FIRST FIVE-YEAR REVIEW REPORT FOR THE SHENANDOAH ROAD GROUNDWATER CONTAMINATION SUPERFUND SITE DUTCHESS COUNTY, NEW YORK

Prepared by

U.S. Environmental Protection Agency
Region 2
New York, New York

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LIST OF ABBREVIATIONS & ACRONYMS

AOC	Administrative Order on Consent
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMP	Comprehensive Monitoring Plan
COC	Contaminant of Concern
DNAPL	Dense Non-Aqueous Liquid
EPA	United States Environmental Protection Agency
ERA	Ecological Risk Assessment
FYR	Five-Year Review
GAC	Granular-Activated Carbon
HHRA	Human Health Risk Assessment
IBM	International Business Machines
ICs	Institutional Controls
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
O&M	Operation and Maintenance
PCE	Tetrachloroethane
POET	Point-of-Entry Treatment System
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
RD/RA	Remedial Design/Remedial Action
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SETS	Source Extraction Treatment System
STWD	Shenandoah Town Water District
TCE	Trichloroethene
VI	Vapor Intrusion
VOC	Volatile Organic Compound

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the first FYR for the Shenandoah Road Groundwater Contamination Superfund site (Site). The triggering action for this policy review is the signature date of the Preliminary Close-Out Report, September 26, 2013. The FYR has been prepared because the remedial action will not leave hazardous substances, pollutants or contaminants on-site above levels that allow for unlimited use and unrestricted exposure but requires five or more years to complete.

The Site consists of one operable unit which will be addressed in this FYR. The selected remedy for the Site included 1) continued operation and maintenance (O&M) of the existing source extraction and treatment system (SETS), 2) monitored natural attenuation (MNA) of the groundwater plume, 3) monitoring program for groundwater, surface water and sediments, 4) maintenance of the existing vapor mitigation systems and 5) implementation of institutional controls (ICs).

The EPA FYR team was led by Damian Duda, remedial project manager (RPM), and includes Sharissa Singh, hydrogeologist, Chuck Nace, human health and ecological risk assessor, Brian Carr, Site attorney and Cecilia Echols, community involvement coordinator (CIC). IBM, the potentially responsible party at the Site, was notified of the initiation of the FYR.

Site Background

The Site is located within the Village of Hopewell Junction, Town of East Fishkill, Dutchess County, New York in an area known as Shenandoah, approximately one mile southwest of the intersection of Interstate 84 and the Taconic State Parkway and one-and-one-half miles southeast of the Hudson Valley Research Park (see **Figure 1)**. The Site is in a rural area consisting of residential subdivisions intermingled with extensive farmland and patches of woodlands.

Between 1965 and 1975, Jack Manne, Inc. and its founder Jack Manne operated a business to clean and repair computer chip racks supplied to it under a contract with the potentially responsible party (PRP), International Business Machines (IBM), at a rented facility at 7 East Hook Cross Road in Hopewell Junction, New York (the Facility). Various solvents and metals were disposed of in an on-site septic tank and an in-ground pit located at the Facility. Disposal practices led to a widespread plume that impacted residential wells in the area.

The area surrounding the Facility is zoned residential, and is expected to remain residential in the future. The majority of the approximately 140 homes, impacted by groundwater contamination, lie within the Shenandoah Town Water District (STWD) and are now connected to a municipal water supply (Town of East Fishkill Public Water Supply (PWS)System) and use septic systems for sanitary wastewater disposal.

The Site is underlain by unconsolidated glacial deposits that over lie complexly folded/faulted and highly fractured dolostone and gneiss bedrock. The overburden thickness ranges from zero to 90 feet. The glacial overburden and bedrock represent two distinct aquifer systems. Groundwater flows to the north, east and south and may discharge to unnamed streams and associated wetlands (see **Figure 2**).

The Site was added to the National Priorities List on June 14, 2001.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Shenandoah Road Groundwater Contamination Superfund Site		
EPA ID: NYSFN0204269		
Region: 2	**State:** NY	**City/County:** East Fishkill/Dutchess
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**		
Author name (Federal or State Project Manager): Damian J. Duda		
Author affiliation: EPA		
Review period: 9/26/2013 – 9/26/2018		
Date of site inspection: 7/18/2018		
Type of review: Policy		
Review number: 1		
Triggering action date: 9/26/2013		
Due date *(five years after triggering action date)*: 9/26/2018		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

The risk assessment for the remedial investigation/feasibility study (RI/FS) indicated that there were elevated cancer risks for the combined future adult/child residents as a result of volatile organic compounds (VOCs), including cis-1,2-dichloroethene (cis-1,2-DCE), tetrachloroethane (PCE) and trichloroethene (TCE), in the groundwater when used for drinking and showering in a residential use scenario.

There was an ecological risk assessment (ERA) completed for the Site that evaluated ecological exposure to groundwater discharge to sediment and surface water. The ERA concluded there were no unacceptable ecological risks from groundwater discharge to the wetlands area near Interstate 84; however, it was recommended to include future monitoring to ensure conditions that were evaluated remained the same.

Response Actions

In April/May 2000, groundwater sampling in the area showed that approximately 60 residential wells were contaminated with PCE above the federal and state standard of 5 µg/L. Subsequently, EPA initiated an emergency response action at the Site which included delivery of bottled water to affected homeowners and installation of point-of-entry treatment (POET) systems in affected homes until a more permanent drinking water solution could be implemented.

In November/December 2000, EPA conducted a removal action at the Facility, including the excavation and disposal of a septic tank and contaminated soils, as well as, demolition and removal of the main buildings associated with the contamination at the Facility.

In May 2001, an Administrative Order on Consent for a Removal Action (Removal-AOC) was executed between IBM and EPA. IBM assumed responsibility for removing the remaining soils at the Facility. Approximately 10,000 tons of soils were removed from the Facility by EPA and IBM and disposed of at a permitted facility.

In September 2002, EPA and IBM entered into a second Administrative Order on Consent to perform the Remedial Investigation and Feasibility Study (RI/FS-AOC) phase of the project. Information gathered during the RI led to the implementation of several additional response actions.

In 2004, EPA began an ongoing investigation of the vapor intrusion (VI) pathway at the Site. EPA evaluated all sampling results and, during 2008/2009, determined that four residences required subslab mitigation systems to abate the VI pathway; these were installed in 2009.

From 2007 until 2009, IBM designed and constructed the above mentioned PWS system for the STWD. In March 2009, the PWS system was deemed fully operational to the Shenandoah community.

In 2011, during the course of the RI work, IBM determined that residual pure-phase PCE liquid, *i.e.*, dense non-aqueous liquid (DNAPL) is present in the groundwater and within the fractured bedrock underlying the Facility. As a result of this finding of DNAPL, EPA determined that conducting a non-time critical source removal action (NTCSRA) to control the DNAPL source would be beneficial. In 2011, pursuant to the Removal AOC, and with EPA oversight, IBM prepared a NTCSRA work plan to address the DNAPL source.

In 2012, the NTCSRA was completed and the SETS was constructed and consists of the four groundwater extraction wells (SRMW-18RA, 18RB, 18RC and 18RE), previously installed in the source zone, and two granulated activated-carbon (GAC) adsorption vessels in series to treat the contaminated groundwater (**Figure 3**). The treated groundwater is then discharged to a designated storm water conveyance in compliance with NYS substantive permit requirements.

EPA issued a Record of Decision on September 30, 2012 to address the VOCs in the groundwater.

The ROD had the following remedial action objectives (RAOs):

- To restore groundwater to maximum contaminant levels (MCLs) consisting of NYS Groundwater Quality Class GA Standards (6 NYCRR Part 703) of 5 µg/L for PCE, TCE and cis-1,2 DCE.
- To reduce and to control the residual DNAPL source in fractured gneiss bedrock beneath the Facility and to prevent migration to the groundwater.
- To reduce VOC concentrations in the source area until the aquifer is attenuating sufficiently to achieve NYS MCLs.
- To prevent ingestion/direct contact of residential human receptors with groundwater having a concentration of PCE, TCE or cis-1,2 DCE or their degradation products which exceed NYSDOH Drinking Water Standards (10 NYCRR, Part 5, Subpart 5-1) of 5 µg/L for principal organic contaminants and with vapors derived from these contaminants in groundwater that may come to be present at significant concentrations.

In order to achieve the RAOs for the contaminated groundwater, EPA selected the following remedy components in the ROD:

- Continued operation and maintenance (O&M) of the existing SETS to address the DNAPL source area.
- Natural attenuation of the groundwater plume through the processes of dispersion, dilution, degradation and sorption of VOCs in the groundwater plume in order to reduce VOC concentrations to federal and more stringent state MCLs or standards.
- Comprehensive monitoring program for groundwater, surface water and sediments.
- Continued maintenance of the four existing vapor mitigation systems and the continuation of the vapor intrusion monitoring program and the installation of additional mitigation systems if monitoring results demonstrate that they are warranted.
- Institutional controls (ICs) in the form of existing governmental controls consisting of local laws that limit exposure to contaminated groundwater by restricting the drilling of private residential wells and their use as a domestic supply within established public water

districts, as well as proprietary institutional controls in the form of environmental easements and/or restrictive covenants placed on the Facility property to ensure that no construction or other invasive activities are conducted on the property which would interfere with existing remedial components, including the SETS.

Status of Implementation

Currently, the source control SETS was installed under removal authority and continues to operate as designed. The groundwater SETS was constructed in 2012 and consists of four extraction wells, previously installed at the Facility in the source zone, to reduce DNAPL in the fractured bedrock and to control groundwater chemical flux from the source area to the groundwater plume. The capture zone of the extraction well network is approximately 16 acres surrounding the source area (see **Figure 4**). The treatment train for the contaminated groundwater consists of two GAC vessels. Treated groundwater is discharged to a designated storm sewer, in accordance with permit requirements.

The monitoring of the groundwater, surface water and sediments is performed monitored on a quarterly, semi-annual or annual frequency, respectively, according to the Comprehensive Monitoring Plan (CMP) which governs the monitoring of the groundwater plume throughout the Site. Specifically, groundwater monitoring is conducted on a quarterly (27 wells/intervals), semiannual (18 wells/intervals) and annual (15 wells/intervals) basis, depending on the location and the type of well. A total of 159 groundwater samples are collected each year and analyzed for the COCs. Surface water samples are collected from two NYS regulated wetlands (HJ-54 and HJ-59) on a quarterly basis and analyzed for PCE, TCE, cis-1,2-DCE and vinyl chloride (VC). Sediment samples are co-located with the surface water samples from the two NYS regulated wetlands (HJ-54 and HJ-59) and are collected on a quarterly basis and analyzed for the same VOCs. The sediments and surface water sampling data are shown in **Tables 3A and 3B**.

For monitoring the MNA parameters, a specific subset of monitoring wells/intervals are sampled. The MNA sampling and analysis plan (SAP) consists of well locations 1) within the source area, 2) associated with historically higher concentrations within the groundwater plume area, 3) associated with lower concentrations along the plume boundary and 4) any groundwater seep, surface water and sediments of Wetland HJ-54 (see **Figure 5**).

Under this component of the CMP, sampling and analysis is conducted at thirty-four (34) well locations/intervals to track the rate of COC concentration reductions following the startup of the SETS in March 2012. After the ROD was issued, no further monitoring wells were installed; however, there were residential wells which have been converted to monitoring wells.

Vapor mitigation systems were installed under EPA's removal authority and continue to be operated and monitored.

IC Summary Table

Table A: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater	Yes	Yes	Site	To prevent installation of groundwater production wells.	Regulation East Fishkill Town Code Chapters 186 and 189 (6/28/2018)
Groundwater, Soils and Soil vapor	Yes	Yes	Site	To protect the groundwater remedy and any activities affecting that could affect Site operations	Environmental Easement filed for three Site properties (9/18)

System Operations/Operation & Maintenance

As per the O&M Plan, dated September 30, 2013. the SETS is being monitored and maintained. O&M data indicate that the system is running efficiently. Periodic inspections of the plant operations and building ensure that the SETS is running smoothly and that the remote access programmable logic controls is operational. The contaminated groundwater influent and resulting effluent VOC concentrations are monitored on a monthly basis. To date, effluent data show that there have been no exceedances of permit requirements for all site-related contaminants.

The vapor mitigation systems installed at the four affected properties continue to be maintained. Also, EPA will continue to sample the subslab soil vapors and the indoor air at the affected properties, including those with mitigation systems, once a year during the winter heating season.

Potential site impacts from climate change have been assessed, and the performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the Site.

III. PROGRESS SINCE THE LAST REVIEW

This is the first FYR for the Site.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On October 2, 2017, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 31 Superfund sites in New York and New Jersey, including the Shenandoah Road site. The announcement can be found at the following web address: https://www.epa.gov/sites/production/files/2017-10/documents/five_year_reviews_fy2018_final.pdf.

In addition to this notification, a public notice was made available on EPA's Shenandoah Road website: https://www.epa.gov/superfund/shenandoah-road. On July 18, 2018, the public notice was also sent to the Supervisor's office of the Town of East Fishkill. The purpose of the public notice is to inform the community about the FYR and to list where the final report will be posted. The notice also included the addresses and telephone numbers of the RPM and the CIC for questions or comments related to the FYR process or the Site. Once the FYR is completed, the results will be made available on EPA's Shenandoah Road webpage and at the Site repositories located at EPA, 290 Broadway, 18th Floor, New York, New York and at the Town of East Fishkill Library on Route 376, Hopewell Junction, New York.

No interviews were conducted during the Site inspection.

Data Review

Groundwater

Laboratory results from groundwater monitoring wells and the effluent from the SETS indicate that site-related contaminants are being reduced and removed from the aquifer and treated to performance requirements. The SETS is continuing to remove mass from the groundwater in the source area via the extraction wells. The capture zone for the extraction wells system demonstrates that containment of the bedrock aquifer is being achieved. O&M data indicate that the system is running efficiently and does not affect protectiveness of the remedy. Cleanup levels are being achieved by the SETS which continues to remove mass from the groundwater in the source area extraction wells (see **Table 4** and **Table 5**). Analysis of the groundwater contours and the capture zone for the extraction wells demonstrates that containment of the bedrock aquifer is being achieved (see **Figure 4**).

Data from perimeter monitoring wells and monitoring wells within the groundwater plume show that concentrations of site-related contaminants are decreasing, thus demonstrating a stable and/or shrinking plume. The perimeter wells are also monitored for natural attenuation parameters. The geochemical data indicate that there is substantial evidence of reductions in COC concentrations throughout the plume, such as the creation of PCE degradation products, and consistent decreasing concentrations of PCE by orders of magnitude, as shown on **Figure 6 and Figure** 7.

As noted previously, 159 groundwater samples are collected each year. The Site also contains some FLUTe wells which monitor various depths of the aquifer. Monitoring wells that show higher concentrations of COCs and the four extraction wells are sampled more frequently.

Based on the most recent sampling data from 2018, source area wells continue to show concentrations of site-related contaminants above regulatory standards. However, a review of trend analyses indicates that the concentrations of the source area wells are steadily decreasing over time (see **Figure 6**). In 2006, the PCE concentration found in the source area well (SRMW-18A) was 16,000 µg/L. In 2018, during the most recent sampling event, the PCE concentration detected in SRMW-18A was 2,100 µg/L.

Table 6 shows both historical values and current values of PCE in the source extraction wells and a select group of monitoring wells, including some ports of the various FLUTe wells. The data show substantial decreases in the majority of the wells sampled. The most recent data is from 2017 to 2018.

As part of the removal action, a series of pit water collection pipes were installed to capture storm water that has infiltrated into the subsurface. The most recent sampling data from these pipes shows detectable concentration of site-related contaminants above regulatory standards; however, the water collected in these pipes are contained and, ultimately, are removed by the SETS.

Surface Water

Surface water samples are collected from two NYS regulated wetlands (HJ-54 and HJ-59) on a quarterly basis. PCE was historically detected in a few locations in these wetlands at a maximum concentration of 60 µg/L in 2006. Recent sampling data from 2018 indicate that PCE concentrations in the four sampling locations range from non-detect to 18 µg/L. The other site-related contaminants are non-detect for all sampling locations.

Sediments

Sediment samples are co-located with the surface water samples from the two NYS regulated wetlands (HJ-54 and HJ-59) and are collected on a quarterly basis. PCE was historically detected in the sediment samples at a maximum concentration of 4.7 µg/kg in 2006. The most recent sampling data from 2018 indicate that all site-related contaminants are non-detect in all of the sample locations.

Vapor Intrusion

VI sampling is conducted by EPA on a yearly basis in approximately 10 residential properties in the Site area. Four of these properties are fitted with subslab mitigation systems. The latest VI data show that the majority of the affected properties have indoor air levels of PCE below EPA guidelines.

However, VI sampling conducted at one affected property has shown somewhat elevated levels of PCE in the indoor air. The subslab soil vapor data at this property is actually below where EPA would require remediation. Since this property includes a large house, two subslab mitigation systems were installed to reduce these PCE levels. In 2017, further sampling at this property confirmed that additional mitigation efforts were necessary. In 2018, the property was retro-fitted with a more active mitigation system. EPA expects the indoor air PCE levels at this property to be further reduced following the 2019 winter VI sampling effort.

Site Inspection

EPA performed a site inspection at the Site on July 18, 2018. The following personnel were in attendance: from EPA: Damian Duda, RPM, Sharissa Singh, hydrogeologist, and Charles Nace, human health and ecological risk assessor; from NYSDEC: Kiera Thompson, project manager; from Groundwater Sciences: Dorothy Bergman and Chris Shannon; from IBM: Tom Morris, Dean Chartrand and Pete Putignano. Kristin Kulow of NYSDOH joined the meeting portion of the inspection by conference call. There were no new or outstanding issues identified.

The group toured the Facility where the SETS was located, including the extraction wells. Also, the group noted the water tank located near the Facility. The group also witnessed the sampling procedures of a multi-port FLUTe well located on Shenandoah Road.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Based on a review of the groundwater contour maps and groundwater monitoring well data, the remedy is functioning as intended by the decision documents.

The SETS is operating as designed and shows that the capture zone for the SETS demonstrates that containment of the bedrock aquifer is being achieved. O&M data indicate that the system is running efficiently and does not affect protectiveness of the remedy.

Data from perimeter monitoring wells show that groundwater contaminant concentrations are decreasing which demonstrates a stable and/or shrinking plume. In addition, the concentration of site-related contaminants in the groundwater are showing decreasing concentration trends.

Quarterly surface water and sediments sampling have also shown decreasing trends.

The VI sampling has shown that the majority of the affected properties are not affected by PCE levels in indoor air. Four properties are fitted with vapor mitigation systems and will be continued to be monitored. Performance monitoring for the mitigation system shows that all are operational.

ICs are in place and are proving to be effective in preventing exposure to contaminated groundwater.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy still valid**?**

The exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy are still valid.

Human Health

The human health risk assessment (HHRA) evaluated exposure to on-site trespassers/recreators, construction/utility workers and adult and child residents for ingestion, inhalation and dermal contact with groundwater, surface water and sediment. The exposure assumptions that were used for the receptors and exposure pathways were the standard default values that were valid at the time that the HHRA was completed. The standard exposure default values have changed for several parameters including: body weight, water ingestion rate and skin surface area since the HHRA was completed, however the changes result in only a marginal change in risk and hazard estimates (*i.e.*, slightly lower). The use of the new values would not impact the decision that was made for the site, therefore the exposure assumptions used at the time would still be considered to be valid.

Similar to the exposure assumptions, several toxicity values have changed since the HHRA was completed. In general, the toxicity values became more stringent, which would slightly increase the risk and hazard estimates. Although the former toxicity values would no longer be valid, as new values have replaced them, the decisions made based on the former values would still be valid.

The exposure pathways that were identified as completed pathways, specifically ingestion of groundwater and VI into buildings, have been eliminated as part of the remedy implementation. A municipal water supply was provided for residents, eliminating the use of private wells as a drinking water source, and subslab vapor mitigation systems were installed to eliminate the VI pathway. EPA will continue to monitor the mitigation systems to ensure that they operate as designed. In addition, ongoing sampling of homes impacted by vapor intrusion continues. Therefore, all former completed exposure pathways have been eliminated.

The cleanup goals that were selected were based on federal and state applicable or relevant and appropriate requirements and/or to-be-considered values, and they remain valid for all compounds. Therefore, all the cleanup goals that were chosen, remain protective of human health are still valid.

The RAOs which focused on preventing exposure to and migration of contaminants in groundwater are still valid.

Ecological

The ecological risk assessment (ERA) for the Site evaluated ecological exposure to groundwater discharge to sediments and surface water. The ERA concluded there were no unacceptable ecological risks from groundwater discharge to the wetlands area near Interstate 84; however, it was recommended to include future monitoring to ensure conditions that were evaluated remained the same.

Since the COC concentrations in the toe of the groundwater plume are decreasing over time, lower concentrations are being potentially discharged to the wetlands area. Therefore, the conclusions from the initial Screening Level ERA (that there are no unacceptable ecological risks) is still valid.

In addition, the exposure pathways, assumptions and toxicity values that were used in the risk assessment were reviewed and they are still valid. Although there were no cleanup values associated with the surface water or sediment, the data review confirms that cleanup values are not applicable for ecological receptors and thus the lack of ecological cleanup values for the site is still valid.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
Operable Unit: 1	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedies implemented at the Shenandoah Road Groundwater Contamination Superfund Site are protective of protect human health and the environment.		

Sitewide Protectiveness Statement	
Protectiveness Determination: Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The remedies implemented at the Shenandoah Road Groundwater Contamination Superfund Site are protective of human health and the environment.	

VIII. NEXT REVIEW

The next FYR report for the Shenandoah Road Groundwater Contamination Superfund Site is required five years from the completion date of this review.

APPENDIX A

TABLES

TABLE 1
Chronology of Site Events
Shenandoah Road Groundwater Contamination Superfund Site

Dates	Event
March 2009	Town of East Fishkill Public Water Supply deemed fully operational to the Shenandoah Town Water District
March 2012	Start-up of Groundwater Extraction and Treatment System
August 2012	Final Remedial Investigation/Feasibility Study Report issued
September 30, 2012	Record of Decision issued
September 25, 2013	Remedial Design/Remedial Action Work Plan issued
September 2013	Groundwater Treatment Facility Operation, Maintenance and Monitoring Manual issued
September 2013	Comprehensive Monitoring Plan issued (Groundwater Monitoring Well Sampling and Operation and Maintenance of the Groundwater Extraction and Treatment System)
October 2013 through March 2018	Comprehensive Groundwater Sampling conducted
August 2014	Consent Decree for Remedial Design /Remedial Action issued
September 2014 to January 2017	Institutional Controls Implementation and Assurance Plan issued
December 2014	Three Draft Hybrid Environmental Easements and Surveys issued for 1) 7 East Hook Cross Road, 2) 11 East Hook Cross Road and 3) 47 Stone Ridge Lane
May 30, 2018	Signed and Notarized Three Environmental Easements
June 15, 2018	IBM Transmitted Executed Easements (7 East Hook Cross Road, 11 East Hook Cross Road and 47 Stone Ridge Lane) to NYSDEC for Final Signature
September 10, 2018	NYSDEC Director executes the three easements
September 18, 2018	IBM received the three executed easements
September 25, 2018	The three executed easements are filed with the Dutchess County Clerk

TABLE 2 **Documents Reviewed in Completing this Five-Year Review**	
Document Title, Author	**Submittal Date**
Removal Action – Final Report, 7 East Hook Cross Road Facility, Shenandoah Road Groundwater Contamination Superfund Site, IBM and Groundwater Sciences Corp.	December 2, 2002
Non-Time Critical Source Removal Action – Final Report, Shenandoah Road Groundwater Contamination Superfund Site, IBM and Groundwater Sciences Corp.	July/October 2011
Remedial Investigation/Feasibility Study Report, IBM and Groundwater Sciences Corp.	August 27, 2012
Record of Decision, U. S. Environmental Protection Agency	September 30, 2012
Remedial Design /Remedial Action Work Plan, Shenandoah Road Groundwater Contamination Superfund Site, IBM and Groundwater Sciences Corp.	September 25, 2013
Groundwater Treatment Facility Operation, Maintenance and Monitoring Manual, Shenandoah Road Groundwater Contamination Superfund Site, IBM and Groundwater Sciences, Corp.	September 30, 2013
Consent Decree for Remedial Design/Remedial Action, IBM and the United States	August 2014
Final Institutional Controls Implementation and Assurance Plan (ICIAP), Shenandoah Road Ground Contamination Superfund Site, IBM and Groundwater Sciences Corp.	January 11, 2017
Draft Remedial Action Report Shenandoah Road Groundwater Contamination Superfund Site, IBM and Groundwater Sciences Corp.	September 2018
Monthly Progress Reports, Consent Decree for Remedial Design/Remedial Action, IBM	2014 – 2018

TABLE 3A

Sediments Sampling Summary

		PCE (ug/kg)	TCE (ug/kg)	cis-12DCE (ug/kg)	VC (ug/kg)
SRSD-12	max	0.13 J	ND	ND	ND
	current	ND	ND	ND	ND
SRSD-13	max	4.7	1.0	ND	ND
	current	ND	ND	ND	ND
SRSD-14	max	3.2	0.67 J	ND	ND
	current	ND	ND	ND	ND
SRSD-18	max	4.5	1.8	ND	ND
	current	ND	ND	ND	ND

TABLE 3B

Surface Water Sampling Summary

		PCE (ug/L)	TCE (ug/L)	cis-12DCE (ug/L)	VC (ug/L)
SRSW-12	max	0.42 J	ND	ND	ND
	current	ND	ND	ND	ND
SRSW-13	max	21	ND	ND	ND
	current	18	ND	ND	ND
SRSW-14	max	9.7	0.35 J	ND	ND
	current	4.1	ND	ND	ND
SRSD-18	max	2.6	ND	ND	ND
	current	ND	ND	ND	ND

TABLE 4

Shenandoah Road Groundwater Contamination Superfund Site Water Quailty Monitoring Summary

SETS - Combined Influent (all extraction wells) (July 2018)

Date	Days Elapsed	PCE (ug/L)	TCE (ug/L)	12-DCE(tot) (ug/L)	VC (ug/L)	Total pumped since 3/26/2012
3/26/2012						0
3/30/2012	4	630.00	1.60	1.0 U	1.0 U	109,093
4/19/2012	20	780.00	3.50	1.0 U	1.0 U	441,651
4/27/2012	8	730.00	3.40	1.0 U	1.0 U	609,255
5/18/2012	21	670.00	4.10	1.0 U	1.0 U	1,148,141
6/22/2012	35	610.00	0.00	1.0 U	1.0 U	1,936,857
7/20/2012	28	520.00	5.40	1.0 U	1.0 U	2,490,072
8/17/2012	28	510.00	5.30	1.0 U	1.0 U	3,018,199
9/25/2012	39	440.00	6.00	1.0 U	1.0 U	3,735,525
10/23/2012	28	480.00	5.90	1.0 U	1.0 U	4,240,801
11/16/2012	24	390.00	4.60	1.0 U	1.0 U	4,758,634
12/14/2012	28	360.00	5.60	1.0 U	1.0 U	5,374,338
1/11/2013	28	380.00	5.30	1.0 U	1.0 U	6,029,759
1/18/2013	7	210.00	2.60	1.0 U	1.0 U	6,161,697
2/15/2013	28	370.00	5.00	1.0 U	1.0 U	6,745,563
3/13/2013	26	320.00	4.70	1.0 U	1.0 U	7,399,215
4/12/2013	30	330.00	5.00	1.0 U	1.0 U	8,151,320
5/10/2013	28	320.00	5.30	1.0 U	1.0 U	8,783,535
5/16/2013	6	300.00	5.30	1.0 U	1.0 U	8,881,343
5/23/2013	7	320.00	5.30	1.0 U	1.0 U	9,039,901
5/30/2013	7	150.00	1.70	1.0 U	1.0 U	9,139,140
6/7/2013	8	250.00	4.00	1.0 U	1.0 U	9,233,007
7/12/2013	35	330.00	5.20	1.0 U	1.0 U	10,095,260
8/15/2013	34	280.00	6.30	1.0 U	1.0 U	10,733,695
9/11/2013	27	310.00	6.10	1.0 U	1.0 U	11,168,574
9/23/2013	12	310.00	6.30	1.0 U	1.0 U	11,346,292
10/17/2013	24	310.00	6.70	1.0 U	1.0 U	11,664,815
11/15/2013	29	300.00	7.50	1.0 U	1.0 U	12,049,086
12/12/2013	27	320.00	7.40	1.0 U	1.0 U	12,388,500
1/9/2014	28	320.00	6.20	1.0 U	1.0 U	12,801,632
2/7/2014	29	340.00	5.90	1.0 U	1.0 U	13,363,162
3/7/2014	28	350.00	6.50	1.0 U	1.0 U	13,817,361
4/10/2014	34	330.00	5.80	1.0 U	1.0 U	14,511,818
5/9/2014	29	320.00	5.40	1.0 U	1.0 U	15,105,555
6/12/2014	34	270.00	5.30	1.0 U	1.0 U	15,725,860
7/10/2014	28	280.00	6.40	1.0 U	1.0 U	16,200,908
8/13/2014	34	290.00	6.00	1.0 U	1.0 U	16,723,113
9/11/2014	29	89.00	2.10	1.0 U	1.0 U	17,129,488
10/2/2014	21	350.00	6.80	1.0 U	1.0 U	17,398,429
11/13/2014	42	250.00	5.90	1.0 U	1.0 U	17,898,550
12/12/2014	29	250.00	4.60	1.0 U	1.0 U	18,255,700
1/15/2015	34	270.00	5.10	1.0 U	1.0 U	18,862,931
2/12/2015	28	280.00	5.40	1.0 U	1.0 U	19,348,780
3/12/2015	28	270.00	5.60	1.0 U	1.0 U	19,783,699
4/9/2015	28	260.00	4.80	1.0 U	1.0 U	20,289,157
5/7/2015	28	260.00	4.40	1.0 U	1.0 U	20,804,270
6/4/2015	28	260.00	5.80	1.0 U	1.0 U	21,256,007
7/9/2015	35	260.00	5.60	1.0 U	1.0 U	21,715,868
8/13/2015	35	260.00	5.60	1.0 U	1.0 U	21,729,501
9/10/2015	28	200.00	5.50	1.0 U	1.0 U	22,480,514
10/8/2015	28	200.00	6.00	1.0 U	1.0 U	22,769,920
11/12/2015	35	270.00	5.10	1.0 U	1.0 U	23,038,765
12/8/2015	26	270.00	6.10	1.0 U	1.0 U	23,339,849
1/8/2016	31	240.00	4.60	1.0 U	1.0 U	23,762,725

TABLE 4 (Cont'd)

Date	Days Elapsed	PCE (ug/L)	TCE (ug/L)	12-DCE(tot) (ug/L)	VC (ug/L)	Total pumped since 3/26/2012
2/9/2016	32	230.00	4.40	1.0 U	1.0 U	24,262,342
3/10/2016	30	260.00	4.70	1.0 U	1.0 U	24,738,098
4/12/2016	33	230.00	4.80	1.0 U	1.0 U	25,244,290
5/12/2016	30	220.00	4.60	1.0 U	1.0 U	25,691,941
6/9/2016	28	210.00	4.60	1.0 U	1.0 U	26,529,209
7/12/2016	33	210.00	5.10	1.0 U	1.0 U	26,550,977
8/11/2016	30	200.00	4.20	1.0 U	1.0 U	26,887,434
9/13/2016	33	200.00	4.20	1.0 U	1.0 U	26,898,558
10/13/2016	30	200.00	4.20	1.0 U	1.0 U	27,539,748
11/9/2016	27	200.00	5.10	1.0 U	1.0 U	27,784,402
12/8/2016	29	240.00	4.40	1.0 U	1.0 U	28,055,085
1/12/2017	35	280.00	4.70	1.0 U	1.0 U	28,066,436
2/7/2017	26	220.00	3.40	1.0 U	1.0 U	28,920,791
3/9/2017	30	190.00	3.20	1.0 U	1.0 U	29,346,022
4/13/2017	35	190.00	2.90	1.0 U	1.0 U	29,889,053
5/11/2017	28	210.00	2.90	1.0 U	1.0 U	30,317,889
6/13/2017	33	190.00	3.00	1.0 U	1.0 U	30,800,415
7/13/2017	30	180.00	3.30	1.0 U	1.0 U	31,182,261
8/10/2017	28	200.00	4.70	1.0 U	1.0 U	31,488,580
9/14/2017	35	170.00	4.70	1.0 U	1.0 U	31,826,477
10/12/2017	28	160.00	5.20	1.0 U	1.0 U	32,070,930
11/7/2017	26	140.00	4.20	1.0 U	1.0 U	32,282,036
12/12/2017	35	190.00	1.0U	1.0 U	1.0 U	32,290,007
1/12/2018	31	190.00	1.0U	1.0 U	1.0 U	32,806,309
2/13/2018	32	220.00	3.50	1.0 U	1.0 U	33,157,242
3/13/2018	28	210.00	3.20	1.0 U	1.0 U	33,562,940
4/12/2018	30	180.00	3.30	1.0 U	1.0 U	33,998,131
5/22/2018	40	190.00	1.0U	1.0 U	1.0 U	34,535,273
6/14/2018	23	180.00	1.0U	1.0 U	1.0 U	34,858,881

TABLE 5

Shenandoah Road Groundwater Contamination Superfund Site
Water Quality Monitoring Summary
SETS Effluent (July 2018)

Date	Days Elapsed	PCE (ug/L)	TCE (ug/L)	12-DCE(tot) (ug/L)	VC (ug/L)	Total pumped since 3/26/2012
3/26/2012						0
3/30/2012	4	1.0 U	1.0 U	1.0 U	1.0 U	109,093
4/19/2012	20	1.0 U	1.0 U	1.0 U	1.0 U	441,651
4/27/2012	8	1.0 U	1.0 U	1.0 U	1.0 U	609,255
5/18/2012	21	1.0 U	1.0 U	1.0 U	1.0 U	1,148,141
6/22/2012	35	1.0 U	1.0 U	1.0 U	1.0 U	1,936,857
7/20/2012	28	1.0 U	1.0 U	1.0 U	1.0 U	2,490,072
8/17/2012	28	1.0 U	1.0 U	1.0 U	1.0 U	3,018,199
9/25/2012	39	1.0 U	1.0 U	1.0 U	1.0 U	3,735,525
10/23/2012	28	1.0 U	1.0 U	1.0 U	1.0 U	4,240,801
11/16/2012	24	1.0 U	1.0 U	1.0 U	1.0 U	4,758,634
12/14/2012	28	1.0 U	1.0 U	1.0 U	1.0 U	5,374,338
1/11/2013	28	1.0 U	1.0 U	1.0 U	1.0 U	6,029,759
1/18/2013	7	1.0 U	1.0 U	1.0 U	1.0 U	6,161,697
2/15/2013	28	1.0 U	1.0 U	1.0 U	1.0 U	6,745,563
3/13/2013	26	1.0 U	1.0 U	1.0 U	1.0 U	7,399,215
4/12/2013	30	1.0 U	1.0 U	1.0 U	1.0 U	8,151,320
5/10/2013	28	1.0 U	1.0 U	1.0 U	1.0 U	8,783,535
5/16/2013	6	1.0 U	1.0 U	1.0 U	1.0 U	8,881,343
5/23/2013	7	1.0 U	1.0 U	1.0 U	1.0 U	9,039,901
5/30/2013	7	1.0 U	1.0 U	1.0 U	1.0 U	9,139,140
6/7/2013	8	1.0 U	1.0 U	1.0 U	1.0 U	9,233,007
7/12/2013	35	1.0 U	1.0 U	1.0 U	1.0 U	10,095,260
8/15/2013	34	1.0 U	1.0 U	1.0 U	1.0 U	10,733,695
9/11/2013	27	1.0 U	1.0 U	1.0 U	1.0 U	11,168,574
9/23/2013	12	1.0 U	1.0 U	1.0 U	1.0 U	11,346,292
10/17/2013	24	1.0 U	1.0 U	1.0 U	1.0 U	11,664,815
11/15/2013	29	1.0 U	1.0 U	1.0 U	1.0 U	12,049,086
12/12/2013	27	1.0 U	1.0 U	1.0 U	1.0 U	12,388,500
1/9/2014	28	1.0 U	1.0 U	1.0 U	1.0 U	12,801,632
2/7/2014	29	1.0 U	1.0 U	1.0 U	1.0 U	13,363,162
3/7/2014	28	1.0 U	1.0 U	1.0 U	1.0 U	13,817,361
4/10/2014	34	1.0 U	1.0 U	1.0 U	1.0 U	14,511,818
5/9/2014	29	1.0 U	1.0 U	1.0 U	1.0 U	15,105,555
6/12/2014	34	1.0 U	1.0 U	1.0 U	1.0 U	15,725,860
7/10/2014	28	1.0 U	1.0 U	1.0 U	1.0 U	16,200,908
8/13/2014	34	1.0 U	1.0 U	1.0 U	1.0 U	16,723,113
9/11/2014	29	1.0 U	1.0 U	1.0 U	1.0 U	17,129,488
10/2/2014	21	1.0 U	1.0 U	1.0 U	1.0 U	17,398,429
11/13/2014	42	1.0 U	1.0 U	1.0 U	1.0 U	17,898,550
12/12/2014	29	1.0 U	1.0 U	1.0 U	1.0 U	18,255,700
1/15/2015	34	1.0 U	1.0 U	1.0 U	1.0 U	18,862,931
2/12/2015	28	1.0 U	1.0 U	1.0 U	1.0 U	19,348,780
3/12/2015	28	1.0 U	1.0 U	1.0 U	1.0 U	19,783,699
4/9/2015	28	1.0 U	1.0 U	1.0 U	1.0 U	20,289,157
5/7/2015	28	1.0 U	1.0 U	1.0 U	1.0 U	20,804,270
6/4/2015	28	1.0 U	1.0 U	1.0 U	1.0 U	21,256,007
7/9/2015	35	1.0 U	1.0 U	1.0 U	1.0 U	21,715,868
8/13/2015	35	1.0 U	1.0 U	1.0 U	1.0 U	21,729,501
9/10/2015	28	1.0 U	1.0 U	1.0 U	1.0 U	22,480,514
10/8/2015	28	1.0 U	1.0 U	1.0 U	1.0 U	22,769,920
11/12/2015	35	1.0 U	1.0 U	1.0 U	1.0 U	23,038,765
12/8/2015	26	1.0 U	1.0 U	1.0 U	1.0 U	23,339,849

TABLE 5 (cont'd)

Date	Days Elapsed	PCE (ug/L)	TCE (ug/L)	12-DCE(tot) (ug/L)	VC (ug/L)	Total pumped since 3/26/2012
1/8/2016	31	1.0 U	1.0 U	1.0 U	1.0 U	23,762,725
2/9/2016	32	1.0 U	1.0 U	1.0 U	1.0 U	24,262,342
3/10/2016	30	1.0 U	1.0 U	1.0 U	1.0 U	24,738,098
4/12/2016	33	1.0 U	1.0 U	1.0 U	1.0 U	25,244,290
5/12/2016	30	1.0 U	1.0 U	1.0 U	1.0 U	25,691,941
6/9/2016	28	1.0 U	1.0 U	1.0 U	1.0 U	26,529,209
7/12/2016	33	1.0 U	1.0 U	1.0 U	1.0 U	26,550,977
8/11/2016	30	1.0 U	1.0 U	1.0 U	1.0 U	26,887,434
9/13/2016	33	1.0 U	1.0 U	1.0 U	1.0 U	26,898,558
10/13/2016	30	1.0 U	1.0 U	1.0 U	1.0 U	27,539,748
11/9/2016	27	1.0 U	1.0 U	1.0 U	1.0 U	27,784,402
12/8/2016	29	1.0 U	1.0 U	1.0 U	1.0 U	28,055,085
1/12/2017	35	1.0 U	1.0 U	1.0 U	1.0 U	28,066,436
2/7/2017	26	1.0 U	1.0 U	1.0 U	1.0 U	28,920,791
3/9/2017	30	1.0 U	1.0 U	1.0 U	1.0 U	29,346,022
4/13/2017	35	1.0 U	1.0 U	1.0 U	1.0 U	29,889,053
5/11/2017	28	1.0 U	1.0 U	1.0 U	1.0 U	30,317,889
6/13/2017	33	1.0 U	1.0 U	1.0 U	1.0 U	30,800,415
7/13/2017	30	1.0 U	1.0 U	1.0 U	1.0 U	31,182,261
8/10/2017	28	1.0 U	1.0 U	1.0 U	1.0 U	31,488,580
9/14/2017	35	1.0 U	1.0 U	1.0 U	1.0 U	31,826,477
10/12/2017	28	1.0 U	1.0 U	1.0 U	1.0 U	31,835,552
11/7/2017	26	1.0 U	1.0 U	1.0 U	1.0 U	32,282,036
12/12/2017	35	1.0 U	1.0 U	1.0 U	1.0 U	32,557,948
1/12/2018	31	1.0 U	1.0 U	1.0 U	1.0 U	32,806,309
2/13/2018	32	1.0 U	1.0 U	1.0 U	1.0 U	33,157,242
3/13/2018	28	1.0 U	1.0 U	1.0 U	1.0 U	33,562,940
4/12/2018	30	1.0 U	1.0 U	1.0 U	1.0 U	33,998,131
5/22/2018	40	1.0 U	1.0 U	1.0 U	1.0 U	34,535,273
6/14/2018	23	1.0 U	1.0 U	1.0 U	1.0 U	34,858,881

TABLE 6

Shenandoah Road Groundwater Contamination Superfund Site

Monitoring Well Data Summary

SRMW-01RC	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	0.25 J	ND@1.0	ND@2.0	ND@1.0
Current	ND@1.0	ND@1.0	ND@2.0	ND@1.0

SRMW-02RA	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	0.38 J	9.7	11	ND@1.0
Current	ND@1.0	5.5	11	ND@1.0

SRMW-11R, Port 4	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	6.7	0.46 J	ND@2.0	ND@1.0
Current	5.9	0.46 J	ND@2.0	ND@1.0

SRMW-12RA	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	44	7.9	0.86 J	ND@1.0
Current	29	4.6	0.43 J	ND@1.0

SRMW-12RB	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	38	4.3	0.64 J	0.17 J
Current	28	4.3	0.49 J	ND@1.0

SRMW-12RC	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	ND@4.4	ND@4.4	ND@4.4	ND@4.4
Current	ND@1.0	ND@1.0	ND@2.0	ND@1.0

SRMW-12S	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	57	ND@2.4	ND@2.4	ND@2.4
Current	27	ND@1.0	ND@2.0 J	ND@1.0

SRMW-14R, Port 1	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	12	0.75 J	ND@2.0	ND@1.0
Current	6.3	0.75 J	ND@2.0	ND@1.0

SRMW-14R, Port 2	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	1.2 J	0.11 J	ND@6.1	ND@6.1
Current (average)	0.50 J	ND@1.0	ND@2.0	ND@1.0

SRMW-14RA	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	29	0.22 J	ND@2.0	ND@1.0
Current	12	ND@1.0	ND@2.0	ND@1.0

SRMW-14RB	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	28	0.18 J	ND@2.0	ND@1.0
Current	0.64 J	ND@1.0 J	ND@2.0	ND@1.0

SRMW-14S	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	53	ND@1.9	ND@2.0	ND@1.9
Current	36	ND@1.0 J	ND@2.0	ND@1.0

SRMW-16R, Port 1	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	1.1	0.35 J	7.4	ND@1.0
Current	ND@1.0	ND@1.0	1.5	ND@1.0

SRMW-16R, Port 2	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	3.6	0.72 J	9.9	ND@1.0
Current	0.60 J	ND@1.0	1.5	ND@1.0

SRMW-16R, Port 3	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	37	27	34	ND@1.0
Current	3.1	22	11	ND@1.0

SRMW-17R, Port 2	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	32	5.2	10	2.4
Current	9.0	2.0	3.0	2.4

SRMW-17R, Port 3	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	26	5.5	49	6.8
Current	1.2	0.77 J	26	6.8

SRMW-17R, Port 4	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	75	11	33	9.6 J
Current	0.98 J	0.45 J	29	9.6 J

SRMW-17R, Port 5	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	41	9.5	53	24
Current	0.87 J	0.62 J	9.1	24

SRMW-17R, Port 6	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	29	21	25	8.7
Current	2.7	6.6	11	8.7

SRMW-17R, Port 7	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	8.7	30	36	18
Current	1.5	6.4	24	11 J

SRMW-18A	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	16000	ND@500	ND@500	ND@500
Current	2100	ND@50	ND@100	ND@50

SRMW-18B	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	2600	12 J	6.1 J	ND@100
Current	350	ND@13	ND@25	ND@13

SRMW-18C	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	1500	9.5	ND@25	ND@13
Current	260	4.7	ND@17	ND@8.3

TABLE 6 (cont'd)

Shenandoah Road Groundwater Contamination Superfund Site
Monitoring Well Data Summary

SRMW-15R, Port 2	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	23	7.5	30	3.2
Current	ND@1.0	ND@1.0	4.4	2.7

SRMW-18D	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	320	32	8.7	ND@3.6
Current	88	21	8.7	ND@3.3

SRMW-15R, Port 3	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	51	19	8.9	0.62 J
Current	13	16	2.7	ND@1.0

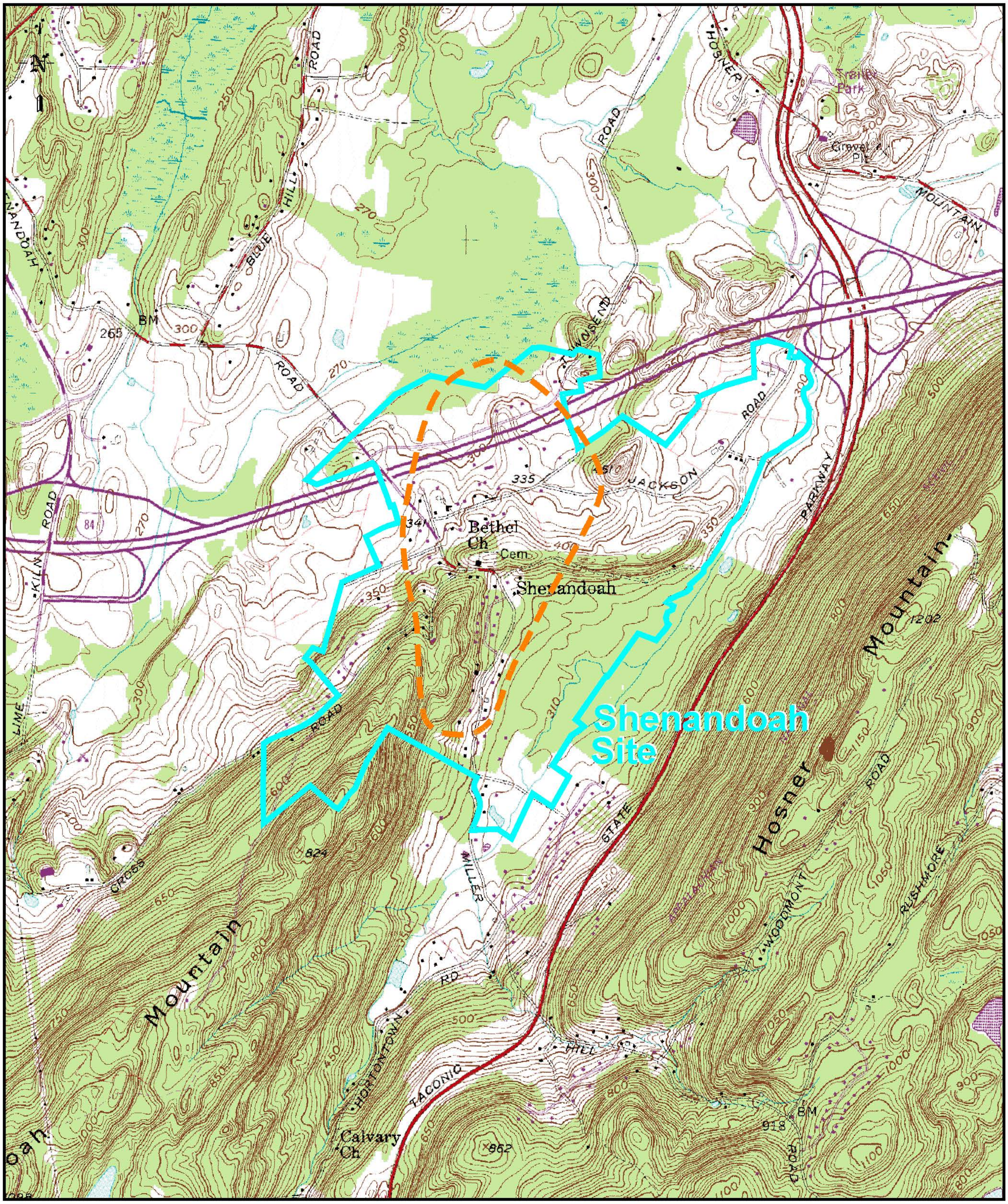
SRMW-18E	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	170	8.2	0.94 J	ND@5.0
Current	50	3.5	ND@4.0	ND@2.0

SRMW-15R, Port 4	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	49	24	9.3	1.2
Current	2.1	8.1	3.3	0.89 J

SRMW-18F, Port 1	PCE (ug/L)	TCE (ug/L)	1,2-DCE (ug/L)	VC (ug/L)
Historical Max	ND@2.6	ND@2.6	ND@2.6	ND@2.6
Current	ND@1.0	ND@1.0	ND@2.0	ND@1.0

APPENDIX B

FIGURES



- - - - Extent of Individual Site C0PCs Detected Above 5 µg/L in Groundwater

Scale

0 1000' 2000'

Portion of the Hopewell Junction, NY
7.5-Minute NYSDOT Quadrangle

FIGURE 1

Shenandoah Road Groundwater Contamination Superfund Site
Study Area Setting

GROUNDWATER SCIENCES CORPORATIOA

2100.3-002-F12 / 03-.30-05

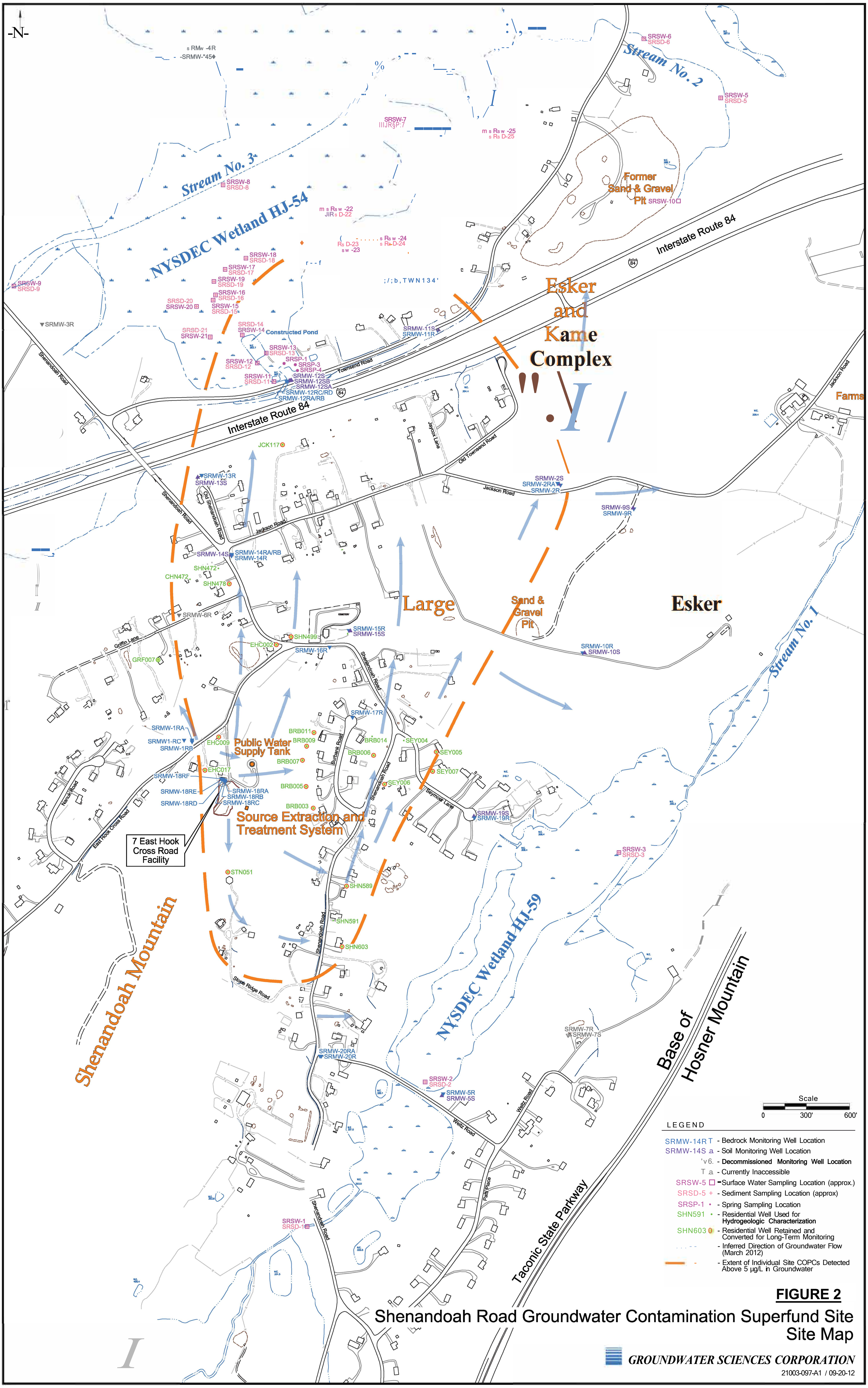
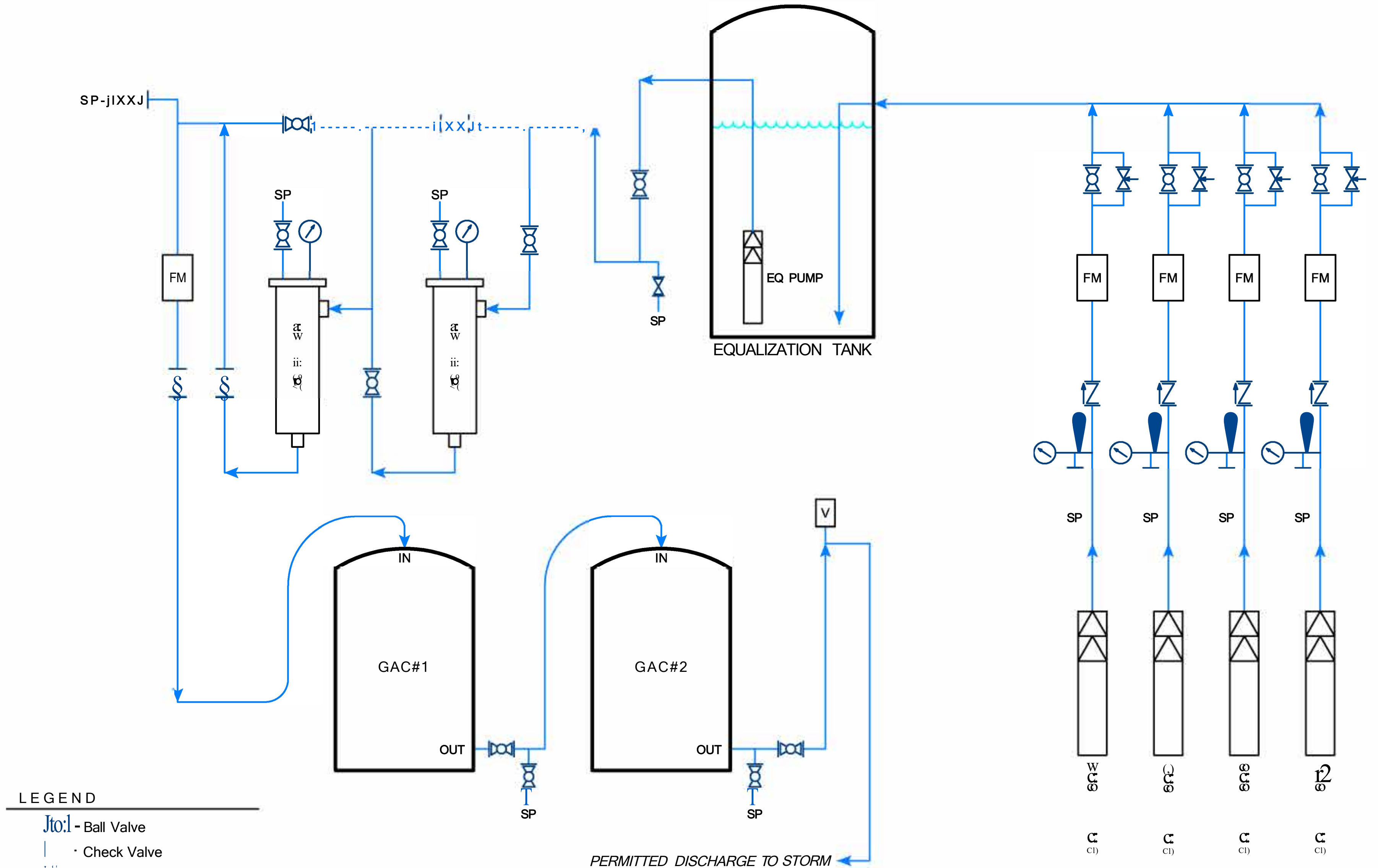


FIGURE 2

Shenandoah Road Groundwater Contamination Superfund Site
Site Map



LEGEND

- Ball Valve
- Check Valve
- Needle Valve
- Pressure Gauge
- Direction of Flow

FM - Flow Meter
GAC - Granular Activated Carbon
SP - Sample Port
V - Siphon Break

NOT TO SCALE

FIGURE 3

Shenandoah Road Groundwater Contamination Superfund Site
Source Extraction and Treatment System Flow Diagram

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21003-083-82 / 09-06-12

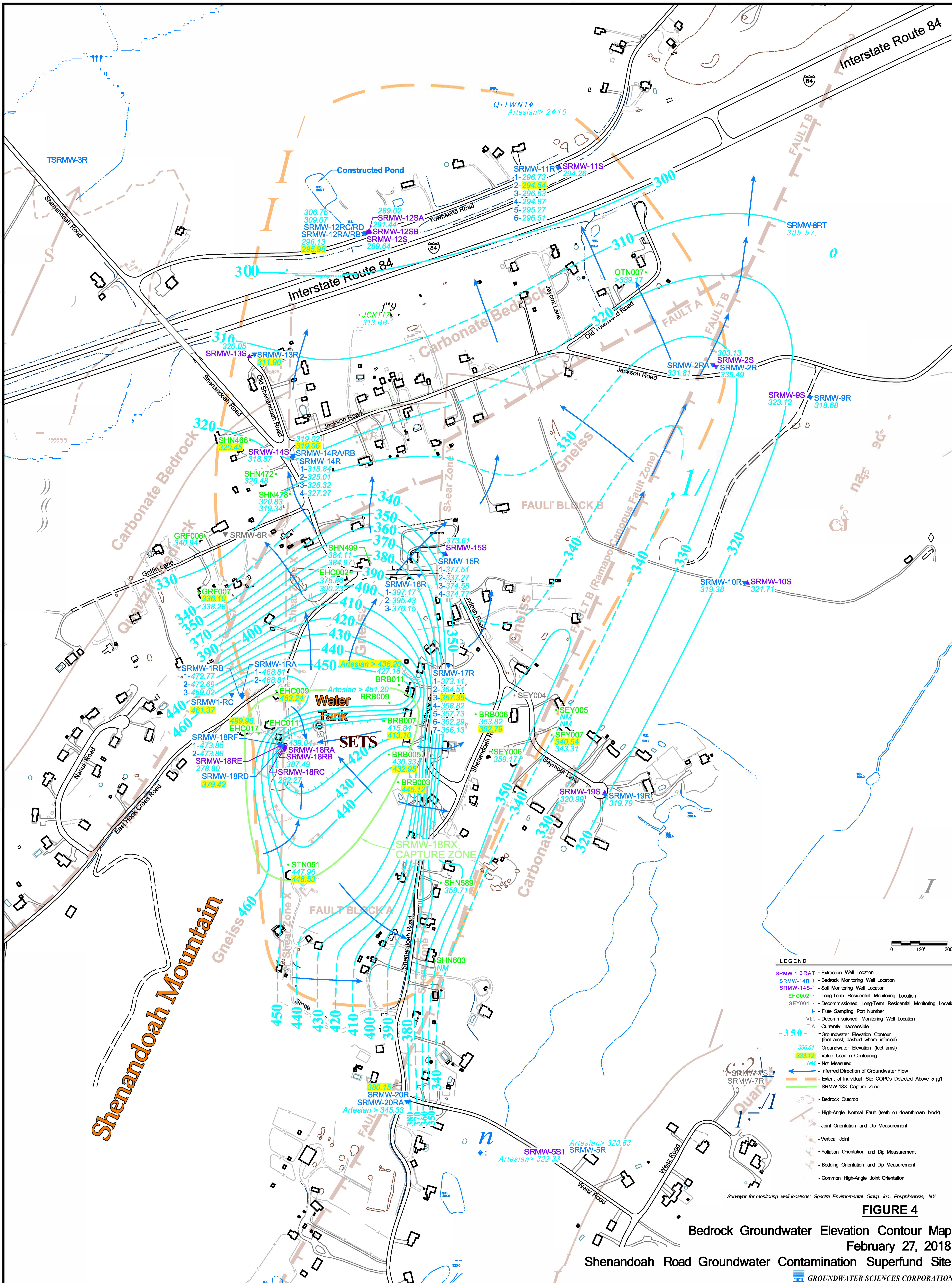

FIGURE 4

Bedrock Groundwater Elevation Contour Map
February 27, 2018
Shenandoah Road Groundwater Contamination Superfund Site

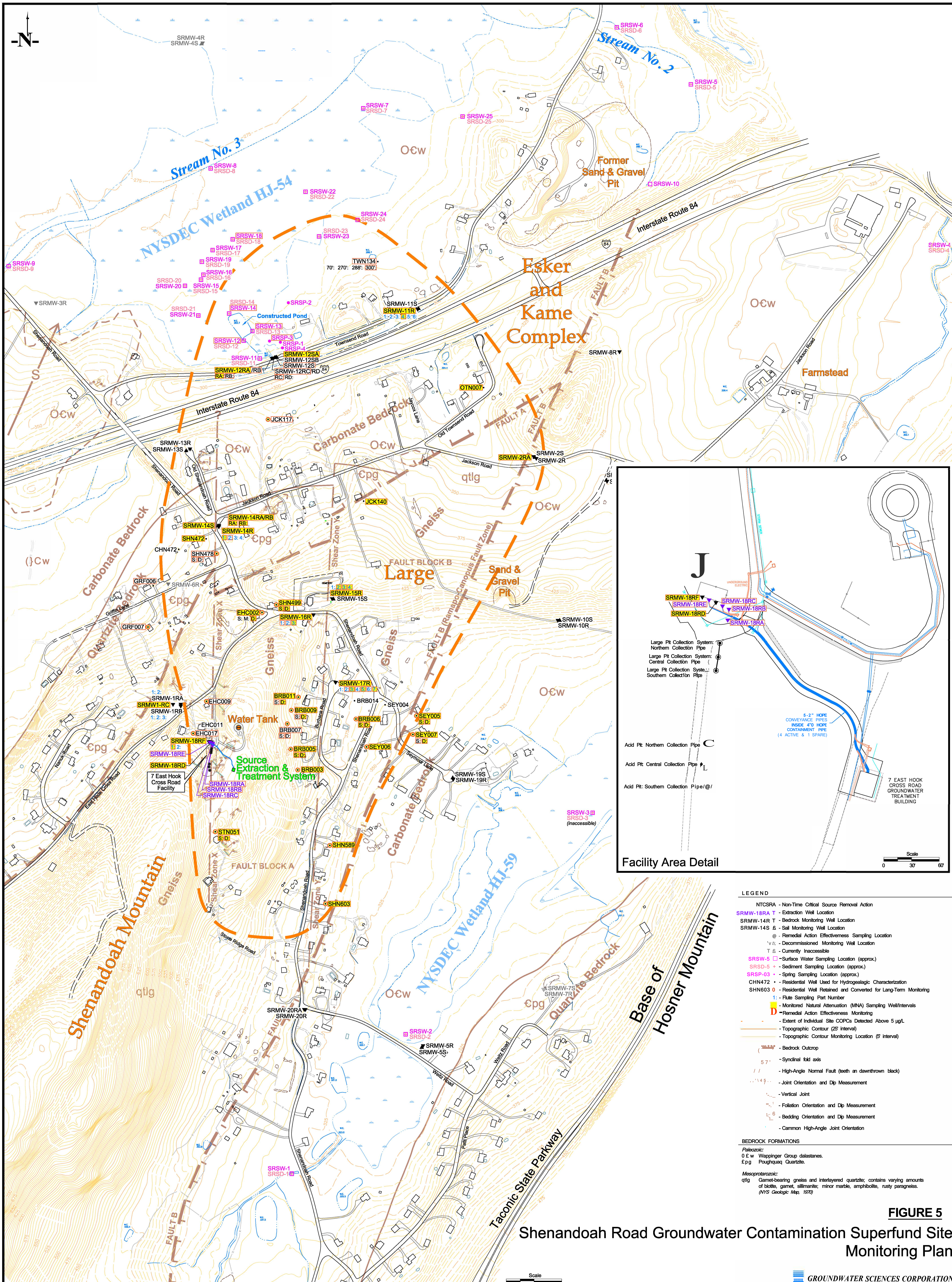

FIGURE 5

Shenandoah Road Groundwater Contamination Superfund Site Monitoring Plan

FIGURE 6

PCE and TCE Concentration Graphs
2008 - Present, Log Scale
Shenandoah Road Groundwater Contamination Superfund Site

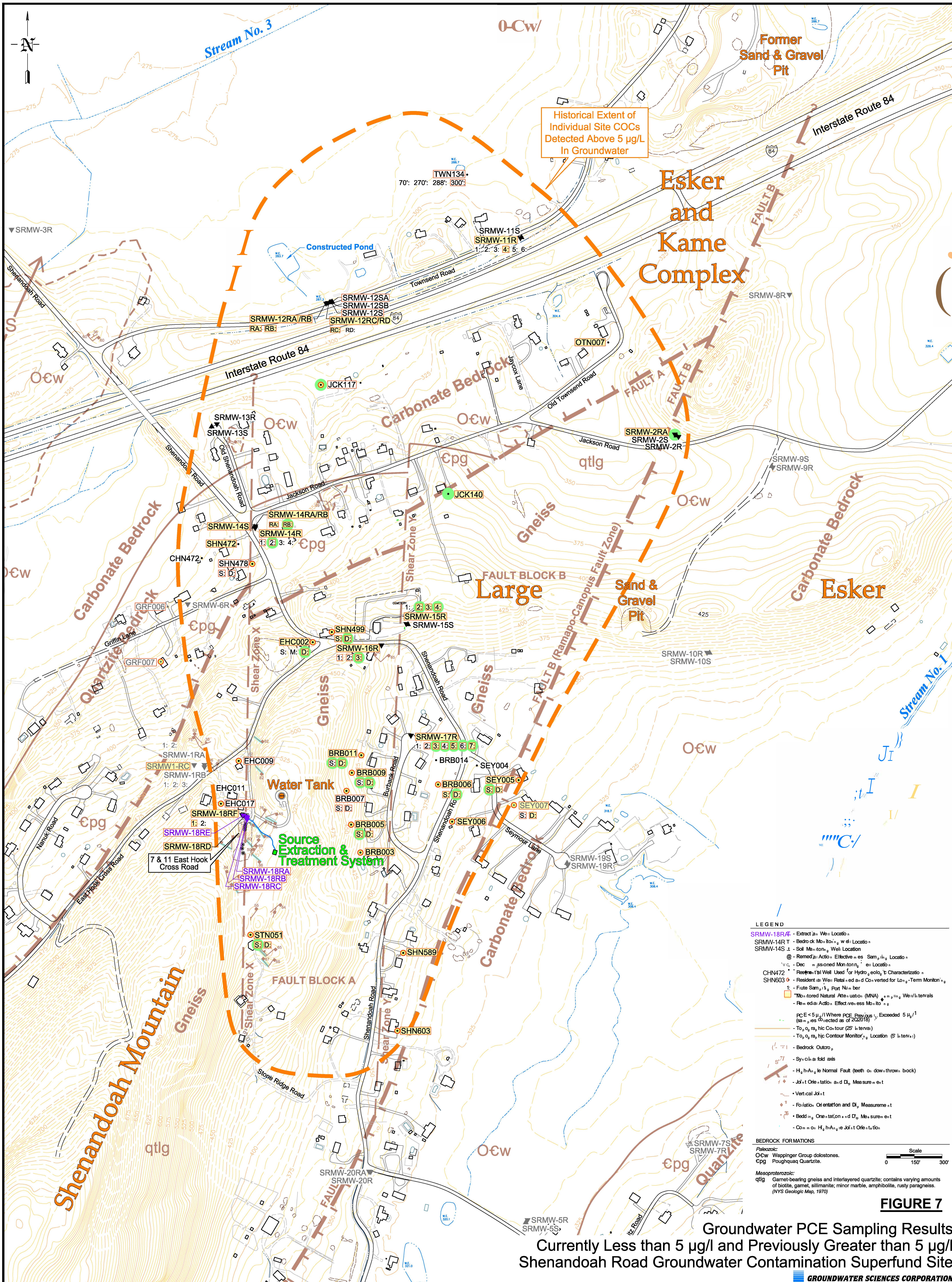

FIGURE 7

Groundwater PCE Sampling Results
Currently Less than 5 µg/l and Previously Greater than 5 µg/l
Shenandoah Road Groundwater Contamination Superfund Site