AECOM Environment

Prepared for:
WDNR
Fitchburg, Wisconsin

Prepared by:
AECOM
Milwaukee, WI
60139756
June 2011

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Remedial Design Report

Former Beaver Cleaners Site
Beaver Dam, Wisconsin

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June 14, 2011

Ms. Denise Nettesheim
Wisconsin Department of Natural Resources
3911 Fish Hatchery Road
Madison, Wisconsin 53711-5397

RE: Remedial Design Report, Former Beaver Cleaners, Beaver Dam, WI
BRRTS# 02-14-522724 - AECOM Project No. 60139756

Dear Ms. Nettesheim:

Please find enclosed a Remedial Design Report for the referenced site, prepared by AECOM. As a follow-up to the Wisconsin Department of Natural Resources (WDNR) letter dated May 10, 2011, this Report was prepared to provide information required under Wisconsin Administrative Code (WAC) NR 724.09 and 724.11. The purpose of this Remedial Design Report is to provide a description of the remedial action for vadose zone soil and an evaluation of its treatment effectiveness.

If you have any questions or comments concerning the information contained herein, please feel free to contact us at your convenience.

Yours sincerely,

Mark M. Mejac

Mark M. Mejac, PG, CGWP
Senior Hydrogeologist
mark.mejac@aecom.com

cc: Mr. Virgil Lauth

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1.0 Introduction

Pursuant to Wisconsin Administrative Code (WAC) Chapter NR 724, this Remedial Design Report has been prepared by AECOM to address impacted vadose zone soil conditions at the former Beaver Cleaners site (the "Site") located in Beaver Dam, Wisconsin (Figure 1). The purpose of the Remedial Design Report is to provide a description of the proposed remedial action and an evaluation of its treatment effectiveness. The following sections describe the Site background, remedial objectives and remedial actions to be implemented.

1.1 Involved Parties

Parties currently involved with this project include the following:

Responsible Party:

Mr. Virgil Lauth
Former Beaver Cleaners
N5737 Highway 151
Beaver Dam, Wisconsin 53916
920-885-9416

Wisconsin Department of Natural Resources (WDNR):

Ms. Denise Nettesheim
Wisconsin Department of Natural Resources
3911 Fish Hatchery Road
Fitchburg, Wisconsin 53711-5397
608-275-3209

Environmental Consultant:

Mr. Mark Mejac, P.G.
AECOM
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Milwaukee, WI 53224
414-359-3030

1.2 Site Location

The Site is located at 111 West Maple Avenue in Beaver Dam, Wisconsin in the northeast quarter of the northwest quarter of Section 4, T12N, R14E, Dodge County (Figure 1). The Site is listed under the WDNR Bureau of Remediation Redevelopment Tracking System (BRRTS) as activity Number 02-14-522724.

1.3 Background Information

The Site is located at 111 West Maple Avenue, Beaver Dam, Wisconsin, one block to the north of downtown Beaver Dam. The surrounding land use is mixed commercial, with an occasional

residence above a street level commercial establishment. An elementary school is located to the west of the Site. Maple Avenue is located to the north of the Site, with a parking lot further to the north. Another parking lot and a bank are located to the east of the Site. South of the Site is a city alley with adjacent commercial buildings.

Dry cleaning has been performed at the facility since 1927. Stoddard solvent (petroleum-based), "Valclean" (a fluoride-based solvent), and tetrachloroethene (PCE) were historically used as dry cleaning solvents at this facility. The facility was also a conditionally-exempt small quantity generator of hazardous waste (based on the previous use of cleaning solvents). Historically, an underground storage tank (UST) was used to store the Stoddard solvent for on-site use. The UST was located outside the rear door of the original facility. The UST had been removed and that area is currently covered with a building addition. Spent solvent filters were also previously stored outside the rear of the building prior to removal by a disposal firm. The dry cleaning equipment and former UST areas are indicated on Figure 2.

Soil and groundwater samples were collected during Site Investigation Scoping activities that were performed in October 2003. The results of the scoping investigation documented soil and groundwater impacts from Stoddard and dry-cleaning solvents. The WDNR was notified of the release in January 2004. In February 2004, the WDNR directed Mr. Lauth, the property owner, to investigate the nature and extent of the release.

No emergency, interim, or remedial actions have been conducted at the Site. MSA Professional Services (MSA) conducted a WAC NR 716 Site Investigation from 2004 through 2006 to characterize the soil and groundwater impacts. A total of nine soil borings, five water table monitoring wells, and two piezometers were installed and sampled to evaluate the impacts. The locations of the soil borings, monitoring wells and piezometers are identified on Figure 3. Impacted soil that exceeds WAC NR 720 values for direct contact and groundwater protection has been identified. Source areas include an area inside of the facility building near the former Stoddard solvent UST and dry cleaning machines, and an area outside the building with near-surface contamination. Both chlorinated and petroleum-based dry cleaning solvent impacts have been detected.

PCE, trichloroethene (TCE), and vinyl chloride (VC) have been detected at concentrations that exceed their respective WAC NR 140 enforcement standard (ES) values for groundwater in the unconsolidated soil and bedrock wells. PCE concentrations in groundwater have exceeded 100 micrograms per liter (µg/L), and VC concentrations have exceeded 30 µg/L.

Subsequent to the 2004 through 2006 Site Investigation, MSA collected two sub-slab vapor samples from within the facility building in December 2007. The sub-slab vapor samples were collected using Summa canisters and analyzed using Method TO-15. The results of the sub-slab vapor sample analyses revealed maximum PCE and TCE concentrations of 407 parts per billion-volume (ppbv) and 2.3 ppbv, respectively. These concentrations exceed their respective Table 2c Target Shallow Soil Gas Concentrations of 1.2 ppbv (PCE) and 0.04 ppbv (TCE) as contained in the U.S. Environmental Protection Agency (EPA) "Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (November 2002)."

The WDNR letter dated June 3, 2008 indicated that the Site Investigation of the unconsolidated soils and bedrock aquifer was complete. As a follow-up to the AECOM "Proposal for Remedial Action Services" dated August 28, 2008, AECOM was retained in September 2008 to implement a soil removal action, followed by groundwater monitoring to evaluate the progress of groundwater

remediation by natural attenuation and provide necessary groundwater data to achieve regulatory case closure.

As indicated in the April 9, 2009 AECOM Excavation Documentation Report and Groundwater Monitoring Plan, excavation and backfilling of impacted soil was conducted in October 2008. The final excavated area was a maximum of approximately 25 feet long in the north-south direction, and a maximum of approximately 24 feet wide in the east-west direction. The excavation generally extended vertically to depths of 7.5 feet to 10 feet below ground surface, which was the depth to the water table. The northern extent of the excavated area was limited by the presence of the facility building. The eastern extent of the excavated area was partially limited by the presence of an underground telephone utility line, bedrock monitoring well MW-1A, and bedrock piezometer MW-1B. The western extent of the excavation was limited by the presence of an underground natural gas utility corridor and the western Site boundary located approximately 5 feet to the west of the natural gas utility corridor.

WAC NR 720 industrial land use direct contact residual contaminant levels (RCLs) were not exceeded in any of the closure confirmation soil samples. However, the obstructions identified above resulted in exceedances of the non-industrial land use direct contact RCL for PCE and the groundwater pathway RCL for PCE and TCE in a subset of the closure confirmation soil samples.

1.4 Hydrogeologic Setting

The Site elevation is approximately 870 feet above mean sea level. Approximately 12 feet of unconsolidated deposits of glacial origin (basal till) overlie dolomitic bedrock at the Site. The unconsolidated deposits generally consist of yellow-brown to brown lean silts and silty sands of Horicon Members of the Holy Hill Formation (Wisconsin Geological and Natural History Survey, *1997*). One to three feet of weathered bedrock is present at the bedrock interface, and competent bedrock is encountered at approximately 15 feet below ground surface (bgs). The bedrock is believed to consist of Ordovician-age Galena Dolomite.

The depth to groundwater ranges from 10 to 12 feet bgs, such that the water table elevation is situated one to three feet above the bedrock surface. The groundwater flow direction is to the southwest, with an approximate horizontal hydraulic gradient of 0.001 ft/ft. Vertical hydraulic gradients are negligible at the Site. The estimated hydraulic conductivity of the unconsolidated deposits is approximately 7×10^{-4} centimeters per second (cm/sec), and the estimated hydraulic conductivity of the bedrock aquifer is approximately 5×10^{-3} cm/sec.

1.5 Potential Receptors

No public or private potable wells, wetlands, documented sensitive habitats, or listed outstanding resource waters are located within 1,200 feet of the Site. No surface waters, buried utilities or adjacent structures appear to have been impacted by the release. A city storm sewer traverses the alley south of the Site and through the parking lot east of the Site. Storm water catch basins are present in the alley and parking lot to the east. The on-site water and sanitary service exits to Maple Avenue from the north side of the building. A concrete basement is present at the Site.

The school building adjacent to the western Site boundary has a partial basement below the gymnasium that contains a boiler room and shop. The basement is concrete and the floor is situated approximately 15 feet bgs. Observations made during the MSA Site Investigation revealed that groundwater seeps into the eastern edge of the basement, flows along the floor, and runs into a floor drain. Vapors were not reported by the occupants, and no solvent orders were reported associated

with the seep water. The basement was also monitored by MSA for vapors during the course of air-hammer drilling associated with the bedrock wells. No vapors were reportedly detected with a photoionization detector (PID) during the MSA investigation.

2.0 Site Remedial Action Objectives

The remediation of the former Beaver Cleaners Site is regulated under WAC Chapters NR 140, and NR 700 to NR 750. Relevant state and federal laws are provided in these Chapters by reference. The constituents of interest in Site soil, and their respective remedial objectives (assuming unrestricted regulatory case closure) are provided below.

By comparing constituent concentrations detected in soil samples collected as part of the previous subsurface investigations within the intended SVE treatment zone at the former Beaver Cleaners Site with NR 720 WAC RCLs, the following constituents of interest in soil and their associated non-industrial land use RCLs are identified:

	Groundwater Pathway	Direct Contact
	SSRCL	SSRCL
Tetrachloroethene (PCE)	4.1 µg/kg	1,230 µg/kg
Trichloroethene (TCE)	3.7 µg/kg	160 µg/kg

3.0 Selected Remedial Technology

3.1 Evaluation of Remedial Alternatives

At the request of the WDNR, AECOM has completed an evaluation of applicable remedial alternatives to remediate the residual impacted vadose zone soils at the Site. The evaluated remedial alternatives included in-situ chemical oxidation using potassium permanganate, and soil vapor extraction (SVE). Pursuant to the AECOM correspondence dated April 27, 2011 and based on an evaluation of effectiveness, implementability and economic criteria, AECOM recommends that the residual impacted vadose zone soils at the Site be remediated using SVE technology. SVE, also known as "soil venting" or "vacuum extraction", is an *in-situ* remedial technology that reduces concentrations of VOCs adsorbed to soils in the unsaturated (vadose) zone. In this technology, a vacuum is applied through extraction wells near the source of contamination in the soil. Volatile constituents of the contaminant mass "evaporate" and the vapors are drawn toward the extraction wells. Extracted vapor is then treated as necessary (commonly with carbon adsorption) before being released to the atmosphere. SVE is most effective in removing VOCs at sites with homogeneous, relatively coarse grained soils where the water table is sufficiently deep such that upwelling of groundwater into SVE wells does not occur.

3.2 SVE Processes

SVE is an in-situ unsaturated (vadose) zone soil remediation technology in which a vacuum is applied to the soil to induce the controlled flow of air and remove VOCs from the soil. The gas leaving the soil may be treated to recover or destroy the contaminants, depending on local and state air discharge regulations. Vertical extraction vents are typically used at depths of several feet or greater and have been successfully applied as deep as 300 feet. Horizontal extraction vents (installed in trenches or horizontal borings) can be used as warranted by contaminant zone geometry, drill rig access, or other site-specific factors. Geomembrane covers are sometimes placed over the soil surface to reduce short circuiting and to increase the radius of influence of the SVE wells. Groundwater depression pumps may be used to reduce groundwater upwelling induced by the vacuum or to increase the depth of the vadose zone. Air injection is effective for facilitating extraction of deep contamination, contamination in low permeability soils, and contamination in the saturated zone.

3.3 Application of SVE at Former Beaver Cleaners Site

Implementation of the SVE system will reduce migration and actively extract VOCs from the vadose zone subsurface at the former Beaver Cleaners Site. The SVE system layout and details are shown on Figures 4 and 5, respectively. The SVE system will consist of eight SVE wells installed outdoors near the periphery of the former excavation. The SVE wells will extend approximately 6 feet below grade, to just above the water table. The SVE wells will be constructed of 2-inch diameter schedule 40 PVC with 4 foot slotted (0.010 inch) well screen backfilled with a graded filter pack. The upper 1.5 feet of the annual space between the boring and the well casing will be sealed with bentonite and / or concrete to provide a surface seal. The SVE wells will be constructed to allow for monitoring vacuum pressure, vapor sampling (if required) and to maintain system performance.

The SVE wells will be connected to a common manifold system installed above-grade, and will be completed with an inline valve to regulate vacuum pressure and air flow. Each manifold will transfer vapors to a mechanical extraction system consisting of a vacuum blower, condensate separator and electrical control panel. AECOM anticipates that this equipment will be housed in a small (6 foot by 8 foot) enclosure located adjacent south of the existing building. A pressure gauge will be attached to the vacuum manifold between the condensate separator and blower to allow for monitoring of SVE system performance.

A pitot tube assembly (Dwyer Model 160-8P, 5/16-inch diameter with an 8-inch insertion length) will be installed within the vapor discharge pipe. A dual scale magnehelic differential pressure gauge will be attached to the pitot tube. Also attached to the discharge pipe will be a thermometer capable of recording temperatures between -20 to 160 degrees Fahrenheit, and a sampling labcock valve to allow for monitoring vapor emissions.

Electrical service to the SVE equipment may originate from one of the existing main control panels located in the facility building, or a new service may be required. The vacuum blower will be controlled by an on/off switch (with motor starter) that will be attached to the wall of the facility building and secured within a lockable enclosure.

To eliminate operating costs associated with vapor emission treatment, AECOM anticipates operating the SVE system at a rate which will limit vapor emissions to meet the following regulatory criteria:

- WAC NR 445 Regulatory Threshold: 9.11 lbs per hour or 301 lbs per year for PCE, and 14.4 lbs per hour or 888 lbs per year for TCE; and,
- WAC NR 406 General Exemption: 5.7 lbs per hour for total VOCs.

4.0 Confirmation Sampling

During system startup, operating conditions of each vapor extraction well will be evaluated and adjusted, as necessary, to balance the system to provide efficient remediation. Vapor samples of air emissions from the extraction system will be collected for chemical analyses in accordance with regulatory guidance. During system operations, the SVE system performance will be monitored based on the following anticipated schedule:

- Once during initial startup of the system operation;
- Once a week for the following three weeks; and,
- Quarterly thereafter for one year.

During each site visit, AECOM will measure vacuum pressure at each SVE well and adjust the system as necessary to maintain optimum system performance. In addition, airflow rates at the air emission discharge stack will be recorded and vapor emissions will be screened with a flame ionization detector (FID) to estimate the VOC mass removal. The system flow rate will be modified, if necessary, to maintain VOC discharge rates within the regulatory criteria identified above. On a quarterly basis, AECOM will collect a vapor emission sample for analysis to determine individual VOC emissions.

Pursuant to WAC NR 724.15, a Construction Documentation Report will be prepared after installation of the SVE system, which will include the following information: a summary of the remedial action and documentation that the design and construction was carried out in accordance with the specifications provided herein; an explanation of any minor changes to the technical approach and the rationale for those changes; and a description of the public health and environmental laws applicable to the contamination and the remedial action selected.

Upon termination of SVE system operations, subsurface soils samples will be collected to evaluate residual VOC concentrations. Specifically, four hand-augered soil samples will be collected from approximate depths of four feet below ground surface; each of these four soil samples will be collected from the vicinity of one of the walls of the former excavation. The collected soil samples will be submitted for laboratory analysis of VOCs.

A groundwater monitoring program will be implemented following installation of the SVE system to evaluate the effectiveness of the vadose zone remedial action. Groundwater samples will be collected from the existing monitoring well network on a periodic basis using low flow sampling methods, and submitted for laboratory analysis of VOCs. The groundwater samples will be analyzed with a reporting limit of 0.2 µg/L for VC (which is the ES for VC). In addition, field instruments would be used to measure geochemical parameters, including dissolved oxygen and oxidation-reduction potential.

The monitoring well network will consist of the eight existing monitoring wells located near the former Beaver Cleaners Site. The monitoring wells are identified as MW-1A, MW-1B, MW-2, MW-3, MW-4A, MW-4B, MW-5 and MW-6. One quality assurance/quality control (QA/QC) duplicate groundwater sample and one QA/QC laboratory trip blank sample will be submitted for laboratory analysis of VOCs as part of each monitoring event. For cost estimating purposes, AECOM assumes that the natural attenuation monitoring will be conducted for a minimum four monitoring events, to supplement data

obtained from previous groundwater monitoring events. Additional rounds of groundwater monitoring may be necessary to demonstrate stable or declining VOC concentrations to achieve site closure.

5.0 Schedule for Implementation of Remedial Action

Based on the assumption that AECOM receives authorization to proceed with the remedial tasks identified herein by August 1, 2011, we estimate the following task completion milestone dates:

1. Construction and Start-up of SVE System – August 2011
2. Completion of WAC NR 724.15 Construction Documentation Report – October 2011
3. Completion of Four Groundwater Monitoring Events – November 2011, February 2012, May 2012 and August 2012.

Based on experience with similar sites, operation of the SVE system is anticipated to extend over a period of one to two years.

6.0 References

Dragun, J., 1988, The Soil Chemistry of Hazardous Materials, Hazardous Materials Control Research Institute, Silver Spring, Maryland.

Mackay, D., W.Y. Shiu, and K.C. Ma, 1992 Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals; Monoaromatic Hydrocarbons, Chlorobenzenes, and PCBs. Lewis Publishers Inc., Chelsea, Michigan.

Yaws, C.L., 1992, Thermodynamic and Physical Property Data, Gulf Publishing Company, Houston, Texas.

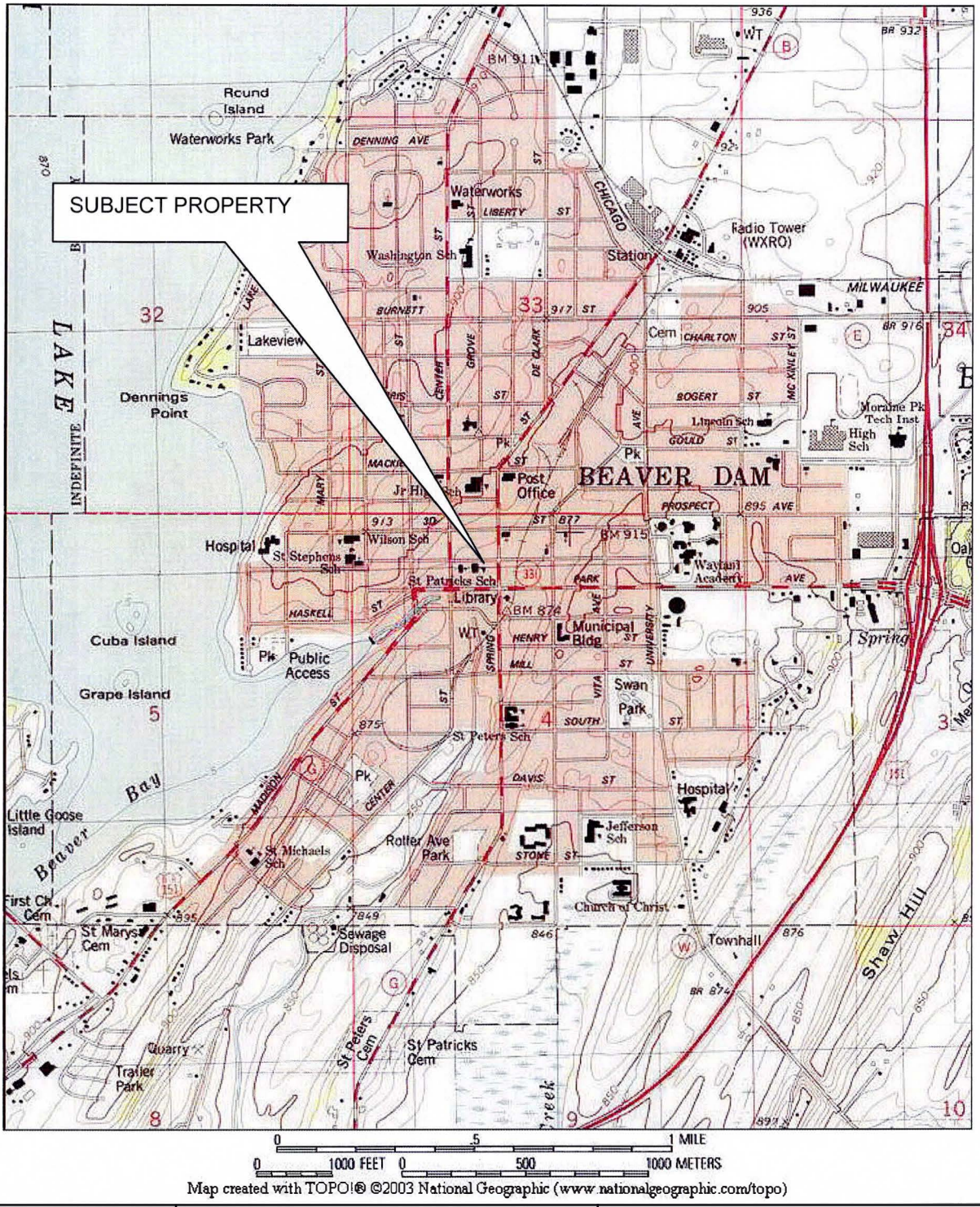
7.0 Certification

I, Mark M. Mejac, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03(1), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. 700 to 726, Wis. Adm. Code.

Mark M. Mejac

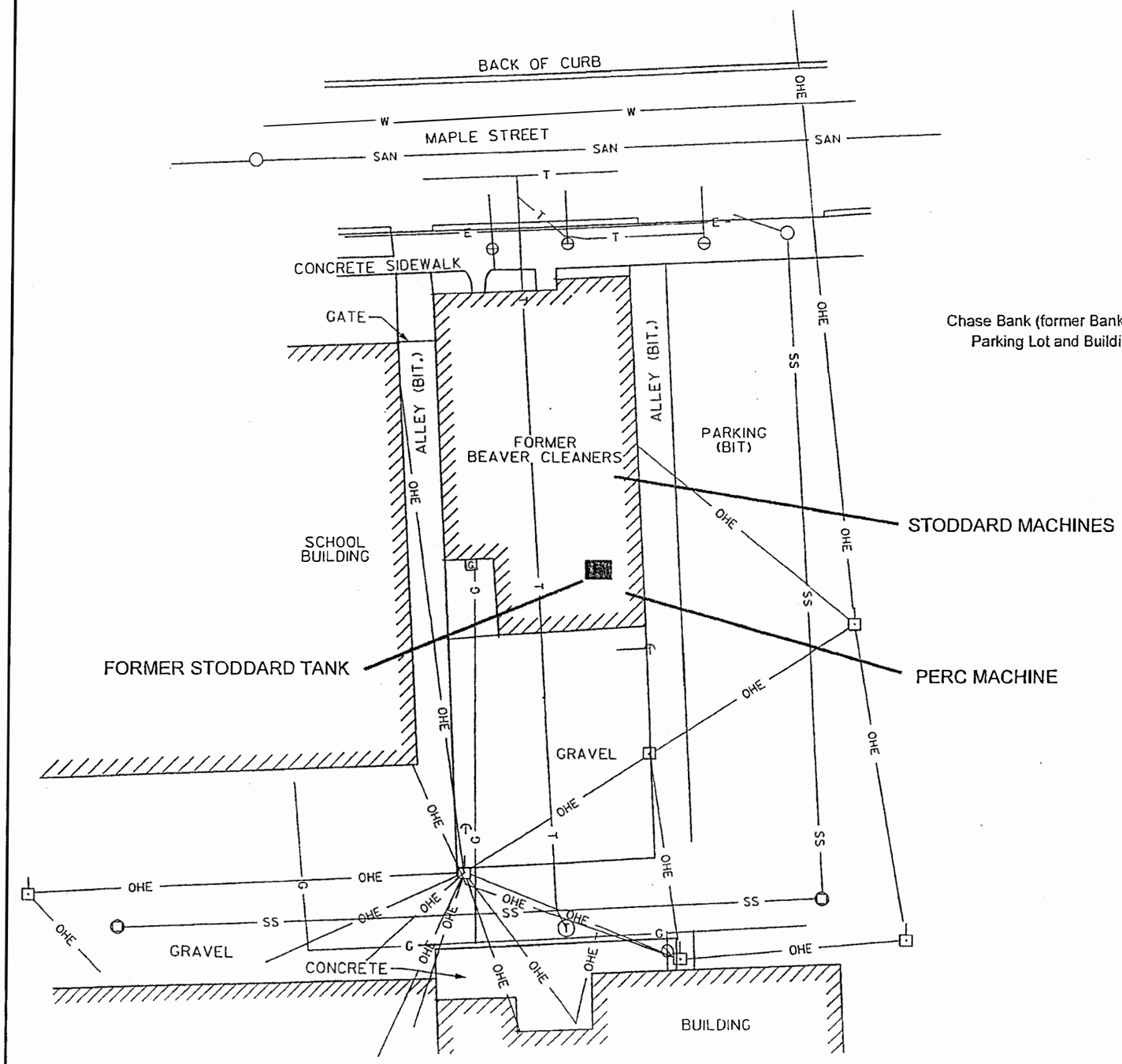
Mark M. Mejac, P.G.
Senior Hydrogeologist

Figures



Map created with TOPO!® ©2003 National Geographic (www.nationalgeographic.com/topo)

AECOM	BEAVER CLEANERS BEAVER DAM, WISCONSIN	Site Location 60139756 Figure 1



NOTE: BASE MAP FROM DRAWING BY MSA PROFESSIONAL SERVICES DATED 10/12/2004

LEGEND

	POWER POLE
	GUY WIRE
	VALVE
	CATCHBASIN
	MANHOLE
	GAS METER
—— T ——	UNDERGROUND TELEPHONE
—— E ——	UNDERGROUND ELECTRIC
—— G ——	NATURAL GAS
—— W ——	WATER MAIN
—— SS ——	STORM SEWER
—— SAN ——	SANITARY SEWER
—— OHE ——	OVERHEAD ELECTRIC

N
W E
S

30 0 30
SCALE IN FEET

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SITE LAYOUT MAP
BEAVER CLEANERS
BEAVER DAM, WISCONSIN

Drawn :	CJH	8/22/2008
Checked:	MMM	8/22/2008
Approved:	MMM	8/22/2008
PROJECT NUMBER	60139756	
FIGURE NUMBER	2	

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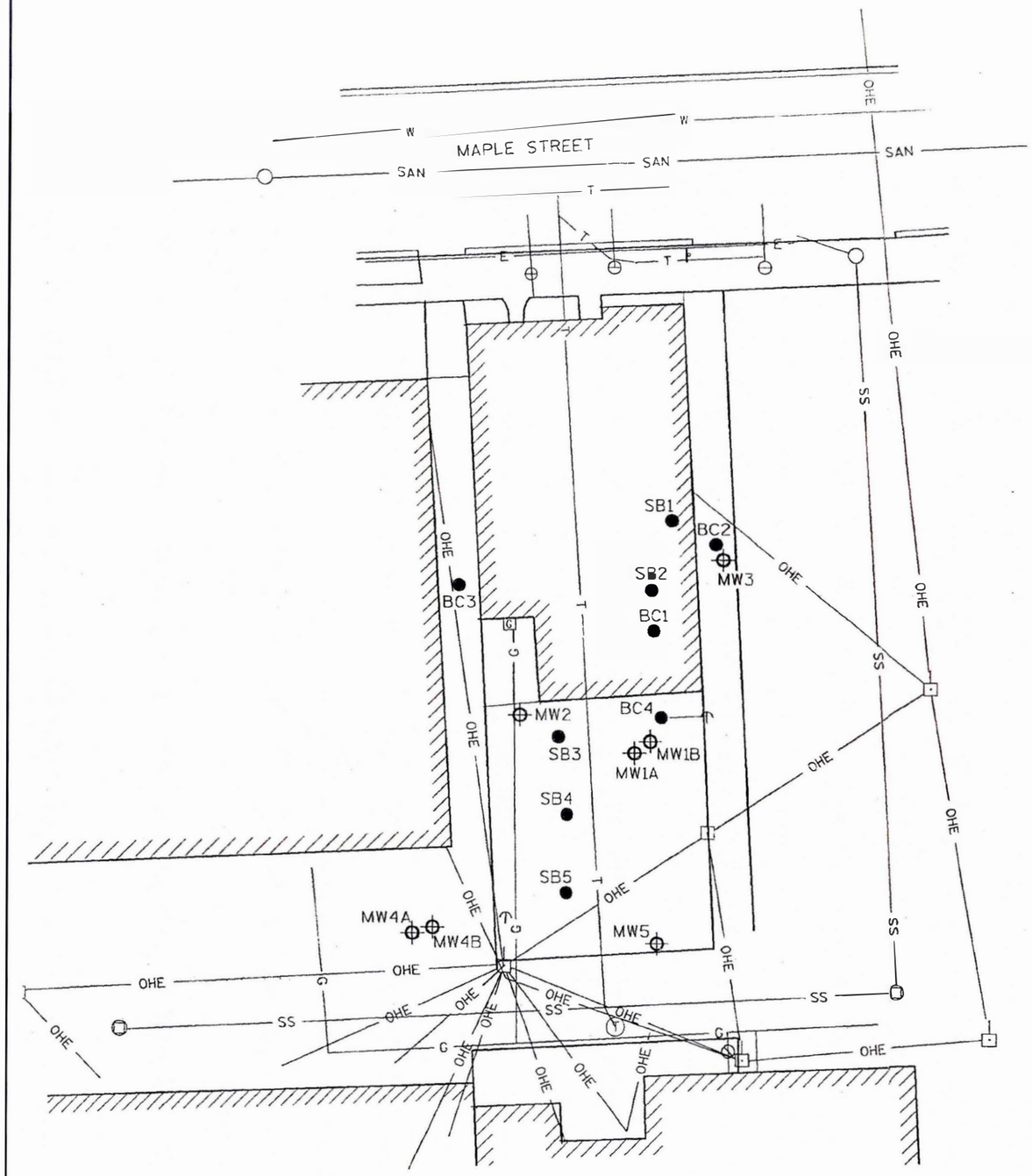

LEGEND

● SOIL BORING

⊕ MONITORING WELL

NOTE:
FOR ADDITIONAL NOTES AND LEGEND, REFER TO FIGURE 2.

N
W E
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30 0 30
SCALE IN FEET

NOTE: BASE MAP FROM DRAWING BY MSA PROFESSIONAL SERVICES DATED 4/7/2006

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SOIL BORING AND MONITORING WELL LOCATIONS

BEAVER CLEANERS
BEAVER DAM, WISCONSIN

Drawn:	CJH	8/22/2008
Checked:	MMM	8/22/2008
Approved:	MMM	8/22/2008
PROJECT NUMBER	60139756	
FIGURE NUMBER	3	

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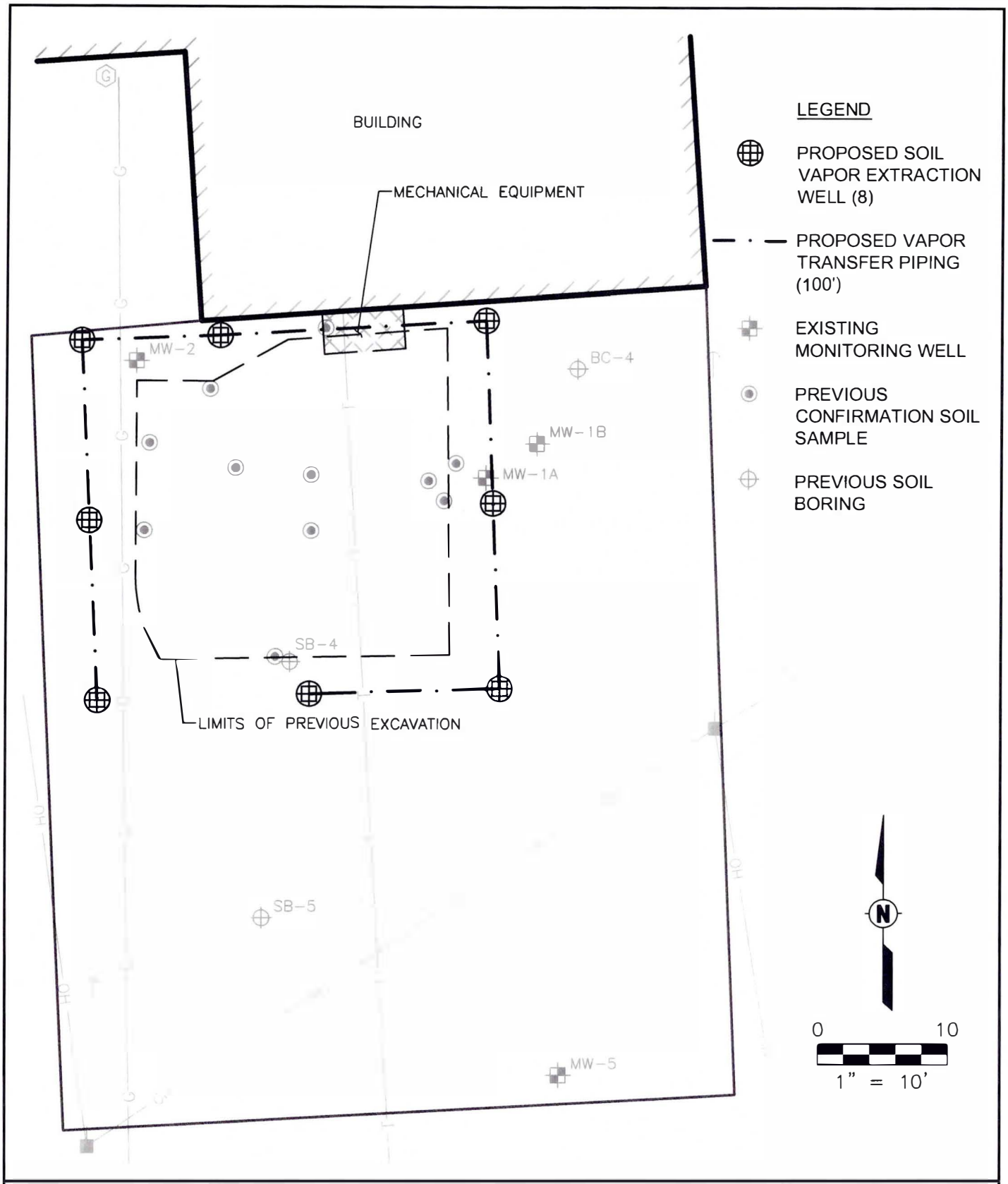

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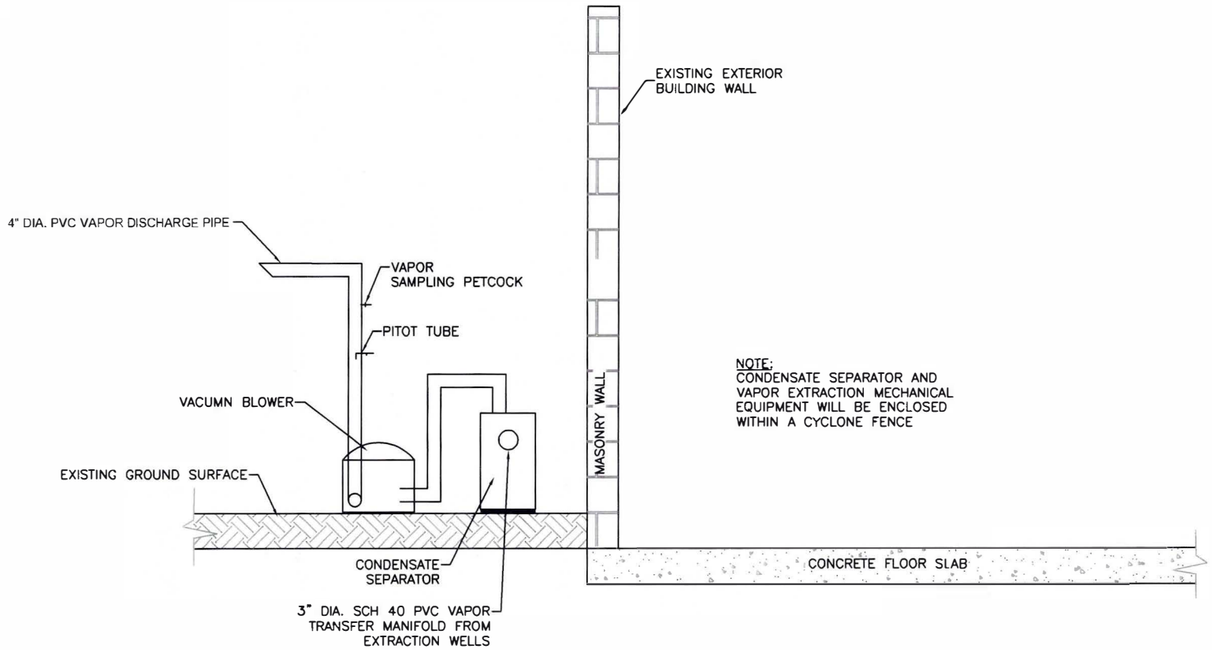
SOIL VAPOR EXTRACTION SYSTEM LAYOUT

BEAVER CLEANERS
BEAVER DAM, WISCONSIN

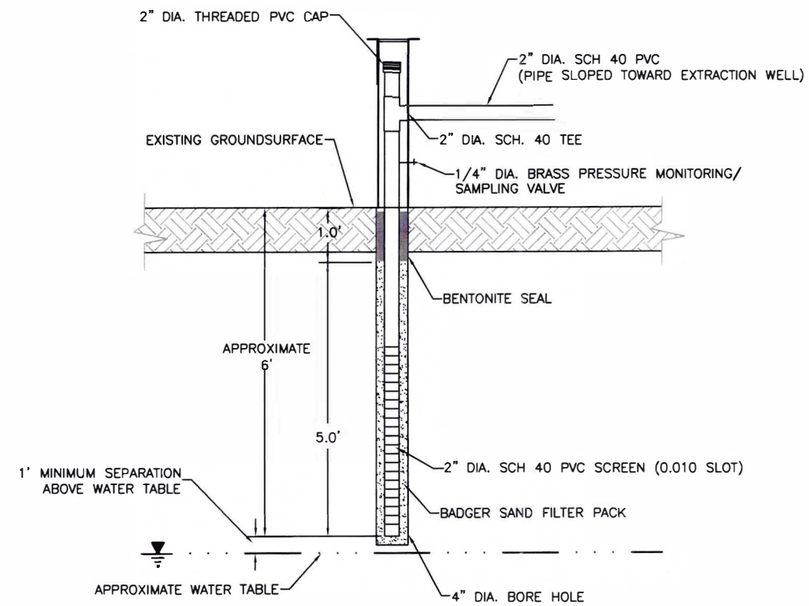
Drawn:	CJH	2/1/2011
Checked:	MMM	2/1/2011
Approved:	MMM	2/1/2011
PROJECT NUMBER	60139756	
FIGURE NUMBER	4	

X:\projects\60139756\dwg\Figure 2 . soil vapor extraction system layout.dwg; 6/14/2011 9:09:51 AM; RILEY, CRAIG; STS.stb



VAPOR EXTRACTION EQUIPMENT DETAIL

SCALE: N.T.S.



TYPICAL VAPOR EXTRACTION WELL DETAIL

SCALE: N.T.S.

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SVE DETAILS

FORMER BEAVER CLEANERS SITE
BEAVER DAM, WISCONSIN

Drawn :	CJH	6/8/2011
Checked:	MMM	6/8/2011
Approved:	MMM	6/8/2011
PROJECT NUMBER	60139756	
FIGURE NUMBER	5	

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