PERIODIC REVIEW REPORT (2016)
AMERICAN THERMOSTAT SITE
NYSDEC SITE NO. 420006

WORK ASSIGNMENT NO. D007619-01

Prepared for:

New York State Department of Environmental Conservation
Albany, New York

Prepared by:

MACTEC Engineering and Consulting, P.C.
Portland, Maine

MACTEC: 3612112204

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

AGC	Annual Guideline Concentrations
AT	American Thermostat Company
AWQ	Ambient Water Quality
bgs	below ground surface
BOD	Basis of Design
EC	engineering control
EW	bedrock well
GAC	granular activated carbon
gpm	gallon(s) per minute
GWETS	groundwater extraction and treatment system
HMI	human machine interface
IC	institutional control
LTM	long term monitoring
MACTEC	MACTEC Engineering and Consulting, P.C.
µg/l	microgram(s) per liter
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
O&M	operation and maintenance
OM&M	Operation, Maintenance and Monitoring
OU	operable unit
OW	overburden well

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

PCE	tetrachloroethene
PLC	Programmable Logic Controller
POET	point of exposure treatment system
PRR	periodic review report
RAO	Remedial Action Objective
ROD	Record of Decision
RSO	remedial systems optimization
SGC	Short-Term Guideline Concentrations
Site	American Thermostat site
SM	site management
SMP	Site Management Plan
SVI	soil vapor intrusion
TCE	trichloroethene
USEPA	United States Environmental Protection Agency
VI	vapor intrusion
VOC	volatile organic compound

EXECUTIVE SUMMARY

The American Thermostat (Site No. 420006; herein referred to as the Site) is an approximately eight acre site located in South Cairo, Town of Catskill, Greene County, NY. The Site was remediated in accordance with Record of Decision (ROD) for Operable Unit 1 (OU1) (potable water supply) (United States Environmental Protection Agency [USEPA], 1988) and OU2 (soil, sediment, surface water, groundwater, and building contamination) (USEPA, 1990). The Site includes an active groundwater extraction and treatment system (GWETS). The contaminants of concern are volatile organic compounds including tetrachloroethene (PCE), trichloroethene, 1,2-dichloroethene, and vinyl chloride. Remedial goals outlined in the ROD documents for the Site are to ensure protection of groundwater from site contaminants in soil, restore groundwater to drinking water standards or until a point has been reached at which contaminant concentrations in the groundwater "level off", and reduce risk to human health and the environment. Current Site Management (SM) requirements for monitoring the performance and effectiveness of the remedial measures completed at the Site consist of operating the groundwater extraction system to maintain hydraulic control in source area, routine inspection, sampling, and reporting.

The GWETS has been operational for eighteen years, and monitoring results have indicated that achieving groundwater cleanup goals in a reasonable period of time will not be possible. The exposure pathways resulting from Site contaminants being released into the environment have either been eliminated through previous and current actions (i.e., extension of the public water supply and thermal treatment of shallow contaminated soil, as well as residential point of exposure treatment systems), or are not complete (i.e., vapor intrusion). However, mitigation of the on-Site American Thermostat building may be warranted if occupancy of the currently vacant building resumes. The objective of treating groundwater "until federal and state standards for the organic contaminants have been achieved" is not realistic at this site. As a result, the Remedial Action Objective for the Site has been redefined to focus on hydraulic containment of the source area. This is an achievable goal that is protective and cost-effective.

Based on information gathered as part of the RSO investigation and the updated conceptual site model, optimization measures to the GWETS were implemented in 2013 and are continuing. By focusing on hydraulic containment of the source area and eliminating off-site deep bedrock extraction

wells, the northwestern edge of the PCE plume is expected to separate from the remainder of the plume and migrate towards Catskill Creek. Therefore, the effectiveness of the GWETS will be increased, operating costs will decrease, groundwater will continue to be treated and its quality gradually improved with time, and on-going monitoring will evaluate migration pathways and potential receptors.

This Periodic Review Report (PRR) summarizes SM activities completed at the Site from January 2016 through December 2016. The recommendations highlighted in the RSO Implementation Activities Report (MACTEC Engineering and Consulting, P.C. [MACTEC], 2013a), were detailed in a Basis of Design Memorandum for improvement to the treatment facility (MACTEC, 2013b) as well as to the groundwater extraction system (MACTEC, 2013c). The modifications continued throughout 2016, and are anticipated for completion in 2017. During the reporting period, the GWETS was shut down on several occasions for continued system optimization. As of December 2016, the GWETS is essentially modified and returned to operating status. Hydraulic gradient verification and groundwater quality monitoring (15 month cycle) was performed in March 2016. The extraction system is maintaining an inward hydraulic gradient to the site. The groundwater plume's concentration core is responding to the reconfiguration of extraction well pumping. Residual offsite groundwater contamination appears to be migrating toward Catskill Creek as expected.

1.0 SITE OVERVIEW

1.1 SITE HISTORY AND DESCRIPTION

American Thermostat Company (AT) produced thermostats and used chlorinated and non-chlorinated solvents in its manufacturing from 1954 to 1985. The waste solvents were disposed on the property and/or discharged to the septic system.

In 1981, the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health sampled nearby residential wells and detected tetrachloroethene (PCE) in residential wells exceeding the federal maximum contaminant levels. Shortly thereafter, the United States Environmental Protections Agency (USEPA) took over the management of the American Thermostat site (Site) and installed a Point of Exposure Treatment System (POET) consisting of carbon filtration units on affected homeowners' wells. AT ended site operations in 1985, and in 1987 USEPA commissioned a focused Feasibility Study to evaluate an Alternative Water Supply for the affected residents. In 1988, a Record of Decision (ROD) was signed for Operable Unit 1 (OU1) that outlined an extension of the existing public water supply as well as maintaining POET systems for several private wells, including the communal water supply for the Country Estates trailer park. USEPA conducted a Remedial Investigation for soil, surface water and groundwater at the Site. In 1990, the ROD for OU2 was issued outlining mitigation measures for the source area, including implementation of a groundwater extraction and treatment system (GWETS).

The ROD for OU2 states that: "The groundwater treatment will continue until federal and state standards for the organic contaminants have been achieved in the groundwater throughout the contaminated plume area or until a point has been reached at which contaminant concentrations in the groundwater 'level off'. At that point, the remedy will be reevaluated for its effectiveness". It was assumed in the OU2 ROD that the selected remedial alternative for groundwater would take up to 30 years to achieve cleanup levels (5 micrograms per liter [µg/L] for PCE).

The GWETS became fully operational in 1998 and the USEPA conducted 5-year reviews in 2003, 2008 and 2013. In 2008, following 10 years of Site management (SM) by the USEPA, the Site was

transferred to NYSDEC. NYSDEC completed a Periodic Review Report (PRR) in 2010. This review indicated that monitoring of plume concentrations was primarily conducted at active extraction wells, and concentrations of site contaminants appear to be steady and/or slightly trending downward in the plume area. However, in the source area, concentrations remain elevated (above 1,000 µg/l) and declining at even a slower rate indicating that concentrations may be sustained by the presence of a residual contaminant source. It appeared that groundwater treatment had reached a point at which contaminant concentrations had more or less 'leveled off' and the remedial action should be reevaluated for its effectiveness.

In the winter of 2012, the vapor intrusion (VI) pathway within the plume boundaries was evaluated (MACTEC Engineering and Consulting, P.C. [MACTEC], 2012). Soil VI (SVI) Sampling indicated a potential migration pathway of vapors to the Site manufacturing building and the adjacent Hook property. A sump cover was installed by the property owner to reduce potential exposure to vapors.

In the spring/summer 2012, an RSO Implementation field investigation was conducted. Results of the RSO Implementation activities suggested numerous recommendations for improvement regarding the groundwater remedy (MACTEC, 2013a). Specific to the GWETS, a Basis of Design (BOD) memorandum (MACTEC, 2013b) was prepared following the RSO Implementation Activities Report to define modifications to the groundwater treatment system for a more streamlined system to improve effectiveness and lower operating costs.

From 2013 through the end of 2015, the majority of GWETS improvements were completed. In 2016, GWETS operation troubleshooting efforts were underway to optimize flow, groundwater elevation, reduction of maintenance. A new control system was also installed at the extraction wells and within the main plant. Currently, the GWETS consists of five bedrock extraction wells and seven overburden extraction wells, and effluent discharges to a surface drainage swale on the eastern side of the Site that eventually leads to Catskill Creek. Besides the GWETS, the groundwater remedial measure includes individual wellhead treatment of three residential wells with granular activated carbon (GAC).

1.2 PHYSICAL SETTING

The Site is located in a rural residential area in South Cairo, Town of Catskill, Greene County, New York, approximately 30 miles southwest of Albany and five miles west of the Village of Catskill. The approximately eight-acre site is bordered by Routes 23B and Route 23 on the north and south, respectively, by a residential property on the west, and by New York State (NYS)-owned property on the east (see Figure 1.1). The Site contains the former American Thermostat building and the water treatment plant constructed for the implementation of the groundwater remedy.

The topography within the vicinity of the Site is characterized by the gently rolling foothills of the Catskill Mountains, which are deeply incised by stream channels. The Site is located on a slight ridge overlooking Catskill Creek Valley. Immediately west of the facility is a small valley which includes Tributary B, a tributary of Catskill Creek. East of the facility is Tributary A, which also flows into Catskill Creek, located approximately a quarter mile to the east of the Site.

Regionally, the bedrock within Greene County consists of interbedded shales and sandstones of Devonian age, known as the Catskill Formation. The Catskill Formation is made up of four distinct bedrock groups. From oldest to youngest, these groups are Hamilton, Genesee, Sonya, and West Falls. The Site lies within the Hamilton Group. In the vicinity of the Site, the bedrock is at an average depth of 28 to 30 feet below the ground surface (bgs); however, in the vicinity of the former manufacturing building, bedrock is approximately 100 feet bgs. The overburden overlying the bedrock is primarily glacially-derived soils.

A groundwater investigation as part of the RSO Implementation activities indicated that there is limited hydraulic connection between the overburden and bedrock at the Site. Overburden groundwater is perched and slowly drains laterally toward low lying areas, and vertically into the bedrock aquifer. Bedrock groundwater level fluctuations recorded during the RSO Implementation activities were compared to barometric fluctuations over the same time period. The resulting relationship between water level fluctuation and barometric fluctuation indicated that the bedrock aquifer is likely semi-confined.

The area surrounding the Site is characterized as rural-residential. There are a few full-time residences, vacation homes, and several small businesses in the vicinity of the Site. The American Thermostat Corporation was the only manufacturing facility in the area.

Approximately 5,000 people live within a 3-mile radius of the Site in low-density residential areas. Until a public water supply line was installed to protect the public from exposure to contaminated groundwater, all homes within ½ mile of the Site used private wells. At present, various residences and businesses within the immediate vicinity of the Site property receive water from the municipal water supply of the Village of Catskill. However, while a municipal water supply was provided, property owners were not required to connect to the system. Therefore the need for GAC systems remains in three private residential wells and the trailer park within the limits of the groundwater plume.

Catskill Creek is classified as a trout stream and has considerable recreational value to local and visiting fishermen. The Creek is also an auxiliary water supply for the Village of Catskill.

1.3 CLEANUP GOALS AND REMEDIAL PROGRESS

Based on the ROD, groundwater treatment will continue until "federal and state standards for the organic contaminants have been achieved in the groundwater throughout the contaminated plume area or until a point has been reached at which contaminants concentrations in the groundwater 'level off'. At that point, the remedy will be reevaluated for its effectiveness". Based on the results of the RSO activities and presented in the 2012 PRR, the remedial objective has been modified by the NYSDEC to be limited to source control and (onsite) hydraulic containment of grossly contaminated groundwater.

Hydraulic containment is accomplished through the use of five bedrock extraction wells and seven overburden wells. Previous offsite extraction wells maintained the shape and direction of the plume against the natural groundwater flow path towards Catskill Creek. The RSO investigation findings predicted eliminating the off-site deep bedrock extraction wells would separate the northeastern edge of the PCE plume from the plume and migrate towards Catskill Creek. As a result a small portion of the offsite plume will be drawn into the Country Estates wells where it will be treated via the existing treatment system that is in place, and the remainder of the plume will begin to slowly move

toward Catskill Creek where it will eventually discharge and dilute to low concentrations. Monitoring the migration and/or degradation of the plume is accomplished with the long term monitoring (LTM) program.

2.0 EVALUATION OF REMEDY PERFORMANCE, EFFECTIVENESS AND PROTECTIVENESS

The SM Plan (SMP) for the AT Site includes an institutional controls/engineering controls (ICs/ECs) Plan, Operation and Maintenance (O&M) Plan, LTM Plan, and associated reporting (MACTEC, 2016). SM requirements are summarized in Table 2.1. The contents of Table 2.1 is a combination of the requirements specified in the SMP and those being implemented as part of the RSO Implementation recommendations (MACTEC, 2013a). The SMP is currently being updated to reflect the numerous changes being implemented at the Site.

2.1 INSTITUTIONAL CONTROLS/ENGINEERING CONTROLS

IC/ECs provide added measures of protection for potentially exposed receptors over and above natural attenuation mechanisms and source area remedial measures. ECs off-site consist of restrictions directing potentially affected residential groundwater supplies through GAC units. These ECs are monitored through the collection and analysis of samples following water supply treatment through the GAC units for three individual residential supply wells. On-site, institutional controls consist of a restriction on excavation, groundwater use and well installation, and engineered controls consist of the GWETS and site perimeter fence. Some off-site groundwater is also captured by the GWETS to confine the plume extent and migration and recover contaminant mass.

The RSO Implementation field activities in 2012 identified surface and subsurface soil PCE contamination at the Site that exceeds the ROD cleanup goal of 1 milligram per kilogram. Surface soil contamination was identified immediately adjacent to the former manufacturing building (MACTEC, 2013a). The SMP includes a soil excavation plan controlling exposure to contaminants during excavation of soil, thereby establishing an IC for soil at American Thermostat (MACTEC, 2016).

The former manufacturing building is now being used to store vintage cars slated for restoration. The building owner is not permitted to excavate soil on the property without permission of the NYSDEC. If the owner uses the building for other than storage (current use), vapor mitigation will be necessary to address exposure to SVI.

2.1.1 Site Controls and Evaluation

Requirements for the Site controls are presented on Table 2.1. Effectiveness of the groundwater remedial measures is directly related to monitoring and maintenance of the groundwater residential well GAC units, and maintenance and monitoring of treatment processes related to the GWETS. Progress of the groundwater remediation is tracked through the LTM program (Table 2.2), interpretation of plume extent, and evaluation of trends in concentration over time. Observations regarding each of these components are discussed in the following subsections.

2.1.2 GWETS

Operating parameters for the GWETS include monitoring volume treated (gallons), flow rate and flow per reporting period (approximately monthly) and total volatile organic compounds (VOCs) extracted from groundwater. These quantities are summarized on Tables 2.3 and 2.4. During the reporting period, the treatment plant processed approximately 13.2 million gallons of groundwater at an average flow rate of approximately 27 gallons per minute (gpm), and removed approximately 200 pounds of total VOCs. A summary of GWETS performance monitoring results for 2016 are provided in the tables and charts located in Appendix A.

In 2016, modifications to the extraction system continued (BOD Memorandum MACTEC, 2013b). Improvements implemented during 2016 include:

- Control panel improvements at each extraction well, including:
    - Human machine interface (HMI) panel programming to provide process data logging and HMI screens for operator use
    - Programmable logic controller (PLC) programming to provide advanced operations of extraction well pumps to support RAOs
    - Improved labelling for more efficient operations and maintenance activities.
- Control panel improvements at the main control panel, including:
    - HMI panel programming to provide process data logging and HMI screens for operator use
    - PLC programming to provide advanced operations of extraction well pumps to support RAOs
    - Connection of fiber optic communications between eleven of twelve operational

extraction wells (except EW-9) including monitoring capabilities from the treatment building.

- Improved labelling for more efficient operations and maintenance activities.

2.1.3 Residential GAC Treatment Systems

While municipal water is supplied through the town distribution system to many houses in the area, three households located within the plume are equipped with wellhead protection via small ultraviolet and GAC treatment trains. Sampling and reporting are conducted on a quarterly basis.

2.2 OPERATION & MAINTENANCE PLAN

The remedial measures in place require routine inspection, sampling, and maintenance to provide effective remediation and reduction of exposure to site-related contaminants. O&M procedures and requirements are presented in the SMP (MACTEC, 2016). The O&M Plan is being revised as part of the SMP to incorporate the numerous changes implemented at the Site over the last four years. The following subsections describe requirements and compliance with the O&M Plan with respect to the GWETS, and individual residential GAC units.

2.2.1 GWETS

Monthly progress reports are generated to summarize GWETS system operation and to present operational and maintenance data to the NYSDEC (MACTEC, 2016a-k; MACTEC, 2017).

A total of 12 extraction wells are active and include 5 bedrock wells (EWs) and 7 overburden wells (OWs):

- EW-2, EW-6, EW-7, EW-9, EW-16
- OW-2, OW-3, OW-5, OW-7, OW-13, OW-14, OW-16

During this reporting period, approximately 590 hours were reported as downtime. The GWETS was shut down on several occasions in 2016 due to system alarms. Down time represented approximately 7 percent of total available operating time.

During this reporting period, approximately 13.2 million gallons of extracted groundwater were processed with an average flow rate of approximately 27 gpm, and approximately 200 pounds of total VOCs were removed (Tables 2.3 and 2.4). The influent and effluent VOC samples are collected and analyzed monthly, so mass removal is an approximation.

Downtime for the GWETS was reduced between 2015 and 2016 (16% and 7%, respectively). As a result, the total amount of water pumped over the current reporting period was greater than the reporting periods of 2013, 2014, and 2015. In 2016, the system pumped approximately 91% of the total water pumped in 2012, which was the first reporting period after the initial implementation of improvements laid out by the RSO Implementation Activities Report (MACTEC, 2013b).

As of 2013, the NYSDEC started using the Ambient Water Quality (AWQ) Standards and Guidance (NYSDEC, 1998) for comparison to the treated groundwater being discharged to the swale. These limitations are applicable at the point of discharge at the end of the force main which leads to the unnamed Tributary A (a Class C surface water body). Air discharge limits for the Site are based on meeting the requirements in the NYSDEC Division of Air Resources DAR-1 Annual Guideline Concentrations (AGC)/ Short-Term Guideline Concentrations (SGC) guidance tables which require ground-level ambient air concentrations at the property boundary and beyond to not exceed AGC and SGC.

Performance monitoring results are summarized in Table 2.5. As shown, effluent iron concentrations were observed to exceed the AWQ criterion for two months during 2016; however, air discharge criteria were met and all influent VOCs were removed by the air stripper in 2016. Treated groundwater effluent is discharged to a drainage swale which ultimately leads to Catskill Creek. With the exception of two detections of iron above AWQ criteria, the treated effluent met surface discharge limits during the reporting period.

2.2.2 Residential GAC Treatment Systems

Maintenance and monitoring of the three residential wellhead protection systems (Klinke, Kubler, and Viella) is performed on a quarterly basis. Results are summarized in Table 2.6. As shown, cis-1,2-dichloroethene was detected as an estimated value above the reporting limit (but below the NYS Class GA groundwater standard) at the Klinke residential system during one quarterly sampling event

in October 2016. As a result, a carbon filter change out for the Klinke residential system occurred during the reporting period.

2.3 LONG TERM MONITORING

The LTM program includes collecting samples and recording water level measurements (depth to groundwater) at selected extraction wells and monitoring wells for plume delineation and bedrock potentiometric surface maps (see Figure 2.1 and 2.2).

On December 8, 2016, water levels were measured in 23 monitoring wells, 5 bedrock extraction wells and 7 overburden extraction wells (Table 2.7). During the water level measurements, the transducers, which have been installed in each of the extraction wells, were calibrated with respect to well-specific surveyed measuring points. The height of water above the transducer was recorded from the PLC at each extraction well by connecting to a laptop computer at the well head. At the same time, the depth to water was measured using a stilling tube and an electronic water level meter to ensure an accurate measurement. The PLC reference point value (a constant) was established by taking the manually measured water level and subtracting the PLC reading (i.e., height of water above the transducer). The PLC reference point is then added to subsequent PLC readings and the resulting value is the elevation of the water level in the well. Calibrating the transducers permits monitoring of water levels and elevations in the extraction wells without the need of manual measurements. In 2017, programming will be completed so that depth to water and/or elevation of groundwater in the pumping wells will be displayed on the control panel within the treatment plant. The PLC measurements and calculation backup for transducer calibration is provided in Appendix B.

Figure 2.2 shows the bedrock potentiometric surface when the five bedrock extraction wells are pumping. The equipotential lines indicate that groundwater flow in proximity to the site is toward the site; groundwater is no longer flowing to the west from the site. An anomalous groundwater high exists in the vicinity of IW-10. The groundwater elevation at IW-10 is approximately 77 feet higher than in IW-8, which is located approximately 200 feet to the southeast. Based on a recent Google Earth image, the pond in Tributary B just west of IW-10 is approximately 223 feet in elevation. It is

possible that the pond may be hydraulically connected to IW-10 and as a result is affecting/controlling groundwater levels in the well.

Since 2014, the groundwater sampling events for the site are schedule on a 15-month basis. The last LTM sampling event was conducted in March 2016. During that event, 28 wells were sampled, including 5 bedrock and 7 overburden extraction wells (Table 2.8). Laboratory results are provided in Appendix C.

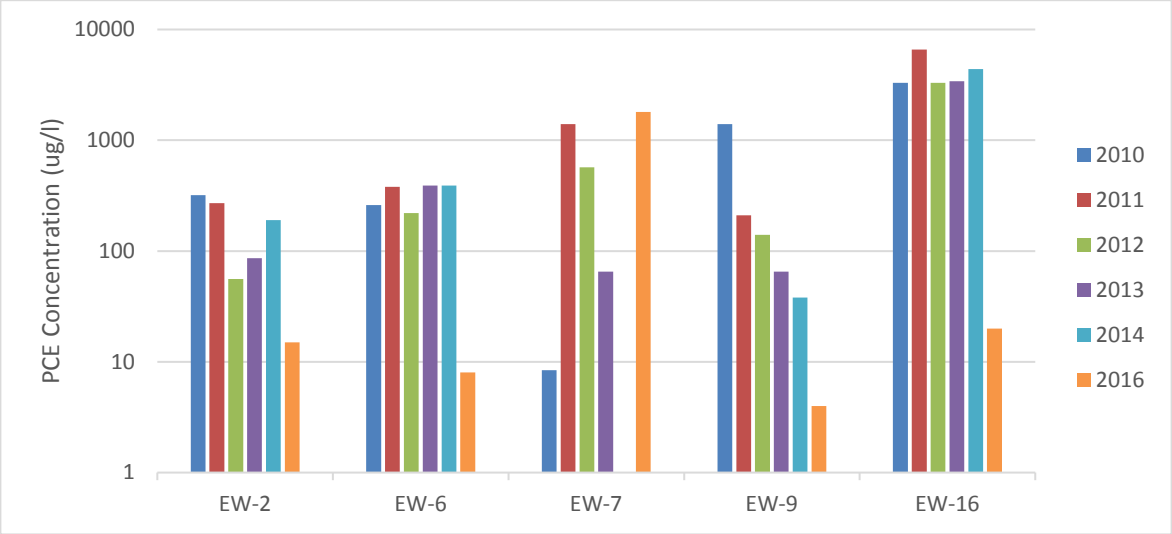
Table 2.8 summarizes LTM results observed at concentrations exceeding Class GA groundwater standards. The principal compounds detected during 2016 are PCE, trichloroethene (TCE), cis-1,2-DCE and vinyl chloride. The highest concentration of PCE in bedrock was detected in EW-7 (3,700 µg/l) along with TCE at 1,800 µg/l. This is a change from 2014 when EW-16 had the highest concentrations of PCE and TCE detected at 1,400 and 2,000 µg/l, respectively. In overburden during the March 2016 sampling round, OW-3 contained the highest concentration of PCE (11,000 µg/l) in contrast to 2014 when OW-14 contained the highest concentration of PCE (9,300 µg/l). The PCE concentration in OW-14 has dropped to 150 µg/l as indicated by the latest round of sampling. Laboratory results for all collected samples were provided to NYSDEC in electronic document delivery format for loading into EQuIS.

The distribution of PCE in bedrock groundwater is shown on Figure 2.3. PCE was not detected at location CE-1 in the March round of sampling; however, a low concentration of PCE (1.7 µg/L) was detected in CE-2. Previous sampling in 2014 showed that CE-1 had PCE at a concentration of 2.5 µg/L and CE-2 was non-detect. The current detection of PCE in CE-2 suggests that the residual plume in that area is migrating, perhaps enhanced by pumping at CE-2.

The plume seems to be changing shape and shifting toward Catskill Creek, likely as a result of the discontinuance of offsite extraction wells. The leading edge of the bedrock groundwater plume, as evidenced by PCE detected at EW-13, is interpreted to be beyond the influence of the on-site extraction system and will continue to migrate towards Catskill Creek.

The core of the plume, previously centered around EW-16, appears to have shifted northeastward to EW-7 (see Figure 2.3). The histogram plot below shows PCE concentrations over time in the bedrock extraction wells. As shown, a decrease in PCE concentrations is observed in all wells except

EW-7, which shows an increase compared to previous years. Note - samples were not collected in 2015 due to a prolonged system shut down during remedial system optimization activities.



The April 2016 sampling event was the first event with extraction wells being equipped with variable frequency drive pumps (i.e., grab samples) and piping, installed as part of the system upgrade of the extraction wells.

Comparing 2016 results to historical results indicates the concentration of PCE via grab sample from well IW-9 has decreased from 1300 µg/L in 2013 to 240 µg/L in 2016. The re-configured extraction well arrangement appears to have resulted in pulling back the plume (i.e., to the southeast) from its previous high offsite concentration location at IW-9. The change in concentrations observed in 2016 will continue to be evaluated during the next 15-month sampling event.

Time series plots of PCE in select wells were constructed to evaluate the long-term effectiveness of the modified extraction well network (Appendix C). Overburden extraction well OW-14 and bedrock extraction well EW-16 were selected to monitor the on-site changes in groundwater quality at these two wells, both have shown consistently high concentrations of PCE over their sampling

history. As shown on the plots, the general trend over the past three years has been a decline in concentration (see Appendix C).

Monitoring well M-5 was selected as a measure of the northeastward (offsite) progression of the plume that, as shown in Figure 2.3, appears to be migrating more northward since the offsite extraction wells located northwest of the site were shut down. Although PCE concentration in groundwater at location M-5 during March 2016 was not detected, cis-1, 2-DCE was observed demonstrating degradation of PCE. Country Estates primary supply well, CE-2, is used to track in time-series the distal end (i.e., northwest tip) of the residual plume as the offsite body of the plume continues to flow toward the northeast and eventual discharge in Catskill Creek. March 2016 sampling shows a decrease in PCE concentration in CE-1 and an increase in concentration in CE-2 (still below the NYS standard of 5 µg/L for PCE), suggesting that the plume is influenced by pumping of Country Estates primary supply well. It should be noted that 1,2-DCE was detected at 5.9 µg/L, just above the NYS standard of 5 µg/L in CE-1.

3.0 COST CONTROL SUMMARY

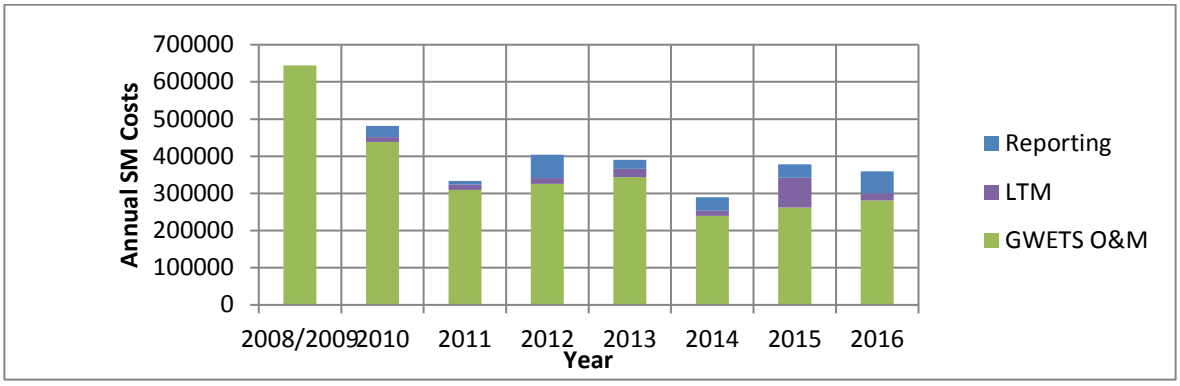
A cost summary for the reporting period is provided below by task. As shown, the majority of SM costs for the reporting period were incurred for operation and maintenance of the GWETS.

Task 1 (Scoping)	
Labor	$6,827
Task 2 (GWETS OM&M)[a]	
Labor	$134,024
Lodging, Travel, and MI&E	$8,890
Shipping	$155
Waste Disposal	$1,865
Phone/Internet	$1,569
Plowing	$3,060
Supplies & Equipment	$2,548
Electricity*	$13,124
Propane*	$5,312
Water*	$274
Laboratory Services*	$5,205
	$176,026
Task 3 (LTM)	
Labor	$17,228
Lodging, Travel, and MI&E	$698
Shipping	$41
Supplies & Equipment	$892
	$18,859
Task 4 (Reporting, incl PRR)	
Labor	$26,824
Shipping	$45
	$26,869
Task 5 (SMP updates)	
Labor	$32,710
Task 6 (GWETS Modifications)	
Labor	$37,523
Lodging, Travel, and MI&E	$1,575
	$39,098

Task 7 (GWETS Commissioning)	
Labor	$51,991
Lodging, Travel, and MI&E	$4,937
Supplies & Equipment	$8
	$56,936
Annual Total:	**357,325**

NOTES:
[a] includes residential GAC system Operation, Maintenance & Monitoring (OM&M)
*NYSDEC direct expense

Since the NYSDEC has assumed responsibility for the Site, annual OM&M costs have decreased by an average of 42percent. Optimization measures to reduce the overall operating expenses have been and will continue to be implemented in an effort to provide further cost savings at the Site.



Notes:
GWETS O&M includes Country Estates and residential GAC system O&M, as applicable.

2008/2009: Costs as of 10/1/2008

2010: Reporting includes preparation of 2008/2009 PRR.

2012: O&M includes preparation of detailed design drawings for GWTS improvements; Reporting includes preparation of SMP and 2001/2011 PRR.

2013: O&M does not include preparation of detailed design drawings for GWTS improvements or implementation of RSO improvements. LTM includes conducting hydraulic effectiveness monitoring and EW-9 step test.

2014: Reporting includes 2014 PRR and drafting SMP update. O&M does not include GWETS Modifications.

2015: GWETS O&M includes oversight and coordination of GWETS upgrades/modifications; LTM reflects quarterly residential GAC system OM&M, extraction well decommissioning, EW-5 over drilling/MW conversion, & EW-5 investigation derived waste disposal.

2016: GWETS O&M included modifications, GWETS commissioning, & scoping amendment; Reporting includes PRR and SMP updates.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The Remedial Action Objective (RAO) was redefined in 2012 to focus on hydraulic containment of the source area. During the 2016 reporting period progress continued to be made toward the implementation of the RSO improvements/upgrades. Completion of the site improvements, anticipated in early 2017, will result in an achievable goal that is protective and cost-effective. The following recommendations reflect the redefined RAO.

4.1 INSTITUTIONAL CONTROLS/ENGINEERING CONTROLS

The current ICs/ECs are adequate to achieve the objectives for protection of human health and the environment based on current Site use. A soil vapor exposure pathway exists at the former manufacturing building; however, the building is currently used only for storage purposes. Therefore, mitigation would be necessary to address exposure to SVI should the building be occupied.

Effluent concentrations of site-related VOCs did not exceed the surface water or DAR-1 discharge criteria in 2016. Monthly influent and effluent water concentrations could be used to calculate the air discharge concentrations if needed; therefore, the collection of monthly air discharge samples is no longer needed.

GAC systems on three residential wells continue to provide adequate protection from site-related contaminants of concern.

4.2 O&M PLAN

The O&M Plan (a component of the SMP) will be updated in 2017 to reflect the changes made to the GWETS. As a result of the system modification, once fully implemented a reduction in OM&M operator level of effort and supplies will result in 2017.

4.3 GROUNDWATER MONITORING PROGRAM

LTM sampling was completed in March 2016. The next LTM sampling event will be conducted in June 2017. Changes in concentration resulting from the extraction well array modifications have been observed and are consistent with the objective of establishing hydraulic capture of contaminated bedrock groundwater in close proximity to the Site. The changes in groundwater concentrations will continue to be monitored during the 15-month sampling events. The apparent groundwater mound in proximity of IW-10 will continue to be monitored and evaluated to assess whether the mound is well-specific or affecting the general area proximate to IW-10. Lastly, now that the extraction well transducers have been calibrated with respect to an existing elevation benchmark, the flow rate of the extraction system should be optimized to maximize capture of onsite bedrock contamination.

4.4 PHASE II AND III UPGRADE ACTIVITIES

Work continued on Phase II and Phase III upgrade activities on the GWETS throughout 2016. Treatment building control panel modifications, wellfield fiber optic communications and well control panel upgrades continued to be worked on throughout 2016 and are anticipated for completion in 2017. Upon completion of the control panel and user interface modifications, it is expected that operations and maintenance staffing will be reduced to approximately 8 hours per week of routine on-site labor with 4 hours per week of off-site remote monitoring labor.

4.5 SMP

The SMP will be modified in 2017 to reflect the various changes and revisions implemented at the Site during 2013, 2014, 2015, and 2016.

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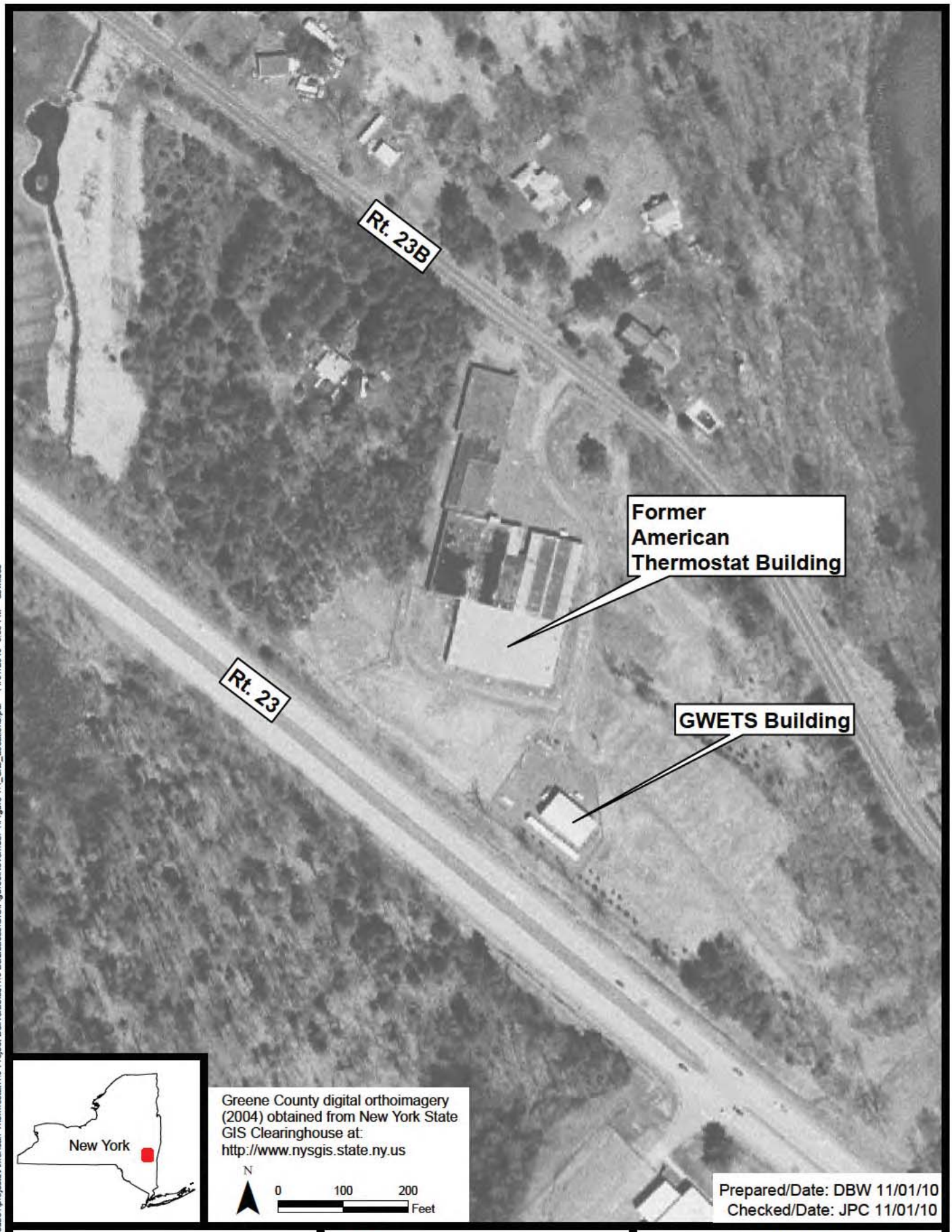
FIGURES



PERIODIC REVIEW REPORT
AMERICAN THERMOSTAT
SOUTH CAIRO, NEW YORK

MACTEC

Site Location
PROJECT 3612112204
FIGURE 1.1

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KLINKE
KUBLER
VIELLA
R-1
CE-2
CE-1
EW-14
SPEENBURGH
M-6
M-5
EW-13
R-6
IW-14
R-18
EW-15
EW-12
M-14
IW-12
EW-10
M-12
R-11
M-7
R-12
M-10
IW-11
WB-1A
MUELLER
EW-8
IW-10
IW-8
IW-9
EW-9
I-30
M-8
EW-16
EW-6
MW-02
M-4
EW-11
R-19
M-3
EW-3
IW-1
IW-6

EW-7
IW-5
EW-4
OW-2
IW-3
OW-3
EW-2
OW-7
OW-5
IW-4
IW-2
OW-13
EW-5
OW-14
OW-16

Inset Scale:
0 75 150
Feet

Legend

- Monitoring Well
- Residential Well with Point of Entry Treament System
- Overburden Extraction Well
- Bedrock Extraction Well
- Decommissioned Well

N
0 200 400
Feet

Greene County digital orthoimagery (2009) obtained from New York State GIS Clearinghouse at: http://www.nysgis.state.ny.us

Prepared/Date: BRP 04/02/14
Checked/Date: RHA 04/02/14

PERIODIC REVIEW REPORT (2016)
AMERICAN THERMOSTAT SITE 420006
SOUTH CAIRO, NEW YORK

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GROUNDWATER WELL LOCATIONS

Project 3612-11-2204 Figure 2.1

Document: P:\Projects
ysdec1\Contract D007619\Projects\American Thermostat - SM\4.0_Deliverables\4.5_Databases\GIS\MapDocuments\Periodic Review Report\PRR_GW_Dec2016_11x17LS.mxd PDF: M:\Projects\American_thermo\Fig_2_2_ Bedrock_GW_PRR.pdf 1/31/2017 8:06 AM ian.desjarlais

EW-15
223.02

EW-11
163.03

EW-12
164.76

EW-10
217.51

IW-10
227.88

IW-8
149.52

IW-9
143.78

EW-9
145.21

EW-7
66.64

M-8
249.71

EW-16
105.16

IW-5

EW-4
142.88

IW-3

EW-2
148.29

EW-6
151.94

EW-3
143.30

IW-4

IW-2

EW-5
255.55

IW-1

IW-6

EW-1

M-9
165.29

180

160

140

120

100

225

200

Tributary B

Tributary A

Catskill Creek

Legend

- Bedrock Well
- Active Extraction Well
- Interpreted Bedrock Groundwater Contour, feet above mean sea level

DTW measurements collected December 8, 2016.
Inferred groundwater gradient.

N

0 115 230 Feet

Greene County digital orthoimagery (2013) obtained from New York State GIS Clearinghouse at: http://www.nysgis.state.ny.us

Prepared/Date: ICD 01/31/17
Checked/Date: RHA 01/31/17

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DECEMBER 2016 INTERPRETED BEDROCK POTENTIOMETRIC SURFACE (PUMPING)
Project 3612112204 Figure 2.2

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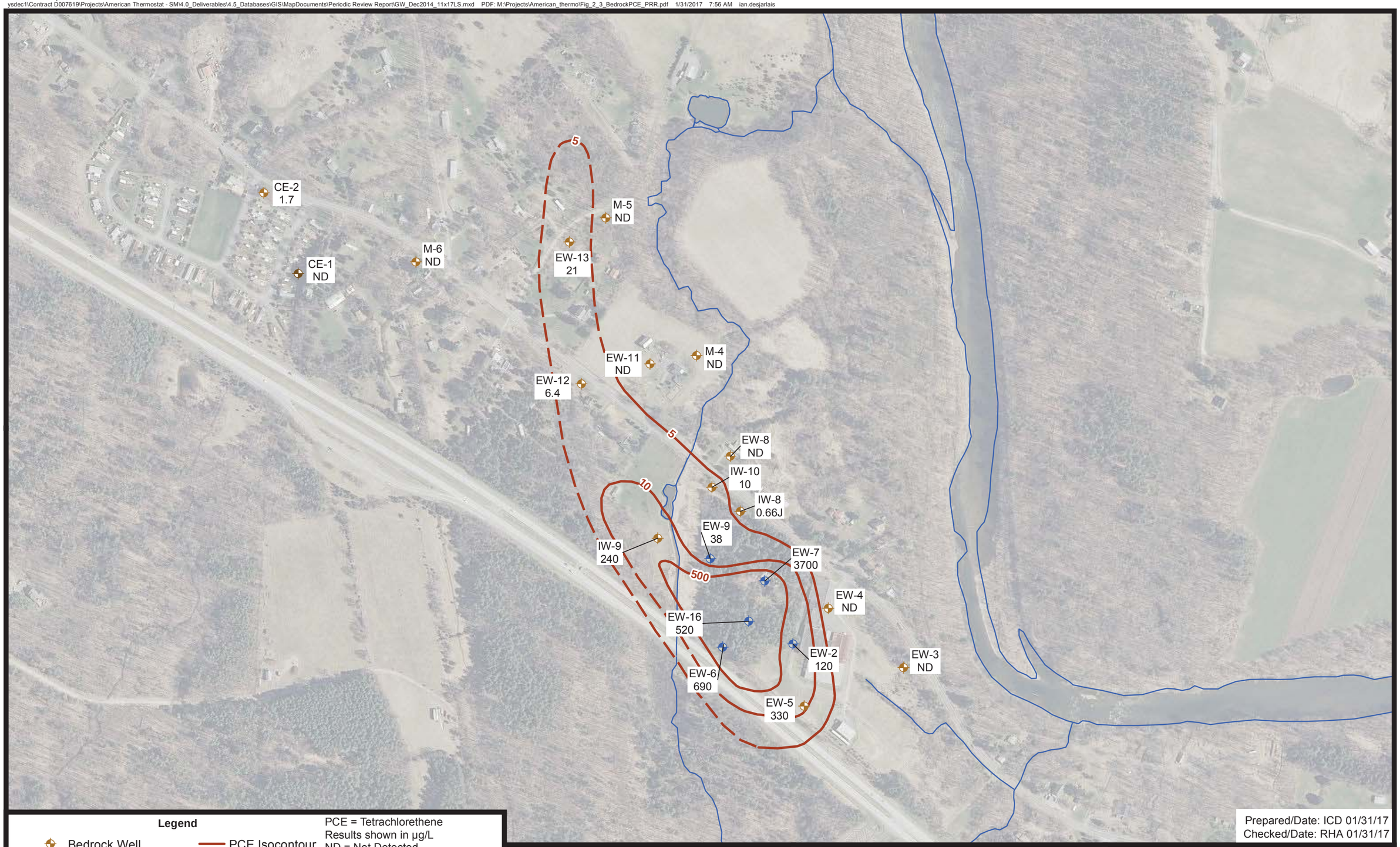

Legend

- Bedrock Well
- Active Extraction Well
- PCE Isocontour

PCE = Tetrachlorethene
Results shown in µg/L
ND = Not Detected
NS = Not Sampled

N

0 200 400 Feet

Greene County digital orthoimagery (2009) obtained from New York State GIS Clearinghouse at: http://www.nysgis.state.ny.us

Prepared/Date: ICD 01/31/17
Checked/Date: RHA 01/31/17

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AMERICAN THERMOSTAT SITE 420006
SOUTH CAIRO, NEW YORK

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BEDROCK GROUNDWATER PCE PLUME
APRIL 2016
Project 3612112204 Figure 2.3

TABLES

Table 2.1: Site Management Requirements

Component	Action	Required Frequency	Comments/Recommendations
Groundwater Extraction and Treatment System			
GWETS Operation - Checklist	Inspection	Each O&M Visit	Check water treatment operation: flow rates, chemical usage, meter readings, system components.
Extraction wells	Inspection	Weekly	Check extraction wells, housing, control panels.
Control panel, heaters, septic holding tank	Inspection	Weekly	Check function of control panel indicating lights. Check level of septic holding tank. In cold weather verify pilot light operation of heaters.
Safety equipment, plant lighting	Inspection	Monthly	Inspect safety equipment (ladders, eyewash, fire extinguishers, etc.). Inspect plant lighting for proper operation.
Site Security	Inspection	Monthly	Check treatment building door locks, fencing, and site perimeter fence for defects.
Air stripper	Inspection	Annually	Perform cleaning of air stripper unit trays and sump.
Plant heaters	Inspection	Annually	Have subcontractor perform maintenance on treatment plant heaters.
Ground Water Monitoring System	Inspection	15 Months	Inspect well pads/locks at site wells; repair as necessary to maintain integrity and security.
System Performance Monitoring (see Table 2.2)			
Influent Tank	Influent water sampling	Monthly	Grab sample collected to evaluate and monitor GWETS system performance.
Air stripper effluent water	Air stripper effluent water sampling	Monthly	Grab sample collected to evaluate and monitor GWETS system performance.
Point of Entry Treatment System			
POET System	Residential water supply sampling and inspection	Quarterly	Grab sample collected between carbon filters to evaluate and monitor water supply. Perform system maintenance on carbon filters, UV system as needed, annual at a minimum.
Environmental Monitoring (see Table 2.2)			
Groundwater Monitoring Program	groundwater sampling of 31 wells	15-month sampling interval	Grab samples collected from 31 locations; including 2 public supply wells, monitoring wells, former and active bedrock and overburden extraction wells, former injection wells, and residential water supply wells before filters.

Table 2.2: Long Term Monitoring and System Performance Sampling

Sampling Location	Semiannual Water Level	15 Month Sampling Site-related VOCs 8260	Sample Description	Well Depth (ft)	Sample Depth (ft)	Reference Point
Monitoring Wells						
M-4	X	X	PDB	200	130	TOC
M-5	X	X	PDB	200	129	TOC
M-6	X	X	grab	100	unknown	TOC
M-8	X	NS	gw elevation	200	N/A	TOR
M-9	X	NS	gw elevation	200	N/A	TOR
MW-104	X	NS	gw elevation	81.6	N/A	TOFM
MW-108	X	NS	gw elevation	86.1	N/A	TOFM
MW-109	X	NS	gw elevation	87.5	N/A	TOFM
MW-112	X	NS	gw elevation	25.1	N/A	TOFM
MW-113	X	NS	gw elevation	25	N/A	TOFM
Mueller	X	X	PDB	114	69	TOC
CE-1	N/A	X	Before filters	535	unknown	TOC
CE-2	N/A	X	Before filters	287	unknown	TOC
EW-3	X	X	PDB	295	275	TOV
EW-4	X	X	PDB	322	302	TOV
EW-5	X	X	PDB	235.2	216	TOC
EW-8	X	X	PDB	318	200	TOC
EW-10	X	NS	gw elevation	225	N/A	TOFM
EW-11	X	X	PDB	172.2	117	TOFM
EW-12	X	X	PDB	270.5	115	TOV
EW-13	X	X	PDB	360	200	TOFM
EW-14	X	NS	gw elevation	185	N/A	TOV
EW-15	X	NS	gw elevation	275	N/A	TOV
IW-8	X	X	PDB	391.8	339	TOV
IW-9	X	X	PDB	358.1	333	TOFM
IW-10	X	X	PDB	176.3	40	TOV
Active Bedrock Extraction Wells						
EW-2	X	X	grab	322	pump intake	TOC
EW-6	X	X	grab	325	pump intake	TOC
EW-7	X	X	grab	227	pump intake	TOC
EW-9	X	X	grab	365	pump intake	TOC
EW-16	X	X	grab	417	pump intake	TOC
Active Overburden Extraction Wells						
OW-2	X	X	grab	30	pump intake	TOC
OW-3	X	X	grab	25	pump intake	TOC
OW-5	X	X	grab	30	pump intake	TOC
OW-7	X	X	grab	25	pump intake	TOC
OW-13	X	X	grab	29.5	pump intake	TOC
OW-14	X	X	grab	30	pump intake	TOC
OW-16	X	X	grab	30	pump intake	TOC
Residential Wells						
VIELLA	N/A	X	Before filters	300		TOC
KUBLER	N/A	X	Before filters	300		TOC
KLINKE	N/A	X	Before filters	240		TOC

System Performance Monitoring				VOCs	Metals	TDS
VIELLA	N/A	X (before filter)	Between filters	Quarterly	-	-
KUBLER	N/A	X (before filter)	Between filters	Quarterly	-	-
KLINKE	N/A	X (before filter)	Between filters	Quarterly	-	-
PS-INFLUENT	N/A	N/A	Influent	Monthly	Monthly	Monthly
PS-AS-EFFLUENT	N/A	N/A	Air stripper effluent water	Monthly	-	-

X = analysis or measurement scheduled

CE-1 = Country Estates Well #1 TOC = Top of Casing TOFM= Top of Flush Mount

CE-2 = Country Estates Well #2 TOV = Top of Vault NS = Not Sampled

VOCs = volatile organic compounds analyzed using EPA method 8260 N/A = Not Applicable

Metals = Metals analyzed using EPA method 6010

TDS = total dissolved solids

Note: For system performance monitoring, air stripper effluent air samples will be collected if results from the previous month's influent water sample exceed maximum allowable liquid concentrations.

Table 2.3: Treatment Plant Monthly Throughput

Month	Calendar Year (Gallons)									
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
January	-	2,327,342	2,188,662	3,154,385	2,643,561	3,112,140	1,452,060	1,969,101	1,850,648	1,860,431
February	-	1,946,464	1,828,969	3,202,253	2,400,906	2,640,103	1,323,679	1,627,579	1,724,943	1,484,866
March	-	1,570,828	2,782,069	3,397,280	2,581,039	3,032,627	1,433,444	1,505,083	1,726,705	1,797,869
April	-	1,986,297	2,625,243	3,325,592	3,015,136	2,956,081	1,621,998	1,888,648	1,860,726	1,651,491
May	-	1,876,550	2,689,205	3,507,403	2,827,722	2,279,599	1,511,813	1,679,210	2,038,414	1,595,631
June	-	1,810,328	2,515,671	3,241,052	3,087,176	2,817,292	1,378,343	1,635,094	2,225,379	1,567,880
July	-	1,880,672	2,845,066	2,846,350	3,109,504	2,828,580	1,829,427	1,679,658	1,700,523	1,656,624
August	1,845,307	2,865,086	2,656,221	3,323,930	2,969,001	2,862,294	2,488,132	1,675,021	1,505,840	1,680,981
September	2,326,580	2,849,292	2,790,754	3,116,812	2,826,453	2,805,159	2,214,838	1,668,387	1,573,918	1,559,100
October	2,000,099	2,967,620	3,191,008	3,172,179	3,126,848	2,889,540	2,016,922	1,048,462	2,365,602	1,624,903
November	1,387,734	2,840,040	2,906,470	2,668,748	3,151,070	2,703,444	2,147,628	1,753,165	2,542,691	1,628,116
December	1,515,814	2,996,042	3,089,535	2,676,774	3,043,354	1,743,574	2,218,612	1,804,582	1,570,319	1,779,807
Total for Calendar Year	9,075,534	27,916,561	32,108,873	37,632,758	34,781,770	32,670,433	21,636,896	19,933,990	22,685,708	19,887,699
Cumulative Total Throughput	9,075,534	36,992,095	69,100,968	106,733,726	141,515,496	174,185,929	195,822,825	215,756,815	238,442,523	258,330,222

Month	Calendar Year (Gallons)								
	2008	2009	2010	2011	2012	2013	2014	2015	2016
January	1,621,909	2,009,299	1,715,140	1,660,400	1,617,600	1,287,600	605,868	1,055,444	1,028,212
February	1,661,136	1,973,492	1,562,130	1,608,200	1,592,100	1,165,900	537,554	726,839	1,142,661
March	1,872,515	2,109,251	2,144,107	1,677,100	1,545,800	1,213,400	828,412	818,456	1,197,620
April	1,922,613	2,164,940	1,972,606	1,807,700	976,300	1,213,400	1,311,895	829,691	1,176,265
May	1,496,402	2,086,536	1,692,254	1,869,800	1,050,200	1,024,000	1,181,124	918,585	1,105,646
June	1,519,804	2,069,749	1,657,835	1,617,700	655,200	560,000	1,036,409	1,174,145	1,027,389
July	1,344,964	2,413,904	1,710,898	1,626,100	435,000	-	1,101,365	1,364,309	1,159,271
August	2,366,862	1,461,639	1,814,591	1,676,400	1,572,000	368,300	968,790	1,069,571	1,156,925
September	2,053,268	1,572,872	1,502,900	1,764,200	1,098,900	282,600	516,422	1,424,510	1,179,487
October	2,649,688	1,962,537	1,736,300	1,646,400	1,363,800	1,133,000	771,419	890,175	1,145,887
November	2,172,569	1,782,527	1,505,900	1,806,000	1,223,500	1,240,188	643,451	-	936,208
December	2,466,153	2,171,560	1,799,400	1,966,500	1,351,200	950,031	804,076	251,416	953,286
Total for Calendar Year	23,147,883	23,778,306	20,814,061	20,726,500	14,481,600	10,438,419	10,306,785	10,523,141	13,208,857
Cumulative Total Throughput	281,478,105	305,256,411	326,070,472	346,796,972	361,278,572	371,716,991	382,023,776	392,546,917	405,755,774

Note:
Plant modifications resulted in plant shut down during the months of July 2013 and November 2015.

Table 2.4: Total VOCs in Extracted Groundwater (lbs)

Month	Calendar Year									
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
January	-	26.5	57.5	42.7	28.1	38.2	29.7	39.4	33.8	32.3
February	-	49.3	47.2	42.6	26.0	37.3	31.3	33.0	28.5	19.8
March	-	43.7	62.3	50.5	28.3	43.8	39.2	20.5	27.2	28.8
April	-	39.2	58.7	44.1	43.4	44.8	42.0	21.8	29.0	34.4
May	-	26.7	43.7	54.4	42.5	34.1	34.6	29.6	40.2	19.8
June	-	31.0	50.0	45.5	44.8	45.5	32.6	23.6	44.1	18.7
July	-	23.9	40.8	34.7	40.5	32.7	32.1	24.3	13.1	20.2
August	104.7	47.3	41.5	41.2	38.5	42.0	31.6	14.3	14.1	16.4
September	24.5	39.0	33.9	29.5	37.3	51.9	26.9	17.5	24.4	15.8
October	42.4	63.2	34.6	71.5	36.9	49.3	36.0	15.2	40.1	15.8
November	26.6	58.1	42.7	23.9	42.3	35.1	26.8	31.8	40.4	20.2
December	35.0	66.9	49.9	27.9	42.8	34.4	34.3	31.3	23.1	21.9
Total for Calendar Year (lbs)	233	515	563	509	451	489	397	302	358	264
Cumulative Total VOCs (lbs)	233	748	1,311	1,820	2,271	2,760	3,157	3,460	3,818	4,082

Month	Calendar Year								
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
January	23.9	23.0	19.0	18.2	18.5	21.8	7.5	14.1	24.0
February	24.3	18.5	19.4	15.9	18.6	27.9	11.0	6.4	19.1
March	34.0	20.0	30.6	35.5	18.0	30.2	25.1	6.1	18.0
April	30.6	21.0	23.6	26.3	18.8	18.7	18.1	15.5	32.1
May	22.7	23.8	15.1	25.1	24.0	18.6	26.1	15.5	14.4
June	14.7	19.4	13.9	22.9	5.4	13.1	15.6	16.8	17.6
July	11.8	25.3	12.0	19.5	27.5	-	13.0	16.9	14.1
August	24.7	15.8	9.8	19.8	39.6	20.0	40.3	14.2	9.5
September	21.8	14.8	13.7	25.0	12.8	10.4	7.0	17.4	9.5
October	24.8	16.9	21.8	22.5	29.2	17.1	8.9	10.5	13.4
November	24.1	19.9	18.0	19.8	23.9	18.5	14.0	-	8.6
December	25.3	26.5	30.4	22.5	17.0	14.1	10.7	8.9	16.1
Total for Calendar Year (lbs)	283	245	227	273	253	211	197	142	196
Cumulative Total VOCs (lbs)	4,364	4,609	4,836	5,109	5,363	5,573	5,770	5,912	6,109

Note:
Total VOCs in Extracted Groundwater = GWETS Influent Total VOCs Concentrations per month multiplied by the Monthly Flow Rate and the Monthly System Operating Duration.
Values are in pounds (lbs).
July 2013/November 2015 - system down for plant modifications.

Table 2.5: System Performance Sampling Results

				Parameter	1,2-DCE (total)	PCE	TCE	Vinyl Chloride	Barium	Iron	Total Dissolved Solids
				ACG	1,984,204	31,505	15,748	3,465			
				GA Std	5 ug/l	5 ug/l	5 ug/l	2 ug/l	NS	NS	500 mg/l
				AWQ Criteria	-	1 ug/l	40 ug/l	-		300 ug/l	
Location	**Matrix**	**Date**	**Field Sample ID**	**Units**							mg/L
PS-Influent	L	1/4/2016	PS-INFLUENT	ug/l	**900**	**1,500**	**460**	**7.2**			
PS-Influent	L	2/3/2016	PS-INFLUENT	ug/l	**660**	**1,100**	**400**	**7.4**			
PS-Influent	L	3/16/2016	PS-INFLUENT	ug/l	**620**	**920**	**370**	6.4			
PS-Influent	L	4/11/2016	PS-INFLUENT	ug/l	**920 J**	**1,700 J**	**650 J**	**20 U**			
PS-Influent	L	5/2/2016	PS-INFLUENT	ug/l	**540**	**640**	**360**	20 U			
PS-Influent	L	6/6/2016	PS INFLUENT	ug/l	**510**	**1200**	**340**	20 U			
PS-Influent	L	7/6/2016	PS-INFLUENT	ug/l	**600**	**550**	**310**	20 U			
PS-Influent	L	8/3/2016	PS-INFLUENT	ug/l	**420**	**360**	**200**	**20** U	53.1	151	360
PS-Influent	L	9/7/2016	PS-INFLUENT	ug/l	**570**	**250**	**130**	**20** U	81.3	**343**	382
PS-Influent	L	10/10/2016	PS-INFLUENT	ug/l	**570**	**610**	**220**	**20** U	65.1	77.3	333
PS-Influent	L	11/2/2016	PS-INFLUENT	ug/l	**620**	**360**	**120**	**20** U	56.8	231	357
PS-Influent	L	12/7/2016	PS-INFLUENT	ug/l	**890**	**750**	**370**	20 U	76	**1120**	457
Air Stripper Eff	L	1/4/2016	PS-AS EFFLUENT	ug/l	2 U	1 U	1 U	1 U			
Air Stripper Eff	L	2/3/2016	PS-AS EFFLUENT	ug/l	2 U	**1** U	1 U	1 U			
Air Stripper Eff	L	3/16/2016	PS-AS EFFLUENT	ug/l	2 U	1 U	1 U	1 U			
Air Stripper Eff	L	4/11/2016	PS-AS EFFLUENT	ug/l	2 U	1 U	1 U	1 U			
Air Stripper Eff	L	5/2/2016	PS-AS EFFLUENT	ug/l	2 U	1 U	1 U	1 U			
Air Stripper Eff	L	6/6/2016	PS-AS-EFFLUENT	ug/l	2 U	1 U	1 U	1 U			
Air Stripper Eff	L	7/6/2016	PS-AS-EFFLUENT	ug/l	2 U	1 U	1 U	1 U			
Air Stripper Eff	L	8/3/2016	PS-AS-EFFLUENT	ug/l	2 U	1 U	1 U	1 U	54.7	94.8	360
Air Stripper Eff	L	9/7/2016	PS-AS-EFFLUENT	ug/l	2 U	1 U	1 U	1 U	74.9	231	364
Air Stripper Eff	L	10/10/2016	PS-AS-EFFLUENT	ug/l	2 U	1 U	1 U	1 U	67	114	353
Air Stripper Eff	L	11/2/2016	PS-AS EFFLUENT	ug/l	2 U	1 U	1 U	1 U	64.5	**304**	364
Air Stripper Eff	L	12/7/2016	PS-AS-EFFLUENT	ug/l	2 U	1 U	1 U	1 U	83	**389**	406
Air Stripper Eff[1]	G	1/4/2016	PS-AS DISCHARGE	ug/m3	5,900	9,700	3,000	55			

Notes:
ug/l = Micrograms per liter
mg/l = Milligrams per liter
FS = Field Sample
FD = Field Duplicate
1 = Air Stripper Effluent sampling was discontinued after January 2016

Table 2.6: Residential Treatment System Sampling Results

Location	Sample Date	Description	1,2-Dichloroethene (total)	Cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Tetrachloroethene	Trichloroethene	Vinyl chloride
Parameter								
Units			ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GA			5	5	5	5	5	2
KLINKE	1/13/2016	Between Filters	2 U	1 U	1 U	1 U	1 U	1 U
KLINKE	4/1/2016	Between Filters	2 U	1 U	1 U	1 U	1 U	1 U
KLINKE	7/6/2016	Between Filters	2 U	1 U	1 U	1 U	1 U	1 U
KLINKE	10/10/2016	Between Filters	1.5 J	1.5	1 U	1 U	1 U	1 U
VIELLA	1/13/2016	Between Filters	2 U	1 U	1 U	1 U	1 U	1 U
VIELLA	4/1/2016	Between Filters	2 U	1 U	1 U	1 U	1 U	1 U
VIELLA	7/6/2016	Between Filters	2 U	1 U	1 U	1 U	1 U	1 U
VIELLA	10/10/2016	Between Filters	2 U	1 U	1 U	1 U	1 U	1 U
KUBLER	1/13/2016	Between Filters	2 U	1 U	1 U	1 U	1 U	1 U
KUBLER	4/1/2016	Between Filters	2 U	1 U	1 U	1 U	1 U	1 U
KUBLER	7/6/2016	Between Filters	2 U	1 U	1 U	1 U	1 U	1 U
KUBLER	10/10/2016	Between Filters	2 U	1 U	1 U	1 U	1 U	1 U

U - Not Detected
J - Estimated value

Table 2.7 Groundwater Elevations, December 8, 2016

Sampling Location	Measurement Point Elevation (ft msl)	Well Depth (ft)	Measurement Point Reference	Depth to Water (ft)	Groundwater Elevation (feet msl)
Monitoring Wells					
M-4	232.19	200	TOC	69.16	163.03
M-5	213.88	200	TOC	48.69	165.19
M-6	248.31	100	TOC	31.07	217.24
M-8	261.57	200	TOC	11.86	249.71
M-9	256.39	200	TOC	91.1	165.29
MW-104	258.00	81.6	TOC	31.55	226.45
MW-108	254.72	86.1	TOC	23.38	231.34
MW-109	255.96	87.5	TOC	19.91	236.05
MW-112	256.60	25.1	TOC	3.08	253.52
MW-113	257.38	25	TOC	8.76	248.62
Mueller	183.25	114	TOC	22.64	160.61
CE-1	224.91	535	TOC	NA	NA
CE-2	224.946	287	TOC	NA	NA
EW-3	259.67	295	TOC	116.37	143.3
EW-4	256.01	322	TOC	113.13	142.88
EW-5	259.85	235.2	TOC	4.3	255.55
EW-8	223.93	318	TOC	89.55	134.38
EW-10	234.09	225	TOC	16.58	217.51
EW-11	231.4	172.2	TOC	68.37	163.03
EW-12	232.76	270.5	TOC	68	164.76
EW-13	217.06	360	TOC	54.39	162.67
EW-14	234.85	185	TOC	NA	NA
EW-15	232.47	275	TOC	9.45	223.02
IW-8	239.47	391.8	TOC	89.95	149.52
IW-9	224.37	358.1	TOC	80.59	143.78
IW-10	235.57	176.3	TOC	7.69	227.88
Active Bedrock Extraction Wells					
EW-2	255.29	322	TOC	107	148.29
EW-6	242.94	325	TOC	91	151.94
EW-7	251.64	227	TOC	185	66.64
EW-9	236.21	365	TOC	91	145.21
EW-16	248.16	417	TOC	143	105.16
Active Overburden Extraction Wells					
OW-2	257.03	30	TOC	15	242.03
OW-3	256.81	25	TOC	13.8	243.01
OW-5	258.2	30	TOC	10	248.2
OW-7	254.57	25	TOC	20.31	234.26
OW-13	259.95	29.5	TOC	8	251.95
OW-14	261.24	30	TOC	14	247.24
OW-16	259.81	30	TOC	16	243.81
Residential Wells					
VIELLA	NM	300	TOC	NA	NA
KUBLER	245.11	300	TOC	NA	NA
KLINKE	NM	240	TOC	NA	NA

CE-1 = Country Estates Well #1
CE-2 = Country Estates Well #2
TOC = Top of Casing
TOV = Top of Vault
TOFM = Top of Flush Mount
NA = Not applicable
ft = feet
msl = mean sea level

Table 2.8: Environmental Monitoring Results Above NYS Standards

Location	Sample Date	Sample ID	1,2-Dichloroethene (total)	Cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Tetrachloroethene	Trichloroethene	Vinyl chloride
Parameter								
Units			ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
GA			5	5	5	5	5	2
CE-1	3/30/2016	CE-1	**5.9**	**5.9**	1 U	1 U	0.81 J	1 U
CE-2	4/1/2016	CE-2	2 U	1 U	1 U	1.7	0.49 J	1 U
EW-11	3/29/2016	EW-11	4.9	4.9	1 U	1 U	1 U	1 U
EW-12	3/29/2016	EW-12	2 U	1 U	1 U	**6.4**	0.83 J	1 U
EW-13	3/29/2016	EW-13	**20**	**20**	1 U	**25**	4.3	1 U
EW-16	3/30/2016	EW-16	**640**	**640**	20 U	**520**	**400**	20 U
EW-2	3/30/2016	EW-2	**130**	**130**	5 U	**120**	**15**	**14**
EW-3	3/29/2016	EW-3	**39**	**38**	0.95 J	1 U	0.83 J	**6.3**
EW-4	3/29/2016	EW-4	**17**	**14**	3.2	1 U	1 U	1 U
EW-5	3/29/2016	EW-5	**300**	**300**	4 U	**330**	**120**	**4.6**
EW-6	3/30/2016	EW-6	**200**	**200**	8 U	**690**	**180**	8 U
EW-7	3/30/2016	EW-7	**950**	**940**	**9.1** J	**3700**	**1800**	10 U
EW-8	3/29/2016	EW-8	4.1	4.1	1 U	1 U	1 U	1 U
EW-9	3/30/2016	EW-9	**150**	**150**	4 U	**45**	**18**	4 U
IW-10	3/29/2016	IW-10	**19**	**19**	1 U	**10**	2.9	1 U
IW-8	3/29/2016	IW-8	1.1 J	1.1	1 U	0.66 J	0.65 J	1 U
IW-9	3/29/2016	IW-9	**960**	**960**	25 U	**240**	**270**	**41**
M-4	3/29/2016	M-4	2 U	1 U	1 U	1 U	1 U	1 U
M-5	3/29/2016	M-5	**23**	**22**	1.1	1 U	1 U	1 U
M-6	3/30/2016	M-6	2 U	1 U	1 U	1 U	1 U	1 U
MUELLER	3/29/2016	MUELLER	2 U	1 U	1 U	1 U	1 U	1 U
OW-13	3/30/2016	OW-13	**70**	**70**	5 U	**140**	**13**	5 U
OW-14	3/30/2016	OW-14	**2100**	**2100**	40 U	**150**	**460**	40 U
OW-16	3/31/2016	OW-16	**110**	**110**	10 U	**350**	**59**	10 U
OW-2	3/30/2016	OW-2	**110**	**110**	20 U	**1300**	**26**	20 U
OW-3	3/30/2016	OW-3	**160**	**160**	80 U	**11000**	**190**	80 U
OW-5	3/30/2016	OW-5	**2400**	**2400**	200 U	**7300**	**420**	200 U
OW-7	3/30/2016	OW-7	**1700**	**1700**	20 U	20 U	20 U	20 U

APPENDIX A

GWETS COMPONENT PERFORMANCE

		Location	Air Stripper Eff		Air Stripper Eff		Air Stripper Eff		Air Stripper Eff		Air Stripper Eff		Air Stripper Eff	
		Field Sample Date	1/4/2016		2/3/2016		3/16/2016		4/11/2016		5/2/2016		6/6/2016	
		Lab Sample Delivery Group	480-93435-1		480-94793-1		480-96719-1		480-98106-1		480-99420-1		480-101243-1	
		Field Sample ID	PS-AS EFFLUENT		PS-AS EFFLUENT		PS-AS EFFLUENT		PS-AS EFFLUENT		PS-AS EFFLUENT		PS-AS-EFFLUENT	
		Qc Code	FS		FS		FS		FS		FS		FS	
Method	**Parameter**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260C	1,1,1-Trichloroethane	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	1,1,2,2-Tetrachloroethane	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	1,1,2-Trichloroethane	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	1,1-Dichloroethene	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	1,2-Dichloroethane	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	1,2-Dichloroethene (total)	ug/l	2	U	2	U	2	U	2	U	2	U	2	U
SW8260C	2-Hexanone	ug/l	5	U	5	U	5	U	5	U	5	U	5	U
SW8260C	Acetone	ug/l	10	U	10	U	10	U	10	U	10	U	10	U
SW8260C	Carbon disulfide	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	Carbon tetrachloride	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	Chloroform	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	Chloromethane	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	Cis-1,2-Dichloroethene	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	Methylene chloride	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	Tetrachloroethene	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	Toluene	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	trans-1,2-Dichloroethene	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	Trichloroethene	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW8260C	Vinyl chloride	ug/l	1	U	1	U	1	U	1	U	1	U	1	U
SW6010C	Aluminum	ug/l												
SW6010C	Arsenic	ug/l												
SW6010C	Barium	ug/l												
SW6010C	Cadmium	ug/l												
SW6010C	Chromium	ug/l												
SW6010C	Copper	ug/l												
SW6010C	Iron	ug/l												
SW6010C	Lead	ug/l												
SW6010C	Manganese	ug/l												
SW6010C	Nickel	ug/l												
SW6010C	Zinc	ug/l												
SW7470A	Mercury	ug/l												
SM2540C	Total Dissolved Solids	mg/l												
SM2540D	Total Suspended Solids	mg/l												

Notes:
ug/l = Micrograms per liter
mg/l = Milligrams per liter
FS = Field Sample
FD = Field Duplicate

Created by: KMS 1/19/16
Checked by:

		Location	Air Stripper Eff		Air Stripper Eff		Air Stripper Eff		Air Stripper Eff	
		Field Sample Date	7/6/2016		8/3/2016		9/7/2016		10/10/2016	
		Lab Sample Delivery Group	480-102696-1		480-104108-1		480-105579-1		480-107378-1	
		Field Sample ID	PS-AS-EFFLUENT		PS-AS-EFFLUENT		PS-AS-EFFLUENT		PS-AS-EFFLUENT	
		Qc Code	FS		FS		FS		FS	
Method	**Parameter**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260C	1,1,1-Trichloroethane	ug/l	1	U	1	U	1	U	1	U
SW8260C	1,1,2,2-Tetrachloroethane	ug/l	1	U	1	U	1	U	1	U
SW8260C	1,1,2-Trichloroethane	ug/l	1	U	1	U	1	U	1	U
SW8260C	1,1-Dichloroethene	ug/l	1	U	1	U	1	U	1	U
SW8260C	1,2-Dichloroethane	ug/l	1	U	1	U	1	U	1	U
SW8260C	1,2-Dichloroethene (total)	ug/l	2	U	2	U	2	U	2	U
SW8260C	2-Hexanone	ug/l	5	U	5	U	5	U	5	U
SW8260C	Acetone	ug/l	10	U	10	U	10	U	10	U
SW8260C	Carbon disulfide	ug/l	1	U	1	U	1	U	1	U
SW8260C	Carbon tetrachloride	ug/l	1	U	1	U	1	U	1	U
SW8260C	Chloroform	ug/l	1	U	1	U	1	U	1	U
SW8260C	Chloromethane	ug/l	1	U	1	U	1	U	1	U
SW8260C	Cis-1,2-Dichloroethene	ug/l	1	U	1	U	1	U	1	U
SW8260C	Methylene chloride	ug/l	1	U	1	U	1	U	1	U
SW8260C	Tetrachloroethene	ug/l	1	U	1	U	1	U	1	U
SW8260C	Toluene	ug/l	1	U	1	U	1	U	1	U
SW8260C	trans-1,2-Dichloroethene	ug/l	1	U	1	U	1	U	1	U
SW8260C	Trichloroethene	ug/l	1	U	1	U	1	U	1	U
SW8260C	Vinyl chloride	ug/l	1	U	1	U	1	U	1	U
SW6010C	Aluminum	ug/l			200	U	200	U	200	U
SW6010C	Arsenic	ug/l			6	U	6	U	6	U
SW6010C	Barium	ug/l			54.7		74.9		67	
SW6010C	Cadmium	ug/l			1	U	1	U	1	U
SW6010C	Chromium	ug/l			4	U	4	U	4	U
SW6010C	Copper	ug/l			10	U	10	U	10	U
SW6010C	Iron	ug/l			94.8		231		114	
SW6010C	Lead	ug/l			3	U	3	U	3	U
SW6010C	Manganese	ug/l			36		48.2		46.6	
SW6010C	Nickel	ug/l			10	U	10	U	10	U
SW6010C	Zinc	ug/l			10	U	10	U	10	U
SW7470A	Mercury	ug/l			0.12	U	0.12	U	0.12	U
SM2540C	Total Dissolved Solids	mg/l			360		364		353	
SM2540D	Total Suspended Solids	mg/l			4	U	4	U	8	

Notes:
ug/l = Micrograms per liter
mg/l = Milligrams per liter
FS = Field Sample
FD = Field Duplicate

APPENDIX B

TRANSDUCER CALIBRATION

American Thermostat

Initial Transducer Calibration

Conversion of PLC Readout to Water Elevation and Depth to Water

December 2016

Sampling Location	Measurement Point Elevation (ft msl)	Well Depth (ft bgs)	Measurement Point Reference	8 Dec 16 Manual Depth to Water (ft bTOC)	8 Dec 16 Manually Measured Groundwater Elevation (ft msl)	8 Dec 16 PLC Reading (H20 above transducer in ft)	PLC Reference Point[1]	8 Dec 16 PLC Measured Groundwater Elevation (ft msl)	PCL Measured Depth to Water (ft bTOC)
Bedrock Extraction Wells									
EW-2	255.29	322	TOC	107	148.29	171	-22.71	148.29	107
EW-6	242.94	325	TOC	91	151.94	191	-39.06	151.94	91
EW-7	251.64	227	TOC	185	66.64	12	54.64	66.64	185
EW-9	236.21	365	TOC	91	145.21	213	-67.79	145.21	91
EW-16	248.16	417	TOC	143	105.16	11	94.16	105.16	143
Overburden Extraction Wells									
OW-2	257.03	30	TOC	15	242.03	5	237.03	242.03	15
OW-3	256.81	25	TOC	13.8	243.01	NA	NA	NA	NA
OW-5	258.2	30	TOC	10	248.2	10	238.2	248.2	10
OW-7	254.57	25	TOC	20.31	234.26	NA	NA	NA	NA
OW-13	259.95	29.5	TOC	8	251.95	12	239.95	251.95	8
OW-14	261.24	30	TOC	14	247.24	7	240.24	247.24	14
OW-16	259.81	30	TOC	16	243.81	4	239.81	243.81	16

[1]PCL Reference Point = Manually Measured GW Elevation - PLC Reading

prepared by: HA 1/23/17

checked by: JA 1/25/17

APPENDIX C

TIME SERIES PLOTS OF KEY WELLS

Appendix B-2: Time-Series Graphs