Remedial Design

Groundwater Remediation - ISCO
Brownfield Cleanup Program
South Hill Business Campus
950 Danby Road
Ithaca, New York

BCP Site # C755012

June 2008

S&W
REDEVELOPMENT

REMEDIAL DESIGN
BCP SITE No. C755012
GROUNDWATER REMEDIATION - ISCO
BROWNFIELD CLEANUP PROGRAM
SOUTH HILL BUSINESS CAMPUS
950 DANBY ROAD
ITHACA, NEW YORK

Prepared for

New York State Department of Environmental Conservation
Division of Environmental Remediation
615 Erie Boulevard West
Syracuse, New York 13204

Prepared on Behalf of

South Hill Business Campus, LLC
950 Danby Road
Ithaca, New York 14850

June 2008

Project No.B4001

S&W
REDEVELOPMENT

ISCO REMEDIAL DESIGN
TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

SECTION 1 - INTRODUCTION

South Hill Business Campus, LLC (SHBC) is a Volunteer in the New York State Brownfield Cleanup Program (BCP). As part of a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC), the Volunteer has completed a Remedial Investigation (RI) at the South Hill Business Campus, located at 950 Danby Road, Ithaca, New York. See Figure 1 for the site location.

The history and environmental conditions at the site are described in the *Remedial Investigation Report* prepared by S&W Redevelopment of North America, LLC (SWRNA, January 2008). Figure 2 shows the site plan with RI sampling locations. The Volunteer is prepared to proceed with the remedial action component of the BCA, and submitted to NYSDEC a Remedial Work Plan (RWP – SWRNA, March 2008) based on the findings of the RI and the ongoing commercial use of the site. The RWP was subsequently approved by NYSDEC/NYSDOH.

The remedial activities for the SHBC site will address the following items, as described in the RWP:

- Remaining on-site sources of contamination, which include the two former 9,000 gallon underground storage tanks (USTs), will be assessed and if contamination is present removed along with contaminated soil surrounding them. This action will be taken to address potential sources of contamination that remain at the site in relation to past manufacturing operations.

- Groundwater will be treated to reduce contaminant levels and preclude off-site migration of on-site groundwater contamination. In-Situ Chemical Oxidation (ISCO) will be used to remediate the groundwater contaminants, including trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride (VC). The treatment will involve the injection of potassium permanganate in a series of injection points. The injection point array, the amount of potassium permanganate injected, and the number of injections will be determined based on field and laboratory pilot tests, and presented in a remedial design document that will be reviewed and accepted by NYSDEC prior to implementation.

- Institutional controls will be implemented, which will restrict future use of the site to commercial use, and prohibit the use of site groundwater without proper treatment and prior approval by NYSDEC/NYSDOH.

- Engineering controls were installed as an Interim Remedial Measure (IRM). The IRM included installation of a sub-slab depressurization system (SSDS) in 2007 to prevent soil vapor intrusion (SVI) in the southern portion of the building near the suspected contaminant source. Sub-slab depressurization will also be applied to western rooms that jut-out from the main portion of the building. An air exchange system will maintain positive indoor air pressure in the northern portion of the building outside the SSDS target area. The SSDS and positive pressure air system will operate continuously to mitigate potential exposure of building occupants to potential soil vapor contamination. New occupied buildings within the BCP site boundary may need to be fitted with SSDS's and/or positive pressure air exchange systems if it is determined necessary to mitigate SVI in the future based on site conditions.

- A Site Management Plan (SMP) will be developed and implemented to maintain the institutional and engineering controls. This Plan will require periodic certification of the engineering controls. Post-implementation groundwater monitoring will be preformed under the SMP. If that data indicates that ISCO has not met remediation goals for this project, additional remedial measures will be evaluated for implementation.

The above remediation elements will be implemented on-site to meet the stated remedial action objectives for this site and support the intended end use.

The SSDS IRM/engineering controls were begun in 2007 and will be fully implemented in 2008. In addition, remedial actions were taken relative to the two 9,000 gallon USTs in March 2008 (see Section 2.3).

This Remedial Design Document addresses the implementation of the groundwater remedy for the site, which will utilize potassium permanganate to destroy site groundwater contamination by ISCO.

Following final implementation of the specified elements of the site remedy, a Final Engineering Report (FER) will be provided to document that the specified remedial actions have been implemented as proposed. The SMP will be appended to the FER.

SECTION 2 - PROJECT OVERVIEW

2.1 - NATURE AND EXTENT OF CONTAMINATION

The area of dissolved phase groundwater contamination containing TCE, DCE, and VC, extends downgradient – to the west/northwest – from the southwest portion of the building, affecting the lower tiered parking area and the low-lying wooded area beyond it. Figures 3 and 4 depict the approximate extent of overburden and shallow bedrock groundwater contamination, respectively.

Analytical data indicates TCE and DCE contamination levels in shallow bedrock decline by two orders of magnitude – from thousands of µg/L near the building source area (monitoring well MW06-24BR) to a few tens of µg/L at the most downgradient monitoring well (MW06-25BR):

Parameter	MW06-24BR (source zone)	MW06-25BR (downgradient)
TCE	2,200 µg/L	57 µg/L
cis-1,2-DCE	3,700 µg/L	42 µg/L

Downgradient monitoring well MW06-25BR is approximately 200 feet upgradient of the downgradient site boundary.

The RI Report compares analytical data from previous investigations to recent RI data, and indicates that chlorinated organic contaminants are being naturally attenuated in groundwater by degradation reactions. Eleven of the thirteen monitoring wells that were sampled during both the 2004 Source Area Investigation (ERM) and the 2006 RI (SWRNA) had lower levels of chlorinated organics in 2006. As indicated in the RI Report, the percent decrease in DCE between 2004 and 2006 was greater than that for TCE, which is evidence that the contamination is being naturally degraded, as opposed to being diluted (in which case the DCE and TCE levels would decline at the same rate).

Previous investigations and the RI indicate no evidence of dense non-aqueous phase liquid (DNAPL) at the site related to the observed dissolved phase TCE and DCE contamination. The orientation of the dissolved groundwater plume with respect to past site operations indicates that the two decommissioned 9,000 gallon USTs, and the

removed 6,000 gallon UST, were potential former sources of contamination. There is no evidence from the RI that groundwater contamination at the site is related to ongoing active sources of contamination. The RWP included further investigation of the two decommissioned 9,000 gallon USTs at the southwest corner of the building to confirm they are not potential sources. All other known potential sources (i.e. USTs in the former UST area) have been removed, and no other potential sources of contamination were identified by the RI.

The RI has also indicated soil vapor contamination exists, derived from the dissolved phase groundwater contamination. Soil vapor samples collected from vapor monitoring wells outside the building indicate elevated concentrations of VOCs near the groundwater contamination area on the west and southwest portion of the building. Elevated soil vapor levels appear to extend downgradient in the same direction as groundwater flow. An off-site soil vapor sample collected approximately 850 feet west of the downgradient site boundary also contained VOCs, however, it is not conclusive that there is a direct connection to site groundwater contamination. Soil vapor samples collected laterally away from the groundwater plume, and also adjacent to a sanitary sewer line, contained significantly lower levels of soil vapor than did vapor samples obtained from directly above the groundwater plume.

Soil vapor, sub-slab vapor, and indoor air data collectively indicate that soil vapors are present primarily below the southern portion of the building, near the groundwater contamination area, but are less evident to the north farther away from the potential source area. Sub-slab vapor samples that contained VOCs indicate that soil vapor intrusion is potentially possible.

Soil sample analytical results from the RI indicate that sixteen of the seventeen soil samples analyzed meet commercial soil cleanup objectives (SCOs) for brownfield sites. One of the 17 soil samples, collected near the edge of the lower parking lot, contained a single SVOC – benzo(a)pyrene – above commercial SCOs, which may merely reflect the presence of asphalt pavement. In addition to the RI soil samples, fifty five soil samples were analyzed during previous investigations. All of the previous soil samples analyzed, including seven samples collected below the building, met commercial SCOs.

In recognition of the potential for future soil vapor intrusion, the Volunteer installed a sub-slab depressurization system (SSDS) as a precautionary Interim Remedial Measure (IRM), in August 2007. The SSDS currently operates in the main southern portion of the building, in the vicinity of the groundwater contamination area. Post-installation pressure field extension (PFE) testing indicates the SSDS negative pressure field reaches all but the very northern-most portion of the building, and western rooms that jut out from the main building area. A positive pressure air exchange system will operate in the northern portion of the building away from the contaminant source area to prevent potential SVI in northern areas beyond the reach of the SSDS. Individual SSDSs will also be installed to prevent SVI in the individual western rooms that jut out from the main building area. As was done for the existing SSDS, Design Documents will be produced and submitted to NYSDEC for approval prior to implementing subsequent measures taken to address the western rooms. The SSDSs and positive air exchange systems will continue to operate in the future as necessary to prevent soil vapor intrusion. Operating requirements will be included in the SMP.

2.2 - SITE HYDROGEOLOGY

2.2.1 - GROUNDWATER OCCURRENCE

Groundwater at the site exists primarily in the upper weathered zone of shale bedrock. The overburden also contains groundwater, but overburden saturated thickness across much of the site is less than five feet, and in the main area where groundwater contamination exists, overburden saturated thickness is less than one foot. The upper weathered bedrock zone is therefore regarded as the principal water-bearing unit for this site, and the unit in which the majority of groundwater contamination exists.

Groundwater flows primarily within interconnected horizontal fractures in the upper bedrock zone. Rock cores retrieved from RI soil borings exhibit numerous horizontal fractures, but very little indication of vertical fractures.

The bedrock fracture density diminishes with depth, based on an examination of rock cores that show an increase in the rock quality designation (RQD) with core depth. Figure 5 shows the measured RQD for bedrock cores retrieved from RI soil borings, versus the bottom depth of each core below the top of weathered bedrock as determined

by split spoon refusal depth. The pattern suggests an increase in RQD with depth. The average RQD for rock cores retrieved from the upper ten feet of weathered bedrock was 16.6%, whereas the average RQD for rock cores greater than 10 feet into bedrock was 34.8%.

The increase in RQD with depth is especially apparent for the rock cores from MW08-29BR, installed as a component of an ISCO pilot test (see Section 3.2.1), as shown on Figure 5. RQD values increased from 0% for the first rock core from MW08-29BR (2.5 ft – 4.6 ft below top of rock), to 42% (4.6 ft – 9.6 ft), 66% (9.6 ft – 14.6 ft), 68% (14.6 ft – 19.8 ft), and 78% (19.8 ft – 22.8 ft).

The decrease in fracture density depth infers that the water-transmitting capacity of the bedrock aquifer is likely to diminish with depth. This inference is substantiated by field observations that MW08-29BR (screened from 20.5 ft to 22.5 ft below top of weathered rock), two weeks after it was installed, produced enough water to fill a single 40 ml vial, but afterwards was dry.

2.2.2 - DRAINAGE SWALE

Monitoring well MW08-29BR was installed along a natural drainage swale that bisects the site from southeast to northwest (see Figure 2). Historic aerial photographs dating back to 1938 indicate that the swale was present prior to site development, suggesting it is a natural site feature. The USGS topographic map for the site (see Figure 1) also indicates a slight incision across the site where the swale is located, parallel to numerous similar features along the slope of South Hill that tend to form along fracture planes. A stormwater collection pipe for the site was evidently built within the depression of the swale to make use of the site's natural drainage patterns.

Groundwater flow at the site appears to be influenced by the swale. As was noted in the RI Report, the swale's orientation aligns with a zone of diminished overburden saturated thickness (Figure 6). Within the hydraulic influence of the swale the saturated thickness is less than one foot, but beyond its influence the saturated thickness is noticeably greater. The swale appears to dewater the overburden as it intercepts groundwater, and based on pilot test observations (see Section 3.2 below) the swale appears to be locally connected with horizontal fractures in the upper weathered bedrock zone.

Pilot test results (Section 3.2) indicate the degree of hydraulic communication between the swale and the surrounding bedrock diminishes with lateral distance from the swale. Communication between the swale and bedrock is also believed to diminish with depth, owing to the overall decrease in fracture density with depth, and particularly the absence of vertical fractures in rock cores. It is recalled that deep bedrock well MW08-29BR, despite its close proximity to the swale, contained very little groundwater and recharges only very slowly. This indicates bedrock under the swale, and below the upper weathered bedrock zone, has a very low water-bearing capacity.

2.2.3 - HYDRAULIC CONDUCTIVITY

In-situ hydraulic conductivity tests (i.e. "slug" tests) were conducted in the overburden and bedrock wells installed during the RI. The tests were performed as rising head tests, in which a bailer-full of water was rapidly evacuated from each well, and then allowed to recover.

The geometric mean conductivity value for all overburden and bedrock wells analyzed is 5.45×10^{-6} cm/sec. Overburden permeability is only marginally higher (geometric mean $K = 7.93\ E^{-6}$ cm/sec) than the permeability of the shale bedrock (geometric mean $K = 3.99\ E^{-6}$ cm/sec). Overall, hydraulic conductivity measurements ranged from 2.92×10^{-7} cm/sec (MW06-26BR) to 2.34×10^{-4} cm/sec (MW06-23BR).

The variability in the test results reflects factors inherent in the test methods. Hydraulic conductivity tests measure local aquifer conditions in close proximity to each well tested, by withdrawing (rising head test) or displacing (falling head test) a small volume (typically less than 1 gallon). For the bedrock wells screened in weathered shale, the estimates are biased by localized variability in horizontal fracture density. This results in orders-of-magnitude differences in hydraulic conductivity estimates for shallow bedrock, which for this site range from $2.34\ E^{-4}$ cm/s (MW02-23BR) to $2.92\ E^{-7}$ cm/s (MW06-26BR).

As indicated in the RI Report the raw test data were analyzed using Aquifer Test © software (version 3.01, Waterloo Hydrogeologic). The analysis utilizes common curve matching techniques to estimate hydraulic conductivity (K) based on the slope of a

groundwater recovery curve. In many cases manual curve matching must be applied, subject to the professional experience and judgment of the analyst, to select the segment of the recovery curve that best represents the water transmitting capacity of the aquifer. Due to this subjectivity, the resulting K estimates are subject to a degree of professional interpretation.

Figure 7 plots the hydraulic conductivity (K) estimates for overburden and bedrock monitoring wells, versus the approximate elapsed time for water level recovery to reach asymptotic conditions. The estimated K values for each well are fairly well aligned with the respective recovery times. This suggests that reasonable interpretation was applied to the raw test data, producing conductivity estimates based on the observed rates of recovery.

In general, groundwater recharge has been observed to be very slow following purging of site monitoring wells. Typically, monitoring wells had to be purged a day prior to sample collection to allow for adequate recharge overnight to fill sample bottles. Empirically, this suggests hydraulic conductivity is fairly low, which is consistent with the measured range (10^{-4} to 10^{-7} cm/s).

Recalling the scale-dependency of hydraulic conductivity testing, it is noted that slug tests measure local water-bearing properties of aquifer material by removing or displacing a small volume of water. In contrast, the ISCO approach will introduce thousands of gallons of potassium permanganate over a much greater area than can be measured by any individual slug test. On a larger scale, in particular where fracture flow is significant, it is expected that the actual hydraulic conductivity may potentially exceed estimates produced by localized slug tests. Nonetheless, the slug test results for the weathered bedrock can be used as appropriately conservative hydraulic conductivity estimates for the ISCO design.

2.3 - UNDERGROUND STORAGE TANKS (USTs)

Two 9,000 gallon underground storage tanks (USTs) located outside the southwest corner of the building reportedly received rinse water that contained waste solvent from former plating and heat treating processes, via trench drains located in the southwest portion of the building (see Figure 8). These two USTs were reportedly decommissioned in place in

1986, at the same time that the heat treating and plating facilities were dismantled. The two 9,000 gallon USTs were emptied and subsequently backfilled. The type of backfill used appeared to be a flowable aggregate type fill.

A third UST that also contained TCE was located just north of the heat treating/plating area (Figure 8). This 6,000 gallon UST was decommissioned and removed from the site in 1986.

The RWP indicated the two 9,000 gallon USTs that remained in place would be removed along with associated contaminated soil and groundwater as might be encountered during UST removal. These actions were proposed in the RWP because the USTs were considered a potential source of chlorinated organic groundwater contamination at the site, since they reportedly contained waste solvent when in use.

Soil excavation at the two 9,000 gallon USTs began on March 31, 2008, and continued into April 1, 2008. An NYSDEC representative was present on site, along with SWRNA and Town of Ithaca Public Works personnel, on April 1, 2008 to observe excavation at the two 9,000 gallon USTs. The previous day, upon excavating the top and sides of the USTs, it had been discovered that the USTs were filled in with what appeared to be stone aggregate and flowable fill. The walls of the USTs were 12 inches thick, reinforced with rebar, and lined on the inside with brick. The UST appeared to be coated on the outside with an asphaltic material commonly used for sealing underground structures. A soil sample that was coated with this material was submitted for qualitative analysis by method 310-13, and the results indicated chemical similarity to "motor oil". Analytical results are summarized on Table 1.

Excavation observed by NYSDEC and SWRNA on April 1, 2008 indicated that the USTs were intact, with no evidence of leaks or cracks on the exterior walls of the USTs. Based on visual observations and photoionization detector PID readings, there was no indication of volatile organic compound (VOC) contamination in soil or groundwater in proximity to the USTs. A sheen of light non-aqueous phase liquid (LNAPL) was observed on groundwater at the bottom of the excavation adjacent to the USTs. Because there were no indications of VOC impacts by PID screening, it appeared that the LNAPL was residual coating material from the exterior walls of the tanks that over time had eroded off of the tanks. Sorbent pads were used to soak up residual LNAPL, and were

subsequently retrieved from the excavation for off-site disposal. Because the USTs did not appear to represent a source of chlorinated organic groundwater contamination identified at the site, they were left in place, with NYSDEC concurrence.

Two vitrified clay drain tiles were discovered at the base of the two USTs, which joined to a single drain line that connected to the sanitary sewer approximately 60 feet west of the USTs. It was discovered that an existing groundwater monitoring well, MW-08, had been installed immediately adjacent to the juncture of the two drain lines with the single line. This well was removed as a consequence of the soil excavation.

With the concurrence of NYSDEC and Town of Ithaca Public Works personnel, the drain line was disconnected, and both ends (at the USTs and at the entrance to the sewer) were sealed with grout.

Soil excavation was stopped on the afternoon of April 1, 2008, with NYSDEC concurrence, after end-point soil samples were collected from the excavation sidewalls. A bottom soil sample and groundwater sample were also collected. Analytical results for the end-point soil samples are presented on Table 1, and indicate volatile organic compounds (VOCs) in the samples were below commercial soil cleanup objectives (SCOs).

Excavated soil was screened with a photoionization detector (PID) and examined for visible/olfactory signs of contamination. PID screening did not indicate the presence of contamination, but soil that had a visible coating of the aforementioned asphaltic material was segregated from soil that had no evidence of contamination. With NYSDEC concurrence, uncontaminated soil was used as backfill, along with clean crushed stone from an off-site source. Approximately fourteen (14) tons of contaminated soil was removed form the site and properly disposed at the City of Auburn Landfill.

Prior to backfilling the excavation, approximately 50 pounds of potassium permanganate powder was placed at the bottom of the excavation, with NYSDEC concurrence, to provide chemical oxidation of any organic contamination that might be present in the area. In addition, on April 2, 2008 SWRNA placed a four-inch diameter PVC well in the UST excavation pit, and backfilled the surrounding area with pea stone. The purpose of the well is for potential use as a future ISCO injection point if appropriate.

2.4 – REMEDIATION GOALS

The overall remediation goal for the site is to protect human health and the environment from site-related contamination, in a manner that supports redevelopment and reuse of the site to the benefit of the community. The remedial strategy will focus on eliminating or reducing potential human health exposure to site contamination.

In order to achieve site remediation goals, the following Remedial Action Objectives (RAOs) have been identified (RWP, SWRNA March 2008).

- remove, contain, or treat, to the extent practicable, potential on-site sources of contamination;
- prevent, to the extent feasible, potential future off-site migration of on-site groundwater and/or soil vapor contamination;
- eliminate, to the extent feasible, potential on-site environmental or public health exposures to on-site contamination that may remain in groundwater and/or soil vapor.

To address groundwater RAOs, an in-situ chemical oxidation (ISCO) system has been designed to treat groundwater contamination by chemical oxidation processes. By reducing the contaminant mass at the site, this system will permanently reduce the potential for future migration of, and exposure to, site contaminants.

The basis of design and the conceptual approach to implement the ISCO groundwater treatment system as originally outlined in the RWP have been appropriately modified to account for the results of field-scale pilot testing. The following sections provide a more detailed discussion of the ISCO system design.

SECTION 3 - EVALUATION OF REMEDIAL APPROACH

As noted in the RWP, the ISCO objective is to target the "core" of the groundwater contamination near the site building. Soil excavation around the two 9,000 gallon USTs did not provide evidence that a contamination source is present in that area. The focus of the ISCO approach will be the former UST area, in particular where a 6,000 gallon solvent tank was formerly located, and the area of monitoring wells where groundwater contamination is most apparent, including overburden wells MW-5 and MW-7, and bedrock wells MW06-23BR and -24BR.

The RWP indicated that both overburden and bedrock groundwater will be targeted. However, the results of the pilot test indicate that the upper weathered bedrock zone should be the principal target (see Section 3.2). During the pilot test, no groundwater was observed in overburden observation wells installed around MW-7, and in general the RI identified less than one foot of saturated thickness in overburden in the target area of groundwater contamination.

ISCO injection near the site building will treat the source area of contamination, and post-implementation groundwater monitoring will be conducted downgradient of the injection zone to establish ISCO effectiveness. It is proposed that potassium permanganate be applied to a network of trenches dug into the top of bedrock, in which horizontal well screens will be installed. ISCO by potassium permanganate has been identified by NYSDEC's Division of Environmental Remediation (DER) as a presumptive/proven remedial technology for VOCs in groundwater, including chlorinated VOCs such as TCE and its degradation products (DER-15, February 2007).

A slotted horizontal screen in each trench will connect with a vertical riser. Horizontal injection is recommended over vertical injection points to increase contact with fractures and thereby maximize dispersion of the oxidant into the weathered bedrock zone. The objective will be to inject the oxidant such that it will naturally disperse along the same pathways by which the contaminants may have migrated.

3.1 - BENCH TEST

Carus Chemical Company performed a bench test of aquifer material from the site in March 2008 to determine the permanganate soil/site groundwater oxidant demand (PSOD). The permanganate demand is the amount of permanganate consumed in a given amount of time. Natural soil and rock typically contain reduced minerals that may consume oxidants such as potassium permanganate when injected into the matrix. It is therefore essential to measure the oxidant demand of the aquifer matrix to estimate the proper potassium permanganate dose.

The bench tests were conducted on both overburden soil samples as well as rock material retrieved from shallow bedrock cores from the site. The bedrock samples were broken into small pieces by the laboratory analyst (> 1 gram), and placed in reaction vessels in which potassium permanganate solutions were added.

Tests were run on soil and bedrock samples at three different permanganate strengths (low dose, medium dose, high dose). This was done to measure how the reaction rate increases as the permanganate strength increased. Because the rate of oxidant consumption may increase as the permanganate dose increases, there may be a loss of reaction efficiency at higher doses.

The bench test results are expressed as permanganate soil oxidant demand (PSOD), as presented below:

Permanganate Concentrations	Soil PSOD (per 48 hours)	Bedrock PSOD (per 48 hours)
2.9 g/kg (low dose)	> 2.9 g/kg	1.8 g/Kg
14.3 g/kg (medium dose)	12.2 g/kg	3.3 g/Kg
28.7 g/kg (high dose)	18.8 g/kg	4.1 g/Kg

The measured PSOD indicates the grams of permanganate consumed per Kg dry weight of soil/rock at the indicated dosages over a 48-hour period. Overall, site bedrock exerted a low permanganate demand, and the overburden soil exerted a moderate demand. According to Carus, sites with a permanganate soil demand less than 35 g/Kg at 48 hours for the high permanganate dose are favorable for ISCO with permanganate.

Because the aquifer matrix is composed of rock, and due to the standard test methods employed, the measured PSOD is likely to overstate the actual, or effective, PSOD. The rock samples collected from cores had to be broken into small pieces (less than one gram) to enable bench testing. This significantly increased the reaction surface area of the rock matrix. In addition, it is standard procedure to invert the sample vessel once during the 48 hour test, which agitates the sample and increases reactivity. Although this is standard procedure, it produces a conservative estimate of PSOD that typically exceeds the actual in-field value. Based on empirical observations from numerous test sites, Carus has indicated that the *effective* PSOD is typically 10 to 20 percent of the measured PSOD from bench tests (personal communication). For the type of fractured rock matrix at this site, it is expected that the effective PSOD will not significantly exceed 0.41 g/Kg.

3.2 - PILOT TEST

A pilot test was conducted in March 2008 to collect hydraulic data for ISCO system design, including radius of influence (ROI), travel time, mounding, and injection flow rates. The planned approach was to inject approximately 500 gallons of a chemical oxidant (potassium permanganate solution) into two existing site monitoring wells (overburden well MW-07 and bedrock well MW06-24BR), which are located in close proximity to the drainage swale that traverses the site from east to west, and where the highest concentrations of groundwater contamination had been identified.

3.2.1 - PILOT TEST OBSERVATION WELLS

Four (4) overburden observation wells (OW-1, OW-2, OW-3, OW-4) and 4 bedrock observation wells (ROW-1, ROW-2, ROW-3, ROW-4) were installed adjacent to pilot test injection wells MW-7 and MW06-24BR, between March 5 and March 11, 2008 (see Figure 8). The observation wells were checked during the pilot test injection to monitor the dispersion of the oxidant into the subsurface. Boring logs for MW-07, MW06-24BR, and the eight observation wells (OW-1 through -4 and ROW-1 through -4) are included as Appendix A.

In general, the overburden observation wells were completed approximately 15 to 16 feet below ground surface (bgs), with 5 feet of well screen set at the top of the bedrock (see boring logs, Appendix A). The bedrock observation wells were completed approximately 22.5 to 26.5 feet bgs. To be consistent with the pre-existing bedrock wells used for pilot

test injection (MW06-23BR and MW06-24BR), the bedrock observation wells were constructed with two feet of well screen approximately 7 to 10 feet below the top of bedrock.

All four overburden observation wells were dry after their installation. Wells OW-3 and OW-4 contained traces of water during the pilot test, but not enough to produce a measurable amount in a bailer. Wells OW-1 and OW-2 contained measurable water near the end of the pilot test, ten days after they were installed.

The depth to groundwater in the rock observation wells, during drilling and after well completion (March 11, 2008), is indicated below:

Well I.D.	Total Well Depth (ft)	Depth To Bedrock (ft)	Depth to Groundwater (ft) During Drilling	Depth to Groundwater (ft) After Completion
ROW-1	26.5	16	dry	11.71
ROW-2	26.5	18	17.5	15.56
ROW-3	22.4	9	dry	11.51
ROW-4	22.5	12	dry	18.68

Two additional observation wells were installed as a bedrock well couplet (MW08-29/29BR), along the drainage swale approximately 25 feet downslope of the drainage swale outfall. The purpose of the couplet was to supplement the findings of the pilot test injections (see Section 3.2.4) that indicate overburden and shallow bedrock groundwater, in the main area of groundwater contamination near the swale, flows preferentially to the swale and discharges to the surface west of the parking lot. The two wells are located at the edge of the swale, screened within the upper weathered bedrock zone, and below the weathered bedrock zone, respectively:

Well I.D.	Date Installed	Total Well Depth (ft)	Depth To Bedrock (ft)	Depth To Groundwater (ft)
MW08-29	4/7/08	7	3.5	~0.5
MW08-29BR	3/25-26/08	27	4.5	23.5

3.2.2 - PRE-TEST GROUNDWATER ANALYTICAL RESULTS

Prior to the pilot test, groundwater samples were collected from the bedrock observation wells, plus pre-existing monitoring wells MW-1, MW-5, MW-6, MW-11, MW-12,

MW06-23BR, MW06-25BR, BR-1S, and BR-1D. As previously indicated, overburden observation wells OW-1 through OW-4 were dry, as well as MW07-28 inside the building.

Groundwater analytical results are included in Appendix B. The groundwater samples were analyzed for VOCs (8260) and field parameters (pH, Eh, dissolved oxygen, specific conductance, temperature). Pre-pilot test analytical results for March 2008 are summarized on Table 2, along with previous RI analytical data from 2006 where available.

The March 2008 groundwater analytical results are similar to the 2006 RI analytical results, indicating good reproducibility. While certain fluctuations are apparent, on the whole the same parameters were detected for each event, and the magnitude of detected concentrations is fairly consistent.

3.2.3 - SSDS EXHAUST AIR ANALYSIS

An air sample was collected before the pilot test from the exhaust of the sub-slab depressurization system (SSDS) currently operating at the site. This was done in accordance with the RWP, to compare with a second sample to be collected immediately after the conclusion of the pilot test.

Air sample results for the pre-pilot test exhaust sample (Stack: March 2008) are included in Appendix B, and are presented on Table 3 compared with exhaust sample results shortly after SSDS start-up (November 2007: S-1, S-2, S-3). Relative to the November 2007 results, the March 2008 analysis indicates lower concentrations of VOCs are present in the exhaust sample.

A second post-injection air sample was not taken because the pilot test could not be carried out in accordance with the NYSDEC- approved RWP.

3.2.4 - PILOT TEST INJECTIONS

The injection of potassium permanganate occurred from March 18 to 28, 2008. NYSDEC personnel were present to observe the injections.

Injection at overburden well MW-7 occurred first, followed by injection at bedrock well MW06-24BR.

a. MW-07. The pilot test began at MW-07 on March 18, 2008. To minimize head buildup the permanganate solution was gravity fed into MW-07, at an approximate flow rate of 2 gallons per minute (gpm). After approximately 125 gallons of permanganate solution had been introduced into MW-07 (approximately 30 minutes into the test), purple potassium permanganate solution was observed in the outfall down slope of the parking lot, in the drainage swale. There was no evidence of potassium permanganate in any of the eight observation wells. Pilot testing at MW-07 was stopped, and the outfall was visually monitored for the next several hours as the purple coloration gradually dissipated.

b. MW06-24BR. On the morning of March 19, 2008, water at the outfall was colorless, and so was groundwater in each of the four (4) bedrock observation wells. The 4 overburden observation wells were dry.

Permanganate solution left over from the previous day's batch was introduced at bedrock well MW06-24BR. Prior to injection, the depth to water in MW06-24BR was measured to be 16.12 feet. Approximately 3 minutes after injection commenced at approximately 2 gpm, permanganate solution had risen to near the top of the PVC riser. Injection was stopped to dissipate the head buildup. Eight minutes after stopping, the permanganate solution level had dropped to approximately 6 feet below the top of PVC. Based on the capacity of a 2-inch diameter well, which is 0.16 inches per foot, approximately 1 gallon of liquid was introduced into the aquifer as the hydraulic head declined 6 feet over the 8-minute period (1/8 gpm). When injection resumed at MW06-24BR, no coloration was observed in any of the observation wells or at the outfall. The flow rate was maintained at less than ½ gpm to prevent excessive head buildup.

After approximately 30 minutes, a total of approximately 15 gallons of permanganate solution had been injected into MW06-24BR. A faint purple color was again observed in water at the outfall, and injection was stopped. No purple coloration was apparent in any of the observation wells. A number of monitoring wells were also checked for purple coloration, including BRW-1S, BRW-2S, MW06-25BR, MW06-26BR, MW-11,

MW07-27BR, MW07-27OB, and MW06-23BR. No purple coloration was observed in any of these monitoring wells.

On the morning of March 20, 2008, no color was observed in the following monitoring/observation wells in proximity to MW-07 and MW06-24BR: MW-1, MW-6, MW-11, MW07-27OB, MW07-27BR, BRW-1S, BRW-1D, and ROW-1 through ROW-4. Overburden observation wells OW-1 through OW-4 each contained a small quantity of turbid groundwater (grayish brown), but no evidence of purple coloration. MW-07 and MW06-24BR contained deep purple water from the previous days' injections.

After conferring with NYSDEC about previous pilot test observations, it was decided to conduct additional pilot test injections at monitoring wells located further away from the swale than the two previous injection wells MW-07 and MW06-24BR. This included MW06-23BR (bedrock) and MW-8 (overburden).

c. MW06-23BR. A pilot test injection was conducted at MW06-23BR on March 20, 2008. The initial depth to water in bedrock well MW06-23BR was 13.06 feet below top of PVC. At an initial permanganate introduction rate of 3 gpm the well filled to the top of PVC almost immediately, after 2 gallons had been introduced. Injection was stopped and the fluid level began to immediately decline. The test was resumed 10 minutes later at a flow rate of less than ½ gpm, and it took approximately 2 minutes for fluid level to rise to the top of PVC, at which point the test was again stopped.

After seventeen (17) minutes the fluid level had dropped 8.51 feet, indicating that ~ 1.4 gallons had recharged the aquifer (~ 0.08 gpm). The test then resumed at ~ 1.5 gpm, and in slightly less than one minute the fluid level had risen again to the top of PVC. Permanganate injection proceeded during the course of the day as a sequence of injections, each of approximately 1.3 to 1.5 gallons, and separated by approximately 20 minutes. A total of ~ 20 gallons of permanganate solution was injected. No purple coloration was observed in any of the monitoring wells or observation wells checked during the course of the day. No purple coloration was observed at the swale outfall.

There was measurable water in overburden observation wells OW-1 and OW-2 for the first time on March 21, 2008. Bailers removed from these two wells contained

groundwater to approximately ¼ to ½ bailer capacity. The water was very turbid, but there was no evidence of purple color. Observation wells OW-3 and OW-4 remained dry.

d. MW-08. Overburden monitoring well MW-08 was located near the southwest corner of the site building, adjacent to the two 9,000 gallon former USTs. Permanganate solution was injected at MW-08 on March 28, 2008, and monitoring wells in the general area, including MW-2, MW-3, MW-9, MW-11, and MW-14, were monitoring periodically for permanganate breakthrough, along with the swale outfall.

Approximately 350 gallons of permanganate solution was injected into MW-08, and no coloration was apparent in area monitoring wells or at the swale outfall. As previously noted in Section 2.3, monitoring well MW-08 had been installed immediately adjacent to the connection of two UST drain lines with a line that ran to the sanitary sewer. It is suspected that permanganate injected at MW-08 may have seeped into the drain line preventing it from dispersing.

Monitoring well MW-08 was removed, with NYSDEC concurrence, during soil excavation around the former 9,000 gallon USTs (see Section 2.3).

3.2.5 – BEDROCK WELL COUPLET (MW08-29/29BR)

The initial pilot test injections at MW-07 and MW06-24BR verified that overburden and shallow bedrock near the swale, in the main area of groundwater contamination, is hydraulically connected to the swale. This connection was evidenced by breakthrough of permanganate solution at the swale outfall after it was injected into wells MW-07 and MW06-24BR. The evidence suggests that groundwater near the swale, where contaminant concentrations are highest, flows preferentially into the swale, and subsequently discharges to ground surface at the outfall.

The confirmation that groundwater flows preferentially to the swale and discharges at the outfall did not preclude the possibility that some groundwater contamination might also flow below the swale in bedrock, without discharging to the surface, past the outfall. To evaluate that possibility, a bedrock well couplet [MW08-29(shallow)/MW08-29BR(deep)] was installed at the edge of the drainage swale approximately 25 feet

downslope of the drainage swale outfall (Figure 2) as previously indicated in Section 3.2.1.

The bedrock well couplet tested the hypothesis that the swale exerts a localized hydraulic influence that captures groundwater in the contaminant source area close to the swale, causing the contamination to migrate preferentially into the swale, thereby minimizing migration of groundwater contamination in bedrock *below* the swale. This hypothesis would be supported if little or no groundwater contamination was detected in bedrock below the swale, downgradient of the contaminant source area.

Two groundwater samples were collected from deep bedrock well MW08-29BR (March 28 and April 14, 2008), and one sample was collected from well MW08-29 installed in the upper weathered bedrock zone (April 14, 2008). It is noted that very little groundwater was present in either well prior to sample collection, barely enough to fill 40 ml vials before the wells were purged dry. Table 4 summarizes the analytical results.

The groundwater sample collected from the upper weathered bedrock well MW08-29 (shallow) contained trichloroethene (TCE) slightly above groundwater quality standards (6.3 ug/L). Acetone was the only other VOC detected above standards (210 ug/L) in this groundwater sample. Acetone was also detected in the laboratory method blank.

The deeper bedrock groundwater sample collected from MW08-29BR on March 28, 2008 contained toluene slightly above groundwater standards (6.8 ug/L). All other VOCs were either below standards or not detected in the March 28, 2008 groundwater sample. All VOCs were below standards in the groundwater sample collected from this well on April 14, 2008.

Groundwater analytical results from the bedrock well couplet indicate that very little groundwater contamination migrates in bedrock below the swale. This supports the hypothesis that the swale captures groundwater contamination in close proximity to it, discharging it primarily to the ground surface, which prevents significant contaminant migration in the underlying bedrock. There is minimal potential for groundwater contamination within the swale's influence to migrate off site.

3.2.6 - PILOT TEST CONCLUSIONS

The pilot test injections at monitoring wells MW-07 and MW06-24BR located adjacent to the drainage swale, and groundwater analytical data from bedrock well couplet MW08-29/29BR, substantiate that the swale exerts a locally significant hydraulic influence over groundwater flow. The data suggest that in close proximity to the swale groundwater flows preferentially toward the swale, which intercepts groundwater, which is conveyed along the swale, and discharges to the ground surface at the outfall. This finding is consistent with observations made during the RI that overburden appeared to be dewatered by the swale (see Figure 6).

There is no evidence that significant groundwater contamination exists in bedrock directly below the swale downgradient of the contaminant source area. This suggests that the swale reduces the migration potential of groundwater contamination, by intercepting groundwater flow and discharging it to the ground surface.

As might be expected, data indicate the hydraulic influence of the swale decreases with increasing distance from the swale. The pilot test conducted at bedrock well MW06-23BR, approximately 80 feet from the swale, did not result in permanganate breakthrough at the outfall, indicating there is no significant preferential flow toward the swale at that location.

Pilot test injections near the swale were ineffective at dispersing potassium permanganate solution into the aquifer matrix due to the swale's influence. However, it appears that the swale is providing a degree of natural containment of contamination as it captures groundwater flow and discharges it at the surface outfall. Although ISCO injection near the swale may not be feasible, it is not essential for preventing off-site contaminant migration because the migration potential for groundwater contamination near the swale is evidently low.

By applying ISCO injection in the contaminant source area, targeting the full width of the groundwater plume, groundwater contamination outside the influence of the swale will be targeted for treatment. The proposed approach is to begin ISCO injections at the margins of the groundwater plume, working inward towards the swale, and stopping if/when permanganate is observed at the outfall. Trenches keyed approximately 2 to 3 feet into

bedrock, rather than vertical injection wells, will be used to increase the contact of the injected oxidant with fractures to facilitate its dispersal.

3.3 - ALTERNATIVES ASSESSMENT

In-situ chemical oxidation (ISCO) has been selected as the preferred remedial technology for this site for the following reasons:

- ISCO has been identified as a proven/presumptive remedial technology for VOCs in groundwater (DER-15, February 2007)
- ISCO treatment will destroy contamination in the source area, reducing the mass of contamination at the site, and subsequently cause groundwater contaminant concentrations to decline overall to meet RAOs
- ISCO technologies are fairly straightforward to implement and involves simple monitoring and very little if any maintenance after implementation
- ISCO generates no waste by-products by the treatment process
- ISCO can potentially meet RAOs as quickly as or quicker than other less feasible remedial options

ISCO using potassium permanganate ($KMnO_4$) involves cleavage of carbon-carbon bonds often facilitated by free-radical oxidation mechanisms. By-products from the reaction include carbon dioxide, manganese dioxide solids, potassium and chloride; these by-products are non-toxic at the levels produced. The following equation describes the overall chemical reaction for the oxidation of TCE, DCE, and VC using $KMnO_4$:

TCE: $2KMnO_4 + C_2HCl_3 \Rightarrow 2CO_2 + 2MnO_2(s) + 2K^+ + 3Cl^- + H^+$

DCE: $8KMnO_4 + 3C_2H_2Cl_2 + 2H^+ \Rightarrow 6CO_2 + 8MnO_2(s) + 8K^+ + 6Cl^- + 4H_2O$

VC: $10KMnO_4 + 3C_2H_3Cl \Rightarrow 6CO_2 + 10MnO_2(s) + 10K^+ + 3Cl^- + H_2O + 7OH^-$

The following remedial alternatives to ISCO were also considered for application to this site, but were found to be less feasible.

3.3.1 - EX-SITU ALTERNATIVES

One of the key benefits of ISCO is that is actually destroys contamination without

creating waste by-products, which makes it an attractive alternative to *ex-situ* methods, such as pump-and-treat, which attempt to remove contamination from the subsurface for above-ground treatment. Pump-and-treat is considered less apt to meet RAOs than ISCO for this site. Industry experience over the past 30 years has indicated the effectiveness of pump-and-treat systems diminishes quickly over time. While these systems may effectively *contain* contamination and control its migration, this approach is simply not as effective at *removing* groundwater contamination from the subsurface as ISCO. (Similar to the way the natural swale at the site appears to contain contamination in close proximity to it, but does not destroy it). In addition, pumping contaminated groundwater from the subsurface creates waste material that requires disposal or treatment prior to discharge.

3.3.2 - IN-SITU ALTERNATIVES

Other in-situ options that were considered aside from ISCO include in situ-thermal treatment and in-situ chemical reduction. Thermal treatment alternatives involve heating the aquifer matrix and groundwater, usually be electrical current, to thermally vaporize contamination. This may be a preferred alternative for cases where soil is heavily contaminated and/or where NAPL is present. For this site the contamination exists in the dissolved phase in bedrock groundwater, which is not especially suitable for applying thermal treatment. In addition, thermal treatment creates organic vapors, which would require additional measures such as soil vapor extraction to abate potential soil vapor intrusion issues. In contrast, chemical oxidation by potassium permanganate typically does not produce organic vapors.

In-situ chemical reduction (ISCR) is similar to ISCO in its application, but relies on a different set of chemical reactions to destroy the contamination – reductive dechlorination as opposed to oxidation. A number of commercially available chemicals may be used to cause reductive dechlorination, common ones including zero-valent iron (ZVI) and various types of hydrogen release compound (HRC).

ISCR can be applied using the same injection concepts that are used for ISCO, to destroy contamination in the source zone. This approach subjects ISCR to the same engineering and design issues as ISCO, and for this site ISCR does not appear to have a discernable advantage over ISCO in meeting RAOs.

3.3.3 - HYDRAULIC FRACTURING

Hydraulic fracturing, or hydro-fracturing, is a process by which a fluid (typically water) is injected into the subsurface at high pressure to increase the size and connectivity of fractures to improve the permeability of aquifers. This technology has been used for decades in the petroleum and water resource industries to increase well yields. It may also be used to increase permeability in an aquifer being targeted for groundwater treatment, and thereby make it easier to disperse treatment chemicals.

A potentially significant drawback of hydro-fracturing relates to the displacement of groundwater contamination as high pressure water is injected. As water is jetted into fractures, contaminated groundwater that already occupies the fractures is pushed aside, possibly causing it to migrate much farther than it otherwise would have. Based on RI and pilot test data, under existing conditions groundwater contamination at the site does not appear to have migrated off site, has little potential to migrate off-site in the future, and the groundwater plume is well defined. The nature and extent of groundwater contamination may be altered, and contaminant mobility increased, by application of hydro-fracturing. This approach is not likely to be feasible especially near the swale owing to its apparent hydraulic connection with bedrock. Because the unclear benefits of hydro-fracturing related to its potential risks at worsening groundwater contaminant issues make it infeasible for this site.

3.3.4 - ALTERNATIVE CHEMICAL OXIDANTS

Having identified ISCO as the preferred alternative, chemical oxidants were evaluated. Potassium permanganate has been chosen as the preferred chemical oxidant because of a combination of factors:

- It is commercially available and a strong enough oxidant to destroy the groundwater contaminants present
- Among other commercially available chemical oxidants, such as peroxide and ozone, potassium permanganate offers a number of advantages:
    - It is relatively more stable chemically than peroxide or ozone, making it relatively safe to transport and handle

- It is likely to have a longer reactive life in the groundwater than other oxidants (e.g. peroxide, ozone) which tend to react more quickly.

Based on an assessment of multiple potentially viable remedial alternatives, ISCO using potassium permanganate has been chosen as the preferred remedy.

It is noted that a Site Management Plan (SMP – see Section 6) will be prepared after the ISCO remedy is implemented. Post-implementation groundwater monitoring will be done as part of the SMP. If a review of post-implementation monitoring performed as part of the SMP presents data that indicates ISCO has not met remediation goals for this project, additional remedial measures will be evaluated for implementation.

SECTION 4 - REMEDIAL DESIGN

The ISCO remedial approach for this site will apply an adequate mass of chemical oxidant in a single injection event to destroy groundwater contamination in the source area. The design of the ISCO system utilizes oxidant demand results from bench-scale oxidation testing, together with empirical observations from the field-scale pilot test, so that one injection event should be sufficient to meet remedial objectives. Following ISCO implementation, post-implementation groundwater sampling will occur, in accordance with a Site Management Plan (SMP – see Section 6), to monitor ISCO effectiveness.

The ISCO dosage will be aimed at destroying 100% of the contamination by a single injection of potassium permanganate solution, in order to reach RAOs. The cleanup goal for groundwater is the New York State groundwater standards. If this goal can not be achieved, the alternate groundwater cleanup goal will be based on the practicable limits of the groundwater remediation technology. Low-level asymptotic conditions and bulk contaminant removal shall be used to consider the need for further remediation.

4.1 - INJECTION SYSTEM

4.1.1 - INJECTION TRENCHES

The remedial approach will involve an array of injection trenches oriented perpendicular to the direction of groundwater flow in the contaminant source area. Trench locations are proposed on Figure 9. Trench locations will avoid areas in which underground utilities exist, and the actual number of trenches will depend on their completed lengths. It is estimated that each trench will be between 15 and 20 feet in length, to transect the indicated areas on Figure 9. Figure 9 shows 13 trenches that are 15 feet in length.

A line of trenches will extend across the lateral limits of the groundwater plume, parallel to the site building, to destroy contamination from potential residual sources that may exist. This trench line will extend approximately from monitoring well MW-14 (south) to monitoring well MW-5 (north), and will cross the area in which USTs were formerly located (see Figure 8).

The second group of trenches will be located approximately 40 feet downgradient of the first line, and target areas where groundwater contaminant levels are highest, in the core of the groundwater plume.

The trenches will be dug using a track-mounted excavator with adequate reach to extend the excavations into the top of weathered bedrock, which across the target area averages approximately 15 feet below ground surface (bgs) (Figure 10). The trenches will be keyed 2 to 3 feet into bedrock and a 6-inch diameter perforated PVC pipe will be installed horizontally along the full length of the trench (i.e. 15 to 20 feet in length). The horizontal perforated pipe will be installed as level as possible and surrounded by pea stone to assure dispersion of potassium permanganate solution along the entire length of the trench (Figure 11).

Soil that is excavated from each trench will be field screened (PID, visual, olfactory) for evidence of contamination. Contaminated soil will be segregated from soil with no evidence of contamination. Uncontaminated soil will be used to backfill the remainder of the trench after the PVC and pea stone are installed, and compacted in lifts. Contaminated soil will be properly disposed of off site.

A vertical 4-inch PVC riser will be connected to the mid-point of the horizontal perforated PVC pipe, and extend to the ground surface. The top of the vertical riser will be completed with a flush mounted bolt-down cover. This construction approach will be applied to each trench. As previously noted, the horizontal perforated pipe, installed in linear bedrock trenches, will improve the dispersion of chemical oxidant over that of vertical well screens by increasing contact with permeable fractures.

It is expected that the upper weathered bedrock zone is rippable to allow excavation using a standard bucket, but a hydraulic hammer attachment will be used as necessary to create the bedrock trenches.

During excavation activities, air monitoring will be conducted for VOCs and particulates (i.e. "dust") in accordance with the previously approved Community Air Monitoring Plan (RWP, March 2008).

4.1.2 - OBSERVATION WELLS

A network of bedrock and overburden observation wells will be used to monitor permanganate dispersion and ISCO effectiveness during ISCO implementation (see Section 5.5.2). Four (4) two-inch diameter observation wells will be installed at locations shown on Figure 9. In general, the observation wells will be located approximately 15 feet downgradient of the injection trenches, with actual locations subject to the presence of underground utilities.

Three of the observation wells will be bedrock wells (OWBR-1, -2, -3)installed by advancing augers two (2) feet into bedrock, followed by coring ten (10) feet into competent bedrock. Two inch diameter PVC monitoring wells will be installed in the completed boring. The well screen will extend from the bottom of the borehole to the top of bedrock, as shown on Figure 12. The well construction will include a sand filter pack that extends two feet above the top of well screen, and a 3-foot bentonite seal above the top of the sand pack. The remaining space will be backfilled with a Portland cement grout.

The fourth observation well (OW-4) will have approximately 5 feet of screen installed at the top of the overburden/bedrock interface (estimate approximately 8 feet bgs), downgradient of the northernmost injection trench, in the area of MW-5 where groundwater contamination was found primarily at that depth. The observation wells will be monitored during ISCO implementation as discussed in Section 5.2, and will also be used following ISCO implementation under a Site Management Plan, as indicated in Section 6.

Groundwater flow velocity is apparently low for this site, which may lengthen the travel time for the injected potassium permanganate. Permanganate breakthrough in the observation wells may not be immediately apparent. However, the ISCO dosage (see below) is based on conservative estimates to provide more chemical than is likely to be needed to destroy the contamination. Despite the potentially slow travel times, the goal of the design is to provide ample permanganate residence time in the aquifer.

4.2 - PERMANGANATE DOSAGE

The amount of permanganate solution required to meet RAOs is based on the mass of permanganate required to destroy the estimated contamination mass, plus the estimated effective permanganate soil oxidant demand (effective PSOD). Table 5, provided by Carus Corporation, provides a conservative estimate of the mass of potassium permanganate required to destroy TCE contamination at the site, taking into account the PSOD for the aquifer matrix.

The contaminant source area being targeted for ISCO is estimated to be approximately 14,400 square feet (see Figure 9). A vertical thickness of 15 feet is targeted, corresponding to the upper bedrock zone where fractures are most prevalent. The effective porosity is very conservatively estimated to be 20 percent, noting that the effective porosity of fractured rocks is normally much less (Freeze and Cherry, 1979). Based on the above assumptions, the total treatment volume is estimated to be approximately 323,000 gallons of contaminated groundwater.

The mass of contamination is conservatively estimated within this volume, by assuming the entire volume contains the maximum TCE concentration detected in monitoring well MW06-24BR, which is 2,100 µg/L. By this approach the target mass of TCE at the site is approximately 5.6 pounds.

Accounting for the effective PSOD, the amount of potassium permanganate required to destroy 5.6 pounds of TCE is approximately 9,755 pounds.

To create a 6 percent permanganate solution, 18,600 gallons of water is required. Divided evenly among the 13 proposed injection trenches, each trench will receive approximately 1,430 gallons of solution. If flow rates during ISCO injection are not significantly greater than those observed during the pilot test (i.e. 1 gpm or less), it may take more than 20 hours to deliver 1,430 gallons of permanganate solution to each trench. For planning purposes, injection at each trench may take two days. If the feed system were manifolded such that injection occurred at two trenches at once, the ISCO injection could be completed in approximately two to three weeks.

4.3 - FEED SYSTEM COMPONENTS

As indicated above, the injection trenches may be manifolded in groups of two, so that permanganate solution can be injected into at least two trenches at a time. Potassium permanganate solution will be fed to each group of the injection trenches via a system that will be engineered to control injection rates. The following is a schedule of basic feed system equipment that will be used.

Quantity	Item Description
1	Water supply tank
1	500 gallon polyethylene dilution tank
1	Pneumatic bladder pump
2	2-point distribution manifolds
1	185 cfm compressor, 6 hp diesel
1	2" Self-priming centrifugal transfer pump
1	1-inch diameter hose 20 feet in length (chemical grade)
2	2-inch diameter hose 100 ft in length (chemical grade)
2	2-inch diameter hose 5 ft in length (chemical grade)
1	Eductor
1	600 ft of 5/8 inch hose
40	330 pound drums of potassium permanganate (~9,755 lbs)
1	6,000 watt generator
5	12/3 extension chords

4.4 - SEDIMENT/EROSION CONTROL

The area of the site where the trenches are to be dug is covered by asphalt paving. All areas of excavation will be completed below grade with minimal potential for soil erosion. Stockpiled soil from the excavations will be staged on plastic sheeting, and

covered with plastic sheeting at the end of each work day to minimize erosion by contact with rain water and wind.

SECTION 5 - ISCO REMEDY IMPLEMENTATION

5.1- ISCO SYSTEM REQUIREMENTS

The solution mixer and diaphragm pump run off compressed air. One 40 amp generator can power other system components, however, electrical power will be available from the building. The eductor system which transfers permanganate to the mixing (dilution) tank requires a 220V AC-single phase power source. The unit runs on a 3 HP motor, at 50 gpm and 70 psi, and can transfer 1,320 pounds of permanganate per hour. The centrifugal transfer pump which may be used to supply source water to the dilution tank can be run off of the generator or from a building power source..

The system requires water at 15 gpm and a pressure between 10 psi and 40 psi. The on-site potable water source will be used, and connections will include back-flow preventers where appropriate.

5.2 ISCO EQUIPMENT SET-UP

The equipment and potassium permanganate drums will be delivered to the site via a shipping truck with a hydraulic lift. Eight (8) pallets will be ordered for ISCO injection and each pallet will have four drums (1,320 pounds of potassium permanganate per pallet). The drums are made of heavy gauge steel to prevent damage and spills during handling and storage. The equipment will be mounted on wooden skids to eliminate the need for a fork lift to move the equipment around the site.

All equipment will be stored outside but a tent may be used to protect it from the elements.

The permanganate solid will be fed to the 500 gallon dilution tank by the eductor system.

Water will be transferred from a supply tank to the eductor system via a transfer pump, through a 2-inch hose to create a 6% permanganate solution, which will be conveyed to the dilution tank. A backflow preventer will be installed on the water supply tank to prevent flow of the potassium permanganate solution into the supply tank. The

permanganate solution will be mixed/agitated in the dilution tank using a pneumatic mixer.

The dilution tank has three 2-inch orifices for removal of the potassium permanganate solution. One at the top of the tank for overflow and the other at the bottom to be used for flushing the permanganate solution. Both will drain into a bucket for collection and later disposal. A 1-inch diameter hose will be connected to the third orifice and attach to the pneumatic pump, which will then be attached to the distribution head. Two (2) 100 foot 5/8-inch diameter hoses will be attached to the outputs on the distribution head for injection into the trenches. This equipment schematic can be found on Figure 13.

5.3 ISCO SYSTEM START-UP

Permanganate solution will be fed to the dilution tank as a slurry via an eductor. Once the drum is attached to the eductor system., the water supply valve will be opened and a 2-inch transfer pump will convey water to the eductor, which will create an aqueous slurry of permanganate. The slurry will be conveyed to the dilution tank at approximately 15 gpm. When 2 inches of water is in the tank, power on the mixer and slowly open the iris valve.

The mix tank will be filled to three quarters or capacity before beginning the ISCO application. At this point, the outlet from the mix tank will be opened, and the diaphragm pump turned on to begin discharging the solution to the injection trenches.

5.4 ISCO EQUIPMENT STORAGE

At the end of each injection event, the feed equipment will be emptied of all potassium permanganate. The unit will be emptied by operating the feeder until the hopper is empty. During the last injection event, every effort will be made to empty liquid potassium permanganate into the injection points by draining the solution from the tank of each individual hose. If the feeder cannot be completely emptied by normal operation, the remaining potassium permanganate can be "scooped" from the hopper and placed in a clean, dry, metal or HDPE plastic drum for proper disposal or reuse. All crystalline potassium permanganate and/or all permanganate aqueous solution will be removed from the dissolver/mix tank, all pumps, hoses and accessories. It is important to note that as the crystalline potassium permanganate absorbs moisture, it will cake and harden. In this

case, the only option may be to dissolve the permanganate using water. The permanganate solution must be collected in dilute solution (<6% by weight) and neutralized using a reducing agent such as sodium bisulfite before disposal.

All equipment surfaces that may have residual potassium permanganate will be thoroughly cleaned. The equipment will be rinsed with water (inside and out) and allowed to dry before shipment. Wet rags will be used to wipe down the equipment and the rags will be thoroughly rinsed with copious amounts of water to wash away any visible purple. If not rinsed thoroughly, rags may become more concentrated with permanganate upon drying, increasing risk of spontaneous combustion. All valves shall be closed and hoses capped.

The equipment will be packaged by crating or palletizing and stretch-wrapped for return shipment. The crating, pallets, or packaging materials that the equipment was delivered in will be reused.

5.5 ISCO EFFECTIVENESS MONITORING OVERVIEW

The overall objective of effectiveness monitoring is to verify that ISCO implementation was carried out in accordance with design expectations, and has met or is likely to meet the remedial objectives for this site.

Effectiveness monitoring for ISCO will include the following elements:

- **Pre-implementation Baseline Sampling**:
  - Collecting groundwater samples from designated observation wells/monitoring wells prior to ISCO implementation to establish a water quality baseline.

- **Implementation Process Monitoring**:

  Measuring flow rates and injection volumes of potassium permanganate solution during ISCO implementation; Measuring the potassium permanganate dispersion during ISCO implementation around injection trenches based on the color of water samples taken from downgradient observation and monitoring wells

- **Post-Implementation Sampling:**
  - Measuring contaminant levels (VOCs) and indicator parameters (pH, Eh, specific conductance, turbidity, temperature) in samples taken from designated observation and monitoring wells after implementation, in accordance with a Site Management Plan (SMP – see Section 6);

It is critical to note that measurable effects of ISCO often take several months to appear following implementation. The SMP will define a post-implementation sampling program (see Section 6) that accounts for ISCO processes that may be slow, particularly in cases where groundwater flow velocity is low, and that results may not be immediately apparent in the short term. As was noted in Section 4.2, the conservative estimates used to calculate the permanganate dosage are aimed at providing more chemical oxidant than is needed to destroy the contamination, and also account for the natural PSOD. More than enough permanganate will be introduced to sustain the chemical reactions that destroy contamination as the permanganate slowly disperses across the treatment area.

5.6 BASELINE SAMPLING (PRE-IMPLEMENTATION)

Groundwater samples will be collected from the four newly-installed bedrock observation wells prior to permanganate injection, to establish a pre-remediation baseline for those wells. The groundwater samples will be analyzed for the following parameters:

- VOCs
- Chemical Oxygen Demand (COD)
- Total Organic Carbon (TOC)
- Field Parameters (pH, Eh, specific conductance, temperature, turbidity, dissolved oxygen)

5.7 IMPLEMENTATION PROCESS MONITORING

Process monitoring refers to system performance measurements during ISCO implementation. The objective of implementation process monitoring is to demonstrate

that potassium permanganate solution has been successfully introduced into the subsurface in accordance with the approved Design Document.

The flow rate of permanganate injection will be maintained by a flow meter. The flow meter will be observed during ISCO injection and adjusted as needed to maintain a flow rate, which is expected to range between approximately 1 and 3 gallons per minute.

Process monitoring will utilize the four newly-installed ISCO observation wells along with pre-existing RI monitoring wells to determine the rate of migration and reaction of the chemical oxidant with site groundwater, and the radius of influence (ROI). The observation wells and monitoring wells will be checked periodically each day during ISCO injection for purple coloration. The wells will be checked again for purple coloration 72 hours after ISCO implementation has been completed.

Process monitoring during ISCO injection will also include observing the swale outfall for signs of permanganate breakthrough. The outfall will be visually monitored by SWRNA personnel throughout the duration of the injections, and injection at a particular trench will stop immediately upon seeing purple permanganate solution at the outfall. The flow meter will maintain the injection rate between 1 and 3 gpm to assure that flow can be stopped quickly in the event of breakthrough in the swale.

SECTION 6 – SITE MANAGEMENT PLAN & POST-IMPLEMENTATION SAMPLING

Following implementation of the remedy, a Final Engineering Report (FER) will be prepared to identify the requirements for the operation, maintenance, and certification of engineering controls at the site. The FER will also include a Site Management Plan (SMP) that describes post-implementation groundwater sampling requirements for the ISCO remedy, and related reporting requirements to NYSDEC. The SMP will be incorporated into the site Environmental Easement (EE) as required under the BCA, and filed with the Tompkins County clerk.

The baseline sampling parameters identified in Section 5.5.1 will be applied to post-ISCO implementation sampling as part of the SMP. The expected behavior of these parameters in response to the chemical oxidant is described below.

- **VOCs.** The ISCO system is designed to destroy 100 percent of the contaminant that it comes in contact with in the source area, with a remedial goal of Class GA groundwater quality standards. By destroying contamination at the source, contaminant levels downgradient of the source will diminish with time. ISCO effectiveness will be measured in terms of the percent reduction in VOC levels. Post-remediation monitoring may be determined complete if asymptotic conditions are reached and/or trends indicate the cleanup target will be achieved. Groundwater samples will be collected from observation wells to measure the reduction in contaminant levels.

- **pH** may decrease slightly depending on how well buffered (i.e. resistant to changes in pH) the soil and groundwater is. A decline in pH at a monitoring well downgradient of an injection point would indicate that the monitoring well is within the radius of influence (ROI) of the injection point.

- **Eh.** Like pH, Eh is measured as a field parameter. Eh is a measure of the "redox state" of groundwater – whether it is oxidizing or reducing. Dispersion of the chemical oxidant will increase Eh.

- **Temperature.** A slight rise in groundwater temperature may signal exothermic reactions that occur as permanganate reacts with dissolved groundwater constituents.

- **Color.** As permanganate reacts with water it produces a pink or purple color. In many cases the color is clearly visible so that no colorimetric instruments are needed to verify it. In any case, color will be monitored during the injection period to determine the ROI of the permanganate solution.

- **COD & TOC.** Both of these parameters would be expected to decrease in the ROI of the injection points, as the chemical oxidant consumes oxidizable material.

Note that post-implementation groundwater samples with purple color will not be analyzed, since after such samples are collected the presence of reactive permanganate in the samples will alter the samples' chemistry during holding time prior to analysis. However, analysis of purple samples is unnecessary, since the purple coloration is proof of dispersion and contact with contamination.

The SMP post-implementation monitoring approach proposed in this Design Document will be finalized and become effective as part of the SMP, subject to NYSDEC approval. The proposed approach has been modified from that which was previously described in the RWP (SWRNA, March 2008), based on the outcome of the ISCO pilot test and the remedial design being implemented. The proposed approach will be to collect post-implementation groundwater samples for up to eight (8) quarters, with periodic review of analytical results every six months (i.e. after every two quarterly events). These periodic check point reviews will provide an opportunity to discontinue post-implementation monitoring prior to completing eight quarters of sampling if it is determined RAOs have been achieved, are likely to be achieved, or asymptotic conditions have been reached.

6.1 - SMP POST-IMPLEMENTATION SAMPLING APPROACH

Post-implementation monitoring will begin two (2) weeks after ISCO implementation is completed, and involve visual examination for purple coloration in the following observation and monitoring wells:

Overburden wells	Bedrock Wells
OW-4	OWBR-1
MW-2	OWBR-2
MW-3	OWBR-3
MW-7	MW06-24BR
MW06-19OB	MW06-25BR
MW06-25OB	MW07-27BR
	MW08-29BR

Bi-weekly checks for purple coloration at the above thirteen (13) wells will continue for as long as purple coloration is evident, and will stop at the beginning of the post-implementation quarterly sampling program, three months after ISCO injection is completed.

Post-implementation groundwater sampling will begin three months following the completion of the ISCO injection. Groundwater samples will be collected from the above thirteen (13) observation/monitoring wells and analyzed for VOCs, pH, Eh, TOC, and COD.

Subsequent post-implementation sampling events will occur quarterly following the first post-implementation sampling event under the SMP. After the second and fourth quarterly events (i.e. every 6-months) the data will be evaluated and presented in a summary report to NYSDEC.

After four quarterly post-implementation sampling events are completed, the analytical results in the two 6-month summary reports will be reviewed to determine the need for and duration/frequency of additional monitoring.

The SMP will indicate post-implementation groundwater sampling may continue for an additional four (4) quarters, following review of data from the first four (4) quarters, if it is determined necessary to confirm remedial objectives have been met or are likely to be met. Periodic 6-month data review of analytical results would continue after every two quarterly events. These 6-month check point reviews will provide an opportunity to discontinue post-implementation monitoring prior to completing eight quarters of sampling if it is determined RAOs have been achieved, are likely to be achieved, or asymptotic conditions have been reached.

The periodic data reviews will determine the percent of contaminant reduction by comparing the pre-remediation data (i.e. baseline data) and post-remediation groundwater analytical data. Pre-remediation average concentrations of total VOCs and total chlorinated VOCs will be determined, respectively, for each of the observation/monitoring wells at the site. In addition, an average concentration of total VOCs will be determined based on results from all of the observation wells to provide a site-wide pre-remediation estimate.

The pre-remediation averages for the individual observation wells will be compared to each round of post-remediation data for each well, to determine the apparent remediation progress, and the percent decline in groundwater concentrations at each well will be used to compute the percent reduction of contamination.

As previously noted, ISCO using potassium permanganate is considered a presumptive remedy that may not produce immediate results, but over time is known to be a highly effective remedy. The SMP will describe scenarios based on post-implementation data, and actions that may subsequently result. As indicated in the Post-Implementation Monitoring Schedule (see Section 7.2), 6-month check-points will occur throughout the post-remediation period to review quarterly data and enable decision making. Three potential post-remediation scenarios are anticipated:

> Scenario No. 1. Little or no pink/purple coloration is observed in certain observation wells over time following ISCO implementation, indicating that the permanganate solution may not have adequately dispersed. In this case, a subsequent injection episode(s) may occur in specific areas where dispersion has not yet occurred and/or may include the installation of additional injection wells

to increase the potential for dispersion. This approach would utilize specific injection trenches.

Scenario No. 2: Under Scenario 2, the analytical data for the first two (2) post-implementation sampling events demonstrate that groundwater standards have been reached, or has reached conditions and trends indicating it is likely to be achieved. In this case, no further action would be recommended after the first 6-month checkpoint review, aside from continued quarterly monitoring for two additional quarters.

Scenario No. 3: Under Scenario No. 3, a check-point review of analytical data indicate that a substantial reduction in contamination has occurred but has not reached groundwater standards or reached conditions and trends indicating it is likely to be achieved, and there is indication that the potassium permanganate solution still resides in the injection and/or monitoring wells. In that case, it would be recommended that post-implementation quarterly monitoring continue to determine whether, given enough time, the permanganate injection may produce satisfactory results. If after the subsequent quarterly monitoring events, groundwater standards are not reached or trends indicate it is likely not to be achieved a subsequent injection episode would be conducted, including a repeat of the effectiveness monitoring program. The additional injection episode would focus on the areas where groundwater standards were not achieved or likely to be achieved.

The SMP will indicate that post-implementation injection episodes, if any are needed, may utilize multiple or individual trenches, where data indicates additional permanganate is needed.

The SMP will also address the prospect of contamination rebound following ISCO implementation. Rebound has sometimes been observed in contaminant source areas for other sites where significant residual contamination exists in soil, which may dissolve after ISCO injection is complete. Previous soil borings and test pits dug in the potential source area for this site have not revealed the presence of heavy soil contamination or NAPL that might cause significant post-implementation rebound. The trenches excavated for the ISCO injection will provide further observation of subsurface

conditions that might indicate a potential for post-implementation rebound. These observations will be discussed in the FER, and the SMP will make appropriate recommendations to address the potential for rebound.

The need and approach for subsequent injections will be determined following the post-remediation monitoring after the initial injection and reviewed with the NYSDEC for their concurrence.

The SMP will further state that if post-implementation monitoring data indicates that ISCO has not met remediation goals for this project, additional remedial measures will be evaluated for implementation.

SECTION 7 - SCHEDULE

The following timeline is proposed for implementing the remedial action.

7.1 - IMPLEMENTATION

June 2 – June 20, 2008 – Install ISCO Injection Trenches & Observation Wells
June 23-26, 2008 – Collect baseline (pre-remediation) groundwater samples from thirteen (13) observation wells.
June 26-27, 2008 – Construction/installation of ISCO feed and delivery system.
June 30 – July 25, 2008 – ISCO injection.
July 28, 2008 – ISCO Process Monitoring (Check observation wells for coloration)
August 15, 2008 – Submit Final Engineering Report (FER) including Site Management Plan (SMP)
August 29, 2008 – NYSDEC Comments on FER
September 5, 2008 – SWRNA Response to NYSDEC Comments
September 15, 2008 – Record Environmental Easement with Tompkins County and Distribute Fact Sheet that FER is Complete
October 1, 2008 – NYSDEC Issues COC

7.2 - SMP POST-IMPLEMENTATION MONITORING

August 8 – October 17, 2008 – bi-weekly permanganate color checks in observation and monitoring wells
October 24, 2008 – complete 1st quarterly round of post-remediation groundwater sampling
January 23, 2009 – complete 2nd quarterly round of post-remediation groundwater sampling
February 13, 2009 – Check-point review of post-remediation data (#1)
April 23, 2009 – complete 3rd quarterly round of post-remediation data
July 23, 2009 - complete 4th quarterly round of post-remediation data
August 7, 2009 – Check-point review of post-remediation data (#2)

If determined necessary based on check-point review #2:
October 23, 2009 - complete 5th quarterly round of post-remediation data

January 22, 2010 - complete 6th quarterly round of post-remediation data
February 5, 2010 – Check-point review of post-remediation data (#3)

If determined necessary based on check-point review #3:
April 23, 2010 - complete 7th quarterly round of post-remediation data
July 23, 2010 - complete 8th quarterly round of post-remediation data

REFERENCES

Division of Environmental Remediation, February 27, 2007. *DER-15: Presumptive/Proven Remedial Technologies*. New York State Deprtment of Environmental Conservation.

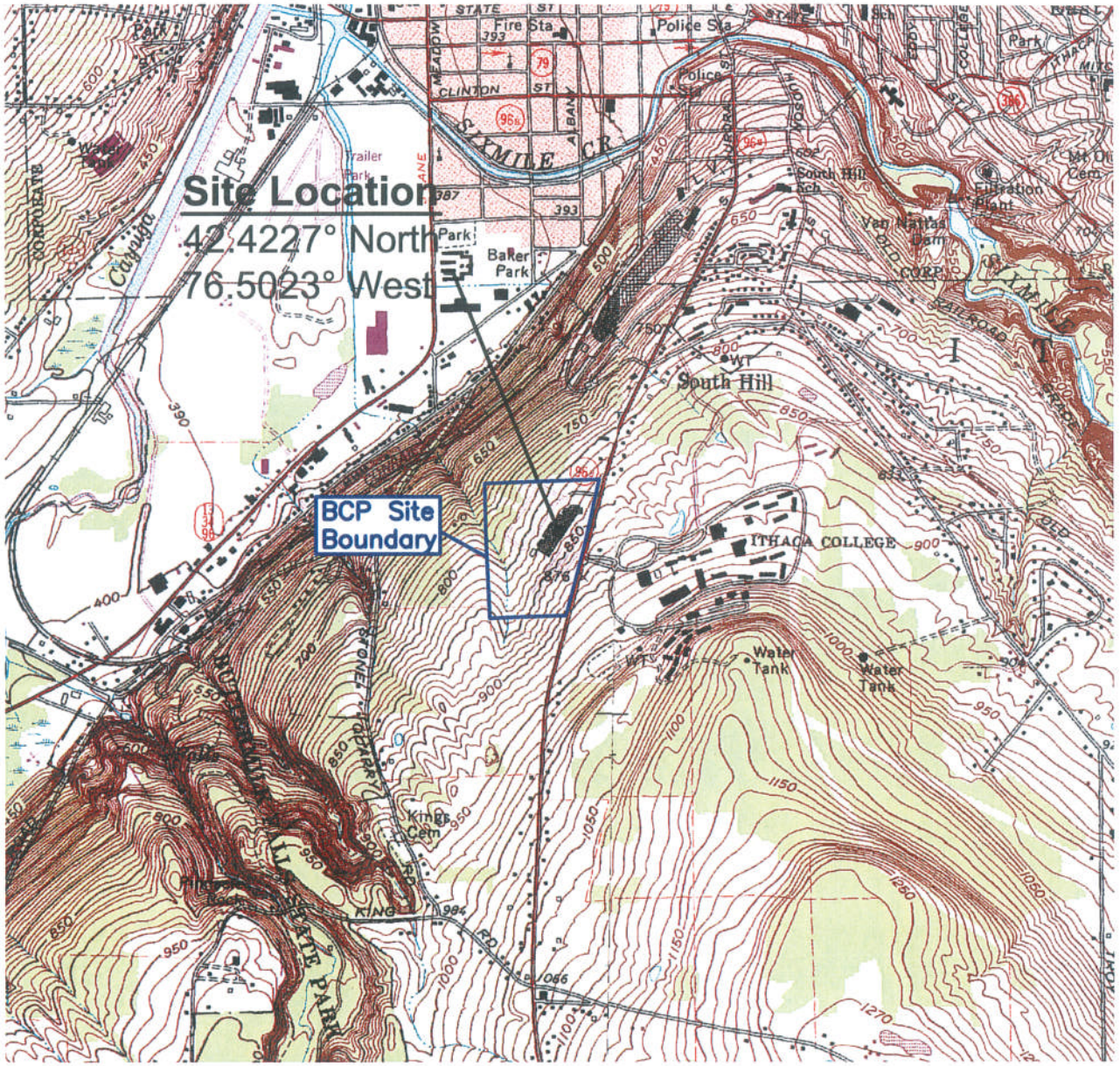
Environmental Resources Management (ERM), March 2004. *Source Investigation Report, Axiohm Facility, 950 Danby Road, Ithaca, NY.*

Freeze, R. Allen & John A. Cherry, 1979. *Groundwater.* Prentice-Hall, Inc. Englewood Cliffs, NJ. p. 408.

S&W Redevelopment of North America, LLC, January 2008. *Remedial Investigation Report, Brownfield Cleanup Program, South Hill Business Campus, 950 Danby Road, Ithaca, NY.*

S&W Redevelopment of North America, LLC, March 2008. *Remedial Work Plan, Brownfield Cleanup Program, South Hill Business Campus, 950 Danby Road, Ithaca, NY.*

Figures



QUADRANGLE LOCATION

SCALE in FEET

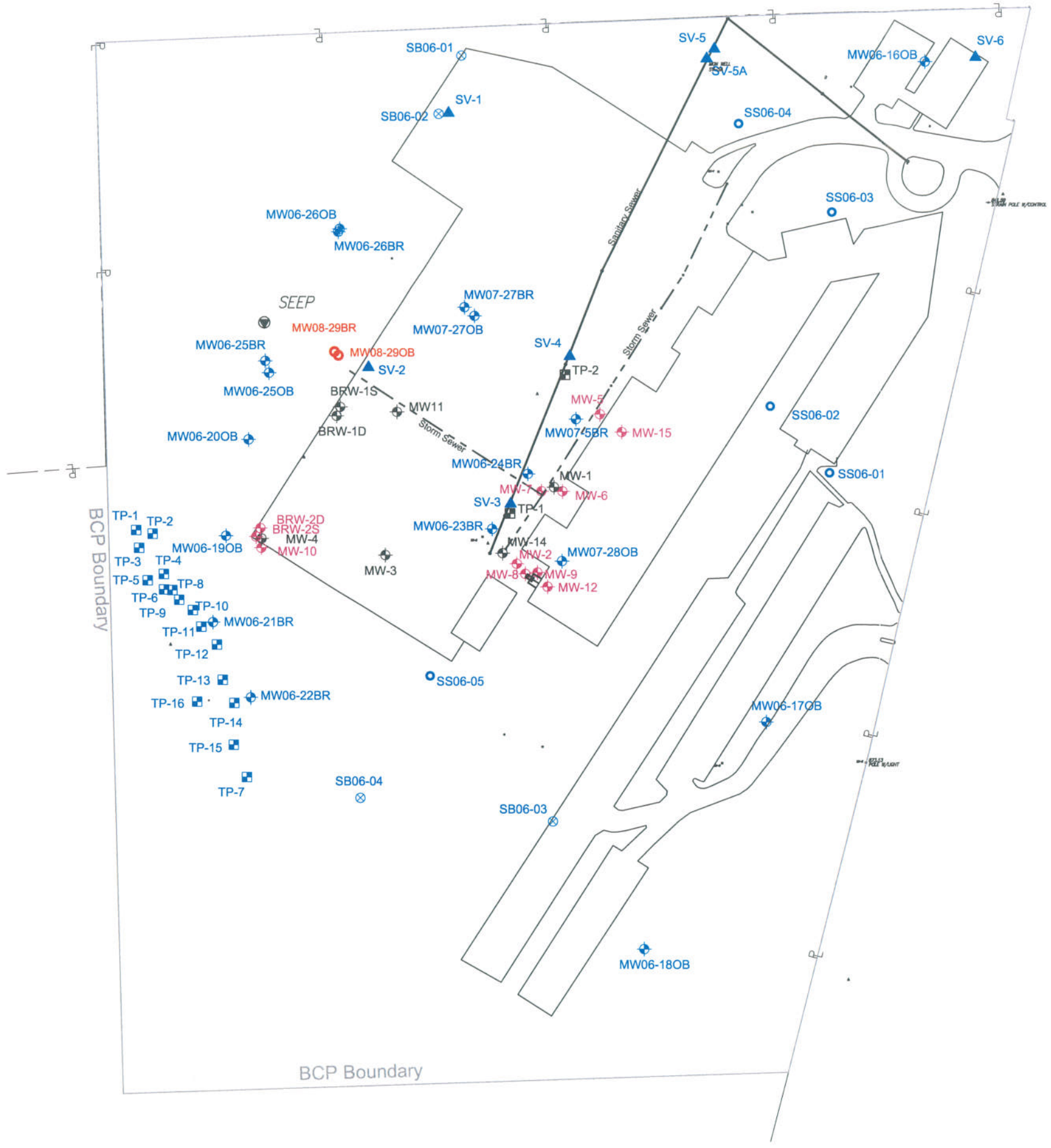
1,000 0 1,000 3,000 5,000

Contour Interval: 10 Feet

Map Taken From: USGS 7.5 Minute Series
Topographic Quadrangles
Ithaca West (1969, Photorevised 1978) &
Ithaca East (1969, Photorevised 1978)
(www.nysgis.state.ny.us/quads/usgsdrg.htm)

S&W Redevelopment of North America, LLC. Syracuse, New York DATE:2/2007 JOB No.:B4001	In-situ Chemical Oxidation Remedial Design 950 Danby Road, Ithaca, Tompkins Co., New York BCP Site # C755012 Figure 1 Site Location

X-REF: Ithaca Westo42076d5.tif, Ithaca Easto42076d4.tif
2004/october/syracuse/jlk
J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Design Doc May 08\Figures\950 Danby Fig 1.dwg



Previous Sample Locations

- EPS Groundwater Monitoring Well, 2003 (surveyed)
- ERM Groundwater Monitoring Well, 2004 (surveyed)

  Locations for MW-12 & -15 approximate.

RI Sample Locations (2006-2007)

- SWRNA Groundwater Monitoring Well, 2006 and 2007 (surveyed)
- Soil Boring Location (surveyed)
- Soil Vapor Monitoring Well Location (surveyed)
- Surface Soil Location (approximate)
- Test Pit Location (surveyed, fill area 2006)
- Test Pit Location (surveyed, sewer line 2007)
- Seep Location (surveyed)
- SWRNA Groundwater Monitoring Well, 2008 (approximate)

SCALE IN FEET
50 0 25 50 100 200

Figure based on Survey by Bryant Assoc., P.C., Aug, 2006.

S&W Redevelopment
of North America, LLC.
Syracuse, New York
DATE:11/2007 JOB No: B4001

In-situ Chemical Oxidation Remedial Design
950 Danby Road Ithaca
Tompkins County, New York
BCP Site # C755012

Figure 2
Site Plan & Sample Locations

X-REF: NAMES?
2007/Nov/Syr/am
J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Design Doc May 08\Figures\950 Danby Fig 2.dwg

- Overburden Groundwater Monitoring Well I.D. (TCE Concentration ppb)
- Seep Sample Location (TCE Concentration ppb))
- TCE > 100 ppb
- TCE 50 - 99 ppb
- TCE 25 - 49 ppb
- TCE 10 - 24 ppb
- Dashed line is inferred 5 ppb TCE boundary. Its location is estimated and may not precisely represent the actual 5ppm boundary

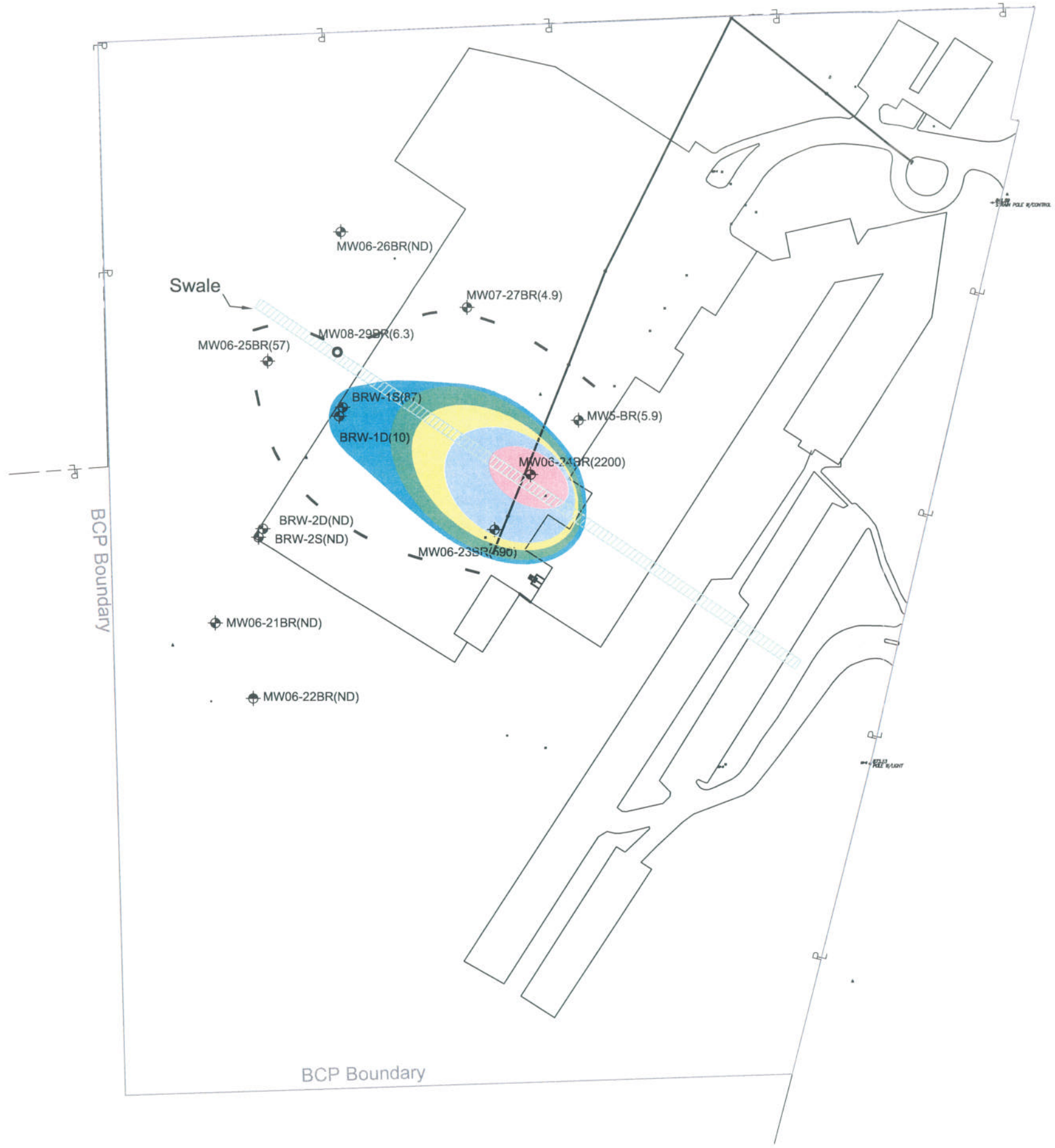
Steep terrain at the western site boundary prevented installation of downgradient monitoring wells further west of the ones shown

SCALE IN FEET
50 0 25 50 100 200

Figure based on Survey by Bryant Assoc., P.C., Aug, 2006.

S&W Redevelopment of North America, LLC. Syracuse, New York DATE:11/2007 JOB No: B4001	In-situ Chemical Oxidation Remedal Design 950 Danby Road Ithaca Tompkins County, New York BCP Site # C755012
	Figure 3 TCE in Overburden Groundwater

X-REF: NAMES?
2007/Nov/Syr/am
J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Design Doc May 08\Figures\950 Danby Fig 3.dwg



- Bedrock Groundwater Monitoring Well I.D. (TCE Concentration ppb)
- TCE > 1,000 ppb
- TCE 500 - 999 ppb
- TCE 250 - 499 ppb
- TCE 125 - 249 ppb
- TCE 75 - 124 ppb
- Dashed line is inferred 5 ppb TCE boundary. Its location is estimated and may not precisely represent the actual 5ppm boundary

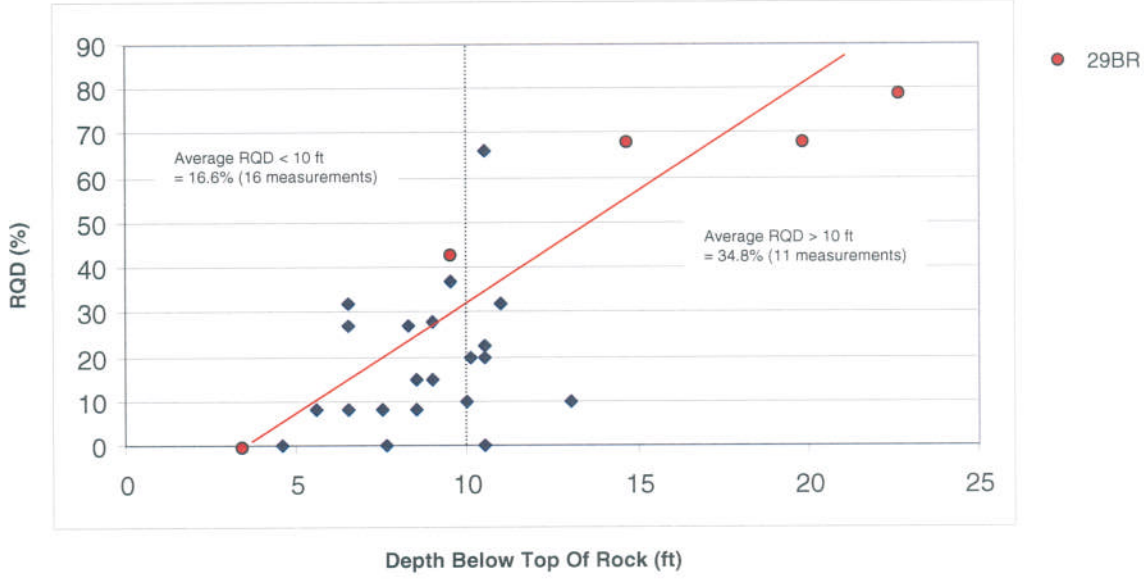
Steep terrain at the western site boundary prevented installation of downgradient monitoring wells further west of the ones shown

SCALE IN FEET
50 0 25 50 100 200

Figure based on Survey by Bryant Assoc., P.C., Aug, 2006.

S&W Redevelopment of North America, LLC. Syracuse, New York DATE:11/2007 JOB No: B4001	In-situ Chemical Oxidation Remedial Design 950 Danby Road Ithaca Tompkins County, New York BCP Site # C755012 Figure 4 TCE in Bedrock Groundwater

X-REF: NAMES?
2007/Nov/Syr/am
J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Design Doc May 08\Figures\950 Danby Fig 4.dwg



The Rock Quality Designation (RQD) generally increases with depth below the top of the weathered bedrock surface.

RQD = the combined length of individual rock fragments greater than 4" divided by the total length of the core run.

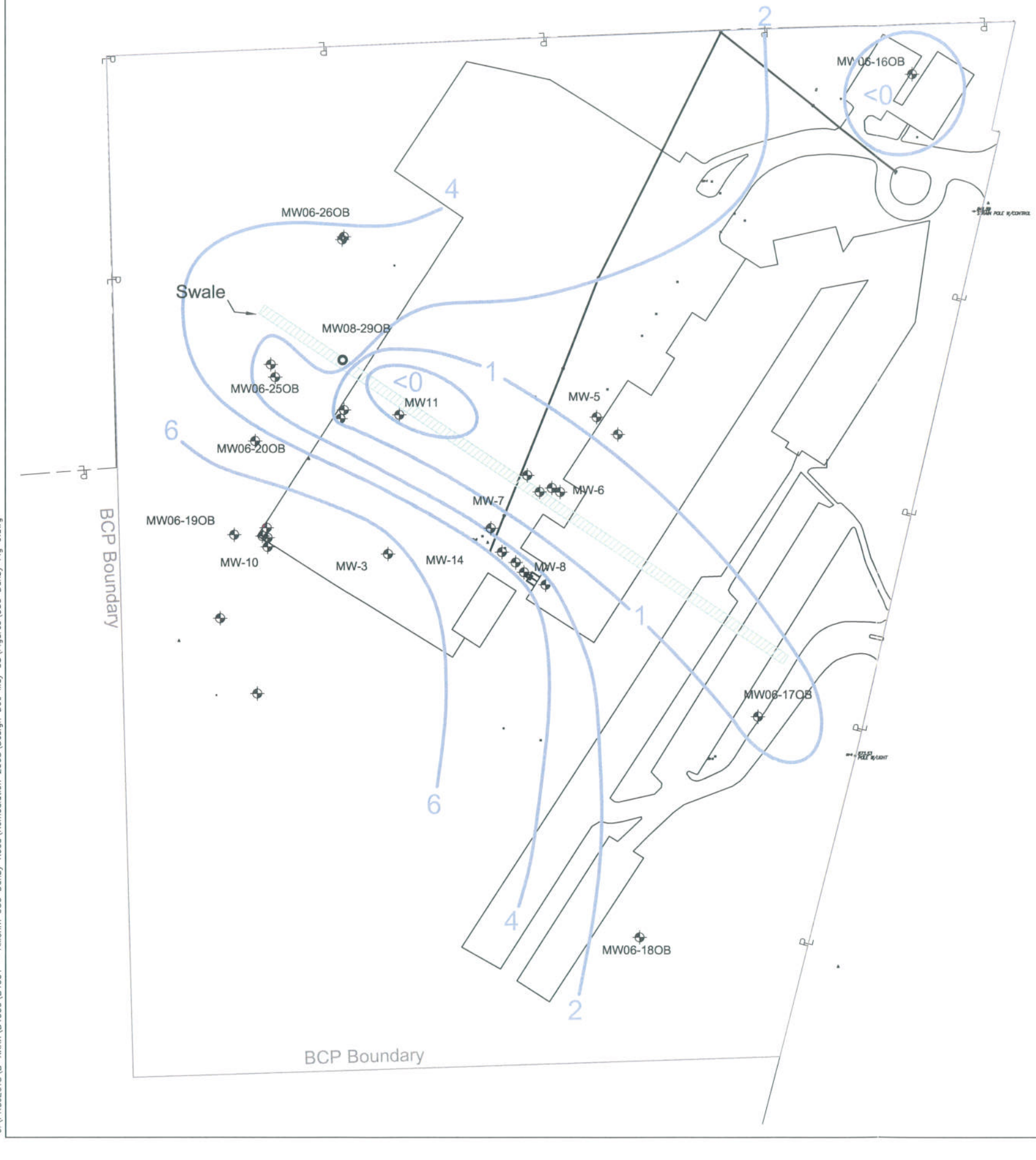
S&W Redevelopment
of North America, LLC

Syracuse, NY

DATE: 5/2008 JOB No: B4001.60

In-situ Chemical Oxidation Remedial Design
950 Danby Road Ithaca
Tompkins County, New York
BCP Site # C755012

FIGURE 5
Rock Quality Designation (RQD)



Overburden Monitoring Well I.D.

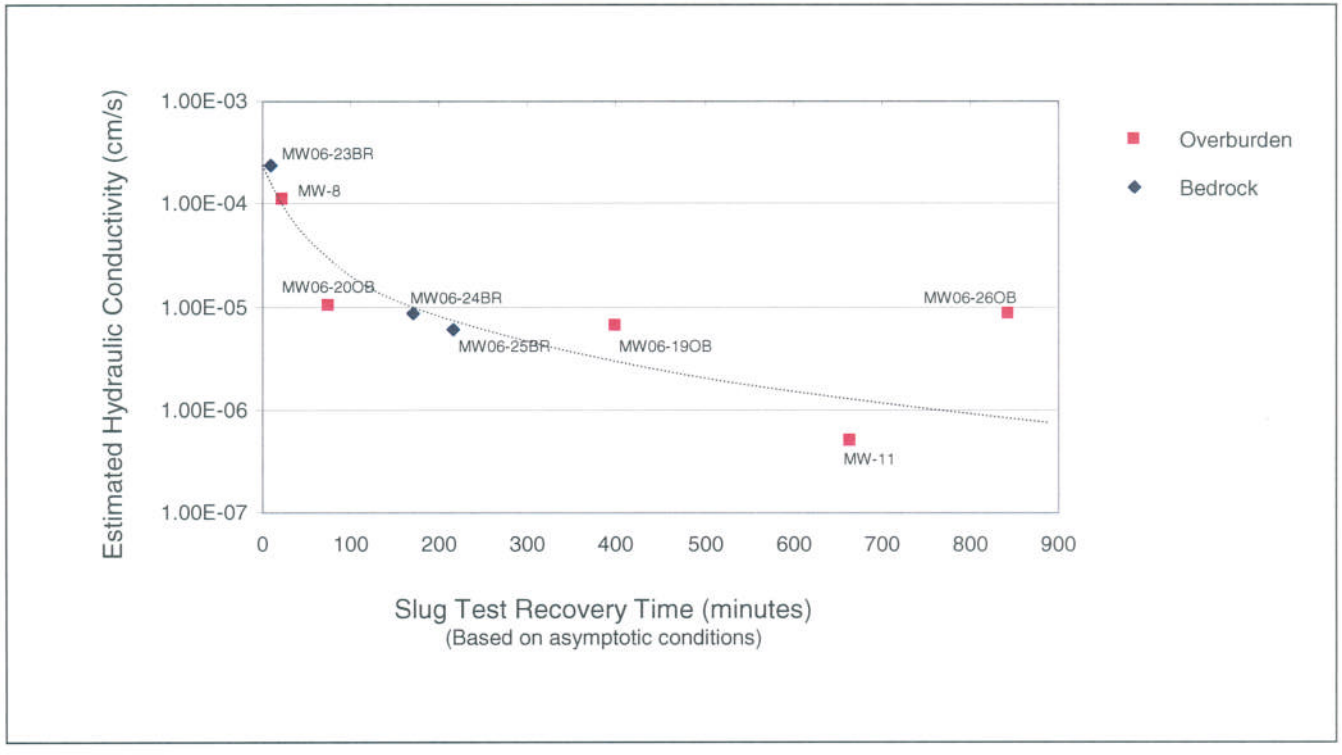
Overburden Saturated Thickness Contours (feet)

SCALE IN FEET
50 0 25 50 100 200

Figure based on Survey by Bryant Assoc., P.C., Aug, 2006.

S&W Redevelopment of North America, LLC. Syracuse, New York DATE:2/2007 JOB No: B4001	In-situ Chemical Oxidation Remedial Design 950 Danby Road Ithaca Tompkins County, New York BCP Site # C755012 Figure 6 Overburden Saturated Thickness

X-REF: NAMES?
2007/Jan/Sky/jlk
J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Design Doc May 08\Figures\950 Danby Fig 6.dwg



The plot shows estimated hydraulic conductivity values for overburden and bedrock wells versus the time at which groundwater recovery approached asymptotic conditions. At least 85% of the initial drawdown was recovered during slug tests for the wells shown.

Notes:
Bedrock wells MW06-22BR and -26BR, which are not shown, appeared to reach asymptotic conditions after 300 minutes (52% recovery) and 240 minutes (10% recovery), respectively. Hydraulic conductivity for MW06-22BR is estimated to be 2.21E-06 cm/s, and for MW06-26BR is estimated to be 2.92E-07 cm/s.

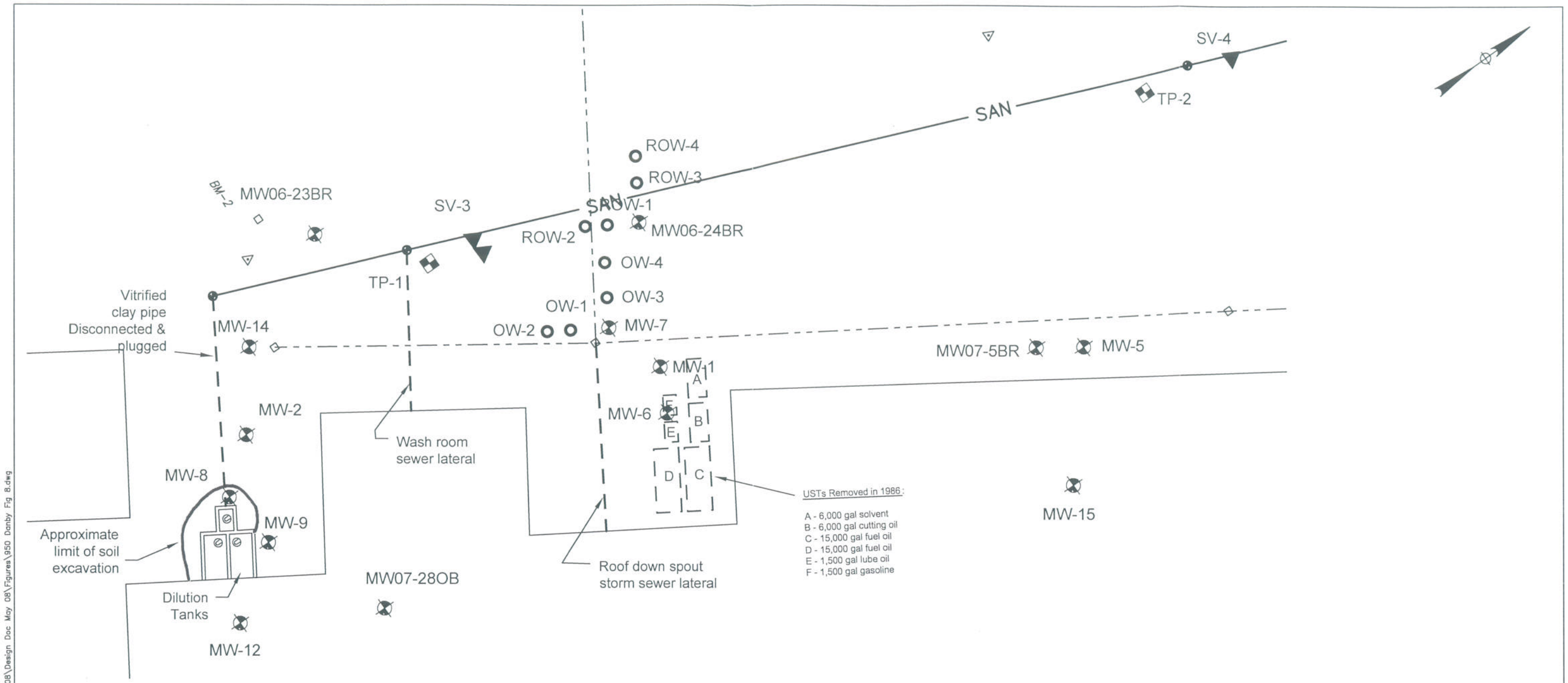
S&W Redevelopment
of North America, LLC

Syracuse, NY

DATE: 5/2008 JOB No: B4001.60

In-situ Chemical Oxidation Remedial Design
950 Danby Road Ithaca
Tompkins County, New York
BCP Site # C755012

FIGURE 7
Hydraulic Conductivity Test Data



- Pilot Test Monitoring/Observation Well Locaiton (approximate).
- SWRNA Groundwater Monitoring Well (surveyed)
- Soil Vapor Monitoring Well Location (surveyed)
- Test Pit Location (surveyed)

SCALE in FEET

15 0 30 60

Figure based on Survey by Bryant Assoc., P.C., Aug, 2006.

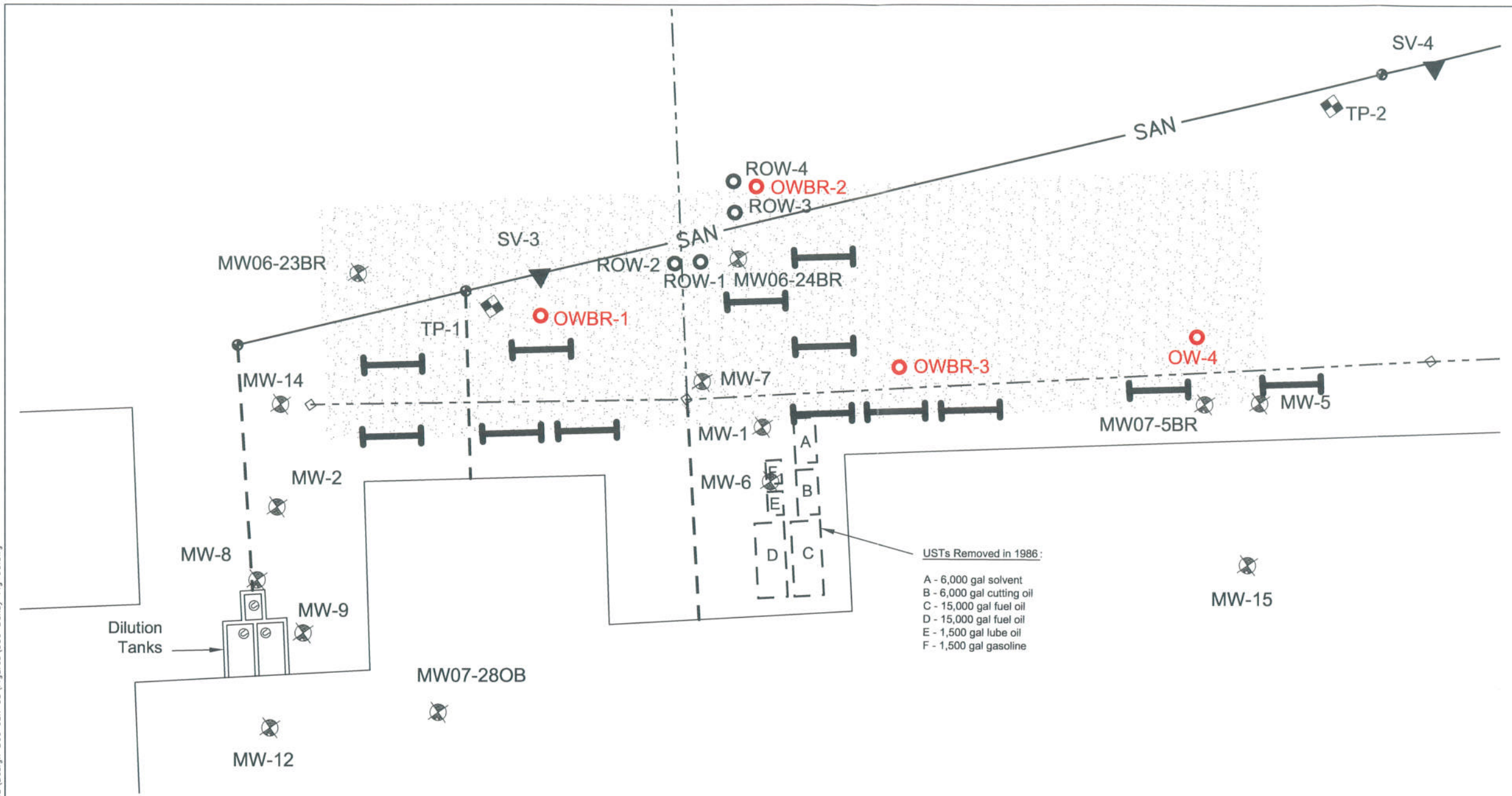
S&W Redevelopment
of North America, LLC.
Syracuse, New York

DATE:5/2008 JOB No: B4001.60

In-situ Chemical Oxidation Remedial Design
950 Danby Road Ithaca
Tompkins County, New York
BCP Site # C755012

Figure 8
Former USTs & Dilution Tank Excavation

X-REF: NAMES?
2007/Nov/Syr/am
J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Design Doc May 08\Figures\950 Danby Fig 8.dwg



- Existing Groundwater Monitoring Well (surveyed)
- Soil Vapor Monitoring Well Location (surveyed)
- Test Pit Location (surveyed)
- Existing ISCO Pilot Test Observation Well Location (4).
- Proposed ISCO Observation Wells (4) .
- 15 foot long Injection Trench.
- Treatment area, approximately 14,400 square feet.

Note: The total number of trenches will depend on the actual lengths of the completed trenches, which may range between 15 & 25 feet each, depending on soil conditions. An adequate number of trenches will be dug to cover the indicated areas.

SCALE in FEET

15 0 30 60

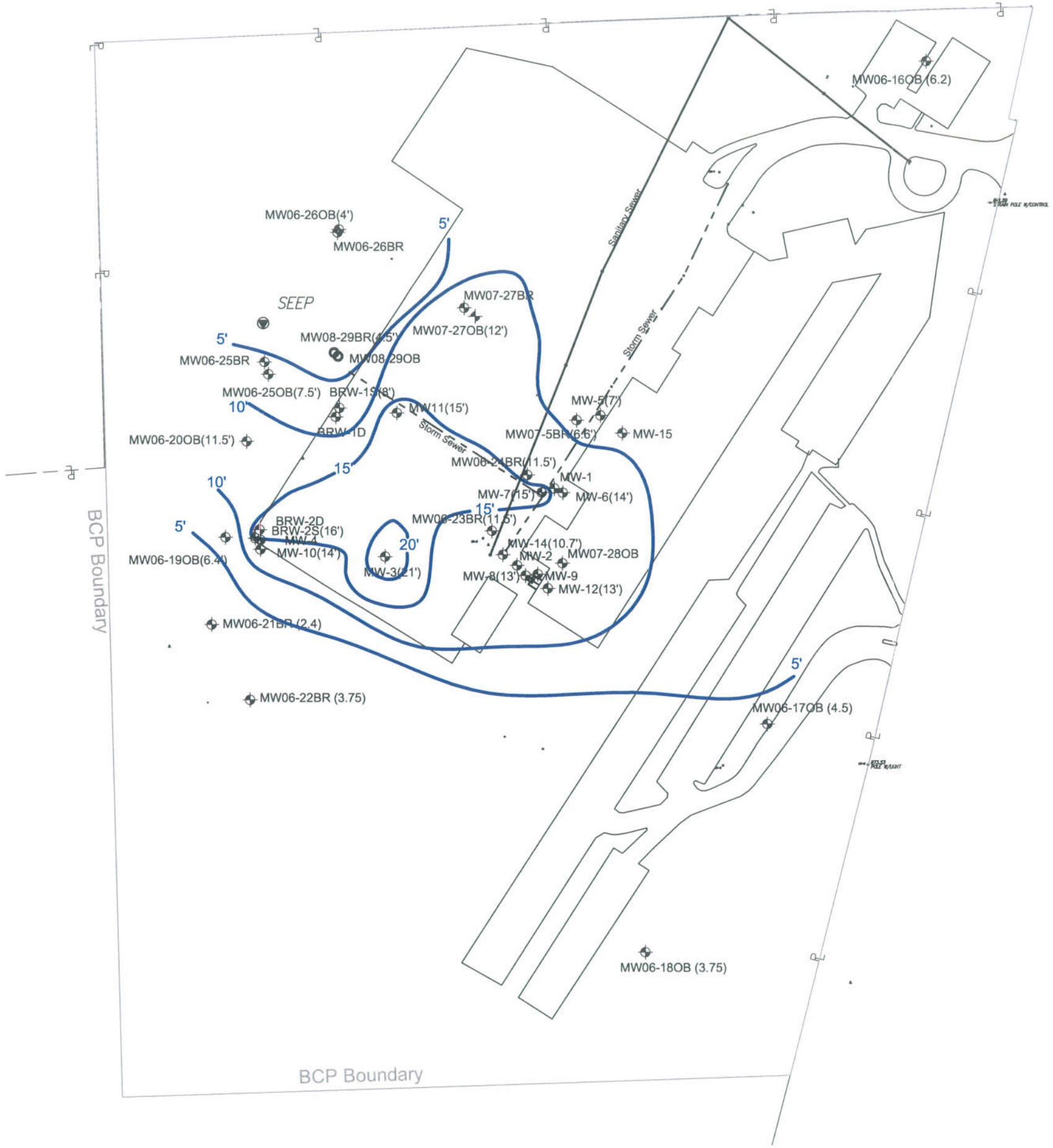
Figure based on Survey by Bryant Assoc., P.C., Aug, 2006.

S&W Redevelopment
of North America, LLC.
Syracuse, New York
DATE:5/2008 JOB No: B4001.60

In-situ Chemical Oxidation Remedial Design
950 Danby Road Ithaca
Tompkins County, New York
BCP Site # C755012

Figure 9
Injection Trench/Observation Well Plan

X-REF: NAMES?
2007/Nov/Syr/am
J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Design Doc Jun 08\Figures\950 Danby Fig 9a.dwg



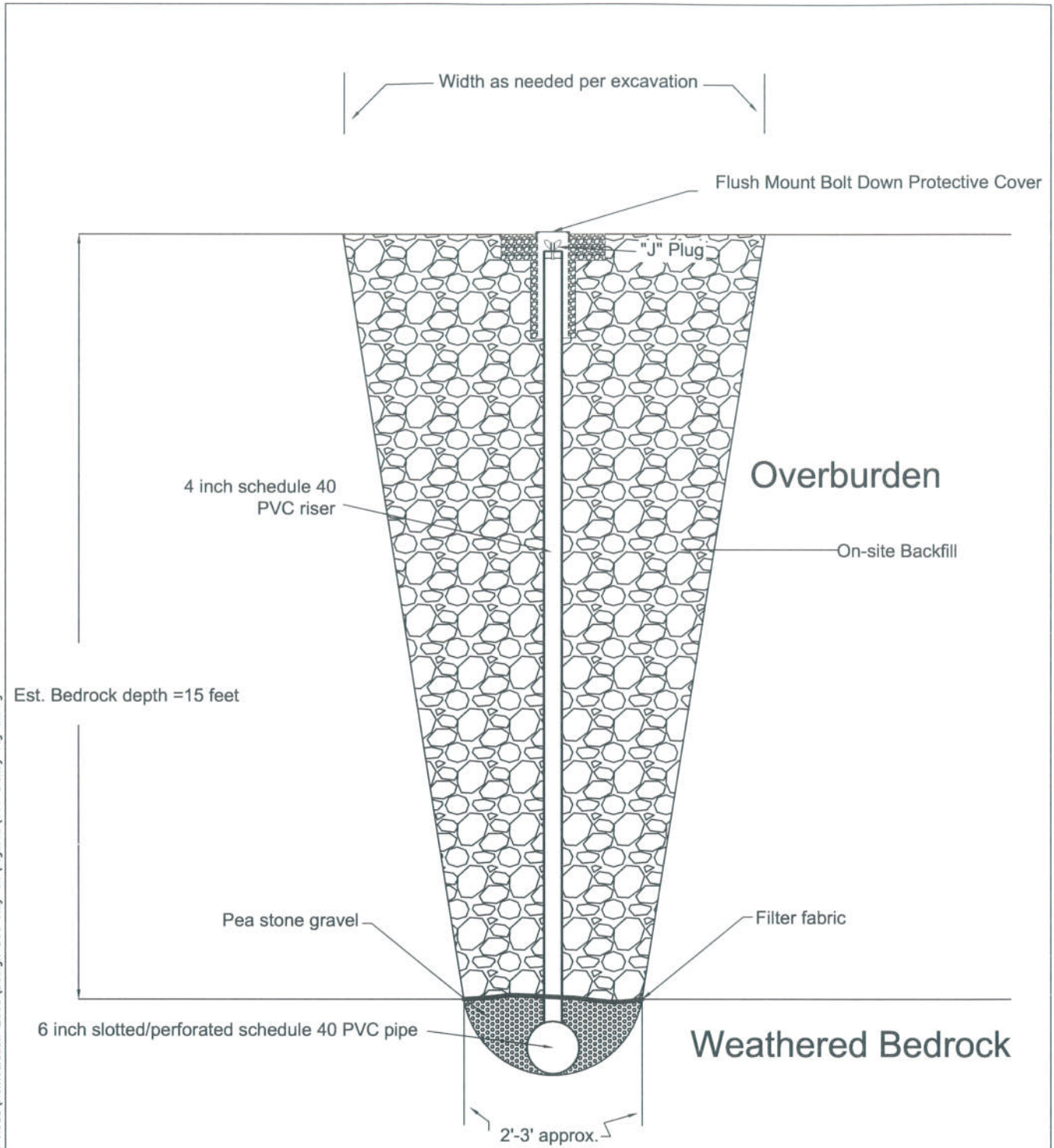
Monitoring well I.D. (depth to bedrock ft bgs)

Depth to bedrock contour interval 5 feet.

SCALE IN FEET
50 0 25 50 100 200

Figure based on Survey by Bryant Assoc., P.C., Aug, 2006.

S&W Redevelopment of North America, LLC. Syracuse, New York DATE:5/2008 JOB No: B4001.60	In-situ Chemical Oxidation Remedial Design 950 Danby Road Ithaca Tompkins County, New York BCP Site # C755012 Figure 10 Depth to Bedrock Contours



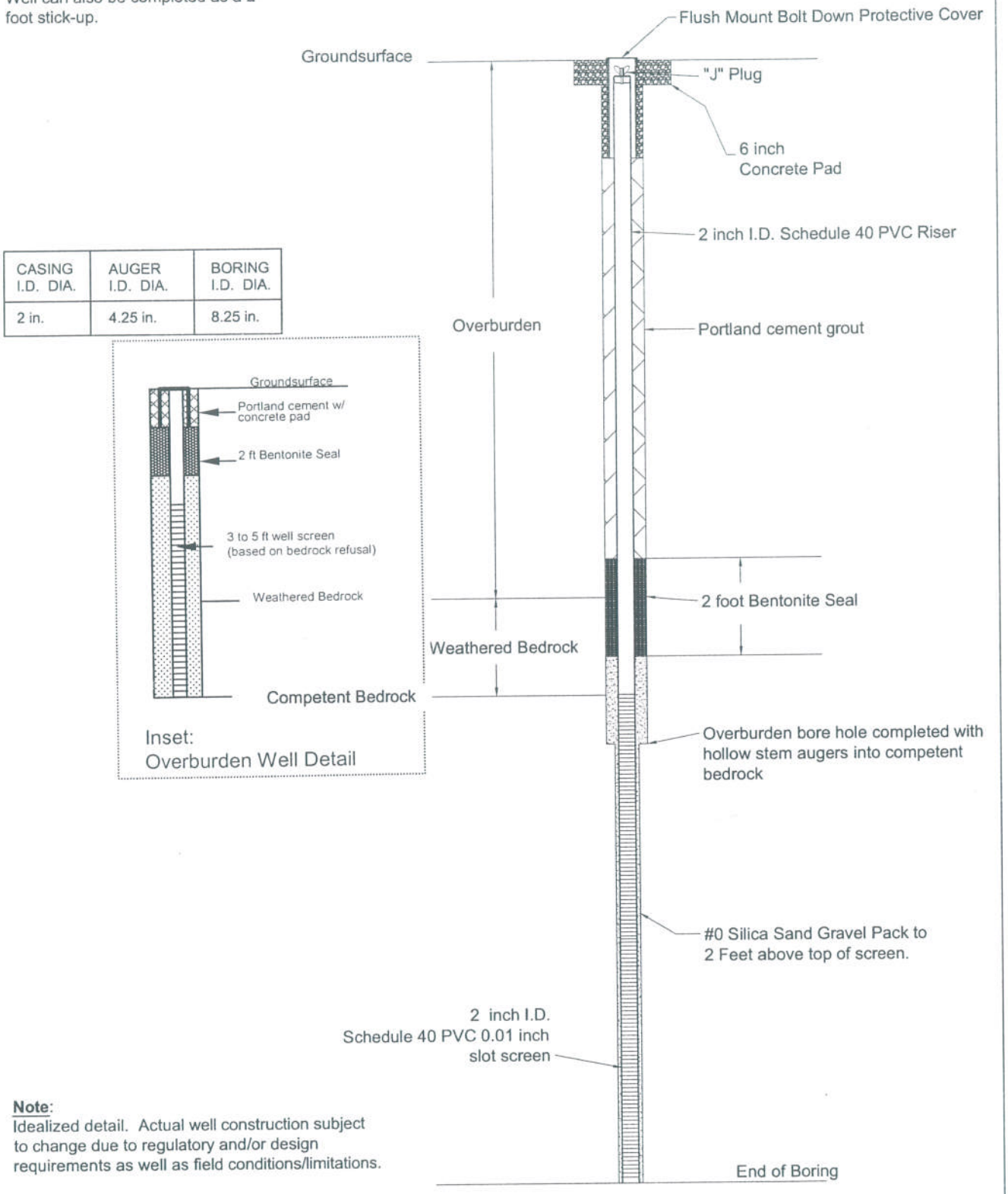
Not to Scale

X-REF: NAMES?
J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Design Doc May 08\Figures\950 Danby Fig 9.dwg
2008/Feb/Syr/jlk

S&W Redevelopment of North America, LLC. Syracuse, New York DATE:5/2008 JOB No.:B4001.60	In-situ Chemical Oxidation Remedial Design 950 Danby Rd., Ithaca, Tompkins Co., New York BCP Site # C755012 Figure 11 Permanganate Injection Trench Detail

Bedrock Well Detail

Note:
Well can also be completed as a 2 foot stick-up.



CASING I.D. DIA.	AUGER I.D. DIA.	BORING I.D. DIA.
2 in.	4.25 in.	8.25 in.

Inset:
Overburden Well Detail

Note:
Idealized detail. Actual well construction subject to change due to regulatory and/or design requirements as well as field conditions/limitations.

Not to Scale

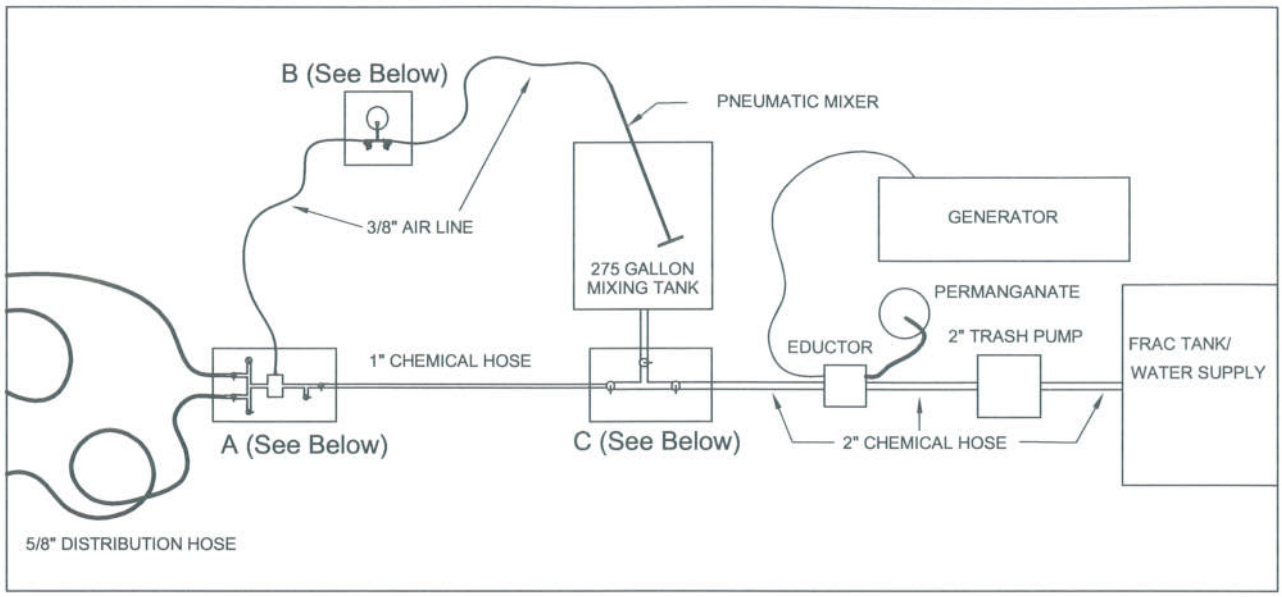
S&W Redevelopment
of North America, LLC.
Syracuse, New York

DATE:5/2008 JOB No.:B4001.60

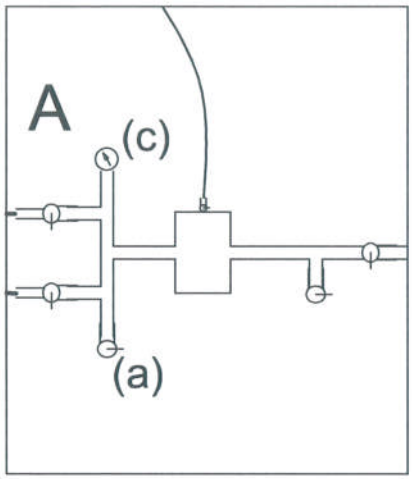
In-situ Chemical Oxidation Remedial Design
950 Danby Rd., Ithaca, Tompkins Co., New York
BCP Site # C755012

Figure 12
Observation Well Detail

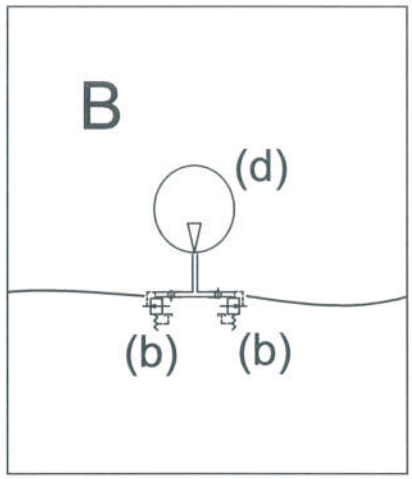
X-REF: NAMES?
2005/September/jlk
J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Design Doc May 08\Figures\950 Danby Fig 12.dwg



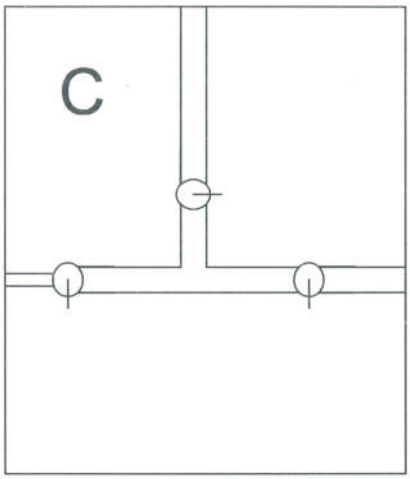
PERMANGANATE DISTRIBUTION SYSTEM



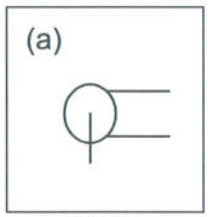
PNEUMATIC DIAPHRAM PUMP &
DISTRIBUTION MANIFOLD



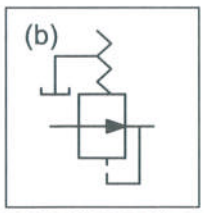
AIR COMPRESSOR &
DISTRIBUTION MANIFOLD



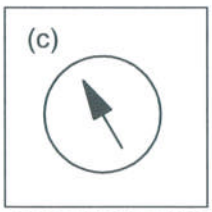
MIXING TANK MANIFOLD



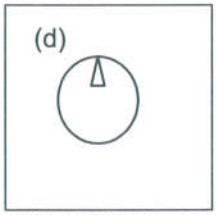
VALVE



PRESSURE CONTROL
VALVE



PRESSURE GAUGE



AIR COMPRESSOR

S&W Redevelopment
of North America, LLC.
Syracuse, New York
DATE:5/2008 JOB No.:B4001.60

In-situ Chemical Oxidation Remedial Design
950 Danby Rd., Ithaca, Tompkins Co., New York
BCP Site # C755012

Figure 13
Permanganate Delivery System

X-REF: NAMES?
2008/Feb/Syr/jlk
J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Design Doc May 08\Figures\950 Danby Fig 13.dwg

Tables

Table 1. Soil Analytical Data, UST Excavation Confirmatory Samples. Former Axiohm Brownfield Site, 950 Danby Road, Ithaca, NY.

ug/Kg	WEST	NORTH	SOUTH	BOTTOM
Acetone	5.1 J	5.8 J	U	4.4 J
Benzene	U	U	U	U
Bromodichloromethane	U	U	U	U
Bromoform	U	U	U	U
Bromomethane	U	U	U	U
Methyl Ethyl Ketone	U	U	U	U
Carbon disulfide	U	U	U	U
Carbon tetrachloride	U	U	U	U
Chlorobenzene	U	U	U	U
Chloroethane	U	U	U	U
Chloroform	U	U	U	U
Chloromethane	U	U	U	U
Dibromochloromethane	U	U	U	U
1,1-Dichloroethane	U	U	U	U
1,2-Dichloroethane	U	U	U	U
1,1-Dichloroethene	U	3.7 J	U	U
1,2-Dichloropropane	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U
trans-1,3-Dichloropropene	U	U	U	U
Ethylbenzene	U	U	2.8 J	U
2-Hexanone	U	U	U	U
Methylene Chloride	4.4 J	5.4 J	1.8 J	1.6 J
methyl isobutyl ketone	U	U	U	U
Styrene	U	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U
Tetrachloroethene	1.2 J	U	1.9 J	U
Toluene	1.2 J	1.5 J	2.3 J	U
1,1,1-Trichloroethane	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U
Trichloroethene	12	260	26	2.5 J
Vinyl chloride	U	U	U	U
Xylenes, Total	U	U	42	U
cis-1,2-Dichloroethene	U	7.1 J	U	U
trans-1,2-Dichloroethene	U	3.3 J	U	U

310-13 TPH				
S-1	Fuel Oil #2	260	U	mg/Kg
S-1	Fuel Oil #4	260	U	mg/Kg
S-1	Fuel Oil #6	260	U	mg/Kg
S-1	Gasoline	260	U	mg/Kg
S-1	Kerosene	260	U	mg/Kg
S-1	Motor Oil	25000		mg/Kg
S-1	Other-1	170	J	mg/Kg

U = not detected (below method detection limit)
J = estimated value

Table 2. Groundwater Analytical Data, March 2008, Pre-Pilot Test. Former Axiohm Brownfield Site, 950 Danby Road, Ithaca, NY.

Monitoring Wells - 2006 (RI) and March 2008

Compound	Class GA	MW-5		MW-12		MW-11		MW-1		MW-6		MW06-23BR		BRW-1D		BRW-1S		MW06-25BR	
µg/L (ppb)	Standard	RI 2006	Mar-08	RI 2006	Mar-08	RI 2006	Mar-08	RI 2006	Mar-08	RI 2006	Mar-08	RI 2006	Mar-08	RI 2006	Mar-08	RI 2006	Mar-08	RI 2006	Mar-08
Acetone	50	U	U M	U	7.9 J	U	U M	U	U M	U	U M	U	U M	32	15	U	1.7 J	U	U
Benzene	1	U	U	U	U	U	U	U	U	U	U	U	U	**2.9** J	**4.3** J	U	0.28 J	U	U
Bromodichloromethane	50	U	U	U	U	U	U	1.4 J	U	U	U	U	U	U	U	U	U	U	U
Bromoform	50	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Bromomethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	1.8 J	U	U	U	U
Methyl Ethyl Ketone	50	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Carbon disulfide	60	U	U	U	0.48 J	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Carbon tetrachloride	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chlorobenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chloroform	7	U	U	U	U	U	U	2.2 J	0.41 J	1.5 J	0.58 J	U	U	U	U	U	U	U	U
Chloromethane		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Dibromochloromethane	50	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-Dichloroethane	5	U	U	0.84 J	0.47 J	U	U	U	U	U	U M	U	6.9 J M	U	1.6 J	U	0.92 J	30	28
1,2-Dichloroethane	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-Dichloroethene	5	U	U	U	U	U	U	U	U	U	U	U	6.4 J	U	U	U	U	15	20
1,2-Dichloropropane	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,3-Dichloropropene	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trans-1,3-Dichloropropene	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Ethylbenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	0.49 J	U	U	U	U
2-Hexanone	50	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Methylene Chloride	5	U	U	3.5 J	24 B	U	U	U	U	U	U	U	11 J B	U	U	U	U	U	2.6 J B
methyl isobutyl ketone		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Styrene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Tetrachloroethene	5	U	U	U	U M	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Toluene	5	U	U	U	1.2 J	U	U	U	U	U	U	U	U	5	7.6	0.41	U	U	U
1,1,1-Trichloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	**240**	**270**
1,1,2-Trichloroethane	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Trichloroethene	5	**63**	**11**	**46**	**46**	**10**	2.3 J	2.5 J	**6.7**	3.9 J	3.2 J	**590**	**1200**	**10**	**9**	**87**	**33**	**57**	**50**
Vinyl chloride	2	U	U	U	U	U	U	U	0.71 J	U	U	**46**	**54** J	U	U	**8.2**	**2.2** J	U	**10** J
Xylenes, Total	5	U	U	U	U	U	U	U	U	U	U	U	U	1.9 J	2.7 J	U	U	U	U
cis-1,2-Dichloroethene	5	**13**	1.3 J	**18**	**14**	2.9 J	0.62 J	0.85 J	**9.3**	U	1.4 J	**420**	**910**	**34**	**32**	**80**	**50**	**42**	**45**
trans-1,2-Dichloroethene	5	U	U	U	0.88 J	U	U	U	0.32 J	U	U	U	8.5 J	U	0.41 J	4.2 J	3.2 J	U	0.91 J M

Bedrock Observation Wells (March 2008)

µg/L (ppb)	Standard	ROW-1	ROW-2	ROW-3	ROW-4
Acetone	50	5 J	U	U M	U M
Benzene	1	0.34 J	U	U	U
Bromodichloromethane	50	4.7 J	0.28 J	0.35 J	U
Bromoform	50	U	U	U	U
Bromomethane	5	U	U	U	U
Methyl Ethyl Ketone	50	U	U	U	U
Carbon disulfide	60	0.2 J M	0.31 J M	U	U
Carbon tetrachloride	5	U	U	U	U
Chlorobenzene	5	U	U	U	U
Chloroethane	5	U	U	U	U
Chloroform	7	8.2	0.61 J	0.94 J	0.52 J
Chloromethane		U	U	U	U
Dibromochloromethane	50	2.6 J	U	U	U
1,1-Dichloroethane	5	U	U	U	U
1,2-Dichloroethane	0.6	U	U	U	U
1,1-Dichloroethene	5	U	U	U	U
1,2-Dichloropropane	1	U	U	U	U
cis-1,3-Dichloropropene	0.4	U	U	U	U
trans-1,3-Dichloropropene	0.4	U	U	U	U
Ethylbenzene	5	U	U	U	U
2-Hexanone	50	U	U	U	U
Methylene Chloride	5	U M	U	U	U M
methyl isobutyl ketone		U	U	U	U
Styrene	5	U	U	U	U
1,1,2,2-Tetrachloroethane	5	U	U	U	U
Tetrachloroethene	5	U	U	U	U
Toluene	5	1.2 J	0.3 J	0.3 J	0.31 J
1,1,1-Trichloroethane	5	U	U	U	U
1,1,2-Trichloroethane	1	U	U	U	U
Trichloroethene	5	4.4 J	0.48 J	0.29 J	U
Vinyl chloride	2	U	U	U	U
Xylenes, Total	5	U	U	U	U
cis-1,2-Dichloroethene	5	U	U	U	U
trans-1,2-Dichloroethene	5	U	U	U	U

U - Below Detection Limit

J - Estimated concentration detected below quantitation limit

M - Manually integrated

Exceeds Class GA Standard

Table 3. SSDS Exhaust Air Sample Analysis Results. Former Axiohm Brownfield Site, 950 Danby Road, Ithaca, NY.

Compound	S-1 ‡ Exhaust Nov-07 ug/m^3	S-2 Exhaust Nov-07 ug/m^3	S-3 Exhaust Nov-07 ug/m^3	Stack Exhaust Mar-08 ug/m^3
1,1,1-Trichloroethane	62	31	28	21
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
1,1-Dichloroethane	7	7	6.7	2.8
1,1-Dichloroethene	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND
1,2,4-Trimethylbenzene	3.3	3.9	3.8	1.2
1,2-Dibromoethane	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
1,3,5-Trimethylbenzene	1.9	2.1	2.1	0.65
1,3-butadiene	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND
1,4-Dichlorobenzene	2.3	2.4	2.4	ND
1,4-Dioxane	ND	ND	ND	ND
2,2,4-trimethylpentane	ND	ND	ND	ND
4-ethyltoluene	0.65	0.65	0.7	0.55
Acetone	710 (E)	440	520 (E)	27
Allyl chloride	ND	ND	ND	ND
Benzene	1.2	1.2	1.1	1.6
Benzyl chloride	ND	ND	ND	ND
Bromodichloromethane	2.1	2.2	2.2	2.9
Bromoform	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Carbon disulfide	0.51	0.57	0.57	0.51
Carbon tetrachloride	ND	ND	0.64	0.64
Chlorobenzene	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Chloroform	10	11	10	5.9
Chloromethane	1.2	1.4	ND	0.76
cis-1,2-Dichloroethene	19	9.3	8.9	5.4
cis-1,3-Dichloropropene	ND	ND	ND	ND
Cyclohexane	ND	ND	0.77	0.84
Dibromochloromethane	ND	ND	ND	ND
Ethyl acetate	ND	ND	ND	1.8
Ethylbenzene	0.93	1.1	1.1	1.5
Freon 11	3.3	3.3	3.3	2.4
Freon 113	330	160	150	79
Freon 114	ND	ND	ND	ND
Freon 12	3.6	4.5	4.4	2.5
Heptane	1.3	ND	ND	4.5
Hexachloro-1,3-butadiene	ND	ND	ND	ND
Hexane	3.7	3.6	3.5	1.9
Isopropyl alcohol	5.6	ND	ND	ND
m&p-Xylene	1.7	2.1	2	4.6
Methyl Butyl Ketone	ND	ND	ND	ND
Methyl Ethyl Ketone	100	44	38	2.7
Methyl Isobutyl Ketone	ND	ND	ND	ND
Methyl tert-butyl ether	ND	ND	ND	ND
Methylene chloride	31	15	14	30
o-Xylene	0.71	0.79	0.79	1.4
Propylene	ND	ND	ND	ND
Styrene	0.65	0.78	ND	0.61
Tetrachloroethylene	2.6	2.1	2	1.2
Tetrahydrofuran	240	150	130	1.4
Toluene	2.3	2.4	2.2	21
trans-1,2-Dichloroethene	0.44	ND	ND	0.73
trans-1,3-Dichloropropene	ND	ND	ND	ND
Trichloroethene	170	97	87	61
Vinyl acetate	ND	ND	ND	ND
Vinyl bromide	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	0.44

NA - Not analyzed

NS - Not sampled due to excessive moisture in soil vapor well

ND - Not Detected

All results in micrograms per cubic meter

‡ S-1, S-2, and S-3 were taken in immediate sequence

Table 4. Groundwater Analytical Data, March-April 2008, Swale Bedrock Monitoring Wells. Former Axiohm Brownfield Site, 950 Danby Road, Ithaca, NY.

µg/L (ppb)	Class GA Standard	28-Mar-08 BR08-29BR	14-Apr-08 BR08-29BR	14-Apr-08 BR08-29
Acetone	50	40	11	**210** B
Benzene	1	0.71 J	0.24 J	0.54 J
Bromodichloromethane	50	U	U	U
Bromoform	50	U	U	U
Bromomethane	5	U	U	U
Methyl Ethyl Ketone	50	15	U	33
Carbon disulfide	60	0.79 JM	U	1.2 J
Carbon tetrachloride	5	U	U	U
Chlorobenzene	5	U	U	U
Chloroethane	5	U	U	U
Chloroform	7	U	U	U
Chloromethane		U	U	U
Dibromochloromethane	50	U	U	U
1,1-Dichloroethane	5	U	U	U
1,2-Dichloroethane	0.6	U	U	U
1,1-Dichloroethene	5	U	U	U
1,2-Dichloropropane	1	U	U	U
cis-1,3-Dichloropropene	0.4	U	U	U
trans-1,3-Dichloropropene	0.4	U	U	U
Ethylbenzene	5	U	U	U
2-Hexanone	50	U	U	U
Methylene Chloride	5	U	U	4.4 JB
methyl isobutyl ketone		1.2 J	U	8.5 J
Styrene	5	U	U	U
1,1,2,2-Tetrachloroethane	5	U	U	U
Tetrachloroethene	5	U	U	U
Toluene	5	**6.8**	1.5 J	0.93 J
1,1,1-Trichloroethane	5	U	U	U
1,1,2-Trichloroethane	1	U	U	U
Trichloroethene	5	4.6 J	3.4 J	**6.3** J
Vinyl chloride	2	U	U	U
Xylenes, Total	5	1.4 J	U	U
cis-1,2-Dichloroethene	5	5 J	2.7 J	3.3 J
trans-1,2-Dichloroethene	5	U	U	U

U - Below Detection Limit

J - Estimated concentration detected below quantitation limit

M - Manually integrated

Exceeds Class GA Standard

Table 5. Potassium Permanganate Dosage Estimate. Former Axiohm Brownfield Site, 950 Danby Road, Ithaca, NY.

Version 3.0 0104

Parameters	Units	Estimates
*** Site Description ***		
Length	Ft.	60
Width	Ft.	240
Area	Sq. Ft.	14400
Thickness	Ft.	15
Total Volume	Cu. Yd.	8000
Porosity	%	20
Plume Total Pore Volume	Gal.	323158
Avg. Contaminant Conc.	ppm	2.1
Mass of Contaminant	lb.	5.663447261
PSOD	g/kg	4.1
Effective PSOD %	10	0.41
PSOD	lb/yd3	1.2177
PSOD Oxidant Demand	lb	9741.60
Avg. Stoichiometric Demand	lb/lb	2.4
Contaminant Oxidant Demand	lb.	13.59227343
Calculated Oxidant Demand	lb.	9755.19

Dry KMnO4 Injection Options

Pounds of KMnO4 (Dry Crystals)
9,755

Total Gallons of Dilution Water Required
18,325.10

Number of Pails	Number of Drums
176.96	29.49

Spreadsheet provided by Carus Chemical Corp.

APPENDICES

Appendix A
Soil Boring Logs

S&W Redevelopment

of North America, LLC

South Hill Business Campus
Remedial Action Pilot Test
950 Danby Road
Ithaca, New York

Job No. B4001.60

BORING LOG: OW-1

Date Started	: 3/11/08
Time	: 1:00pm
Date Completed	: 3/11/08
Time	: 2:45pm
Drilling Contractor	: Parratt-Wolff
Driller	: Mickey

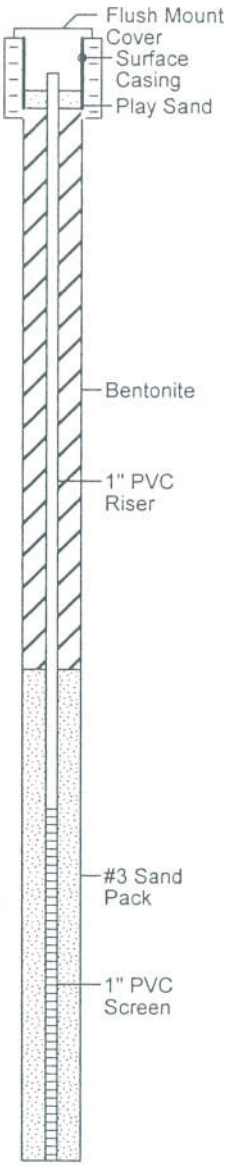
Total Boring Depth	: 16 ft bgs
Drilling Method	: 3 1/4" Hollow-stem auger
Drilling Equipment	: CME 55
Sampling Method	: N/A
Logged By	: DJH
Survey	: N/A
Boring Location	: Initial Pilot Test Area
	: 11.5' South of MW-7

Sample Condition
- No Recovery
- Recovery
- No Sample

Water Levels
- After Completion
- During Drilling

Depth (ft bgs)	Recovery (Inches)	Sample	PID (Vppm)	DESCRIPTION	REMARKS
0				No Samples collected	
14				refusal encountered	
16				End of Boring	

Observation Well: OW-1



Hole was advanced over previous OW-1 Boring, which had been drilled to a depth of 14' on 3/6/08.

BORING LOG: OW-1

04-25-2008 J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Pilot Test Well Boring Logs\OW-1.bor

S&W Redevelopment

of North America, LLC

South Hill Business Campus
Remedial Action Pilot Test
950 Danby Road
Ithaca, New York

Job No. B4001.60

BORING LOG: OW-2

Date Started	: 3/11/08
Time	: 10:00am
Date Completed	: 3/11/08
Time	: 12:00pm
Drilling Contractor	: Parratt-Wolff
Driller	: Mickey

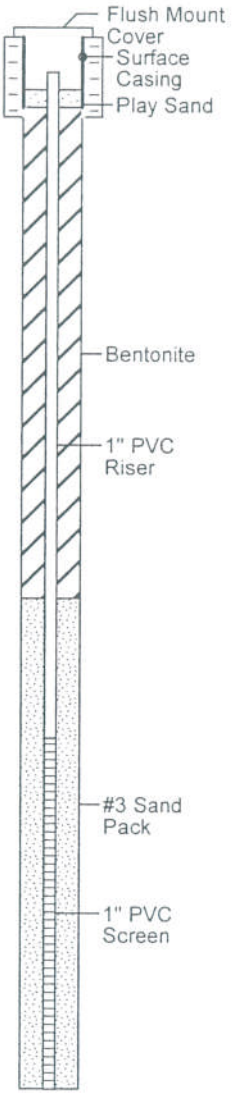
Total Boring Depth	: 16 ft bgs
Drilling Method	: 3 1/4" Hollow-stem auger
Drilling Equipment	: CME 55
Sampling Method	: N/A
Logged By	: DJH
Survey	: N/A
Boring Location	: Initial Pilot Test Area
	: 18.5' South of MW-7

Sample Condition
- No Recovery
- Recovery
- No Sample

Water Levels
- After Completion
- During Drilling

Depth (ft bgs)	Recovery (Inches)	Sample	PID (Vppm)	DESCRIPTION	REMARKS
0				No Samples collected	
12				Near-refusal encountered. Able to auger gradually through variably resistant material.	
16				Refusal encountered (probable bedrock surface) End of Boring	

Observation Well: OW-2



Hole was advanced over previous OW-2 Boring, which had been drilled to a depth of 10.5' on 3/6/08.

BORING LOG: OW-2

04-25-2008 J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Pilot Test Well Boring Logs\OW-2.bor

S&W Redevelopment

of North America, LLC

South Hill Business Campus
Remedial Action Pilot Test
950 Danby Road
Ithaca, New York

Job No. B4001.60

BORING LOG: OW-3

Date Started	: 3/11/08
Time	: 8:00am
Date Completed	: 3/11/08
Time	: 9:30pm
Drilling Contractor	: Parratt-Wolff
Driller	: Mickey

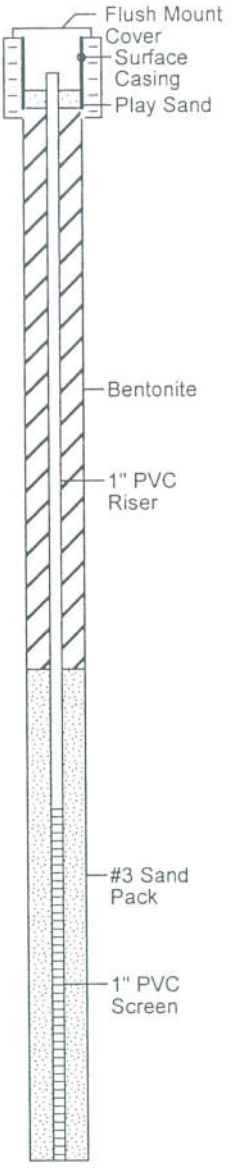
Total Boring Depth	: 16 ft bgs
Drilling Method	: 3 1/4" Hollow-stem auger
Drilling Equipment	: CME 55
Sampling Method	: N/A
Logged By	: DJH
Survey	: N/A
Boring Location	: Initial Pilot Test Area
	: 9' West of MW-7

Sample Condition
- No Recovery
- Recovery
- No Sample

Water Levels
- After Completion
- During Drilling

Depth (ft bgs)	Recovery (Inches)	Sample	PID (Vppm)	DESCRIPTION	REMARKS
0				No Samples collected	
10				Near-refusal encountered. Able to break through resistant material after 20-30 minutes of augering.	
16				Refusal encountered (probable bedrock surface)	
				End of Boring	

Observation Well: OW-3



Hole was advanced over previous OW-3 Boring, which had been drilled to a depth of 10.5' on 3/6/08.

BORING LOG: OW-3

04-25-2008 J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Pilot Test Well Boring Logs\OW-3.bor

S&W Redevelopment
of North America, LLC

South Hill Business Campus
Remedial Action Pilot Test
950 Danby Road
Ithaca, New York

Job No. B4001.60

BORING LOG: OW-4

Date Started	: 3/11/08
Time	: 8:00am
Date Completed	: 3/11/08
Time	: 9:30pm
Drilling Contractor	: Parratt-Wolff
Driller	: Mickey

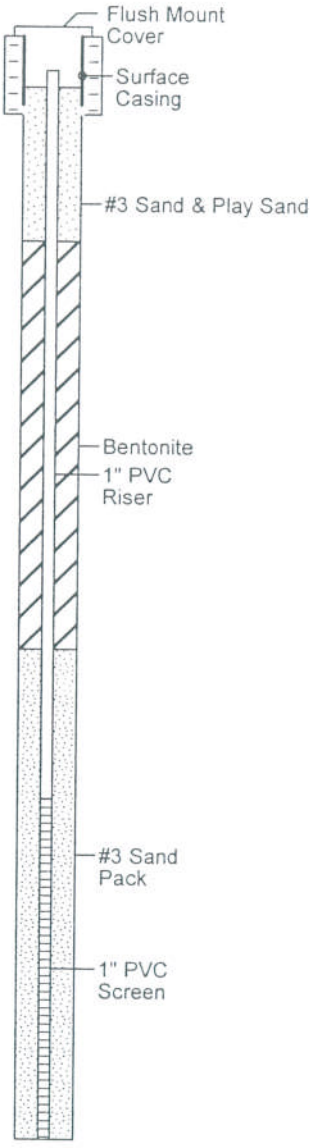
Total Boring Depth	: 16.2 ft bgs
Drilling Method	: 3 1/4" Hollow-stem auger
Drilling Equipment	: CME 55
Sampling Method	: N/A
Logged By	: DJH
Survey	: N/A
Boring Location	: Initial Pilot Test Area
	: 19.5' West of MW-7

Sample Condition
- No Recovery
- Recovery
- No Sample

Water Levels
- After Completion
- During Drilling

Depth (ft bgs)	Recovery (Inches)	Sample	PID (Vppm)	DESCRIPTION	REMARKS
0				No Samples collected	
16				Refusal encountered. Augered for 5 minutes to 16.2'. End of Boring	

Observation Well: OW-4



Hole was advanced over previous OW-4 Boring, which had been drilled to a depth of 11.8' on 3/7/08.

BORING LOG: OW-4

04-25-2008 J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Pilot Test Well Boring Logs\OW-4.bor

S&W Redevelopment

of North America, LLC

South Hill Business Campus
Remedial Action Pilot Test
950 Danby Road
Ithaca, New York

Job No. B4001.60

BORING LOG: ROW-1

Date Started	: 3/5/08
Time	: 8:00am
Date Completed	: 3/10/08
Time	: 12:00pm
Drilling Contractor	: Parratt-Wolff
Driller	: Mickey

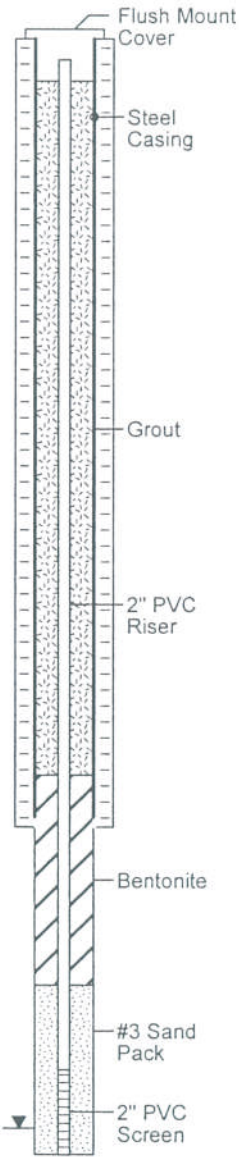
Total Boring Depth	: 27 ft bgs
Drilling Method	: Hollow-stem auger to 18.5'
	: Roller-bit coring 18.5-27'
Drilling Equipment	: CME 55
Sampling Method	: 2" Split spoon/ core(rock)
Logged By	: JLK
Survey	: N/A
Boring Location	: Initial Pilot Test Area
	: 9'9" South of MW06-24BR

Sample Condition
- No Recovery
- Recovery
- No Sample

Water Levels
- After Completion
- During Drilling

Depth (ft bgs)	Recovery (Inches)	Sample	PID (Vppm)	DESCRIPTION	REMARKS
0					
2					
4					
6	18"			Dry-moist, dark gray CLAY, little silt, some medium gravel (shale fragments). Fill material.	
8					
10					
12					
14					
16				bedrock encountered (shale)	
18					
20					run#1: RQD = 28%
22	5'				
24					
26	2'				run#2: RQD = 32%
				End of Boring	

Observation Well: ROW-1



BORING LOG: ROW-1

04-25-2008 J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Pilot Test Well Boring Logs\ROW-1.bor

S&W Redevelopment

of North America, LLC

South Hill Business Campus
Remedial Action Pilot Test
950 Danby Road
Ithaca, New York

Job No. B4001.60

BORING LOG: ROW-2

Date Started	: 3/6/08
Time	: 10:30am
Date Completed	: 3/10/08
Time	: 3:30pm
Drilling Contractor	: Parratt-Wolff
Driller	: Mickey

Total Boring Depth	: 27 ft bgs
Drilling Method	: Hollow-stem auger to 19'
	: Roller-bit coring 19-27'
Drilling Equipment	: CME 55
Sampling Method	: 2" Split spoon/ core(rock)
Logged By	: DJH
Survey	: N/A
Boring Location	: Initial Pilot Test Area
	: 16'5" South of MW06-24BR

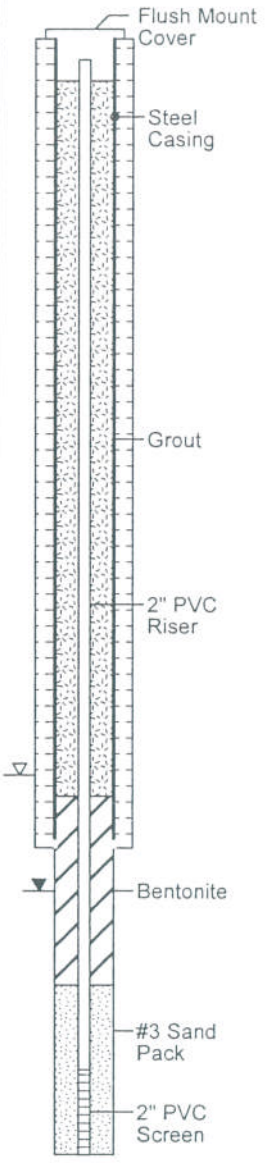
Sample Condition: No Recovery; Recovery; No Sample

Water Levels: After Completion; During Drilling

Depth (ft bgs)	Recovery (Inches)	Blow Count	Sample	PID (Vppm)	DESCRIPTION	REMARKS
0	7"	6 6			dark silt and asphalt fragments	
2	14"	5 4		0.2	wet, medium stiff, gray-brown CLAY, some silt, little medium-coarse gravel	
4	13"	4 6 10		0.4	Same as above, moist, some fine-coarse gravel including large rocks up to 2"	
6	14"	4 5 6 6		0.0	moist-dry rock fragments and dry red-brown SILT/clay	
8	14"	6 6 10 12		0.3	wet, medium stiff, gray-brown CLAY, some silt and rock fragments	
10	16"	10 3 7 14 9		0.3	dry, dark and light gray, fine to coarse rock fragments, little silt/clay	
12	8"	6 6 6 4 3		0.1	moist, soft, brown CLAY, some silt, little fine-medium gravel moist-dry, brown-orange CLAY and fine-coarse rock fragments	
14	14"	4 7 7 10 6		0.3	Same as above, some rock fragments are red large gray rock fragment (shale)	
16		2 2 6 7 3		1.2	soft, orange-brown, CLAY, little fine gravel wet, soft, brown CLAY and rock fragments	
18	2"	3 50/.3			bedrock encountered (shale) dark gray fractured bedrock in thin flakes to powder	
20						run#1: RQD = 27%
22	5'					
24						run#2: RQD = 15%
26	1.9'					

End of Boring

Observation Well: ROW-2



PID utilized: MiniRae 2000 calibrated to 100 Vppm isobutylene.

BORING LOG: ROW-2

04-25-2008 J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Pilot Test Well Boring Logs\ROW-2.bor

S&W Redevelopment

of North America, LLC

South Hill Business Campus
Remedial Action Pilot Test
950 Danby Road
Ithaca, New York

Job No. B4001.60

BORING LOG: ROW-3

Date Started	: 3/5/08
Time	: 3:00pm
Date Completed	: 3/7/08
Time	: 4:00pm
Drilling Contractor	: Parratt-Wolff
Driller	: Mickey

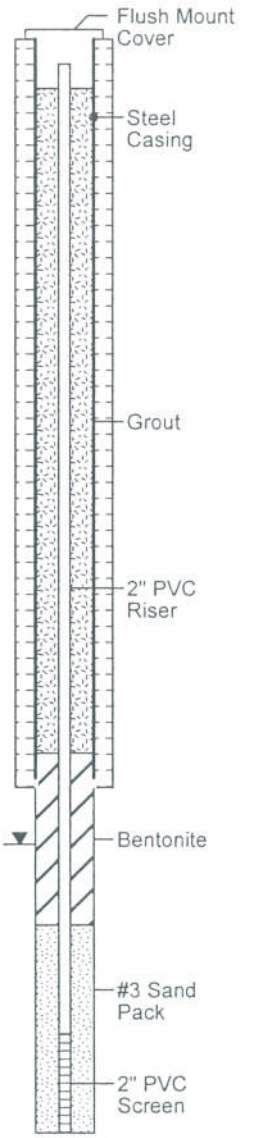
Total Boring Depth	: 23 ft bgs
Drilling Method	: Hollow-stem auger to 15'
	: Roller-bit coring 15-23'
Drilling Equipment	: CME 55
Sampling Method	: 2" Split spoon/ core(rock)
Logged By	: JLK
Survey	: N/A
Boring Location	: Initial Pilot Test Area
	: 12' West of MW06-24BR

Sample Condition
- No Recovery
- Recovery
- No Sample

Water Levels
- After Completion
- During Drilling

Depth (ft bgs)	Recovery (Inches)	Blow Count	Sample	PID (Vppm)	DESCRIPTION	REMARKS
0						Perched Water 6"-12" bgs
8	12"	1, 7, 14, 3			moist, dark gray CLAY, little silt, some medium gravel (shale). Fill material.	
10					grinding on rock (shale)	
14						run#1: RQD = 10%
16	4.5'					
20	2.9'					run#2: RQD = 10%
22					End of Boring	

Observation Well: ROW-3



04-25-2008 J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Pilot Test Well Boring Logs\ROW-3.bor

BORING LOG: ROW-3

S&W Redevelopment

of North America, LLC

South Hill Business Campus
Remedial Action Pilot Test
950 Danby Road
Ithaca, New York

Job No. B4001.60

BORING LOG: ROW-4

Date Started	: 3/6/08
Time	: 8:00am
Date Completed	: 3/7/08
Time	: 12:00pm
Drilling Contractor	: Parratt-Wolff
Driller	: Mickey

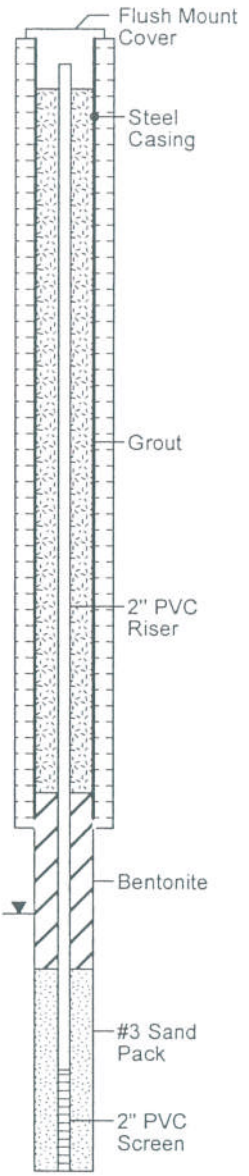
Total Boring Depth	: 22.5 ft bgs
Drilling Method	: Hollow-stem auger to 15.5'
	: Roller-bit coring 15.5-23'
Drilling Equipment	: CME 55
Sampling Method	: 2" Split spoon/ core(rock)
Logged By	: JLK
Survey	: N/A
Boring Location	: Initial Pilot Test Area
	: 19'6" West of MW06-24BR

Sample Condition: No Recovery; Recovery; No Sample

Water Levels: After Completion; During Drilling

Depth (ft bgs)	Recovery (Inches)	Blow Count	Sample	PID (Vppm)	DESCRIPTION	REMARKS
0	12"	3 7 5		0.0	moist, gray CLAY, some silt, some fine-medium gravel. Fill material with weathered rock.	
2	10"	14 14 10		0.0		
4	14"	17 5 6 7		0.0		
6	12"	10 3 5 7		0.0		
8	6"	9 3 5 6		0.0		
10	4"	5 8 9 9		0.0		
12	2"	18 50/.2			bedrock encountered (shale) spoon refusal, shale in nose	
14	1"	50/.1				run#1: RQD = 8%
16	4'					
18						run#2: RQD = 20%
20	3'					
22					End of Boring	

Observation Well: ROW-4



PID utilized: MiniRae 2000 calibrated to 100 Vppm isobutylene.

BORING LOG: ROW-4

04-25-2008 J:\PROJECTS\B-XXXX\B4000\B4001 - Axiohm 950 Danby Road\Remediation 2008\Pilot Test Well Boring Logs\ROW-4.bor

S&W Redevelopment
of North America, LLC

950 Danby Road
Remedial Investigation
BCP Site No. C755012
Ithaca, Tompkins County, New York

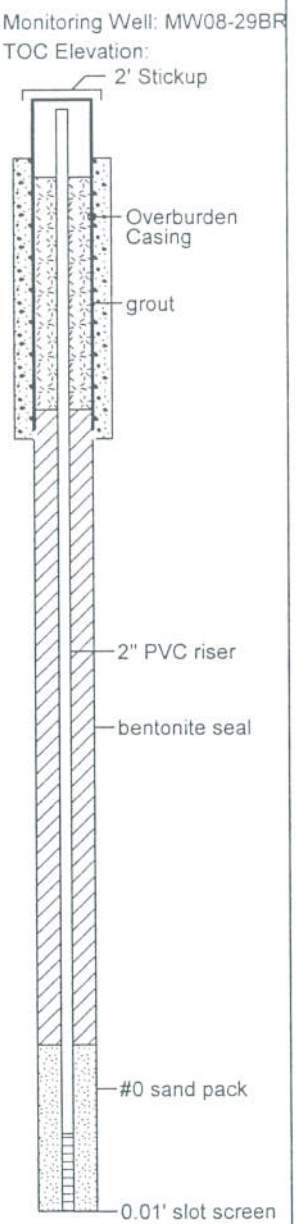
Project No. B4001.60

Depth of Boring	: 27.3-feet bgs
Drilling Contractor	: Parratt Wolff, Inc.
Drilling Rig Type	: ATV-D-50
Driller	: Jim Lansing/Brad Palmer
Drilling Method	: Hollow Stem Augers
Hydraulic Hammer	:
Sampling Method	: Split Spoon 1-3/8" ID
Logged By	: JLK
Surveyed By	:

LOG OF BORING MW08-29BR
(Page 1 of 1)

Date/Time Started	: 3-25-08; 11:50
Date/Time Completed	: 3-26-08; 15:00
Weather	: overcast, 30F
Boring Location	: West of Parking lot below stormwater outfall

Depth in Feet (bgs)	Surf. Elev. 818.68	Recovery (Inches)	DESCRIPTION
0	818	16	Soil & organic matter wet, soft brown clay, trace gravel
2	816	9	wet, gray weatherd shale, little clay spoon refusal @ 3 ft bgs, shale, augered to 4 ft bgs
4	814	6	dry shale chips spoon refusal at 4.5 ft bgs, augered to 7 ft bgs
6	812		Shale
8	810	2.1	1st core - 7 - 9.1 ft bgs, Recovered 2.1 ft - RQD 0.0%
10	808		
12	806	60	2nd core - 9.1 - 14.1 bgs, Recovered 5 ft - RQD 42%
14	804		
16	802	59	3rd core - 14.1 - 19.1 ft bgs, Recovered 5 ft - RQD 66.1%
18	800		
20	798		4th core - 19.1 - 24.3 ft bgs, Recovered 5.2 ft - RQD 68.2%
22	796	63	
24	794		5th core - 24.3 - 27.3 ft bgs. Recovered 3 ft - RQD 77.8%
26	792	36	
28	790		End Boring
30			



NOTES:
bgs - below ground surface
NR - no recovery
RQD - Rock Quality Designation (%)

LOG OF BORING MW08-29BR
(Page 1 of 1)

S&W Redevelopment

of North America, LLC

950 Danby Road
Remedial Investigation
BCP Site No. C755012
Ithaca, Tompkins County, New York

Project No. B4001.10

Depth of Boring	: 7-feet bgs
Drilling Contractor	: Parratt Wolff
Drilling Rig Type	: CME-850
Driller	: Joe Percy, Joel, Brad
Drilling Method	: HSA
Hydraulic Hammer	: hydraulic hammer
Sampling Method	: Split Spoon 1-3/8" ID
Logged By	: JLK
Surveyed By	: Bryant Assoc, P.C.

LOG OF BORING MW08-29OB

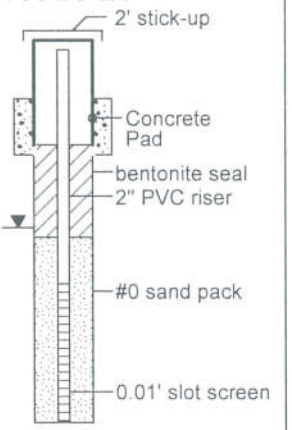
(Page 1 of 1)

Date/Time Started	: 4-7-08; 9:00
Date/Time Completed	: 4-7-08: 11:00
Weather	: part cloudy, 53F
Boring Location	: 30 off west end of parking lot along swale

Depth in Feet (bgs)	Surf. Elev. 818.63	Blow Count	Recovery (Inches)	DESCRIPTION
0	818			Soil & organic matter moist, soft, brown CLAY, little silt
2	816	No		wet, grey-green CLAY & weathered shale wet, weathered shale, little clay
4	814	Blow Count		Spoon refusal at 3.3 feet bgs, augered to 7 feet bgs.
6	812			
8	810			End Boring
10	808			
12	806			
14	804			
16	802			
18	800			
20	798			
22	796			
24				

Depth in Feet (bgs): 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24

Monitoring Well: MW08-29OB
TOC Elevation:



NOTES:
bgs - below ground surface
NR - no recovery
HSA - Hollow Stem Auger

LOG OF BORING MW08-29OB

(Page 1 of 1)

Appendix B
Laboratory Analysis Reports

Client: S & W Redevelopment LLC

Job Number: 220-4624-1
Sdg Number: 220-4624

Client Sample ID: **WEST**

Lab Sample ID: 220-4624-1
Client Matrix: Solid
% Moisture: 13.0
Date Sampled: 04/01/2008 1440
Date Received: 04/03/2008 0930

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 04/05/2008 2215
Date Prepared: 04/05/2008 2215
Analysis Batch: 220-14820
Instrument ID: HP 5890/5971A GC/MS
Lab File ID: O3340.D
Initial Weight/Volume: 5 g
Final Weight/Volume: 5 mL

Analyte	DryWt Corrected: Y Result (ug/Kg)	Qualifier	MDL	RL
Acetone	5.1	J	2.7	23
Benzene	5.7	U	0.82	5.7
Bromodichloromethane	5.7	U	0.75	5.7
Bromoform	5.7	U	2.0	5.7
Bromomethane	5.7	U	1.7	5.7
Methyl Ethyl Ketone	11	U	3.9	11
Carbon disulfide	5.7	U	0.61	5.7
Carbon tetrachloride	5.7	U	0.82	5.7
Chlorobenzene	5.7	U	1.0	5.7
Chloroethane	5.7	U	1.5	5.7
Chloroform	5.7	U	0.61	5.7
Chloromethane	5.7	U	1.2	5.7
Dibromochloromethane	5.7	U	1.2	5.7
1,1-Dichloroethane	5.7	U	0.75	5.7
1,2-Dichloroethane	5.7	U	1.2	5.7
1,1-Dichloroethene	5.7	U	0.91	5.7
1,2-Dichloropropane	5.7	U	1.1	5.7
cis-1,3-Dichloropropene	5.7	U	0.71	5.7
trans-1,3-Dichloropropene	5.7	U	1.2	5.7
Ethylbenzene	5.7	U	0.82	5.7
2-Hexanone	11	U	3.0	11
Methylene Chloride	4.4	J	1.6	23
methyl isobutyl ketone	5.7	U	1.1	5.7
Styrene	5.7	U	1.5	5.7
1,1,2,2-Tetrachloroethane	5.7	U	1.2	5.7
Tetrachloroethene	1.2	J	0.85	5.7
Toluene	1.2	J	0.68	5.7
1,1,1-Trichloroethane	5.7	U	0.84	5.7
1,1,2-Trichloroethane	5.7	U	1.0	5.7
Trichloroethene	12		1.1	5.7
Vinyl chloride	5.7	U	1.5	5.7
Xylenes, Total	5.7	U	2.8	5.7
cis-1,2-Dichloroethene	5.7	U	1.1	5.7
trans-1,2-Dichloroethene	5.7	U	1.1	5.7

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	72	49 - 134
4-Bromofluorobenzene	55	36 - 133
Dibromofluoromethane	76	60 - 130
Toluene-d8 (Surr)	73	51 - 137

Client: S & W Redevelopment LLC

Job Number: 220-4624-1
Sdg Number: 220-4624

Client Sample ID: 3-NORTH

Lab Sample ID: 220-4624-2
Client Matrix: Solid
% Moisture: 17.3
Date Sampled: 04/01/2008 1140
Date Received: 04/03/2008 0930

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 2.0
Date Analyzed: 04/08/2008 2107
Date Prepared: 04/08/2008 2107
Analysis Batch: 220-14907
Instrument ID: HP 5890/5971A GC/MS
Lab File ID: O3386.D
Initial Weight/Volume: 5 g
Final Weight/Volume: 5 mL

Analyte	DryWt Corrected: Y Result (ug/Kg)	Qualifier	MDL	RL
Acetone	5.8	J	5.7	48
Benzene	12	U	1.7	12
Bromodichloromethane	12	U	1.6	12
Bromoform	12	U	4.2	12
Bromomethane	12	U	3.7	12
Methyl Ethyl Ketone	24	U	8.1	24
Carbon disulfide	12	U	1.3	12
Carbon tetrachloride	12	U	1.7	12
Chlorobenzene	12	U	2.1	12
Chloroethane	12	U	3.1	12
Chloroform	12	U	1.3	12
Chloromethane	12	U	2.4	12
Dibromochloromethane	12	U	2.6	12
1,1-Dichloroethane	12	U	1.6	12
1,2-Dichloroethane	12	U	2.6	12
1,1-Dichloroethene	3.7	J	1.9	12
1,2-Dichloropropane	12	U	2.3	12
cis-1,3-Dichloropropene	12	U	1.5	12
trans-1,3-Dichloropropene	12	U	2.6	12
Ethylbenzene	12	U	1.7	12
2-Hexanone	24	U	6.4	24
Methylene Chloride	5.4	J	3.4	48
methyl isobutyl ketone	12	U	2.3	12
Styrene	12	U	3.1	12
1,1,2,2-Tetrachloroethane	12	U	2.5	12
Tetrachloroethene	12	U	1.8	12
Toluene	1.5	J	1.4	12
1,1,1-Trichloroethane	12	U	1.8	12
1,1,2-Trichloroethane	12	U	2.1	12
Trichloroethene	260		2.4	12
Vinyl chloride	12	U	3.1	12
Xylenes, Total	12	U	5.9	12
cis-1,2-Dichloroethene	7.1	J	2.2	12
trans-1,2-Dichloroethene	3.3	J	2.3	12

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	70	49 - 134
4-Bromofluorobenzene	72	36 - 133
Dibromofluoromethane	80	60 - 130
Toluene-d8 (Surr)	81	51 - 137

Client: S & W Redevelopment LLC

Job Number: 220-4624-1
Sdg Number: 220-4624

Client Sample ID: 1-SOUTH

Lab Sample ID: 220-4624-3
Client Matrix: Solid

% Moisture: 15.4

Date Sampled: 04/01/2008 1515
Date Received: 04/03/2008 0930

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 04/05/2008 2305
Date Prepared: 04/05/2008 2305

Analysis Batch: 220-14820

Instrument ID: HP 5890/5971A GC/MS
Lab File ID: O3342.D
Initial Weight/Volume: 5 g
Final Weight/Volume: 5 mL

Analyte	DryWt Corrected: Y	Result (ug/Kg)	Qualifier	MDL	RL
Acetone		24	U	2.8	24
Benzene		5.9	U	0.84	5.9
Bromodichloromethane		5.9	U	0.77	5.9
Bromoform		5.9	U	2.0	5.9
Bromomethane		5.9	U	1.8	5.9
Methyl Ethyl Ketone		12	U	4.0	12
Carbon disulfide		5.9	U	0.63	5.9
Carbon tetrachloride		5.9	U	0.84	5.9
Chlorobenzene		5.9	U	1.0	5.9
Chloroethane		5.9	U	1.5	5.9
Chloroform		5.9	U	0.63	5.9
Chloromethane		5.9	U	1.2	5.9
Dibromochloromethane		5.9	U	1.3	5.9
1,1-Dichloroethane		5.9	U	0.77	5.9
1,2-Dichloroethane		5.9	U	1.3	5.9
1,1-Dichloroethene		5.9	U	0.93	5.9
1,2-Dichloropropane		5.9	U	1.1	5.9
cis-1,3-Dichloropropene		5.9	U	0.73	5.9
trans-1,3-Dichloropropene		5.9	U	1.3	5.9
Ethylbenzene		2.8	J	0.84	5.9
2-Hexanone		12	U	3.1	12
Methylene Chloride		1.8	J	1.7	24
methyl isobutyl ketone		5.9	U	1.1	5.9
Styrene		5.9	U	1.5	5.9
1,1,2,2-Tetrachloroethane		5.9	U	1.2	5.9
Tetrachloroethene		1.9	J	0.87	5.9
Toluene		2.3	J	0.70	5.9
1,1,1-Trichloroethane		5.9	U	0.86	5.9
1,1,2-Trichloroethane		5.9	U	1.0	5.9
Trichloroethene		26		1.2	5.9
Vinyl chloride		5.9	U	1.5	5.9
Xylenes, Total		42		2.9	5.9
cis-1,2-Dichloroethene		5.9	U	1.1	5.9
trans-1,2-Dichloroethene		5.9	U	1.1	5.9

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	79	49 - 134
4-Bromofluorobenzene	57	36 - 133
Dibromofluoromethane	78	60 - 130
Toluene-d8 (Surr)	80	51 - 137

Client: S & W Redevelopment LLC

Job Number: 220-4624-1
Sdg Number: 220-4624

Client Sample ID: **BOTTOM**

Lab Sample ID: 220-4624-4
Client Matrix: Solid
% Moisture: 13.2
Date Sampled: 04/01/2008 1440
Date Received: 04/03/2008 0930

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 04/05/2008 2330
Date Prepared: 04/05/2008 2330
Analysis Batch: 220-14820
Instrument ID: HP 5890/5971A GC/MS
Lab File ID: O3343.D
Initial Weight/Volume: 5 g
Final Weight/Volume: 5 mL

Analyte	DryWt Corrected: Y	Result (ug/Kg)	Qualifier	MDL	RL
Acetone		4.4	J	2.7	23
Benzene		5.8	U	0.82	5.8
Bromodichloromethane		5.8	U	0.75	5.8
Bromoform		5.8	U	2.0	5.8
Bromomethane		5.8	U	1.8	5.8
Methyl Ethyl Ketone		12	U	3.9	12
Carbon disulfide		5.8	U	0.61	5.8
Carbon tetrachloride		5.8	U	0.82	5.8
Chlorobenzene		5.8	U	1.0	5.8
Chloroethane		5.8	U	1.5	5.8
Chloroform		5.8	U	0.61	5.8
Chloromethane		5.8	U	1.2	5.8
Dibromochloromethane		5.8	U	1.2	5.8
1,1-Dichloroethane		5.8	U	0.75	5.8
1,2-Dichloroethane		5.8	U	1.2	5.8
1,1-Dichloroethene		5.8	U	0.91	5.8
1,2-Dichloropropane		5.8	U	1.1	5.8
cis-1,3-Dichloropropene		5.8	U	0.71	5.8
trans-1,3-Dichloropropene		5.8	U	1.2	5.8
Ethylbenzene		5.8	U	0.82	5.8
2-Hexanone		12	U	3.0	12
Methylene Chloride		1.6	J	1.6	23
methyl isobutyl ketone		5.8	U	1.1	5.8
Styrene		5.8	U	1.5	5.8
1,1,2,2-Tetrachloroethane		5.8	U	1.2	5.8
Tetrachloroethene		5.8	U	0.85	5.8
Toluene		5.8	U	0.68	5.8
1,1,1-Trichloroethane		5.8	U	0.84	5.8
1,1,2-Trichloroethane		5.8	U	1.0	5.8
Trichloroethene		2.5	J	1.1	5.8
Vinyl chloride		5.8	U	1.5	5.8
Xylenes, Total		5.8	U	2.8	5.8
cis-1,2-Dichloroethene		5.8	U	1.1	5.8
trans-1,2-Dichloroethene		5.8	U	1.1	5.8

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	84	49 - 134
4-Bromofluorobenzene	69	36 - 133
Dibromofluoromethane	83	60 - 130
Toluene-d8 (Surr)	86	51 - 137

Client: S & W Redevelopment LLC

Job Number: 220-4624-1
Sdg Number: 220-4624

Client Sample ID: **TANK-1**

Lab Sample ID: 220-4624-6
Client Matrix: Water

Date Sampled: 04/01/2008 0845
Date Received: 04/03/2008 0930

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 04/09/2008 1228
Date Prepared: 04/09/2008 1228

Analysis Batch: 220-15018

Instrument ID: HP 5890/5971 GC/MS
Lab File ID: L5631.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	10	U	1.6	10
Benzene	5.0	U	0.23	5.0
Bromodichloromethane	5.0	U	0.24	5.0
Bromoform	5.0	U *	1.2	5.0
Bromomethane	5.0	U	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	5.0	U	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	5.0	U	0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	5.0	U	0.21	5.0
1,1-Dichloroethane	8.4		0.23	5.0
1,2-Dichloroethane	5.0	U *	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	5.0	U	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	5.0	U	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U	0.30	5.0
Toluene	5.0	U	0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	4.3	J	0.26	5.0
Vinyl chloride	22		0.30	5.0
Xylenes, Total	5.0	U	0.46	5.0
cis-1,2-Dichloroethene	6.7		0.33	5.0
trans-1,2-Dichloroethene	0.69	J	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	70	53 - 125
4-Bromofluorobenzene	111	73 - 127
Dibromofluoromethane	86	54 - 137
Toluene-d8 (Surr)	104	63 - 121

Mr. Dan Ours
S & W Redevelopment LLC
430 East Genesee Street, Suite 140
Syracuse, NY 13202

Job Number: 220-4736-1
Lab Sample Id: 220-4736-1
Client Matrix: Water
Date Sampled: 04/14/2008 1010
Date Received: 04/15/2008 0945

Client Sample ID: MW08-29BR

	Result/Qualifier		Unit	RL	Method	Date Prepared	Date Analyzed	Dilution
GC/MS VOA								
Acetone	11		ug/L	10	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Benzene	0.24	J	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Bromodichloromethane	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Bromoform	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Bromomethane	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Methyl Ethyl Ketone	10	U	ug/L	10	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Carbon disulfide	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Carbon tetrachloride	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Chlorobenzene	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Chloroethane	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Chloroform	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Chloromethane	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Dibromochloromethane	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
1,1-Dichloroethane	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
1,2-Dichloroethane	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
1,1-Dichloroethene	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
1,2-Dichloropropane	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
cis-1,3-Dichloropropene	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
trans-1,3-Dichloropropene	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Ethylbenzene	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
2-Hexanone	10	U	ug/L	10	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Methylene Chloride	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
methyl isobutyl ketone	10	U	ug/L	10	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Styrene	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
1,1,2,2-Tetrachloroethane	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Tetrachloroethene	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Toluene	1.5	J	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
1,1,1-Trichloroethane	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
1,1,2-Trichloroethane	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Trichloroethene	3.4	J	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0

Mr. Dan Ours
S & W Redevelopment LLC
430 East Genesee Street, Suite 140
Syracuse, NY 13202

Job Number: 220-4736-1
Lab Sample Id: 220-4736-1
Client Matrix: Water
Date Sampled: 04/14/2008 1010
Date Received: 04/15/2008 0945

Client Sample ID: MW08-29BR

	Result/Qualifier		Unit	RL	Method	Date Prepared	Date Analyzed	Dilution
GC/MS VOA								
Vinyl chloride	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
Xylenes, Total	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
cis-1,2-Dichloroethene	2.7	J	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0
trans-1,2-Dichloroethene	5.0	U	ug/L	5.0	8260B	04/15/2008 2144	04/15/2008 2144	1.0

Mr. Dan Ours
S & W Redevelopment LLC
430 East Genesee Street, Suite 140
Syracuse, NY 13202

Job Number: 220-4736-1
Lab Sample Id: 220-4736-2
Client Matrix: Water
Date Sampled: 04/14/2008 1000
Date Received: 04/15/2008 0945

Client Sample ID: MW08-29OB

	Result/Qualifier		Unit	RL	Method	Date Prepared	Date Analyzed	Dilution
GC/MS VOA								
Acetone	210	B	ug/L	20	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Benzene	0.54	J	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Bromodichloromethane	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Bromoform	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Bromomethane	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Methyl Ethyl Ketone	33		ug/L	20	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Carbon disulfide	1.2	J	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Carbon tetrachloride	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Chlorobenzene	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Chloroethane	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Chloroform	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Chloromethane	10	U *	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Dibromochloromethane	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
1,1-Dichloroethane	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
1,2-Dichloroethane	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
1,1-Dichloroethene	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
1,2-Dichloropropane	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
cis-1,3-Dichloropropene	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
trans-1,3-Dichloropropene	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Ethylbenzene	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
2-Hexanone	20	U	ug/L	20	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Methylene Chloride	4.4	J * B	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
methyl isobutyl ketone	8.5	J	ug/L	20	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Styrene	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
1,1,2,2-Tetrachloroethane	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Tetrachloroethene	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Toluene	0.93	J	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
1,1,1-Trichloroethane	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
1,1,2-Trichloroethane	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Trichloroethene	6.3	J	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0

Mr. Dan Ours
S & W Redevelopment LLC
430 East Genesee Street, Suite 140
Syracuse, NY 13202

Job Number: 220-4736-1
Lab Sample Id: 220-4736-2
Client Matrix: Water
Date Sampled: 04/14/2008 1000
Date Received: 04/15/2008 0945

Client Sample ID: MW08-29OB

	Result/Qualifier		Unit	RL	Method	Date Prepared	Date Analyzed	Dilution
GC/MS VOA								
Vinyl chloride	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
Xylenes, Total	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
cis-1,2-Dichloroethene	3.3	J	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0
trans-1,2-Dichloroethene	10	U	ug/L	10	8260B	04/16/2008 1204	04/16/2008 1204	2.0

Mr. Dan Ours
S & W Redevelopment LLC
430 East Genesee Street, Suite 140
Syracuse, NY 13202

Job Number: 220-4591-1
Lab Sample Id: 220-4591-1
Client Matrix: Water
Date Sampled: 03/28/2008 0925
Date Received: 03/29/2008 1045

Client Sample ID: MW08-29BR

	Result/Qualifier		Unit	RL	Method	Date Prepared	Date Analyzed	Dilution
GC/MS VOA								
Acetone	40		ug/L	10	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Benzene	0.71	J	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Bromodichloromethane	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Bromoform	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Bromomethane	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Methyl Ethyl Ketone	15		ug/L	10	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Carbon disulfide	0.79	J M	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Carbon tetrachloride	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Chlorobenzene	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Chloroethane	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Chloroform	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Chloromethane	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Dibromochloromethane	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
1,1-Dichloroethane	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
1,2-Dichloroethane	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
1,1-Dichloroethene	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
1,2-Dichloropropane	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
cis-1,3-Dichloropropene	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
trans-1,3-Dichloropropene	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Ethylbenzene	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
2-Hexanone	10	U	ug/L	10	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Methylene Chloride	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
methyl isobutyl ketone	1.2	J	ug/L	10	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Styrene	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
1,1,2,2-Tetrachloroethane	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Tetrachloroethene	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Toluene	6.8		ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
1,1,1-Trichloroethane	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
1,1,2-Trichloroethane	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Trichloroethene	4.6	J	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0

Mr. Dan Ours
S & W Redevelopment LLC
430 East Genesee Street, Suite 140
Syracuse, NY 13202

Job Number: 220-4591-1
Lab Sample Id: 220-4591-1
Client Matrix: Water
Date Sampled: 03/28/2008 0925
Date Received: 03/29/2008 1045

Client Sample ID: MW08-29BR

	Result/Qualifier		Unit	RL	Method	Date Prepared	Date Analyzed	Dilution
GC/MS VOA								
Vinyl chloride	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
Xylenes, Total	1.4	J	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
cis-1,2-Dichloroethene	5.0	J	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0
trans-1,2-Dichloroethene	5.0	U	ug/L	5.0	8260B	03/31/2008 1301	03/31/2008 1301	1.0

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: BRW-1D

Lab Sample ID: 220-4423-1
Client Matrix: Water

Date Sampled: 03/12/2008 1510
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 03/26/2008 0144
Date Prepared: 03/26/2008 0144

Analysis Batch: 220-14481

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4192.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	15		1.6	10
Benzene	4.3	J	0.23	5.0
Bromodichloromethane	5.0	U	0.24	5.0
Bromoform	5.0	U	1.2	5.0
Bromomethane	1.8	J	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	5.0	U	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	5.0	U	0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	5.0	U	0.21	5.0
1,1-Dichloroethane	1.6	J	0.23	5.0
1,2-Dichloroethane	5.0	U	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	0.49	J	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	5.0	U	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U	0.30	5.0
Toluene	7.6		0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	9.0		0.26	5.0
Vinyl chloride	5.0	U	0.30	5.0
Xylenes, Total	2.7	J	0.46	5.0
cis-1,2-Dichloroethene	32		0.33	5.0
trans-1,2-Dichloroethene	0.41	J	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	84	53 - 125
4-Bromofluorobenzene	118	73 - 127
Dibromofluoromethane	95	54 - 137
Toluene-d8 (Surr)	98	63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: **MW-12**

Lab Sample ID: 220-4423-2
Client Matrix: Water

Date Sampled: 03/12/2008 1600
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 03/26/2008 0210
Date Prepared: 03/26/2008 0210

Analysis Batch: 220-14481

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4193.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	7.9	J	1.6	10
Benzene	5.0	U	0.23	5.0
Bromodichloromethane	5.0	U	0.24	5.0
Bromoform	5.0	U	1.2	5.0
Bromomethane	5.0	U	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	0.48	J	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	5.0	U	0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	5.0	U	0.21	5.0
1,1-Dichloroethane	0.47	J	0.23	5.0
1,2-Dichloroethane	5.0	U	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	5.0	U	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	24	B	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U M	0.30	5.0
Toluene	1.2	J	0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	46		0.26	5.0
Vinyl chloride	5.0	U	0.30	5.0
Xylenes, Total	5.0	U	0.46	5.0
cis-1,2-Dichloroethene	14		0.33	5.0
trans-1,2-Dichloroethene	0.88	J	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	85	53 - 125
4-Bromofluorobenzene	124	73 - 127
Dibromofluoromethane	98	54 - 137
Toluene-d8 (Surr)	103	63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: **MW-11**

Lab Sample ID: 220-4423-3
Client Matrix: Water

Date Sampled: 03/12/2008 1630
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 03/26/2008 0236
Date Prepared: 03/26/2008 0236

Analysis Batch: 220-14481

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4194.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	10	U M	1.6	10
Benzene	5.0	U	0.23	5.0
Bromodichloromethane	5.0	U	0.24	5.0
Bromoform	5.0	U	1.2	5.0
Bromomethane	5.0	U	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	5.0	U	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	5.0	U	0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	5.0	U	0.21	5.0
1,1-Dichloroethane	5.0	U	0.23	5.0
1,2-Dichloroethane	5.0	U	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	5.0	U	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	5.0	U	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U	0.30	5.0
Toluene	5.0	U	0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	2.3	J	0.26	5.0
Vinyl chloride	5.0	U	0.30	5.0
Xylenes, Total	5.0	U	0.46	5.0
cis-1,2-Dichloroethene	0.62	J	0.33	5.0
trans-1,2-Dichloroethene	5.0	U	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	82	53 - 125
4-Bromofluorobenzene	119	73 - 127
Dibromofluoromethane	94	54 - 137
Toluene-d8 (Surr)	98	63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: **MW06-25BR**

Lab Sample ID: 220-4423-4
Client Matrix: Water

Date Sampled: 03/12/2008 1640
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 4.0
Date Analyzed: 03/26/2008 1543
Date Prepared: 03/26/2008 1543

Analysis Batch: 220-14507

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4219.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	40	U	6.4	40
Benzene	20	U	0.92	20
Bromodichloromethane	20	U	0.96	20
Bromoform	20	U	4.6	20
Bromomethane	20	U	4.1	20
Methyl Ethyl Ketone	40	U	4.2	40
Carbon disulfide	20	U	0.56	20
Carbon tetrachloride	20	U	1.2	20
Chlorobenzene	20	U	0.60	20
Chloroethane	20	U	1.9	20
Chloroform	20	U	1.1	20
Chloromethane	20	U	0.96	20
Dibromochloromethane	20	U	0.84	20
1,1-Dichloroethane	28		0.92	20
1,2-Dichloroethane	20	U	1.0	20
1,1-Dichloroethene	20		1.0	20
1,2-Dichloropropane	20	U	1.3	20
cis-1,3-Dichloropropene	20	U	1.1	20
trans-1,3-Dichloropropene	20	U	1.1	20
Ethylbenzene	20	U	1.1	20
2-Hexanone	40	U	1.5	40
Methylene Chloride	2.6	J B	1.0	20
methyl isobutyl ketone	40	U	1.5	40
Styrene	20	U	2.8	20
1,1,2,2-Tetrachloroethane	20	U	0.92	20
Tetrachloroethene	20	U	1.2	20
Toluene	20	U	0.36	20
1,1,1-Trichloroethane	270		1.5	20
1,1,2-Trichloroethane	20	U	1.3	20
Trichloroethene	50		1.0	20
Vinyl chloride	10	J	1.2	20
Xylenes, Total	20	U	1.8	20
cis-1,2-Dichloroethene	45		1.3	20
trans-1,2-Dichloroethene	0.91	J M	0.88	20

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	84	53 - 125
4-Bromofluorobenzene	118	73 - 127
Dibromofluoromethane	98	54 - 137
Toluene-d8 (Surr)	97	63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: **BRW-1S**

Lab Sample ID: 220-4423-5
Client Matrix: Water

Date Sampled: 03/12/2008 1655
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 03/26/2008 1118
Date Prepared: 03/26/2008 1118

Analysis Batch: 220-14507

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4209.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	1.7	J	1.6	10
Benzene	0.28	J	0.23	5.0
Bromodichloromethane	5.0	U	0.24	5.0
Bromoform	5.0	U	1.2	5.0
Bromomethane	5.0	U	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	5.0	U	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	5.0	U	0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	5.0	U	0.21	5.0
1,1-Dichloroethane	0.92	J	0.23	5.0
1,2-Dichloroethane	5.0	U	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	5.0	U	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	5.0	U	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U	0.30	5.0
Toluene	5.0	U	0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	33		0.26	5.0
Vinyl chloride	2.2	J	0.30	5.0
Xylenes, Total	5.0	U	0.46	5.0
cis-1,2-Dichloroethene	50		0.33	5.0
trans-1,2-Dichloroethene	3.2	J	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	78	53 - 125
4-Bromofluorobenzene	113	73 - 127
Dibromofluoromethane	88	54 - 137
Toluene-d8 (Surr)	94	63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: **MW-5**

Lab Sample ID: 220-4423-6
Client Matrix: Water

Date Sampled: 03/13/2008 0900
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 03/26/2008 1145
Date Prepared: 03/26/2008 1145

Analysis Batch: 220-14507

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4210.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	10	U M	1.6	10
Benzene	5.0	U	0.23	5.0
Bromodichloromethane	5.0	U	0.24	5.0
Bromoform	5.0	U	1.2	5.0
Bromomethane	5.0	U	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	5.0	U	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	5.0	U	0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	5.0	U	0.21	5.0
1,1-Dichloroethane	5.0	U	0.23	5.0
1,2-Dichloroethane	5.0	U	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	5.0	U	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	5.0	U	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U	0.30	5.0
Toluene	5.0	U	0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	11		0.26	5.0
Vinyl chloride	5.0	U	0.30	5.0
Xylenes, Total	5.0	U	0.46	5.0
cis-1,2-Dichloroethene	1.3	J	0.33	5.0
trans-1,2-Dichloroethene	5.0	U	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	78	53 - 125
4-Bromofluorobenzene	110	73 - 127
Dibromofluoromethane	87	54 - 137
Toluene-d8 (Surr)	92	63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: **ROW-1**

Lab Sample ID: 220-4423-7
Client Matrix: Water

Date Sampled: 03/13/2008 0950
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 03/26/2008 1211
Date Prepared: 03/26/2008 1211

Analysis Batch: 220-14507

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4211.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	5.0	J	1.6	10
Benzene	0.34	J	0.23	5.0
Bromodichloromethane	4.7	J	0.24	5.0
Bromoform	5.0	U	1.2	5.0
Bromomethane	5.0	U	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	0.20	J M	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	8.2		0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	2.6	J	0.21	5.0
1,1-Dichloroethane	5.0	U	0.23	5.0
1,2-Dichloroethane	5.0	U	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	5.0	U	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	5.0	U M	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U	0.30	5.0
Toluene	1.2	J	0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	4.4	J	0.26	5.0
Vinyl chloride	5.0	U	0.30	5.0
Xylenes, Total	5.0	U	0.46	5.0
cis-1,2-Dichloroethene	5.0	U	0.33	5.0
trans-1,2-Dichloroethene	5.0	U	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	80	53 - 125
4-Bromofluorobenzene	116	73 - 127
Dibromofluoromethane	90	54 - 137
Toluene-d8 (Surr)	93	63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: ROW-2

Lab Sample ID: 220-4423-8
Client Matrix: Water

Date Sampled: 03/13/2008 1005
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 03/26/2008 1237
Date Prepared: 03/26/2008 1237

Analysis Batch: 220-14507

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4212.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	10	U	1.6	10
Benzene	5.0	U	0.23	5.0
Bromodichloromethane	0.28	J	0.24	5.0
Bromoform	5.0	U	1.2	5.0
Bromomethane	5.0	U	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	0.31	J M	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	0.61	J	0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	5.0	U	0.21	5.0
1,1-Dichloroethane	5.0	U	0.23	5.0
1,2-Dichloroethane	5.0	U	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	5.0	U	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	5.0	U	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U	0.30	5.0
Toluene	0.30	J	0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	0.48	J	0.26	5.0
Vinyl chloride	5.0	U	0.30	5.0
Xylenes, Total	5.0	U	0.46	5.0
cis-1,2-Dichloroethene	5.0	U	0.33	5.0
trans-1,2-Dichloroethene	5.0	U	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	77	53 - 125
4-Bromofluorobenzene	112	73 - 127
Dibromofluoromethane	87	54 - 137
Toluene-d8 (Surr)	93	63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: ROW-3

Lab Sample ID: 220-4423-9
Client Matrix: Water

Date Sampled: 03/13/2008 1020
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 03/26/2008 1304
Date Prepared: 03/26/2008 1304

Analysis Batch: 220-14507

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4213.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	10	U M	1.6	10
Benzene	5.0	U	0.23	5.0
Bromodichloromethane	0.35	J	0.24	5.0
Bromoform	5.0	U	1.2	5.0
Bromomethane	5.0	U	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	5.0	U	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	0.94	J	0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	5.0	U	0.21	5.0
1,1-Dichloroethane	5.0	U	0.23	5.0
1,2-Dichloroethane	5.0	U	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	5.0	U	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	5.0	U	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U	0.30	5.0
Toluene	0.30	J	0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	0.29	J	0.26	5.0
Vinyl chloride	5.0	U	0.30	5.0
Xylenes, Total	5.0	U	0.46	5.0
cis-1,2-Dichloroethene	5.0	U	0.33	5.0
trans-1,2-Dichloroethene	5.0	U	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	84	53 - 125
4-Bromofluorobenzene	122	73 - 127
Dibromofluoromethane	94	54 - 137
Toluene-d8 (Surr)	100	63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: ROW-4

Lab Sample ID: 220-4423-10
Client Matrix: Water

Date Sampled: 03/13/2008 1030
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 03/26/2008 1331
Date Prepared: 03/26/2008 1331

Analysis Batch: 220-14507

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4214.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	10	U M	1.6	10
Benzene	5.0	U	0.23	5.0
Bromodichloromethane	5.0	U	0.24	5.0
Bromoform	5.0	U	1.2	5.0
Bromomethane	5.0	U	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	5.0	U	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	0.52	J	0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	5.0	U	0.21	5.0
1,1-Dichloroethane	5.0	U	0.23	5.0
1,2-Dichloroethane	5.0	U	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	5.0	U	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	5.0	U M	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U	0.30	5.0
Toluene	0.31	J	0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	5.0	U	0.26	5.0
Vinyl chloride	5.0	U	0.30	5.0
Xylenes, Total	5.0	U	0.46	5.0
cis-1,2-Dichloroethene	5.0	U	0.33	5.0
trans-1,2-Dichloroethene	5.0	U	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	78	53 - 125
4-Bromofluorobenzene	112	73 - 127
Dibromofluoromethane	87	54 - 137
Toluene-d8 (Surr)	93	63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: **MW-1**

Lab Sample ID: 220-4423-11
Client Matrix: Water

Date Sampled: 03/13/2008 1100
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 03/26/2008 1357
Date Prepared: 03/26/2008 1357

Analysis Batch: 220-14507

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4215.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	10	U M	1.6	10
Benzene	5.0	U	0.23	5.0
Bromodichloromethane	5.0	U	0.24	5.0
Bromoform	5.0	U	1.2	5.0
Bromomethane	5.0	U	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	5.0	U	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	0.41	J	0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	5.0	U	0.21	5.0
1,1-Dichloroethane	5.0	U	0.23	5.0
1,2-Dichloroethane	5.0	U	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	5.0	U	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	5.0	U	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U	0.30	5.0
Toluene	5.0	U	0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	6.7		0.26	5.0
Vinyl chloride	0.71	J	0.30	5.0
Xylenes, Total	5.0	U	0.46	5.0
cis-1,2-Dichloroethene	9.3		0.33	5.0
trans-1,2-Dichloroethene	0.32	J	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	77	53 - 125
4-Bromofluorobenzene	115	73 - 127
Dibromofluoromethane	86	54 - 137
Toluene-d8 (Surr)	91	63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: **MW-6**

Lab Sample ID: 220-4423-12
Client Matrix: Water

Date Sampled: 03/13/2008 1115
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 03/26/2008 1424
Date Prepared: 03/26/2008 1424

Analysis Batch: 220-14507

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4216.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	10	U M	1.6	10
Benzene	5.0	U	0.23	5.0
Bromodichloromethane	5.0	U	0.24	5.0
Bromoform	5.0	U	1.2	5.0
Bromomethane	5.0	U	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	5.0	U	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	0.58	J	0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	5.0	U	0.21	5.0
1,1-Dichloroethane	5.0	U M	0.23	5.0
1,2-Dichloroethane	5.0	U	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	5.0	U	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	5.0	U	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U	0.30	5.0
Toluene	5.0	U	0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	3.2	J	0.26	5.0
Vinyl chloride	5.0	U	0.30	5.0
Xylenes, Total	5.0	U	0.46	5.0
cis-1,2-Dichloroethene	1.4	J	0.33	5.0
trans-1,2-Dichloroethene	5.0	U	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	84	53 - 125
4-Bromofluorobenzene	120	73 - 127
Dibromofluoromethane	94	54 - 137
Toluene-d8 (Surr)	99	63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: **MW06-23BR**

Lab Sample ID: 220-4423-13
Client Matrix: Water

Date Sampled: 03/13/2008 1140
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 20
Date Analyzed: 03/27/2008 1626
Date Prepared: 03/27/2008 1626

Analysis Batch: 220-14532

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4258.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	200	U M	32	200
Benzene	100	U	4.6	100
Bromodichloromethane	100	U	4.8	100
Bromoform	100	U	23	100
Bromomethane	100	U	20	100
Methyl Ethyl Ketone	200	U	21	200
Carbon disulfide	100	U	2.8	100
Carbon tetrachloride	100	U	5.8	100
Chlorobenzene	100	U	3.0	100
Chloroethane	100	U	9.6	100
Chloroform	100	U	5.4	100
Chloromethane	100	U	4.8	100
Dibromochloromethane	100	U	4.2	100
1,1-Dichloroethane	6.9	J M	4.6	100
1,2-Dichloroethane	100	U	5.0	100
1,1-Dichloroethene	6.4	J	5.0	100
1,2-Dichloropropane	100	U	6.4	100
cis-1,3-Dichloropropene	100	U	5.6	100
trans-1,3-Dichloropropene	100	U	5.6	100
Ethylbenzene	100	U	5.6	100
2-Hexanone	200	U	7.4	200
Methylene Chloride	11	J B	5.2	100
methyl isobutyl ketone	200	U	7.6	200
Styrene	100	U	14	100
1,1,2,2-Tetrachloroethane	100	U	4.6	100
Tetrachloroethene	100	U	6.0	100
Toluene	100	U	1.8	100
1,1,1-Trichloroethane	100	U	7.6	100
1,1,2-Trichloroethane	100	U	6.6	100
Trichloroethene	1200		5.2	100
Vinyl chloride	54	J	6.0	100
Xylenes, Total	100	U	9.2	100
cis-1,2-Dichloroethene	910		6.6	100
trans-1,2-Dichloroethene	8.5	J	4.4	100

Surrogate	%Rec		Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	92		53 - 125
4-Bromofluorobenzene	126	M	73 - 127
Dibromofluoromethane	101		54 - 137
Toluene-d8 (Surr)	102		63 - 121

Client: S & W Redevelopment LLC

Job Number: 220-4423-1
Sdg Number: 220-4423

Client Sample ID: **TRIP BLANK**

Lab Sample ID: 220-4423-14TB
Client Matrix: Water

Date Sampled: 03/13/2008 0000
Date Received: 03/14/2008 0943

8260B Volatile Organic Compounds by GC/MS

Method: 8260B
Preparation: 5030B
Dilution: 1.0
Date Analyzed: 03/27/2008 1600
Date Prepared: 03/27/2008 1600

Analysis Batch: 220-14532

Instrument ID: HP 6890/5973 GC/MS
Lab File ID: V4257.D
Initial Weight/Volume: 5 mL
Final Weight/Volume: 5 mL

Analyte	Result (ug/L)	Qualifier	MDL	RL
Acetone	10	U M	1.6	10
Benzene	5.0	U	0.23	5.0
Bromodichloromethane	5.0	U	0.24	5.0
Bromoform	5.0	U	1.2	5.0
Bromomethane	5.0	U	1.0	5.0
Methyl Ethyl Ketone	10	U	1.1	10
Carbon disulfide	5.0	U	0.14	5.0
Carbon tetrachloride	5.0	U	0.29	5.0
Chlorobenzene	5.0	U	0.15	5.0
Chloroethane	5.0	U	0.48	5.0
Chloroform	5.0	U	0.27	5.0
Chloromethane	5.0	U	0.24	5.0
Dibromochloromethane	5.0	U	0.21	5.0
1,1-Dichloroethane	5.0	U	0.23	5.0
1,2-Dichloroethane	5.0	U	0.25	5.0
1,1-Dichloroethene	5.0	U	0.25	5.0
1,2-Dichloropropane	5.0	U	0.32	5.0
cis-1,3-Dichloropropene	5.0	U	0.28	5.0
trans-1,3-Dichloropropene	5.0	U	0.28	5.0
Ethylbenzene	5.0	U	0.28	5.0
2-Hexanone	10	U	0.37	10
Methylene Chloride	5.0	U M	0.26	5.0
methyl isobutyl ketone	10	U	0.38	10
Styrene	5.0	U	0.70	5.0
1,1,2,2-Tetrachloroethane	5.0	U	0.23	5.0
Tetrachloroethene	5.0	U	0.30	5.0
Toluene	5.0	U	0.090	5.0
1,1,1-Trichloroethane	5.0	U	0.38	5.0
1,1,2-Trichloroethane	5.0	U	0.33	5.0
Trichloroethene	5.0	U	0.26	5.0
Vinyl chloride	5.0	U	0.30	5.0
Xylenes, Total	5.0	U	0.46	5.0
cis-1,2-Dichloroethene	5.0	U	0.33	5.0
trans-1,2-Dichloroethene	5.0	U	0.22	5.0

Surrogate	%Rec	Acceptance Limits
1,2-Dichloroethane-d4 (Surr)	83	53 - 125
4-Bromofluorobenzene	117	73 - 127
Dibromofluoromethane	89	54 - 137
Toluene-d8 (Surr)	94	63 - 121

Centek Laboratories, LLC

Date: *26-Mar-08*

CLIENT:	S&W Redevelopment	**Client Sample ID:**	Stack
Lab Order:	C0803017	**Tag Number:**	189,60
Project:	950 Danby Rd. B4001.06.1701	**Collection Date:**	3/18/2008
Lab ID:	C0803017-001A	**Matrix:**	AIR

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
FIELD PARAMETERS		**FLD**				Analyst:
Vacuum Reading "Hg	-13			"Hg		3/18/2008
1UG/M3 W/ 0.25UG/M3 TCE BY METHOD TO15		**TO-15**				Analyst: **LL**
1,1,1-Trichloroethane	21	17		ug/m3	20	3/20/2008 2:38:00 AM
1,1,2,2-Tetrachloroethane	ND	1.0		ug/m3	1	3/20/2008 9:59:00 AM
1,1,2-Trichloroethane	ND	0.83		ug/m3	1	3/20/2008 9:59:00 AM
1,1-Dichloroethane	2.8	0.62		ug/m3	1	3/20/2008 9:59:00 AM
1,1-Dichloroethene	ND	0.60		ug/m3	1	3/20/2008 9:59:00 AM
1,2,4-Trichlorobenzene	ND	1.1		ug/m3	1	3/20/2008 9:59:00 AM
1,2,4-Trimethylbenzene	1.2	0.75		ug/m3	1	3/20/2008 9:59:00 AM
1,2-Dibromoethane	ND	1.2		ug/m3	1	3/20/2008 9:59:00 AM
1,2-Dichlorobenzene	ND	0.92		ug/m3	1	3/20/2008 9:59:00 AM
1,2-Dichloroethane	ND	0.62		ug/m3	1	3/20/2008 9:59:00 AM
1,2-Dichloropropane	ND	0.70		ug/m3	1	3/20/2008 9:59:00 AM
1,3,5-Trimethylbenzene	0.65	0.75	J	ug/m3	1	3/20/2008 9:59:00 AM
1,3-butadiene	ND	0.34		ug/m3	1	3/20/2008 9:59:00 AM
1,3-Dichlorobenzene	ND	0.92		ug/m3	1	3/20/2008 9:59:00 AM
1,4-Dichlorobenzene	ND	0.92		ug/m3	1	3/20/2008 9:59:00 AM
1,4-Dioxane	ND	1.1		ug/m3	1	3/20/2008 9:59:00 AM
2,2,4-trimethylpentane	ND	0.71		ug/m3	1	3/20/2008 9:59:00 AM
4-ethyltoluene	0.55	0.75	J	ug/m3	1	3/20/2008 9:59:00 AM
Acetone	27	14		ug/m3	20	3/20/2008 2:38:00 AM
Allyl chloride	ND	0.48		ug/m3	1	3/20/2008 9:59:00 AM
Benzene	1.6	0.49		ug/m3	1	3/20/2008 9:59:00 AM
Benzyl chloride	ND	0.88		ug/m3	1	3/20/2008 9:59:00 AM
Bromodichloromethane	2.9	1.0		ug/m3	1	3/20/2008 9:59:00 AM
Bromoform	ND	1.6		ug/m3	1	3/20/2008 9:59:00 AM
Bromomethane	ND	0.59		ug/m3	1	3/20/2008 9:59:00 AM
Carbon disulfide	0.51	0.47		ug/m3	1	3/20/2008 9:59:00 AM
Carbon tetrachloride	0.64	0.96	J	ug/m3	1	3/20/2008 9:59:00 AM
Chlorobenzene	ND	0.70		ug/m3	1	3/20/2008 9:59:00 AM
Chloroethane	ND	0.40		ug/m3	1	3/20/2008 9:59:00 AM
Chloroform	5.9	0.74		ug/m3	1	3/20/2008 9:59:00 AM
Chloromethane	0.76	0.31		ug/m3	1	3/20/2008 9:59:00 AM
cis-1,2-Dichloroethene	5.4	0.60		ug/m3	1	3/20/2008 9:59:00 AM
cis-1,3-Dichloropropene	ND	0.69		ug/m3	1	3/20/2008 9:59:00 AM
Cyclohexane	0.84	0.52		ug/m3	1	3/20/2008 9:59:00 AM
Dibromochloromethane	ND	1.3		ug/m3	1	3/20/2008 9:59:00 AM
Ethyl acetate	1.8	0.92		ug/m3	1	3/20/2008 9:59:00 AM
Ethylbenzene	1.5	0.66		ug/m3	1	3/20/2008 9:59:00 AM

Qualifiers:

- B Analyte detected in the associated Method Blank
- E Value above quantitation range
- H Holding times for preparation or analysis exceeded
- J Analyte detected at or below quantitation limits
- JN Non-routine analyte. Quantitation estimated.
- ND Not Detected at the Reporting Limit
- S Spike Recovery outside accepted recovery limits

Centek Laboratories, LLC

Date: *26-Mar-08*

CLIENT:	S&W Redevelopment	**Client Sample ID:**	Stack
Lab Order:	C0803017	**Tag Number:**	189,60
Project:	950 Danby Rd. B4001.06.1701	**Collection Date:**	3/18/2008
Lab ID:	C0803017-001A	**Matrix:**	AIR

Analyses	Result	Limit	Qual	Units	DF	Date Analyzed
1UG/M3 W/ 0.25UG/M3 TCE BY METHOD TO15		**TO-15**				Analyst: LL
Freon 11	2.4	0.86		ug/m3	1	3/20/2008 9:59:00 AM
Freon 113	79	23		ug/m3	20	3/20/2008 2:38:00 AM
Freon 114	ND	1.1		ug/m3	1	3/20/2008 9:59:00 AM
Freon 12	2.5	0.75		ug/m3	1	3/20/2008 9:59:00 AM
Heptane	4.5	0.62		ug/m3	1	3/20/2008 9:59:00 AM
Hexachloro-1,3-butadiene	ND	1.6		ug/m3	1	3/20/2008 9:59:00 AM
Hexane	1.9	0.54		ug/m3	1	3/20/2008 9:59:00 AM
Isopropyl alcohol	ND	0.37		ug/m3	1	3/20/2008 9:59:00 AM
m&p-Xylene	4.6	1.3		ug/m3	1	3/20/2008 9:59:00 AM
Methyl Butyl Ketone	ND	1.2		ug/m3	1	3/20/2008 9:59:00 AM
Methyl Ethyl Ketone	2.7	0.90		ug/m3	1	3/20/2008 9:59:00 AM
Methyl Isobutyl Ketone	ND	1.2		ug/m3	1	3/20/2008 9:59:00 AM
Methyl tert-butyl ether	ND	0.55		ug/m3	1	3/20/2008 9:59:00 AM
Methylene chloride	30	11		ug/m3	20	3/20/2008 2:38:00 AM
o-Xylene	1.4	0.66		ug/m3	1	3/20/2008 9:59:00 AM
Propylene	ND	0.26		ug/m3	1	3/20/2008 9:59:00 AM
Styrene	0.61	0.65	J	ug/m3	1	3/20/2008 9:59:00 AM
Tetrachloroethylene	1.2	1.0		ug/m3	1	3/20/2008 9:59:00 AM
Tetrahydrofuran	1.4	0.45		ug/m3	1	3/20/2008 9:59:00 AM
Toluene	21	11		ug/m3	20	3/20/2008 2:38:00 AM
trans-1,2-Dichloroethene	0.73	0.60		ug/m3	1	3/20/2008 9:59:00 AM
trans-1,3-Dichloropropene	ND	0.69		ug/m3	1	3/20/2008 9:59:00 AM
Trichloroethene	61	4.4		ug/m3	20	3/20/2008 2:38:00 AM
Vinyl acetate	ND	0.54		ug/m3	1	3/20/2008 9:59:00 AM
Vinyl Bromide	ND	0.67		ug/m3	1	3/20/2008 9:59:00 AM
Vinyl chloride	0.44	0.39		ug/m3	1	3/20/2008 9:59:00 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected at or below quantitation limits
JN	Non-routine analyte. Quantitation estimated.	ND	Not Detected at the Reporting Limit
S	Spike Recovery outside accepted recovery limits		