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New York State Department of Environmental Conservation

Division of Environmental Remediation

Active Industrial Uniform Site

Site No. 152125

2017 Periodic Review Report

(January 2017 through December 2017)

D&B Engineers and Architects, P.C.

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EXECUTIVE SUMMARY

The Active Industrial Uniform Site (the Site) groundwater extraction and treatment system (GWE&TS) is located in the Village of Lindenhurst, Suffolk County, New York. The GWE&TS was designed to recover and treat a chlorinated solvent groundwater contamination plume emanating from the Site and discharge the treated groundwater to Little Neck Creek in accordance with all applicable discharge standards.

Based on evaluation of the performance, effectiveness and protectiveness of the GWE&TS throughout this reporting period (January 1, 2017 through December 31, 2017), the following conclusions and associated recommendations are briefly summarized:

Conclusions:

Operation and Maintenance

- O&M Plan Requirements and Compliance: As noted in Section 3.0, the O&M scope of services was performed in accordance with the requirements of the site-specific O&M Plan, dated April 2002 and September 2012 SMP, revised January 2014 with the exception of routine maintenance of the pressure blower and transfer pump.
- GWE&TS Downtime: The GWE&TS was shut down throughout this reporting period a total of 129 days (or 3,096 hours). The GWE&TS was restarted on April 26, 2017, of this reporting period following troubleshooting activities and system modifications in March 2017. Some downtime occurred following the GWE&TS restart due to alarm conditions and equipment malfunctions; however, the GWE&TS was operating for the majority of the reporting period after the system restart on April 26, 2017.

Monitoring Plan

- System Monitoring: As noted in Section 4.1, monitoring requirements were generally maintained throughout the reporting period.
- System Aqueous-Phase Effluent Contaminant Concentrations: Based on the analytical data, all analytes in the system aqueous-phase effluent were in compliance with SPDES requirements throughout this reporting period, with the exception of one lead exceedance in July 2017, as detailed in Section 4.2.
- Vapor-Phase Effluent Sampling: Based on the analytical data, all analytes in the system vapor-phase effluent were in compliance with permit equivalency requirements, as well as the site-specific total VOC effluent limit of 0.5 lbs/hr throughout this reporting period, as detailed in Section 4.2.
- Monitoring Well Contaminant Concentrations: Site-specific VOCs have been detected at concentrations in exceedance of their Class GA Standard in several monitoring wells during this reporting period (on-site monitoring wells MW-103 through MW-106, MW-108, MW-4D, as well as off-site monitoring well MW-2S).

Institutional and Engineering Controls

- IC/EC Compliance Status: ICs consisting of a Declaration of Covenant and Restrictions, including groundwater and land-use restrictions, is currently filed with the Suffolk County Clerk's office and the Village of Lindenhurst. There is no on-site use of groundwater for potable purposes and the use of the property has been and will continue to be restricted to operation of the GWE&TS only. No changes have been made to the property during this reporting period. The GWE&TS has generally operated in accordance with the SMP requirements throughout the majority of this reporting period, with the exception of one isolated aqueous-phase effluent exceedance for lead on July 26, 2017.

Recommendations:

Operation and Maintenance

- Routine Maintenance of the Pressure Blower and Transfer Pump: In order to reduce the likelihood of premature equipment failure and resulting system downtime, D&B recommends that the NYSDEC "call-out" contractor perform maintenance of the pressure blower and transfer pump, and all other system components, in accordance with their respective manufacturer's specifications.
- Facility Maintenance: Ensure snow plowing/removal activities and lawn maintenance activities, as well as proper reporting of such, are completed, as necessary.
- OM&M Logs: D&B recommends that the NYSDEC Remedial Services Contractor record more clear and detailed descriptions of completed field activities and issues encountered, as well as alarm triggers, downtime dates and times, as appropriate. In addition, multiple copies of logs, including some differing information is periodically reviewed. As such, D&B further recommends that the NYSDEC Remedial Services Contractor make an effort to provide one set of logs with all descriptions and dates of activities clearly indicated. These steps will help enable D&B to better understand the current status of the GWE&TS and facilitate a more efficient preparation of the Site Management Quarterly Reports.

GWE&TS Repairs:

- GWE&TS Influent Manifold: D&B recommends that the NYSDEC Remedial Services Contractor complete a full rebuild of the influent manifold.
- Sump-Pump: D&B recommends that the NYSDEC Remedial Services Contractor replace the leaking check valve on the sump pump effluent line.
- Well Redevelopment: D&B recommends that the NYSDEC Remedial Services Contractor complete well redevelopment activities at extraction well RW-2.

Monitoring Plan

- Monitoring/Extraction Well Sampling: Based on the widely varying VOC concentrations detected in several wells over previous reporting periods, it is recommended that the NYSDEC ensures that the Remedial Services Contractor is utilizing proper and consistent sampling techniques during each groundwater and system sampling event.
- System Aqueous-Phase Effluent Contaminant Concentrations: All aqueous-phase effluent sample results should be monitored on a routine basis to ensure all contaminants are below SPDES limits.

Institutional Controls/Engineering Controls

- IC/ECs: As all IC/ECs for the site are in place and functioning in accordance with the SMP requirements there are no recommendations relative to IC/ECs at this time.

Green and Sustainability Recommendations

- Building Lighting: It is recommended that all light bulbs within the building be replaced with high efficiency bulbs, when needed.
- Renewable Energy Feasibility Assessment: D&B recommends evaluating the feasibility of installing alternate energy sources or purchasing renewable energy credits in order to off-set the electricity usage for the GWE&TS from non-renewable energy sources.
- Reduction of Paper Use: Continue transmitting reports electronically as PDF files to the NYSDEC for review and approval.

General Recommendations

- General GWE&TS Operation: The GWE&TS should remain in-place and operating as designed until remedial objectives have been obtained.
- RSO Evaluation: RSO evaluation should resume once the above recommended system repairs are completed.
- SMP Revisions: It is recommended to revise the Site SMP to include the revised sampling frequencies and include additional information regarding remaining contamination at the Site.
- PRR Reporting Frequency: Based on a review of the guidance documents provided by the NYSDEC, it is recommended that PRRs be completed on an annual basis. The frequency of follow-up PRRs will be determined by the NYSDEC based on future Site conditions and compliance.

1.0 INTRODUCTION

The purpose of this Periodic Review Report (PRR) is to summarize and evaluate the performance of the groundwater extraction and treatment system (GWE&TS) at the Active Industrial Uniform Site (the Site), located at 63 West Montauk Highway in the Village of Lindenhurst, Suffolk County, New York (see Figure 1-1). The information provided in this report covers the period from January 1, 2017 through December 31, 2017; however, portions of this report incorporate pertinent historical background information and monitoring data, as appropriate.

Several clickable hyperlinks are provided in this report (indicated by blue text), which include tables, graphs, figures, etc.

Environmental Assessment and Remediation (EAR), a NYSDEC Remedial Services contractor, completed all operation, maintenance, monitoring and sampling activities throughout this reporting period, while all evaluation, reporting and engineering services were completed by D&B.

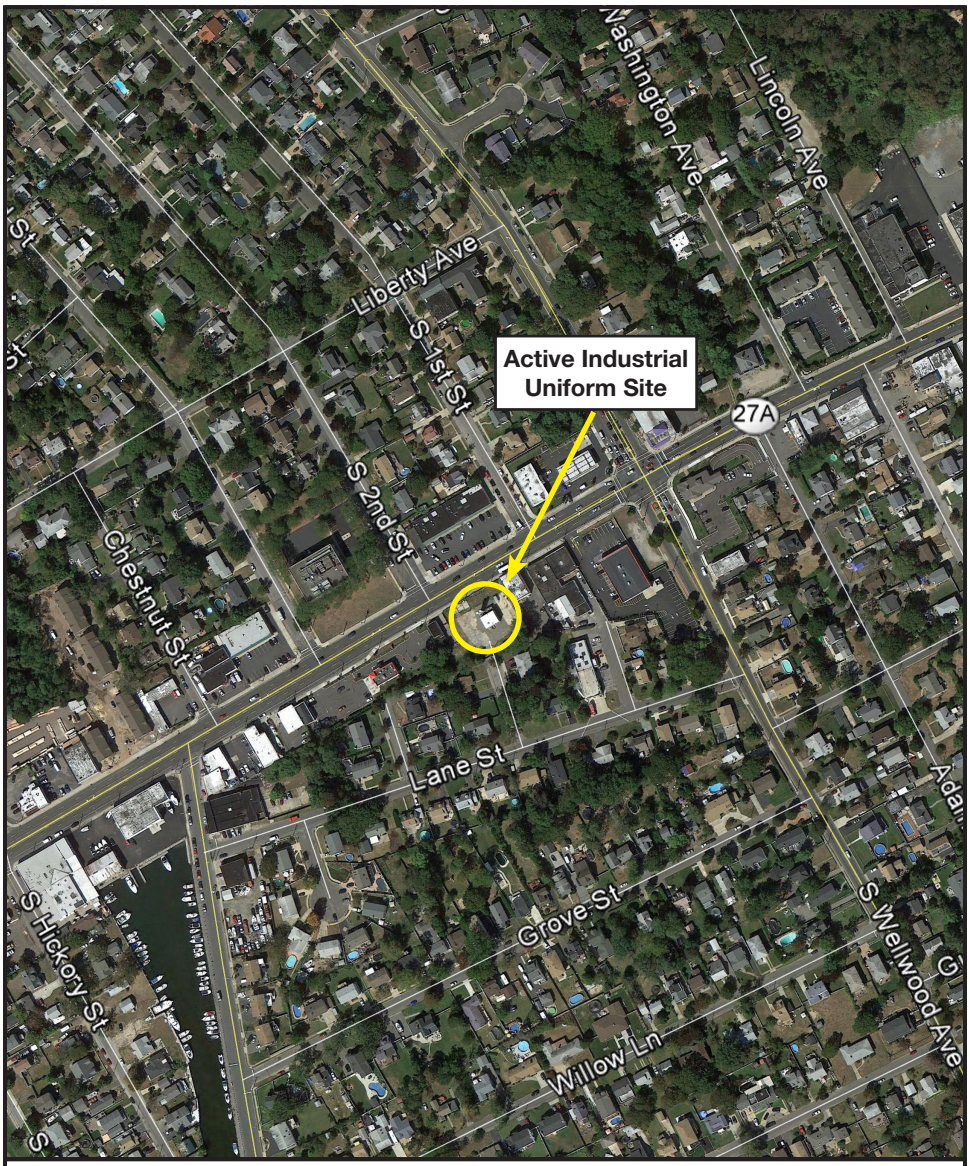
It should be noted that the GWE&TS was restarted on April 26, 2017, of this reporting period, as described below.

The objectives of this PRR include:

- Identify the remedial goals established for the Site.
- Present a description of the GWE&TS components.
- Review Site monitoring and sampling protocols.
- Evaluate the GWE&TS operation and performance.
- Present recommendations regarding the operation of the GWE&TS with respect to system performance, effectiveness and protectiveness, and its ability to achieve the goals established for the Site by the Record of Decision (ROD), dated March 1997.

Figure 1-1

Site Location Map



SOURCE: GOOGLE EARTH PROFESSIONAL, 2013

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SCALE IN FEET

1.1 Remedial System Optimization

As part of an ongoing Remedial System Optimization (RSO) effort to improve the efficiency, effectiveness and net environmental benefit of the GWE&TS, an on-site source area assessment and temporary well plume re-delineation program was completed at the Site in February and March 2013. As per a recommendation of the associated July 2013 RSO Data Summary Report, a remedial alternatives study was performed for the Site in October 2013. Following review of the remedial alternatives study and several follow-up discussions with the NYSDEC, it was determined that further plume delineation would be required prior to implementing any alternative remedial approach for the Site.

To this end, and based on D&B's recommendations, a membrane interface probe (MIP) investigation, including targeted groundwater sample collection, was completed at the Site on July 7 through 11 and July 14, 2014. It should be noted that the GWE&TS was manually shut down during the MIP Investigation in an effort to achieve static aquifer conditions. The results of the completed MIP investigation and groundwater sampling activities were summarized in the February 2015 MIP Investigation Summary Report. RSO evaluation should resume once the below recommended system repairs are completed.

1.2 Treatment System Operational Issues

As discussed in recent Site Management Quarterly Reports, several operational issues are currently affecting the GWE&TS, or have affected the GWE&TS in 2017, as further detailed below:

<u>System Wiring and Controls</u>

During a previous reporting period the NYSDEC Remedial Services Contractor contacted ALM Systems, a systems integrator, to assess and troubleshoot issues associated with electrical wiring and systems controls. Following their assessment, several wiring issues were noted at the systems control panel and the PLC was also noted to not be optimally programmed. ALM Systems also concluded that wiring in the VFD had been incorrectly installed and an inoperable cooling fan in the VFD was contributing to operational issues with Transfer Pump P-1. ALM Systems recommended the wiring and systems control issues be rectified. In February of 2016 the NYSDEC Remedial Services Contractor replaced the pressure transducers at AST-1 and AST-2. On January 16, 2017, the NYSDEC Remedial Services Contractor was on-site to complete troubleshooting activities for the GWE&TS. While on-site the technician completed a check of the transducer wiring to confirm the correct wiring was previously evaluated. On January 17, 2017, the NYSDEC Remedial Services Contractor was on-site to continue troubleshooting activities. At the start of testing the technician reported no readings from the transducers at the PLC and the NYSDEC Remedial Services Contractor then checked and confirmed the transducer was receiving power. After re-checking the wiring and connections, all were determined to be shielded and grounded properly. No motors were found to be running, no freezing was evident at the transducer and no splices were found in the lines. The technician continued the system check utilizing a process meter; however, all readings displayed at the PLC were erratic. On January 18, 2017, the NYSDEC Remedial Services Contractor returned to Site to continue troubleshooting activities. Utilizing a process meter, the NYSDEC Remedial Services Contractor continued simulating signal checks at the PLC; however, all readings displayed erratic results. In response to the issues noted by the NYSDEC Remedial Services Contractor, D&B continued troubleshooting activities on February 14, 2017. They confirmed that the transducers were properly wired and producing appropriate outputs based on varying levels in the respective sumps. Based on their observations it was concluded that the erratic readings observed at the PLC were most likely attributed to faulty PLC components and recommended coordinating with a controls contractor to continue troubleshooting efforts. On March 8, 2017, D&B returned to the Site with ALM Systems where the following items were identified and remedied:

1. The VFD for the fan blower would not run when the system was in auto and required the operator to start the VFD manually. A jumper was installed to automatically engage the drive instead of relying on manually starting the blower;
2. The pressure switches at the discharge of Transfer Pumps P-1 & P-2 had been disabled and the pressure switch at Transfer Pump P-1 was also inoperable. As Transfer Pump P-2 had failed, its pressure switch was relocated to Transfer Pump P-1 and the switch was properly hooked up to the system controls; and,

3. The PLC analog input module was replaced, as erroneously high readings were being observed at the PLC for liquid levels in AST-1 and AST-2 and for flow readings. Upon replacement, the levels observed properly correlated to the level readings anticipated from directly powering and measuring the pressure transducers at the towers. Additionally, the flow readings correlated with the readings observed at the individual flow meters except for at discharge flow meter. The span was adjusted for the discharge flow meter to correct the discrepancy.

Following completion of the above repairs, the system was successfully restarted on March 8, 2017, utilizing only AST-1 as Transfer Pump P-2 needed repair or replacement. Based on the system inspection completed on March 8, 2017, D&B recommended implementation of the following repairs pertaining to the GWE&TS wiring and controls:

1. Addition of a low safety switch for the AST-1 and AST-2 sumps;
2. Replacement of the pressure switches for Transfer Pump P-1 and P-2
3. Repair of wiring for Transfer Pump P-1 and P-2;
4. Replacement of the control panel lights with LEDs as all lights were inoperable;
5. Replacement of the auto dialer as it was inoperable; and,
6. Configuring of the VFDs for Transfer Pump P-1 and P-2 to operate at operator selected fixed frequencies instead of PID loops.

On March 13, 2017, D&B returned to the Site for a system inspection and found the system off due to a freeze up at AST-1. Additionally, erratic signals were observed at the PLC and D&B recommended replacing the PLC base. Per the NYSDEC's direction, the system was left off pending completion of additional system repairs. On April 5, 2017, D&B met with the NYSDEC Remedial Services Contractor to review the proposed repairs to the system wiring and controls discussed above, as well as to discuss the required repairs to the various other system components further discussed below. The NYSDEC Remedial Services Contractor returned to the Site from April 12 through April 14, 2017, where they added a low safety switch for AST-1 and replaced the pressure switch for Transfer Pump P-1. They returned again on April 18, 2017, to repair the wiring for Transfer Pumps P-1 and P-2. On April 20, 2017, D&B and ALM Systems continued troubleshooting the system controls. During troubleshooting they confirmed a faulty PLC base and replaced the unit. Additionally, they configured the VFDs as recommended above. The system was left off at this time pending completion of the remaining control repairs. On April 26, 2017, D&B met the NYSDEC Remedial Services Contractor to complete the remaining repairs to the system controls and wiring, except for the installation of the low safety switch for AST-2 and pressure switch for Transfer Pump P-2. Upon completion of the repairs the system was successfully restarted with only Transfer Pump P-1 running. The NYSDEC Remedial Services Contractor returned to the Site from June 6 through June 12, 2017, to install the remaining low safety switch at AST-2. On October 3, 2017, the NYSDEC Remedial Services Contractor returned to the Site and replaced the pressure switch at Transfer Pump P-2, which completed the repairs to the system controls and wiring.

Transfer Pump P-1

Based on the system inspection completed on March 8, 2017, D&B recommended repairing a leak that was identified at the 4-inch discharge union of Transfer Pump P-1. The NYSDEC Remedial Services Contractor returned to the Site from April 12 through April 14, 2017, where they completed the above recommended repairs.

Transfer Pump P-2

Based on the system inspection completed on March 8, 2017, D&B recommended repair or replacement of the Transfer Pump P-2 pump head and repair of the Transfer Pump P-2 motor shroud. Additionally, D&B recommended replacing the pressure gauge for Transfer Pump P-2. The NYSDEC Remedial Services Contractor returned to the Site on April 26, 2017, where they replaced the pressure gauge for Transfer Pump P-2 and again on June 8, 2017, to decontaminate the pump head for shipment to the manufacturer for evaluation. On August 28, 2017, the NYSDEC Remedial Services Contractor reinstalled a replacement pump end for Transfer Pump P-2.

Influent and Effluent Piping

Based on the system inspection completed on March 8, 2017, D&B recommended implementation of the following repairs pertaining to the GWE&TS influent and effluent piping:

- Replacing of the pressure gauges for RW-1 and the combined influent line;
- Installing a vacuum breaker on the effluent line to eliminate siphoning; and,
- Repairing a leak identified at the threaded plug/tee where piping exits through the building slab.

The NYSDEC Remedial Services Contractor returned to the Site from April 12 through April 14, 2017, where they completed the above recommended repairs. Additionally, on August 29, 2017, of this reporting period, the NYSDEC Remedial Services Contractor was on-site to install a new vacuum breaker to prevent siphoning at the Transfer Pump P-2 effluent line.

GWE&TS Influent Manifold

On December 11, 2017, the NYSDEC Remedial Services Contractor responded to a system alarm due to a high water condition in AST-1. At this time it was identified that a leaking ball valve on the influent manifold was allowing water to enter the tower. On December 21, 2017, the NYSDEC Remedial Services Contractor returned to the Site to replace the ball valve; however, at that time it was identified that a full rebuild of the influent manifold was necessary to complete the repair.

Condensate Pump and Piping

Based on the system inspection completed on March 8, 2017, D&B recommended repairing the piping from the fan blower knock-out tank and from the pump to the system influent line. The NYSDEC Remedial Services Contractor returned to the Site from April 12 through April 14, 2017, where they completed this repair.

Air Stripper Towers

Based on the system inspection completed on March 8, 2017, D&B recommended implementation of the following repairs pertaining to the Air Stripper Towers:

- Reinstalling heat trace and associated insulation on the drains of both towers;
- Replacing the vacuum gauges and associated tubing for both towers; and,
- Installing a sight glass with associated heat trace and insulation for both towers.

The NYSDEC Remedial Services Contractor returned to the Site from April 12 through April 14, 2017, where they replaced the vacuum gages and associated tubing for both towers, as well as installed a sight glass for AST-1. Additionally, they returned to the Site from June 6 through June 12, 2017 to install a sight glass at AST-2.

On September 7, 2017, the NYSDEC Remedial Services Contractor was on-site to install heat trace and associated insulation on all exterior piping, thereby completing the remaining repairs to the air stripper towers.

Extraction Well Redevelopment

On August 9, 2016, well redevelopment activities were attempted at extraction well RW-2. Approximately 13 feet of accumulated material was identified in the well. After several attempts, approximately 6 feet of the accumulated material was removed; however, the NYSDEC Remedial Services Contractor was unable to successfully complete the slated well redevelopment. On August 16, 2016, the NYSDEC Remedial Services Contractor was on-site to complete boroscoping activities at extraction well RW-2 to identify any structural issues within the well. The inspection did not identify any structural issues with RW-2.

2.0 SITE OVERVIEW

2.1 Site Operations and Description

The Site is a NYSDEC Class 2 Inactive Hazardous Waste Site and is listed on the New York State Registry of Inactive Hazardous Waste Sites (Site No. 152125). Laundering operations began at the Site in 1945 and continued until 1993.

Dry cleaning activities were also conducted at the Site for a 17-year period between 1970 and 1987. All on-site buildings associated with these operations were demolished in February 1995.

The Site is approximately 1/2 acre in size. The surrounding properties are primarily commercial, with the exception of a residential area located to the south of the Site on Tompkins Lane. Access to the Site is from Tompkins Lane. A Site location map is provided as Figure 1-1.

The GWE&TS consists of two 8-inch diameter extraction wells, with one located on-site in the southwest portion of the Site (RW-1), and one located off-site, approximately 1,500 feet southwest of the Site (RW-2). Extraction Well RW-2 is not currently operating, as directed by the NYSDEC, due to low historical concentrations of site-specific VOCs and a general decline in total VOC concentrations. Extracted groundwater is conveyed to the GWE&TS building via underground piping, and is pumped to two packed-tower air strippers. Based on influent concentrations and flow rate, the operation of each tower is currently switched on a quarterly basis where only one tower is operated at any given time. Treated groundwater is then pumped via underground piping to a storm water basin located approximately 1,000 feet west of the Site, which then discharges into Little Neck Creek, in accordance with all applicable discharge standards.

Exhaust gas from each air stripper was initially treated utilizing two granular activated carbon (GAC) vessels connected in series; however, based on low historic contaminant concentrations detected in the air stripper vapor-phase discharge, the vapor-phase discharge piping was reconfigured to bypass the GAC vessels and discharge directly to the atmosphere in June 2011, per the direction of the NYSDEC. The GWE&TS is equipped with instrumentation and controls which allow for automated startup and operation of the GWE&TS, as well as an auto dial alarm notification system.

2.2 Site Impacts and Investigation History

Initial Investigation Activities

An initial investigation of the Site was completed in December 1987 by the property owner, American Linen Supply. Soil and groundwater samples collected at the Site during the initial investigation exhibited elevated concentrations of chlorinated volatile organic compounds (VOCs), including tetrachloroethene (PCE). The sources of the contamination were determined to be three former PCE storage tanks. These tanks were reportedly removed between 1985 and 1987; however, it was not determined if the contamination was the result of leaks, spills or both. Based on the results of the initial investigation, a soil vapor extraction (SVE) system was installed in the southeast portion of the Site, as part of an Interim Remedial Measure (IRM). The SVE system was placed into operation in July 1991. The goal of the IRM was to remove on-site soil contamination and to prevent migration of soil vapor to off-site areas.

Figure 2-1 depicts the locations of former on-site features, including the former Active Industrial Uniform building, former dry wells/cesspools, the former SVE system, the locations of the former PCE tanks, as well as sample locations associated with the initial and pre-design investigations.

A Remedial Investigation (RI) was performed between October 1993 and April 1994. Based on the results of the RI, both shallow and deep groundwater contaminant plumes were identified extending from the Site in southwesterly directions toward Little Neck Creek (approximately 800 feet southwest of the Site). The shallow plume was found to have concentrations of PCE of as high as 20 milligrams per liter (mg/l) migrating south-southwest. The deep plume had a more southerly direction and was believed to be following a confining clay layer reported to be located at approximately 70 feet bgs. Soil contamination was identified in the on-site dry wells/cesspools with PCE concentrations of as high as 40,000 milligram per kilogram (mg/kg) identified in the southern portion of the Site. Elevated concentrations of PCE were also found in the soil at the former locations of the PCE tanks with concentrations of up to 30,000 mg/kg. Copies of the historical off-site plume maps are provided in ***Appendix A***.

Record of Decision

Based on the findings of the RI, the NYSDEC issued a ROD for the Site in March 1997. In order to eliminate or mitigate threats to human health and the environment, the NYSDEC selected the following remedies:

- Continued operation of the SVE system to remediate shallow source-area soil and expansion of the system to treat contaminated soil in the area of the dry wells/cesspools on the north side of the Site and under portions of the former building.
- Removal of VOCs from the SVE system emissions by activated carbon.
- Installation of an air-sparging (AS) system to remediate shallow on-site groundwater.
- Installation of a GWE&TS to capture and treat shallow off-site groundwater and discharge the treated groundwater to the storm water sewer system.
- Environmental monitoring of groundwater upgradient, on-site and downgradient of the Site and periodic reviews.
- Implementation of a deed restriction, including restrictions on soil excavation and other disturbance of on-site soil, and implementation of a groundwater use restriction for the property.

Pre-Design Investigation

Following the selection of the remedial alternatives outlined in the March 1997 ROD, a Pre-Design Investigation (PDI) was completed in 1998. The purpose of the PDI was to further define on-site soil and groundwater contamination, and off-site groundwater contamination, and to perform groundwater modeling studies to assess various pumping scenarios to best address the contaminant plumes.

The on-site soil and groundwater investigation conducted as part of the PDI targeted the on-site dry wells/cesspools. The locations of the sampling points are depicted on ***Figure 2-1***. Analytical results generated from the PDI identified the on-Site cesspools as a significant source of contamination at the Site. Similar to the results of remedial investigation conducted at the Site between October 1993 and April 1994, the greatest concentrations of chlorinated VOCs were identified in soil samples collected from the southern portion of the Site. PCE concentrations of up to 760,000 mg/kg were detected in the 0 to 4 foot bgs sample collected at soil boring GP-22, located in the southeastern portion of the Site. Additionally, elevated concentrations of petroleum hydrocarbons, most notably total xylenes, were identified in the soil on the southern portion of the property. The maximum recorded concentration of total xylenes was 62,000 ug/kg, detected in the 10 to 11-foot bgs sample collected at soil boring GP-21. Soil boring GP-21 was located in the southeastern portion of the Site. The greatest on-site concentrations of total VOCs in groundwater were identified at temporary groundwater sample point GP-1 (26,000 ug/l), located in the western portion of the Site. All on-site groundwater samples were collected from 10 to 16-feet bgs.

Based on the results of the off-site groundwater investigation, the most significant VOC contamination was present between 26 to 40 feet bgs, extending in a southwesterly direction from the Site. The PDI investigation determined Little Neck Creek to be the discharge point for the contaminant plume.

In order to better monitor on-site and off-site groundwater contaminant concentrations, 11 groundwater monitoring wells were installed as part of the PDI, prior to installation of the GWE&TS. Eight groundwater monitoring wells were installed on-site (MW-101 through MW-108) and three groundwater monitoring wells were installed off-site (MW-109, MW-110 and MW 111), downgradient of the Site (see Figures 2-2 and 2-3 provided below). Note that monitoring well MW-110 was paved over and/or destroyed soon after it was installed and has not been sampled as part of the routine groundwater monitoring activities since D&B assumed O&M duties in February 2005.

Based on the results of the pre-design investigation, the GWE&TS design initially outlined in the ROD was modified by moving the off-site recovery well location further downgradient of the Site than was originally proposed and increasing the design extraction flow rates from 60 gallons per minute (gpm) to 100 gpm.

Monitoring and extraction well as-builts are provided in ***Appendix B***.

November 2000 IRM

Additionally, a second IRM was completed in November 2000 based on the results of the PDI, which consisted of the excavation and off-site disposal of approximately 600 cubic yards of unsaturated contaminated soil from the northeastern and southeastern portions of the Site. A total of twelve dry well structures were also removed and disposed of as part of

these activities. The approximate lateral extent of the soil excavation, as well as, the locations of nine of the dry wells are provided on Figure 2-2 below.

In a letter dated February 5, 2001, the NYSDEC determined that the November 2000 IRM soil excavation had removed the on-site sources of contamination and, as a result, the planned air sparging system would not be installed. The NYSDEC further concluded that if any residual contamination remained on-site, installation of an on-site extraction well (RW-1) pumping at a rate of 100 gpm, would create a sufficient "capture zone" to capture any contamination that would have otherwise been addressed by the air sparging system. It should be noted that the design documents for the GWE&TS indicated that 80% of the design flow rate (or 80 gpm) would be sufficient for containment of the plume.

Figure 2-2

On-Site Monitoring Wells and Extraction Well Locations and Pertinent Historical Features

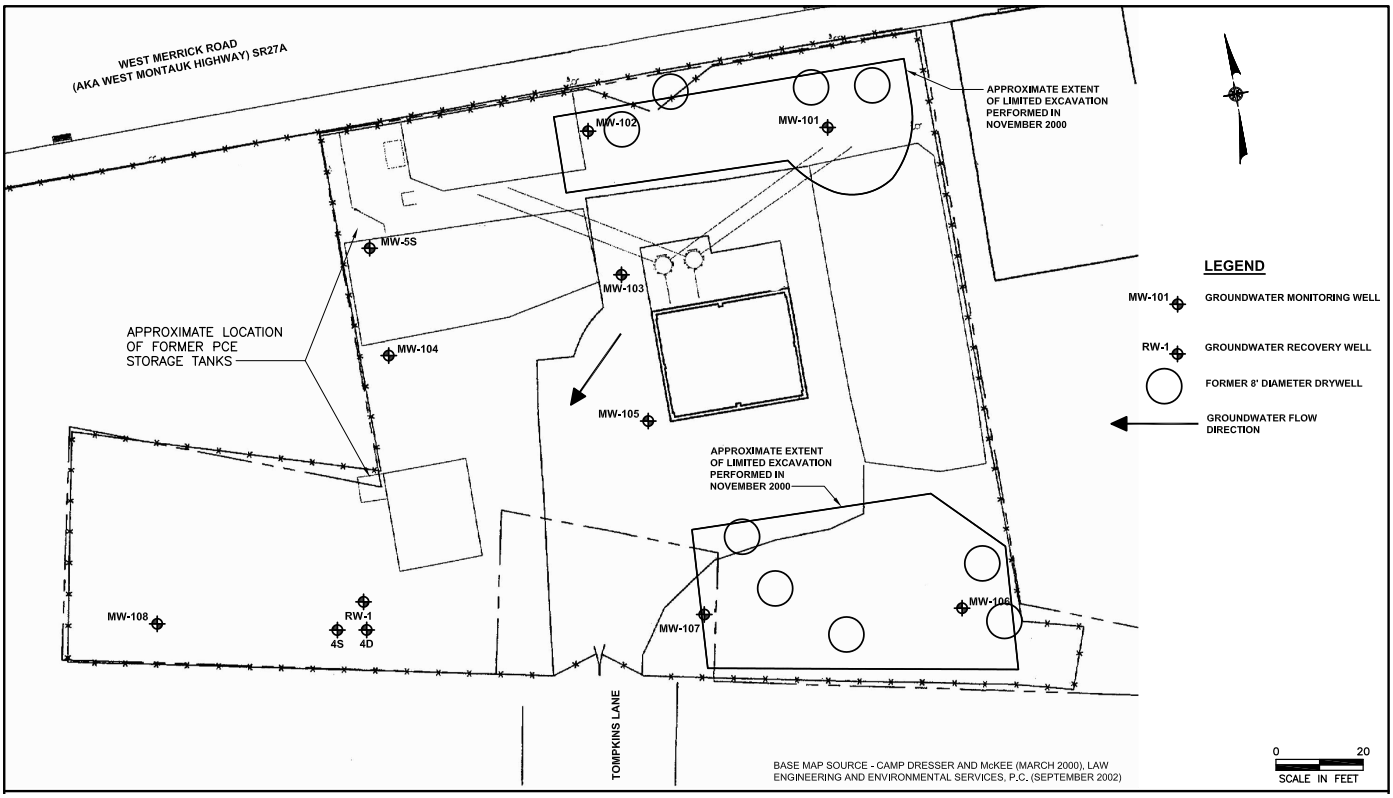


Figure 2-3

Off-Site Monitoring Wells and Extraction Well Location Map

GWE&TS Construction

The construction of the GWE&TS began in June 2001 and was completed in December 2001. It is D&B's understanding that the former SVE system was shut down and dismantled during the GWE&TS construction process. The on-site GWE&TS was placed into routine operation on December 27, 2001 and was operated by others until D&B assumed Site management duties in February 2005.

3.0 OPERATION AND MAINTENANCE (O&M) PLAN COMPLIANCE

3.1 O&M Plan Requirements and Compliance Status

The O&M scope of services for the GWE&TS consists of general facility maintenance activities, routine GWE&TS maintenance activities, non-routine GWE&TS maintenance activities and system alarm/shutdown response activities, in accordance with the requirements of the site-specific Operations and Maintenance Manual (OMM), dated April 2002 and September 2012 Site Management Plan (SMP), revised January 2014. Site Activities Logs and Maintenance reports, which include details of shut downs and non-routine maintenance activities are prepared by the NYSDEC Remedial Services Contractor. Copies of the Site Activities Logs are provided in ***Appendix C***.

Presented below is a summary of the O&M activities performed throughout this reporting period.

General Facility Maintenance Activities

General facility maintenance work items are those tasks which involve the maintenance and upkeep of the GWE&TS, as well as grounds keeping of the GWE&TS property. General facility maintenance activities completed during this reporting period include:

- Landscape maintenance and snow removal on an as-needed basis.
- Periodic inspection of the extraction and monitoring wells to ensure the wells are secure and accessible.
- Periodic verification of posted safety information to ensure all information is current and accurate.
- Periodic maintenance of ground cover to prevent soil erosion and surface runoff.
- Periodic inspection of the vehicle driveway for potholes and other damage.
- Lubrication of gate locks on an as-needed basis.

Routine GWE&TS Inspection and Maintenance Activities

A summary of the routine GWE&TS inspection and maintenance services and their typical frequencies of completion, based on the current SMP are provided on Table 3-1. The routine GWE&TS inspection and maintenance activities completed during this reporting period include:

- Bi-monthly inspection/monitoring (while the GWE&TS was operating) of GWE&TS equipment (extraction well, packed tower air stripper, transfer pump and pressure blower).
- Bi-monthly inspection (while the GWE&TS was operating) of the groundwater recovery pump to check for operating pressure, drawdown, periods of cycling and operation of controls.
- Bi-monthly pressure blower maintenance was completed on May 1, 2017, August 21, 2017, October 16, 2017, November 13, 2017 and December 29, 2017. As such, the NYSDEC Remedial Services Contractor did not complete the pressure blower maintenance per the requirements of the routine maintenance schedule.
- Quarterly transfer pump maintenance was completed on May 1, 2017, August 21, 2017 and October 3, 2017. As such, the NYSDEC Remedial Services Contractor did not complete the transfer pump maintenance per the requirements of the routine maintenance schedule.

Also, note that the particulate filter has been taken out of service for the past several years, per NYSDEC direction and as particulate levels in aqueous-phase effluent did not warrant use of a filter. As such, this routine maintenance item was not completed during this reporting period.

As detailed above, routine maintenance of the pressure blower and transfer pump were not completed as per the frequencies detailed in Table 3-1.

Table 3-1: Routine Inspection and Maintenance Services Summary

Routine Inspection/Maintenance Item	Frequency				
	Bi-Weekly	Monthly	Bi-Monthly	Quarterly	As-Needed
Extraction Well Inspection Items					
Flow Rate (gpm)	✓				
Total Flow (gal)	✓				
Pump Pressure (psi)	✓				
Drawdown	✓				
Controls Inspection	✓				
Air Stripper Tower Inspection Items					
Stripper Inlet Pressure (psi)	✓				

Table 3-1: Routine Inspection and Maintenance Services Summary (cont.)

Routine Inspection/Maintenance Item	Frequency				
	Bi-Weekly	Monthly	Bi-Monthly	Quarterly	As-Needed
Air Stripper Blower Inspection Items					
Sump Level (inches)	✓				
Discharge Speed (%)	✓				
Moisture Knockout Influent Vacuum (inches H_2O)	✓				
Blower Influent Vacuum (inches H_2O)	✓				
Blower Effluent Pressure (inches H_2O)	✓				
Flow Rate (gpm)	✓				
Total Flow (gal)	✓				
Routine Maintenance Items					
Pressure Blower Maintenance			✓		
Particulate Filter Maintenance		✓			
Transfer Pump Maintenance				✓	
Air Stripper Maintenance					✓
GAC Removal and Replacement					✓
Air Stripper Packing Removal and Replacement					✓

Non-Routine GWE&TS Maintenance Activities

Non-routine GWE&TS maintenance activities are those maintenance activities which involve out-of-scope maintenance and upkeep of the GWE&TS, as well as out-of-scope maintenance in response to system alarm and/or shut-down events.

Non-routine maintenance activities completed throughout 2017 are summarized below:

January 1, 2017 through March 31, 2017 (Quarter 49)

- On January 16, 2017, the NYSDEC Remedial Services Contractor was on-site to complete troubleshooting activities for the GWE&TS. While on-site the technician completed a check of the transducer wiring to confirm the correct wiring was previously evaluated. Upon arrival to Site the NYSDEC Remedial Services Contractor found the SCWA waterline cracked at the flow meter due to freezing. The NYSDEC Remedial Services Contractor was able to pump out the accumulated water and repair the copper line prior to departure from Site.
- On January 17, 2017, the NYSDEC Remedial Services Contractor was on-site to continue troubleshooting activities. At the start of testing the technician reported no readings from the transducers at the PLC, the NYSDEC Remedial Services Contractor then checked and confirmed the transducer was receiving power. After re-checking the wiring and connections all were determined to be shielded and grounded properly. No motors were found to be running, no freezing was evident at the transducer and no splices were found in the lines. The technician continued the system check utilizing a process meter; however, all readings displayed at the PLC were erratic.
- On January 18, 2017, the NYSDEC Remedial Services Contractor returned to Site to continue troubleshooting activities. Utilizing a process meter, the NYSDEC Remedial Services Contractor continued simulating signal checks at the PLC; however, all readings displayed erratic results.
- On February 14, 2017, D&B was on-site to continue troubleshooting activities to confirm the transducers were properly wired and producing appropriate outputs based on varying levels in the respective sumps. Based on observations it

was concluded that the erratic readings observed at the PLC were most likely attributed to faulty PLC components and recommended coordinating with a controls contractor to continue troubleshooting efforts.

- On March 8, 2017, D&B and ALM Systems were on-site to continue troubleshooting activities. A jumper was installed at the VFD for the fan blower, allowing for the system to automatically engage the drive instead of relying on the manual start by the operator. It was also identified that the pressure switches at the discharge of Transfer Pump P-1 & P-2 had been disabled and the pressure switch at Transfer Pump P-1 was also inoperable. Due to failure at Transfer Pump P-2 its pressure switch was relocated to Transfer Pump P-1 and the switch was properly hooked up to the system controls. Additionally, the PLC analog input module was replaced as erroneously high readings were being observed for liquid levels in AST-1 and AST-2 and for flow readings. Upon replacement, the levels observed properly correlated to the level readings anticipated from directly powering and measuring the pressure transducers at the towers. In addition, it was observed that flow readings correlated with readings observed at the individual flow meters except for at the discharge flowmeter. D&B and ALM Systems adjusted the span for the discharge flowmeter to correct the discrepancy. Following completion of these repairs the system was successfully restarted.
- On March 13, 2017, D&B was on-site for a system inspection and found the system off due to a freeze up at AST-1. Additionally, erratic signals were observed at the PLC and D&B recommended replacing the PLC base. Per the NYSDEC's direction the system was left off pending completion of additional system repairs recommended by D&B.
- On March 15, 2017, the NYSDEC Remedial Services Contractor was on-site to assess the gas heater operation. Both units were found inoperable and determined HVAC services is required for assessment and or replacement.

April 1, 2017 through June 30, 2017 (Quarter 50)

- On April 5, 2017, D&B and the NYSDEC Remedial Services Contractor were on-site to review previously proposed system modifications and evaluate and resolve any loss of building envelope integrity regarding climate control energy demands.
- On April 12 through 14, 2017, the NYSDEC Remedial Services Contractor was on-site to complete system modifications and repairs. While on-site, the NYSDEC Remedial Services Contractor reconnected the water supply line to the acid storage tank and exterior hose bibs, replaced RW-1 and combined influent pressure gauges, replaced vacuum gauges for each tower and associated tubing, added a low safety switch and sight glass for the AST-1 sump, repaired a leak at the 4" discharge union of Transfer Pump P-1, replaced a pressure switch for Transfer Pump P-1, repaired piping from the fan blower Knock-Out tank to the condensate pump and from the pump to the system influent line, tested pump operations and float switches in the Knock-Out tank and installed a vacuum breaker at Transfer Pump P- 1 to eliminate siphoning.
- On April 18, 2017, the NYSDEC Remedial Services Contractor was on-site to replace Transfer Pumps P-1 and P-2 conduits and junction boxes. The conduits at each transfer pump were broken off as a result the conduits were cut down, male adaptors were installed, and a new junction box was installed.
- On April 20, 2017, the NYSDEC Remedial Services Contractor was on-site to replace control panel LED's. Upon arrival the NYSDEC Remedial Services Contractor noted that float at AST-1 was taking on water. ALM Systems and D&B were on-site for VFD troubleshooting activities.
- On April 26, 2017, the NYSDEC Remedial Services Contractor and D&B were on-site to install a new sensaphone auto dialer, complete installation of replacement float at AST-1, replace and label gauges as necessary and complete an initial system start-up following system maintenance activities.
- On May 4, 2017, the NYSDEC Remedial Services Contractor was on-site to adjust RW-1 influent line pressure switch.
- On May 8, 2017, the NYSDEC Remedial Services Contractor was on-site with All Weather Temp Control Inc. to install two gas heaters.
- On June 8, 2017 through June 12, 2017, the NYSDEC Remedial Services Contractor was on-site to complete system modifications and installation of a sight tube and its associated piping at AST-2, install new low-level float at AST-2 and removed and decontaminated Transfer Pump P-2 pump end for shipment to the manufacturer for evaluation.

July 1, 2017 through September 30, 2017 (Quarter 51)

- On July 12, 2017, the NYSDEC Remedial Services Contractor and Land Valve Specialists were on-site to perform a back flow inspection.
- On August 25, 2017, the NYSDEC Remedial Services Contractor was on-site to repair a leak found at the slop sink.
- On August 28, 2017, the NYSDEC Remedial Services Contractor was on-site to install a replacement Magnatex pump at Transfer Pump P-2 and begin piping installation.
- On August 29, 2017, the NYSDEC Remedial Services Contractor was on-site to install a vacuum breaker at Transfer Pump P-2 effluent line. While on-site the NYSDEC Remedial Services Contractor observed a leak at the Transfer Pump P-2 effluent line ball valve. The technician was able to reset the valve and restart the system.
- On September 7, 2017, D&B and the NYSDEC Remedial Services Contractor to conducted testing of AST-2 operations and disconnected the auto louvre controls, per D&B request. While on-site the NYSDEC Remedial Services Contractor completed winterization of the new exterior plumbing.
- On September 18, 2017, the NYSDEC Remedial Services Contractor was on-site to replace a leaking valve located on the effluent line with a small section of pipe.

October 1, 2017 through December 31, 2017 (Quarter 52)

- On October 3, 2017, the NYSDEC Remedial Services Contractor was on-site to install a pressure switch and pressure gauge at Transfer Pump P-2. The Contractor also switched operation of the GWE&TS from AST-1 to AST-2.

GWE&TS Alarms

The GWE&TS is equipped with an autodialer alarm notification system, which is programmed to call technicians in the event of an alarm condition. The following is a list of the current alarms for the system:

- Alarm #1 – Temperature Alarm
- Alarm #2 – Sound Level Alarm
- Alarm #3 – General Alarm
- Alarm #4 – High Pressure Stripper
- Alarm #5 – High Level Stripper
- Alarm #6 – High Pressure Transfer Pump
- Alarm #7 – Low Flow Stripper
- Alarm #8 – Low Flow Extraction Well

January 1, 2017 through March 31, 2017 (Quarter 49)

- On March 13, 2017, D&B was on-site for a system inspection and found the system off due to general alarm caused by a freeze up at AST-1. Per the NYSDEC's direction the system was left off pending completion of additional system repairs.

April 1, 2017 through June 30, 2017 (Quarter 50)

- On April 29, 2017, the GWE&TS shut down due to a "high pressure" condition caused by pressure build up in the pump at RW-1. The NYSDEC Remedial Services Contractor reset and restarted the system on May 1, 2017.
- On June 19, 2017, the GWE&TS shut down due to a "low-voltage" condition caused by thunderstorms in the area. The NYSDEC Remedial Services Contractor reset and restarted the system on June 20, 2017.

July 1, 2017 through September 30, 2017 (Quarter 51)

- On July 3, 2017, the GWE&TS shut down due to a high sump alarm in the floor sump. The NYSDEC Remedial Services Contractor pumped out the floor sump, reset and restarted the GWE&TS on July 5, 2017; however, later the same day the GWE&TS failed due to a similar alarm, a high sump alarm at the floor sump. The system was left off pending troubleshooting activities on July 6, 2017. On July 6, 2017, the NYSDEC Remedial Services Contractor attempted to restart the GWE&TS; however, due to suspected mechanical issues at the sump pump and a suspected leak from the potable water sink, the system went back down and remained off. The NYSDEC Remedial Services Contractor returned to site on July 7, 2017, to complete troubleshooting activities, where it was identified that a leaking check valve

was allowing extracted groundwater to fill the sump. Per D&B's request the NYSDEC Remedial Services Contractor isolated the line by closing a ball valve and restarted the GWE&TS.

- On August 18, 2017, the NYSDEC Remedial Services Contractor received a general systems alarm. The NYSDEC Remedial Services Contractor reset and restarted the system upon departure on August 21, 2017.
- On August 30, 2017, the NYSDEC Remedial Services Contractor responded to a high water level alarm at AST-1. The NYSDEC Remedial Services Contractor attempted to reset and restart the system on the same day; however, due to a similar alarm the GWE&TS failed later the same day. The NYSDEC Remedial Services Contractor returned to Site on August 31, 2017, to reset and restart the system.
- On September 14, 2017, the GWE&TS shut down due to a high sump alarm at the floor sump. The NYSDEC Remedial Services Contractor responded on September 15, 2017, while on-site the technician attempted to reset and restart the system; however, due to an identified leak in a ball valve on the effluent line between transfer pumps the system was left off pending repair activities. On September 18, 2017, the NYSDEC Remedial Services Contractor returned to the Site to replace the valve with a section of pipe and restarted the GWE&TS upon departure.

October 1, 2017 through December 31, 2017 (Quarter 52)

- On October 29, 2017, the GWE&TS shut down due to a low air flow alarm. The NYSDEC Remedial Services Contractor responded on October 30, 2017, to reset and restart the system.
- On December 3, 2017, the GWE&TS shutdown due to a general alarm caused by power outage at the Site. The NYSDEC Remedial Services Contractor responded on December 4, 2017, to reset and restart the system.
- On December 11, 2017, the GWE&TS shutdown due to a high fluid alarm at AST-1. The NYSDEC Remedial Services Contractor responded on the same day to reset and restart the system.

3.2 Evaluation of O&M Activities

General Facility Evaluation

General facility maintenance activities were completed as needed and as specified in the Site Management Plan (SMP) for the Site. Overall, the scope of services for general facility maintenance activities is considered satisfactory.

GWE&TS Inspection and Operation Evaluation

A summary of the minimum operating requirements for the major GWE&TS components is provided below:

- Extraction wells: The design flow rate for extraction wells RW-1 and RW-2 is 100 gpm. However, based on information presented in the Active Industrial Final Design documents, dated March 2000, containment of the chlorinated plume could be achieved with the on-site extraction well pumping at a minimum of 80% of the design flow rate of 100 gpm (80 gpm).
- Packed-tower air strippers: The design of the packed-tower air strippers is based on the removal of influent contaminant concentrations at the design combined flow rate of 200 gpm and a maximum PCE concentration of 5,900 ug/l, to concentration levels below the specified site-specific effluent limits. As described in Section 1.0, a revised SPDES permit equivalency was issued for the Site by the NYSDEC Division of Water/Bureau of Water Permits on February 12, 2013. The revised permit equivalency is provided in ***Appendix D***.
- Pressure blower: The design flow rate for the pressure blower is a maximum of 1,350 cubic feet per minute (CFM). The pressure blower operated at an average of approximately 1,104 CFM throughout this reporting period.

The GWE&TS was brought back on-line on April 26, 2017, as such a summary of the GWE&TS operating conditions, including average influent pumping rates, flow volumes and total VOC concentrations; total effluent flow volumes and total VOC concentrations; and total VOC removals and efficiencies are provided on Table 3-2.

As summarized on Table 3-2, RW-1 has been operating at an average flow rate of between 48.09 gpm and 56.17 gpm (averaging approximately 52 gpm while operating). The GWE&TS treated and discharged approximately 20,281,415 gallons of contaminated groundwater and removed approximately 10 pounds of total VOCs throughout this reporting period.

Table 3-2: Treatment System Performance Summary

Parameter	Quarter 49 (January 1, 2017 through March 31, 2017)[1]	Quarter 50 (April 1, 2017 through June 30, 2017)	Quarter 51 (July 1, 2017 through September 30, 2017)	Quarter 52 (October 1, 2017 through December 31, 2017)
Influent				
RW-1 Average Pumping Rate (gpm)	50.34	54.42	56.17	48.09
RW-1 Total Flow Volume (gal)	359,452	4,819,668	6,452,258	6,231,083
Maximum Total Influent VOC Concentration (ug/l)	0.91	37	81.3	108.8
Effluent[1]				
Effluent Total Flow Volume (gal)	347,200	5,713,090	7,332,005	6,889,120
Maximum Total Effluent VOC Concentration (ug/l)	NA	3.1	1.39	1.24
VOC Removal Summary				
Total VOC Removal (lbs)[2]	0.01	1.47	3.58	4.55
Average Total VOC Removal Rate (lbs/hr)	5.82E-05	9.99E-04	1.87E-03	2.11E-03
Average Total VOC Removal Efficiency (%)	NA	91.56-98.87%	98.29-99.22%	98.87 - 99.34%

Notes:
NA: Not applicable.

1. As the GWE&TS was not operating throughout the majority of Quarter 49 (January 2017 through March 2017) no aqueous-phase influent or effluent samples were collected throughout that reporting period; however, the NYSDEC Remedial Services Contractor collected a groundwater sample from extraction well RW-1 as part of the quarterly groundwater monitoring event for VOC analysis only, per the NYSDEC.
2. The total annual VOC removal is approximately 10 lbs for this reporting period.

GWE&TS Downtime Evaluation

As previously discussed, the GWE&TS was restarted on April 26, 2017. As such, the GWE&TS experienced a total of 129 days (approximately 3,096 hours) of downtime throughout this reporting period, as compared to approximately 361 days (approximately 8,665 hours) of downtime reported during the previous reporting period.

D&B performed a system evaluation and provided recommendations to the NYSDEC in March 2017, regarding system repairs and modifications in support of restarting the GWE&TS. The recommendations were implemented by the NYSDEC Remedial System Contractor and ALM Systems, a subcontracted controls integrator under the oversight of D&B, subsequently the GWE&TS was brought back on-line on April 26, 2017. Following the GWE&TS restart in April 2017, some downtime occurred throughout this reporting period due to several alarm conditions and equipment malfunctions. Downtime and associated non-routine maintenance and/or alarm events are detailed on Table 3-3.

Table 3-3: Runtime/Downtime Evaluation

Time Period	TOTAL HOURS IN QUARTER	RUNTIME		DOWNTIME		TOTAL NUMBER OF ALARM EVENTS	Downtime Description
		HOURS	PERCENT OF TOTAL TIME PERIOD	HOURS	PERCENT OF TOTAL TIME PERIOD		
Quarter 49 (January 1, 2017 through March 31, 2017)	2,160	114	5.3%	2,046	94.7%	1	On March 13, 2017, D&B was on-site for a system inspection and found the system off due to general alarm caused by a freeze up at AST-1. Per the NYSDEC's direction the system was left off pending completion of additional system repairs.
Quarter 50 (April 1, 2017 through June 30, 2017)	2,184	1,476	67.6%	708	32.4%	2	On April 29, 2017, the GWE&TS shut down due to a "high pressure" condition caused by pressure build up in the pump at RW-1. The NYSDEC Remedial Services Contractor reset and restarted the system on May 1, 2017. On June 19, 2017, the GWE&TS shut down due to a "low-voltage" condition caused by thunderstorms in the area. The NYSDEC Remedial Services Contractor reset and restarted the system on June 20, 2017.
Quarter 51 (July 1, 2017 through September 30, 2017)	2,208	1,915	86.7%	293	13.3%	4	On July 3, 2017, the GWE&TS shut down due to a high sump alarm in the floor sump. The NYSDEC Remedial Services Contractor pumped out the floor sump, reset and restarted the GWE&TS on July 5, 2017; however, later the same day the GWE&TS failed due to a similar alarm, a high sump alarm at the floor sump. The system was left off pending troubleshooting activities on July 6, 2017. On July 6, 2017, the NYSDEC Remedial Services Contractor attempted to restart the GWE&TS; however, due to suspected mechanical issues at the sump pump and a suspected leak from the potable water sink, the system went back down and remained off. The NYSDEC Remedial Services Contractor returned to Site on July 7, 2017, to complete troubleshooting activities, where it was identified that a leaking check valve was allowing extracted groundwater to fill the sump. Per D&B's request the NYSDEC Remedial Services Contractor isolated the line by closing a ball valve and restarted the GWE&TS. On August 18, 2017, the NYSDEC Remedial Services Contractor received a general systems alarm. The NYSDEC Remedial Services Contractor reset and restarted the system upon departure on August 21, 2017. On August 30, 2017, the NYSDEC Remedial Services Contractor responded to a high water level alarm at AST-1. The NYSDEC Remedial Services Contractor attempted to reset and restart the system on the same day; however, due to a similar alarm the GWE&TS failed later the same day. The NYSDEC Remedial Services Contractor returned to Site on August 31, 2017, to reset and restart the system. On September 14, 2017, the GWE&TS shut down due to a high sump alarm at the floor sump. The NYSDEC Remedial Services Contractor responded on September 15, 2017, while on-site the technician attempted to reset and restart the system; however, due to an identified leak in a ball valve on the effluent line between transfer pumps the system was left off pending repair activities. On September 18, 2017, the NYSDEC Remedial Services Contractor returned to the Site to replace the valve with a section of pipe and restarted the GWE&TS upon departure.

Table 3-3: Runtime/Downtime Evaluation (cont.)

Time Period	TOTAL HOURS IN QUARTER	RUNTIME		DOWNTIME		TOTAL NUMBER OF ALARM EVENTS	Downtime Description
		HOURS	PERCENT OF TOTAL TIME PERIOD	HOURS	PERCENT OF TOTAL TIME PERIOD		
Quarter 52 (October 1, 2017 through December 31, 2017)	2,208	2,159	97.8%	49	2.2%	3	On October 29, 2017, the GWE&TS shut down due to a low air flow alarm. The NYSDEC Remedial Services Contractor responded on October 30, 2017, to reset and restart the system. On December 3, 2017, the GWE&TS shutdown due to a general alarm caused by power outage at the Site. The NYSDEC Remedial Services Contractor responded on December 4, 2017, to reset and restart the system. On December 11, 2017, the GWE&TS shutdown due to a high fluid alarm at AST-1. The NYSDEC Remedial Services Contractor responded on the same day to reset and restart the system.
Total	***8,760***	***5,664***	***64.7%***	***3,096***	***35.3%***	***10***	

Groundwater Monitoring Well Condition Summary

All groundwater monitoring wells and extraction wells RW-1 and RW-2 were located as indicated on the Site map and found to be accessible during the groundwater monitoring sampling events completed during this reporting period. All monitoring well concrete well pads, protective casings, surface seals, PVC well risers, well plugs and locks were observed to be present and in good condition; with the exception of,

- A lock is not functional or not present at monitoring wells MW-103 through MW-108, MW-2S, MW-5S, MW-4D and extraction wells RW-1 and RW-2 and should be replaced,
- manhole bolts for MW-102, MW-104 through MW-107 and MW-5S need to be replaced or repaired,
- the manhole vault eyelets at monitoring wells MW-2S and MW-107 are stripped and should be replaced,
- a manhole skirt at MW-103 needs to be replaced or repaired as the skirt is separating from the cover; and
- the dome cap at extraction well RW-2 is reported to be cracked and should be replaced.

Monitoring well inspection forms are provided in ***Appendix E***.

4.0 MONITORING PLAN COMPLIANCE

4.1 Monitoring Requirements and Compliance Status

The monitoring scope of services for the GWE&TS consists of system monitoring activities and groundwater monitoring well network monitoring activities completed in accordance with the requirements of the SMP, unless otherwise noted. Presented below is a summary of each monitoring activity performed throughout this reporting period, as well as associated performance standards, a performance evaluation and associated compliance status, as appropriate.

GWE&TS Monitoring Activities

GWE&TS monitoring activities typically performed include the sampling of the various system processes to monitor overall VOC removal efficiencies, while at the same time, ensuring that all GWE&TS discharges are below applicable standards and/or discharge limits. A summary of the routine GWE&TS monitoring analytes and their typical frequencies of completion are provided below on Table 4-1.

Groundwater Monitoring Activities

Groundwater monitoring activities performed throughout this monitoring period included the sampling of ten on-site groundwater monitoring wells (MW-101 through MW-108, MW-4D and MW-5S) and three off-site groundwater monitoring

wells (MW-109, MW-111 and MW-2S), as well as extraction well RW-2 for VOCs by Method 8260. Additionally, per the request of the NYSDEC, all on-site and off-site groundwater monitoring wells were sampled for polyfluoroalkyl substances (PFAS) and 1,4-dioxane, as detailed below.

As detailed above, extraction well RW-2 was shut down in April 2010 based on low contaminant concentrations, and is currently being monitored on a quarterly basis with the monitoring wells.

Groundwater monitoring activities consist of the collection and analysis of samples from each of these fourteen wells on a quarterly/semiannual basis, as per the frequencies summarized on Table 4-1. Groundwater monitoring well locations are provided in Figures 2-2 and 2-3.

Data Analysis

All groundwater and GWE&TS aqueous-phase influent and effluent samples collected during this reporting period were submitted to Test America Laboratories, Inc. (TAL) for analysis. TAL is a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory. As previously discussed, nine aqueous-phase influent and effluent samples were collected this reporting period for VOC and metal analysis. Vapor-phase effluent samples were collected on two occasions throughout this reporting period on June 1, 2017 and December 1, 2017, as the GWE&TS was operating for the vast majority of this reporting period.

Table 4-1: Treatment System and Groundwater Sampling Summary

Sampling Location	Sampling Frequency			Analytical Parameters				
	Monthly	Quarterly	Semi-Annual	VOC (EPA Method 8260B)	VOC (EPA Method TO-15)	TAL Metals (EPA Method 6010B)	pH (EPA Method 9040)(1)	TDS (EPA Method 160.1 or SM 2540C)
Extraction Well RW-1 (2)	✓			✓		✓		
Extraction Well RW-2(3)	✓			✓		✓		
Combined Influent (4)								
Air Stripper Aqueous-phase Effluent	✓			✓		✓	✓	✓
Air Stripper Vapor-phase Effluent(5)(6)			✓		✓			
Groundwater Monitoring Wells MW-103 through MW-107, MW-2S, MW-4D, MW-5S and RW-2		✓		✓				
Groundwater Monitoring Wells MW-101, MW-102, MW-108, MW-109 and MW-111			✓	✓				

Notes:
1. Field analysis.
2. As the GWE&TS was not operating throughout the vast majority of Quarter 49 (January 2017 through March 2017), one sample was collected from RW-1 for VOC analysis only as part of the routine quarterly groundwater monitoring event, as per NYSDEC direction. Following system start up on April 26, 2017, aqueous-phase influent samples were collected from extraction well RW-1 on a monthly routine basis as part of the system sampling events.
3. As described above, extraction well RW-2 was shut down in April 2010, and has generally remained off since this time, based on low historic VOC concentrations, as per NYSDEC direction. As RW-2 is not currently operating, monthly samples are not collected from this extraction well. RW-2 is currently being sampled on a quarterly basis, as part of the quarterly groundwater sampling effort.
4. Combined influent analysis is not collected when only one extraction well is operating.
5. In addition to the laboratory analysis, total VOC concentrations in vapor-phase are monitored on a monthly basis utilizing a PID.
6. Two vapor-phase effluent system samples were collected this reporting period, on June 1, 2017 and December 1, 2017.

All data packages were reviewed for completeness and compliance with NYSDEC Analytical Services Protocol (ASP) Quality Assurance/Quality Control (QA/QC) requirements. Any QA/QC issues arising with the sample results were qualified in the Active Industrial quarterly monitoring reports. Copies of all tabulated analytical data generated throughout this reporting period are provided in ***Appendix F***. Copies of all Data Validation Checklists are provided in ***Appendix G***.

4.2 GWE&TS Performance Standards and Compliance Status

Aqueous-Phase Discharge Standards and Compliance Status

The treated groundwater discharged from the GWE&TS is pumped via underground piping to Little Neck Creek. This discharge is authorized by the NYSDEC under a SPDES permit equivalency, which provides for site-specific VOCs, metals, pH and wet chemistry parameter discharge limits. As described in Section 1.0, a revised SPDES permit equivalency was issued for the Site by the NYSDEC Division of Water/Bureau of Water Permits on February 12, 2013. The revised permit equivalency is provided in ***Appendix D*** .

Based on the analytical data, all analytes in the treated groundwater discharged from the GWE&TS were in compliance with all SPDES equivalency requirements throughout this reporting period, with the exception of one lead exceedance, as detailed below.

- Lead was detected at a concentration of 11.3 ug/l on July 26, 2017, in exceedance of the site-specific aqueous-phase effluent limit of 8.0 ug/l. The NYSDEC was notified of this exceedance.

Vapor-Phase Discharge Standards and Compliance Status

The GWE&TS vapor-phase discharge is authorized by the NYSDEC under an air discharge permit equivalency, which provides for site-specific discharge parameters. A copy of the air discharge permit equivalency document and a summary of site-specific vapor-phase discharge limits, as included in the site-specific O&M Plan, are provided in ***Appendix H***. In addition, a site-specific total VOC effluent limit of 0.5 lbs/hr was developed in consultation with the NYSDEC and is utilized as a means to monitor total vapor-phase VOCs discharged by the GWE&TS.

Two vapor-phase effluent system samples were collected on June 1, 2017 and December 1, 2017. VOCs were not detected at concentrations exceeding their respective site-specific vapor-phase discharge limits during this reporting period. The site specific total vapor-phase VOC discharge limit of 0.5 lbs/hr was not exceeded during this reporting period.

4.3 GWE&TS Performance Evaluation

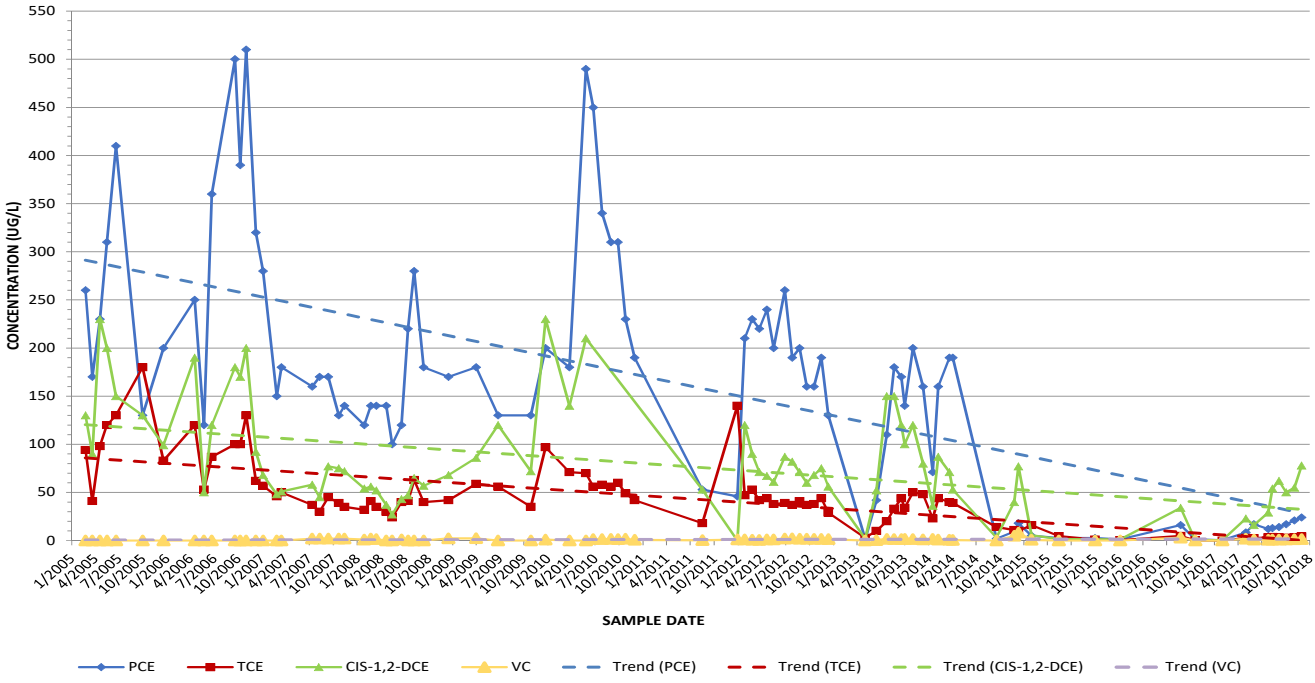
Groundwater Treatment Performance

Based on the influent sample results for this reporting period, RW-1 influent total VOC concentrations ranged from a low of 0.91 micrograms per liter (ug/l) to a high of 108.78 ug/l, detected on December 1, 2017. Cis-1,2-DCE and PCE have been detected at concentrations in RW-1 influent groundwater above their applicable NYSDEC Class GA Standards throughout this reporting period. A graph depicting the concentrations of PCE, TCE, cis-1,2-DCE and VC in extraction well RW-1 since D&B assumed O&M duties in February 2005 through the end of this reporting period, is provided as Figure 4-1. As shown on Figure 4-1, historically PCE was the predominant site-specific VOC detected in RW-1 influent groundwater; however, during this reporting period cis-1,2-DCE was the predominant site-specific VOC detected.

All site-specific VOC contaminants of concern have exhibited generally decreasing trends since D&B assumed Site management duties in February 2005, as depicted in Figure 4-1 below.

Figure 4-1

Historical Results of RW-1 Influent Analysis – Site Specific VOCs



Based on the influent sample results for this reporting period, PCE concentrations in extraction well RW-1 influent ranged from 0.39 ug/l to a maximum concentration of 24 ug/l, which was detected on December 1, 2017. Cis-1,2-DCE ranged from 0.53 ug/l to a maximum concentration of 78 ug/l, which was detected on December 1, 2017. Contaminants of concern TCE and VC exhibited concentrations below their SCGs of 5 ug/l and 2 ug/l throughout this reporting period. It should be noted that several other VOCs, including methyl tert-butyl ether (MTBE) and trans-1,2-dichloroethene were detected at generally low levels and well below their respective Class GA Standards in extraction well RW-1.

Total VOC results during this reporting period in extraction well RW-1 exhibited an increasing trend; however, since start up in 2005 RW-1 total VOC concentrations have exhibited a decreasing trend. As discussed in Section 4.2, the GWE&TS has effectively been treating the extracted groundwater to below the required aqueous-phase effluent standards,with the exception of one lead exceedance. Approximately 10 pounds of VOCs were removed from the extracted groundwater during this reporting period. A summary of the GWE&TS performance results for the reporting period is provided on Table 3-2.

Vapor Phase Treatment Performance

PID readings collected from the vapor-phase effluent ranged from 0 ppm to 0.1 ppm during this reporting period.

Vapor-phase effluent samples were collected on two occasions during this reporting period on June 1, 2017 and December 1, 2017. Sample results corresponded to total VOC emissions of 6.91E-02 lbs/hr and 3.46E-03 lbs/hr respectively, well below the site-specific maximum total VOC emissions limit of 0.5 lbs/hr. Additionally, no VOCs were detected at concentrations exceeding their respective site-specific vapor-phase discharge limits during this reporting period.

TABLE 4.2 - Vapor-phase Air Stripper Effluent Concentrations Summary			
SAMPLE	**JUNE 1, 2017**	**DECEMBER 1, 2017**	**Site-Specific Limits**
PCE	0.000413 lbs/hr	0.000541 lbs/hr	0.007 lbs/hr
TCE	0.000063 lbs/hr	0.000087 lbs/hr	0.006 lbs/hr
Total Xylenes	0.000016 lbs/hr	0.000324 lbs/hr	0.001 lbs/hr
1,2-DCE (total)	ND	0.00195 lbs/hr	0.003 lbs/hr
VC	0.000017 lb/hr	0.000027 lbs/hr	0.014 lbs/hr
1,1,1-TCA	ND	ND	0.001 lbs/hr
Total VOC Concentrations (field screening with PID) [2]	0.0 ppm	0.1	NA
Maximum Total VOC Emissions[3]	0.06909 lbs/hr	0.00346 lbs/hr	0.5 lbs/hr

ND: Constituent concentration below the analytical detection limit. NA: Not applicable.
PID: Photoionization Detector
Red font denotes an exceedance of the applicable site-specific limit.

1. Vapor-phase effluent samples for laboratory analysis are collected on a semi-annual basis throughout this reporting period on June 1, 2017 and December 1, 2017.
2. The total VOC concentrations observed this reporting period were well below the Site-Specific Maximum Total VOC Emissions Limit.
3. The Site-Specific Maximum Total VOC Emissions Limit of 0.5 lbs/hr was developed in consultation with the NYSDEC and is utilized as a means to monitor total vapor-phase VOCs emitted by the GWE&TS.

4.4 Groundwater Monitoring Well Network Evaluation

On-Site Monitoring Well Network (MW-101 through MW-108, MW-4D and MW-5S)

A summary of the site-specific VOCs (PCE, TCE, cis-1,2-DCE and VC) detected throughout this reporting period in each of the ten on-site groundwater monitoring wells is provided below. The Class GA Standard for PCE, TCE and cis-1,2-DCE is 5 ug/l and the Class GA Standard for VC is 2 ug/l. Note that contaminant concentrations detected in exceedance of the Class GA Standards are presented on graphs provided in hyperlinks below.

- MW-101 (screened at 5 to 15 feet below grade): Concentrations of site-specific VOCs have been detected at concentrations well below their respective Class GA Standards throughout this reporting period.
- MW-102 (screened at 5 to 15 feet below grade): Concentrations of site-specific VOCs have been detected at concentrations below their respective Class GA Standards throughout this reporting period.
- ***MW-103*** (screened at 5 to 15 feet below grade): Concentrations of site-specific VOCs have generally been detected at concentrations below their respective Class GA Standards during previous reporting periods; however, it should be noted that monitoring well MW-103 has exhibited an increasing trend throughout the last two year period. Three site-specific contaminants were detected at concentrations exceeding the Class GA Standards during this reporting period: PCE, cis-1,2-DCE and VC, as follows:
  - PCE was detected at a concentration of 6.2 ug/l on January 19, 2017, exceeding its respective Class GA Standards of 5.0 ug/l.
  - Cis-1,2-DCE was detected at a concentration of 180 ug/l on January 19, 2017, exceeding its respective Class GA Standards of 5.0 ug/l.
  - VC was detected at concentrations of 29 ug/l on January 19, 2017, exceeding its respective Class GA Standards of 2.0 ug/l.
- ***MW-104*** (screened at 5 to 15 feet below grade): Site-specific VOCs have been consistently detected at concentrations in exceedance of the Class GA Standards in MW-104. Note that the site-specific contaminants within monitoring well

MW-104 have steadily decreased since D&B assumed O&M duties in February 2005. PCE was detected in exceedance of the respective Class GA Standards, as follows:

- PCE was detected at concentrations ranging from 20 ug/l to 49 ug/l, with the maximum concentration detected on April 24, 2017. PCE has generally exhibited a slightly decreasing trend, as compared to the previous reporting period.

- ***MW-105*** (screened at 5 to 15 feet below grade): Concentrations of site-specific VOCs have generally been detected at concentrations below their respective Class GA Standards during recent previous reporting periods; however, it should be noted that MW-105 has exhibited an increasing trend in total contaminants of concern throughout the last two year period. Three site-specific contaminants were detected at concentrations exceeding the Class GA Standards during this reporting period: PCE, cis-1,2-DCE and VC, as follows:
  - PCE was detected at concentrations ranging from 1.4 ug/l to 14 ug/l, with the maximum concentration detected on January 19, 2017.
  - Cis-1,2-DCE was detected at concentrations ranging from non-detect to 260 ug/l, with the maximum concentration detected on April 24, 2017.
  - VC was detected at concentrations ranging from non-detect to 27 ug/l, with the maximum concentration detected on April 24, 2017.
- ***MW-106*** (screened at 5 to 15 feet below grade): Site-specific VOCs have generally been detected at concentrations in exceedance of the Class GA Standards throughout this reporting period and since D&B assumed O&M duties in February 2005. PCE, TCE, cis-1,2-DCE and VC have been detected in exceedance of their respective Class GA Standards, as follows:
  - PCE was detected at concentrations ranging from 6.7 ug/l to 17 ug/l, with the maximum concentration detected on April 24, 2017. Overall, PCE concentrations have exhibited a decreasing trend since February 2005.
  - TCE was detected at concentrations ranging from 4.9 ug/l to 9.1 ug/l, with the maximum concentration detected on January 19, 2017. Overall, TCE concentrations have exhibited a stable trend since the previous reporting period, and an overall decreasing trend since February 2005.
  - Cis-1,2-DCE was detected at concentrations ranging from 27 ug/l to 420 ug/l, with the maximum concentration detected on July 3, 2017. Overall, cis-1,2-DCE concentrations have exhibited an increasing trend throughout this reporting period; however, an overall decreasing trend since February 2005.
  - VC was detected at concentrations ranging from 3.1ug/l to 49 ug/l, with the maximum concentration detected on July 3, 2017. Overall, VC concentrations have exhibited an increasing trend throughout this reporting period, and a generally decreasing trend since February 2005.
- MW-107 (screened at 5 to 15 feet below grade): Concentrations of site-specific VOCs have been detected at concentrations below their respective Class GA Standards throughout this reporting period, similar to the previous reporting period.
- ***MW-108*** (screened at 5 to 15 feet below grade): Site-specific VOCs have generally been detected at concentrations below the Class GA Standards throughout this reporting period, with the exception of PCE. PCE was detected at a concentration of 6.9 ug/l on January 19, 2017. Overall, PCE concentrations have exhibited a stable trend throughout this reporting period and since February 2005.
- ***MW-4D*** (screened at 60 to 70 feet below grade): Site-specific VOCs have been detected at concentrations in exceedance of their Class GA Standard since this well was added to the routine groundwater monitoring list in June 2012. PCE, TCE and cis-1,2-DCE exceedances detected during this reporting period are as follows:
  - PCE was detected at concentrations ranging from 350 ug/l to 4,500 ug/l, with the maximum concentration detected on October 6, 2017. Overall, PCE concentrations have exhibited an increasing trend throughout this reporting period.
  - TCE was detected at concentrations ranging from 54 ug/l to 580 ug/l, with the maximum concentration detected on October 6, 2017. Overall, TCE concentrations have exhibited an increasing trend throughout this reporting period.

- Cis-1,2-DCE was detected at concentrations ranging from 9.1 ug/l to 78 ug/l, with the maximum concentration detected on October 6, 2017. Overall, cis-1,2-DCE concentrations have exhibited an increasing trend throughout this reporting period.

- MW-5S (screened at 14 to 24 feet below grade): MW-5S has been sampled as part of D&B's work assignment since June 2010. Site-specific VOCs have been detected at concentrations below their respective Class GA Standards throughout this reporting period and have exhibited generally stable trends since June 2010.

In general, site-specific VOCs have shown a decreasing trend in the majority of on-site monitoring wells since the previous reporting period and since D&B assumed Site management duties in February 2005. Consistent with the previous reporting period, monitoring well MW-4D exhibited elevated concentrations of PCE and TCE. It should also be noted that site-specific VOC concentrations in MW-4D have been detected at widely varying concentrations since 2012.

Monitoring well MW-4D is screened at a depth of approximately 60 to 70 feet below grade, approximately 30 feet deeper than on-site extraction well RW-1 and the site-wide monitoring well network. It should be noted that the Gardiners Clay is located below the Site at a depth of approximately 70 feet below grade and is likely acting as a lower "confining unit" for the groundwater plume. Based on the relatively dense nature of chlorinated solvents, the groundwater plume may be "pooling" or migrating along the top of the Gardiners Clay.

Off-Site Monitoring Well Network (MW-109, MW-111, MW-2S and RW-2)

A summary of the site-specific VOCs (PCE, cis-1,2-DCE, TCE and VC) detected during this reporting period in each off-Site groundwater monitoring well located downgradient of the GWE&TS and extraction well RW-2 are provided below. Contaminant concentrations detected in exceedance of the Class GA Standards are presented on graphs provided in the hyperlinks below.

- MW-109 (screened at 25 to 35 feet below grade): Monitoring well MW-109 is located approximately 1,800 feet south of the Site. Site-specific VOCs have been detected at concentrations below their respective Class GA Groundwater Standards from June 2006 through the end of this reporting period.
- MW-111 (screened at 25 to 35 feet below grade): Monitoring well MW-111 is located approximately 580 feet southwest of the Site. Site-specific VOCs have been detected at concentrations below their respective Class GA Standards since start-up of the GWE&TS and through the end this reporting period.
- ***MW-2S*** (screened at 12 to 22 feet below grade): Monitoring well MW-2S is located approximately 220 feet south of the Site. Site-specific VOCs (primarily including PCE and cis-1,2-DCE) have consistently been detected at concentrations in exceedance of their respective Class GA Standards from when this well was added to the routine groundwater monitoring list (September 2008) through the end of this reporting period. PCE, cis-1,2-DCE and VC exceedances during this reporting period are as follows:
  - PCE was detected at concentrations ranging from 1.7 ug/l to 61 ug/l, with the maximum concentration detected on July 3, 2017. Overall, PCE has exhibited an increasing trend over the last two year period.
  - Cis-1,2-DCE was detected at concentrations ranging from 11 ug/l to 82 ug/l, with the maximum concentration detected on October 16, 2017. Overall, cis-1,2-DCE concentrations have fluctuated greatly over the past several years.
  - VC was detected at concentrations ranging from 0.72 ug/l to 2.9 ug/l, with the maximum concentration detected on July 3, 2017. Overall, VC has exhibited an increasing trend over the past several years.
- ***RW-2*** (screened at 12 to 37 feet below grade): Extraction well RW-2 is located approximately 1,500 feet southwest of the Site. As detailed above, RW-2 is now monitored on a quarterly basis with the site-wide monitoring wells due to generally low contaminant concentrations. It should be noted that site-specific VOC concentrations were observed to be erratic during previous reporting periods; however, concentrations of all site-specific VOCs have decreased in RW-2, and have remained generally stable throughout this reporting period. Throughout this reporting period, site specific contaminants of concern were detected below their Class GA Groundwater Standards.

Additionally, per the request of the NYSDEC, all on-site and off-site groundwater monitoring wells (MW-101 through MW-109, MW-111, MW-4D, MW-5S, MW-2S and RW-2) were sampled for polyfluoroalkyl substances (PFAS) and 1,4-dioxane as part of the site-wide groundwater sampling event in Quarter 51 (July through September 2017). ***Appendix F*** presents tabulated analytical results for 1,4-dioxane and PFAS.

5.0 INSTITUTIONAL CONTROL/ENGINEERING CONTROL (IC/EC) CERTIFICATION PLAN

The intent of this section is to provide a description of the Institutional and Engineering Controls (IC/ECs) in place for the Site, as well as the mechanisms used to monitor and enforce these controls.

Institutional Controls

By definition, an IC is any non-physical means for enforcing restriction on the use of real property that limits human health and environmental exposure, restricts the use of groundwater, provides notice to potential owners, operators, or member of the public, or prevents action that would interfere with the effectiveness and/or integrity of operation, maintenance and monitoring activities at or pertaining to a remedial Site.

ICs in the form of a groundwater use restriction and land-use restriction are mandatory controls required for the Site as per the site-specific ROD dated March 1997. A copy of the Declaration of Covenant and Restrictions for the Active Industrial Uniform property was obtained from the NYSDEC, which is provided in ***Appendix I***. The Covenant certifies that ICs, including land and groundwater use restrictions, are in place at the Site and ensures that the current owner and any future property owners are aware of these site-specific restrictions until no longer deemed necessary by the NYSDEC. In addition, a copy of the deed for the Active Industrial Uniform property was obtained from the Suffolk County Clerk's Office and a freedom of information request was submitted to the Village of Lindenhurst. A copy of this documentation is provided in ***Appendix J***. Property owner certifications are provided in ***Appendix K***. On-site groundwater restrictions will remain in-place and the use of the property has been and will continue to be restricted to operation of the GWE&TS only. No changes have been made to the property during this reporting period.

Engineering Controls

By definition, an EC is any physical barrier or method employed to actively or passively contain, stabilize or monitor contamination, restrict the movement of contamination to ensure long-term effectiveness of a remedial program or eliminate potential exposure pathways to contamination. The GWE&TS and associated monitoring well network, fencing and security signage are the ECs currently in-place at the Site. The Site fencing and security signage are currently in-place and functioning properly. The GWE&TS has generally operated in accordance with the design standards throughout the majority of this reporting period, with the exception of one isolated aqueous-phase effluent exceedance for lead on July 26, 2017.

A copy of the completed IC/EC Certification form, as provided by the NYSDEC, is included as ***Appendix L***.

6.0 GREEN REMEDIATION PLAN

In accordance with the NYSDEC's DER-31 Green Remediation policy, the following section provides a qualitative assessment of the overall environmental impacts or "footprint" associated with the operation of the GWE&TS. In addition, recommendations are provided in order to minimize the environmental impacts of the remedy.

6.1 Qualitative Overview of Environmental Impacts

Electric Usage

The GWE&TS currently obtains 100% of its electricity from the local electric utility, PSEG Long Island (PSEG). Based on publicly available information, PSEG currently supplies electricity from a variety of fuel sources, including fossil fuels (46%), nuclear (11%), refuse burning (4%) and renewables (3%). The remaining 35% of its electric is supplied from other outside electric utilities. Electricity usage associated with the GWE&TS while operating is mainly attributed to operation of the submersible pump within extraction well RW-1, the pressure blower and the effluent transfer pump. Minor electricity usage can also be attributed to building and Site lighting, building HVAC and system controls, as well as the electric heaters utilized in the winter months.

Based on a review of the electric utility bill summary for this reporting period provided by the NYSDEC, the GWE&TS used a total of approximately 53,560 kilowatt-hours (KWH) of electricity, at an average of 147 KWH/day. It should be noted that the average electricity usage during the previous reporting period (January 2016 through December 2016) was 36 KWH/day. This increase in electric usage is due to the system being restarted this reporting period.

Fossil Fuel Usage

The GWE&TS was designed to use fossil fuels (e.g., natural gas) for the operation of the building heaters. However, note that the building heaters were historically not functioning. The building heaters were repaired on May 8, 2017, of this reporting period. In addition, fossil fuels are indirectly used during the completion of maintenance and monitoring activities associated with the overall operation of the GWE&TS.

Fossil fuel use results from completion of the following Site-related activities:

- Operation of the natural gas building heaters.
- Transportation to and from the Site for monitoring, sampling and system alarm response/non-routine maintenance.
- Operation of a portable generator to power a submersible pump for groundwater monitoring well sampling activities.
- Off-site transportation and shipment of samples collected for laboratory analysis.
- Disposal of waste generated at the Site.

Water Usage

The GWE&TS does not directly use water for operation. However, as the GWE&TS building is connected to the Suffolk County Public Water Supply, a nominal amount of water was utilized during the completion of maintenance and monitoring activities associated with the GWE&TS and groundwater monitoring well network.

Air Emissions

Vapor-phase discharge from the packed-tower air strippers is released directly to the atmosphere. As previously discussed, vapor-phase effluent samples were collected on June 1, 2017 and December 1, 2017, as the GWE&TS was operating for the majority of this reporting period. Contaminant concentrations within vapor-phase discharge were well below the Site-specific discharge limits, as discussed above. While the GWE&TS is in operation, the vapor-phase discharge is monitored on a routine basis to prevent or limit any vapor-phase contaminant concentration exceedance events.

Monitoring and maintenance activities associated with the GWE&TS also result in indirect emissions to the air through the off-site generation of electricity utilized to power the GWE&TS and the combustion of fossil fuels, as discussed above.

Consumption of Materials and Generation of Waste

Monitoring, maintenance and reporting activities associated with the GWE&TS result in material consumption and the generation of waste. A summary of the current material consumption and waste generation activities for the GWE&TS are summarized below:

- Personal protective equipment associated with GWE&TS and groundwater sampling, such as nitrile gloves and hearing protection, etc.
- Polyethylene tubing associated with groundwater sampling.
- Packaging material and ice used to pack and preserve samples to be submitted for laboratory analysis.
- Florescent light bulbs for building lighting.
- Paper and office supplies associated with GWE&TS Site logs, monitoring logs and report preparation.
- Repair and replacement of equipment associated with the GWE&TS, such as transfer pumps and gauges, etc.
- Consumable GWE&TS materials such as, air stripper packing material.

7.0 COST EVALUATION

The total cost of operation of the GWE&TS from January 1, 2017 through December 31, 2017, was approximately $189,560. It should be noted that this total does not include any administrative costs incurred by the NYSDEC in support of this project throughout this reporting period. This total includes engineering and subcontractor costs, as well as utility costs associated with the operation of the GWE&TS (electric, telephone, natural gas and water). A review of these costs is provided on Table 7-1. The following provides a brief review of each cost item:

- Subcontractors include the NYSDEC Remedial Services Contractor, analytical laboratory and maintenance contractors associated with the routine/non-routine maintenance of the GWE&TS. As summarized on Table 7-1, subcontractor costs were approximately 43% of the total costs for this reporting period.
- Engineering costs include effort invoiced in association with project management, report preparation, project planning and other office-related work items. As summarized on Table 7-1, engineering costs were approximately 48% of the total costs for this reporting period.
- Utilities consumed in support of the overall operation of the GWE&TS include electric, telephone, gas and water. As summarized on Table 7-1, utility costs were approximately 9% of the total costs for this reporting period, primarily due to electric usage.

Based on the total cost of $189,560 incurred during this reporting period, with the average monthly cost of approximately $15,797. The majority of this overall cost was the result of ongoing GWE&TS maintenance completed by the NYSDEC Remedial Services Contractor. As the GWE&TS was restarted on April 26, 2017, and operational for the majority of this reporting period with the exception of some downtime, the cost per pound removed is $19,725 based on a total of 9.61 lbs removed. As summarized on Table 3-2.

Table 7-1: Treatment System Cost Summary

COST ITEM	BUDGET EXPENDED (January 1, 2017 THROUGH December 31, 2017)	PERCENT OF TOTAL
ENGINEERING SUPPORT		
D&B Engineers and Architects, P.C.	$90,254	47.61%
SUBCONTRACTORS		
NYSDEC Remedial Services Contractor[1] (Routine/Non-Routine Maintenance Activities)	$70,923	37.41%
Test America (Analytical Laboratory)	$11,399	6.01%
SUB-TOTAL	$82,322	43.43%
UTILITIES		
Electric	$15,253	8.05%
Telephone	$751	0.40%
Natural Gas	$551	0.30%
Water	$429	0.23%
SUB-TOTAL	$16,984	9.0%
TOTAL COSTS	$189,560	100%
AVERAGE COST/MONTH	$15,797	8.33%
COST/POUND OF VOC REMOVED[2]	$19,725	

Notes:
1. Remedial Services contractor costs do not include utility costs.
2. As the GWE&TS was operating for the majority of this reporting period, 9.61 lbs of VOCs were removed throughout this reporting period.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

Based on the evaluation of the GWE&TS performance, effectiveness and protectiveness throughout this reporting period, and as detailed in the preceding sections, the following conclusions have been established:

Operation and Maintenance

- O&M Plan Requirements and Compliance: As noted in Section 3.0, the O&M scope of services was performed in accordance with the requirements of the site-specific O&M Plan, dated April 2002 and September 2012 SMP, revised January 2014 with the exception of routine maintenance of the pressure blower and transfer pump.
- GWE&TS Downtime: The GWE&TS was shut down throughout this reporting period a total of 129 days (or 3,096 hours). The GWE&TS was restarted on April 26, 2017, of this reporting period following troubleshooting activities and system modifications in March 2017. Some downtime occurred following the GWE&TS restart due to alarm conditions and equipment malfunctions; however, the GWE&TS was operating for the majority of the reporting period after the system restart on April 26, 2017.

Monitoring Plan

- System Monitoring: As noted in Section 4.1, monitoring requirements were generally maintained throughout the reporting period.
- System Aqueous-Phase Effluent Contaminant Concentrations: Based on the analytical data, all analytes in the system aqueous-phase effluent were in compliance with SPDES requirements throughout this reporting period, with the exception of one lead exceedance in July 2017, as detailed in Section 4.2.
- Vapor-Phase Effluent Sampling: Based on the analytical data, all analytes in the system vapor-phase effluent were in compliance with permit equivalency requirements, as well as the site-specific total VOC effluent limit of 0.5 lbs/hr throughout this reporting period, as detailed in Section 4.2.
- Monitoring Well Contaminant Concentrations: Site-specific VOCs have been detected at concentrations in exceedance of their Class GA Standard in several monitoring wells during this reporting period (on-site monitoring wells MW-103 through MW-106, MW-108, MW-4D, as well as off-site monitoring well MW-2S).

Institutional and Engineering Controls

- IC/EC Compliance Status: ICs consisting of a Declaration of Covenant and Restrictions, including groundwater and land-use restrictions, is currently filed with the Suffolk County Clerk's office and the Village of Lindenhurst. There is no on-Site use of groundwater for potable purposes and the use of the property has been and will continue to be restricted to operation of the GWE&TS only. No changes have been made to the property during this reporting period. The GWE&TS has generally operated in accordance with the SMP requirements throughout the majority of this reporting period, with the exception of one isolated aqueous-phase effluent exceedance for lead on July 26, 2017.

8.2 Recommendations

Based on evaluation of the operation of the GWE&TS throughout this reporting period, and as detailed in the preceding sections, the following recommendations have been established to improve the overall performance, effectiveness and protectiveness of the GWE&TS:

Operation and Maintenance

- Routine Maintenance of the Pressure Blower and Transfer Pump: In order to reduce the likelihood of premature equipment failure and resulting system downtime, D&B recommends that the NYSDEC "call-out" contractor perform maintenance of the pressure blower and transfer pump, and all other system components, in accordance with their respective manufacturer's specifications.
- Facility Maintenance: Ensure snow plowing/removal activities and lawn maintenance activities, as well as proper reporting of such, are completed, as necessary.

- OM&M Logs: D&B recommends that the NYSDEC Remedial Services Contractor record more clear and detailed descriptions of completed field activities and issues encountered, as well as alarm triggers, downtime dates and times, as appropriate. In addition, multiple copies of logs, including some differing information is periodically reviewed. As such, D&B further recommends that the NYSDEC Remedial Services Contractor make an effort to provide one set of logs with all descriptions and dates of activities clearly indicated. These steps will help enable D&B to better understand the current status of the GWE&TS and facilitate a more efficient preparation of the Site Management Quarterly Reports.

GWE&TS Repairs:

- GWE&TS Influent Manifold: D&B recommends that the NYSDEC Remedial Services Contractor complete a full rebuild of the influent manifold.
- Sump-Pump: D&B recommends that the NYSDEC Remedial Services Contractor replace the leaking check valve on the sump pump effluent line.
- Well Redevelopment: D&B recommends that the NYSDEC Remedial Services Contractor complete well redevelopment activities at extraction well RW-2.

Monitoring Plan

- Monitoring/Extraction Well Sampling: Based on the widely varying VOC concentrations detected in several wells over previous reporting periods, it is recommended that the NYSDEC ensures that the Remedial Services Contractor is utilizing proper and consistent sampling techniques during each groundwater and system sampling event.
- System Aqueous-Phase Effluent Contaminant Concentrations: All aqueous-phase effluent sample results should be monitored on a routine basis to ensure all contaminants of concern are below SPDES limits.

Institutional Controls/Engineering Controls

- IC/ECs: As all IC/ECs for the site are in place and functioning in accordance with SMP requirements there are no recommendations relative to IC/ECs at this time.

Green and Sustainability Recommendations

- Building Lighting: It is recommended that all light bulbs within the building be replaced with high efficiency bulbs, when needed.
- Renewable Energy Feasibility Assessment: D&B recommends evaluating the feasibility of installing alternate energy sources or purchasing renewable energy credits in order to off-set the electricity usage for the GWE&TS from non-renewable energy sources.
- Reduction of Paper Use: Continue transmitting reports electronically as PDF files to the NYSDEC for review and approval.

General Recommendations

- General GWE&TS Operation: The GWE&TS should remain in-place and operating as designed until remedial objectives have been obtained.
- RSO Evaluation: RSO evaluation should resume once the above recommended system repairs are completed.
- SMP Revisions: It is recommended to revise the Site SMP to include the revised sampling frequencies and include additional information regarding remaining contamination at the Site.
- PRR Reporting Frequency: Based on a review of the guidance documents provided by the NYSDEC, it is recommended that PRRs be completed on an annual basis. The frequency of follow-up PRRs will be determined by the NYSDEC based on future Site conditions and compliance.