration Detected at Each Location.
2. Data Collected in February 2007, Except Locations WP-1 Through WP-27 Collected in July 2006, & ERM-14 Through ERM-17 Collected May 2007.

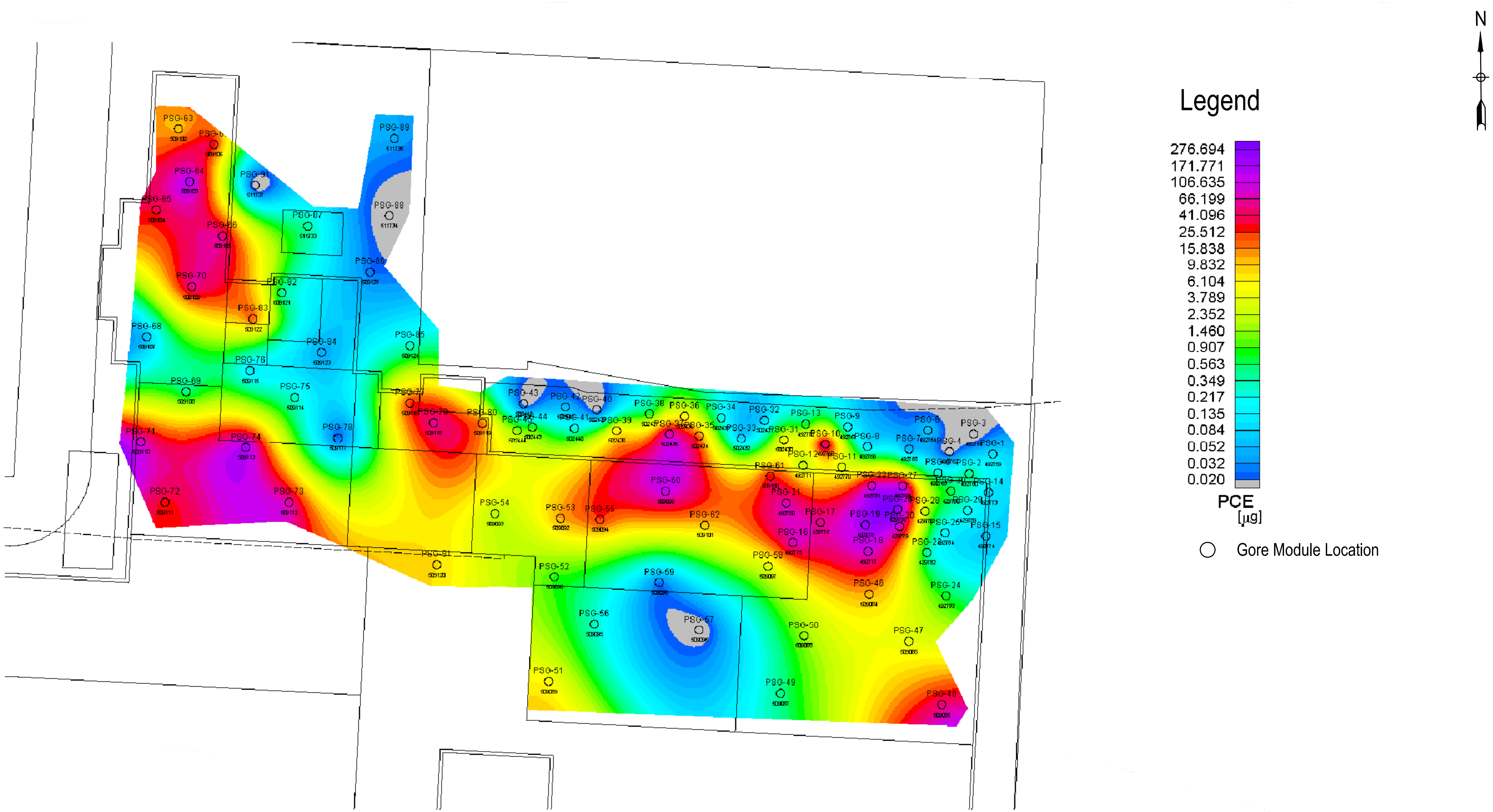
**Figure 8 -** Most Recent PCE Concentrations in Groundwater
July 2006, February 2007 & May 2007
Energizer Facility
401 Gage Street, Bennington, VT


Legend
TCE Concentration (µg/L) in Groundwater
- NS ( Not Sampled )
- ND ( Not Detected )
- ND- < 5
- 5- < 50
- 50- < 500
- 500- < 5,000
- Morgan Brook ( Dashed Where Culverted )
- Water Table Groundwater Samples only
- TCE Concentration Contours (µg/L) ( Groundwater Contours Beneath Plant I Building Footprint Are Inferred Based on Passive Soil Gas Survey Results.)

Note:
1. For Modified Waterloo Profiler Boring Locations, Value Shown is the Highest Concentration Detected at Each Location.
2. Data Collected in February 2007, Except Locations WP-1 Through WP-27 Collected in July 2006, & ERM-14 Through ERM-17 Collected May 2007.

**Figure 9 -** Most Recent TCE Concentrations in Groundwater
July 2006, February 2007 & May 2007
Energizer Facility
401 Gage Street, Bennington, VT

ERM




Scale 1:600

25 0 25 50 75 100 125

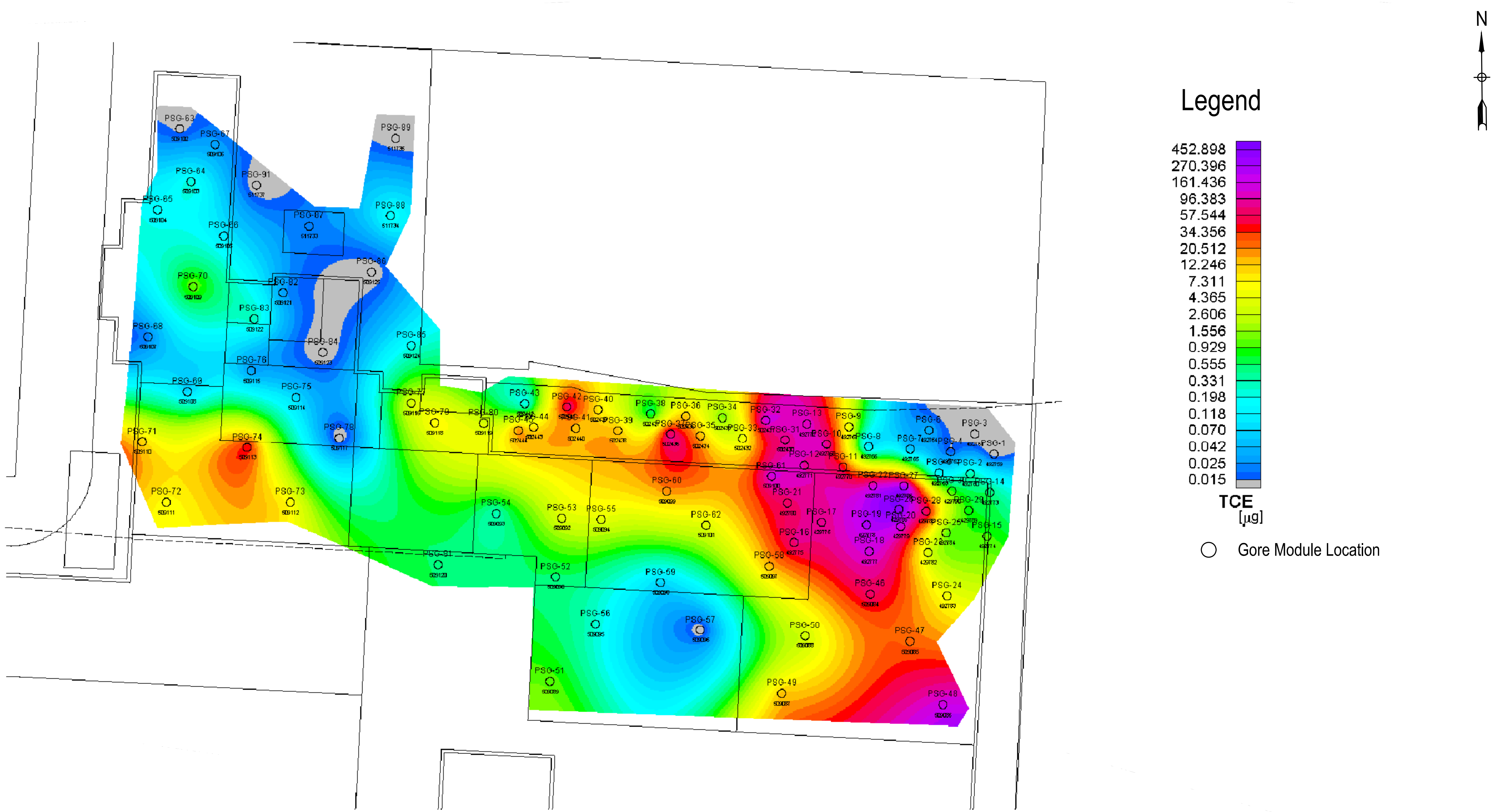
feet

Note: Source W.L Gore & Associates Inc, 1 Nov 2006

**Figure 10 -** Passive Soil Gas Results - PCE
Energizer Facility
401 Gage Street, Bennington, VT

ERM

R:\Energizer\REPORT - CAP\CAP Report Figures\Figure 10 Passive Soil Gas Results - PCE.dwg (09/26/2007 - 1:01pm Boston)




Note: Source W.L Gore & Associates Inc, 1 Nov 2006

Scale 1:600

25 0 25 50 75 100 125

feet

**Figure 11 -** Passive Soil Gas Results - TCE
Energizer Facility
401 Gage Street, Bennington, VT

ERM


LEGEND

- SVE-17 ● SOIL VAPOR EXTRACTION WELL
- AS-40 ● AIR SPARGING WELL
- SITE BOUNDARY
- MORGAN BROOK (DASHED WHERE CULVERTED)

Scale (1"=40')

20' 0 20' 40' 80'

**Figure 12** - Interim Remedial Measure Design Locations
Energizer Facility
401 Gage Street, Bennington, VT

ERM

R:\energizer\REPORT - CAP\CAP Report Figures\figure 12 Interim Remedial Measure.dwg (09/26/2007 - 4:04pm Boston)

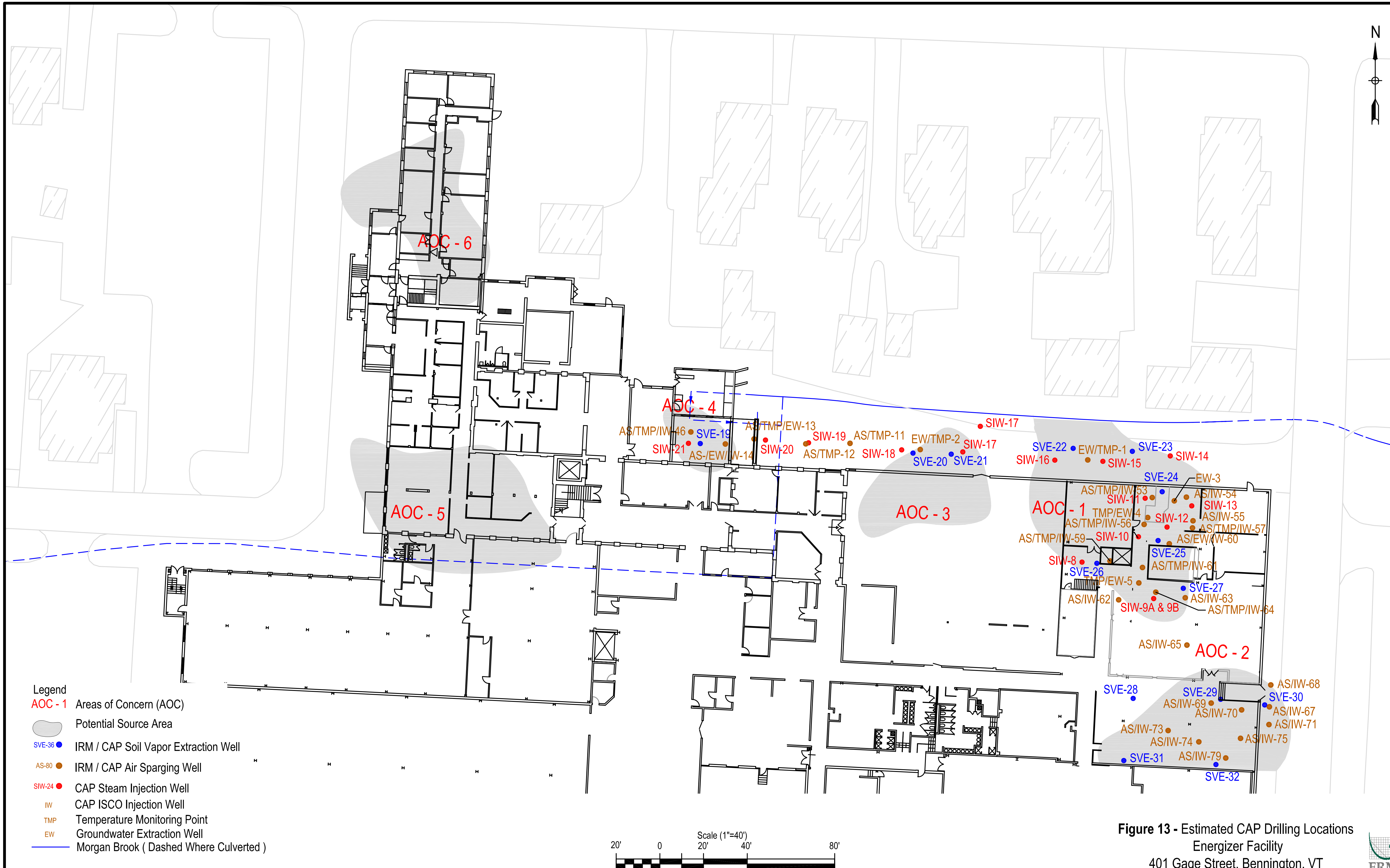
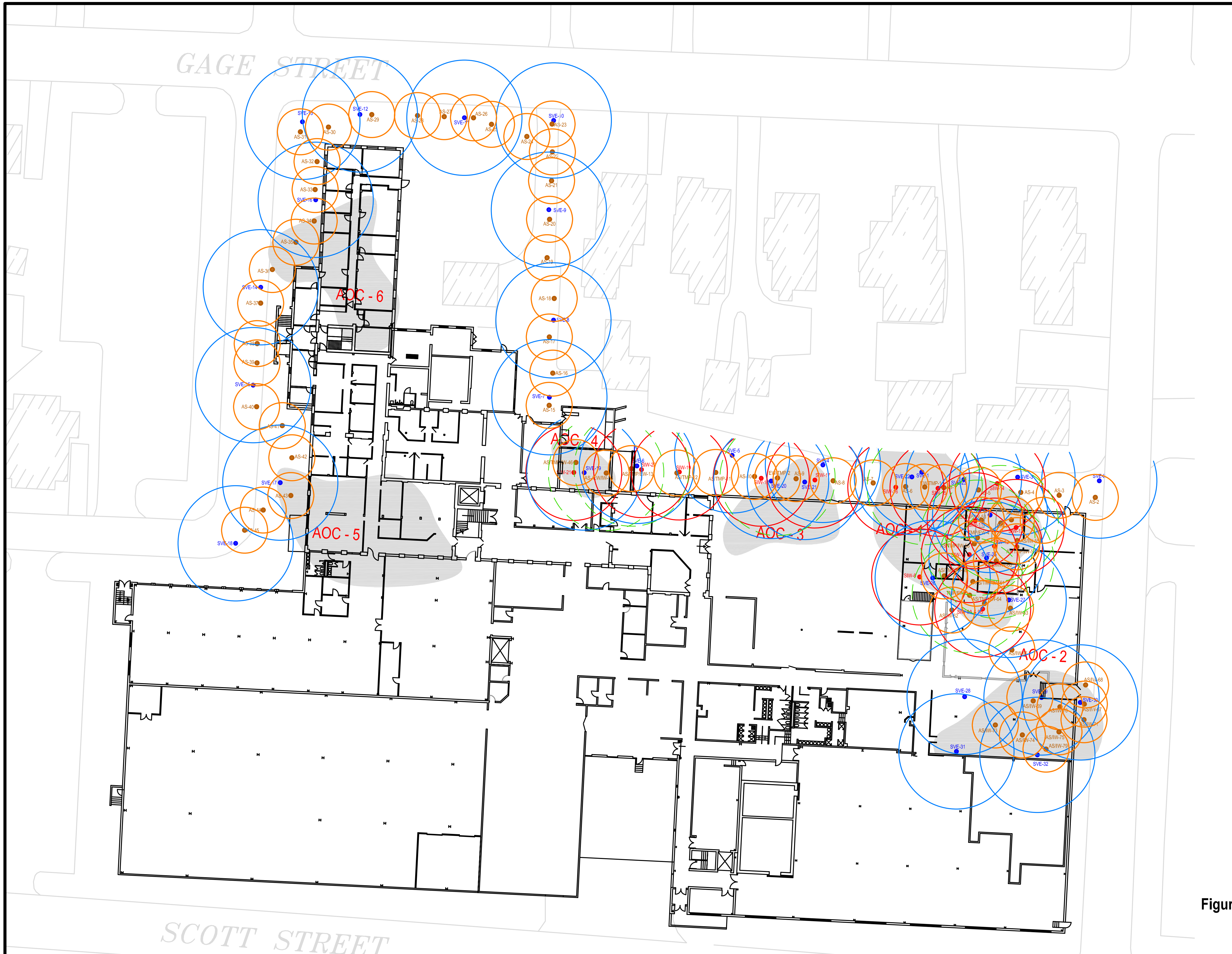



**Figure 13 -** Estimated CAP Drilling Locations
Energizer Facility
401 Gage Street, Bennington, VT

ERM

R:\energizer\REPORT - CAP\CAP Report Figures\FIGURE 13 ESTIMATED ICAP DRILLING LOCATIONS 1.dwg (09/26/2007 - 4:26pm Boston)




Legend

AOC - 1 Areas of Concern (AOC)

Potential Source Area

SVE-36 IRM / CAP Soil Vapor Extraction Well

AS-80 IRM / CAP Air Sparging Well

SIW-24 CAP Steam Injection Well

IW CAP ISCO Injection Well

TMP Temperature Monitoring Point

EW Groundwater Extraction Well

Morgan Brook ( Dashed Where Culverted )

Soil Vapor Extraction Well Showing Radius of Influence

Groundwater Extraction Well Showing Radius of Influence

Steam Injection Well Showing Radius of Influence

Air Sparging Well Showing Radius of Influence

Note:
IRM Wells SVE-1 through SVE-18 & AS-1 through AS-45 are as-built locations.

Scale (1"=50')

25' 0 25' 50' 100'

**Figure 14 -** Estimated Radii of Influence - IRM/CAP Wells
Energizer Facility
401 Gage Street, Bennington, VT

ERM

R:\energizer\REPORT - CAP\CAP Report Figures\Figure 14 Radii of Influence - CAP and IRM wells.dwg (09/26/2007 - 4:38pm Boston)

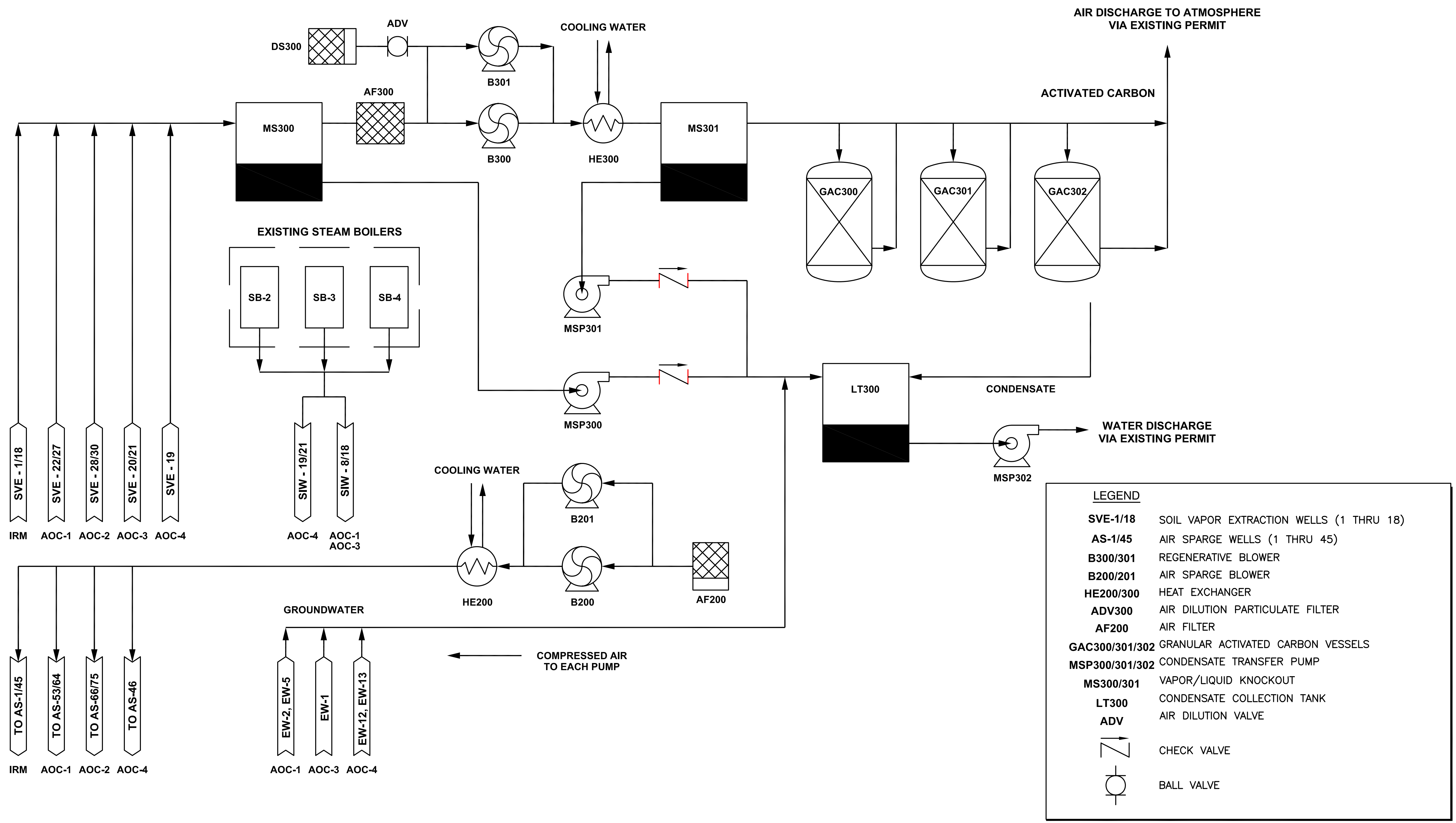
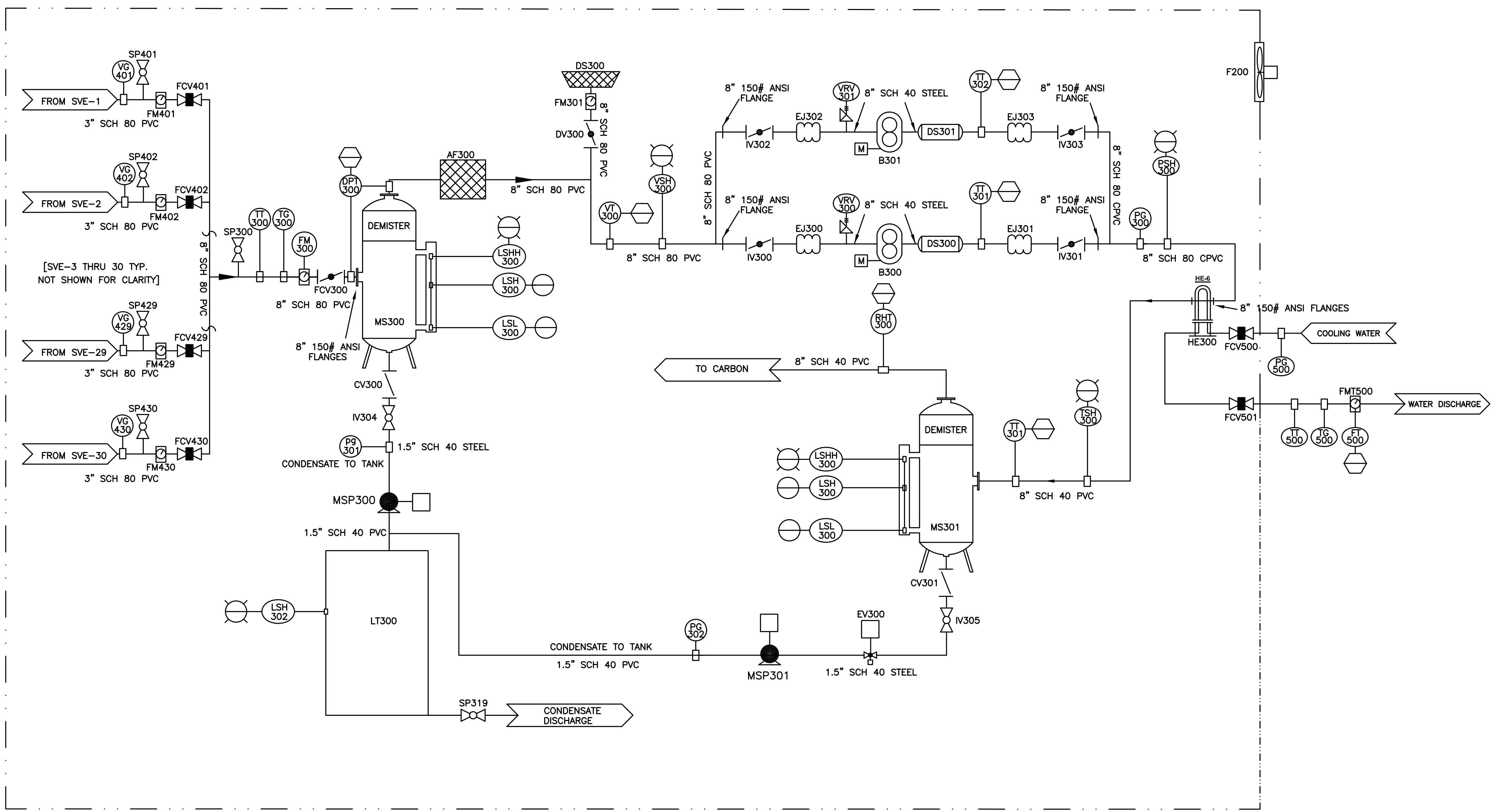



**Figure 15** - Process Flow Diagram
Energizer Facility
401 Gage Street, Bennington, VT

Note: Not to Scale

ERM

R:\energizer\REPORT - CAP\CAP Report Figures\FIGURE 15 Process Flow Diagram.dwg (09/27/2007 - 10:15am Boston)




Not to Scale

**Figure 16 -** Process & Instrumentation Diagram
SVE System
Energizer Facility
401 Gage Street, Bennington, VT

R:\energizer\REPORT - CAP\CAP Report Figures\Figure 16.dwg (09/27/2007 - 10:16am Boston)

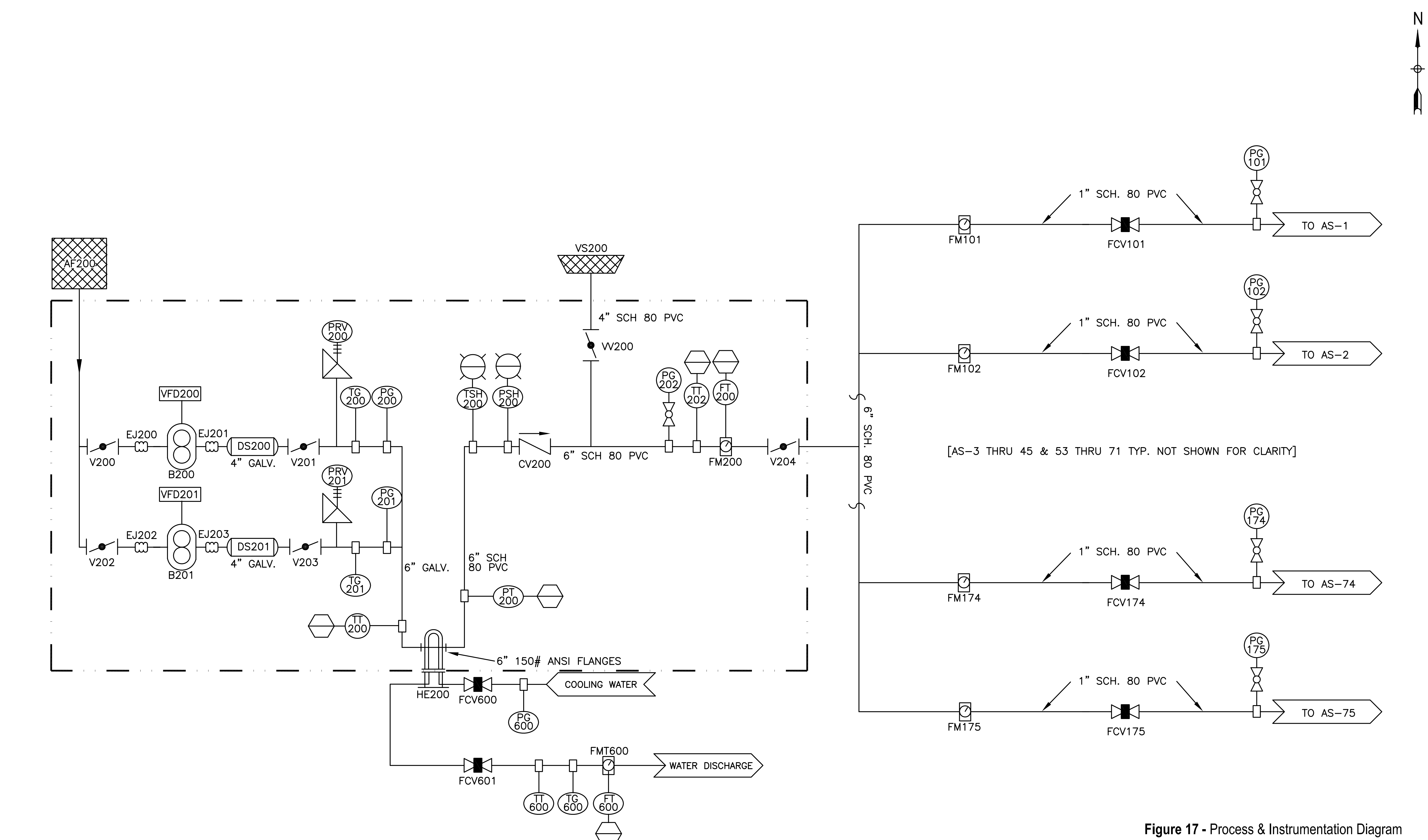



**Figure 17 -** Process & Instrumentation Diagram
Air Sparge System
Energizer Facility
401 Gage Street, Bennington, VT

Not to Scale

R:\energizer\REPORT - CAP\CAP Report Figures\Figure 17.dwg (09/27/2007 - 10:15am Boston)

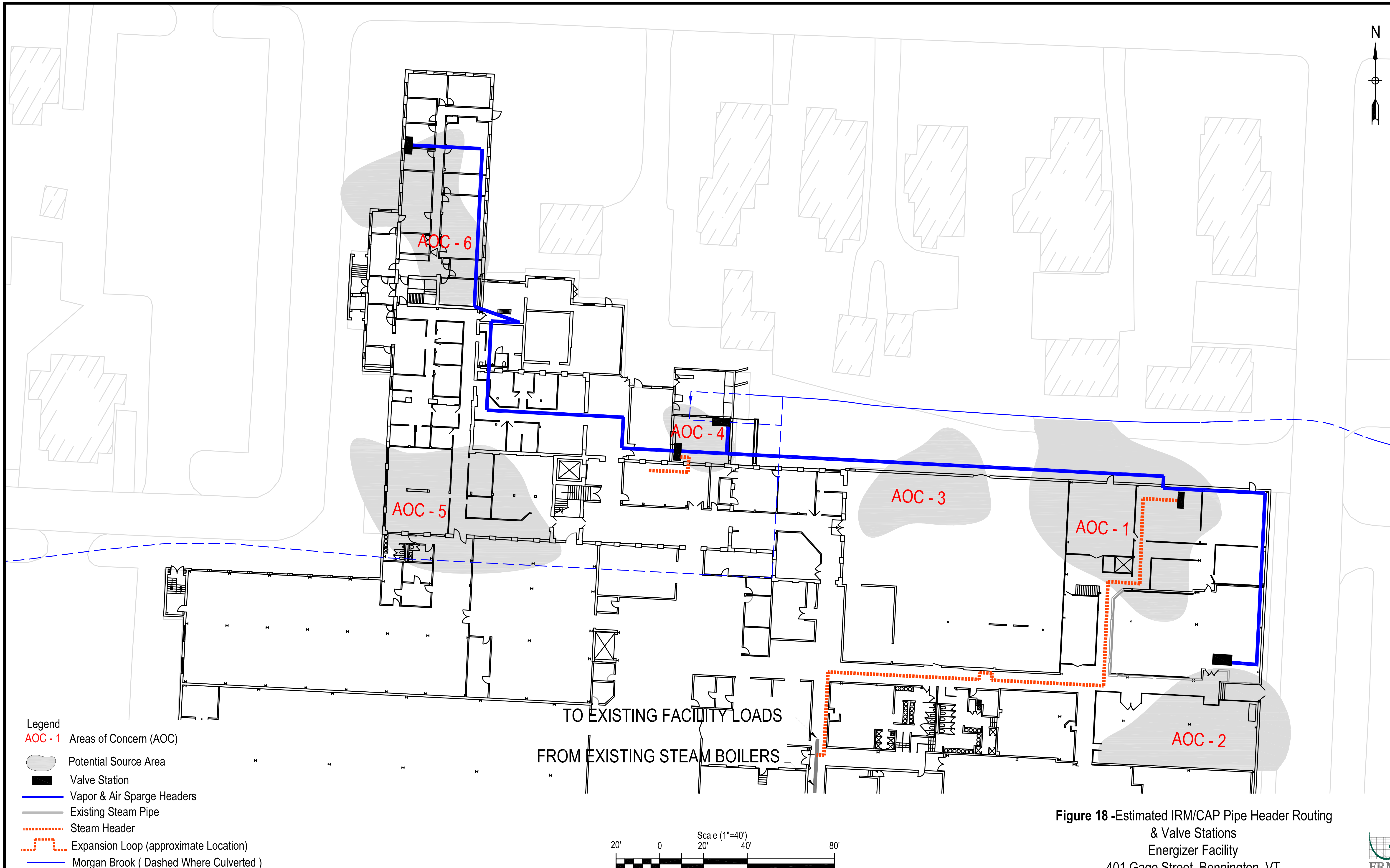



**Figure 18 -**Estimated IRM/CAP Pipe Header Routing
& Valve Stations
Energizer Facility
401 Gage Street, Bennington, VT

R:\energizer\REPORT - CAP\CAP Report Figures\FIGURE_18_ESTIMATED_IRM-CAP_PIPE_HEADER_ROUTING.dwg (09/26/2007 - 4:06pm Boston)

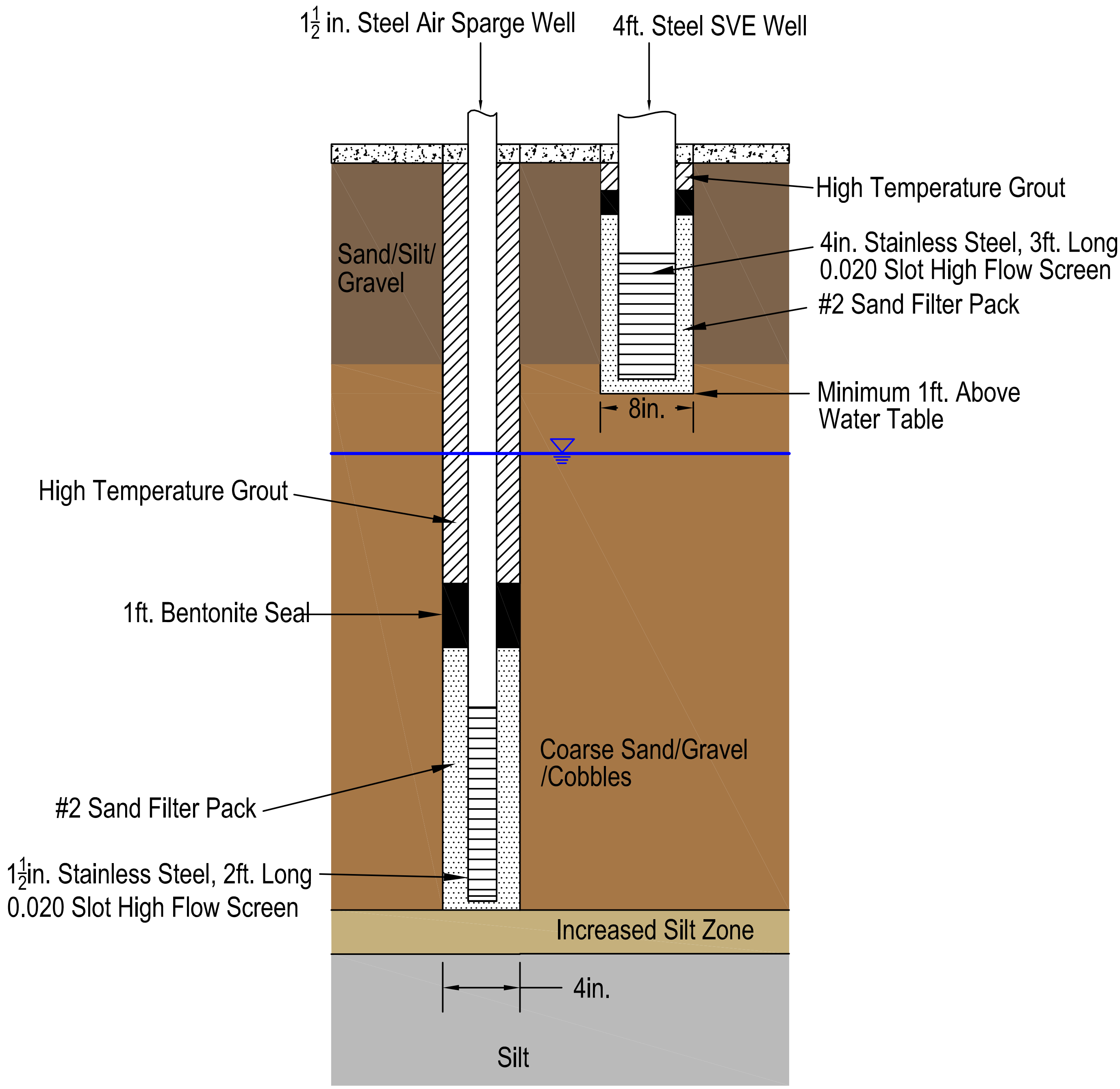
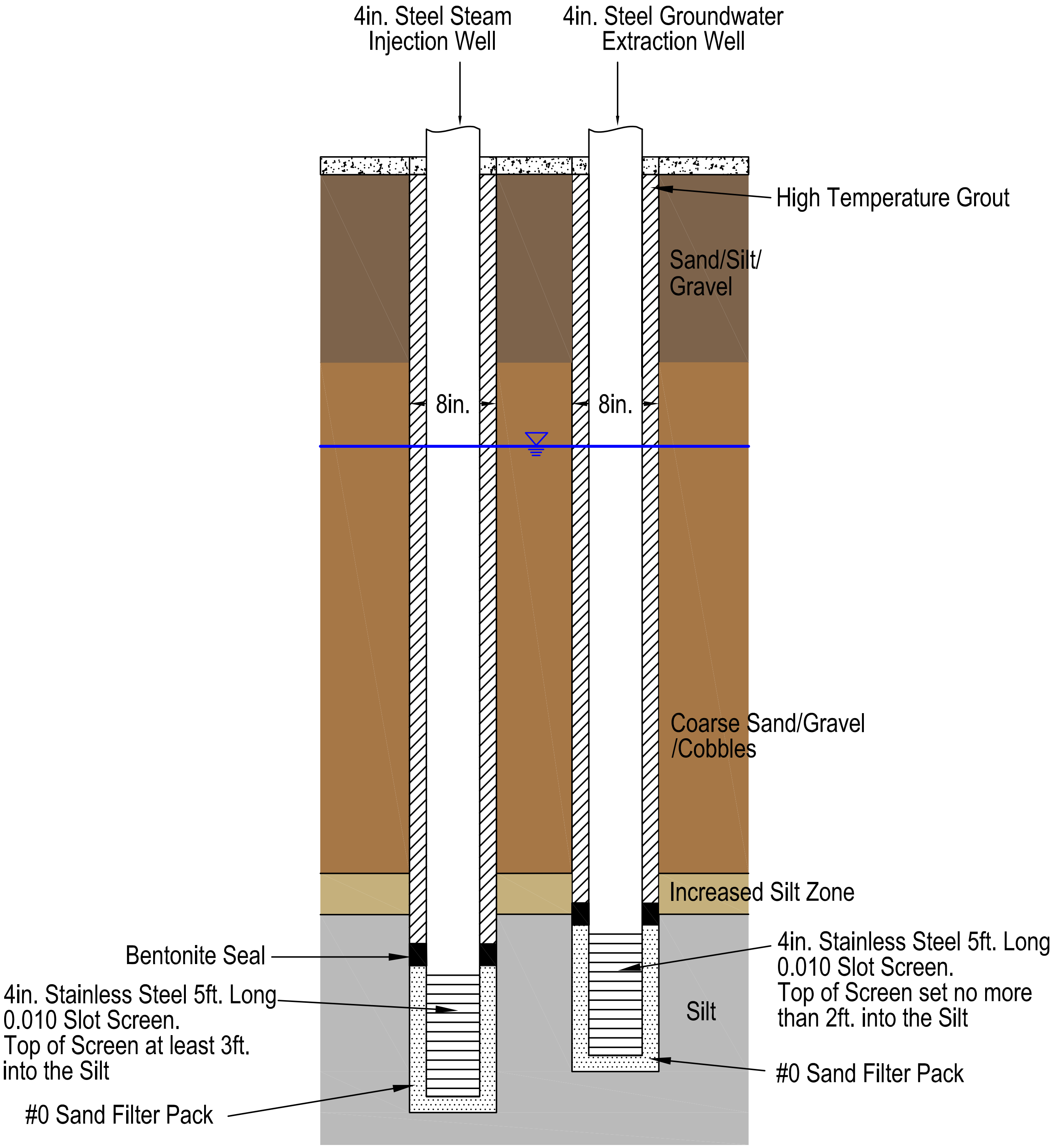



**Figure 19** - Typical SVE and AS Well Details
Energizer Facility
401 Gage Street, Bennington, VT

Not to Scale

ERM

R:\energizer\REPORT - CAP\CAP Report Figures\Figure 19 and 20 Typical Well Details.dwg (09/26/2007 - 11:01am Boston)




Note: Subsurface temperature monitoring will be conducted using digital temperature sensors placed in 1inch I.D. galvanized steel water-tight conduit. Bottom of conduit will be capped and placed 10 feet below depth of closest Steam Injection Well

Not to Scale

**Figure 20** - Steam, Groundwater Extraction Well Details
Energizer Facility
401 Gage Street, Bennington, VT

ERM

R:\energizer\REPORT - CAP\CAP Report Figures\Figure 19 and 20 Typical Well Details.dwg (09/26/2007 - 11:00am Boston)