

**Pennsylvania Avenue Landfill  
Brooklyn, New York  
NYSDEC Site No. 224002**

**Annual Post-Closure Operation, Maintenance  
and Monitoring Report  
January 2014 through December 2014**

**March 2015**

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## **Section 1 - Introduction**

This Post-Closure Annual Summary Report (Report) has been prepared by the New York City Department of Environmental Protection (NYCDEP) to fulfill the reporting requirements contained in the Pennsylvania Avenue Landfill (PAL) Operation and Maintenance (O&M) Manual, the PAL Monitoring Plan, and 6NYCRR Part 360. This Report documents the operation, maintenance and monitoring activities performed during the PAL sixth annual post-closure reporting period from January 1 through December 31, 2014.

## **Section 2 - Site Background**

The PAL inactive hazardous waste disposal site (Site) is located on 110 acres at the southern end of Pennsylvania Avenue in Brooklyn, New York. It is bounded by the Belt Parkway, Jamaica Bay, Hendrix Creek and Fresh Creek. A site location map is provided in Figure 1.

In 1956, the Site was opened to receive residential and commercial wastes, including construction and demolition (C&D) residuals and waste oil. In 1962, land-filling activities shifted to the Fountain Avenue Landfill (FAL). The PAL was reopened for disposal of C&D wastes in 1968. It is reported that, between 1974 and 1980, illegal dumping of hazardous wastes occurred at the Site. Disposal of all wastes stopped by 1980, and the Site was added to the Registry of Inactive Hazardous Waste Disposal Sites requiring surveillance. In 1983, the Site was reclassified to a Class 3, which is a site considered not to pose a significant threat, and for which action can be deferred. After an oil inventory and product recovery feasibility study conducted in 1984, the Site was reclassified to a Class 2, a site which poses a significant threat to public health or the environment.

On December 16, 1985, and again on April 17, 1990, the New York State Department of Environmental Conservation (NYSDEC) executed Orders on Consent with the New York City Department of Sanitation (DOS) to close and remediate the Site. On April 7, 1992, the DEP entered into a Consent Order with the NYSDEC to perform a remedial program at the Site.

In response to this, DEP conducted a Remedial Investigation/Feasibility Study (RI/FS) to determine the nature and extent of contamination. The Final RI/FS, dated May 1994, revealed that certain areas and media at the Site required remediation; a summary of these results follows:

- Surface soil and sediment samples exhibited varying levels of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, pesticides and PCBs contamination.
- It was determined that a floating product (i.e., separate-phase petroleum) plume beneath the Site contaminated the groundwater in the leachate mound and the surface water in Fresh Creek. Tests indicated that the waste oils with the capacity to migrate to the shoreline had already done so, and the remaining oils are stationary. In addition to the VOC and SVOC levels associated with residual petroleum contamination, the waste oil contained PCB levels that classify it as a hazardous waste.

- Groundwater in the leachate mound (U wells – fill aquifer) was somewhat contaminated with VOCs, SVOCs and PCBs, and it was more so in the areas where it was in contact with the floating oil plume. The shallow and deep Upper Glacial Aquifer (S & D wells) did not require remediation because they did not exhibit significant levels of contamination.

By the Order on Consent, Interim Remedial Measures (IRMs) were implemented. An interim cover was placed to prevent casual contact with exposed waste and minimize emissions. Rip-rap was installed for shoreline protection. Construction of a passive waste oil interceptor trench was completed in January 1994. The purpose of the trench is to capture waste oil before it reaches Fresh Creek; however, to date actual oil migration to the trench has been minimal.

The goals for the remediation program were set to eliminate or minimize the threats to the public health and the environment, by addressing the contamination of subsurface soils and waste disposal areas; by protecting surface waters through eradication of run-off and erosion from contaminated substrates and the migration of leachate into surrounding waters; by minimizing the impact of contaminated groundwater; by reducing soil and sediment contamination levels and removing the possibility of human or animal contact; and, by controlling and containing landfill gas emissions.

The Final Feasibility Study Report, dated September 1994, detailed the selection process and the remedial alternative chosen. The option selected included a 6NYCRR Part 360 cap, leachate collection along Fresh Creek, limited sediment excavation, active gas control, and long term monitoring of site media.

The Record of Decision (ROD), dated February 1995, presented the remedial action. In accordance with the ROD, the Site was remediated under construction Contracts Nos. LF-PAL-G2/E2 and LF-PAL-G3. The main elements of this action included:

- Remediation of approximately 30,000 cubic yards of sediment along the Fresh Creek shoreline.
- Installation of a groundwater/leachate (GW/L) management system consisting of a 750-foot-long interceptor trench, two pumping stations, a force-main and an enclosed leachate pre-treatment system with subsequent disposal to the 26<sup>th</sup> Ward Wastewater Treatment Plant (WWTP).
- Regrading of the Site to provide proper drainage and minimize erosion.
- Installation of a stormwater collection, conveyance and outfall system.
- Installation of an actively vented impermeable final cover consisting, from top to bottom, of a vegetated top soil layer (6" minimum), a soil barrier protection layer (12"), a Type 2 cover double-sided geocomposite drainage layer or a Type 1 cover cushion geotextile, an LLPDE geomembrane liner (40 mil thick), and a sub-base grading fill layer.
- Planting of warm season grasses and approximately 13,000 shrubs and trees
- Installation of an active landfill gas (LFG) collection system and flaring station.

The ROD called for a pre-approved Post-Closure Monitoring, Sampling and Analysis Plan (the Monitoring Plan, the Plan) to commence within one month of DEP's receipt of NYSDEC's

written approval of the Final Engineering Report (FER) for the Site. The FER acceptance letter was dated March 26, 2009, and the first monitoring round was initiated within a month of its receipt and performed in accordance with the Monitoring Plan requirements. Subsequently, the ground-water portion of the Monitoring Plan was revised to allow the low-flow purging and sampling method to be used to collect groundwater samples for the analysis of both the inorganic and organic parameters. These revised Monitoring Plan requirements were utilized commencing with the second Post-Closure monitoring event. Based on the results of one year of quarterly post-closure monitoring, the frequency of ground water monitoring was reduced from quarterly to annually in rotating calendar quarters (i.e., once every five quarters), and the list of parameters required to be monitored was reduced. The 2011 annual monitoring round was performed during the first quarter of 2011, the 2012 annual monitoring round was performed during the second quarter of 2012, and the 2013 annual monitoring round was performed during the third quarter of 2013. Soil gas quality readings are taken from the five gas monitoring wells located beyond the perimeter of the cap, parallel to the Belt Parkway quarterly.

Prior to approval of the FER, a preliminary groundwater sampling and analysis round was conducted in July 2007. Since their installation in May 2008, the perimeter soil gas wells are monitored as needed, and at least quarterly as mandated by the Monitoring Plan.

In July 2012, the NYSDEC changed the classification of the PAL site from a Class 2 to a Class 4 site on the Registry of Inactive Hazardous Waste Disposal Sites since it was properly remediated and requires site management.

## **Section 3 – 2014 Annual Summary Report**

This Report covers the sixth annual post-closure reporting period from January 1 through December 31, 2014.

### **3.1 Groundwater/Leachate Management System**

The groundwater/leachate (GW/L) management system represents one of the components of the selected remedy in the Site's ROD. The ROD stipulated the construction of an active leachate collection trench in the area of the waste oil outbreak along Fresh Creek and pumping the leachate to an on-site facility for pre-treatment prior to discharge to the 26<sup>th</sup> Ward WWTP.

The GW/L collection, pre-treatment and disposal system was designed to prevent migration of GW/L containing oil and dissolved contaminants to Fresh Creek and to produce a treated effluent acceptable for discharge. The main components of the GW/L management system consist of a stone-filled interceptor trench with two pump stations; a 3-inch diameter HDPE leachate force main carrier pipe in a 6-inch diameter HDPE casing pipe; a pre-treatment facility and a 4-inch diameter HDPE pretreated leachate force main pipe ultimately discharging to a junction manhole at the 26<sup>th</sup> Ward WWTP. The GW/L pre-treatment facility was designed to treat up to 30 gpm. The facility's components include oil-water separation with citric acid conditioning, bag filtration and carbon adsorption.

The effluent was originally regulated under DEP's Industrial Wastewater Discharge (IWD) Permit No. 07-P3145-2, effective from August 27, 2007 to August 26, 2012. Based on the historical sampling data indicating that the groundwater/leachate quality in the interceptor trench met the plant's Industrial Pre-Treatment Permit discharge limits prior to pre-treatment, the DEP received approval in 2011 to install diversion piping within the PAL GW/L Pre-Treatment Plant to divert the influent directly to the plant effluent piping. Figure 2 shows the current Pre-Treatment System Schematic, which includes the diversion-related modifications. The programmable logic control (PLC) was also reprogrammed to accommodate this second mode of operation. The facility has operated in Pre-Treatment Plant Diversion Mode since November 1, 2011. The Pre-Treatment Plant equipment within the building has been, and shall continue to be properly maintained so that if the GW/L water quality degrades, the Pre-Treatment Plant can be put back into operation in accordance with the PAL O&M Manual.

A new IWD Permit No. 11-P3145-1, reflecting the relocated M-1 sampling location was issued on November 11, 2011 and expires on November 10, 2016. Monthly M-1 sampling continues to be performed under the new permit and is reported quarterly in the Self Monitoring Reports submitted to the IIPS. Appendix B of the 2014 Quarterly Reports contains the results of the laboratory analyses as well as the Self-Monitoring Reports.

Examination of the M-1 sampling data for the 2014 annual reporting period summarized in Table 1 indicates that the concentration of each detected parameter in the M-1 samples is lower than its respective IWD permit discharge limit. To document that operation of interceptor trench collection system is still warranted, the M-1 sample results were also compared to the NYSDEC 6NYCRR Part 703 standards and guidance values for Class SA (Saline) surface waters. Based on that comparison, in 2014, frequently the concentrations of chlorobenzene and occasionally the concentrations of total dichlorobenzenes in the interceptor trench water continued to exceed the 5-ug/L guidance value for protection of saltwater fish propagation. In addition, the lead concentrations of the interceptor trench water continued to periodically exceed the 8-ug/L standard for protection of saltwater fish propagation. Two other parameters N-nitrosodiphenylamine (previously detected) and methylene chloride also exceeded their guidance values for protection of saltwater fish propagation on one occasion in 2014. Therefore, operation of the interceptor trench collection system is still warranted.

During this annual reporting period, 8,400,705 gallons were discharged to the WWTP from the interceptor trench. The following table summarizes the flow data for the twelve-month period.



	<b>Total Flow (Gallons)</b>	<b>Average Flow (GPM)</b>	<b>Average Daily Flow (GPD)</b>	<b>Maximum Daily Flow (GPD)</b>	<b>Number of days in service</b>	<b>Percent of time in service</b>
<b>Jan-14</b>	800,922	17.9	25,836	31,630	31	100%
<b>Feb-14</b>	800,393	19.9	28,585	40,200	28	100%
<b>Mar-14</b>	786,560	17.6	25,373	28,970	31	100%
<b>Apr-14</b>	841,580	19.5	28,053	40,190	30	100%
<b>May-14</b>	854,260	19.1	27,557	32,770	31	100%
<b>Jun-14</b>	637,355	14.8	21,245	24,620	30	100%
<b>Jul-14</b>	511,960	11.5	16,515	20,880	31	100%
<b>Aug-14</b>	446,580	10.0	14,406	16,700	31	100%
<b>Sep-14</b>	367,330	8.5	12,244	14,020	30	100%
<b>Oct-14</b>	633,660	14.2	20,441	36,537	31	100%
<b>Nov-14</b>	747,780	17.3	24,926	29,030	30	100%
<b>Dec-14</b>	972,325	21.8	31,365	42,640	31	100%
<b>Average</b>	<b>700,059</b>	<b>16.0</b>	<b>23,106</b>	NA	NA	<b>100%</b>
<b>Maximum</b>	972,325	21.8	31,365	42,640	NA	NA
<b>Total</b>	<b>8,400,705</b>	NA	NA	NA	<b>365</b>	NA

Although the system is in diversion mode, the interceptor trench continues to be inspected daily for the presence of product (separate-phase petroleum) and to verify water levels. There was no indication of separate-phase petroleum in the trench or off-site leachate migration during this annual reporting period.

Inspection and monitoring of the GW/L pre-treatment system was conducted following the O&M Manual procedures. Daily Operations, bi-weekly (GWL-1), monthly (GWL-2), quarterly (GWL-3), and annual (GWL-5) inspections were performed. Another form, DP-1, "Description of Deficiencies and Problems," was used to highlight specific problems requiring timely attention. While many of the deficiencies caused by the impact of the Hurricane Sandy surge were addressed during a previous reporting period, sand and road material intrusion into the Pump Station No. 1 valve vault will be removed after repairs to the embankment and Road D are completed because vehicular access is needed to perform the repair. Although the product storage tank is not utilized, it will also be placed back on its base once vehicular access is restored following the Road D/embankment repair. Other equipment components exposed to the Hurricane Sandy surge that are currently operational will continue to be monitored and assessed over time and may be replaced in the future, if necessary.

No separate-phase petroleum has ever been detected at the leachate pump stations. However, as a precautionary measure, the replacement of the scavenger pumps was examined but determined not to be necessary at this time. The pump stations will continue to be inspected on a daily basis and the water quality will continue to be sampled on a monthly basis in accordance with the Discharge Permit requirements. Should separate-phase petroleum be observed, mitigation

measures will be taken at that time to ensure they are appropriate to the actual conditions encountered. The replacement of the OWS influent filter casing and the petroscreen coalescer baskets has been placed on hold since the treatment system can be placed back on line without these items, thereby, allowing for their replacement when and if the pre-treatment system is placed back on-line. At the commencement of the diversion mode operation, the pre-treatment plant equipment and piping that was being circumvented, was power-washed and prepared in accordance with manufacturer's recommendations to remain in a standby condition. The equipment continues to be inspected as required to ensure that they remain in good operating condition and ready to return to service if needed. Copies of the inspection reports were provided in Appendix A of the 2014 Quarterly Reports.

### **3.2 Landfill Gas Management System**

The landfill gas (LFG) management system represents one of the elements of the selected remedy in the Site's ROD. The ROD required the selected remedy "to ensure full collection and control of landfill gas". This system must also meet the requirements of 6NYCRR Part 360 to limit off-site gas migration to the lower explosive limit (LEL) at the property line (i.e., 5% gas in air) and 25% of the LEL in structures (i.e., 1.25% gas in air). The LFG management system operates in accordance with an Air Facility Registration Certificate # 2-6105-00762/00001 issued by the NYSDEC.

The system features 46 gas extraction wells (EWs), a below grade polyethylene collection header piping network with isolation valves, two 375-scfm centrifugal blowers (blower 301 and blower 302), condensate collection system, an enclosed flare system, process instrumentation and controls, a PLC management system, a fire alarm system and an emergency condition alarm autodialer phone system. A plan of the overall LFG management system is shown on Figure 3 illustrating the location of the extraction wells, header pipe and flare facility. All 46 gas EWs were inspected and monitored for gas content (percent CH<sub>4</sub>, CO<sub>2</sub> and O<sub>2</sub>), temperature and vacuum pressure each month. Deficiencies such as missing signage, track cleaning or sampling port repair are corrected at the time of the inspection, work orders are issued for other work. The LFG-3 inspection reports are included in Appendix C of the 2014 Quarterly Reports.

The four main headers that convey the landfill gas are connected to a condensate drain line at their low point located adjacent to the flare station. This condensate drain line and the condensate drain lines from the two blower demisters (knock out pots) empty into the 2,500 gallon condensate tank located at the flare station. On September 22<sup>nd</sup>, 2,000 gallons of condensate was removed by private hauler. Prior to removal the condensate was sampled and buffered. At the end of the 2014 annual post-closure period, the condensate tank contained 82 gallons.

Main piping on the vacuum side of the blowers contains an 8-inch butterfly valve with an electric actuator. This automatically adjusts the valve position according to the vacuum transmitter readings in order to control the landfill vacuum. This is followed by an 8-inch electro-pneumatic butterfly valve which operates with a compressed nitrogen cylinder. This valve automatically closes in the event of a system failure or shutdown. The gas flare system is designed to operate with one blower in service and one as redundant standby. Although designed to collect up to 375 scfm of landfill gas, the system averaged 72.1 scfm during the 2014 annual post-closure period.

Process gas temperature and pressure readings from the vacuum and discharge side are recorded daily in the LFG-1 inspection log. The monthly summary report of the LFG-1 daily inspections is included in Appendix C of the 2014 Quarterly Reports.

Landfill gas is discharged from the blowers through an 8-inch header and flame arrestor into the enclosed flare. The flare pilot is fired using natural gas from the utility company. The natural gas is also used as auxiliary fuel to supplement the recovery of landfill gas. During the 2014 annual post-closure period, 4,354 SCF of natural gas was consumed for the pilot and to help bring system to temperature after start ups. The accuracy and function of the natural gas meter remains in question, and a request for its replacement was placed by the utility company technician. The flare support system includes a purge air blower, two manual and two automatic dampers, temperature control with three thermocouples. The flare operation is on automatic control using the middle thermocouple at a target temperature of 1,500 °F.

During 2014 annual post-closure period, the landfill gas flaring system processed 35,461,531 SCF of landfill gas. The flare ran for 93.3% of the time. Flame failure, low flow and low blower current faults, PLC malfunction caused by a power failure, LEL sensor malfunction, repair and calibration, routine equipment inspection and maintenance, flow meter calibration, and, during the fourth quarter, condensate issues that generated severe flow fluctuations tripping the flare with low flow and flame failure faults accounted for 591 hours or 6.7% of the 2014 annual post-closure period. Flow and process gas content data is summarized in the table that follows.

<b>Pennsylvania Avenue Landfill</b>			
<b>Flare Operation - 2014</b>			
<b>Month</b>	<b>CH<sub>4</sub> (% by Volume)</b>	<b>Time in service (Hours)</b>	<b>Flow (SCF)</b>
January-14	19.3%	744.0	3,708,457
February-14	21.2%	672.0	3,068,593
March-14	21.6%	733.0	3,699,256
April-14	21.2%	719.2	3,776,044
May-14	20.5%	720.7	3,282,998
June-14	20.6%	720.0	2,797,746
July-14	22.0%	744.0	2,975,066
August-14	23.0%	744.0	2,827,301
September-14	23.0%	715.3	2,517,758
October-14	20.0%	701.0	2,573,660
November-14	18.0%	452.3	1,939,158
December-14	18.3%	527.5	2,295,494
<b>Average</b>	<b>20.7%</b>	<b>NA</b>	<b>2,955,128</b>
<b>Total</b>	<b>NA</b>	<b>8,193.0</b>	<b>35,461,531</b>

Bi-weekly (LFG-2) and quarterly (LFG-4) inspections were conducted, and copies are included in Appendix C of the 2014 Quarterly Reports. Deficiencies identified at the flare and blower station during scheduled inspections, the bent louver arm bracket and the bottom thermocouple were both replaced on November 18<sup>th</sup>. The one deficiency encountered, and still pending, is the condensate issue which is producing erratic flows; solutions to this problem are under investigation. Additional recommended operational equipment components that were impacted by the Hurricane Sandy surge waters will be replaced when the remaining Hurricane Sandy repairs are performed. Other equipment components exposed to the Hurricane Sandy surge that are currently operational but not designated for replacement will continue to be monitored and assessed over time and may be replaced in the future, if necessary. There were no other significant deficiencies pending at the end of this annual reporting period.

### **3.3 Final Cover System**

The landfill final cover system (FCS) prevents stormwater infiltration into the landfill and landfill gas migration into the atmosphere. The ROD stipulated the construction of a 6NYCRR Part 360 landfill cap. According to the O&M Manual, the cover is comprised of a vegetative topsoil layer with a minimum thickness of 6 inches; a 12-inch thick soil barrier protection layer; a Type 2 cover system double-sided geocomposite drainage layer (areas with less than 5% slope); a Type 1 cover system cushion geotextile layer (areas with slopes greater than 5%); a 40-mil thick LLDPE (linear low density polyethylene) geomembrane liner; and 6-inch thick Type II cover soil.

The O&M Manual requires the final cover system be inspected on a monthly basis and after each major rainfall event equal to or exceeding the 2 year 24-hour precipitation event (3.5 inches in 24 hours). The surface of the landfill was divided into 17 inspection zones. The surface of the landfill was divided into 17 inspection zones. All 17 inspection zones are shown in Figure 4 which is utilized to identify the system components. This figure is also utilized to identify the components of the stormwater and ancillary systems. A record of the final cover system inspection is summarized on a Monthly Checklist Form FCS-1, with deficiencies noted on the Deficiency and Problems Form (DP-1). The monthly inspection reports can be found in Appendix D of the 2014 Quarterly Reports. The final cover system is inspected for surface cracking, vegetative growth, vector penetration, settlement, erosion, slope stability, seepage, and vandalism. The inspection is performed by walking up and down the side slopes and across each zone several times. The deficiencies encountered due to heavy rains on April 30<sup>th</sup>, erosion in inspection Zone 4 and ponding in inspection Zones 2 and 8, and subsequent ponding in inspection Zones 1, 5 and 16 are pending and repair details will be developed. The repairs of the erosion on the water side perimeter of Zone 9 caused by Hurricane Sandy will be addressed with other storm related restoration work.

### **3.4 Stormwater Management System**

The stormwater management system (SWM) is an integral part of the capping and closure system required under the 6NYCRR Part 360 regulations to protect the landfill final cover system. The system was designed to collect, transport and discharge stormwater to the surface

waters surrounding the PAL in order to prevent stormwater ponding and erosion damage to the final cover system.

The stormwater management system consists of several components which require monitoring, inspection, and periodic maintenance. The system has been divided into three subsystems (SWM-1, SWM-2 and SWM-3) for ease of inspection and reporting. These subsystems include:

- SWM-1: Geocomposite drain pipes and stormwater drainage swales,
- SWM-2: Outlets, culverts, rip rap inlet and outlet protection and revetment area, and
- SWM-3: HDPE downchute pipes, manholes, pipe trenches and energy dissipation structures.

The O&M Manual requires that the stormwater management systems SWM-1, SWM-2 and SWM-3 be inspected on a monthly basis and after each major rainfall event equal to or exceeding the 2 year 24-hour precipitation event (3.5 inches in 24 hours). A record of the inspection is summarized on Monthly Checklist Forms SWM-1, SWM-2, SWM-3 and DP-1 (for SWM-1, SWM-2 and SWM-3) for each system in accordance with the requirements of the O&M Manual. A Deficiency and Problems Form DP-1 is completed to summarize the items marked not satisfactory (NS) in the stormwater system checklist forms.

Deficiencies identified during the 2014 annual post-closure period do not necessarily affect the efficient performance of this system. Inspection of the System during and after storm events, indicate that it is working properly. The concrete pad around Manhole D1A is cracked and has shifted; this is monitored and there has been no change to this condition in the past seven and a half years. The swales and culverts were mowed, weed-wacked, and excessive vegetative growth and debris was removed when observed during inspections. The monthly inspection reports and DP-1 Forms can be found in Appendix D of the 2014 Quarterly Reports.

### **3.5 Ancillary Systems**

The ancillary systems (ANS) are those support systems at the PAL that are used for site access and security. The ancillary systems include five (5) access roads (A, B, C, D and E) and two (2) nature trails (East & West), along with fences, gates, and locks. The roadways are integral in providing access to perform required inspection, monitoring and maintenance activities. In addition, since the selected remedy resulted in leaving waste on-site, the security fences and gates provide important institutional controls to prevent site access to unauthorized individuals.

The O&M Manual requires that the ANS be inspected on a monthly basis. A record of the inspection is summarized on Monthly Checklist Forms ANS-1 and DP-1 (for ANS-1) in accordance with the requirements of the O&M Manual. The instructions for the checklists further require inspections after each major rainfall event equal to or exceeding the 2 year 24-hour precipitation event (3.5 inches in 24 hours). These are incorporated into the monthly inspections reports found in Appendix D of the 2014 Quarterly Reports.

Damage and wear are inherent in unpaved roads. Potholes on the access roads are recurring and are filled in as part of routine maintenance. Repairs to the embankment, the paved road and the gate along Hendrix Creek around Outlet A, damaged by previous severe weather, were completed in August. The damage caused by Hurricane Sandy to Road D and the embankment along Fresh Creek, Hendrix Creek and Jamaica Bay will be repaired when the remaining Hurricane Sandy repairs are performed.

Holes in the perimeter fence are repaired as soon as possible after they are found during each monthly inspection and/or the weekly inspections conducted during fair weather. Locks are inspected and lubricated quarterly and as needed. Safety inspections are performed monthly. Damaged and missing “No Trespassing”, “Confined Space” and “Hazard” signs were also replaced. The project sign along the Belt Parkway was lost during Hurricane Sandy. Both project signs were replaced in June, they developed wrinkles and were, therefore, replaced again in August.

### **3.6 Post-Closure Environmental Monitoring**

The Monitoring Plan for the PAL went into effect when the FER was approved by NYSDEC at the end of March 2009. The Plan addresses the performance evaluation of the effectiveness of the cap and/or landfill gas collection system in controlling leachate and landfill gas migration. It requires monitoring of the groundwater elevation and quality at ten wells (HP wells) located around the perimeter, outside the limits of the closure cap, and soil gas quality in five perimeter gas monitoring wells located outside the limits of the cap parallel to the Belt Parkway. Additionally, monitoring for landfill gas is performed on a monthly basis inside the GW/L pre-treatment facility building, as per 6NYCRR Part 360 requirements.

#### **3.6.1 Groundwater Monitoring Program**

In the NYSDEC letter of March 2, 2011 to DEP, the NYSDEC approved the DEP's request to reduce the frequency of groundwater monitoring from quarterly to annually, in rotating quarters (i.e., once every five quarters), and to reduce the frequency of monitoring for pesticides and PCBs to once every five years. The fourth quarter of 2014 groundwater monitoring round served as the annual monitoring event for the period covered by this Report. The next groundwater monitoring round will be performed during the first quarter of 2016.

Water-levels and samples were collected from the ten groundwater monitoring wells (see Figure 5) on December 8<sup>th</sup>, 16<sup>th</sup>, 18<sup>th</sup>, and 23<sup>rd</sup>. The groundwater beneath the PAL is influenced by the tide cycle. However, hydraulic analysis determined that while tide cycle causes pressure fluctuations in the wells, it does not significantly influence groundwater flow beneath the site. Accordingly, monitoring rounds are conducted independently of the tide cycle, and water-level data are used for informational purposes only but not to determine groundwater flow directions or gradients.

The samples were analyzed for all required annual parameters, specifically volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), leachate indicators, and inorganic parameters (Metals) by an ELAP-certified environmental laboratory. Pesticides and



PCBs were not analyzed for during this round. They will again be analyzed for in 2018 as approved by the NYSDEC to coincide with the last year of each five-year review period.

The laboratory results were validated by an independent data validator. The validated results are summarized and compared to the State's Class GA potable ground-water standards and guidance values in Tables 2 through 5, respectively. The groundwater elevation data, the sample collection field logs, the tabulated summary of laboratory results, the laboratory reports, and the Data Usability Summary Report are included in the 2014 Fourth Quarter Report, Appendix E. The complete Data Validation Report can be found in the computer disks located in Appendix G of the 2014 Fourth Quarter Report.

Overall, the results of the 2014 annual ground water-monitoring round are consistent with previous results, and continue to indicate that the Site is not a significant source of releases of hazardous or toxic substances to ground water. It should be noted that the ground water beneath the Site is naturally saline and therefore non-potable. The results are compared to the potable water standards and guidance values because no standards or guidance values exist for saline ground water. Accordingly, an exceedance of a potable ground-water standard or guidance value does not necessarily indicate a significant concern for this Site.

Note that five of the groundwater monitoring wells sampled are screened in the saturated fill zone above the tidal marsh deposit (HP-101U, HP-407U, HP-104A, HP-318 and HP-603), two are screened in the upper portion of the Upper Glacial Aquifer (UGA) which lies under the tidal marsh deposit (HP-101S and HP-407S), and three wells are screened in the lower portion of the Upper Glacial Aquifer (HP-101D, HP-407D and HP-103D).

The specific results for each analyte group are summarized below. A detailed comparison to previous results, including a trend analysis, will be provided in the next five-year review report.

VOCs – The results of the 2014 annual ground water-monitoring round continue to indicate that the Site is not a significant source of VOC impacts to ground water. Specifically, although each ground-water sample was analyzed for 47 target VOCs, only two VOCs (acetone and chlorobenzene) were actually detected. Moreover, as shown in Table 1, acetone was only detected in one well at a low, estimated concentration; and chlorobenzene was only detected in four wells, also primarily at low, estimated concentrations. Exceedances of the Class GA potable ground-water standards and guidance values were limited to a slight exceedance for chlorobenzene in Well HP-603.

All of the VOC detections occurred in wells screened in the saturated zone above the tidal marsh deposits. The occurrence and distribution of VOCs in ground water during the 2014 annual monitoring round indicate that the tidal marsh deposits are continuing to serve as a hydraulic barrier to vertical migration of ground water from the saturated zone above to tidal marsh deposits to the underlying Upper Glacial Formation.

SVOCs - The results of the 2014 annual ground water-monitoring round continue to indicate that the Site is also not a significant source of SVOC impacts to ground water. Specifically, although each ground-water sample was analyzed for 67 target SVOCs, only two SVOCs were actually

detected. Moreover, as shown in Table 2, those detections were limited to sporadic, low concentrations of acenaphthene in one well (HP-603) and bis(2-ethylhexyl) phthalate in three wells (HP-101-U, HP-103-D and HP-407U). All of the SVOC detections were lower than their respective Class GA standard or guidance value.

Three of the four wells in which SVOCs were detected are screened in saturated zone above the tidal marsh deposits. The occurrence and distribution of SVOCs in ground water during the 2014 monitoring round also indicate that the tidal marsh deposits are continuing to serve as a hydraulic barrier to vertical migration of ground water from the saturated zone above to tidal marsh deposits to the underlying Upper Glacial Formation.

Leachate Indicators – The 2014 leachate indicator parameter results are consistent with the Site being an old, closed and capped municipal landfill that is underlain by saline ground water. Specifically, as shown in Table 3, most of these parameters were detected in nearly every well; except for cyanide and phenols, which typically do not occur naturally at detectable concentrations in saline ground water; and nitrate, which is metabolized by bacteria in the ground water.

Moreover, the concentrations of the parameters known to occur naturally in seawater, such as bromide, chloride, hardness, sulfate, and total dissolved solids, are highest in the wells screened in the lower portion of the Upper Glacial Aquifer where the ground water would be expected to be the most saline. Other parameters, such as alkalinity, ammonia, color, and phenols (in one well only), appear to be Site-related because they are detected only, or at significantly higher concentrations, in wells screened in the saturated zone above the tidal marsh deposits.

The concentrations of a number of parameters exceed the Class GA potable ground-water standards. However, it should be noted that most of the exceedances are for parameters that are related to the naturally saline ground water beneath the Site. The exceedances for the Site-related parameters, such as ammonia and phenols, are not a significant concern because the ground water is non-potable, as noted above. Moreover, ammonia occurs naturally in seawater, and is not persistent in the environment; and the standard for phenols is aesthetics-based rather than health-based.

Metals – The 2014 metals results continue to indicate that the Site is not a significant source of metals-related impacts to ground water. Specifically, as shown in Table 4, most of the target analytes, including the heavy metals, were either not detected or were only detected sporadically and/or at low concentrations. The concentrations of the frequently-detected parameters, such as iron, magnesium, potassium and sodium, are generally higher in the wells screened in the Upper Glacial Aquifer than in the wells screened in the saturated zone above the tidal marsh deposits. This pattern indicates that they are primarily attributed to the naturally saline ground-water conditions beneath the Site.

The concentrations of certain metals exceed the Class GA potable ground-water standards and guidance values. However, it should be noted that most of the exceedances, and the highest-magnitude exceedances, are for parameters that are related to the naturally saline ground water



beneath the Site. Exceedances for heavy metals are limited to low-magnitude exceedances for cadmium in three wells and lead in seven wells.

### 3.6.2 Gas Monitoring Program

Perimeter soil gas readings at the five perimeter gas monitoring wells were taken quarterly, on March 27<sup>th</sup>, June 26<sup>th</sup>, September 22<sup>nd</sup> and November 17<sup>th</sup>, and to confirm the absence of off-site gas migration after intermittent extended flare outages on February 14<sup>th</sup>, October 27<sup>th</sup> and December 3<sup>rd</sup>. Figure 5 shows the locations of the perimeter gas wells. Table 6 contains a summary of the perimeter gas monitoring well results during the 2014 annual post-closure period.

Methane readings were consistently 0.0% at GMW-02, 0.0% and once 0.1% at GMW-01 and GMW-05, 0.0% and once 0.4% at GMW-03, and three times 0.0%, three times 0.1% and once 1.2% at GMW-04. Accordingly, methane levels at all five gas monitoring wells were less than the lower explosive limit (i.e., 5% gas in air) at the property line and thus meet the 6NYCRR Part 360 requirements.

Methane readings within the GW/L pre-treatment facility building were obtained on a monthly basis and were consistently 0.0% throughout the facility. These readings were taken on January 14<sup>th</sup>, February 11<sup>th</sup>, March 5<sup>h</sup>, April 10<sup>th</sup>, May 8<sup>th</sup>, June 12<sup>th</sup>, July 2<sup>nd</sup>, August 11<sup>th</sup>, September 16<sup>th</sup>, October 13<sup>th</sup>, November 19<sup>th</sup> and December 8<sup>th</sup>. The data is summarized in Table 7 of this Report. Accordingly, methane levels within the building were less than 25% of the LEL (i.e., 1.25% gas in air) and therefore meet 6NYCRR Part 360 requirements.

On March 19<sup>th</sup> and September 18<sup>th</sup>, landfill surface gas readings were taken, with no detections observed throughout the landfill. Sample locations are shown in Figure 6, and results are included in Appendix E of the First and Third Quarter 2014 Reports, respectively.

Based on the results of the post-closure landfill-gas monitoring performed during this annual reporting period, methane levels measured were less than the 6NYCRR Part 360 limits, and indicate that landfill gas being generated by the PAL is being contained by the collection and treatment system and preventing off-site methane migration. It is expected that landfill gas concentrations will continue to decrease over time as the landfill ages.

## **Section 4 – Conclusions and Recommendations**

Based on the results of the post-closure activities performed during this annual reporting period, the PAL engineering controls and associated institutional controls are in place, performing properly and remain effective. The PAL remedy continues to be protective of public health and the environment and is compliant with the PAL ROD. The activities associated with the O&M Manual and the Post-Closure Monitoring Plan (as approved by the NYSDEC) continue to be implemented.

Routine system maintenance and repair of each of the remediation systems should continue in compliance with the requirements of the PAL O&M Manual. In general, it is recommended that areas of the Site affected by Hurricane Sandy should be restored to their existing condition prior to the storm event.

Specific conclusions and recommendations for each of the remediation systems are identified in the following paragraphs.

#### **4.1 Groundwater/Leachate Management System**

The GW/L management system continued to be operational and prevent off-site leachate migration during this annual reporting period. Since November 1, 2011, the GW/L management system has been operating in plant diversion mode. In this mode, the treatment system processes are being circumvented since the quality of the interceptor trench water being collected meets the permit discharge limits without pre-treatment. During this reporting period, the untreated discharge continued to meet the required permit limits. The interceptor trench discharge monthly monitoring for permit-required parameters will be continued in accordance with the permit requirements. Should it be necessary in the future for the treatment processes to be brought back online, it would be recommended that monthly influent/effluent water quality sampling be reinstated.

While the Monthly M-1 sample results during this reporting period continue to meet the required permit discharge limits without pre-treatment, the concentrations of certain parameters in the influent continue to exceed the NYSDEC limits for saline surface water. Therefore, operation of the interceptor trench is still warranted.

As previously recommended in prior Post-Closure Reports, since no separate-phase petroleum has ever been detected at the leachate pump stations, the replacement of the scavenger pumps was examined and determined not to be necessary. The pump stations should continue to be inspected on a daily basis and the water quality should continue to be sampled on a monthly basis in accordance with the Discharge Permit requirements. Should separate-phase petroleum be observed, mitigation measures should be taken at that time to ensure they are appropriate to the actual conditions encountered. Based on the results of the monitoring and inspection activities performed during this reporting period, this recommendation remains in effect.

The remaining recommended operational equipment components that were impacted by the Hurricane Sandy surge and designated for replacement should be replaced. Other equipment components exposed to the Hurricane Sandy surge that are currently operational but not designated for replacement should continue to be monitored and assessed over time and may be replaced in the future, if necessary. Following the repair of Road D, the sand/road material from the PS #1 valve vault should be removed and the product storage tank should be reset.

In general, it is recommended that individual pieces of equipment that are not in use be maintained in good working condition and ready to be placed back on-line, if necessary. The interceptor trench pump stations and related equipment will continue to be operated and maintained. If deficiencies are noted they will be repaired and/or replaced in a timely manner to

minimize system down time. Specifically, the recommended corrective actions listed in Form DP-1, Leachate Pre-Treatment System, Descriptions of Deficiencies and Problems, in Appendix A of the quarterly reports should be implemented.

#### **4.2 Landfill Gas Management System**

The LFG management system continues to be operational and prevent off-site gas migration. As the landfill ages, the methane quality and quantity of gas generated by the landfill will continue to decline. The LFG management system should continue to be operated to maximize methane quality at the flare in order to minimize the use of supplemental gas. The recommendations made by the DEP oversight consultant to improve system performance should continue to be implemented. The LFG management system performance should continue to be monitored to determine if adjustments and/or modifications to the system are necessary as the landfill gas quality and quantity diminishes in the future.

The remaining recommended operational equipment components that were impacted by the Hurricane Sandy surge and designated for replacement should be replaced. Other equipment components exposed to the Hurricane Sandy surge that are currently operational but not designated for replacement should continue to be monitored and assessed over time and may be replaced in the future, if necessary. In addition, the recommended corrective actions listed in Form DP-1, Landfill Gas System, Descriptions of Deficiencies and Problems, in Appendix C of the quarterly reports should be implemented.

#### **4.3 Final Cover System**

Overall the landfill final cover system is in good condition and protecting landfill cap beneath it as intended. Conditions found were typical of those encountered during the landfill post-closure period, with only a few deficiencies noted. In general, it is recommended that routine maintenance continue to be performed to prevent problem areas from expanding and worsening. This would include filling ruts caused by erosion, reseeding areas where necessary and maintaining landfill surface slope to promote stormwater runoff. The perimeter areas of the final cover system affected by Hurricane Sandy should be restored to their existing condition prior to the storm event. In addition, the recommended corrective actions listed in Form DP-1, FCS-1, Descriptions of Deficiencies and Problems, in Appendix D of the quarterly reports should be implemented.

#### **4.4 Stormwater Management System**

The stormwater management system continues to convey stormwater runoff to its outfall locations. Conditions found were typical of those encountered during the landfill post-closure period, with a few deficiencies noted. In general, it is recommended that silt and vegetation in drainage swales continue to be periodically removed and sediment be removed from other portions of the drainage system. The recommended corrective actions listed in Form DP-1 (SWM-1, SWM-2 SWM-3), Descriptions of Deficiencies and Problems, in Appendix D of the quarterly reports should be implemented as deemed appropriate.

#### **4.5 Ancillary Systems**

The roads and nature trails of the ancillary systems continue to provide access throughout the Site while the fencing and gates continue to allow for controlled site access. Conditions found were typical of those encountered during the landfill post-closure period, with a few deficiencies noted. In general, it is recommended that routine maintenance continue to be performed to prevent problem areas from expanding and worsening. This would include filling ruts and depressions in roads and trails and repairing site fencing and gates when necessary. Areas of the ancillary systems affected by Hurricane Sandy should be restored to their existing condition prior to the storm event. In addition, the recommended corrective actions listed in Form DP-1, ANS-1, Descriptions of Deficiencies and Problems, in Appendix D of the quarterly reports should be implemented.

#### **4.6 Post-Closure Environmental Monitoring**

In summary, taken as a whole, the results from 2014 annual groundwater monitoring event indicate that the PAL is not a significant source of toxic or hazardous substance releases to groundwater, and that groundwater-quality conditions beneath the Site are stable or improving over time in response to the remediation. The results also confirm that the reductions in the scope and frequency of post-closure groundwater monitoring were justified, and that further reductions (e.g., reducing the frequency of monitoring for SVOCs from annually to once every five years) may be warranted in the future.

Based on the results of the post-closure landfill-gas monitoring performed during this annual reporting period, methane levels measured met the 6NYCRR Part 360 requirements indicating that the landfill gas being generated by the PAL is being contained by the collection and treatment system and preventing off-site methane migration. It is expected that landfill gas concentrations will continue to decrease over time as the landfill ages.

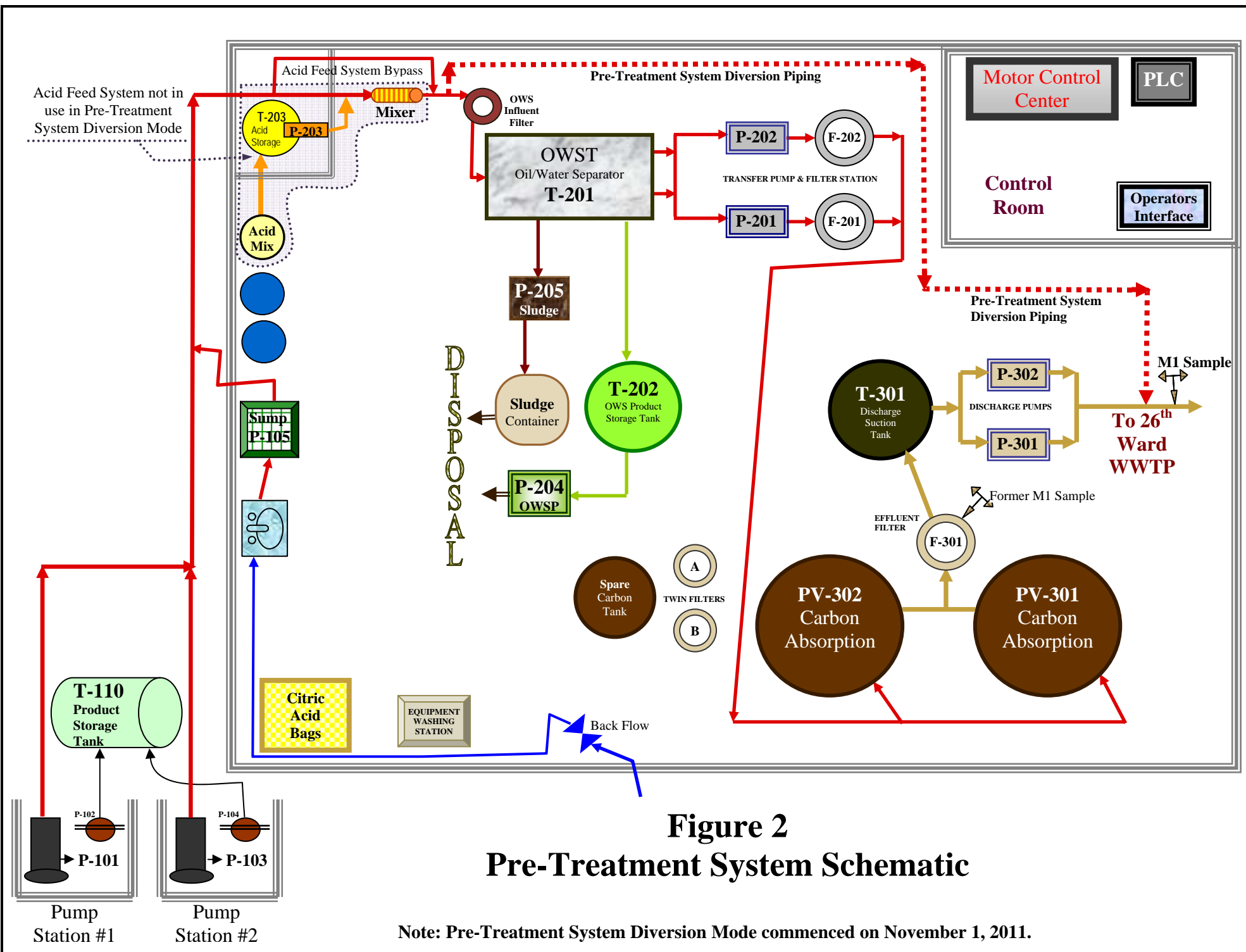
Recommendations for post-closure monitoring are to continue to perform the environmental monitoring in accordance with the modified Monitoring Plan (approved by the NYSDEC in March 2011) reflecting the reduction in the frequency of groundwater monitoring to annually, in rotating quarters (i.e., once every five quarters) and the reduction in the frequency of monitoring for pesticides and PCBs to once every five years to coincide with the five-year review periods. In addition, since 2011, Annual Reporting has been on a calendar year basis. The next groundwater monitoring round will be performed during the first quarter of 2016. This schedule has been approved by NYSDEC so that monitoring will not be conducted in consecutive quarters and annual monitoring will be performed once in each calendar quarter during each five year reporting period.

## Figures





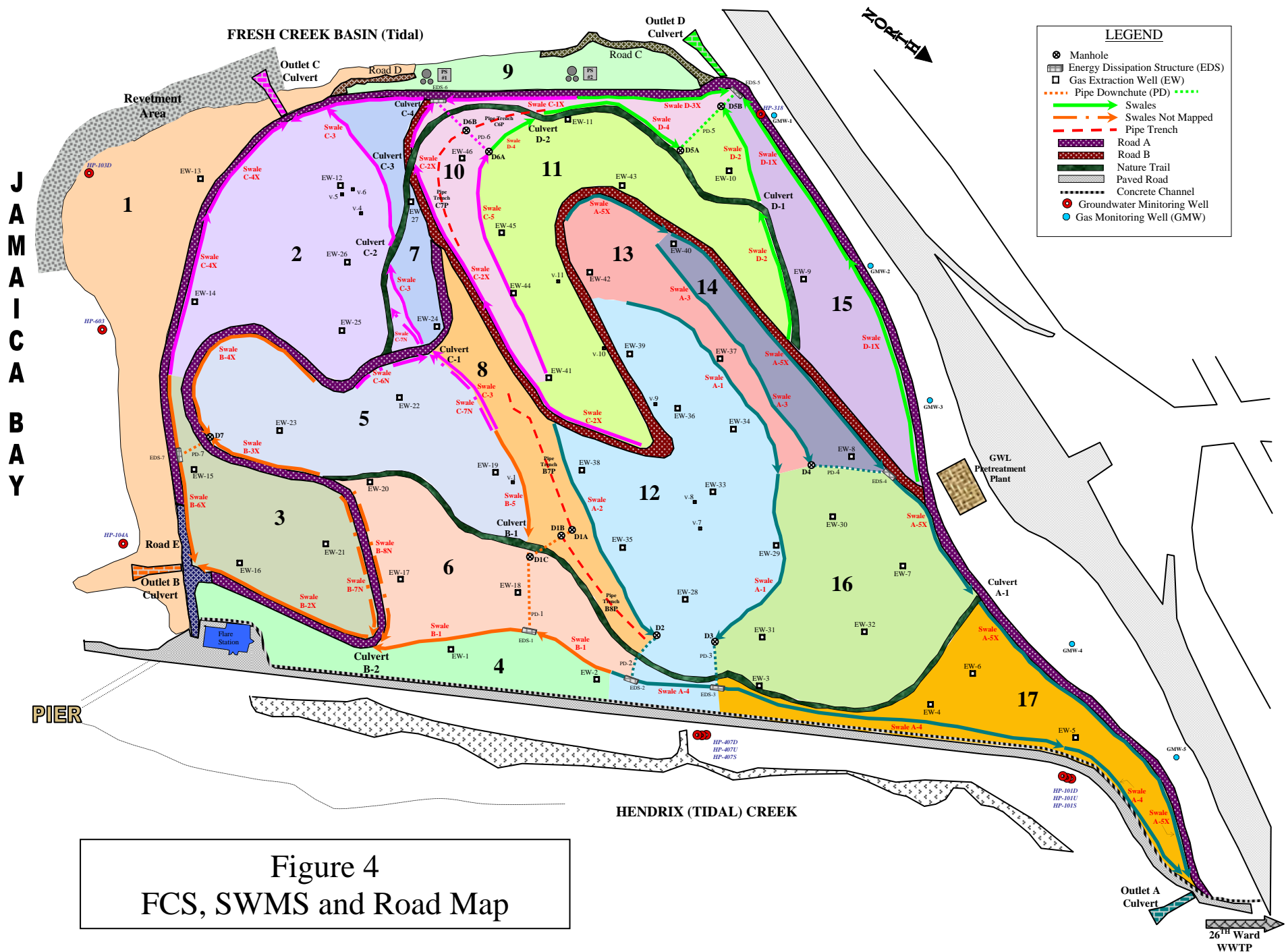
FIGURE 1  
SITE LOCATION MAP















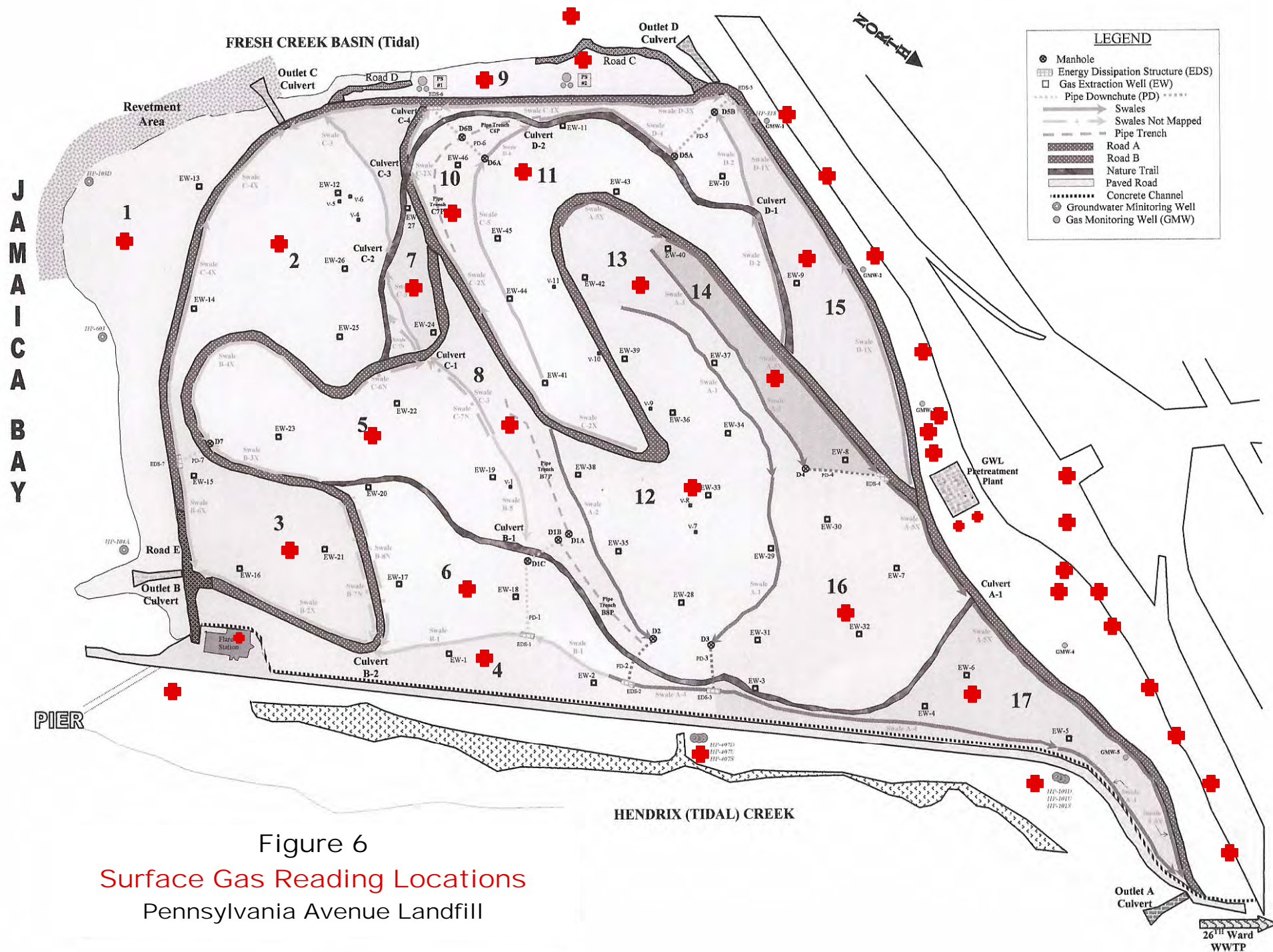


Figure 6  
 Surface Gas Reading Locations  
 Pennsylvania Avenue Landfill

## Tables

Pennsylvania Avenue Landfill

Table 1 - Parameters Detected in the Groundwater Leachate Pretreatment System Discharge

Analyte	Units	Permit			TOGS SA (Fish Propogation) Standards	M1 Discharge Sample Results												
		Max. Conc.	Daily Limit	Monthly Limit		01/14/14	02/11/14	03/05/14	04/10/14	05/08/14	06/12/14	07/02/14	08/11/14	09/16/14	10/13/14	11/19/14	12/08/14	
Chromium	mg/L				0.05 (GA)	<0.01	<0.01	0.018	<0.010	<0.010	<0.010	<0.010	0.010	<0.010	<0.010	<0.010	<0.010	
Lead	ug/L	2000			8	<5.00	25.4	51	13	20	30	34	<5.0	30	<5.0	<5.0	<5.0	
Zinc	mg/L	5.0			0.066	0.03	0.02	0.02	<0.020	0.022	<0.020	<0.020	<0.020	0.021	0.028	0.057	0.045	
Carbonaceous Biological Oxygen Demand	mg/L					<4	<4	<4	<4	5	4	<4	4	<4	<4	<4	<4	
Chloride	mg/L					2830 D	2100 D	2040 D	1710 D	1570 D	1140 D	1,710 D	2,850 D	3,380 D	3,890 D	32.3	2,180 D	
Nitrate as N	mg/L					<0.10	0.81	0.36	0.45	0.77	0.39	0.18	0.20	0.14	0.32	<1.0	0.38	
Nitrogen, Kjeldahl, Total	mg/L					50.5 D	48.0 D	63.5 D	52.0 D	52.5 D	57.0 D	68.5 D	51.0 D	43.5 D	39.5 D	51.3 D	35.4 D	
Nitrogen, Total	mg/L					50.5	48.8	63.9	52.5	53.3	57.4	68.7	51.2	43.6	39.8	51.3	35.7	
Suspended Solids (Residue, Non-Filterable)	mg/L	350				<10	<10	13	14	13	11	<10.0	15	20	16	22	16	
Suspended Solids (Residue, Non-Filterable)	mg/L	↓				<10	<10	10	<10.0	<10.0	<10.0	10	17	17	17	14	<10	
Suspended Solids (Residue, Non-Filterable)	mg/L						<10	<10	<10	<10.0	<10.0	<10.0	<10.0	13	20	16	22	11
Suspended Solids (Residue, Non-Filterable)	mg/L						<10	<10	11	10	<10.0	<10.0	<10.0	11	20	16	17	12
pH (Lab pH Qualifier H)																		
pH Grab 1 (Field/Lab)	SU	5.0 - 11.0				6.70 / 6.9	7.08 / 6.9	6.87 / 6.9	6.75 / 6.9	6.78 / 6.9	6.79 / 6.8	6.71 / 6.8	6.61 / 6.9	6.77 / 6.8	6.65 / 7.0	6.68 / 7.0	6.71 / 7.0	
pH Grab 2 (Field/Lab)	SU	Standard Units				6.65 / 6.9	7.03 / 6.9	6.82 / 7.0	6.79 / 6.8	6.88 / 6.9	6.74 / 6.7	6.67 / 6.8	6.61 / 6.8	6.63 / 6.8	6.61 / 7.1	6.67 / 6.9	6.64 / 7.0	
pH Grab 3 (Field/Lab)	SU					6.69 / 6.9	6.94 / 6.9	6.56 / 7.0	6.75 / 6.8	6.79 / 6.9	6.75 / 6.7	6.64 / 6.8	6.60 / 6.8	6.64 / 6.8	6.60 / 7.1	6.65 / 6.9	6.67 / 7.0	
pH Grab 4 (Field/Lab)	SU					6.67 / 6.9	7.00 / 6.9	6.75 / 7.0	6.78 / 6.8	6.75 / 6.9	6.71 / 6.7	6.61 / 6.8	6.60 / 6.8	6.63 / 6.8	6.61 / 7.0	6.66 / 6.9	6.66 / 7.0	
VOCs																		
1,2-Dichlorobenzene	µg/L					2	1.9	2.6	1.5	1.9	2.0	3.6	1.5	<1.0	<1.0	1.3	1.9	
1,3-Dichlorobenzene	µg/L					<1.0	<1.0	1.1	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	
1,4-Dichlorobenzene	µg/L					3	3	3.4	2.2	3.7	2.9	5.5	2.8	1.7	1.7	2.2	2.7	
					5 (GV) - Sum of Dichlorobenzenes	5	4.9	7.1	3.7	5.6	4.9	10.5	4.3	1.7	1.7	3.5	4.6	
2-Butanone	µg/L					<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	10	<5.0	<5.0	<5.0	
Acetone	µg/L				No Standard	<5.0	5.2	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
Benzene	µg/L		134	57	190 (GV)	1.8	1.5	1.2	<1.0	<1.0	1.2	2.6	<1.0	1.8	1.4	1.5	<1.0	
Chlorobenzene	µg/L				5 (GV)	21	20	13	8.2	<1.0	16	29	4.3	13	11	22	10	
m,p-Xylene	µg/L					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	
Methylene chloride	µg/L				5 (Class GA Limit)	<1.0	<1.0	9.2 Bc	1.4 B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	<1.0	
o-Xylene	µg/L					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Xylene (total)	µg/L		74	28		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6	<1.0	
SVOs																		
Bis(2-ethylhexyl)phthalate	µg/L					<1.0	<1.0	<1.0	<1.0	<1.0	2.4 B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Di-n-butyl phthalate	µg/L					<1.0	<1.0	<1.0	<1.0	<1.0	43 B	<1.0	<1.0	43 B	<1.0	<1.0	43	
N-Nitrosodiphenylamine	µg/L				5 (GV)	2.8	4.3	4.3	4.4	3.6	4.5	4.3	3.2	2.5	2.8	5.1	3.4	
Qualifiers:		D = Result for dilution																
		B = Found in blank																
		c = Calibration acceptability criteria exceeded for this sample																

Table 2 - Volatile Organic Compounds Detected in Pennsylvania Avenue Landfill Monitoring Wells During 2014 Monitoring Round

VOCs Detected In Ground-Water Samples	Class GA Standard	Well Number and Result, in ug/L										
		HP-101-U	101-U Dup.	HP-101-S	HP-101-D	HP-103-D	HP-104-A	HP-318	HP-407-U	HP-407-S	HP-407-D	HP-603
Acetone	50 <sup>GV</sup>	<5	<5	<5	<5	<5	<5	<5	2 J	<5	<5	<5
Chlorobenzene	5	1 J	2 J	<5	<5	<5	<5	1 J	2 J	<5	<5	<b>6</b>

Notes: J = Estimated concentration.

GV = Guidance value.

Bold font indicates exceedance of Class GA standard or guidance value.

Table 3 - Semivolatile Organic Compounds Detected in Pennsylvania Avenue Landfill Monitoring Wells During 2014 Monitoring Round

SVOCs Detected In Ground-Water Samples	Class GA Standard	Well Number and Result, in ug/L										
		HP-101-U	101-U Dup.	HP-101-S	HP-101-D	HP-103-D	HP-104-A	HP-318	HP-407-U	HP-407-S	HP-407-D	HP-603
Acenaphthene	20 <sup>GV</sup>	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
Bis(2-ethylhexyl) Phthalate	5	2	<1	<1	<1	1	<1	<1	4	<1	<1	<1

Notes: J = Estimated concentration.

GV = Guidance value.

\* = Standard is per-isomer.

Bold font indicates exceedance of Class GA standard or guidance value.

Table 4 - Leachate Indicator Parameter Results for 2014 Pennsylvania Avenue Landfill Ground-Water Samples

Leachate Indicator Parameter	Class GA Standard	Well Number and Result, in mg/L*										
		HP-101-U	101-U Dup.	HP-101-S	HP-101-D	HP-103-D	HP-104-A	HP-318	HP-407-U	HP-407-S	HP-407-D	HP-603
Alkalinity	No Std.	486	469	374	462	270	576	143	1,280	472	166	760
Bromide	2 <sup>GV</sup>	<0.50	0.53	<0.50	<b>32.0</b>	<b>48.7</b>	<0.50	<0.50	<b>2.25</b>	<b>25.6</b>	<b>30.8</b>	1.17
Chloride	250	<b>470</b>	<b>480</b>	28.2	<b>15,900</b>	<b>14,400</b>	88.0	90	224	<b>9,570</b>	<b>11,200</b>	226
Sulfate	250	192 J	<b>453 J</b>	49.7	<b>1,370</b>	<b>1,390</b>	110	229	13.3	<b>935</b>	<b>1,380</b>	134
BOD	No Std.	<4	<4	<4	<4	<4	<4	3	18	5	<4	<4
COD	No Std.	30.5	31.1	94.0	165	180	33.7	12.1	196	135	147	67.4
Color (Units)	15	<b>35.0</b>	<b>35.0</b>	<b>25.0</b>	<b>90.0</b>	<b>55.0</b>	<b>90.0</b>	<b>25.0</b>	<b>55.0</b>	<b>90.0</b>	<b>35.0</b>	<b>65.0</b>
Cyanide	200	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Hardness	No Std.	460	480	600	4,500	5,300	1,300	500	600	3,400	3,600	1,100
Ammonia	2	<b>2.26</b>	<b>2.76</b>	<b>9.25</b>	<b>7.19</b>	<b>7.29</b>	<b>8.03</b>	1.18	<b>101</b>	<b>28.0</b>	<b>2.14</b>	<b>9.53</b>
Nitrate	10	0.49	0.40	2.63	<0.10	<0.10 J	<0.10	3.08	<0.10	<0.10	<0.10	5.14
Phenols	0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<b>0.0066</b>	<0.005	<0.005	<0.005	<0.005
TDS	500	<b>1,450</b>	<b>1,500</b>	<b>1,410</b>	<b>23,100</b>	<b>24,900</b>	<b>4,240</b>	<b>558</b>	<b>1,360</b>	<b>13,200</b>	<b>16,300</b>	<b>1,330</b>
TKN	No Std.	3.05	3.39	8.08	6.25	7.02	7.40	1.24	92.1	24.9	1.86	9.87
TOC	No Std.	125	116	84.4	111	79.4	12.1	42.7	305	51.2	49.5	199

Notes: J = Estimated concentration.

GV = Guidance value.

\* = Except for Color, which is in Color Units.

Bold font indicates exceedance of Class GA standard or guidance value.

Table 5 - Inorganic Parameter Results for 2014 Pennsylvania Avenue Landfill Ground-Water Samples

Inorganic Parameter	Class GA Standard	Well Number and Result, in ug/L										
		HP-101-U	101-U Dup	HP-101-S	HP-101-D	HP-103-D	HP-104-A	HP-318	HP-407-U	HP-407-S	HP-407-D	HP-603
Aluminum	No Std.	<34.6	<24.0	<97.7	<10.4	<150	<21.1	<92.4	<29.9	<21.8	<17.4	<26.2
Antimony	3	<1.6	<1.6	<1.6	<1.6	<3.0	<3.0	<1.6	<1.6	<1.6	<1.6	<1.6
Arsenic	10*	<1.8	<1.8	<1.8	<1.8	<3.3	<3.3	<1.8	<1.8	<1.8	<1.8	<1.8
Barium	1,000	103 J	96.2 J	93.8 J	108 J	101 J	214	21.7 J	557	189 J	57.9 J	76.3 J
Beryllium	3 <sup>GV</sup>	<0.20	<0.20	<0.20	<0.20	<0.10	<0.10	<0.20	<0.20	<0.20	<0.20	<0.20
Boron	1,000	326	311	248	<b>2,580</b>	<b>3,260</b>	271	104	<b>1,790</b>	<b>1,610</b>	<b>1,770</b>	934
Cadmium	5	1.3 J	1.2 J	1.6 J	<b>8.0</b>	1.8 J	2.1 J	<0.20	<0.20	<b>6.5</b>	<b>8.6</b>	2.1 J
Calcium	No Std.	125,000	121,000	91,000	264,000	378,000	199,000	111,000	81,800	216,000	262,000	247,000
Chromium, Total	50	<6.1	<6.0	<6.6	12.0	15.2	6.7 J	<7.2	14.9	11.9	10.6	10.1
Chromium, Hexavalent	50	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cobalt	No Std.	1.2 J	1.3 J	<0.20	2.1 J	<0.60	<0.60	0.40 J	6.8 J	2.6 J	0.80 J	2.9 J
Copper	200	<21.2	<18.4	<18.2	<7.4	<15.6	<17.6	<6.5	<1.3	<6.9	<8.4	<4.0
Iron	300	<b>592</b>	<b>640</b>	<b>541</b>	<b>19,000</b>	<b>8,260</b>	<b>12,700</b>	<b>539</b>	<b>1,270</b>	<b>16,900</b>	<b>21,700</b>	<b>6,960</b>
Iron and Manganese	500	<b>643</b>	<b>699</b>	<b>563</b>	<b>19,457</b>	<b>9,590</b>	<b>13,424</b>	<b>609</b>	<b>1,566</b>	<b>17,513</b>	<b>22,486</b>	<b>7,519</b>
Lead	25	24.9	22.0	<b>27.9</b>	<b>28.9</b>	2.6 J	4.7 J	<b>27.2</b>	<b>35.4</b>	<b>42.3</b>	<b>35.1</b>	<b>25.3</b>
Magnesium	35,000 <sup>GV</sup>	23,100	22,400	22,000	<b>838,000</b>	<b>1,100,000</b>	<b>40,200</b>	30,700	<b>76,800</b>	<b>495,000</b>	<b>842,000</b>	<b>72,000</b>
Manganese	300	51.3	58.8	21.5	<b>457</b>	<b>1,330</b>	<b>724</b>	69.9	296	<b>613</b>	<b>786</b>	<b>559</b>
Mercury	0.7	<0.10	<0.10	<0.10	<0.10	0.12 J	0.12 J	<0.10	<0.10	<0.10	<0.10	<0.10
Nickel	100	13.3 J	12.1 J	21.0 j	39.6 J	18.3 J	<3.3	<4.2	7.1 J	78.2 J	<3.5	5.8 J
Potassium	No Std.	12,400	11,600	8,760	268,000	342,000	15,700	8,840	55,100	221,000	242,000	14,300
Selenium	10	<1.7	2.0 J	<1.7	<b>11.5</b>	<3.8	<3.8	<1.7	<1.7	7.5	<b>10.3</b>	<1.7
Silver	50	<3.4 J	<3.4 J	<3.4 J	<3.4 J	<2.2 J	<2.2 J	<3.4 J	<3.4 J	<3.4 J	<3.4 J	<3.4 J
Sodium	20,000	<b>503,000</b>	<b>615,000</b>	<b>193,000</b>	<b>8,550,000</b>	<b>9,250,000</b>	<b>71,600</b>	<b>53,000</b>	<b>459,000</b>	<b>5,460,000</b>	<b>7,030,000</b>	<b>154,000</b>
Thallium	0.5 <sup>GV</sup>	<2.7	<3.6	<4.1	<13.2	<b>5.3 J</b>	<3.8 J	<4.1	<4.4	<9.8	<13.2	<6.6
Vandium	No Std.	<2.8	2.8	<2.8	<2.8	<5.1	<0.90	<2.8	8.8 J	<2.8	<2.8	<2.8
Zinc	2,000 <sup>GV</sup>	<142	<130	202 J	<15.6	<84.3	<76.3	<19.4	<12.5	<11.4	<14.2	<13.5

Notes: J = Estimated concentration.

GV = Guidance value.

Bold font indicates exceedance of Class GA standard or guidance value.



**Table 6**  
**Summary of Perimeter Gas Monitoring Well Results**  
**Pennsylvania Avenue Landfill, Brooklyn, NY**

Quarterly Monitoring Round	Date	GMW-1	GMW-2	GMW-3	GMW-4	GMW-5
<b>Methane</b> (% by volume)						
<b>1Q14</b>	14-Feb	0.0	0.0	0.0	0.0	0.0
	27-Mar	0.0	0.0	0.4	1.2	0.0
<b>2Q14</b>	26-Jun	0.1	0.0	0.0	0.1	0.0
<b>3Q14</b>	22-Sep	0.0	0.0	0.0	0.1	0.1
<b>4Q14</b>	27-Oct	0.0	0.0	0.0	0.1	0.0
	17-Nov	0.0	0.0	0.0	0.0	0.0
	3-Dec	0.0	0.0	0.0	0.0	0.0
<b>Carbon Dioxide</b> (% by volume)						
<b>1Q14</b>	14-Feb	0.8	0.7	0.1	6.5	0.4
	27-Mar	2.8	1.7	3.7	7.3	1.9
<b>2Q14</b>	26-Jun	3.5	2.3	2.4	2.9	2.7
<b>3Q14</b>	22-Sep	8.4	4.0	4.5	15.1	2.0
<b>4Q14</b>	27-Oct	7.1	6.5	5.1	16.0	2.0
	17-Nov	6.5	6.3	4.3	18.4	1.9
	3-Dec	4.7	3.2	3.2	10.7	1.4
<b>Oxygen</b> (% by volume)						
<b>1Q14</b>	14-Feb	18.9	19.3	18.6	10.0	20.2
	27-Mar	13.1	19.1	8.6	0.0	19.6
<b>2Q14</b>	26-Jun	7.7	18.3	18.2	18.0	17.8
<b>3Q14</b>	22-Sep	2.7	17.3	15.5	7.0	19.6
<b>4Q14</b>	27-Oct	6.0	4.3	14.6	2.3	18.7
	17-Nov	6.1	5.8	16.1	1.0	19.4
	3-Dec	5.8	10.6	17.2	8.8	19.8

**Note:** Monitoring performed to confirm the absence of off-site gas migration after intermittent extended flare outages on February 14<sup>th</sup>, October 27<sup>th</sup> and December 3<sup>rd</sup>.

**Table 7:  
Summary of Gas Monitoring Results within the Groundwater  
Leachate Pre-Treatment Building**

**Pennsylvania Avenue Landfill  
Brooklyn, NY**

	<b>Date</b>	<b>Leachate Treatment Building Methane (% by Volume)</b>
<b>1Q14</b>	1/14/14	0.0
	2/11/14	0.0
	3/5/14	0.0
<b>2Q14</b>	4/10/14	0.0
	5/8/14	0.0
	6/12/14	0.0
<b>3Q14</b>	7/2/14	0.0
	8/11/14	0.0
	9/16/14	0.0
<b>4Q14</b>	10/13/14	0.0
	11/19/14	0.0
	12/8/14	0.0