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New York State Department of Environmental Conservation

Division of Environmental Remediation

Franklin Cleaners Site

Groundwater Extraction and Treatment System

Site No. 130050

2017 Periodic Review Report

(March 2017 through February 2018)

D&B Engineers and Architects, P.C.

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EXECUTIVE SUMMARY

The Franklin Cleaners Site (the Site) is located at 206-208B South Franklin Street in the Incorporated Village of Hempstead, Nassau County, New York. The groundwater extraction & treatment system (GWE&TS) is located approximately one mile downgradient of the Site at 1000 Hempstead Avenue in the Village of Rockville Centre, New York. The GWE&TS was designed to recover and treat the "leading edge" of a chlorinated solvent groundwater contamination plume emanating from the Site and discharge the treated groundwater to a Nassau County Department of Public Works storm sewer manhole in accordance with all applicable discharge standards.

It should be noted that the quarterly reporting schedule for this project does not follow a typical calendar year schedule, as the quarterly monitoring period and associated reporting schedule begins in March rather than January. The reporting period for PRRs has been aligned with the project quarterly reporting period reports. As such, the reporting period for this PRR includes the period from March 2017 through February 2018.

Based on evaluation of the performance, effectiveness and protectiveness of the GWE&TS throughout this reporting period (March 1, 2017 through February 28, 2018), the following conclusions and associated recommendations are briefly summarized:

General

- GWE&TS Operation and Remedial Objectives: The overall GWE&TS and remedial components operated in a generally efficient manner and generally within design specifications during this reporting period, with the exceptions as noted below. The GWE&TS EC should remain in place until remedial objectives have been reached; however, it should be noted that the operational and performance data set for the GWE&TS indicates that the system, as configured, may be approaching asymptotic conditions. As such it was recommended in the 2016 PRR that continued operation of the GWE&TS be evaluated in accordance with the Site Management Plan. The evaluation was recommended to consist of "pulsing" of the system and monitoring of contaminant concentrations within the existing monitoring well network located in the vicinity and downgradient of the GWE&TS. Pulsing would involve the periodic shutdown and startup of the system to allow for the subsurface environment to come to equilibrium prior to resuming groundwater extraction, as necessary. Consistent with these recommendations, the GWE&TS was shutdown on July 17, 2017, and has been out of operation since.
- Periodic Reviews: Based on a review of the guidance documents provided by the NYSDEC, it is recommended that PRRs continue to 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.

Operation and Maintenance Plan

- O&M Plan: The Operation and Maintenance (O&M) scope of services was performed in accordance with the requirements of the O&M Plan and SMP, with the exception of routine maintenance of the pressure blower, which was completed more frequently than what is specified in the routine maintenance schedule while the GWE&TS was in operation.
- Alarm Conditions/Downtime: Several alarm conditions and non-routine system shutdowns occurred throughout this reporting period. These shutdown events were primarily associated with low-voltage electric issues reportedly due to storm events, low water level conditions at extraction well EW-2 and low-flow issues associated with the pressure blower. Downtime throughout this reporting period is also attributed to the GWE&TS being shutdown on July 17, 2017, per the request of the NYSDEC.
- System Evaluation: As contaminant concentrations within the monitoring well network have remained relatively stable since the GWE&TS was shutdown on July 17, 2017 of this reporting period, it is recommended that the GWE&TS remain off and for evaluation efforts to continue. This evaluation should consist of monitoring of contaminant concentrations within the existing monitoring well network located in the vicinity and downgradient of the GWE&TS.

Monitoring Plan

- System Monitoring: Monitoring requirements were generally maintained throughout the reporting period while the GWE&TS was operating, in accordance with the requirements of the monitoring schedule provided in the SMP. As the GWE&TS was shut down on July 17, 2017, monitoring events were not completed for the remainder of the reporting period.
- pH Readings: pH readings were not collected from aqueous-phase system samples on three occasions throughout this reporting period as the NYSDEC Remedial Services Contractor's pH meter was not functioning. pH readings should be collected on a bi-monthly basis while the GWE&TS is in operation.
- Monitoring Well Sampling: Quarterly groundwater sampling should continue to gather data in support of the ongoing system evaluation. The NYSDEC Remedial Services Contractor should continue to coordinate with Molloy College to collect groundwater samples from ASMW-7 per the routine schedule provided in the July 2012 SMP. In addition, the NYSDEC Remedial Services Contractor should continue to sample extraction wells EW-1 and EW-2 as part of the routine quarterly groundwater monitoring events.

Institutional and Engineering Controls

- IC/EC Compliance: ICs are not required by the March 1998 ROD as an element of the remedy. Therefore, ICs such as land or groundwater use restrictions are not currently implemented at the Site. However, note that the Site's inclusion in the New York State Registry of Inactive Hazardous Waste Sites as a Class 4 Inactive Hazardous Waste Site (Site No. 130050) acts as an IC for the Site. As per the NYSDEC, the GWE&TS was shutdown in July 2017, of this reporting period as the operational and performance data set for the GWE&TS indicates that the system, as configured, may be approaching asymptotic conditions. The GWE&TS EC, as listed in the IC/EC Certification Form provided by the NYSDEC, is currently in-place and can be restarted, if needed pending the continued monitoring of contaminant concentrations within the existing monitoring well network. As such, the groundwater monitoring well network (ASMW-1 through ASMW-6) is still in place and sampled on a quarterly basis. In addition, the alternate groundwater irrigation well (ASMW-7) is in-place downgradient of the GWE&TS on Molloy College property and the soil vapor mitigation system, operated by others, is in-place at the Site "source area." Based on available information, ICs such as groundwater and land-use restrictions are not currently required for the Site. Based on the evaluation presented in Section 5.0, these restrictions are not warranted to be implemented at or downgradient of the Site at this time.

1.0 INTRODUCTION

The purpose of this Periodic Review Report (PRR) is to summarize and evaluate the performance of the Franklin Cleaners site (the Site) groundwater extraction and treatment system (GWE&TS). The Site is located at 206-208B South Franklin Street in the Incorporated Village of Hempstead, Nassau County, New York (see Figure 1-1), while the GWE&TS is located at 1000 Hempstead Avenue in the Village of Rockville Centre, Nassau County, New York, approximately one mile downgradient of the Site.

It should be noted that the quarterly reporting schedule for this project does not follow a typical calendar year schedule as the quarterly reporting schedule begins in March rather than January.

The reporting period for PRRs has been aligned with the project quarterly reporting schedule. As such, the reporting period for this PRR includes March 2017 through February 2018. In addition, 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 and other pertinent information.

D&B Engineers and Architects, P.C.

FRANKLIN CLEANERS SITE
VILLAGE OF HEMPSTEAD, NEW YORK

SITE LOCATION MAP

SOURCE: GOOGLEARTH.COM

FIGURE 1-1

Environmental Assessment and Remediations (EAR), a NYSDEC Remedial Services Contractor, was responsible for GWE&TS operation and all monitoring and sampling activities and site maintenance throughout this reporting period, while all reporting and engineering services were completed by D&B Engineers and Architects, P.C. (D&B).

Based on operational and performance data sets discussed below for the GWE&TS, the NYSDEC determined the system, as configured, may be approaching asymptotic conditions. As a result, and in accordance with recommendations in Site Management Quarterly Reports and the 2016 Periodic Review Report for the Site, the NYSDEC directed that the GWE&TS be shutdown in July 2017 of this reporting period to evaluate if continued operation of the GWE&TS is necessary.

The objectives of this PRR for the Site include:

- Presenting background information.
- Identifying the remedial goals established for the Site.
- Presenting a brief description of the overall GWE&TS and its major remedial components.
- Reviewing Site monitoring protocols.
- Evaluating the GWE&TS operation and performance.
- Presenting recommendations regarding the operation, pulsing or shutdown of the GWE&TS with respect to system performance, effectiveness and protectiveness of the GWE&TS, and its ability to achieve the goals established for the Site by the Record of Decision (ROD), dated March 1998.

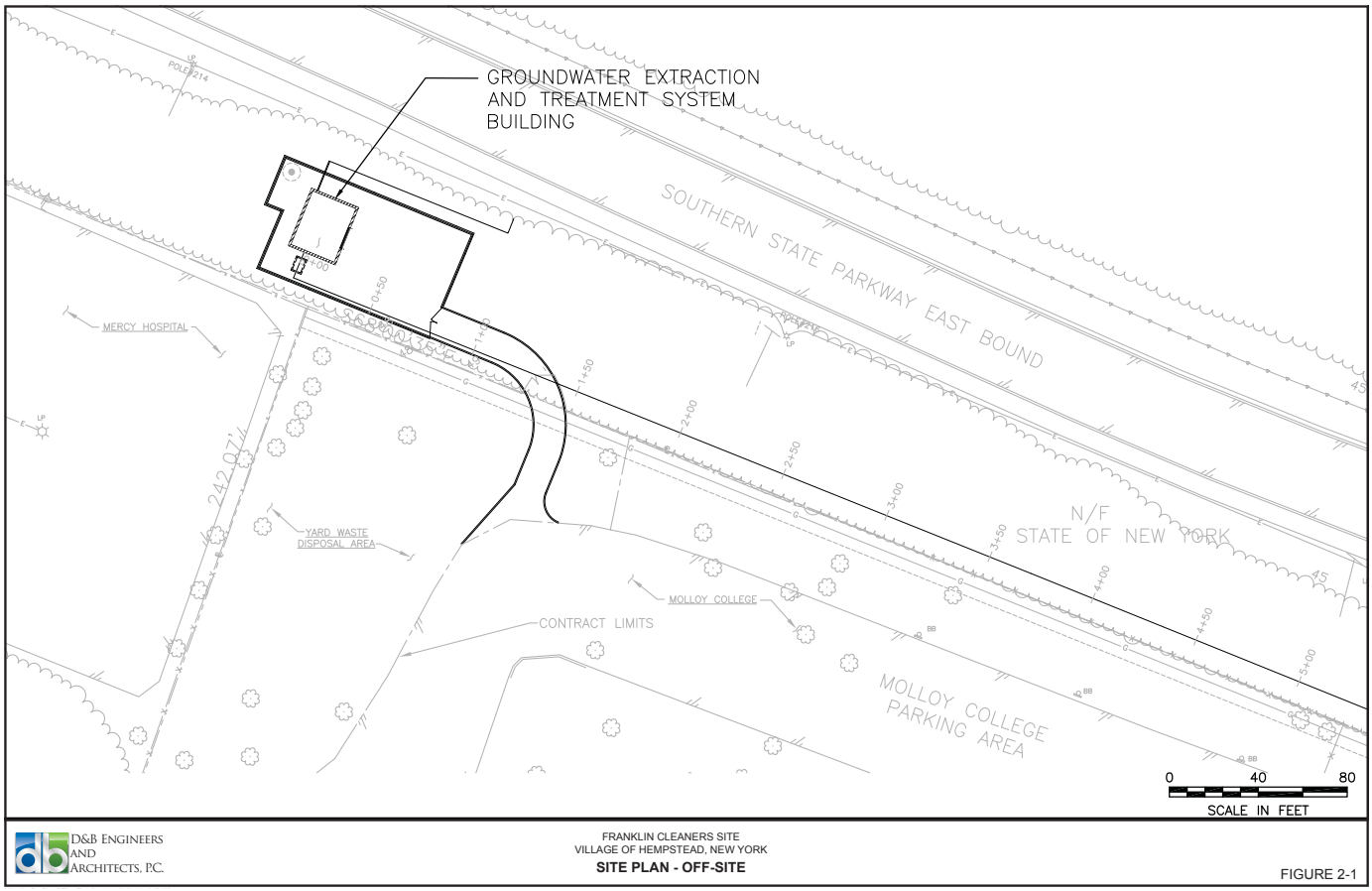
2.0 SITE OVERVIEW

2.1 Site Operations and Description

The Site is a former NYSDEC Class 2 Inactive Hazardous Waste Site (currently classified as a Class 4 site) and is listed on the New York State Registry of Inactive Hazardous Waste Sites (Site No. 130050). The Site operated as a dry cleaner and laundromat from 1957 through 1991. The dry cleaner is reported to be the source of the chlorinated solvent contamination identified at the Site, as well as the groundwater plume extending from the Site to the GWE&TS. However, it should be noted that the July 2015 Plume Redelineation Summary Report indicated the likely presence of additional upgradient sources of PCE contamination.

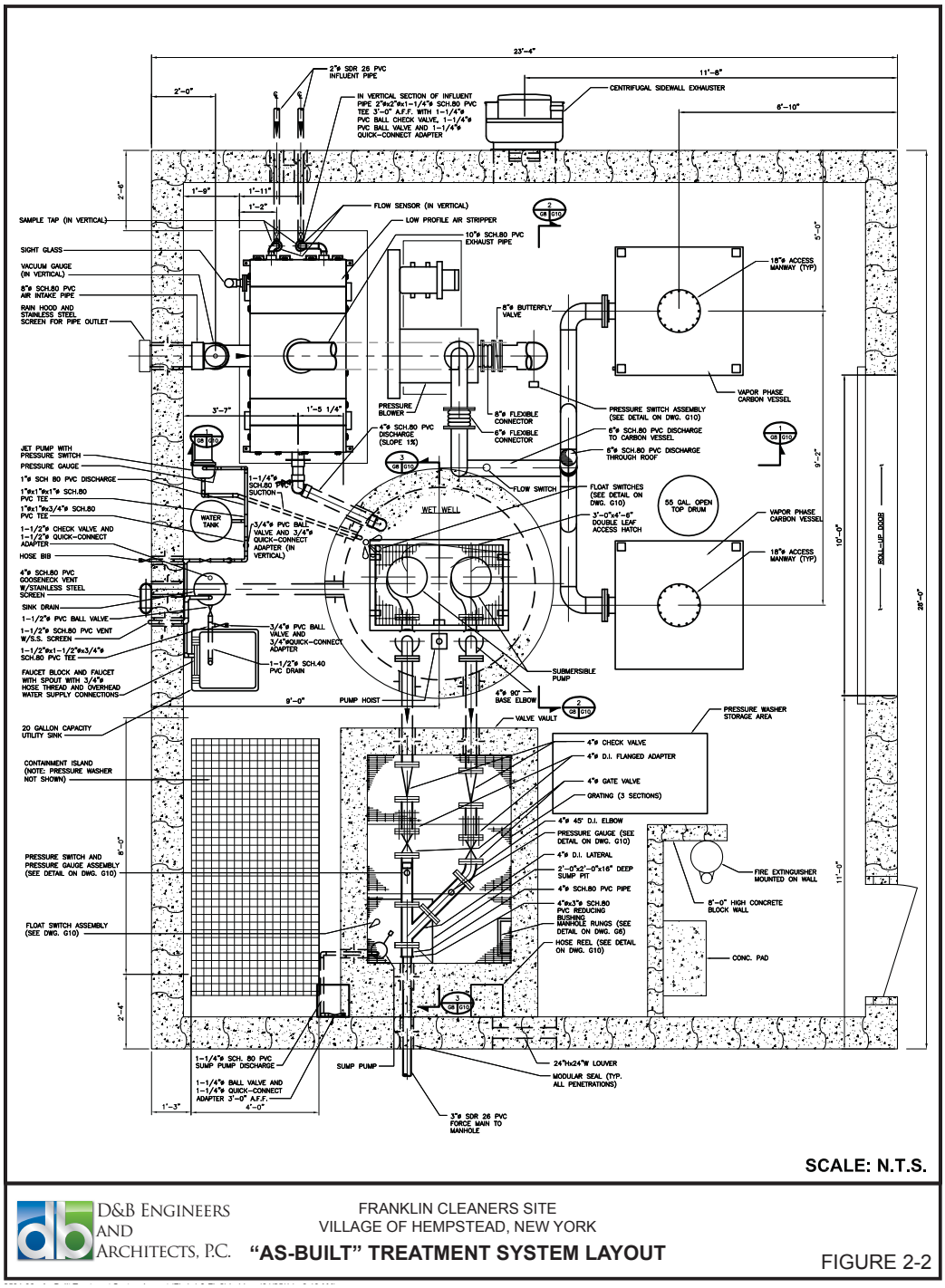
The Site is bordered by Marvin Avenue to the south, private residences to the north and east, with commercial buildings and South Franklin Street to the west (see Figure 1-1). The Site is approximately 0.25-acre in area and currently includes a two-story building with a coin-operated laundromat and delicatessen on the first floor, residential apartments on the second floor and a full basement. Portions of the first floor and basement were utilized by the former dry cleaner.

As summarized in further detail below, the on-site “source area” of soil and groundwater contamination was remediated via a soil vapor extraction and air sparging (SVE/AS) system, which operated from November 2003 to August 2004. The SVE/AS system was shutdown in August 2004 based on contaminant concentrations within the soil and groundwater being below NYSDEC Standards and Guidance Values.



The GWE&TS is located at 1000 Hempstead Avenue in the Village of Rockville Centre, Nassau County, New York, approximately one mile downgradient of the Site. The GWE&TS is located on an approximately 0.25-acre property bounded by the Southern State Parkway to the north, Molloy College to the south, Hempstead Avenue to the east, and Mercy Medical Center to the west. A Site Plan is provided as Figure 2-1.

Start-up and routine system operation of the GWE&TS was initiated in September 2004; however, based on information presented in the 2016 PRR the NYSDEC determined the GWE&TS, as configured, may be approaching asymptomatic conditions. To evaluate if continued operation of the GWE&TS is necessary, the system was shutdown on July 17, 2017. A GWE&TS layout is provided as Figure 2-2. "As-built" drawings for the GWE&TS, including monitoring well and extraction well "as-builts," are provided in *Appendix A.*



The GWE&TS consists of two 6-inch diameter extraction wells (EW-1 and EW-2) screened at a depth of 70-90 and 75-90 feet below grade, respectively. Extracted groundwater is conveyed via underground piping to a low profile stacked-tray air stripper located in the GWE&TS building. Treated groundwater is discharged from the air stripper to a wet well located in the treatment system building. Two alternating submersible pumps convey the treated water via underground piping to a Nassau County Department of Public Works (NCDPW) storm sewer manhole in accordance with all applicable discharge standards.

Exhaust gas from the air stripper was initially treated utilizing two 1,000 lb. granular activated carbon (GAC) vessels connected in series. However, based on historic low contaminant concentrations detected in the air stripper vapor-phase discharge, the air stripper exhaust piping was reconfigured to bypass the GAC vessels and discharge exhaust gas directly to the atmosphere in June 2011, per the NYSDEC. The GWE&TS is equipped with instrumentation and controls which allow for automated start-up and operation, and an autodial alarm notification system.

In order to monitor the effectiveness of the GWE&TS, a monitoring well network was installed in the vicinity and downgradient of the GWE&TS. Monitoring well locations are provided in *Figure 2-3*. A routine groundwater monitoring well sampling program was initiated following construction of the GWE&TS and the associated groundwater monitoring well network. The program consists of collection of groundwater samples from the network of monitoring wells on a quarterly basis.

2.2 Site Impacts and Investigation History

In March 1990, the Nassau County Department of Health (NCDOH) investigated a complaint of tainted drinking water from a private residence located approximately 100 feet southwest and downgradient of the Site. The residence was found to have a drinking water well (approximately 45 feet deep) and an irrigation well (approximately 32 feet deep) with concentrations of tetrachloroethene (PCE) at 5,500 micrograms per liter (ug/l) and 29,000 ug/l, respectively.

In order to investigate the identified PCE contamination, the NCDOH performed an inspection of the Site in April 1990. As part of this investigation, soil samples were collected from surface soil exposed at cracks and gaps within the building basement and from surface soil at the rear of the Site. Soil samples collected from the building basement exhibited PCE concentrations as high as 9,400 ug/kg. In addition, soil samples collected from the rear of the property exhibited PCE concentrations as high as 650,000 ug/kg, trichloroethene (TCE) concentrations as high as 1,700 ug/kg and dichloroethene (DCE) concentrations as high as 680 ug/kg.

Several additional investigations were completed at the Site in order to further evaluate the extent of soil and groundwater contamination. In addition, several interim remedial actions (IRMs) were completed at the Site in an effort to mitigate/reduce the potential for exposure to the elevated concentrations of chlorinated solvents within on-site soil and groundwater.

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site:

Preliminary Site Assessment (March 1993)

Based on the results of the initial NCDOH groundwater and soil investigations from 1990, as detailed above, a Preliminary Site Assessment was performed by the NCDPW between April 1992 and December 1992. As part of this investigation, four groundwater monitoring wells were installed as follows: monitoring well FC-1 was installed upgradient of the Site to a depth of 40 feet below ground surface and monitoring wells FC-2, FC-3 and FC-4 were installed downgradient of the Site, each to a depth of 37 feet below ground surface. Groundwater samples were subsequently collected from this groundwater monitoring well network for volatile organic compound (VOC) analysis. Groundwater monitoring well FC-2 exhibited PCE at a concentration of 83 ug/l, in exceedance of its Class GA Groundwater Standard of 5.0 ug/l. However, upgradient groundwater monitoring well FC-1 and downgradient groundwater monitoring wells FC-3 and FC-4 did not exhibit exceedances of PCE.

Remedial Investigation Feasibility Study (December 1996 through April 1997)

A Remedial Investigation and Feasibility Study (RI/FS) was performed by D&B between December 1996 and April 1997. The goals of the RI/FS were to identify the source of groundwater contamination at the Site, further characterize the nature and extent of the on-site groundwater contamination and develop an IRM to remediate the source of contamination at the Site. A draft RI/FS report was issued in October 1997 and the final RI/FS was issued in November 1998. The results of the RI/FS are briefly summarized below:

- Elevated concentrations of PCE of up to 280,000 ug/kg were detected in soil beneath the basement floor slab, as well as within surface and subsurface soil located in the rear portion of the Site.

- Elevated concentrations of PCE in exceedance of 1,000 ug/l were detected in shallow groundwater in the immediate vicinity of the Site.
- Elevated concentrations of PCE and its associated breakdown products, including TCE, 1,1-dichloroethene (1,1-DCE) and 1,2-DCE, were detected in exceedance of 5 ug/l in shallow groundwater at depths of 20 to 26 feet below grade and up to 3,000 feet downgradient of the Site.
- Elevated concentrations of PCE and its associated breakdown products were detected in deeper groundwater samples at depths of 33 to 87 feet below grade and as far as 4,500 feet downgradient of the Site.
- Elevated concentrations of PCE were detected in indoor air samples collected from within the Site building (basement, 1st floor commercial areas and 2nd floor residential areas), and from commercial and residential properties immediately adjacent to the Site.

Based on these results, several remedial actions were recommended in the RI/FS to remediate the identified Site "source area" soil and groundwater contamination and associated downgradient groundwater contamination plume, including:

"Source Area" Remedial Actions

- Installation of a Soil Vapor Extraction/Air Sparge (SVE/AS) system, to remediate elevated concentrations of chlorinated VOCs within Site soil and groundwater.
- Installation of asphalt in the rear of the Site and patching of targeted areas of the building basement floor with concrete to limit short circuiting of the SVE/AS system and the migration of soil vapor.
- Use of the existing groundwater monitoring well network (and possible installation of additional wells) to monitor the effectiveness of the SVE/AS system.

Downgradient Remedial Actions

- Installation of a GWE&TS downgradient of the Site.
- Use of any existing groundwater monitoring wells (and possible installation of additional wells) to monitor the effectiveness of the GWE&TS.

Interim Remedial Measure (January 1998)

An Interim Remedial Measure (IRM) was conducted at the Site in January 1998 to address the elevated concentrations of PCE detected in the indoor air samples collected from the basement, first and second floors of the on-site building. As part of this IRM, fans with integrated particulate and GAC filters, designed to recirculate and filter air to remove particulates and VOCs, were installed within the Site building. In addition, a wall was constructed to isolate the portions of the basement where the former dry cleaner "cooker" was located and where elevated PCE concentrations were detected in soil immediately beneath the basement floor slab.

Record of Decision (March 1998)

Based on the findings of the RI/FS, the NYSDEC issued a ROD in March 1998. In order to eliminate or mitigate threats to human health and the environment, the NYSDEC selected the following Institutional Controls/Engineering Controls (ICs/ECs) to be implemented at the Site:

- SVE to address PCE-contaminated soils at the Site with treatment of contaminated vapors using a vapor-phase granular activated carbon (GAC) treatment system.
- Air sparging of shallow on-site groundwater and capture of PCE vapors by the SVE system.
- Extraction of contaminated groundwater at the leading edge of the contaminant plume for up to 20 years and treatment of water through the use of chemical precipitation and filtering of metals and air stripping of VOCs along with GAC treatment of off gasses, if necessary.
- Off-site disposal of all spent GAC at a Toxic Substance Control Act (TSCA) and Resource Conservation and Recovery

Act (RCRA)-permitted incinerator.

- Installation of a deep irrigation/monitoring well located at Molloy College, downgradient of the Site to replace an existing irrigation well at Molloy College located in the Upper Glacial aquifer.
- Long-term groundwater monitoring and groundwater use restrictions, as necessary.
- Control of indoor air contamination using air purifying, ventilation and vapor barrier systems along with a monitoring program until the "source area" remediation has been effectively completed.

Pre-Design Investigation (July 1999 through December 2000)

A pre-design investigation (PDI) was completed by D&B between July 1999 and December 2000 to aid in the design and construction of the GWE&TS. The results of the PDI are detailed in the Franklin Cleaners GWE&TS Design Report, dated December 2000. Based on the results of the PDI, the groundwater contamination plume emanating from the Site was determined to be approximately 400 feet wide at the shoulder of the east-bound Southern State Parkway, and was concentrated at a depth of approximately 80 to 95 feet below ground surface, immediately above a clay layer.

As part of the PDI a pilot extraction well was installed along the leading edge of the groundwater plume to establish parameters for the design of the GWE&TS (e.g. hydraulic conductivity, radius of influence and drawdown, etc). Several pump tests were completed utilizing the pilot extraction well at various flow rates for the purpose of developing capture zone modeling scenarios. The pump tests and groundwater flow/capture zone modeling determined that a minimum required flow rate of 20 gallons per minute (gpm), utilizing a one or two-well pumping scenario, would be sufficient for plume containment.

Based on the recommendations provided in the Design Report, D&B prepared remedial construction drawings and specifications for the construction of the GWE&TS to capture the leading edge of the groundwater plume.

Remedial Construction (June 2002 through September 2003)

On-site remedial activities and the construction of the on-site SVE/AS system were completed in September 2003, and included the following:

- Site preparation.
- Construction of Site fencing and gates.
- Remedial excavation and restoration of a contaminated dry well.
- Installation of an awning at the rear of the building to control Site drainage.
- Installation of the SVE/AS system and associated soil vapor extraction and air sparge wells.
- Installation of several soil vapor monitoring probes and groundwater monitoring wells.
- Repair and sealing of basement flooring cracks within the building and asphalt paving at the rear of the property.
- Start-up and performance testing of the SVE/AS system.
- Operation and maintenance of the SVE/AS system.
- Removal and decommissioning of the SVE/AS system and associated temporary utilities.

The AS/SVE system operated from November 2003 to August 2004, at which point it was shutdown based on concentrations of PCE below 5 ug/l in on-site groundwater monitoring wells and non-detectable concentrations of PCE in soil vapor extracted from the SVE wells. Further details of the "source area" remediation are provided in the Final Remediation Report for the Franklin Cleaners On-Site SVE/AS System, dated June 2009.

In addition, a subslab depressurization system (SSDS) was installed within the Site building basement in January 2007 to address concentrations of chlorinated VOCs that were detected in soil gas immediately beneath the basement floor slab

following the decommissioning of the AS/SVE system. The SSDS consists of four suction points installed through the building floor slab, connected to centrifugal fans and piping, which discharge through an exhaust stack to the atmosphere above the building. Based on available records, the operation of the SSDS is the responsibility of the property owner; however, inspection and maintenance of the SSDS are being managed by the NYSDEC under a separate State-wide program. A copy of the annual letter to the Property Owner regarding operation of the SSDS is provided as *Appendix B*. Maintenance and inspection procedures and schedules are described in the Generic Work Plan prepared by HDR, Inc., dated July 2009.

As detailed in Section 2.1, the construction of the GWE&TS was completed in July 2003.

On-Site and Downgradient Groundwater and Soil Vapor Investigations (December 2008, March 2009 and September 2011)

Following the decommissioning of the SVE/AS system, the NYSDEC completed several groundwater and soil vapor investigations in the vicinity and downgradient of the Site pursuant to reclassifying the Site's Class 2 designation. Results of these groundwater investigations showed a general decline in PCE concentrations from December 2008 to September 2011.

PCE was detected in three out of nine groundwater samples collected during a December 2008 groundwater monitoring well sampling round. PCE was detected at a concentration of 29 ug/l, exceeding its Class GA Standard of 5.0 ug/l, in one monitoring well: MW-2S, located approximately 300 feet downgradient of the Site.

An additional round of groundwater samples was collected from the nine groundwater monitoring wells in March 2009 in order to confirm the results of the December 2008 sampling event. PCE was again detected in exceedance of its Class GA Standard of 5.0 ug/l in monitoring well MW-2S, though PCE was detected at a concentration of 7.8 ug/l during this round of sampling, well below the 2008 levels.

A geoprobe groundwater investigation was completed along the center line of the groundwater plume in September 2011. Groundwater grab samples were collected from 20 geoprobe locations ranging in depth from 18 to 23 feet below grade extending to a distance of up to approximately 3,600 ft. downgradient of the Site, and from four existing groundwater monitoring wells immediately downgradient of the Site. PCE was not detected in exceedance of its Class GA Standard of 5.0 ug/l in any collected groundwater samples, including a sample collected from groundwater monitoring well MW-2S.

The NYSDEC concluded from these investigations that the existing groundwater plume "has significantly decreased and is no longer considered a source of vapors" as summarized in a June 21, 2012 memorandum.

Remedial System Optimization Activities

A RSO evaluation to improve the efficiency and effectiveness of the GWE&TS was initiated in 2011. Following completion of the RSO evaluation, a RSO Report was submitted to the NYSDEC in May 2012, in which several recommendations to increase the efficiency and effectiveness of the GWE&TS were presented. These recommendations included the completion of a plume redelineation program in order to identify the current horizontal and vertical extents of the remaining groundwater plume associated with the Site. The plume redelineation field program was completed in June and July 2014.

Site Reclassification/Delisting

The Site was originally listed as a Class 2 Inactive Hazardous Waste Site by the NYSDEC on June 17, 1993. Since this time, completion of the following project phases has occurred, as summarized below:

Table 2-1: Project Phases and Completion Dates	
Project Phase	**Completion Date**
Remedial Investigation	03/1998
Remedial Design	02/2001
Groundwater Extraction and Treatment System Construction	07/2003 (1)
Remedial Action (Source Area Remediation)	03/2007 (2)

1. Construction of the GWE&TS was completed in July 2003. The GWE&TS was placed into routine operation in September 2004 and its effectiveness is believed to be approaching asymptotic conditions. The system was shutdown on July 17, 2017, to evaluate if continued operation of the GWE&TS is necessary.
2. Source area contaminated soil and groundwater were remediated with the Air Sparge/Soil Vapor Extraction (AS/SVE) system beginning in September 2003. The on-site AS/SVE system has successfully removed the contaminants from the vadose zone and greatly diminished groundwater contaminants to below detectable limits. Although confirmation soil samples met the required remedial goals, a subslab depressurization system replaced the on-site AS/SVE system in 2006 due to the detection of elevated vapor phase VOC concentrations in the basement level and below the basement floor slab.

Given the above, NYSDEC reclassified the Franklin Cleaners GWE&TS Site on December 11, 2012, pursuant to the requirements identified in 6 NYCRR §375-2.7, as a Class 4 Site as the NYSDEC determined that the Site no longer presents a significant threat to public health and/or the environment based on remedial efforts performed to date and implementation of a Site Management Plan (SMP). Site delisting is not feasible at this time, as all remediation and post-remediation activities have not been completed.

3.0 OPERATION AND MAINTENANCE (O&M) PLAN COMPLIANCE

3.1 O&M Plan Requirements and Compliance Status

The Operations and Maintenance (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 O&M Plan and SMP. Copies of the Site Activities Logs and Maintenance reports completed throughout this reporting period, which include details of shutdowns and the non-routine maintenance activities that have occurred throughout this reporting period, 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. Throughout the course of this reporting period, general facility maintenance activities were completed as specified in the O&M Plan, and as per further direction provided by the NYSDEC. General facility maintenance activities completed on an as-needed basis during this reporting period include:

- Landscaping activities were completed on June 8 and 23, July 19, September 1 and 21 and December 8, 2017.
- Although several winter storm events occurred during the winter months of this reporting period, snow plowing/removal activities were not reported to have been completed by the NYSDEC Remedial Services Contractor.
- Replenishment of expendable O&M supplies on an as-needed basis.
- General facility housekeeping 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 are provided on Table 3-1.

Table 3-1: Routine Inspection and Maintenance Services Summary

Routine Inspection/Maintenance Item	Frequency					
	Monthly	Bi-Weekly (1)	Bi-Monthly (2)	Semi-Annual (3)	Annual	As-Needed
Routine Inspection Items						
Extraction Wells						
Flow Rate (gpm)		✓				
Total Flow (gal)		✓				
Pump Runtime (hrs)		✓				
Depth to Water (feet)		✓				
Operating Frequency (Hz)		✓				
Low Profile Stacked-Tray Air Stripper						
Sump Level (in)		✓				
Fresh Air Inlet Vacuum (in H_2O)		✓				
Exhaust Flow Rate (scfm)		✓				
Exhaust Temperature (^oF)		✓				
Pressure Blower						
Blower Suction (in H_2O)		✓				
Blower Discharge (in H_2O)		✓				
Blower Runtime (hrs)		✓				
Effluent Valve Vault						
Pump No. 1 Operating Pressure (psi)		✓				
Pump No. 1 Flow Rate (gpm)		✓				
Discharge No. 1 Line Back Pressure (psi)		✓				
Pump No. 2 Operating Pressure (psi)		✓				
Pump No. 2 Flow Rate (gpm)		✓				
Discharge No. 2 Line Back Pressure (psi)		✓				
Flow Meter Vault						
Total Flow (gpm)		✓				
Jet Pump						
Operational Status		✓				
Line Pressure (psi)		✓				
Pressure Washer/Containment Island						
Operational Status				✓		

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

Routine Inspection/Maintenance Item	Frequency					
	Monthly	Bi-Weekly (1)	Bi-Monthly (2)	Semi-Annual (3)	Annual	As-Needed
Routine Maintenance Items						
Low Profile Stacked-Tray Air Stripper Maintenance						✓
Pressure Blower Maintenance			✓			
Wet Well Submersible Pump Maintenance					✓	
Blower Intake Screen Cleaning/Maintenance						✓
Flow Meter Vault Effluent Screen Cleaning/ Maintenance					✓	
Wet Well Strainer Cleaning/Maintenance					✓	
Utility Sink Screen Cleaning/Maintenance						✓
Pressure Washer/Containment Island Maintenance						✓

Notes:
(1) Bi-weekly is defined as twice per month.
(2) Bi-Monthly is defines as once every other month.
(3) Semi-Annual is defined as twice per year.

The routine GWE&TS inspection and maintenance activities completed during this reporting period are summarized below:

- Bi-weekly performance monitoring of system equipment (extraction well pumps, low profile stacked-tray air stripper, pressure blower, etc.).
- Bi-weekly inspection of all equipment, piping, flanges, valves, instruments, etc. for leakage, unusual noise and proper working condition.
- Bi-monthly pressure blower maintenance was completed on March 2, March 15, April 7, April 18, May 4, May 22, June 8, June 23, July 5 and July 17, 2017.
- Cleaning of the blower intake screen was completed on March 2, March 15, April 7, April 18, May 4, May 22, June 8, June 23, July 5 and July 17, 2017.
- Annual cleaning of the flow meter vault effluent screen was completed on July 24, 2017.
- Annual wet well pump maintenance was completed on July 24, 2017.
- Annual cleaning of the wet well strainer was completed on July 24, 2017.

It should be noted that, the GWE&TS was taken out of operation on July 17, 2017, of this reporting period. As such, routine O&M activities were not completed for the remainder of the reporting period; however, a full round of maintenance activities, including cleaning and draining of all GWE&TS equipment was completed prior to the system shutdown.

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 conditions and/or shutdown events. The non-routine maintenance activities completed during this reporting period include:

Quarter 51 (March 1, 2017 through May 31, 2017)

On April 18, 2017, the NYSDEC Remedial Services Contractor was on-site to repair the lower hinge on the front gate of the property.

On April 22, 2017, the NYSDEC Remedial Services Contractor was on-site to complete troubleshooting activities at the VFD. The GWE&TS was restarted by the Contractor prior to leaving the site.

Quarter 52 (June 1, 2017 through August 31, 2017)

On July 5, 2017, the NYSDEC Remedial Services Contractor was on-site to clear the Air Stripper Blower intake screen.

On July 17, 2017, the NYSDEC Remedial Services Contractor was on-site to complete GWE&TS lubrication and maintenance per the 2003 Operational and Monitoring Manual and began disassembly and cleaning of the air stripper.

On July 18, 2017, the NYSDEC Remedial Services Contractor was on-site to complete repairs to the building exhaust fan and cleaning of the air stripper.

On July 24, 2017, the NYSDEC Remedial Services Contractor was on-site to replace the gaskets for the trays and reassemble the air stripper. Additionally, the wet well submersible pumps were removed and cleaned.

Quarter 53 (September 1, 2017 through November 30, 2017)

On September 21, 2017, the NYSDEC Remedial Services Contractor was on-site to reinstall the Flygt wet well pumps.

Quarter 54 (December 1, 2017 through February 29, 2018)

On January 16, 2018, the NYSDEC Remedial Services Contractor completed repairs to the site facility gate.

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 – Building Entry Alarm
- Alarm #3 – General System Alarm
- Alarm #4 – General Failure Submersible Pump (Wet Well) Alarm
- Alarm #5 – General Failure EW-1/EW-2 Alarm
- Alarm #6 – Pressure Blower Failure Alarm
- Alarm #7 – High Level Air Stripper Sump Alarm
- Alarm #8 – High Level Valve Vault Sump Alarm

The alarm conditions occurring during this reporting period include the following:

Quarter 51 (March 1, 2017 through May 31, 2017)

- On May 7, 2017, the GWE&TS shutdown due to a "low-air flow" condition. The NYSDEC Remedial Services Contractor reset and restarted the GWE&TS on May 8, 2017.
- On May 16, 2017, the GWE&TS shutdown due to a ground fault at the VFD. The NYSDEC Remedial Services Contractor attempted to reset and restart the GWE&TS on May 17, 2017; however, due to equipment malfunctions the GWE&TS was reset and restarted after trouble shooting activities on May 22, 2017.

Quarter 52 (June 1, 2017 through August 31, 2017)

- Alarm conditions did not occur throughout this reporting period.

Quarter 53 (September 1, 2017 through November 30, 2017)

- Alarm conditions did not occur throughout this reporting period as the GWE&TS was shutdown.

Quarter 54 (December 1, 2017 through February 29, 2018)

- Alarm conditions did not occur throughout this reporting period as the GWE&TS was shutdown.

A system downtime evaluation is provided below in Section 3.2.

3.2 Evaluation of O&M Activities

GWE&TS Inspection and Operation Evaluation

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

- Extraction Wells: Based on extraction scenario modeling completed during the PDI utilizing either one or two well pumping scenarios, the minimum required pumping rate for the GWE&TS is 20 gpm. However, since the extraction scenario modeling was based on a simplification of actual Site conditions and utilized several assumptions, extraction

wells EW-1 and EW-2 have been operating at flow rates of approximately 33.6 gpm and 5.3 gpm, respectively, since system start-up in September 2004 in order to provide for a factor of safety. The lower operating flow rate of extraction well EW-2 is the result of a silty clay soil unit located within the well screen zone. Note, due to the relatively high concentrations of VOCs detected in samples collected from the screened interval of EW-2 during its installation, the NYSDEC decided to keep the extraction well at this location and depth, and required the well to be pumped at its maximum yield.

- Low Profile Stacked-Tray Air Stripper: The design of the low profile stacked-tray air stripper is based on the removal of influent contaminant concentrations at a maximum design combined flow rate of 70 gpm and a maximum PCE concentration of 1,200 ug/l, to concentrations below the specified site-specific effluent limits, as detailed on the State Pollution Discharge Elimination System (SPDES) permit equivalency, provided in *Appendix D*.
- Pressure Blower: The design flow rate for the pressure blower is 740 cubic feet per minute (cfm); however, due to influent water contaminant concentrations that are well below the maximum design concentrations, the pressure blower has been operating at an average of approximately 648 cubic feet per minute (cfm) throughout this reporting period, as discussed with the NYSDEC.

A summary of the GWE&TS operating conditions during this reporting period, including average influent pumping rates, flow volumes and total VOC concentrations, total effluent flow volumes and total VOC concentrations, as well as total VOC removals and efficiencies is provided on Table 3-2.

Table 3-2: Treatment System Performance Summary [1]

Parameter	Quarter 51 (March 1, 2017 through May 31, 2017)	Quarter 52 (June 1, 2017 through August 31, 2017)	Quarter 53 (September 1, 2017 through November 30, 2017) [3]	Quarter 54 (December 1, 2017 through February 28, 2018) [3]
Influent				
EW-1 Average Pumping Rate (gal per min)	22.1	21.5	--	--
EW-1 Total Flow Volume (gal)	2,751,236	1,427,317	--	--
EW-1 Maximum Influent PCE Concentration (ug/l)	4.5	3.8	--	--
EW-2 Average Pumping Rate (gal per min)	4.4	4.5	--	--
EW-2 Total Flow Volume (gal)	591,095	416,140	--	--
EW-2 Maximum Influent PCE Concentration (ug/l)	100	110	--	--
Effluent				
Effluent Total Flow Volume (gal) [1]	4,074,452	2,109,367	--	--
Maximum Effluent PCE Concentration (ug/l)	Nondetect	2.1	--	--
VOC Removal Summary				
Total PCE Removal (lbs)	0.23	0.39	--	--
Average PCE Removal Rate (lbs/hr)	2.62 E-04	2.78 E-04	--	--
PCE Removal Efficiency Range (%) [2]	99.35-99.43	90.14 - 99.06	--	--

Notes:

1. The influent flow meters were replaced in June 2011 and the effluent flow meter was replaced in May 2012 due to influent/effluent flow total inconsistencies. Although influent/effluent total flow inconsistencies remain, the influent/effluent flows are more consistent than prior to these modifications.
2. The PCE removal efficiency has ranged from approximately 90.14% to 99.84% from system start-up in September 2004 to July 17, 2017, of this reporting period when the GWE&TS was shutdown.
3. It should be noted that, the GWE&TS was shutdown on July 17, 2017 of this reporting period. As such system monitoring was not completed for the remainder of the reporting period; however, extraction wells EW-1 and EW-2 were sampled as part of the quarterly groundwater monitoring events. Sample results for extraction wells EW-1 and EW-2 are included in the groundwater monitoring data tables included in Appendix E.

Based on the NYSDEC Remedial Services Contractor's system monitoring logs, the GWE&TS treated and discharged approximately 6,183,819 gallons of contaminated groundwater and removed approximately 0.62 pounds of PCE throughout this reporting period.

With regard to the overall operation of the GWE&TS, the majority of the system components functioned as intended throughout Quarter 51 (March 2017 through May 2017); however, as detailed above, several issues were noted with regard to low-flow conditions at the pressure blower and low voltage issues at the VFD. Additionally, per the NYSDEC, the GWE&TS was shutdown in July 2017 of Quarter 52 (June 2017 through August 2017), as such the GWE&TS has remained off for the remainder for this reporting period.

As described above, pressure blower maintenance activities were not completed as per the requirements of the routine maintenance schedule, as the NYSDEC Remedial Services Contractor completed maintenance of the pressure blower more frequently than what is specified in the routine maintenance schedule.

GWE&TS Downtime Evaluation

Overall, the GWE&TS was down for a total of approximately 233 days (5,602 hours) throughout this reporting period, as compared to 40 days (971 hours) during the previous reporting period. This downtime was the result of alarm events associated with low-voltage electrical issues and low-flow conditions at the pressure blower, as reported by the NYSDEC Remedial Services Contractor and the system shutdown on July 17, 2017.

A summary of system downtime and associated details regarding system shutdown/alarm events is provided on Table 3-3.

Table 3-3: Runtime/Downtime Evaluation

Time Period	Total Hours	Runtime		Downtime		Total Number of Shutdown/ Alarm Events	Downtime Description
		Approximate Hours	Percent of Total Time Period	Approximate Hours	Percent of Total Time Period		
Quarter 51 (March 1, 2017 through May 31, 2017)	2,208	2,045	92.6%	163	7.4%	2	On May 7, 2017 the GWE&TS shutdown due to a "low-air flow" condition. The NYSDEC Remedial Services Contractor reset and restarted the GWE&TS on May 8, 2017. On May 16, 2017, the GWE&TS shutdown due to a ground fault at the VFD. The NYSDEC Remedial Services Contractor attempted to reset and restart the GWE&TS on May 17, 2017; however, due to equipment malfunctions the GWE&TS was reset and restarted after trouble shooting activities on May 22, 2017.
Quarter 52 (June 1, 2017 through August 31, 2017)	2,208	1,113	50.4%	1,095	49.6%	0	Alarm conditions did not occur throughout this reporting period; however, the system was shutdown on July 17 of this Quarter.
Quarter 53 (September 1, 2017 through November 31, 2017)	2,184	0	0%	2,184	100%	0	Alarm conditions did not occur throughout this reporting period, as the system was not operating.
Quarter 54 (December 1, 2017 through February 28, 2018)	2,160	0	0%	2,160	100%	0	Alarm conditions did not occur throughout this reporting period, as the system was not operating.
Total	***8,760***	***3,158***	***36%***	***5,602***	***64%***	***2***	

3.3 Evaluation Regarding Continued Operation of the GWE&TS

This evaluation of the continued shutdown of the GWE&TS focuses on groundwater samples collected from the wells historically having detectable concentrations of PCE, specifically EW-1, EW-2, ASMW-1 and ASMW-2. Analytical Summary Tables are presented in *Appendix E*. The PCE concentrations detected over the past two year period, in each of the four wells are shown below in Figure 3-1.

The PCE concentrations in groundwater samples collected from well EW-1 have remained near the 5 ug/l Class GA Groundwater Standard since January 2016. PCE concentrations in samples collected after the July 17, 2017 shutdown of the GWE&TS were below the Standard at a concentration of 1.4 ug/l in October 2017, and 2.1 ug/l in January 2018.

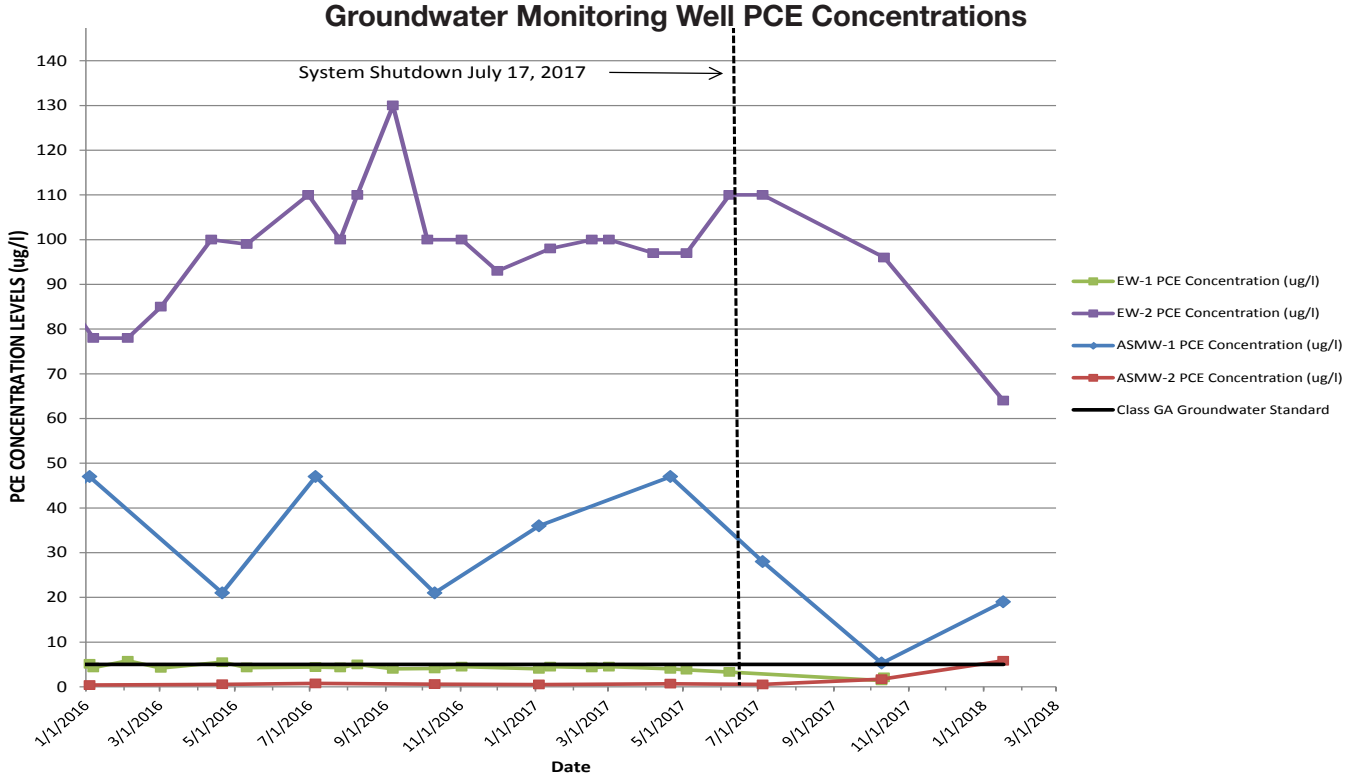
Before the GWE&TS shutdown, PCE concentrations in groundwater samples from well EW-2 ranged from 78 ug/l to 130 ug/l. After the shutdown, the PCE concentrations have declined from 110 ug/l in July 2017 to 64 ug/l in January 2018.

Concentrations of PCE in groundwater samples from ASMW-1 fluctuated from 21 ug/l to 47 ug/l in a two year period prior to the GWE&TS shutdown. Since the shutdown, PCE concentrations initially indicated a declining trend with a low of 5.3 ug/l in October 2017, but were higher in January 2018 at a concentration of 19 ug/l.

Groundwater concentrations of PCE in ASMW-2 were consistently low, ranging 0.38 ug/l to 0.75 ug/l, prior to the GWE&TS shutdown. Since the shutdown the PCE concentrations increased slightly to a high of 5.8 ug/l in January 2018.

Figure 3-1

Groundwater Monitoring Well PCE Concentrations



4.0 MONITORING PLAN COMPLIANCE

4.1 Monitoring Requirements and Compliance Status

The monitoring scope of services for the GWE&TS consists of monitoring system activities and groundwater monitoring well activities completed in accordance with the requirements of the O&M Plan and SMP. Presented below is a summary of the monitoring activities performed throughout this reporting period, as well as associated performance standards, a performance evaluation and associated compliance status, as appropriate. As the GWE&TS was shutdown on July 17, 2017, it should be noted that system monitoring activities were not completed for the remainder of the reporting period.

GWE&TS Monitoring Activities

GWE&TS monitoring activities performed throughout this reporting period included 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 GWE&TS monitoring activities completed during this reporting period, including sampling frequencies and analytes, is provided on Table 4-1.

Table 4-1: Treatment System Monitoring Summary

Sampling Location	Sampling Frequency				Analytical Parameters			
	Monthly (1)	Semi-Monthly (2)	Quarterly (3)	Semi-Annually (4)	VOC (EPA Method 8260)	VOC (EPA Method TO-15)	Iron & Manganese (EPA Methods 150.1 and 236.1)	pH (Field Screening)
Extraction Well No. 1 Influent	✓				✓			
Extraction Well No. 2 Influent	✓				✓			
Air Stripper Aqueous Effluent(5)	✓		✓		✓		✓	✓
Air Stripper Vapor Effluent		✓(6)		✓		✓		
Groundwater Monitoring Wells ASMW-1, ASMW-2 and ASMW-4			✓		✓			
Groundwater Monitoring Wells ASMW-3 and ASMW-5 through ASMW-7				✓	✓			

Notes:
1. As the GWE&TS was shutdown on July 17, 2017, extraction wells EW-1 and EW-2 were not sampled on a monthly basis for the remainder of this reporting period; however, they were sampled as part of the routine quarterly groundwater monitoring events.
2. Semi-monthly is defined as twice per month.
3. Quarterly is defined as once every three months.
4. Semi-annually is defined as twice per year.
5. Please note that in December 2016, per the NYSDEC request the sampling frequency for Iron and Manganese was modified to once per quarter.
6. Semi-monthly effluent vapor samples are analyzed utilizing tedlar bags and a hand-held photoionization detector (PID).

Groundwater Monitoring Activities

Sampling of the monitoring well network was completed during this reporting period to determine groundwater quality at the leading edge of the groundwater plume and downgradient of the GWE&TS. The groundwater monitoring well network consists of three groundwater monitoring wells located at the leading edge of the groundwater plume (ASMW-1 through ASMW-3), and four groundwater monitoring wells located downgradient of the leading edge of the plume (ASMW-4 through ASMW-7). Groundwater monitoring well locations are provided on *Figure 2-3*. Note that groundwater monitoring wells ASMW-4 through ASMW-7 act as early warning or "sentinel" wells for a cluster of Village of Rockville Centre public supply wells located further downgradient of the GWE&TS. As the GWE&TS was shutdown on July 17, 2017 of this reporting period, extraction wells EW-1 and EW-2 were sampled as part of the quarterly groundwater monitoring events conducted in October 2017 and January 2018 of this reporting period.

Additionally, per the request of the NYSDEC, all on-site and off-site groundwater monitoring wells (ASMW-1, ASMW-2, ASMW-3, ASMW-4, ASMW-5, ASMW-6, and ASMW-7) were sampled for polyfluoroalkyl substances (PFAS) and 1,4-dioxane during the groundwater sampling event completed in July 2017.

Groundwater monitoring activities consist of the collection and analysis of samples from each of the seven monitoring wells and the two extraction wells on a quarterly/semiannual basis, per the frequencies summarized on Table 4-1. *Appendix E* presents tabulated analytical results for all sample analysis, including 1,4-dioxane and tabulated analytical results for PFAS.

Data Analysis

All aqueous-phase 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.

All data packages were reviewed for completeness and compliance with NYSDEC Analytical Services Protocol (ASP) Quality Assurance/Quality Control (QA/QC) requirements. Copies of all tabulated analytical data generated during this reporting period are provided in *Appendix E*. Any QA/QC issues arising with the sample results were qualified in the Franklin Cleaners Site Management Quarterly Monitoring Reports. Copies of all Data Validation Checklists are provided in *Appendix F*.

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 a NCDPW storm sewer located along Hempstead Avenue, east of the GWE&TS. This discharge is authorized by the NYSDEC under a State Pollution Discharge Elimination System (SPDES) permit equivalency, which outlines site-specific discharge limits. A copy of the SPDES permit equivalency, is provided in *Appendix D*.

According to information provided by the NYSDEC Remedial Services Contractor, pH readings were not collected on March 15, 2017, June 8, 2017 and July 17, 2017, of this reporting period as the pH meter was not functioning properly. As the GWE&TS was shutdown on July 17, 2017, pH readings were not completed throughout the remainder of the reporting period.

Based on the analytical data, all analytes in the treated groundwater discharged from the GWE&TS during this reporting period were in compliance with all SPDES requirements, with the exception of a one-time exceedance of iron and several pH exceedances, as summarized below:

- pH readings were collected on seven occasions throughout this reporting period. pH was detected below its site-specific effluent limitation range of 6.5 to 8.5 standard units on five occasions throughout this reporting period ranging from 6.12 standard units on June 23, 2017, to a maximum of 6.45 standard units on July 5, 2017. Additionally, pH was detected within its effluent limitation range on two occasions throughout this reporting period on March 2, 2017 and May 22, 2017.

Vapor-Phase Discharge Standards and Compliance Status

PID readings collected from the vapor-phase effluent ranged from 0.0 ppm to 0.3 ppm during this reporting period. In order to more accurately monitor VOC concentrations in the vapor-phase effluent, the collection of vapor-phase effluent samples for laboratory analysis was initiated on a semi-annual basis in 2011. A site-specific effluent limit of 0.5 pounds per hour (lbs/hr) was developed in consultation with the NYSDEC as a means to monitor the vapor-phase VOCs discharged by the GWE&TS.

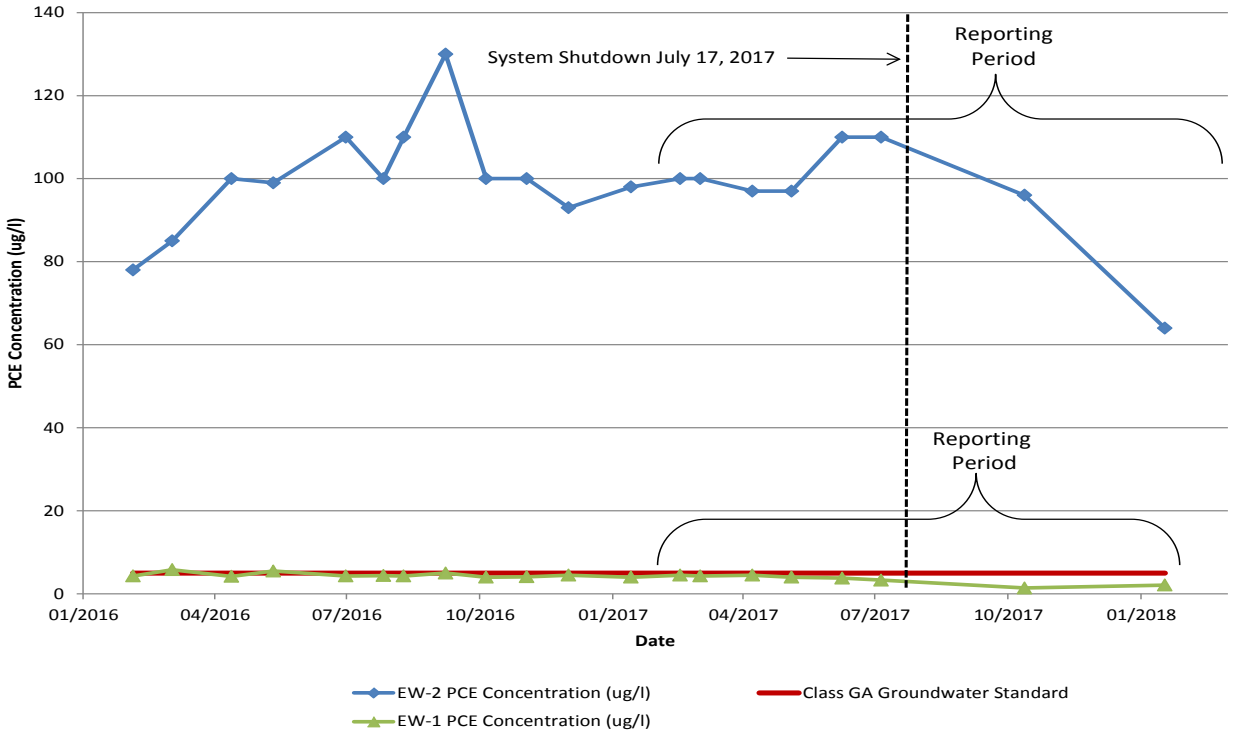
As the GWE&TS was shutdown on July 17, 2017, only one vapor-phase effluent sample was collected on April 18, 2017, of this reporting period. Sample results corresponded to total VOC emissions of 3.0E-4 lbs/hr well below the site-specific maximum total VOC emissions limit of 0.5 lbs/hr.

Groundwater Treatment Performance

Based on the influent sample results, PCE was detected in exceedance of its NYSDEC Class GA Standard of 5 ug/l in groundwater extracted from EW-2 on March 2, April 7, May 4, June 8, and July 5, 2017. Sample results for extraction well EW-1 exhibited PCE levels below its NYSDEC Class GA Standards in all samples collected. As the GWE&TS was shutdown on July 17, 2017 of this reporting period, extraction well EW-1 and EW-2 were sampled as part of the routine quarterly groundwater sampling events on October 12, 2017 and January 16, 2018. PCE concentrations in EW-2 have been detected above Class GA Standards; however, EW-1 exhibited concentrations below Class GA Standards. A graph depicting PCE concentrations in extraction wells EW-1 and EW-2 for a 2-year period, prior to the end of this reporting period (February 2018), is provided as Figure 4-1.

Figure 4-1

EW-1 and EW-2 PCE Concentrations



1. Samples collected in October 12, 2017 and January 16, 2017, from extraction wells EW-1 and EW-2 were collected as part of the routine quarterly groundwater sampling event due to the GWE&TS shutdown, per the NYSDEC.

Based on the influent sample results for this reporting period, PCE concentrations in extraction well EW-1 influent ranged from 1.4 ug/l to a maximum concentration of 4.5 ug/l, detected on April 7, 2017. PCE concentrations detected in extraction well EW-2 influent during this reporting period ranged from a minimum of 64 ug/l detected on January 16, 2018, to a maximum concentration of 110 ug/l, detected on June 8 and July 5, 2017.

It should be noted that several other VOCs, including chloroform, 1,1-dichloroethane 1,1-dicholoroethene, 1,3-dichlorobenzene and methyl tert-butyl ether (MTBE) were detected at generally low levels and well below their respective Class GA Standards in one or both wells during this reporting period.

PCE results during this reporting period in extraction wells EW-1 and EW-2 exhibited stable trends. In general, both extraction wells exhibit an overall decreasing trend since system start-up in September 2004.

As discussed in Section 4.2, the GWE&TS has been removing VOCs in the extracted groundwater to below the required site-specific aqueous-phase discharge standards. VOCs were not detected above site specific SCGs in aqueous-phase discharge during this reporting period; however, PCE concentrations of 2.1 ug/l and 0.22 ug/l, were detected on June 8 and July 5, 2017, respectively. Approximately 0.62 pounds of PCE were removed from the extracted groundwater during this reporting period, slightly less than the previous reporting period (1.84 pounds), and the total pounds per hour (lbs/hr) average PCE removal rate for this reporting period ranged from a low of 2.62E-04 lb/hr in Quarter 51 (March through May 2017) to a high of 2.83E-04 lb/hr in Quarter 52 (June through August 2017), as compared to 2.96E-04 lb/hr to 3.58E-04 lb/hr during the previous reporting period. The reduction in PCE removed was due to the GWE&TS being shutdown on July 17, 2017.

The average total VOC removal efficiency for the GWE&TS throughout this reporting period was approximately 95.59%, slightly lower than the average efficiency throughout the previous reporting period (99.44%). A summary of the GWE&TS performance results for this reporting period is provided on Table 3-2.

4.3 Groundwater Monitoring Well Network Evaluation

Groundwater Monitoring Well Condition Summary

All of the sampled groundwater monitoring wells were found to be accessible during the groundwater monitoring/sampling events conducted throughout this reporting period. All groundwater monitoring wells were located as indicated on the site map and the concrete well pads (where applicable), protective casings, surface seals, well IDs, PVC well risers, well plugs and locks were observed to be present and in good condition with the following exceptions:

Quarter 52 (June 1, 2017 through August 31, 2017)

- A lock is not present at monitoring wells ASMW-2, ASMW-4 and ASMW-5.

Quarter 53 (September 1, 2017 through November, 2017)

- The well IDs for ASMW-5, ASMW-6 and ASMW-7 are missing,
- A lock is missing at ASMW-7; and,
- The well pad at ASMW-5 is cracked and in need of repair.

Quarter 54 (December 1, 2017 through February 28, 2017)

- The well IDs for ASMW-5 and ASMW-6 are missing,
- A lock is missing at ASMW-4 and ASMW-5; and,
- The well pad at ASMW-5 is cracked and in need of repair.

Monitoring well field inspection forms are provided in *Appendix G*.

Contaminant Concentrations

A summary of PCE concentrations detected in the monitoring well network is provided below. Note that graphs are provided in "hyperlinks" indicated in blue below, for monitoring wells exhibiting PCE concentrations in exceedance of its Class GA Standard of 5 ug/l during this reporting period.

As described above, monitoring wells ASMW-1 through ASMW-3 are located along the leading edge of the groundwater plume, in close proximity to the GWE&TS, while monitoring wells ASMW-4 through ASMW-7 are located downgradient of the GWE&TS, and act as early warning or "sentinel" wells for a cluster of Village of Rockville Centre public supply wells located further downgradient of the GWE&TS.

ASMW-1: PCE was detected at concentrations ranging from 5.3 ug/l on October 10, 2017 to a maximum of 47 ug/l, detected on April 21, 2017. Overall, PCE concentrations within monitoring well ASMW-1 have exhibited a generally decreasing trend throughout this reporting period, and a decreasing trend since 2003.

ASMW-2: PCE was detected at concentrations ranging from 0.53 ug/l on July 10, 2017 to a maximum of 5.8 ug/l, detected on January 17, 2017. Overall, PCE concentrations within monitoring well ASMW-2 have exhibited an increasing trend throughout this reporting period; however, an overall decreasing trend since 2003.

ASMW-3: Consistent with historical data, PCE was not detected in the groundwater samples collected from this monitoring well, with the exception of a trace detection at 0.19 ug/l on July 10, 2017. Overall, PCE has exhibited a stable trend in ASMW-3, exhibiting either nondetect or trace concentrations since 2004.

ASMW-4: Consistent with historical data, PCE was not detected in the groundwater samples collected from this monitoring well. Overall, PCE has exhibited either nondetect or trace concentrations since system start-up 2003.

ASMW-5: Consistent with historical data, PCE was not detected in the groundwater samples collected from this downgradient well during this reporting period.

ASMW-6: Consistent with historical data, PCE was not detected in the groundwater samples collected from this downgradient well during this reporting period.

ASMW-7: PCE was has not been detected in the groundwater samples collected from this monitoring well throughout the previous two reporting periods.

Several other VOCs, including chloroform, 1,1-dichloroethene, 1,1-dichloroethane, 1,3-dichlorobenzene, 1,4-dioxane,

MTBE and trichloroethene, were detected at generally low levels and well below their respective Class GA Standards within one or more well during this reporting period.

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

The intent of this section is to provide a description of the 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 are not required by the March 1998 ROD as an element of the remedy. Therefore, ICs such as land or groundwater use restrictions are not currently implemented at the Site. A SMP for the Site, including a Monitoring Plan and an O&M Plan for the GWE&TS, was put in place in July 2012.

It should be noted that the Site's inclusion in the New York State Registry of Inactive Hazardous Waste Sites as a Class 4 Inactive Hazardous Waste Site (Site No. 130050) acts as an IC for the Site. In general, such Sites go through a process of investigation, evaluation, cleanup and monitoring in several distinct phases, which are recorded and maintained by New York State. The information recorded and maintained by New York State typically includes the Site name, identification number, description, cleanup status, types of cleanup, owner information, types and quantities of contaminants, and an assessment of health and environmental issues.

Based on the successful remediation of Site "source area" soil and groundwater contamination utilizing a SVE/AS system, and based on the results of the NYSDEC's September 2009 groundwater sampling event, land use restrictions are not warranted at the Site at this time.

In addition, groundwater is not currently nor planned to be utilized for any purpose at the Site. Based on the availability of public water downgradient of the Site, it is not anticipated that groundwater will be utilized for any purpose for the foreseeable future. In addition, Molloy College, located immediately downgradient of the leading edge of the groundwater plume, is serviced by public water supply. As detailed in Section 2.2, and as part of the requirements of the March 1998 ROD, a deep irrigation well (ASMW-7) was installed at Molloy College to replace shallow irrigation well (MCOL-1), which had the potential to become contaminated with PCE based on its depth and location downgradient of the groundwater plume.

Based on the above evaluation, groundwater use restrictions are not warranted to be implemented at or downgradient of the Site at this time.

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, the groundwater monitoring network (ASMW-1 through ASMW-6) and replacement irrigation well ASMW-7 are the ECs currently in-place downgradient of the Site. The GWE&TS has operated in general accordance with the design standards until July 17, 2017, when the system was shutdown, per NYSDEC direction. In accordance with recommendations in Site Management Quarterly Reports and the 2016 Periodic Review Report for the site, the NYSDEC directed that the GWE&TS be shutdown on July 17, 2017 to evaluate if continued operation of the GWE&TS is necessary. Although not required by the March 1998 ROD, the site fencing and security signage act as ECs at the Site as well. The Site fencing and security signage are currently in-place and functioning properly. In addition, based on information provided by the NYSDEC, a sub-slab soil vapor extraction system is currently operating, maintained by others, in the on-site former "source area."

The IC/EC Certification form provided by the NYSDEC includes the GWE&TS as an EC. A copy of the completed IC/EC Certification form, as provided by the NYSDEC, is included as *Appendix H*. In addition, a property owner certification is provided as *Appendix I*.

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. Based on operational and performance data sets discussed above for the GWE&TS, the NYSDEC determined the system, as configured, may be approaching asymptotic conditions. As a result, and in accordance with recommendations in Site Management Quarterly Reports and the 2016 Periodic Review Report for the Site, the NYSDEC directed that the GWE&TS be shutdown in July 2017 of this reporting period to evaluate if continued operation of the GWE&TS is necessary.

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 36% of its electric is supplied from other outside electric utilities. Electricity usage associated with the GWE&TS is mainly attributed to operation of the submersible pumps within extraction wells EW-1 and EW-2, the pressure blower and the wet well submersible pumps. Minor electricity usage can also be attributed to the treatment system building heating and lighting, as well as system controls.

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 49,134 kilowatt-hours (kWh) of electricity, at an average of approximately 135 kWh/day. Note that the average electricity usage during the previous reporting period was 319 kWh/day. It should be noted that the total average electricity usage decreased during this reporting period, as compared to the previous reporting period. This is likely due to the fact that there was more system downtime during this reporting period, as compared to the previous reporting period, due to the system being shutdown on July 17, 2017.

Fossil Fuel Usage

The GWE&TS does not directly use fossil fuels as part of its routine operation; however, fossil fuels are indirectly used during the completion of maintenance and monitoring activities associated with the overall operation of the GWE&TS. Indirect fossil fuel use results from completion of the following Site related activities:

- Transportation to and from the Site for monitoring, sampling and system alarm response.
- 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. Note that the treatment system building is equipped with a pressurized water storage tank and jet pump, which was installed to provide for the ability store treated groundwater from the wet well for later use in a slop sink located next to the water storage tank. Therefore, the GWE&TS has no net impact associated with water usage.

Air Emissions

Vapor-phase discharge from the low profile stacked-tray air stripper is released directly to the atmosphere. The vapor-phase discharge is monitored on a routine basis to prevent or limit any vapor-phase contaminant concentration exceedances. Contaminant concentrations within vapor-phase discharge are consistently well below the site-specific discharge limits and were below the site-specific discharge limits throughout this reporting period.

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, twine and bailers 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.

7.0 COST EVALUATION

The total cost of operation of the GWE&TS from March 1, 2017 through February 28, 2018, was approximately $93,051. This total includes engineering and subcontractor costs, as well as utility costs associated with the operation of the GWE&TS (electric). 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. A review of these costs is provided on Table 7-1.

The following provides a brief review of each cost item:

- 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 47% of the total costs for this reporting period, slightly less than the previous reporting period.
- 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 42% of the total costs for this reporting period, up from approximately 26% during the previous reporting period.
- Utility costs in support of the overall operation of the GWE&TS include electric. As summarized on Table 7-1, utility costs were approximately 11% of the total costs for this reporting period, and were associated with electric usage, slightly down from approximately 16% during the previous reporting period. This reduction is primarily due to the system shutdown on July 17, 2017.
- Based on the total cost of $93,051 incurred during this reporting period, the average cost of monthly system operation was approximately $7,754 per month. In addition, when compared to a total of 0.62 pounds of VOCs removed throughout this reporting period (as summarized on Table 3-2), the average total VOC removal cost is approximately $150,082 per pound of VOC, up from approximately $76,704 during the previous reporting period. This is due to slightly higher operating costs, slightly less VOC recovery, and the GWE&TS shutdown in July 2017 as compared to the previous reporting period.

Table 7-1: Reporting Period Cost Summary

COST ITEM	BUDGET EXPENDED (March 1, 2017 through February 28, 2018)	PERCENT OF TOTAL
ENGINEERING SUPPORT		
D&B Engineers and Architects, P.C.	$43,500	47%
SUBCONTRACTORS		
NYSDEC Remedial Services Contractor[1] (Routine/Non-Routine Maintenance Activities)	$32,662	35%
Test America (Analytical Laboratory)	$6,290	7%
SUB-TOTAL	$38,952	42%
UTILITIES		
Electric	$10,599	11%
SUB-TOTAL	$10,599	11%
TOTAL COSTS	$93,051	100%
AVERAGE COST/MONTH	$7,754	--
COST/POUND OF VOC REMOVED[2]	$150,082	--

Notes:
1. All expenses and labor are incorporated into the NYSDEC Remedial Services Contractor overall costs, excluding electric and telephone costs.
2. Based on a total of approximately 0.62 lbs of VOCs removed during this reporting period, as the GWE&TS was shutdown in July 17, 2017. As such, the cost per pound for this reporting period is slightly higher than previous reporting periods.

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:

General

- GWE&TS Operation: The overall GWE&TS and remedial components operated in a generally efficient manner and generally within design specifications during this reporting period, prior to the system shutdown on July 17, 2017. In accordance with recommendations for the site, the NYSDEC directed that the GWE&TS be shutdown in July 2017, to evaluate if continued operation of the GWE&TS is necessary.

Operation and Maintenance

- O&M Plan: As noted in Section 3.2, the O&M scope of services was performed in accordance with the requirements of the O&M Plan and SMP, with the exception of routine maintenance of the pressure blower, which was completed more frequently than what is specified in the routine maintenance schedule.
- Alarm Conditions/Downtime: Several alarm conditions and system shutdowns occurred throughout this reporting period prior to the system shutdown on July 17, 2017. These shutdown events were primarily associated with power losses and low-voltage electric issues and low-flow issues associated with the pressure blower.
- System Evaluation: As discussed in Section 3.3, since the shutdown of the GWE&TS on July 17, 2017, the concentrations of PCE in groundwater at the Site have been generally stable except for a slight increase in ASMW-2 and a decreasing trend in EW-2. Therefore, the system shutdown has not caused any contaminant concentrations to rebound.

Monitoring Plan

- System Monitoring: As noted in Section 4.0, monitoring requirements were generally maintained throughout the reporting period in accordance with the requirements of the monitoring schedule provided in the SMP. It should be noted that per direction of the NYSDEC, the sampling frequency for iron and manganese was modified in December 2016 of the previous reporting period to once per quarter. As the GWE&TS was shutdown on July 17, 2017, monitoring events were not completed for the remainder of this reporting period.
- pH Readings: pH readings were not collected from aqueous-phase system samples on three occasions throughout this reporting period as the NYSDEC Remedial Services Contractor's pH meter was not functioning. pH was detected below its site-specific effluent limitation range of 6.5 to 8.5 standard units on five occasions throughout this reporting period ranging from 6.12 standard units on June 23, 2017, to a maximum of 6.45 standard units on July 5, 2017. Additionally, pH was detected within its effluent limitation range on two occasions throughout this reporting period on March 2, 2017 and May 22, 2017.
- Monitoring Well Sampling: As discussed in Section 4.3, the NYSDEC Remedial Services Contractor should continue to coordination with Molloy College to collect groundwater samples from ASMW-7 per the routine schedule provided in the SMP. Additionally, the NYSDEC Remedial Services Contractor should continue to sample extraction wells EW-1 and EW-2 as part of the routine quarterly groundwater sampling events.
- Groundwater Monitoring Well Inspection Summary: All of the sampled groundwater monitoring wells were found to be accessible during the groundwater monitoring/sampling events conducted this reporting period. All groundwater monitoring wells were located as indicated on the site map and the concrete well pads (where applicable), protective casings, surface seals, well IDs, PVC well risers, well plugs and locks were observed to be present and in good condition with the exception of the following;
  - The well IDs for ASMW-5, ASMW-6 and ASMW-7 are missing;
  - A lock is missing at ASMW-2, ASMW-4, ASMW-5 and ASMW-7; and,
  - The well pad at ASMW-5 is cracked and in need of repair.

Institutional and Engineering Controls

- IC/EC Compliance: ICs are not required by the March 1998 ROD as an element of the remedy. Therefore, ICs such as land or groundwater use restrictions are not currently implemented at the Site. However, note that the Site's inclusion in the New York State Registry of Inactive Hazardous Waste Sites as a Class 4 Inactive Hazardous Waste Site (Site No. 130050) acts as an IC for the Site. As per the NYSDEC, the GWE&TS was shutdown in July 2017, of this reporting period as the operational and performance data set for the GWE&TS indicates that the system, as configured, may be approaching asymptotic conditions. The GWE&TS EC, as listed in the IC/EC Certification Form provided by the NYSDEC, is currently in-place and can be restarted if needed pending the continued monitoring of contaminant concentrations within the existing monitoring well network. As such, the groundwater monitoring well network (ASMW-1 through ASMW-6) is still in place and sampled on a quarterly basis. In addition, the alternate groundwater irrigation well (ASMW-7) is in-place downgradient of the GWE&TS on Molloy College property and soil vapor mitigation system, operated by others, is in-place at the Site "source area." Based on available information, ICs such as groundwater and land-use restrictions are not currently required for the Site. Based on the evaluation presented in Section 5.0, these restrictions are not warranted to be implemented at or downgradient of the Site at this time.

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 increase the overall performance, effectiveness and protectiveness of the GWE&TS:

General Recommendations

- GWE&TS Operation and Remedial Objectives: The GWE&TS was operating for the first portion of this reporting period; however, based on operational and performance data sets discussed above for the GWE&TS, the NYSDEC determined the system, as configured, may be approaching asymptotic conditions. As such, the NYSDEC directed that the GWE&TS be shutdown to perform an evaluation of the system as configured. Accordingly, on July 17, 2017, the NYSDEC Remedial Services Contractor conducted a complete round of O&M activities and subsequently shutdown the system.
- Periodic Reviews: 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.

Operation and Maintenance Plan

- Facility Maintenance: Ensure that landscaping and snow plowing activities are adequately completed to maintain access and safety at the Site, as necessary.
- System Evaluation: As contaminant concentrations within the monitoring well network have remained relatively stable since the GWE&TS was shutdown on July 17, 2017 of this reporting period it is recommended that the GWE&TS remain off and for evaluation efforts to continue. This evaluation should consist of monitoring of contaminant concentrations within the existing monitoring well network located in the vicinity and downgradient of the GWE&TS.

Monitoring Plan

- Monitoring Well Sampling: It is recommended that the NYSDEC Remedial Services Contractor continue to coordinate with Molloy College to collect groundwater samples from ASMW-7 per the routine sampling schedule provided in the SMP. Additionally, the NYSDEC Remedial Services Contractor should continue to sample Extraction Wells EW-1 and EW-2 as part of the routine quarterly groundwater sampling event.
- Groundwater Monitoring Well Inspection Summary: It is recommended that the NYSDEC Remedial Services Contractor complete repairs to the following groundwater monitoring wells;
    - Replace the monitoring well IDs for ASMW-5, ASMW-6 and ASMW-7 as they are missing;
    - Replace or repair the locks missing at monitoring wells ASMW-2, ASMW-4, ASMW-5 and ASMW-7; and,
    - Repair the well pad at monitoring well ASMW-5 as it is cracked.

Institutional and Engineering Control Recommendations

- Institutional Controls: Based on available information, ICs such as groundwater and land-use restrictions are not currently required for the Site. Based on the evaluation presented in Section 5.0, these restrictions are not warranted to be implemented at or downgradient of the Site at this time.